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### ETSI

#### 650 Route des Lucioles F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

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# Foreword

This Technical Specification (TS) has been produced by the 3<sup>rd</sup> Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

Where:

- x the first digit:
  - 1 presented to TSG for information;
  - 2 presented to TSG for approval;
  - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

# 1 Scope

. The present document establishes the minimum RF characteristics and minimum performance requirements for E-UTRA User Equipment (UE).

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

- [1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [2] ITU-R Recommendation SM.329-10, "Unwanted emissions in the spurious domain"
- [3] ITU-R Recommendation M.1545: "Measurement uncertainty as it applies to test limits for the terrestrial component of International Mobile Telecommunications-2000".
- [4] 3GPP TS 36.211: "Physical Channels and Modulation".
- [5] 3GPP TS 36.212: "Multiplexing and channel coding".
- [6] 3GPP TS 36.213: "Physical layer procedures".
- [7] 3GPP TS 36.331: " Requirements for support of radio resource management ".
- [8] 3GPP TS 36.307: " Requirements on User Equipments (UEs) supporting a release-independent frequency band".
- [9] 3GPP TS 36.423: "X2 application protocol (X2AP) ".

# 3 Definitions, symbols and abbreviations

### 3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1] and the following apply in the case of a single component carrier. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1].

Aggregated Channel Bandwidth: The RF bandwidth in which a UE transmits and receives multiple contiguously aggregated carriers.

Aggregated Transmission Bandwidth Configuration: The number of resource block allocated within the aggregated channel bandwidth.

**Carrier aggregation:** Aggregation of two or more component carriers in order to support wider transmission bandwidths.

**Carrier aggregation band:** A set of one or more operating bands across which multiple carriers are aggregated with a specific set of technical requirements.

**Carrier aggregation bandwidth class:** A class defined by the aggregated transmission bandwidth configuration and maximum number of component carriers supported by a UE.

**Carrier aggregation configuration**: A combination of CA operating band(s) and CA bandwidth class(es) supported by a UE.

Channel edge: The lowest and highest frequency of the carrier, separated by the channel bandwidth.

**Channel bandwidth:** The RF bandwidth supporting a single E-UTRA RF carrier with the transmission bandwidth configured in the uplink or downlink of a cell. The channel bandwidth is measured in MHz and is used as a reference for transmitter and receiver RF requirements.

**Contiguous carriers:** A set of two or more carriers configured in a spectrum block where there are no RF requirements based on co-existence for un-coordinated operation within the spectrum block.

**Contiguous resource allocation:** A resource allocation of consecutive resource blocks within one carrier or across contiguously aggregated carriers. The gap between contiguously aggregated carriers due to the nominal channel spacing is allowed.

Contiguous spectrum: Spectrum consisting of a contiguous block of spectrum with no sub-block gaps.

Enhanced performance requirements type A: This defines performance requirements assuming as baseline receiver reference symbol based linear minimum mean square error interference rejection combining.

Inter-band carrier aggregation: Carrier aggregation of component carriers in different operating bands.

NOTE: Carriers aggregated in each band can be contiguous or non-contiguous.

Intra-band contiguous carrier aggregation: Contiguous carriers aggregated in the same operating band.

Intra-band non-contiguous carrier aggregation: Non-contiguous carriers aggregated in the same operating band.

**Lower** sub-block **edge:** The frequency at the lower edge of one sub-block. It is used as a frequency reference point for both transmitter and receiver requirements.

Non-contiguous spectrum: Spectrum consisting of two or more sub-blocks separated by sub-block gap(s).

**Sub-block:** This is one contiguous allocated block of spectrum for transmission and reception by the same UE. There may be multiple instances of sub-blocks within an RF bandwidth.

Sub-block bandwidth: The bandwidth of one sub-block.

**Sub-block gap:** A frequency gap between two consecutive sub-blocks within an RF bandwidth, where the RF requirements in the gap are based on co-existence for un-coordinated operation.

Synchronized operation: Operation of TDD in two different systems, where no simultaneous uplink and downlink occur.

**Unsynchronized operation:** Operation of TDD in two different systems, where the conditions for synchronized operation are not met.

**Upper sub-block edge:** The frequency at the upper edge of one sub-block. It is used as a frequency reference point for both transmitter and receiver requirements.

# 3.2 Symbols

For the purposes of the present document, the following symbols apply:

| BW <sub>Channel</sub>       | Channel bandwidth   |
|-----------------------------|---|
| BW <sub>Channel,block</sub> | Sub-block bandwidth, expressed in MHz. BW <sub>Channel,block</sub> = F <sub>edge,block,high</sub> - F <sub>edge,block,low</sub> . |
| $BW_{Channel\_CA}$          | Aggregated channel bandwidth, expressed in MHz.   |
| $BW_{GB}$                   | Virtual guard band to facilitate transmitter (receiver) filtering above / below edge CCs.   |

| $E_{RS}$  | Transmitted energy per RE for reference symbols during the useful part of the symbol, i.e.  |
|---|---|
| 1.5   | excluding the cyclic prefix, (average power normalized to the subcarrier spacing) at the eNode B transmit antenna connector   |
| $\hat{E}_{s}$   | The averaged received energy per RE of the wanted signal during the useful part of the symbol,  |
| F   | i.e. excluding the cyclic prefix, at the UE antenna connector; average power is computed within a set of REs used for the transmission of physical channels (including user specific RSs when present), divided by the number of REs within the set, and normalized to the subcarrier spacing Frequency |
| F <sub>Interferer</sub> (offset)                        | Frequency offset of the interferer  |
| F <sub>Interferer</sub>                                 | Frequency of the interferer   |
| F <sub>C</sub><br>F                                     | Frequency of the carrier centre frequency<br>Center frequency of the highest transmitted/received carrier in a sub-block.   |
| F <sub>C,block, high</sub><br>F <sub>C,block, low</sub> | Center frequency of the lowest transmitted/received carrier in a sub-block.   |
| $F_{C_{low}}$   | The centre frequency of the <i>lowest carrier</i> , expressed in MHz.   |
| $F_{C_{high}}$  | The centre frequency of the highest carrier, expressed in MHz.  |
| $F_{DL_{low}}$  | The lowest frequency of the downlink operating band   |
| F <sub>DL_high</sub>                                    | The highest frequency of the downlink operating band  |
| F <sub>UL_low</sub>                                     | The lowest frequency of the uplink operating band<br>The highest frequency of the uplink operating band   |
| F <sub>UL_high</sub><br>F <sub>edge,block,low</sub>     | The lower sub-block edge, where $F_{edge,block,low} = F_{C,block,low} - F_{offset.}$  |
| $F_{edge,block,high}$                                   | The upper sub-block edge, where $F_{edge,block,high} = F_{C,block,high} + F_{offset.}$  |
| $F_{edge_low}$  | The <i>lower edge</i> of aggregated channel bandwidth, expressed in MHz.  |
| $F_{edge\_high}$  | The <i>higher edge</i> of aggregated channel bandwidth, expressed in MHz.   |
| F <sub>offset</sub>                                     | Frequency offset from $F_{C_{high}}$ to the <i>higher edge</i> or $F_{C_{low}}$ to the <i>lower edge</i> .  |
| $F_{offset,block,low}$                                  | Separation between lower edge of a sub-block and the center of the lowest component carrier within the sub-block  |
| $F_{\rm offset, block, high}$                           | Separation between higher edge of a sub-block and the center of the highest component carrier within the sub-block  |
| F <sub>OOB</sub>  | The boundary between the E-UTRA out of band emission and spurious emission domains.   |
| $I_o$   | The power spectral density of the total input signal (power averaged over the useful part of the  |
|   | symbols within the transmission bandwidth configuration, divided by the total number of RE for this configuration and normalised to the subcarrier spacing) at the UE antenna connector, including the own-cell downlink signal   |
| I <sub>or</sub>   | The total transmitted power spectral density of the own-cell downlink signal (power averaged over   |
|   | the useful part of the symbols within the transmission bandwidth configuration, divided by the total number of RE for this configuration and normalised to the subcarrier spacing) at the eNode B transmit antenna connector  |
| $\hat{I}_{or}$  | The total received power spectral density of the own-cell downlink signal (power averaged over  |
|   | the useful part of the symbols within the transmission bandwidth configuration, divided by the total number of RE for this configuration and normalised to the subcarrier spacing) at the UE antenna connector  |
| $I_{ot}$  | The received power spectral density of the total noise and interference for a certain RE (average   |
|   | power obtained within the RE and normalized to the subcarrier spacing) as measured at the UE antenna connector  |
| L <sub>CRB</sub>  | Transmission bandwidth which represents the length of a contiguous resource block allocation  |
| N <sub>cp</sub>   | expressed in units of resources blocks<br>Cyclic prefix length  |
| N <sub>DL</sub>   | Downlink EARFCN   |
| $N_{oc}$  | The power spectral density of a white noise source (average power per RE normalised to the  |
|   | subcarrier spacing), simulating interference from cells that are not defined in a test procedure, as measured at the UE antenna connector   |
| $N_{oc1}$   | The power spectral density of a white noise source (average power per RE normalized to the  |
| N <sub>oc2</sub>  | subcarrier spacing), simulating interference in non-CRS symbols in ABS subframe from cells that are not defined in a test procedure, as measured at the UE antenna connector.<br>The power spectral density of a white noise source (average power per RE normalized to the                             |
|   | subcarrier spacing), simulating interference in CRS symbols in ABS subframe from all cells that are not defined in a test procedure, as measured at the UE antenna connector.   |

| $N_{oc3}$                                 | The power spectral density of a white noise source (average power per RE normalised to the   |
|---|--|
| 000                                       | subcarrier spacing), simulating interference in non-ABS subframe from cells that are not defined<br>in a test procedure, as measured at the UE antenna connector   |
| $N_{oc}$                                  | The power spectral density (average power per RE normalised to the subcarrier spacing) of the  |
| N <sub>Offs-DL</sub>                      | summation of the received power spectral densities of the strongest interfering cells explicitly defined in a test procedure plus, as measured at the UE antenna connector. The respective power spectral density of each interfering cell relative to is defined by its associated DIP value. Offset used for calculating downlink EARFCN |
| N <sub>Offs-UL</sub>                      | Offset used for calculating uplink EARFCN  |
| N <sub>otx</sub>                          | The power spectral density of a white noise source (average power per RE normalised to the   |
| οιx                                       | subcarrier spacing) simulating eNode B transmitter impairments as measured at the eNode B transmit antenna connector   |
| N <sub>RB</sub>                           | Transmission bandwidth configuration, expressed in units of resource blocks  |
| $N_{RB\_agg}$                             | The number of the aggregated RBs within the fully allocated Aggregated Channel bandwidth.  |
| $N_{RB\_alloc}$                           | Total number of simultaneously transmitted resource blocks in Channel bandwidth or Aggregated Channel Bandwidth.   |
| N <sub>RB,c</sub>                         | The transmission bandwidth configuration of component carrier $c$ , expressed in units of resource blocks  |
| $N_{RB,largest\;BW}$                      | The largest transmission bandwidth configuration of the component carriers in the bandwidth combination, expressed in units of resource blocks   |
| N <sub>UL</sub>                           | Uplink EARFCN.   |
| Rav                                       | Minimum average throughput per RB.   |
| P <sub>CMAX</sub>                         | The configured maximum UE output power.  |
| $P_{CMAX}, c$                             | The configured maximum UE output power for serving cell c.   |
| P <sub>EMAX</sub><br>P <sub>EMAX, c</sub> | Maximum allowed UE output power signalled by higher layers. Same as IE <i>P-Max</i> , defined in [7]. Maximum allowed UE output power signalled by higher layers for serving cell <i>c</i> . Same as IE <i>P-Max</i> , defined in [7].   |
| P <sub>Interferer</sub>                   | Modulated mean power of the interferer   |
| P <sub>PowerClass</sub>                   | P <sub>PowerClass</sub> is the nominal UE power (i.e., no tolerance).  |
| P <sub>UMAX</sub>                         | The measured configured maximum UE output power.   |
| Puw                                       | Power of an unwanted DL signal   |
| Pw  | Power of a wanted DL signal  |
| RB <sub>start</sub>                       | Indicates the lowest RB index of transmitted resource blocks.  |
| RB <sub>end</sub>                         | Indicates the highest RB index of transmitted resource blocks.   |
| $\Delta f_{OOB}$                          | $\Delta$ Frequency of Out Of Band emission.  |
| $\Delta R_{IB,c}$                         | Allowed reference sensitivity relaxation due to support for inter-band CA operation, for serving cell <i>c</i> .   |
| $\Delta T_{IB,c}$                         | Allowed maximum configured output power relaxation due to support for inter-band CA operation, for serving cell c.   |
| $\Delta T_{C}$                            | Allowed operating band edge transmission power relaxation.   |
| $\Delta T_{C,c}$                          | Allowed operating band edge transmission power relaxation for serving cell c.  |
| σ   | Test specific auxiliary variable used for the purpose of downlink power allocation, defined in Annex C.3.2.  |
| $W_{gap}$                                 | Sub-block gap size   |

# 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

| ABS   | Almost Blank Subframe   |
|-------|---|
| ACLR  | Adjacent Channel Leakage Ratio                                |
| ACS   | Adjacent Channel Selectivity                                  |
| A-MPR | Additional Maximum Power Reduction                            |
| AWGN  | Additive White Gaussian Noise                                 |
| BS    | Base Station  |
| CA    | Carrier Aggregation   |
| CA_X  | CA for band X where X is the applicable E-UTRA operating band |

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| ~        |  |
|----------|--|
| CA_X-X   | Non-contiguous intra band CA for band X where X is the applicable E-UTRA operating band    |
| CA_X-Y   | CA for band X and Band Y where X and Y are the applicable E-UTRA operating band            |
| CC       | Component Carriers   |
| CPE      | Customer Premise Equipment   |
| CPE_X    | Customer Premise Equipment for E-UTRA operating band X                                     |
| CW       | Continuous Wave  |
| DL       | Downlink   |
| DIP      | Dominant Interferer Proportion   |
| eDL-MIMO | Down Link Multiple Antenna transmission  |
| EARFCN   | E-UTRA Absolute Radio Frequency Channel Number   |
| EPRE     | Energy Per Resource Element  |
| E-UTRA   | Evolved UMTS Terrestrial Radio Access  |
| EUTRAN   | Evolved UMTS Terrestrial Radio Access Network  |
| EVM      | Error Vector Magnitude   |
| FDD      | Frequency Division Duplex  |
| FRC      | Fixed Reference Channel  |
| HD-FDD   | Half- Duplex FDD   |
| MCS      | Modulation and Coding Scheme   |
| MOP      | Maximum Output Power   |
| MPR      | Maximum Power Reduction  |
| MSD      | Maximum Sensitivity Degradation  |
| OCNG     | OFDMA Channel Noise Generator  |
| OFDMA    | Orthogonal Frequency Division Multiple Access  |
| OOB      | Out-of-band  |
| PA       | Power Amplifier  |
| PCC      | Primary Component Carrier  |
| P-MPR    | Power Management Maximum Power Reduction   |
| PSS      | Primary Synchronization Signal   |
| PSS_RA   | PSS-to-RS EPRE ratio for the channel PSS   |
| RE       | Resource Element   |
| REFSENS  | Reference Sensitivity power level  |
| r.m.s    | Root Mean Square   |
| SCC      | Secondary Component Carrier  |
| SINR     | Signal-to-Interference-and-Noise Ratio   |
| SNR      | Signal-to-Noise Ratio  |
| SSS      | Secondary Synchronization Signal   |
| SSS_RA   | SSS-to-RS EPRE ratio for the channel SSS   |
| TDD      | Time Division Duplex   |
| UE       | User Equipment   |
| UL       | Uplink   |
| UL-MIMO  | Up Link Multiple Antenna transmission  |
| UMTS     | Universal Mobile Telecommunications System   |
| UTRA     | UMTS Terrestrial Radio Access  |
| UTRAN    | UMTS Terrestrial Radio Access Network  |
| xCH_RA   | xCH-to-RS EPRE ratio for the channel xCH in all transmitted OFDM symbols not containing RS |
| xCH_RB   | xCH-to-RS EPRE ratio for the channel xCH in all transmitted OFDM symbols not containing RS |
| ACH_RD   | A ST IS TO DE REFINIO IN THE MAINER ACT IN AN HARSHINGE OF DET SYMBOLS CONTAINING RO       |

# 4 General

# 4.1 Relationship between minimum requirements and test requirements

The Minimum Requirements given in this specification make no allowance for measurement uncertainty. The test specification TS 36.521-1 Annex F defines Test Tolerances. These Test Tolerances are individually calculated for each test. The Test Tolerances are used to relax the Minimum Requirements in this specification to create Test Requirements.

The measurement results returned by the Test System are compared - without any modification - against the Test Requirements as defined by the shared risk principle.

The Shared Risk principle is defined in ITU-R M.1545 [3].

## 4.2 Applicability of minimum requirements

- a) In this specification the Minimum Requirements are specified as general requirements and additional requirements. Where the Requirement is specified as a general requirement, the requirement is mandated to be met in all scenarios
- b) For specific scenarios for which an additional requirement is specified, in addition to meeting the general requirement, the UE is mandated to meet the additional requirements.
- c) The reference sensitivity power levels defined in subclause 7.3 are valid for the specified reference measurement channels.
- d) Note: Receiver sensitivity degradation may occur when:
  - 1) The UE simultaneously transmits and receives with bandwidth allocations less than the transmission bandwidth configuration (see Figure 5.6-1), and
  - 2) Any part of the downlink transmission bandwidth is within an uplink transmission bandwidth from the downlink center subcarrier.
- e) The spurious emissions power requirements are for the long term average of the power. For the purpose of reducing measurement uncertainty it is acceptable to average the measured power over a period of time sufficient to reduce the uncertainty due to the statistical nature of the signal.

### 4.3 Void

# 4.3A Applicability of minimum requirements (CA, UL-MIMO, eDL-MIMO)

The requirements in clauses 5, 6 and 7 which are specific to CA, UL-MIMO, and eDL-MIMO are specified as suffix A, B, C, D where;

- a) Suffix A additional requirements need to support CA
- b) Suffix B additional requirements need to support UL-MIMO
- c) Suffix C additional requirements need to support TBD
- d) Suffix D additional requirements need to support eDL-MIMO

A terminal which supports the above features needs to meet both the general requirements and the additional requirement applicable to the additional subclause (suffix A, B, C and D) in clauses 5, 6 and 7. Where there is a difference in requirement between the general requirements and the additional subclause requirements (suffix A, B, C and D) in clauses 5, 6 and 7, the tighter requirements are applicable unless stated otherwise in the additional subclause.

A terminal which supports more than one feature (CA, UL-MIMO, and eDL-MIMO) in clauses 5, 6 and 7 shall meet all of the separate corresponding requirements.

For a terminal supporting CA, compliance with minimum requirements for non-contiguous intra-band carrier aggregation in any given operating band does not imply compliance with minimum requirements for contiguous intraband carrier aggregation in the same operating band.

For a terminal supporting CA, compliance with minimum requirements for contiguous intra-band carrier aggregation in any given operating band does not imply compliance with minimum requirements for non- contiguous intra-band carrier aggregation in the same operating band.

# 4.4 RF requirements in later releases

The standardisation of new frequency bands may be independent of a release. However, in order to implement a UE that conforms to a particular release but supports a band of operation that is specified in a later release, it is necessary to specify some extra requirements. TS 36.307 [8] specifies requirements on UEs supporting a frequency band that is independent of release.

NOTE: For terminals conforming to the 3GPP release of the present document, some RF requirements in later releases may be mandatory independent of whether the UE supports the bands specified in later releases or not. The set of requirements from later releases that is also mandatory for UEs conforming to the 3GPP release of the present document is determined by regional regulation.

# 5 Operating bands and channel arrangement

### 5.1 General

The channel arrangements presented in this clause are based on the operating bands and channel bandwidths defined in the present release of specifications.

NOTE: Other operating bands and channel bandwidths may be considered in future releases.

- 5.2 Void
- 5.3 Void
- 5.4 Void

# 5.5 Operating bands

E-UTRA is designed to operate in the operating bands defined in Table 5.5-1.

| E-UTRA<br>Operating<br>Band | Uplink (UL) operating band<br>BS receive<br>UE transmit<br>FuL_low - FuL_high                | Downlink (DL) operating band<br>BS transmit<br>UE receive<br>FDL_low - FDL_high   | Duplex<br>Mode   |
|-----------------------------|--|---|------------------|
| 1                           | 1920 MHz – 1980 MHz  | 2110 MHz – 2170 MHz   | FDD              |
| 2                           | 1850 MHz – 1910 MHz  | 1930 MHz – 1990 MHz   | FDD              |
| 3                           | 1710 MHz – 1785 MHz  | 1805 MHz – 1880 MHz   | FDD              |
| 4                           | 1710 MHz – 1755 MHz  | 2110 MHz – 2155 MHz   | FDD              |
| 5                           | 824 MHz – 849 MHz  | 869 MHz – 894MHz  | FDD              |
| 6 <sup>1</sup>              | 830 MHz – 840 MHz  | 875 MHz – 885 MHz   | FDD              |
| 7                           | 2500 MHz – 2570 MHz  | 2620 MHz – 2690 MHz   | FDD              |
| 8                           | 880 MHz – 915 MHz  | 925 MHz - 960 MHz   | FDD              |
| 9                           |  |   | FDD              |
| 10                          | <u>1749.9 MHz – 1784.9 MHz</u><br>1710 MHz – 1770 MHz  | 2110 MHz – 2170 MHz   | FDD              |
| 10                          | 1427.9 MHz – 1447.9 MHz  |   | FDD              |
| 12                          | 699 MHz – 716 MHz  | 729 MHz – 746 MHz   | FDD              |
| 13                          | 777 MHz – 787 MHz  | 746 MHz – 756 MHz   | FDD              |
| 14                          | 788 MHz – 798 MHz  | 758 MHz – 768 MHz   | FDD              |
| 15                          | Reserved   | Reserved  | FDD              |
| 16                          | Reserved   | Reserved  | FDD              |
| 17                          | 704 MHz – 716 MHz  | 734 MHz – 746 MHz   | FDD              |
| 18                          | 815 MHz – 830 MHz  | 860 MHz – 875 MHz   | FDD              |
| 10                          | 830 MHz – 845 MHz  | 875 MHz – 890 MHz   | FDD              |
| 20                          | 832 MHz – 862 MHz  | 791 MHz – 821 MHz   | FDD              |
| 21                          | 1447.9 MHz – 1462.9 MHz  |   | FDD              |
| 22                          | 3410 MHz – 3490 MHz  | 3510 MHz – 3590 MHz   | FDD              |
| 23                          | 2000 MHz – 2020 MHz  | 2180 MHz – 2200 MHz   | FDD              |
| 24                          | 1626.5 MHz – 1660.5 MHz  |   | FDD              |
| 25                          | 1850 MHz – 1915 MHz  | 1930 MHz – 1995 MHz   | FDD              |
| 26                          | 814 MHz – 849 MHz  | 859 MHz – 894 MHz   | FDD              |
| 27                          | 807 MHz – 824 MHz  | 852 MHz – 869 MHz   | FDD              |
| 28                          | 703 MHz – 748 MHz  | 758 MHz – 803 MHz   | FDD              |
| 29                          | N/A  | 717 MHz – 728 MHz   | FDD <sup>2</sup> |
|                             |  |   | 100              |
| 33                          | 1900 MHz – 1920 MHz  | 1900 MHz – 1920 MHz   | TDD              |
| 34                          | 2010 MHz – 2025 MHz  | 2010 MHz – 2025 MHz   | TDD              |
| 35                          | 1850 MHz – 1910 MHz  | 1850 MHz – 1910 MHz   | TDD              |
| 36                          | 1930 MHz – 1990 MHz  | 1930 MHz – 1990 MHz   | TDD              |
| 37                          | 1910 MHz – 1930 MHz  | 1910 MHz – 1930 MHz   | TDD              |
| 38                          | 2570 MHz – 2620 MHz  | 2570 MHz – 2620 MHz   | TDD              |
| 39                          | 1880 MHz – 1920 MHz  | 1880 MHz – 1920 MHz   | TDD              |
| 40                          | 2300 MHz – 2400 MHz  | 2300 MHz – 2400 MHz   | TDD              |
| 41                          | 2496 MHz 2690 MHz  | 2496 MHz 2690 MHz   | TDD              |
| 42                          | 3400 MHz – 3600 MHz  | 3400 MHz – 3600 MHz   | TDD              |
| 43                          | 3600 MHz – 3800 MHz  | 3600 MHz – 3800 MHz   | TDD              |
| 44                          | 703 MHz – 803 MHz  | 703 MHz – 803 MHz   | TDD              |
| NOTE 1: E<br>NOTE 2: R<br>d | and 6 is not applicable<br>Restricted to E-UTRA operation whownlink operating band is paired | nen carrier aggregation is configured.<br>with the uplink operating band (externa<br>at is supporting the configured Pcell. | The              |

Table 5.5-1 E-UTRA operating bands

# 5.5A Operating bands for CA

E-UTRA carrier aggregation is designed to operate in the operating bands defined in Tables 5.5A-1 and 5.5A-2.

| E-UTRA  | E-UTRA | Uplink (UL) operating band                 |   |          | Downlink (D        | Duplex |               |      |
|---------|--------|--|---|----------|--------------------|--------|---------------|------|
| CA Band | Band   | BS receive / UE transmit                   |   |          | BS transi          | nit /  | UE receive    | Mode |
|         |        | F <sub>UL_low</sub> – F <sub>UL_high</sub> |   |          | F <sub>DL_lo</sub> | w -    | $F_{DL_high}$ |      |
| CA_1    | 1      | 1920 MHz                                   | I | 1980 MHz | 2110 MHz           | Ι      | 2170 MHz      | FDD  |
| CA_7    | 7      | 2500 MHz                                   | I | 2570 MHz | 2620 MHz           | Ι      | 2690 MHz      | FDD  |
| CA_38   | 38     | 2570 MHz                                   | I | 2620 MHz | 2570 MHz           | Ι      | 2620 MHz      | TDD  |
| CA_40   | 40     | 2300 MHz                                   | I | 2400 MHz | 2300 MHz           | Ι      | 2400 MHz      | TDD  |
| CA_41   | 41     | 2496 MHz                                   |   | 2690 MHz | 2496 MHz           |        | 2690 MHz      | TDD  |

Table 5.5A-1: Intra-band contiguous CA operating bands

| E-UTRA    | E-UTRA | Uplink (UL)                                       | оре | erating band         | Downlink (D | L) c | perating band        | Duplex     |  |
|-----------|--------|---|-----|----------------------|-------------|------|----------------------|------------|--|
| CA Band   | Band   | BS receive / UE transmit BS transmit / UE receive |     |                      |             | Mode |                      |            |  |
|           |        |   |     | F <sub>UL_high</sub> |             |      | F <sub>DL_high</sub> | 1          |  |
| 0.0.4.5   | 1      | 1920 MHz  | _   | 1980 MHz             | 2110 MHz    | -    | 2170 MHz             |            |  |
| CA_1-5    | 5      | 824 MHz   | _   | 849 MHz              | 869 MHz     | -    | 894 MHz              | FDD        |  |
| 0.0.4.40  | 1      | 1920 MHz  | -   | 1980 MHz             | 2110 MHz    | -    | 2170 MHz             | 500        |  |
| CA_1-18   | 18     | 815 MHz   | —   | 830 MHz              | 860 MHz     | -    | 875 MHz              | FDD        |  |
| 0.4.4.4.0 | 1      | 1920 MHz  | -   | 1980 MHz             | 2110 MHz    | -    | 2170 MHz             | FDD        |  |
| CA_1-19   | 19     | 830 MHz   | -   | 845 MHz              | 875 MHz     | -    | 890 MHz              |            |  |
| CA 1.01   | 1      | 1920 MHz  | -   | 1980 MHz             | 2110 MHz    | -    | 2170 MHz             |            |  |
| CA_1-21   | 21     | 1447.9 MHz  | -   | 1462.9 MHz           | 1495.9 MHz  | -    | 1510.9 MHz           | FDD        |  |
| CA 0.17   | 2      | 1850 MHz  | -   | 1910 MHz             | 1930 MHz    | -    | 1990 MHz             |            |  |
| CA_2-17   | 17     | 704 MHz   | -   | 716 MHz              | 734 MHz     | -    | 746 MHz              | FDD        |  |
| <u> </u>  | 2      | 1850 MHz  | -   | 1910 MHz             | 1930 MHz    | -    | 1990 MHz             |            |  |
| CA_2-29   | 29     |   | N/A |                      | 717 MHz     | -    | 728 MHz              | FDD        |  |
|           | 3      | 1710 MHz  | _   | 1785 MHz             | 1805 MHz    | -    | 1880 MHz             |            |  |
| CA_3-5    | 5      | 824 MHz   | —   | 849 MHz              | 869 MHz     | -    | 894 MHz              | FDD        |  |
| 04 0 7    | 3      | 1710 MHz  | —   | 1785 MHz             | 1805 MHz    | -    | 1880 MHz             | 500        |  |
| CA_3-7    | 7      | 2500 MHz  | -   | 2570 MHz             | 2620 MHz    | -    | 2690 MHz             | - FDD      |  |
|           | 3      | 1710 MHz  |     | 1785 MHz             | 1805 MHz    |      | 1880 MHz             | 500        |  |
| CA_3-8    | 8      | 880 MHz   |     | 915 MHz              | 925 MHz     |      | 960 MHz              | FDD        |  |
| <u></u>   | 3      | 1710 MHz  | -   | 1785 MHz             | 1805 MHz    | -    | 1880 MHz             | 500        |  |
| CA_3-20   | 20     | 832 MHz   | -   | 862 MHz              | 791 MHz     | -    | 821 MHz              | FDD        |  |
| 04.45     | 4      | 1710 MHz  | -   | 1755 MHz             | 2110 MHz    | -    | 2155 MHz             | 500        |  |
| CA_4-5    | 5      | 824 MHz   | _   | 849 MHz              | 869 MHz     | -    | 894 MHz              | FDD        |  |
| 01.17     | 4      | 1710 MHz  |     | 1755 MHz             | 2110 MHz    |      | 2155 MHz             | 500        |  |
| CA_4-7    | 7      | 2500 MHz  |     | 2570 MHz             | 2620 MHz    |      | 2690 MHz             | FDD        |  |
| 0.0. 1.10 | 4      | 1710 MHz  | -   | 1755 MHz             | 2110 MHz    | -    | 2155 MHz             | 500        |  |
| CA_4-12   | 12     | 699 MHz   | -   | 716 MHz              | 729 MHz     | -    | 746 MHz              | FDD        |  |
| 0.0.4.4.0 | 4      | 1710 MHz  | -   | 1755 MHz             | 2110 MHz    | -    | 2155 MHz             | 500        |  |
| CA_4-13   | 13     | 777 MHz   | -   | 787 MHz              | 746 MHz     | -    | 756 MHz              | FDD        |  |
| CA 4 47   | 4      | 1710 MHz  | -   | 1755 MHz             | 2110 MHz    | -    | 2155 MHz             |            |  |
| CA_4-17   | 17     | 704 MHz   | -   | 716 MHz              | 734 MHz     | -    | 746 MHz              | FDD        |  |
| CA 4.00   | 4      | 1710 MHz  | -   | 1755 MHz             | 2110 MHz    | -    | 2155 MHz             |            |  |
| CA_4-29   | 29     |   | N/A |                      | 717 MHz     | -    | 728 MHz              | FDD        |  |
| 04 5 40   | 5      | 824 MHz   | —   | 849 MHz              | 869 MHz     | -    | 894 MHz              |            |  |
| CA_5-12   | 12     | 699 MHz   | -   | 716 MHz              | 729 MHz     | -    | 746 MHz              | FDD        |  |
| 04 5 47   | 5      | 824 MHz   | -   | 849 MHz              | 869 MHz     | -    | 894 MHz              | 500        |  |
| CA_5-17   | 17     | 704 MHz   | -   | 716 MHz              | 734 MHz     | -    | 746 MHz              | FDD        |  |
| 04 7 00   | 7      | 2500 MHz  | -   | 2570 MHz             | 2620 MHz    | -    | 2690 MHz             | <b>FDD</b> |  |
| CA_7-20   | 20     | 832 MHz   | -   | 862 MHz              | 791 MHz     | -    | 821 MHz              | FDD        |  |
| CA 0.00   | 8      | 880 MHz   | -   | 915 MHz              | 925 MHz     | -    | 960 MHz              |            |  |
| CA_8-20   | 20     | 832 MHz   | -   | 862 MHz              | 791 MHz     | -    | 821 MHz              | FDD        |  |
| 04 44 40  | 11     | 1427.9 MHz  | -   | 1447.9 MHz           | 1475.9 MHz  | -    | 1495.9 MHz           | <b>FDD</b> |  |
| CA_11-18  | 18     | 815 MHz   | —   | 830 MHz              | 860 MHz     | -    | 875 MHz              | FDD        |  |

### Table 5.5A-2: Inter-band CA operating bands

| E-UTRA   | E-UTRA | Uplink (UL) operating band |                      |  | Downlink (D | Duplex |            |      |
|----------|--------|----------------------------|----------------------|--|-------------|--------|------------|------|
| CA Band  | Band   | BS receive / UE transmit   |                      |  | BS transi   | nit /  | UE receive | Mode |
|          |        | F <sub>UL_low</sub>        | F <sub>UL_high</sub> | F <sub>DL_low</sub> – F <sub>DL_high</sub> |             |        |            |      |
| CA_25-25 | 25     | 1850 MHz                   | -                    | 1915 MHz                                   | 1930 MHz    | -      | 1995 MHz   | FDD  |
| CA_41-41 | 41     | 2496 MHz                   | -                    | 2690 MHz                                   | 2496 MHz    | Ι      | 2690 MHz   | TDD  |

Table 5.5A-3: Intra-band non-contiguous CA operating bands

# 5.5B Operating bands for UL-MIMO

E-UTRA UL-MIMO is designed to operate in the operating bands defined in Table 5.5-1.

Table 5.5B-1: Void

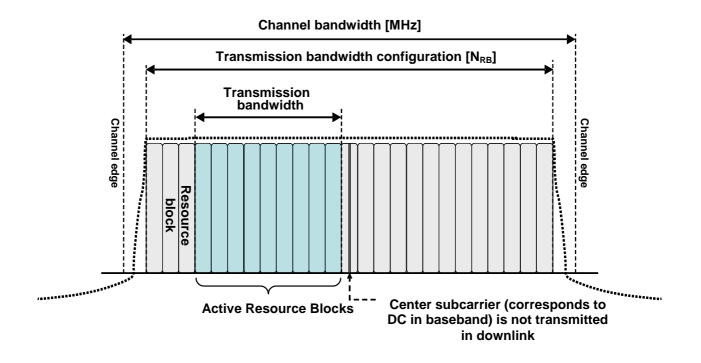
# 5.6 Channel bandwidth

Requirements in present document are specified for the channel bandwidths listed in Table 5.6-1.

### Table 5.6-1: Transmission bandwidth configuration N<sub>RB</sub> in E-UTRA channel bandwidths

| Channel bandwidth<br>BW <sub>Channel</sub> [MHz]        | 1.4 | 3  | 5  | 10 | 15 | 20  |
|---|-----|----|----|----|----|-----|
| Transmission bandwidth<br>configuration N <sub>RB</sub> | 6   | 15 | 25 | 50 | 75 | 100 |

Figure 5.6-1 shows the relation between the Channel bandwidth (BW<sub>Channel</sub>) and the Transmission bandwidth configuration (N<sub>RB</sub>). The channel edges are defined as the lowest and highest frequencies of the carrier separated by the channel bandwidth, i.e. at  $F_C$  +/- BW<sub>Channel</sub>/2.



# Figure 5.6-1: Definition of channel bandwidth and transmission bandwidth configuration for one E-UTRA carrier

### 5.6.1 Channel bandwidths per operating band

a) The requirements in this specification apply to the combination of channel bandwidths and operating bands shown in Table 5.6.1-1. The transmission bandwidth configuration in Table 5.6.1-1 shall be supported for each of the specified channel bandwidths. The same (symmetrical) channel bandwidth is specified for both the TX and RX path.

| E-UTRA band / Channel bandwidth |                 |                 |                  |                  |                  |                     |  |  |  |  |
|---------------------------------|-----------------|-----------------|------------------|------------------|------------------|---------------------|--|--|--|--|
| E-UTRA                          | 1.4 MHz         | 3 MHz           | 5 MHz            | 10 MHz           | 15 MHz           | 20 MHz              |  |  |  |  |
| Band                            |                 | -               | -                | -                |                  | -                   |  |  |  |  |
| 1                               |                 |                 | Yes              | Yes              | Yes              | Yes                 |  |  |  |  |
| 2                               | Yes             | Yes             | Yes              | Yes              | Yes <sup>1</sup> | Yes <sup>1</sup>    |  |  |  |  |
| 3                               | Yes             | Yes             | Yes              | Yes              | Yes <sup>1</sup> | Yes <sup>1</sup>    |  |  |  |  |
| 4                               | Yes             | Yes             | Yes              | Yes              | Yes              | Yes                 |  |  |  |  |
| 5                               | Yes             | Yes             | Yes              | Yes <sup>1</sup> |                  |                     |  |  |  |  |
| 6                               |                 |                 | Yes              | Yes <sup>1</sup> |                  |                     |  |  |  |  |
| 7                               |                 |                 | Yes              | Yes              | Yes <sup>3</sup> | Yes <sup>1, 3</sup> |  |  |  |  |
| 8                               | Yes             | Yes             | Yes              | Yes <sup>1</sup> |                  |                     |  |  |  |  |
| 9                               |                 |                 | Yes              | Yes              | Yes <sup>1</sup> | Yes <sup>1</sup>    |  |  |  |  |
| 10                              |                 |                 | Yes              | Yes              | Yes              | Yes                 |  |  |  |  |
| 11                              |                 |                 | Yes              | Yes <sup>1</sup> |                  |                     |  |  |  |  |
| 12                              | Yes             | Yes             | Yes <sup>1</sup> | Yes <sup>1</sup> |                  |                     |  |  |  |  |
| 13                              |                 |                 | Yes <sup>1</sup> | Yes <sup>1</sup> |                  |                     |  |  |  |  |
| 14                              |                 |                 | Yes <sup>1</sup> | Yes <sup>1</sup> |                  |                     |  |  |  |  |
|                                 |                 |                 | 100              | 100              |                  |                     |  |  |  |  |
| 17                              |                 |                 | Yes <sup>1</sup> | Yes <sup>1</sup> |                  |                     |  |  |  |  |
| 18                              |                 |                 | Yes              | Yes <sup>1</sup> | Yes <sup>1</sup> |                     |  |  |  |  |
| 19                              |                 |                 | Yes              | Yes <sup>1</sup> | Yes <sup>1</sup> |                     |  |  |  |  |
| 20                              |                 |                 | Yes              | Yes <sup>1</sup> | Yes <sup>1</sup> | Yes <sup>1</sup>    |  |  |  |  |
| 20                              |                 |                 | Yes              | Yes <sup>1</sup> | Yes <sup>1</sup> | 163                 |  |  |  |  |
| 21                              |                 |                 | Yes              | Yes              | Yes <sup>1</sup> | Yes <sup>1</sup>    |  |  |  |  |
| 22                              | Yes             | Yes             |                  | Yes              | Yes <sup>1</sup> | Yes <sup>1</sup>    |  |  |  |  |
|                                 | 165             | 165             | Yes              | Yes              | Tes              | 165                 |  |  |  |  |
| 24<br>25                        | Yes             | Yes             | Yes<br>Yes       | Yes              | Yes <sup>1</sup> | Yes <sup>1</sup>    |  |  |  |  |
| 25                              |                 |                 | Yes              | Yes <sup>1</sup> | Yes <sup>1</sup> | 165                 |  |  |  |  |
| 20                              | Yes<br>Yes      | Yes<br>Yes      |                  | Yes <sup>1</sup> | 165              |                     |  |  |  |  |
| 27                              | Tes             | Yes             | Yes<br>Yes       | Yes <sup>1</sup> | Yes <sup>1</sup> | Yes <sup>1, 2</sup> |  |  |  |  |
|                                 |                 | 165             | Tes              | 165              | 165              | Tes                 |  |  |  |  |
|                                 | -               |                 | Vaa              | Voo              | Voo              | Vaa                 |  |  |  |  |
| 33<br>34                        |                 |                 | Yes              | Yes              | Yes              | Yes                 |  |  |  |  |
| _                               | Vaa             | Vaa             | Yes              | Yes              | Yes              | Vaa                 |  |  |  |  |
| 35                              | Yes             | Yes             | Yes              | Yes              | Yes              | Yes                 |  |  |  |  |
| 36                              | Yes             | Yes             | Yes              | Yes              | Yes              | Yes                 |  |  |  |  |
| 37                              |                 |                 | Yes              | Yes              | Yes              | Yes                 |  |  |  |  |
| 38                              |                 |                 | Yes              | Yes              | Yes <sup>3</sup> | Yes <sup>3</sup>    |  |  |  |  |
| 39                              |                 |                 | Yes              | Yes              | Yes              | Yes                 |  |  |  |  |
| 40                              |                 |                 | Yes              | Yes              | Yes              | Yes                 |  |  |  |  |
| 41                              |                 |                 | Yes              | Yes              | Yes              | Yes                 |  |  |  |  |
| 42                              |                 |                 | Yes              | Yes              | Yes              | Yes                 |  |  |  |  |
| 43                              |                 |                 | Yes              | Yes              | Yes              | Yes                 |  |  |  |  |
| 44                              |                 | Yes             | Yes              | Yes              | Yes              | Yes                 |  |  |  |  |
| NOTE 1:                         |                 |                 |                  | elaxation of th  | ne specified     | JE receiver         |  |  |  |  |
|                                 | sensitivity rec |                 |                  |                  |                  |                     |  |  |  |  |
|                                 |                 |                 |                  | num requirem     |                  |                     |  |  |  |  |
|                                 |                 | carrier freque  | encies confin    | ed to either 7   | 13-723 MHz       | or 728-             |  |  |  |  |
| NOTEO                           | 738 MHz         | hand the second |                  | · ···· Bire La A |                  |                     |  |  |  |  |
| NOTE 3:                         | refers to the   | bandwidth f     | or which the     | uplink transm    | ission band      | width can           |  |  |  |  |
|                                 |                 |                 |                  | channel assig    |                  |                     |  |  |  |  |
|                                 |                 |                 | order to me      | et unwanted e    | emissions re     | quirements          |  |  |  |  |
|                                 | (Clause 6.6.3   | 0.∠).           |                  |                  |                  |                     |  |  |  |  |

b) The use of different (asymmetrical) channel bandwidth for the TX and RX is not precluded and is intended to form part of a later release.

# 5.6A Channel bandwidth for CA

For intra-band contiguous carrier aggregation *Aggregated Channel Bandwidth*, *Aggregated Transmission Bandwidth Configuration* and *Guard Bands* are defined as follows, see Figure 5.6A-1.

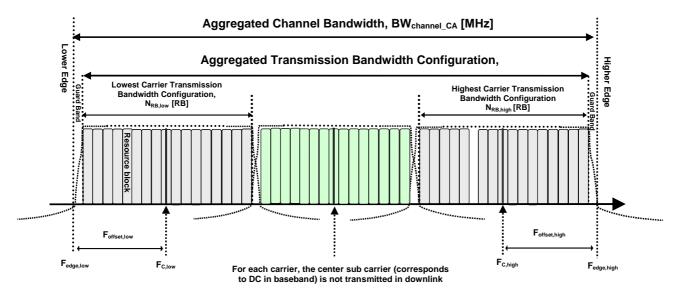


Figure 5.6A-1. Definition of Aggregated channel bandwidth and aggregated channel bandwidth edges

The aggregated channel bandwidth, BW<sub>Channel CA</sub>, is defined as

$$BW_{Channel_CA} = F_{edge,high} - F_{edge,low}$$
 [MHz]

The lower bandwidth edge  $F_{edge,low}$  and the upper bandwidth edge  $F_{edge,high}$  of the aggregated channel bandwidth are used as frequency reference points for transmitter and receiver requirements and are defined by

 $F_{edge,low} = F_{C,low} - F_{offset,low}$   $F_{edge,high} = F_{C,high} + F_{offset,high}$ 

The lower and upper frequency offsets depend on the transmission bandwidth configurations of the lowest and highest assigned edge component carrier and are defined as

$$\begin{split} F_{offset,low} &= (0.18 N_{RB,low} + \Delta f_1)/2 + BW_{GB} \left[ MHz \right] \\ F_{offset,high} &= (0.18 N_{RB,high} + \Delta f_1)/2 + BW_{GB} \left[ MHz \right] \end{split}$$

where  $\Delta f_1 = \Delta f$  for the downlink with  $\Delta f$  the subcarrier spacing and  $\Delta f_1 = 0$  for the uplink, while N<sub>RB,low</sub> and N<sub>RB,high</sub> are the transmission bandwidth configurations according to Table 5.6-1 for the lowest and highest assigned component carrier, respectively. BW<sub>GB</sub> denotes the *Nominal Guard Band* and is defined in Table 5.6A-1, and the factor 0.18 is the PRB bandwidth in MHz.

NOTE: The values of BW<sub>Channel\_CA</sub> for UE and BS are the same if the lowest and the highest component carriers are identical.

Aggregated Transmission Bandwidth Configuration is the number of the aggregated RBs within the fully allocated Aggregated Channel bandwidth and is defined per CA Bandwidth Class (Table 5.6A-1).

For intra-band non-contiguous carrier aggregation *Sub-block Bandwidth* and *Sub-block edges* are defined as follows, see Figure 5.6A-2.

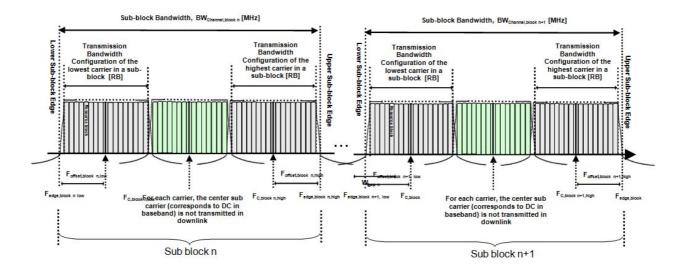


Figure 5.6A-2. Non-contiguous intraband CA terms and definitions

The lower sub-block edge of the Sub-block Bandwidth (BW<sub>Channel,block</sub>) is defined as

 $F_{edge,block, low} = F_{C,block,low} - F_{offset,block, low}$ 

The upper sub-block edge of the Sub-block Bandwidth is defined as

 $F_{edge,block,high} = F_{C,block,high} + F_{offset,block,high}$ .

The Sub-block Bandwidth, BW<sub>Channel.block</sub>, is defined as follows:

BWChannel,block = Fedge,block,high - Fedge,block,low [MHz]

The lower and upper frequency offsets F<sub>offset,block,low</sub> and F<sub>offset,block,high</sub> depend on the transmission bandwidth configurations of the lowest and highest assigned edge component carriers within a sub-block and are defined as

$$\begin{split} F_{offset,block,low} &= (0.18 N_{RB,low} + \Delta f_1)/2 + BW_{GB} \, [MHz] \\ F_{offset,block,high} &= (0.18 N_{RB,high} + \Delta f_1)/2 + BW_{GB} \, [MHz] \end{split}$$

where  $\Delta f_1 = \Delta f$  for the downlink with  $\Delta f$  the subcarrier spacing and  $\Delta f_1 = 0$  for the uplink, while N<sub>RB,low</sub> and N<sub>RB,high</sub> are the transmission bandwidth configurations according to Table 5.6-1 for the lowest and highest assigned component carrier within a sub-block, respectively. BW<sub>GB</sub> denotes the *Nominal Guard Band* and is defined in Table 5.6A-1, and the factor 0.18 is the PRB bandwidth in MHz.

The sub-block gap size between two consecutive sub-blocks  $W_{gap}$  is defined as

 $W_{gap} = F_{edge,block n+1,low} - F_{edge,block n,high [MHz]}$ 

| CA Bandwidth<br>Class   | Aggregated<br>Transmission<br>Bandwidth<br>Configuration  | Maximum<br>number of CC | Nominal Guard Band BW <sub>GB</sub>                          |  |  |  |  |  |
|---|---|-------------------------|--|--|--|--|--|--|
| A   | N <sub>RB,agg</sub> ≤ 100   | 1                       | a₁BW <sub>Channel(1)</sub> - 0.5∆f₁ (NOTE 2)                 |  |  |  |  |  |
| В   | N <sub>RB,agg</sub> ≤ 100   | 2                       | NOTE 3   |  |  |  |  |  |
| С   | 100 < N <sub>RB,agg</sub> ≤ 200   | 2                       | 0.05 $max(BW_{Channel(1)}, BW_{Channel(2)}) - 0.5\Delta f_1$ |  |  |  |  |  |
| D   | 200 < N <sub>RB,agg</sub> ≤ 300   | 3                       | NOTE 3   |  |  |  |  |  |
| E   | 300 < N <sub>RB,agg</sub> ≤ 400   | 4                       | NOTE 3   |  |  |  |  |  |
| F   | 400 < N <sub>RB,agg</sub> ≤ 500   | 5                       | NOTE 3   |  |  |  |  |  |
| NOTE 1: BW <sub>Cha</sub>   | NOTE 1: BW <sub>Channel(1)</sub> and BW <sub>Channel(2)</sub> are channel bandwidths of two E-UTRA component carriers |                         |  |  |  |  |  |  |
| according to Table 5.6-1 and $\Delta f_1 = \Delta f$ for the downlink with $\Delta f$ the subcarrier spacing while $\Delta f_1 =$ |   |                         |  |  |  |  |  |  |
| 0 for the uplink.   |   |                         |  |  |  |  |  |  |
| NOTE 2: $a_1 = 0.16/1.4$ for BW <sub>Channel(1)</sub> = 1.4 MHz whereas $a_1 = 0.05$ for all other channel bandwidths.            |   |                         |  |  |  |  |  |  |
| NOTE 3: Applicaple for later releases.  |   |                         |  |  |  |  |  |  |

Table 5.6A-1: CA bandwidth classes and corresponding nominal guard bands

The channel spacing between centre frequencies of contiguously aggregated component carriers is defined in subclause 5.7.1A.

## 5.6A.1 Channel bandwidths per operating band for CA

The requirements for carrier aggregation in this specification are defined for carrier aggregation configurations with associated bandwidth combination sets. For inter-band carrier aggregation, a *carrier aggregation configuration* is a combination of operating bands, each supporting a carrier aggregation bandwidth class. For intra-band contiguous carrier aggregation, a carrier aggregation configuration is a single operating band supporting a carrier aggregation bandwidth class.

For each carrier aggregation configuration, requirements are specified for all bandwidth combinations contained in a *bandwidth combination set*, which is indicated per supported band combination in the UE radio access capability. A UE can indicate support of several bandwidth combination sets per band combination.

Requirements for intra-band contiguous carrier aggregation are defined for the carrier aggregation configurations and bandwidth combination sets specified in Table 5.6A.1-1. Requirements for inter-band carrier aggregation are defined for the carrier aggregation configurations and bandwidth combination sets specified in Table 5.6A.1-2.

The DL component carrier combinations for a given CA configuration shall be symmetrical in relation to channel centre unless stated otherwise in Table 5.6A.1-1 or 5.6A.1-2.

# Table 5.6A.1-1: E-UTRA CA configurations and bandwidth combination sets defined for intra-band contiguous CA

| E-UTRA CA configuration / Bandwidth combination set |  |   |  |                                      |                                 |  |  |
|---|--|---|--|--------------------------------------|---------------------------------|--|--|
|   | Uplink CA<br>configurations<br>(NOTE 3)    | Component carriers in c<br>freq                               | Maximum  |                                      |                                 |  |  |
| E-UTRA CA configuration                             |  | Channel bandwidths for<br>carrier [MHz]                       | Channel bandwidths for<br>carrier [MHz]  | aggregated<br>bandwidth<br>[MHz]     | Bandwidth<br>combination<br>set |  |  |
| CA_1C   | CA_1C                                      | 15 15   |  | 40                                   |                                 |  |  |
|   |  | 20  | 20   | 40                                   | 0                               |  |  |
| CA_7C   | CA_7C                                      | 15  | 15   | 40                                   | 0                               |  |  |
|   |  | 20  | 20   | 40                                   |                                 |  |  |
| CA 28C  | CA_38C                                     | 15  | 15   | 40                                   | 0                               |  |  |
| CA_38C  |  | 20  | 20   | 40                                   |                                 |  |  |
|   | CA_40C                                     | 10  | 20   |                                      | 0                               |  |  |
| CA_40C  |  | 15  | 15   | 40                                   |                                 |  |  |
|   |  | 20  | 10, 20   |                                      |                                 |  |  |
|   | CA_41C                                     | 10  | 20   |                                      | 0                               |  |  |
| CA_41C  |  | 15  | 15, 20   | 40                                   |                                 |  |  |
|   |  | 20  | 10, 15, 20   |                                      |                                 |  |  |
| index<br>NOTE 2: For the                            | king letter). Absence<br>he supported CC b | e of a CA bandwidth class for<br>andwidth combinations, the C | a CA bandwidth class specified<br>an operating band implies supp<br>C downlink and uplink bandwid<br>prted by the present release of s | oort of all classe<br>ths are equal. |                                 |  |  |

| E-UTRA CA<br>Configuration   | Uplink CA<br>configurations<br>(NOTE 4)  | E-UTRA C<br>E-<br>UTRA<br>Bands | 1.4<br>MHz | 3<br>MHz   | 5<br>MHz              | 10<br>MHz  | 15<br>MHz  | 20<br>MHz           | Maximum<br>aggregated<br>bandwidth<br>[MHz] | Bandwidth<br>combination<br>set |
|------------------------------|--|---------------------------------|------------|------------|-----------------------|------------|------------|---------------------|---|---------------------------------|
| CA_1A-5A                     | -  | 1                               |            |            |                       | Yes        |            |                     | 20  | 0                               |
|                              |  | 5                               |            |            | Vee                   | Yes        | Vee        | Vee                 |   |                                 |
| CA_1A-18A                    | -  | 1                               | -          |            | Yes                   | Yes        | Yes        | Yes                 | - 35  | 0                               |
|                              |  | 18<br>1                         |            |            | Yes                   | Yes<br>Yes | Yes<br>Yes | Yes                 |   | l                               |
| CA_1A-19A                    | -  | 19                              |            |            | Yes<br>Yes            | Yes        | Yes        | res                 | 35  | 0                               |
|                              |  | 19                              |            |            | Yes                   | Yes        | Yes        | Yes                 |   |                                 |
| CA_1A-21A                    | -  | 21                              |            |            | Yes                   | Yes        | Yes        | 165                 | 35  | 0                               |
|                              |  | 2                               |            |            | Yes                   | Yes        | 163        |                     |   |                                 |
| CA_2A-17A                    | -  | 17                              |            |            | Yes                   | Yes        |            |                     | 20  | 0                               |
|                              |  | 2                               |            |            | Yes                   | Yes        |            |                     |   |                                 |
| CA_2A-29A                    | -  | 29                              |            | Yes        | Yes                   | Yes        |            |                     | 20  | 0                               |
|                              |  | 3                               |            | 163        | 163                   | Yes        | Yes        | Yes                 |   |                                 |
|                              |  | 5                               |            |            | Yes                   | Yes        | 163        | 163                 | - 30  | 0                               |
| CA_3A-5A                     | -  | 3                               |            |            | 163                   | Yes        |            |                     |   |                                 |
|                              |  | 5                               |            |            | Yes                   | Yes        |            |                     | 20  | 1                               |
|                              |  | 3                               |            |            | Yes                   | Yes        | Yes        | Yes                 |   |                                 |
| CA_3A-7A                     | -  | 7                               |            |            | 163                   | Yes        | Yes        | Yes                 | 40  | 0                               |
|                              |  | 3                               | -          |            |                       | Yes        | Yes        | Yes                 |   |                                 |
| CA_3A-8A                     | -  | 8                               |            |            | Yes                   | Yes        | 100        | 103                 | - 30  | 0                               |
|                              |  | 3                               |            |            | 103                   | Yes        |            |                     |   |                                 |
|                              |  | 8                               |            |            | Yes                   | Yes        |            |                     | 20  |                                 |
|                              |  | 3                               |            |            | Yes                   | Yes        | Yes        | Yes                 | - 30  | 0                               |
| CA_3A-20A                    | -  | 20                              |            |            | Yes                   | Yes        | 100        | 100                 |   |                                 |
|                              |  | 4                               |            |            | Yes                   | Yes        |            |                     | - 20  | 0                               |
| CA_4A-5A                     | -  | 5                               |            |            | Yes                   | Yes        |            |                     |   |                                 |
|                              |  | 4                               |            |            | Yes                   | Yes        |            |                     | - 30  | 0                               |
| CA_4A-7A                     | -  | 7                               |            |            | Yes                   | Yes        | Yes        | Yes                 |   |                                 |
|                              |  | 4                               | Yes        | Yes        | Yes                   | Yes        |            |                     |   | 0                               |
| CA_4A-12A                    | -  | 12                              |            |            | Yes                   | Yes        |            |                     | 20  |                                 |
|                              |  | 4                               |            |            | Yes                   | Yes        | Yes        | Yes                 |   |                                 |
|                              | -  | 13                              |            |            |                       | Yes        |            |                     | - 30  | 0                               |
| CA_4A-13A                    |  | 4                               |            |            | Yes                   | Yes        |            |                     |   |                                 |
|                              |  | 13                              |            |            |                       | Yes        |            |                     | 20  | 1                               |
| <u></u>                      |  | 4                               |            |            | Yes                   | Yes        |            |                     |   | _                               |
| CA_4A-17A                    | -  | 17                              |            |            | Yes                   | Yes        |            |                     | 20  | 0                               |
| <u> </u>                     |  | 4                               |            |            | Yes                   | Yes        |            |                     |   | 0                               |
| CA_4A-29A                    | -  | 29                              |            | Yes        | Yes                   | Yes        |            |                     | 20  |                                 |
|                              |  | 5                               |            |            | Yes                   | Yes        |            |                     |   | <u> </u>                        |
| CA_5A -12A                   | -  | 12                              |            |            | Yes                   | Yes        |            |                     | - 20  | 0                               |
|                              |  | 5                               |            |            | Yes                   | Yes        |            |                     |   | <u>^</u>                        |
| CA_5A-17A                    | -  | 17                              |            |            | Yes                   | Yes        |            |                     | 20  | 0                               |
| CA_7A-20A                    |  | 7                               |            |            |                       | Yes        | Yes        | Yes                 | - 30  | 0                               |
|                              | -  | 20                              |            |            | Yes                   | Yes        |            |                     |   |                                 |
| CA_8A-20A                    |  | 8                               |            |            | Yes                   | Yes        |            |                     | - 20  | 0                               |
|                              | -  | 20                              |            |            | Yes                   | Yes        |            |                     | 20  | 0                               |
| CA 11A 40A                   |  | 11                              |            |            | Yes                   | Yes        |            |                     | 25  | 0                               |
| CA_11A-18A                   | -  | 18                              |            |            | Yes                   | Yes        | Yes        |                     | 25  | 0                               |
| (the ind)<br>NOTE 2: For eac | Configuration reference<br>lexing letter). Abser<br>th band combination<br>supported CC band | nce of a CA<br>n, all comb      | bandwid    | th class f | or an ope<br>d bandwi | erating ba | and implie | es support<br>e set | of all classes.                             | able 5.6A-1                     |

# Table 5.6A.1-2: E-UTRA CA configurations and bandwidth combination sets defined for inter-band CA

NOTE 4: Uplink CA configurations are the configurations supported by the present release of specifications.

#### Table 5.6A.1-3: E-UTRA CA configurations and bandwidth combination sets defined for noncontiguous intra-band CA

| E-UTRA CA configuration | L-OTIX                                  | Component c                                | n / Bandwidth combin<br>arriers in order of<br>arrier frequency |   |                              |  |
|-------------------------|---|--|---|---|------------------------------|--|
|                         | Uplink CA<br>configurations<br>(NOTE 1) | Channel<br>bandwidths for<br>carrier [MHz] | Channel<br>bandwidths for<br>carrier [MHz]                      | Maximum<br>aggregated<br>bandwidth<br>[MHz] | Bandwidth<br>combination set |  |
| CA_25A-25A              | -                                       | 5, 10                                      | 5, 10   | 20  | 0                            |  |
| CA_41A-41A              | -                                       | 10, 15, 20                                 | 10, 15, 20  | 40  | 0                            |  |

# 5.6B Channel bandwidth for UL-MIMO

The requirements specified in subclause 5.6 are applicable to UE supporting UL-MIMO.

### 5.6B.1 Void

# 5.7 Channel arrangement

### 5.7.1 Channel spacing

The spacing between carriers will depend on the deployment scenario, the size of the frequency block available and the channel bandwidths. The nominal channel spacing between two adjacent E-UTRA carriers is defined as following:

Nominal Channel spacing =  $(BW_{Channel(1)} + BW_{Channel(2)})/2$ 

where  $BW_{Channel(1)}$  and  $BW_{Channel(2)}$  are the channel bandwidths of the two respective E-UTRA carriers. The channel spacing can be adjusted to optimize performance in a particular deployment scenario.

# 5.7.1A Channel spacing for CA

For intra-band contiguous carrier aggregation bandwidth class C, the nominal channel spacing between two adjacent E-UTRA component carriers is defined as the following:

Nominal channel spacing = 
$$\frac{BW_{Channel(1)} + BW_{Channel(2)} - 0.1 |BW_{Channel(1)} - BW_{Channel(2)}|}{0.6} = 0.3 \text{ [MHz]}$$

where  $BW_{Channel(1)}$  and  $BW_{Channel(2)}$  are the channel bandwidths of the two respective E-UTRA component carriers according to Table 5.6-1 with values in MHz. The channel spacing for intra-band contiguous carrier aggregation can be adjusted to any multiple of 300 kHz less than the nominal channel spacing to optimize performance in a particular deployment scenario.

For intra-band non-contiguous carrier aggregation the channel spacing between two E-UTRA component carriers in different sub-blocks shall be larger than the nominal channel spacing defined in this subclause.

### 5.7.2 Channel raster

The channel raster is 100 kHz for all bands, which means that the carrier centre frequency must be an integer multiple of 100 kHz.

### 5.7.2A Channel raster for CA

For carrier aggregation the channel raster is 100 kHz for all bands, which means that the carrier centre frequency must be an integer multiple of 100 kHz.

### 5.7.3 Carrier frequency and EARFCN

The carrier frequency in the uplink and downlink is designated by the E-UTRA Absolute Radio Frequency Channel Number (EARFCN) in the range 0 - 65535. The relation between EARFCN and the carrier frequency in MHz for the downlink is given by the following equation, where  $F_{DL_{low}}$  and  $N_{Offs-DL}$  are given in Table 5.7.3-1 and  $N_{DL}$  is the downlink EARFCN.

 $F_{DL} = F_{DL \text{ low}} + 0.1(N_{DL} - N_{Offs-DL})$ 

The relation between EARFCN and the carrier frequency in MHz for the uplink is given by the following equation where  $F_{UL\_low}$  and  $N_{Offs-UL}$  are given in Table 5.7.3-1 and  $N_{UL}$  is the uplink EARFCN.

 $F_{UL} = F_{UL\_low} + 0.1(N_{UL} - N_{Offs-UL})$ 

| E-UTRA<br>Operating<br>Band<br>1<br>2<br>3 | <b>F</b> <sub>DL_low</sub> (MHz)<br>2110<br>1930                               | Downlink<br>N <sub>Offs-DL</sub>   | Range of N <sub>DL</sub>  | F <sub>UL_low</sub> (MHz)   | Uplink<br>N <sub>offs-UL</sub>                       | Range of NUL                    |
|--|--|--|---|---|--|---------------------------------|
| 2  |  |  |   |   |  |                                 |
| 3  | 1930   | 0  | 0 - 599   | 1920  | 18000  | 18000 – 18599                   |
|  |  | 600  | 600 - 1199  | 1850  | 18600  | 18600 - 19199                   |
| 4  | 1805   | 1200   | 1200 - 1949   | 1710  | 19200  | 19200 - 19949                   |
| 4  | 2110   | 1950   | 1950 – 2399   | 1710  | 19950  | 19950 - 20399                   |
| 5  | 869  | 2400   | 2400 - 2649   | 824   | 20400  | 20400 - 20649                   |
| 6  | 875  | 2650   | 2650 - 2749   | 830   | 20650  | 20650 - 20749                   |
| 7  | 2620   | 2750   | 2750 - 3449   | 2500  | 20750  | 20750 - 21449                   |
| 8  | 925  | 3450   | 3450 - 3799   | 880   | 21450  | 21450 - 21799                   |
| 9  | 1844.9   | 3800   | 3800 - 4149   | 1749.9  | 21800  | 21800 - 22149                   |
| 10   | 2110   | 4150   | 4150 - 4749   | 1710  | 22150  | 22150 - 22749                   |
| 11   | 1475.9   | 4750   | 4750 - 4949   | 1427.9  | 22750  | 22750 - 22949                   |
| 12   | 729  | 5010   | 5010 - 5179   | 699   | 23010  | 23010 - 23179                   |
| 13   | 746  | 5180   | 5180 - 5279   | 777   | 23180  | 23180 - 23279                   |
| 14   | 758  | 5280   | 5280 - 5379   | 788   | 23280  | 23280 - 23379                   |
|  | 100  | 0200   | 0200 0010   | 100   | 20200  | 20200 20070                     |
| 17   | 734  | 5730   | 5730 - 5849   | 704   | 23730  | 23730 - 23849                   |
| 18   | 860  | 5850   | 5850 - 5999   | 815   | 23850  | 23850 - 23999                   |
| 19   | 875  | 6000   | 6000 - 6149   | 830   | 24000  | 24000 - 24149                   |
| 20   | 791  | 6150   | 6150 - 6449   | 832   | 24150  | 24150 - 24449                   |
| 21   | 1495.9   | 6450   | 6450 - 6599   | 1447.9  | 24450  | 24450 - 24599                   |
| 22   | 3510   | 6600   | 6600 - 7399   | 3410  | 24600  | 24600 - 25399                   |
| 23   | 2180   | 7500   | 7500 - 7699   | 2000  | 25500  | 25500 - 25699                   |
| 24   | 1525   | 7700   | 7700 - 8039   | 1626.5  | 25700  | 25700 - 26039                   |
| 25   | 1930   | 8040   | 8040 - 8689   | 1850  | 26040  | 26040 - 26689                   |
| 26   | 859  | 8690   | 8690 - 9039   | 814   | 26690  | 26690 - 27039                   |
| 27   | 852  | 9040   | 9040 - 9209   | 807   | 27040  | 27040 - 27209                   |
| 28   | 758  | 9210   | 9210 - 9659   | 703   | 27210  | 27210 - 27659                   |
| 29 <sup>2</sup>                            | 717  | 9660   | 9660 - 9769   | 100   | N/A  | 21210 21000                     |
|  |  | 0000   | 0000 0100   |   | 10/7   |                                 |
| 33   | 1900   | 36000  | 36000 - 36199   | 1900  | 36000  | 36000 - 36199                   |
| 34   | 2010   | 36200  | 36200 - 36349   | 2010  | 36200  | 36200 - 36349                   |
| 35   | 1850   | 36350  | 36350 - 36949   | 1850  | 36350  | 36350 - 36949                   |
| 36   | 1930   | 36950  | 36950 - 37549   | 1930  | 36950  | 36950 - 37549                   |
| 37   | 1910   | 37550  | 37550 - 37749   | 1910  | 37550  | 37550 - 37749                   |
| 38   | 2570   | 37750  | 37750 - 38249   | 2570  | 37750  | 37750 - 38249                   |
| 39   | 1880   | 38250  | 38250 - 38649   | 1880  | 38250  | 38250 - 38649                   |
| 40   | 2300   | 38650  | 38650 - 39649   | 2300  | 38650  | 38650 - 39649                   |
| 41   | 2496   | 39650  | 39650 - 41589   | 2496  | 39650  | 39650 - 41589                   |
| 42   | 3400   | 41590  | 41590 - 43589   | 3400  | 41590  | 41590 - 43589                   |
| 43   | 3600   | 43590  | 43590 - 45589   | 3600  | 43590  | 43590 - 45589                   |
| 44   | 703  | 45590  | 45590 - 46589   | 703   | 45590  | 45590 - 46589                   |
| с<br>7<br>с<br>1                           | arrier extends bey<br>5 and 100 channe<br>hannel numbers a<br>0, 15 and 20 MHz | yond the operated<br>al numbers at the<br>at the upper oper<br>a respectively. | ate carrier frequenci-<br>ting band edge shall<br>ne lower operating ba<br>erating band edge sh<br>rhen carrier aggrega | not be used. This in<br>and edge and the las<br>all not be used for c | perating band e polies that the fi st 6, 14, 24, 49, | rst 7, 15, 25, 50,<br>74 and 99 |

#### Table 5.7.3-1: E-UTRA channel numbers

#### TX-RX frequency separation 5.7.4

a) The default E-UTRA TX channel (carrier centre frequency) to RX channel (carrier centre frequency) separation is specified in Table 5.7.4-1 for the TX and RX channel bandwidths defined in Table 5.6.1-1

| E-UTRA Operating Band | TX - RX                  |
|-----------------------|--------------------------|
|                       | carrier centre frequency |
|                       | separation               |
| 1                     | 190 MHz                  |
| 2                     | 80 MHz.                  |
| 3                     | 95 MHz.                  |
| 4                     | 400 MHz                  |
| 5                     | 45 MHz                   |
| 6                     | 45 MHz                   |
| 7                     | 120 MHz                  |
| 8                     | 45 MHz                   |
| 9                     | 95 MHz                   |
| 10                    | 400 MHz                  |
| 11                    | 48 MHz                   |
| 12                    | 30 MHz                   |
| 13                    | -31 MHz                  |
| 14                    | -30 MHz                  |
| 17                    | 30 MHz                   |
| 18                    | 45 MHz                   |
| 19                    | 45 MHz                   |
| 20                    | -41 MHz                  |
| 21                    | 48 MHz                   |
| 22                    | 100 MHz                  |
| 23                    | 180 MHz                  |
| 24                    | -101.5 MHz               |
| 25                    | 80 MHz                   |
| 26                    | 45 MHz                   |
| 27                    | 45 MHz                   |
| 28                    | 55 MHz                   |

Table 5.7.4-1: Default UE TX-RX frequency separation

b) The use of other TX channel to RX channel carrier centre frequency separation is not precluded and is intended to form part of a later release.

# 5.7.4A TX-RX frequency separation for CA

For intra-band contiguous carrier aggregation, the same TX-RX frequency separation as specified in Table 5.7.4-1 is applied to PCC and SCC, respectively.

6 Transmitter characteristics

# 6.1 General

Unless otherwise stated, the transmitter characteristics are specified at the antenna connector of the UE with a single or multiple transmit antenna(s). For UE with integral antenna only, a reference antenna with a gain of 0 dBi is assumed.

- 6.2 Transmit power
- 6.2.1 Void

# 6.2.2 UE maximum output power

The following UE Power Classes define the maximum output power for any transmission bandwidth within the channel bandwidth for non CA configuration and UL-MIMO unless otherwise stated. The period of measurement shall be at least one sub frame (1ms).

| EUTRA<br>band      | Class 1<br>(dBm)  | Tolerance<br>(dB)          | Class 2<br>(dBm)                         | Tolerance<br>(dB)               | Class 3<br>(dBm)             | Tolerance<br>(dB)   | Class 4<br>(dBm)                            | Tolerance<br>(dB)     |
|--------------------|---|----------------------------|--|---------------------------------|------------------------------|---|---|-----------------------|
| 1                  |   |                            |  |                                 | 23                           | ±2  |   |                       |
| 2                  |   |                            |  |                                 | 23                           | $\pm 2^2$   |   |                       |
| 3                  |   |                            |  |                                 | 23                           | $\pm 2^2$   |   |                       |
| 4                  |   |                            |  |                                 | 23                           | ±2  |   |                       |
| 5                  |   |                            |  |                                 | 23                           | ±2  |   |                       |
| 6                  |   |                            |  |                                 | 23                           |   |   |                       |
| 7                  |   |                            |  |                                 | 23                           | $\frac{\pm 2}{\pm 2^2}$   |   |                       |
| 8                  |   |                            |  |                                 | 23                           | $\pm 2^2$   |   |                       |
| 9                  |   |                            |  |                                 | 23                           | ±2  |   |                       |
| 10                 |   |                            |  |                                 | 23                           | ±2  |   |                       |
| 11                 |   |                            |  |                                 | 23                           | ±2  |   |                       |
| 12                 |   |                            |  |                                 | 23                           | $\pm 2^2$   |   |                       |
| 13                 |   |                            |  |                                 | 23                           | <u></u><br>±2   |   |                       |
| 14                 | 31  | +2/-3                      |  |                                 | 23                           | ±2  |   |                       |
|                    | 01  | 12/0                       |  |                                 | 20                           | <u> </u>  |   |                       |
| 17                 |   |                            |  |                                 | 23                           | <u>+2</u>   |   |                       |
| 18                 |   |                            |  |                                 | 23                           | ±2 <sup>5</sup>   |   |                       |
| 19                 |   |                            |  |                                 | 23                           | ±2  |   |                       |
| 20                 |   |                            |  |                                 | 23                           | $\pm 2^{2}$   |   |                       |
| 20                 |   |                            |  |                                 | 23                           | ±2  |   |                       |
| 21                 |   |                            |  |                                 | 23                           | $\pm 2$<br>+2/-3.5 <sup>2</sup>   |   |                       |
|                    |   |                            |  |                                 | 23 <sup>6</sup>              | +2/-3.5<br>±2 <sup>6</sup>  |   |                       |
| 23                 |   |                            |  |                                 |                              |   |   |                       |
| 24                 |   |                            |  |                                 | 23                           | $\frac{\pm 2}{\pm 2^2}$   |   |                       |
| 25                 |   |                            |  |                                 | 23                           |   |   |                       |
| 26                 |   |                            |  |                                 | 23                           | $\pm 2^2$   |   |                       |
| 27                 |   |                            |  |                                 | 23                           | ±2  |   |                       |
| 28                 |   |                            |  |                                 | 23                           | +2/-2.5   |   |                       |
|                    |   |                            |  |                                 |                              |   |   |                       |
| 33                 |   |                            |  |                                 | 23                           | ±2  | -   | -                     |
| 34                 |   |                            |  |                                 | 23                           | <u>+2</u>   |   |                       |
| 35                 |   |                            |  |                                 | 23                           | ±2  |   |                       |
| 36                 |   |                            |  |                                 | 23                           | ±2  |   |                       |
| 37                 |   |                            |  |                                 | 23                           | ±2  |   |                       |
| 38                 |   |                            |  |                                 | 23                           | ±2  |   |                       |
| 39                 | ļ   |                            |  | ļ                               | 23                           | ±2  |   |                       |
| 40                 |   |                            |  |                                 | 23                           | $\pm 2$<br>$\pm 2^2$  |   |                       |
| 41                 |   |                            |  |                                 | 23                           |   |   |                       |
| 42                 |   |                            |  |                                 | 23                           | +2/-3   |   |                       |
| 43                 |   |                            |  |                                 | 23                           | +2/-3   |   |                       |
| 44                 |   |                            |  |                                 | 23                           | +2/[-3]   |   |                       |
| NOTE 1:<br>NOTE 2: | $^{2}$ refers to the F <sub>UL_high</sub> – 4           | MHz and $F_{UL_r}$         | n bandwidth<br><sub>igh</sub> , the maxi | s (Figure 5.6-<br>mum output p  | 1) confined                  | within F <sub>UL_low</sub> ar<br>ement is relaxe                          | nd F <sub>UL_low</sub> + 4<br>d by reducing | MHz or<br>g the lower |
| NOTE 4:            | For the UE<br>P <sub>PowerClass</sub> is<br>For a UE th | the maximum at supports bo | UE power s<br>th Band 18                 | specified witho<br>and Band 26, | out taking int<br>the maximu | g frequencies, t<br>to account the t<br>m output power<br>ndwidths confin | olerance<br>requirement                     | t is relaxed by       |
| NOTE 6:            | 818 MHz.  |                            | -  |                                 |                              | 005 MHz shall b   |   |                       |

Table 6.2.2-1: UE Power Class

# 6.2.2A UE maximum output power for CA

The following UE Power Classes define the maximum output power for any transmission bandwidth within the aggregated channel bandwidth.

The maximum output power is measured as the sum of the maximum output power at each UE antenna connector. The period of measurement shall be at least one sub frame (1ms).

For inter-band carrier aggregation with uplink assigned to one E-UTRA band the requirements in subclause 6.2.2 apply.

For intra-band contiguous carrier aggregation the maximum output power is specified in Table 6.2.2A-1.

| E-UTRA CA<br>Configuration  | Class 1<br>(dBm)  | Tolerance<br>(dB) | Class 2<br>(dBm) | Tolerance<br>(dB) | Class 3<br>(dBm) | Tolerance<br>(dB)  | Class 4<br>(dBm) | Tolerance<br>(dB) |
|---|---|-------------------|------------------|-------------------|------------------|--------------------|------------------|-------------------|
| CA_1C   |   |                   |                  |                   | 23               | +2/-2              |                  |                   |
| CA_7C   |   |                   |                  |                   | 23               | $+2/-2^{2}$        |                  |                   |
| CA_38C  |   |                   |                  |                   | 23               | +2/-2              |                  |                   |
| CA_40C  |   |                   |                  |                   | 23               | +2/-2              |                  |                   |
| CA_41C  |   |                   |                  |                   | 23               | +2/-2 <sup>2</sup> |                  |                   |
| NOTE 1: Void<br>NOTE 2: If all transmitted resource blocks (Figure 5.6A-1) over all component carriers are confined within F <sub>UL_low</sub> and<br>F <sub>UL_low</sub> + 4 MHz or/and F <sub>UL_high</sub> – 4 MHz and F <sub>UL_high</sub> , the maximum output power requirement is relaxed by<br>reducing the lower tolerance limit by 1.5 dB |   |                   |                  |                   |                  |                    |                  |                   |
| NOTE 3: P <sub>Power</sub><br>NOTE 4: For in  | <ul> <li>NOTE 3: P<sub>PowerClass</sub> is the maximum UE power specified without taking into account the tolerance</li> <li>NOTE 4: For intra-band contiguous carrier aggregation the maximum power requirement should apply to the total transmitted power over all component carriers (per UE).</li> </ul> |                   |                  |                   |                  |                    |                  |                   |

Table 6.2.2A-1: CA UE Power Class

For intra-band non-contiguous carrier aggregation with one uplink carrier on the PCC, the requirements in subclause 6.2.2 apply.

# 6.2.2B UE maximum output power for UL-MIMO

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the maximum output power for any transmission bandwidth within the channel bandwidth is specified in Table 6.2.2B-1. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2. For UE supporting UL-MIMO, the maximum output power is measured as the sum of the maximum output power at each UE antenna connector. The period of measurement shall be at least one sub frame (1ms).

| EUTRA<br>band | Class 1<br>(dBm)  | Tolerance<br>(dB)                         | Class 2<br>(dBm)           | Tolerance<br>(dB) | Class 3<br>(dBm) | Tolerance<br>(dB)  | Class 4<br>(dBm) | Tolerance<br>(dB) |
|---------------|---|---|----------------------------|-------------------|------------------|--|------------------|-------------------|
| 1             |   |   |                            |                   | 23               | +2/-3  |                  |                   |
| 2             |   |   |                            |                   | 23               | +2/-3 <sup>2</sup>   |                  |                   |
| 3             |   |   |                            |                   | 23               | +2/-32   |                  |                   |
| 4             |   |   |                            |                   | 23               | +2/-3  |                  |                   |
| 5             |   |   |                            |                   | 23               | +2/-3  |                  |                   |
| 6             |   |   |                            |                   | 23               | +2/-3  |                  |                   |
| 7             |   |   |                            |                   | 23               | $+2/-3^{2}$  |                  |                   |
| 8             |   |   |                            |                   | 23               | +2/-3 <sup>2</sup>   |                  |                   |
| 9             |   |   |                            |                   | 23               | +2/-3  |                  |                   |
| 10            |   |   |                            |                   | 23               | +2/-3  |                  |                   |
| 11            |   |   |                            |                   | 23               | +2/-3  |                  |                   |
| 12            |   |   |                            |                   | 23               | +2/-3 <sup>2</sup>   |                  |                   |
| 13            |   |   |                            |                   | 23               | +2/-3  |                  |                   |
| 14            |   |   |                            |                   | 23               | +2/-3  |                  |                   |
|               |   |   |                            |                   | 20               | 12/0   |                  |                   |
| 17            |   |   |                            |                   | 23               | +2/-3  |                  |                   |
| 18            |   |   |                            |                   | 23               | +2/-3  |                  |                   |
| 19            |   |   |                            |                   | 23               | +2/-3  |                  |                   |
| 20            |   |   |                            |                   | 23               | $+2/-3^{2}$  |                  |                   |
| 20            |   |   |                            |                   | 23               | +2/-3  |                  |                   |
| 21            |   |   |                            |                   | 23               | +2/-3<br>+2/-4.5 <sup>2</sup>  |                  |                   |
|               |   |   |                            |                   |                  | +2/-4.3  |                  |                   |
|               |   |   |                            |                   | 00               | .0/0   |                  |                   |
| 23            |   |   |                            |                   | 23               | +2/-3  |                  |                   |
| 24            |   |   |                            |                   | 23               | +2/-3  |                  |                   |
| 25            |   |   |                            |                   | 23               | $+2/-3^{2}$  |                  |                   |
| 26            |   |   |                            |                   | 23               | +2/-32   |                  |                   |
| 27            |   |   |                            |                   | 23               | +2/-3  | -                |                   |
| 28            |   |   |                            |                   | 23               | +2/[-3]  |                  |                   |
|               |   |   |                            |                   |                  | - / -  |                  |                   |
| 33            |   |   |                            |                   | 23               | +2/-3  |                  |                   |
| 34            |   |   |                            |                   | 23               | +2/-3  |                  |                   |
| 35            |   |   |                            |                   | 23               | +2/-3  |                  |                   |
| 36            |   |   |                            |                   | 23               | +2/-3  |                  |                   |
| 37            |   |   |                            |                   | 23               | +2/-3  |                  |                   |
| 38            |   |   |                            |                   | 23               | +2/-3  |                  |                   |
| 39            |   |   |                            |                   | 23               | +2/-3  |                  |                   |
| 40            |   |   |                            |                   | 23               | +2/-3  |                  |                   |
| 41            |   |   |                            |                   | 23               | +2/-3 <sup>2</sup>   |                  |                   |
| 42            |   |   |                            |                   | 23               | +2/-4  |                  |                   |
| 43            |   |   |                            |                   | 23               | +2/-4  |                  |                   |
| 44            |   |   |                            | T                 | 23               | +2/[-3]  |                  |                   |
|               | $^{2}$ refers to the F <sub>UL_high</sub> – 4 letter tolerance line | MHz and F <sub>UL_</sub><br>nit by 1.5 dB | <sub>high</sub> , the maxi | mum output p      | ower require     | within F <sub>UL_low</sub> ar<br>ement is relaxe<br>g frequencies, t | d by reducing    | g the lower       |
|               |   |   |                            |                   |                  | o account the t  |                  | 13 1 1 0.         |

Table 6.2.2B-1: UE Power Class for UL-MIMO in closed loop spatial multiplexing scheme

#### Table 6.2.2B-2: UL-MIMO configuration in closed-loop spatial multiplexing scheme

| Transmission mode | DCI format   | Codebook Index   |
|-------------------|--------------|------------------|
| Mode 2            | DCI format 4 | Codebook index 0 |

For single-antenna port scheme, the requirements in subclause 6.2.2 apply.

# 6.2.3 UE maximum output power for modulation / channel bandwidth

For UE Power Class 1 and 3, the allowed Maximum Power Reduction (MPR) for the maximum output power in Table 6.2.2-1due to higher order modulation and transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3-1.

| Modulation | Modulation Channel bandwidth / Transmission bandwidth (N <sub>RB</sub> ) |            |          |           |           | MPR (dB)  |     |
|------------|--|------------|----------|-----------|-----------|-----------|-----|
|            | 1.4<br>MHz   | 3.0<br>MHz | 5<br>MHz | 10<br>MHz | 15<br>MHz | 20<br>MHz |     |
| QPSK       | > 5  | > 4        | > 8      | > 12      | > 16      | > 18      | ≤ 1 |
| 16 QAM     | ≤ 5  | ≤ 4        | ≤ 8      | ≤ 12      | ≤ 16      | ≤ 18      | ≤ 1 |
| 16 QAM     | > 5  | > 4        | > 8      | > 12      | > 16      | > 18      | ≤ 2 |

Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 1 and 3

For PRACH, PUCCH and SRS transmissions, the allowed MPR is according to that specified for PUSCH QPSK modulation for the corresponding transmission bandwidth.

For each subframe, the MPR is evaluated per slot and given by the maximum value taken over the transmission(s) within the slot; the maximum MPR over the two slots is then applied for the entire subframe.

For transmissions with non-contiguous resource allocation in single component carrier, the allowed Maximum Power Reduction (MPR) for the maximum output power in table 6.2.2-1, is specified as follows

$$MPR = CEIL \{M_A, 0.5\}$$

Where M<sub>A</sub> is defined as follows

| $M_A =$ | 8.00-10.12A  | ; 0.00< A $\leq$ 0.33 |
|---------|--------------|-----------------------|
|         | 5.67 - 3.07A | ; 0.33< A ≤0.77       |
|         | 3.31         | ; 0.77< A ≤1.0        |

Where

 $A = N_{RB\_alloc} \ / \ N_{RB}$ 

CEIL{M<sub>A</sub>, 0.5} means rounding upwards to closest 0.5dB, i.e. MPR  $\in$  [3.0, 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0]

For the UE maximum output power modified by MPR, the power limits specified in subclause 6.2.5 apply.

# 6.2.3A UE Maximum Output power for modulation / channel bandwidth for CA

For inter-band carrier aggregation with uplink assigned to one E-UTRA band (Table 5.6A-1), the requirements in subclause 6.2.3 apply.

For intra-band contiguous carrier aggregation the allowed Maximum Power Reduction (MPR) for the maximum output power in Table 6.2.2A-1due to higher order modulation and contiguously aggregated transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3A-1. In case the modulation format is different on different component carriers then the MPR is determined by the rules applied to higher order of those modulations.

| Modulation |                   | CA bandwidth Class C |                  |                    |      |  |
|------------|-------------------|----------------------|------------------|--------------------|------|--|
|            | 50 RB + 100<br>RB | 75 RB + 75<br>RB     | 75 RB+100<br>RB  | 100 RB + 100<br>RB | (dB) |  |
| QPSK       | > 12 and ≤<br>50  | > 16 and ≤<br>75     | > 16 and ≤<br>75 | > 18 and ≤<br>100  | ≤ 1  |  |
| QPSK       | > 50              | > 75                 | > 75             | > 100              | ≤2   |  |
| 16 QAM     | ≤ 12              | ≤ 16                 | ≤ 16             | ≤ 18               | ≤1   |  |
| 16 QAM     | > 12 and ≤<br>50  | > 16 and ≤<br>75     | > 16 and ≤<br>75 | > 18 and ≤<br>100  | ≤2   |  |
| 16 QAM     | > 50              | > 75                 | > 75             | > 100              | ≤ 3  |  |

Table 6.2.3A-1: Maximum Power Reduction (MPR) for Power Class 3

For PUCCH and SRS transmissions, the allowed MPR is according to that specified for PUSCH QPSK modulation for the corresponding transmission bandwidth.

For intra-band contiguous carrier aggregation bandwidth class C with non-contiguous resource allocation, the allowed Maximum Power Reduction (MPR) for the maximum output power in Table 6.2.2A-1 is specified as follows

$$MPR = CEIL \{M_{A}, 0.5\}$$

Where MA is defined as follows

| $M_A =$ | 8.2          | ; $0 \le A < 0.025$        |
|---------|--------------|----------------------------|
|         | 9.2 - 40A    | ; $0.025\!\le\!A\!<\!0.05$ |
|         | 8 – 16A      | ; 0.05 $\leq A < 0.25$     |
|         | 4.83 - 3.33A | ; $0.25 \le A \le 0.4$ ,   |
|         | 3.83 - 0.83A | ; 0.4 $\leq$ A $\leq$ 1,   |

Where

 $A = N_{RB\_alloc} / N_{RB\_agg.}$ 

CEIL{ $M_{A, 0.5}$ } means rounding upwards to closest 0.5dB, i.e. MPR  $\in$  [3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0, 6.5, 7.0, 7.5, 8.0, 8.5]

For intra-band carrier aggregation, the MPR is evaluated per slot and given by the maximum value taken over the transmission(s) on all component carriers within the slot; the maximum MPR over the two slots is then applied for the entire subframe.

For the UE maximum output power modified by MPR, the power limits specified in subclause 6.2.5A apply.

For intra-band non-contiguous carrier aggregation with one uplink carrier on the PCC, the requirements in subclause 6.2.3 apply.

# 6.2.3B UE maximum output power for modulation / channel bandwidth for UL-MIMO

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the allowed Maximum Power Reduction (MPR) for the maximum output power in Table 6.2.2B-1 is specified in Table 6.2.3-1. The requirements shall be met with UL-MIMO configurations defined in Table 6.2.2B-2. For UE supporting UL-MIMO, the maximum output power is measured as the sum of the maximum output power at each UE antenna connector.

For the UE maximum output power modified by MPR, the power limits specified in subclause 6.2.5B apply.

For single-antenna port scheme, the requirements in subclause 6.2.3 apply.

# 6.2.4 UE maximum output power with additional requirements

Additional ACLR and spectrum emission requirements can be signalled by the network to indicate that the UE shall also meet additional requirements in a specific deployment scenario. To meet these additional requirements, Additional Maximum Power Reduction (A-MPR) is allowed for the output power as specified in Table 6.2.2-1. Unless stated otherwise, an A-MPR of 0 dB shall be used.

For UE Power Class 1 and 3 the specific requirements and identified subclauses are specified in Table 6.2.4-1 along with the allowed A-MPR values that may be used to meet these requirements. The allowed A-MPR values specified below in Table 6.2.4-1 to 6.2.4-15 are in addition to the allowed MPR requirements specified in subclause 6.2.3.

| Network<br>Signalling<br>value | Requirements<br>(subclause) | E-UTRA Band                | Channel<br>bandwidth<br>(MHz) | Resources<br>Blocks ( <i>N</i> <sub>RB</sub> ) | A-MPR (dB)                    |
|--------------------------------|-----------------------------|----------------------------|-------------------------------|--|-------------------------------|
| NS_01                          | 6.6.2.1.1                   | Table 5.5-1                | 1.4, 3, 5, 10,<br>15, 20      | Table 5.6-1                                    | N/A                           |
|                                |                             |                            | 3                             | >5   | ≤ 1                           |
|                                |                             | 0 4 40 00 05               | 5                             | >6   | ≤ 1                           |
| NS_03                          | 6.6.2.2.1                   | 2, 4,10, 23, 25,<br>35, 36 | 10                            | >6   | ≤ 1                           |
|                                |                             | 35, 50                     | 15                            | >8   | ≤1                            |
|                                |                             |                            | 20                            | >10  | ≤1                            |
| NS_04                          | 6.6.2.2.2                   | 41                         | 5                             | >6   | ≤1                            |
| NS_04                          | 0.0.2.2.2                   | 41                         | 10, 15, 20                    | Table  | 6.2.4-4                       |
| NS_05                          | 6.6.3.3.1                   | 1                          | 10,15,20                      | ≥ 50   | ≤ 1                           |
| NS_06                          | 6.6.2.2.3                   | 12, 13, 14, 17             | 1.4, 3, 5, 10                 | Table 5.6-1                                    | N/A                           |
| NS_07                          | 6.6.2.2.3<br>6.6.3.3.2      | 13                         | 10                            | Table  | 6.2.4-2                       |
| NS_08                          | 6.6.3.3.3                   | 19                         | 10, 15                        | > 44   | ≤ 3                           |
|                                | 66224                       | 21                         | 10 15                         | > 40   | ≤1                            |
| NS_09                          | 6.6.3.3.4                   | 21                         | 10, 15                        | > 55   | ≤ 2                           |
| NS_10                          |                             | 20                         | 15, 20                        | Table  | 6.2.4-3                       |
| NS_11                          | 6.6.2.2.1<br>6.6.3.3.13     | 23                         | 1.4, 3, 5, 10,<br>15, 20      | Table 6.2.4-5                                  |                               |
| NS_12                          | 6.6.3.3.5                   | 26                         | 1.4, 3, 5                     | Table  | 6.2.4-6                       |
| NS_13                          | 6.6.3.3.6                   | 26                         | 5                             | Table  | 6.2.4-7                       |
| NS_14                          | 6.6.3.3.7                   | 26                         | 10, 15                        | Table  | 6.2.4-8                       |
| NS_15                          | 6.6.3.3.8                   | 26                         | 1.4, 3, 5, 10,<br>15          |  | 6.2.4-9<br>6.2.4-10           |
| NS_16                          | 6.6.3.3.9                   | 27                         | 3, 5, 10                      |  | , Table 6.2.4-12,<br>6.2.4-13 |
| NS_17                          | 6.6.3.3.10                  | 28                         | 5, 10                         | Table 5.6-1                                    | N/A                           |
| NS_18                          | 6.6.3.3.11                  | 28                         | 5<br>10, 15, 20               | ≥2<br>≥1                                       | ≤ 1<br>≤ 4                    |
| NS_19                          | 6.6.3.3.12                  | 44                         | 10, 15, 20                    | —  | <u>≤ 4</u><br>6.2.4-14        |
| 61_01                          | 6.2.2                       | 44                         | 10, 15, 20                    | rable  | 0.2.4-14                      |
| NS_20                          | 6.6.2.2.1<br>6.6.3.3.14     | 23                         | 5, 10, 15, 20                 | Table  | 6.2.4-15                      |
| NS_22                          | 6.6.3.3.15<br>6.6.3.3.16    | 42, 43                     | 5, 10, 15, 20                 | Table  | 6.2.4-16                      |
|                                |                             |                            |                               |  |                               |
| NS_32                          | -                           | -                          | -                             | -  | -                             |

Table 6.2.4-1: Additional Maximum Power Reduction (A-MPR)

| Parameters   | Re   | egion A            | Regio   | Region B |         |  |
|--|--|--------------------|---------|----------|---------|--|
| RB <sub>start</sub>  |  | 0 - 12             | 13 – 18 | 19 – 42  | 43 – 49 |  |
| L <sub>CRB</sub> [RBs]   | 6-8  | 1 to 5 and<br>9-50 | ≥8      | ≥18      | ≤2      |  |
| A-MPR [dB]   | ≤ 8  | ≤ 12               | ≤ 12    | ≤ 6      | ≤ 3     |  |
| NOTE 1;       RB <sub>start</sub> indicates the lowest RB index of transmitted resource blocks         NOTE 2;       L <sub>CRB</sub> is the length of a contiguous resource block allocation         NOTE 3:       For intra-subframe frequency hopping between two regions, notes 1 and 2 apply on a per slot basis. |  |                    |         |          |         |  |
|  | NOTE 4; For intra-subframe frequency hopping between two regions, the larger A-MPR value of the two regions may be applied for both slots in the subframe. |                    |         |          |         |  |

Table 6.2.4-2: A-MPR for "NS\_07"

Table 6.2.4-3: A-MPR for "NS\_10"

| Channel<br>bandwidth [MHz]  | Parameters  | Region A                       |  |  |  |  |
|---|---|--------------------------------|--|--|--|--|
|   | RB <sub>start</sub>   | 0 – 10                         |  |  |  |  |
| 15  | L <sub>CRB</sub> [RBs]  | 1 -20                          |  |  |  |  |
|   | A-MPR [dB]  | ≤2                             |  |  |  |  |
|   | RB <sub>start</sub>   | 0 – 15                         |  |  |  |  |
| 20  | L <sub>CRB</sub> [RBs]  | 1 -20                          |  |  |  |  |
|   | A-MPR [dB]  | ≤ 5                            |  |  |  |  |
| NOTE 1: RB <sub>start</sub> inc   | licates the lowest RB index   | of transmitted resource blocks |  |  |  |  |
| NOTE 2: LCRB is th  | e length of a contiguous re   | source block allocation        |  |  |  |  |
| NOTE 3: For intra-  | NOTE 3: For intra-subframe frequency hopping which intersects Region A, notes 1 and 2 apply |                                |  |  |  |  |
| on a per  | on a per slot basis   |                                |  |  |  |  |
| NOTE 4: For intra-subframe frequency hopping which intersect Region A, the larger A-MPR |   |                                |  |  |  |  |
| value ma  | y be applied for both slots i   | in the subframe                |  |  |  |  |

| Channel<br>bandwidth<br>[MHz]  | Parameters                                   | Region A         | Region B | Region C         |  |
|--|--|------------------|----------|------------------|--|
| 10   | RB <sub>start</sub>                          | 0 – 12           | 13 – 36  | 37 – 49          |  |
|  | RB <sub>start</sub> + L <sub>CRB</sub> [RBs] | N/A              | >37      | N/A <sup>3</sup> |  |
|  | A-MPR [dB]                                   | ≤3dB             | ≤2dB     | ≤3dB             |  |
| 15   | RB <sub>start</sub>                          | 0 – 18           | 19 – 55  | 56 – 74          |  |
|  | RB <sub>start</sub> + L <sub>CRB</sub> [RBs] | N/A              | >56      | N/A <sup>3</sup> |  |
|  | A-MPR [dB]                                   | ≤3dB             | ≤2dB     | ≤3dB             |  |
| 20   | RB <sub>start</sub>                          | 0 – 24           | 25 – 74  | 75 – 99          |  |
|  | RB <sub>start</sub> + L <sub>CRB</sub> [RBs] | N/A <sup>3</sup> | >75      | N/A <sup>3</sup> |  |
|  | A-MPR [dB]                                   | ≤3dB             | ≤2dB     | ≤3dB             |  |
| NOTE 1:RB <sub>start</sub> indicates the lowest RB index of transmitted resource blocksNOTE 2:L <sub>CRB</sub> is the length of a contiguous resource block allocationNOTE 3: <sup>3</sup> refers to any RB allocation that starts in Region A or C is allowed the specified A-MPRNOTE 4:For intra-subframe frequency hopping which intersects regions, notes 1 and 2 apply on a per slot basisNOTE 5:For intra-subframe frequency hopping which intersects regions, the larger A-MPR value may be applied for |  |                  |          |                  |  |
|  | ts in the subframe                           | 0                |          |                  |  |

| Channel<br>Bandwidth<br>[MHz] | Parameters             |         |           |       |             |              |                             |       |       |       |
|-------------------------------|------------------------|---------|-----------|-------|-------------|--------------|-----------------------------|-------|-------|-------|
|                               | Fc [MHz]               | <20     | 04        |       |             | ≥2004        |                             |       |       |       |
| 3                             | L <sub>CRB</sub> [RBs] | 1-1     | 15        |       | >5          |              |                             |       |       |       |
|                               | A-MPR [dB]             | ≤       | -         |       |             | ≤ 1          |                             |       |       |       |
|                               | Fc [MHz]               | <20     | <2004 200 |       | )4 ≤ Fc <   | 2007         |                             | ≥2(   | 007   |       |
| 5                             | L <sub>CRB</sub> [RBs] | 1-25    |           |       |             | 6 &<br>-25   | 8-12                        |       | >     | ·6    |
|                               | A-MPR [dB]             | ≤]      | 7         |       | 5           | 4            | 0                           |       | S     | 1     |
|                               | Fc [MHz]               | 200     | )5 ≤      | Fc <2 | 2015        | 5            |                             | 201   | 5     |       |
|                               | RB <sub>start</sub>    | 0-49    |           |       |             |              | 0-49                        | 9     |       |       |
| 10                            | L <sub>CRB</sub> [RBs] | 1-50    |           |       | 1-50        |              |                             |       |       |       |
|                               | A-MPR [dB]             | ≤ 12    |           |       | 0           |              |                             |       |       |       |
|                               | Fc [MHz]               | <2012.5 |           |       |             |              |                             |       |       |       |
|                               | RB <sub>start</sub>    | 0-4     |           |       | 5-21        | 1            | 22                          | 22-56 |       | 57-74 |
|                               | L <sub>CRB</sub> [RBs] | ≥1      | 7-:       | 50    | 0-          | 6 & ≥50      | ≤25                         | >2    | 5     | >0    |
|                               | A-MPR [dB]             | ≤15     | ≤         | 7     |             | ≤10          | 0                           | ≤6    | 6     | ≤15   |
| 15                            | Fc [MHz]               |         |           |       |             | 2012         | .5                          |       |       |       |
|                               | RB <sub>start</sub>    | 0-12    |           |       | 13          | -39          | 40-6                        | 5     |       | 66-74 |
|                               | L <sub>CRB</sub> [RBs] | ≥1      | ≥1 ≥30    |       | 0           | <30          | ≥ (69<br>RB <sub>star</sub> |       |       | ≥1    |
|                               | A-MPR [dB]             | ≤10     | ≤10       |       | ≤6 0        |              | ≤2                          |       |       | ≤6.5  |
|                               | Fc [MHz]               | 2       |           | 2010  | )           |              |                             |       |       |       |
|                               | RB <sub>start</sub>    | 0-12    |           | 1     | 13-29 30-68 |              | 68                          |       | 69-99 |       |
| 20                            | L <sub>CRB</sub> [RBs] | ≥1      | 10        | -60   |             | 1-9 &<br>>60 | 1-24                        | ≥2    | 5     | ≥1    |
|                               | A-MPR [dB]             | ≤15     | 4         | ≦7    |             | ≤10          | 0                           | ≤7    | 7     | ≤15   |

Table 6.2.4-5: A-MPR for "NS\_11"

| Channel<br>bandwidth<br>[MHz] | Parameters             | Reg | Region B      |     |
|-------------------------------|------------------------|-----|---------------|-----|
|                               | RB <sub>start</sub>    |     | 0             | 1-2 |
| 1.4                           | L <sub>CRB</sub> [RBs] | ≤3  | ≥4            | ≥4  |
|                               | A-MPR [dB]             | ≤3  | ≤6            | ≤3  |
|                               | RB <sub>start</sub>    | 0-3 |               | 4-5 |
| 3                             | L <sub>CRB</sub> [RBs] | 4-9 | 1-3 and 10-15 | ≥9  |
|                               | A-MPR [dB]             | ≤4  | ≤3            | ≤3  |
|                               | RB <sub>start</sub>    | 0-6 |               | 7-9 |
| 5                             | L <sub>CRB</sub> [RBs] | ≤8  | ≥9            | ≥15 |
|                               | A-MPR [dB]             | ≤5  | ≤3            | ≤3  |

Table 6.2.4-6: A-MPR for "NS\_12"

Table 6.2.4-7: A-MPR for "NS\_13"

| Channel<br>bandwidth<br>[MHz] | Parameters             | Region A |     |
|-------------------------------|------------------------|----------|-----|
|                               | RB <sub>start</sub>    | 0-2      |     |
| 5                             | L <sub>CRB</sub> [RBs] | ≤5       | ≥18 |
|                               | A-MPR [dB]             | ≤3       | ≤2  |

#### Table 6.2.4-8: A-MPR for "NS\_14"

| Channel<br>bandwidth<br>[MHz] | Parameters             | Region A |     |
|-------------------------------|------------------------|----------|-----|
|                               | RB <sub>star</sub> t   | 0        |     |
| 10                            | L <sub>CRB</sub> [RBs] | ≤5       | ≥50 |
|                               | A-MPR [dB]             | ≤3       | ≤1  |
|                               | RB <sub>start</sub>    | 3≥       | 3   |
| 15                            | L <sub>CRB</sub> [RBs] | ≤16      | ≥50 |
|                               | A-MPR [dB]             | ≤3       | ≤1  |

Table 6.2.4-9: A-MPR for "NS\_15" for E-UTRA highest channel edge > 845 MHz and ≤ 849 MHz

| Channel<br>bandwidth<br>[MHz] | Parameters             | Region A | Region B | Region C |
|-------------------------------|------------------------|----------|----------|----------|
| 1.4                           | RB <sub>end</sub> [RB] |          |          | 4-5      |
|                               | A-MPR [dB]             |          |          | ≤3       |
|                               | RB <sub>end</sub> [RB] | 0-1      | 8-12     | 13-14    |
| 3                             | L <sub>CRB</sub> [RB]  | ≤2       | ≥8       | >0       |
|                               | A-MPR [dB]             | ≤4       | ≤4       | ≤9       |
|                               | RB <sub>end</sub> [RB] | 0-4      | 12-19    | 20-24    |
| 5                             | L <sub>CRB</sub> [RB]  | ≤2       | ≥8       | >0       |
|                               | A-MPR [dB]             | ≤4       | ≤5       | ≤9       |
|                               | RB <sub>end</sub> [RB] | 0-12     | 23-36    | 37-49    |
| 10                            | L <sub>CRB</sub> [RB]  | ≤2       | ≥15      | >0       |
|                               | A-MPR [dB]             | ≤4       | ≤6       | ≤9       |
|                               | RB <sub>end</sub> [RB] | 0-20     | 26-53    | 54-74    |
| 15                            | L <sub>CRB</sub> [RB]  | ≤2       | ≥20      | >0       |
|                               | A-MPR [dB]             | ≤4       | ≤5       | ≤9       |

| Channel<br>bandwidth<br>[MHz] | Parameters             | Region A | Region B | Region C |
|-------------------------------|------------------------|----------|----------|----------|
|                               | RB <sub>end</sub> [RB] |          |          | 19-24    |
| 5                             | L <sub>CRB</sub> [RB]  |          |          | ≥18      |
|                               | A-MPR [dB]             |          |          | ≤2       |
|                               | RB <sub>end</sub> [RB] | 0-4      | 29-44    | 45-49    |
| 10                            | L <sub>CRB</sub> [RB]  | ≤2       | ≥24      | >0       |
|                               | A-MPR [dB]             | ≤4       | ≤4       | ≤9       |
|                               | RB <sub>end</sub> [RB] | 0-12     | 44-61    | 62-74    |
| 15                            | L <sub>CRB</sub> [RB]  | ≤2       | ≥20      | >0       |
|                               | A-MPR [dB]             | ≤4       | ≤5       | ≤9       |

Table 6.2.4-10: A-MPR for "NS\_15" for E-UTRA highest channel edge ≤ 845 MHz

## Table 6.2.4-11: A-MPR for "NS\_16" with channel lower edge at ≥807 MHz and <808.5 MHz

| Channel<br>bandwidth<br>[MHz] | Parameter              | Region A | Region B | Region B Region C |       | Region E |
|-------------------------------|------------------------|----------|----------|-------------------|-------|----------|
|                               | RB <sub>start</sub>    | 0        | 1-2      |                   |       |          |
| 3 MHz                         | L <sub>CRB</sub> [RBs] | ≥12      | 12       |                   |       |          |
|                               | A-MPR [dB]             | ≤2       | ≤1       |                   |       |          |
|                               | RB <sub>start</sub>    | 0-1      | 2        | 2-9               | 2-5   |          |
| 5 MHz                         | L <sub>CRB</sub> [RBs] | 1 - 25   | 12       | 15-18             | 20    |          |
|                               | A-MPR [dB]             | ≤5       | ≤1       | ≤2                | ≤3    |          |
|                               | RB <sub>start</sub>    | 0 - 8    | 0-14     |                   | 15-20 | 15-24    |
| 10 MHz                        | L <sub>CRB</sub> [RBs] | 1 - 12   | 15-20    | ≥24               | ≥30   | 24-27    |
|                               | A-MPR [dB]             | ≤5       | ≤3       | ≤7                | ≤3    | ≤1       |

| Table 6.2.4-12: A-MPR for "NS | _16" with channel lower edge at ≥808.5 MHz and <812 MHz |
|-------------------------------|---|
|                               |   |

| Channel<br>bandwidth<br>[MHz] | Parameter              | Region A | Region B | Region C | Region D | Region E |
|-------------------------------|------------------------|----------|----------|----------|----------|----------|
|                               | RB <sub>start</sub>    | 0        | 0-1      | 1-5      |          |          |
| 5 MHz                         | L <sub>CRB</sub> [RBs] | 16-20    | ≥24      | 16-20    |          |          |
|                               | A-MPR [dB]             | ≤2       | ≤3       | ≤1       |          |          |
|                               | RB <sub>start</sub>    | 0.       | -6       | 0-10     | 0-14     | 11-20    |
| 10 MHz                        | L <sub>CRB</sub> [RBs] | 1-12     | 15-20    | 24-32    | ≥36      | 24-32    |
|                               | A-MPR [dB]             | ≤5       | ≤2       | ≤4       | ≤5       | ≤1       |

| Table 6.2.4-13: A-MPR for "NS | _16' | ' with channel | l lower edge at ≥812 MHz |
|-------------------------------|------|----------------|--------------------------|
|-------------------------------|------|----------------|--------------------------|

| Channel<br>bandwidth<br>[MHz] | Parameter              | Region A | Region B | Region C | Region D |
|-------------------------------|------------------------|----------|----------|----------|----------|
|                               | RB <sub>start</sub>    | 0 - 9    | 0        | 1-14     | 0-5      |
| 10 MHz                        | L <sub>CRB</sub> [RBs] | 27-32    | 36-40    | 36-40    | ≥45      |
|                               | A-MPR [dB]             | ≤1       | ≤2       | ≤1       | ≤3       |

| Channel<br>bandwidth<br>[MHz] | Parameters             | Region A |     | Region B |
|-------------------------------|------------------------|----------|-----|----------|
|                               | RB <sub>start</sub>    |          |     | 0-6      |
| 10                            | L <sub>CRB</sub> [RBs] |          |     | ≥40      |
|                               | A-MPR [dB]             |          |     | ≤1       |
|                               | RB <sub>start</sub>    | 0.       | -6  | 7-20     |
| 15                            | L <sub>CRB</sub> [RBs] | ≤18      | ≥36 | ≥42      |
|                               | A-MPR [dB]             | ≤2       | ≤3  | ≤2       |
|                               | RB <sub>start</sub>    | 0-       | 14  | 15-30    |
| 20                            | L <sub>CRB</sub> [RBs] | ≤40      | ≥45 | ≥50      |
|                               | A-MPR [dB]             | ≤2       | ≤3  | ≤2       |

## Table 6.2.4-14: A-MPR for "NS\_19"

## Table 6.2.4-15: A-MPR for "NS\_20"

| Channel<br>Bandwidth<br>[MHz]   | Parameters  |            |                                      |       |      |      |       |            |       |       |
|---|---|------------|--------------------------------------|-------|------|------|-------|------------|-------|-------|
|   | Fc [MHz]  | < 20       | < 2007.5 ≤ Fc < 2012.5 ≤ Fc ≤ 2017.5 |       |      |      |       | c ≤ 2017.5 |       |       |
| 5   | RB <sub>start</sub>   | ≤2         | 24                                   |       | 0    | -3   |       | 4-6        | ≤2    | 24    |
| 5   | L <sub>CRB</sub> [RBs]  | >          | 0                                    | 1:    | 5-19 | ≥2(  | )     | ≥18        | 1-:   | 25    |
|   | A-MPR [dB]  | Ì          | 17                                   |       | ≤1   | ≤4   |       | ≤2         | ≤     | 0     |
|   | Fc [MHz]  |            |                                      |       |      | 2    | 005   |            |       |       |
|   | RB <sub>start</sub>   |            | 0-25                                 |       |      |      | 26-34 |            | 35-   | 49    |
|   | L <sub>CRB</sub> [RBs]  |            | >0                                   |       | 8    | 3-15 | ;     | >15        | >     | 0     |
| 10  | A-MPR [dB]  |            | ≤16                                  |       |      | ≤2   |       | ≤5         | ≤     | 6     |
| 10  | Fc [MHz]  | 2015       |                                      |       |      |      |       |            |       |       |
|   | RB <sub>start</sub>   |            | 0                                    | -5    |      |      |       |            | 6-10  |       |
|   | L <sub>CRB</sub> [RBs]  |            | ≥(                                   | 32    |      |      |       | ≥40        |       |       |
|   | A-MPR [dB]  |            | ≤                                    | 4     |      |      |       | ≤2         |       |       |
|   | Fc [MHz]  |            |                                      |       |      | 20   | )12.5 |            |       |       |
| 15  | RB <sub>start</sub>   |            | 0-14                                 |       |      |      | 15-24 |            | 25-39 | 61-74 |
| 15  | L <sub>CRB</sub> [RBs]  | 1-9 & 4    | 0-75                                 | 10-3  | 39   | 24-2 | 29    | ≥30        | ≥36   | ≤6    |
|   | A-MPR [dB]  | ≤11        |                                      | ≤6    |      | ≤1   |       | ≤7         | ≤5    | ≤6    |
|   | Fc [MHz]  |            |                                      |       |      | 2    | 010   |            |       |       |
| 20  | RB <sub>start</sub>   | 0-21       |                                      | 22-31 |      |      | 32-38 | 39-49      | 50-68 | 69-99 |
| 20  | L <sub>CRB</sub> [RBs]  | >0         | 1-9&3                                | 31-75 | 10-3 | 30   | ≥15   | ≥24        | ≥25   | >0    |
|   | A-MPR [dB]  | ≤17 ≤12 ≤6 |                                      | ≤9    | ≤7   | ≤5   | ≤16   |            |       |       |
|   | NOTE 1: When NS_20 is signaled the minimum requirements for the 10 MHz bandwidth are specified for E-UTRA |            |                                      |       |      |      |       |            |       |       |
| UL carrier center frequencies of 2005 MHz or 2015 MHz.<br>NOTE 2: When NS_20 is signaled the minimum requirements for the 15 MHz channel bandwidth are specified for<br>E-UTRA UL carrier center frequency of 2012.5 MHz. |   |            |                                      |       |      |      |       |            |       |       |

| Channel<br>bandwidth [MHz] | Parameters              | Region A          | Region B          | Region C      | Region D |
|----------------------------|-------------------------|-------------------|-------------------|---------------|----------|
| 5                          | N                       | lo A-MPR is neede | d for 5 MHz chanr | nel bandwidth |          |
| 10                         | RB <sub>start</sub>     | 0-13              | 0-17              | ≤ 6           | ≥12      |
|                            | L <sub>CRB</sub> [RBs]  | > 36              | 33-36             | ≤ 32          | ≤ 32     |
|                            | RBstart + LCRB<br>[RBs] | N/A               | N/A               | N/A           | ≥44      |
|                            | A-MPR [dB]              | 4                 | 3                 | 3             | 3        |
| 15                         | RB <sub>start</sub>     | 0-24              | 0-38              | ≤ 14          | ≥ 23     |
|                            | L <sub>CRB</sub> [RBs]  | > 50              | 37-50             | ≤ 36          | ≤ 36     |
|                            | RBstart + LCRB<br>[RBs] | N/A               | N/A               | N/A           | ≥59      |
|                            | A-MPR [dB]              | 5                 | 4                 | 3             | 3        |
| 20                         | RB <sub>start</sub>     | 0-35              | 0-51              | ≤ 21          | ≥ 31     |
|                            | L <sub>CRB</sub> [RBs]  | > 64              | 49-64             | ≤ 48          | ≤ 48     |
|                            | RBstart + LCRB<br>[RBs] | N/A               | N/A               | N/A           | ≥79      |
|                            | A-MPR [dB]              | 5                 | 4                 | 3             | 3        |

#### Table 6.2.4-16: A-MPR for "NS\_22"

NOTE 4; For intra-subframe frequency hopping between two regions, the larger A-MPR value of the two regions may be applied for both slots in the subframe.

For PRACH, PUCCH and SRS transmissions, the allowed A-MPR is according to that specified for PUSCH QPSK modulation for the corresponding transmission bandwidth.

For each subframe, the A-MPR is evaluated per slot and given by the maximum value taken over the transmission(s) within the slot; the maximum A-MPR over the two slots is then applied for the entire subframe.

For the UE maximum output power modified by A-MPR, the power limits specified in subclause 6.2.5 apply.

#### 6.2.4A UE maximum output power with additional requirements for CA

Additional ACLR, spectrum emission and spurious emission requirements for carrier aggregation can be signalled by the network to indicate that the UE shall also meet additional requirements in a specific deployment scenario. To meet these additional requirements, Additional Maximum Power Reduction (A-MPR) is allowed for the CA Power Class as specified in Table 6.2.2A-1.

If for intra-band carrier aggregation the UE is configured for transmissions within an E-UTRA channel bandwidth, then subclauses 6.2.3 and 6.2.4 apply with the Network Signaling value indicated by the IE additionalSpectrumEmission of the PCC.

For intra-band contiguous aggregation with the UE configured for transmissions within the aggregated channel bandwidth, the maximum output power reductions specified in Table 6.2.4A-1 is allowed when the applicable CA network signalling value is indicated by the IE additionalSpectrumEmissionSCell-r10. Then clause 6.2.3A does not apply, i.e. carrier aggregation MPR = 0 dB.

| CA Network Signalling value | Requirements<br>(subclause) | Uplink CA Configuration | A-MPR [dB]<br>(subclause) |
|-----------------------------|-----------------------------|-------------------------|---------------------------|
| CA_NS_01                    | 6.6.3.3A.1                  | CA_1C                   | 6.2.4A.1                  |
| CA_NS_02                    | 6.6.3.3A.2                  | CA_1C                   | 6.2.4A.2                  |
| CA_NS_03                    | 6.6.3.3A.3                  | CA_1C                   | 6.2.4A.3                  |
| CA_NS_04                    | 6.6.2.2A.1                  | CA_41C                  | 6.2.4A.4                  |
| CA_NS_05                    | 6.6.3.3A.4                  | CA_38C                  | 6.2.4A.5                  |
| CA_NS_06                    | 6.6.3.3A.5                  | CA_7C                   | 6.2.4A.6                  |

Table 6.2.4A-1: Additional Maximum Power Reduction (A-MPR) for CA

For PUCCH and SRS transmissions, the allowed A-MPR is according to that specified for PUSCH QPSK modulation for the corresponding transmission bandwidth.

For intra-band carrier aggregation, the A-MPR is evaluated per slot and given by the maximum value taken over the transmission(s) on all component carriers within the slot; the maximum A-MPR over the two slots is then applied for the entire subframe.

For the UE maximum output power modified by A-MPR specified in table 6.2.4A-1, the power limits specified in subclause 6.2.5A apply.

## 6.2.4A.1 A-MPR for CA\_NS\_01 for CA\_1C

If the UE is configured to CA\_1C and it receives IE CA\_NS\_01 the allowed maximum output power reduction applied to transmissions on the PCC and the SCC for contiguously aggregated signals is specified in table 6.2.4A.1-1.

| CA_1C: CA_NS_01   | RB <sub>start</sub>     | L <sub>CRB</sub> [RBs]    | RB <sub>start</sub> + L <sub>CRB</sub><br>[RBs] | A-MPR for QPSK and 16-<br>QAM [dB] |  |  |
|---|-------------------------|---------------------------|---|------------------------------------|--|--|
|   | 0 – 23 and<br>176 – 199 | > 0                       | N/A   | ≤ 12.0                             |  |  |
| 100 RB / 100 RB   | 24 – 105                | > 64                      | N/A   | ≤ 6.0                              |  |  |
|   | 106 – 175               | N/A                       | > 175   | ≤ 5.0                              |  |  |
|   | 0 – 6 and 143           | 0 < L <sub>CRB</sub> ≤ 10 | N/A   | ≤ 11.0                             |  |  |
|   | - 149                   | > 10                      | N/A   | ≤ 6.0                              |  |  |
| 75 RB / 75 RB   | 7 – 90                  | > 44                      | N/A   | ≤ 5.0                              |  |  |
|   | 91 – 142                | N/A                       | > 142   | ≤ 2.0                              |  |  |
| <ul> <li>NOTE 1: RB_start indicates the lowest RB index of transmitted resource blocks</li> <li>NOTE 2: L_CRB is the length of a contiguous resource block allocation</li> <li>NOTE 3: For intra-subframe frequency hopping which intersects regions, notes 1 and 2 apply on a per slot basis</li> <li>NOTE 4: For intra-subframe frequency hopping which intersects regions, the larger A-MPR value may be applied for both slots in the subframe</li> </ul> |                         |                           |   |                                    |  |  |

Table 6.2.4A.1-1: Contiguous allocation A-MPR for CA\_NS\_01

If the UE is configured to CA\_1C and it receives IE CA\_NS\_01 the allowed maximum output power reduction applied to transmissions on the PCell and the SCell with non-contiguous resource allocation is defined as follows

A-MPR = CEIL 
$$\{M_{A}, 0.5\}$$

Where M<sub>A</sub> is defined as follows

$$\begin{split} M_A = & -22.5 \ A + 17 & ; \ 0 \leq A < 0.20 \\ & -11.0 \ A + 14.7 & ; \ 0.20 \leq A < 0.70 \\ & -1.7 \ A + 8.2 & ; \ 0.70 \leq A \leq 1 \end{split}$$

Where  $A = N_{RB\_alloc} / N_{RB\_agg.}$ 

## 6.2.4A.2 A-MPR for CA\_NS\_02 for CA\_1C

If the UE is configured to CA\_1C and it receives IE CA\_NS\_02 the allowed maximum output power reduction applied to transmission on the PCC and the SCC for contiguously aggregated signals is specified in Table 6.2.4A.2-1.

| CA_1C: CA_NS_02 | RB <sub>end</sub> | L <sub>CRB</sub> [RBs]   | A-MPR for QPSK and<br>16 –QAM [dB] |
|-----------------|-------------------|--------------------------|------------------------------------|
|                 | 0 –20             | > 0                      | ≤ 4 dB                             |
|                 | 21 – 46           | > 0                      | ≤ 3 dB                             |
| 100 RB / 100 RB | 47 – 99           | > RB <sub>end</sub> - 20 | ≤ 3 dB                             |
|                 | 100 – 184         | > 75                     | ≤ 6 dB                             |
|                 | 185 – 199         | > 0                      | ≤ 10 dB                            |
|                 | 0 – 48            | > 0                      | ≤ 2 dB                             |
|                 | 49 - 80           | > RB <sub>end</sub> - 20 | ≤ 3 dB                             |
| 75 RB / 75 RB   | 81 – 129          | > 60                     | ≤ 5 dB                             |
|                 | 130 – 149         | > 84                     | ≤ 6 dB                             |
|                 | 130 – 149         | 1 – 84                   | ≤ 2 dB                             |

Table 6.2.4A.2-1: Contiguous allocation A-MPR for CA\_NS\_02

If the UE is configured to CA\_1C and it receives IE CA\_NS\_02 the allowed maximum output power reduction applied to transmissions on the PCell and the SCell with non-contiguous resource allocation is defined as follows:

A-MPR = CEIL 
$$\{M_{A}, 0.5\}$$

Where MA is defined as follows

$$\begin{split} M_A = & -22.5 \ A + 17 & ; \ 0 \leq A < 0.20 \\ & -11.0 \ A + 14.7 & ; \ 0.20 \leq A < 0.70 \\ & -1.7 \ A + 8.2 & ; \ 0.70 \leq A \leq 1 \end{split}$$

Where  $A = N_{RB\_alloc} / N_{RB\_agg.}$ 

#### 6.2.4A.3 A-MPR for CA\_NS\_03 for CA\_1C

If the UE is configured to CA\_1C and it receives IE CA\_NS\_03 the allowed maximum output power reduction applied to transmission on the PCC and the SCC for contiguously aggregated signals is specified in Table 6.2.4A.3-1.

| CA_1C: CA_NS_03 | RB <sub>end</sub> | L <sub>CRB</sub> [RBs]   | A-MPR for QPSK and<br>16-QAM [dB] |
|-----------------|-------------------|--------------------------|-----------------------------------|
|                 | 0 – 26            | > 0                      | ≤ 10 dB                           |
|                 | 27 – 63           | ≥ RB <sub>end</sub> - 27 | ≤ 6 dB                            |
| 100 RB / 100 RB | 27 – 63           | < RB <sub>end</sub> - 27 | ≤ 1 dB                            |
|                 | 64 – 100          | > RB <sub>end</sub> - 20 | ≤ 4 dB                            |
|                 | 101 – 171         | > 68                     | ≤ 7 dB                            |
|                 | 172 – 199         | > 0                      | ≤ 10 dB                           |
|                 | 0 – 20            | > 0                      | ≤ 10 dB                           |
|                 | 21 – 45           | > 0                      | ≤ 4 dB                            |
|                 | 46 – 75           | > RB <sub>end</sub> – 13 | ≤ 2 dB                            |
| 75 RB / 75 RB   | 76 – 95           | > 45                     | ≤ 5 dB                            |
|                 | 96 – 149          | > 43                     | ≤ 8 dB                            |
|                 | 120 – 149         | 1 - 43                   | ≤ 6 dB                            |

Table 6.2.4A.3-1: Contiguous allocation A-MPR for CA\_NS\_03

If the UE is configured to CA\_1C and it receives IE CA\_NS\_03 the allowed maximum output power reduction applied to transmissions on the PCell and the SCell with non-contiguous resource allocation is defined as follows:

A-MPR = CEIL 
$$\{M_{A}, 0.5\}$$

Where M<sub>A</sub> is defined as follows

$$\begin{split} M_A = & -23.33A + 17.5 & ; \ 0 \leq A < 0.15 \\ & -7.65A + 15.15 & ; \ 0.15 \leq A \leq 1 \end{split}$$

Where  $A = N_{RB\_alloc} / N_{RB\_agg.}$ 

#### 6.2.4A.4 A-MPR for CA\_NS\_04

If the UE is configured to CA\_41C and it receives IE CA\_NS\_04 the allowed maximum output power reduction applied to transmission on the PCC and the SCC for contiguously aggregated signals is specified in Table 6.2.4A.4-1.

| CA Bandwidth<br>Class C  | RB <sub>Start</sub>  | L <sub>CRB</sub><br>[RBs] | RB <sub>start</sub> + L <sub>CRB</sub><br>[RBs] | A-MPR for<br>QPSK [dB] | A-MPR for<br>16QAM [dB] |  |
|--|----------------------|---------------------------|---|------------------------|-------------------------|--|
| 50RB / 100 RB  | 0 – 44 and 105 – 149 | >0                        | N/A   | ≤4dB                   | ≤4dB                    |  |
|  | 45 – 104             | N/A                       | >105  | ≤3dB                   | ≤4dB                    |  |
| 75 RB / 75 RB  | 0 – 44 and 105 – 149 | >0                        | N/A   | ≤4dB                   | ≤4dB                    |  |
|  | 45 – 104             | N/A                       | >105  | ≤4dB                   | ≤4dB                    |  |
| 100 RB / 75 RB   | 0 – 49 and 125 – 174 | >0                        | N/A   | ≤4dB                   | ≤4dB                    |  |
|  | 50 - 124             | N/A                       | >125  | ≤3dB                   | ≤4dB                    |  |
| 100 RB / 100 RB  | 0 – 59 and 140 – 199 | >0                        | N/A   | ≤3dB                   | ≤4dB                    |  |
|  | 60– 139              | N/A                       | >140  | ≤3dB                   | ≤4dB                    |  |
| NOTE 1:       RB <sub>start</sub> indicates the lowest RB index of transmitted resource blocks       Stab       Stab         NOTE 2:       L <sub>CRB</sub> is the length of a contiguous resource block allocation         NOTE 3:       For intra-subframe frequency hopping which intersects regions, notes 1 and 2 apply on a per slot basis         NOTE 4:       For intra-subframe frequency hopping which intersects regions, the larger A-MPR value may be applied for both slots in the subframe |                      |                           |   |                        |                         |  |

If the UE is configured to CA\_41C and it receives IE CA\_NS\_04 the allowed maximum output power reduction applied to transmissions on the PCell and the SCell with non-contiguous resource allocation is defined as follows

$$A-MPR = CEIL \{M_{A}, 0.5\}$$

Where M<sub>A</sub> is defined as follows

$$\begin{split} \mathbf{M}_{A} &= 10.5, & 0 \leq A < 0.05 \\ &= -50.0A + 13.00, & 0.05 \leq A < 0.15 \\ &= -4.0A + 6.10, & 0.15 \leq A < 0.40 \\ &= -0.83A + 4.83, & 0.40 \leq A \leq 1 \end{split}$$

Where  $A = N_{RB\_alloc} / N_{RB\_agg.}$ 

#### 6.2.4A.5 A-MPR for CA\_NS\_05 for CA\_38C

If the UE is configured to CA\_38C and it receives IE CA\_NS\_05 the allowed maximum output power reduction applied to transmission on the PCC and the SCC for contiguously aggregated signals is specified in Table 6.2.4A.5-1.

| $RB_{end}$  | L <sub>CRB</sub> [RBs]   | A-MPR for QPSK and<br>16-QAM [dB]   |  |  |  |
|---|--|---|--|--|--|
| 0 – 12  | >0   | ≤ 5 dB  |  |  |  |
| 13 – 79   | > RB <sub>end</sub> – 13   | ≤ 2 dB  |  |  |  |
| 80 – 180  | >60  | ≤ 6 dB  |  |  |  |
| 181 – 199   | > 0  | ≤ 11 dB   |  |  |  |
| 0 – 70  | > max (0, RB <sub>end</sub> -10)   | ≤ 2 dB  |  |  |  |
| 71- 108   | > 60   | ≤ 5 dB  |  |  |  |
| 109 – 139   | >0   | ≤ 5 dB  |  |  |  |
| 140 – 149   | ≤ 70   | ≤ 2 dB  |  |  |  |
| 140 – 149   | >70  | ≤ 6 dB  |  |  |  |
| <ul> <li>NOTE 1: RB<sub>end</sub> indicates the highest RB index of transmitted resource blocks</li> <li>NOTE 2: L<sub>CRB</sub> is the length of a contiguous resource block allocation</li> <li>NOTE 3: For intra-subframe frequency hopping which intersects regions, notes 1 and 2 apply on a per slot basis</li> <li>NOTE 4: For intra-subframe frequency hopping which intersects regions, the larger A-</li> </ul> |  |   |  |  |  |
|   | 0 - 12<br>13 - 79<br>80 - 180<br>181 - 199<br>0 - 70<br>71- 108<br>109 - 139<br>140 - 149<br>140 - 149<br>dicates the higher<br>the length of a co<br>a-subframe frequent<br>a per slot basis<br>a-subframe frequent | $0 - 12$ >0 $13 - 79$ > RB <sub>end</sub> - 13 $80 - 180$ >60 $181 - 199$ > 0 $0 - 70$ > max (0, RB <sub>end</sub> -10) $71 - 108$ > 60 $109 - 139$ > 0 $140 - 149$ $\leq 70$ $140 - 149$ > 70         idicates the highest RB index of transmitted results a contiguous resource block allo a-subframe frequency hopping which intersect in a per slot basis |  |  |  |

Table 6.2.4A.5-1: Contigous Allocation A-MPR for CA\_NS\_05

If the UE is configured to CA\_38C and it receives IE CA\_NS\_05 the allowed maximum output power reduction applied to transmissions on the PCell and the SCell with non-contiguous resource allocation is defined as follows

$$A-MPR = CEIL \{M_{A, 0.5}\}$$

Where MA is defined as follows

$$\begin{split} M_A &= -14.17 \; A + 16.50 \qquad ; \; 0 \leq A < 0.60 \\ &- 2.50 \; A + 9.50 \qquad ; \; 0.60 \leq A \leq 1 \end{split}$$

Where  $A = N_{RB\_alloc} / N_{RB\_agg}$ 

#### 6.2.4A.6 A-MPR for CA\_NS\_06

If the UE is configured to CA\_7C and it receives IE CA\_NS\_06 the allowed maximum output power reduction applied to transmission on the PCC and the SCC for contiguously aggregated signals is specified in Table 6.2.4A.6-1.

| CA Bandwidth<br>Class C | $RB_{end}$ | L <sub>CRB</sub> [RBs]   | A-MPR for QPSK and<br>16-QAM [dB] |
|-------------------------|------------|--------------------------|-----------------------------------|
|                         | 0 –22      | >0                       | ≤[4 dB                            |
|                         | 23 – 105   | > RB <sub>end</sub> – 10 | ≤ 2 dB                            |
| 100RB/100RB             | 106 – 142  | > 75                     | ≤ 3 dB                            |
|                         | 143 – 177  | >70                      | ≤ 5 dB                            |
|                         | 178 – 199  | > 0                      | ≤ 10 dB                           |
|                         | 0 – 7      | >0                       | ≤ 5 dB                            |
|                         | 20- 74     | > RB <sub>end</sub> – 10 | ≤ 2 dB                            |
| 75RB/75RB               | 75 – 109   | >64                      | ≤ 2 dB                            |
|                         | 110 – 144  | >35                      | ≤ 6 dB                            |
|                         | 145 – 149  | >0                       | ≤ 10 dB                           |

If the UE is configured to CA\_7C and it receives IE CA\_NS\_06 the allowed maximum output power reduction applied to transmissions on the PCell and the SCell with non-contiguous resource allocation is defined as follows:

A-MPR = CEIL  $\{M_{A}, 0.5\}$ 

Where M<sub>A</sub> is defined as follows

 $\begin{array}{rl} M_A = & -23.33A + 17.5 & ; \ 0 \leq A < 0.15 \\ & -7.65A + 15.15 & ; \ 0.15 \leq A \leq 1 \end{array}$ 

Where  $A = N_{RB\_alloc} / N_{RB\_agg.}$ 

## 6.2.4B UE maximum output power with additional requirements for UL-MIMO

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the A-MPR values specified in subclause 6.2.4 shall apply to the maximum output power specified in Table 6.2.2B-1. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2. For UE supporting UL-MIMO, the maximum output power is measured as the sum of the maximum output power at each UE antenna connector. Unless stated otherwise, an A-MPR of 0 dB shall be used.

For the UE maximum output power modified by A-MPR, the power limits specified in subclause 6.2.5B apply.

For single-antenna port scheme, the requirements in subclause 6.2.4 apply.

## 6.2.5 Configured transmitted power

The UE is allowed to set its configured maximum output power  $P_{CMAX,c}$  for serving cell *c*. The configured maximum output power  $P_{CMAX,c}$  is set within the following bounds:

$$P_{CMAX_L,c} \leq P_{CMAX,c} \leq P_{CMAX_H,c}$$

with

$$P_{CMAX\_L,c} = MIN \{P_{EMAX,c} - \Delta T_{C,c}, P_{PowerClass} - MAX(MPR_c + A-MPR_c + \Delta T_{IB,c} + \Delta T_{C,c}, P-MPR_c)\}$$

 $P_{CMAX_H,c} = MIN \{P_{EMAX,c}, P_{PowerClass}\}$ 

where

- P<sub>EMAX,c</sub> is the value given by IE *P*-*Max* for serving cell *c*, defined in [7];

- P<sub>PowerClass</sub> is the maximum UE power specified in Table 6.2.2-1 without taking into account the tolerance specified in the Table 6.2.2-1;
- MPR<sub>c</sub> and A-MPR<sub>c</sub> for serving cell c are specified in subclause 6.2.3 and subclause 6.2.4, respectively;
- $\Delta T_{IB,c}$  is the additional tolerance for serving cell c as specified in Table 6.2.5-2;  $\Delta T_{IB,c} = 0$  dB otherwise;
- $\Delta T_{C,c} = 1.5$  dB when Note 2 in Table 6.2.2-1 applies;
- $\Delta T_{C,c} = 0$  dB when Note 2 in Table 6.2.2-1 does not apply.

P-MPR<sub>c</sub> is the allowed maximum output power reduction for

- a) ensuring compliance with applicable electromagnetic energy absorption requirements and addressing unwanted emissions / self desense requirements in case of simultaneous transmissions on multiple RAT(s) for scenarios not in scope of 3GPP RAN specifications;
- b) ensuring compliance with applicable electromagnetic energy absorption requirements in case of proximity detection is used to address such requirements that require a lower maximum output power.

The UE shall apply P-MPR<sub>c</sub> for serving cell c only for the above cases. For UE conducted conformance testing P-MPR shall be 0 dB

NOTE 1: P-MPR<sub>c</sub> was introduced in the  $P_{CMAX,c}$  equation such that the UE can report to the eNB the available maximum output transmit power. This information can be used by the eNB for scheduling decisions.

NOTE 2: P-MPR<sub>c</sub> may impact the maximum uplink performance for the selected UL transmission path.

For each subframe, the  $P_{CMAX\_L,c}$  for serving cell *c* is evaluated per slot and given by the minimum value taken over the transmission(s) within the slot; the minimum  $P_{CMAX\_L,c}$  over the two slots is then applied for the entire subframe.  $P_{PowerClass}$  shall not be exceeded by the UE during any period of time.

The measured configured maximum output power P<sub>UMAX,c</sub> shall be within the following bounds:

 $P_{CMAX\_L,c} - MAX\{T_L, T(P_{CMAX\_L,c})\} \leq P_{UMAX,c} \leq P_{CMAX\_H,c} + T(P_{CMAX\_H,c})$ 

where  $T(P_{CMAX,c})$  is defined by the tolerance table below and applies to  $P_{CMAX_L,c}$  and  $P_{CMAX_L,c}$  separately, while  $T_L$  is the absolute value of the lower tolerance in Table 6.2.2-1 for the applicable operating band.

| Р <sub>СМАХ,с</sub><br>(dBm)  | Tolerance T(P <sub>CMAX,c</sub> )<br>(dB) |
|-------------------------------|---|
| $23 < P_{CMAX,c} \le 33$      | 2.0                                       |
| $21 \le P_{CMAX,c} \le 23$    | 2.0                                       |
| $20 \le P_{CMAX,c} < 21$      | 2.5                                       |
| 19 ≤ P <sub>CMAX,c</sub> < 20 | 3.5                                       |
| 18 ≤ P <sub>CMAX,c</sub> < 19 | 4.0                                       |
| 13 ≤ P <sub>CMAX,c</sub> < 18 | 5.0                                       |
| 8 ≤ P <sub>CMAX,c</sub> < 13  | 6.0                                       |
| $-40 \le P_{CMAX,c} < 8$      | 7.0                                       |

#### Table 6.2.5-1: PCMAX.c tolerance

For the UE which supports inter-band carrier aggregation configurations with uplink assigned to one E-UTRA band the  $\Delta T_{IB,c}$  is defined for applicable bands in Table 6.2.5-2.

| Inter-band CA<br>Configuration | E-UTRA Band   | ΔT <sub>IB,c</sub> [dB]            |  |  |  |  |  |
|--------------------------------|---|------------------------------------|--|--|--|--|--|
|                                | 1   | 0.3                                |  |  |  |  |  |
| CA_1A-5A                       | 5   | 0.3                                |  |  |  |  |  |
| CA_1A-18A                      | 1   | 0.3                                |  |  |  |  |  |
|                                | 18 0.3  |                                    |  |  |  |  |  |
| CA_1A-19A                      | 1   | 0.3                                |  |  |  |  |  |
|                                | 19  | 0.3                                |  |  |  |  |  |
| CA_1A-21A                      | 1   | 0.3                                |  |  |  |  |  |
|                                | 21  | 0.3                                |  |  |  |  |  |
| CA_2A-17A                      | 2   | 0.3                                |  |  |  |  |  |
| CA 2A-29A                      | 17  | 0.8                                |  |  |  |  |  |
| <u>CA_ZA-Z9A</u>               | Ζ   | 0.3                                |  |  |  |  |  |
|                                | 3   | 0.3                                |  |  |  |  |  |
| CA_3A-5A                       | 5   | 0.3                                |  |  |  |  |  |
|                                | 3   | 0.5                                |  |  |  |  |  |
| CA_3A-7A                       | 7   | 0.5                                |  |  |  |  |  |
| 04 04 04                       | 3   | 0.3                                |  |  |  |  |  |
| CA_3A-8A                       | 8   | 0.3                                |  |  |  |  |  |
| CA_3A-20A                      | 3   | 0.3                                |  |  |  |  |  |
| CA_3A-20A                      | 20  | 0.3                                |  |  |  |  |  |
| CA_4A-5A                       | 4   | 0.3                                |  |  |  |  |  |
| UA_4A-5A                       | 5   | 0.3                                |  |  |  |  |  |
| CA_4A-7A                       | 4   | 0.5                                |  |  |  |  |  |
|                                | 7   | 0.5                                |  |  |  |  |  |
| CA_4A-12A                      | 4   | 0.3                                |  |  |  |  |  |
|                                | 12  | 0.8                                |  |  |  |  |  |
| CA_4A-13A                      | 4 0.3   |                                    |  |  |  |  |  |
|                                | 13  | 0.3                                |  |  |  |  |  |
| CA_4A-17A                      | 17 0.8  |                                    |  |  |  |  |  |
| CA_4A-29A                      | 4   | 0.3                                |  |  |  |  |  |
|                                | 5 0.8   |                                    |  |  |  |  |  |
| CA_5A-12A                      | 12  | 0.4                                |  |  |  |  |  |
|                                | 5   | 0.8                                |  |  |  |  |  |
| CA_5A-17A                      | 17  | 0.4                                |  |  |  |  |  |
| CA_7A-20A                      | 7   | 0.3                                |  |  |  |  |  |
| 07_17-207                      | 20  | 0.3                                |  |  |  |  |  |
| CA_8A-20A                      | 8   | 0.4                                |  |  |  |  |  |
| 0/(_0/(20/(                    | 20  | 0.4                                |  |  |  |  |  |
| CA_11A-18A                     | 11  | 0.3                                |  |  |  |  |  |
|                                |   | 0.3                                |  |  |  |  |  |
|                                | ove additional tolerances are only ap<br>that belong to the supported inter-ban   |                                    |  |  |  |  |  |
|                                | inations  | la camer aggregation               |  |  |  |  |  |
|                                |   | n non-aggregated operation for the |  |  |  |  |  |
|                                | The above additional tolerances also apply in non-aggregated operation for the supported E-UTRA operating bands that belong to the supported inter-band |                                    |  |  |  |  |  |
| carrier                        | carrier aggregation configurations  |                                    |  |  |  |  |  |
|                                | e the UE supports more than one of th   |                                    |  |  |  |  |  |
|                                | egation configurations and a E-UTRA operating band belongs to more than   |                                    |  |  |  |  |  |
|                                | er-band carrier aggregation configura   |                                    |  |  |  |  |  |
|                                | en the E-UTRA operating band freque   |                                    |  |  |  |  |  |
|                                | icable additional tolerance shall be th   |                                    |  |  |  |  |  |
|                                | cated to one decimal place for that op  |                                    |  |  |  |  |  |
|                                | configurations. In case there is a harn   |                                    |  |  |  |  |  |
|                                | and high band DL, then the maximun  |                                    |  |  |  |  |  |
|                                | oorted carrier aggregation configuration  | ons involving such band shall be   |  |  |  |  |  |
| appl                           |   |                                    |  |  |  |  |  |
|                                | en the E-UTRA operating band freque   |                                    |  |  |  |  |  |
|                                | icable additional tolerance shall be th   |                                    |  |  |  |  |  |
| appl                           | ies for that operating band among the   | e supported CA configurations      |  |  |  |  |  |

Table 6.2.5-2: ΔT<sub>IB,c</sub>

- NOTE: The above additional tolerances do not apply to supported UTRA operating bands with frequency range below 1 GHz that correspond to the E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations when such bands are belonging only to band combination(s) where one band is <1GHz and another band is >1.7GHz and there is no harmonic relationship between the low band UL and high band DL. Otherwise the above additional tolerances also apply to supported UTRA operating bands that correspond to the E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations.
- NOTE: To meet the  $\Delta T_{IB,c}$  requirements for CA\_3A-7A with state-of-the-art technology, an increase in power consumption of the UE may be required. It is also expected that as the state-of-the-art technology evolves in the future, this possible power consumption increase can be reduced or eliminated.

# 6.2.5A Configured transmitted power for CA

For uplink carrier aggregation the UE is allowed to set its configured maximum output power  $P_{CMAX,c}$  for serving cell *c* and its total configured maximum output power  $P_{CMAX}$ .

The configured maximum output power  $P_{CMAX,c}$  on serving cell c shall be set as specified in subclause 6.2.5.

For uplink inter-band carrier aggregation,  $MPR_c$  and  $A-MPR_c$  apply per serving cell c and are specified in subclause 6.2.3 and subclause 6.2.4, respectively. P-MPR<sub>c</sub> accounts for power management for serving cell c.  $P_{CMAX,c}$  is calculated under the assumption that the transmit power is increased independently on all component carriers.

For uplink intra-band contiguous carrier aggregation,  $MPR_c = MPR$  and  $A-MPR_c = A-MPR$  with MPR and A-MPR specified in subclause 6.2.3A and subclause 6.2.4A respectively. There is one power management term for the UE, denoted P-MPR, and P-MPR<sub>c</sub> = P-MPR. P<sub>CMAX,c</sub> is calculated under the assumption that the transmit power is increased by the same amount in dB on all component carriers.

#### Table 6.2.5A-1:Void

The total configured maximum output power PCMAX shall be set within the following bounds:

$$P_{CMAX_L} \le P_{CMAX} \le P_{CMAX_H}$$

For uplink inter-band carrier aggregation with one serving cell c per operating band,

 $P_{CMAX\_L} = MIN \{ 10log_{10} \sum MIN \ [ \ p_{EMAX,c'} (\Delta t_{C,c}), \ p_{PowerClass} / (mpr_c \cdot a - mpr_c \cdot \Delta t_{C,c} \cdot \Delta t_{IB,c}) , \ p_{PowerClass} / pmpr_c ], P_{PowerClass} \} = MIN \{ 10log_{10} \sum MIN \ [ \ p_{EMAX,c'} (\Delta t_{C,c}), \ p_{PowerClass} / (mpr_c \cdot a - mpr_c \cdot \Delta t_{C,c} \cdot \Delta t_{IB,c}) , \ p_{PowerClass} / (mpr_c \cdot a - mpr_c \cdot \Delta t_{C,c} \cdot \Delta t_{IB,c}) , \ p_{PowerClass} / (mpr_c \cdot a - mpr_c \cdot \Delta t_{C,c} \cdot \Delta t_{IB,c}) , \ p_{PowerClass} / (mpr_c \cdot a - mpr_c \cdot \Delta t_{C,c} \cdot \Delta t_{IB,c}) , \ p_{PowerClass} / (mpr_c \cdot a - mpr_c \cdot \Delta t_{C,c} \cdot \Delta t_{IB,c}) , \ p_{PowerClass} / (mpr_c \cdot a - mpr_c \cdot \Delta t_{C,c} \cdot \Delta t_{IB,c}) , \ p_{PowerClass} / (mpr_c \cdot a - mpr_c \cdot \Delta t_{C,c} \cdot \Delta t_{IB,c}) , \ p_{PowerClass} / (mpr_c \cdot a - mpr_c \cdot \Delta t_{C,c} \cdot \Delta t_{IB,c}) , \ p_{PowerClass} / (mpr_c \cdot a - mpr_c \cdot \Delta t_{C,c} \cdot \Delta t_{IB,c}) , \ p_{PowerClass} / (mpr_c \cdot a - mpr_c \cdot \Delta t_{C,c} \cdot \Delta t_{IB,c}) , \ p_{PowerClass} / (mpr_c \cdot a - mpr_c \cdot \Delta t_{C,c} \cdot \Delta t_{IB,c}) , \ p_{PowerClass} / (mpr_c \cdot a - mpr_c \cdot \Delta t_{C,c} \cdot \Delta t_{IB,c}) , \ p_{PowerClass} / (mpr_c \cdot a - mpr_c \cdot \Delta t_{C,c} \cdot \Delta t_{IB,c}) , \ p_{PowerClass} / (mpr_c \cdot a - mpr_c \cdot \Delta t_{IB,c}) , \ p_{PowerClass} / (mpr_c \cdot a - mpr_c \cdot \Delta t_{IB,c}) ) , \ p_{PowerClass} / (mpr_c \cdot a - mpr_c \cdot \Delta t_{IB,c}) ) , \ p_{PowerClass} / (mpr_c \cdot a - mpr_c \cdot \Delta t_{IB,c}) )$ 

$$P_{CMAX_H} = MIN\{10 \log_{10} \sum p_{EMAX,c}, P_{PowerClass}\}$$

where

- $p_{EMAX,c}$  is the linear value of  $P_{EMAX,c}$  which is given by IE *P*-Max for serving cell *c* in [7];
- P<sub>PowerClass</sub> is the maximum UE power specified in Table 6.2.2A-1 without taking into account the tolerance specified in the Table 6.2.2A-1; p<sub>PowerClass</sub> is the linear value of P<sub>PowerClass</sub>;
- mpr<sub>c</sub> and a-mpr<sub>c</sub> are the linear values of MPR<sub>c</sub> and A-MPR<sub>c</sub> as specified in subclause 6.2.3 and subclause 6.2.4, respectively;
- pmpr<sub>c</sub> is the linear value of P-MPR<sub>c</sub>;
- $\Delta t_{C,c}$  is the linear value of  $\Delta T_{C,c}$ .  $\Delta t_{C,c} = 1.41$  when Note 2 in Table 6.2.2-1 applies for a serving cell *c*, otherwise  $\Delta t_{C,c} = 1$ ;

-  $\Delta t_{IB,c}$  is the linear value of the inter-band relaxation term  $\Delta T_{IB,c}$  of the serving cell *c* as specified in Table 6.2.5-2; otherwise  $\Delta t_{IB,c} = 1$ .

For uplink intra-band contiguous carrier aggregation,

$$P_{CMAX\_L} = MIN\{10 \ log_{10} \sum p_{EMAX,c} - \Delta T_C, P_{PowerClass} - MAX(MPR + A-MPR + \Delta T_{IB,c} + \Delta T_C, P-MPR)\}$$

 $P_{CMAX_H} = MIN\{10 \log_{10} \sum p_{EMAX,c}, P_{PowerClass}\}$ 

where

- $p_{EMAX,c}$  is the linear value of  $P_{EMAX,c}$  which is given by IE *P-Max* for serving cell *c* in [7];
- P<sub>PowerClass</sub> is the maximum UE power specified in Table 6.2.2A-1 without taking into account the tolerance specified in the Table 6.2.2A-1;
- MPR and A-MPR are specified in subclause 6.2.3A and subclause 6.2.4A respectively;
- $\Delta T_{\text{IB},c}$  is the additional tolerance for serving cell c as specified in Table 6.2.5-2;
- P-MPR is the power management term for the UE;
- $\Delta T_{C}$  is the highest value  $\Delta T_{C,c}$  among all serving cells *c* in the subframe over both timeslots.  $\Delta T_{C,c} = 1.5$  dB when Note 2 in Table 6.2.2A-1 applies to the serving cell *c*, otherwise  $\Delta T_{C,c} = 0$  dB.

For each subframe, the  $P_{CMAX_L}$  is evaluated per slot and given by the minimum value taken over the transmission(s) within the slot; the minimum  $P_{CMAX_L}$  over the two slots is then applied for the entire subframe.  $P_{PowerClass}$  shall not be exceeded by the UE during any period of time.

The measured maximum output power P<sub>UMAX</sub> over all serving cells shall be within the following range:

 $P_{CMAX\_L} - T(P_{CMAX\_L}) \leq P_{UMAX} \leq P_{CMAX\_H} + T(P_{CMAX\_H})$ 

 $P_{UMAX} = 10 \log_{10} \sum p_{UMAX,c}$ 

where  $p_{UMAX,c}$  denotes the measured maximum output power for serving cell *c* expressed in linear scale. The tolerance  $T(P_{CMAX})$  is defined by the table below and applies to  $P_{CMAX_L}$  and  $P_{CMAX_H}$  separately.

| Р <sub>смах</sub><br>(dBm)  | Tolerance T(P <sub>CMAX</sub> )<br>Intra-band with two<br>active UL serving<br>cells<br>(dB) |  |
|-----------------------------|--|--|
| $21 \le P_{CMAX} \le 23$    | 2.0  |  |
| $20 \le P_{CMAX} < 21$      | [2.5]  |  |
| 19 ≤ P <sub>CMAX</sub> < 20 | [3.5]  |  |
| 18 ≤ P <sub>CMAX</sub> < 19 | [4.0]  |  |
| 13 ≤ P <sub>CMAX</sub> < 18 | [5.0]  |  |
| 8 ≤ P <sub>CMAX</sub> < 13  | [6.0]  |  |
| $-40 \le P_{CMAX} < 8$      | [7.0]  |  |

Table 6.2.5A-2: P<sub>CMAX</sub> tolerance

#### Table 6.2.5A-3: Void

## 6.2.5B Configured transmitted power for UL-MIMO

For UE supporting UL-MIMO, the transmitted power is configured per each UE.

The definitions of configured maximum output power  $P_{CMAX,c}$ , the lower bound  $P_{CMAX\_L,c}$ , and the higher bound  $P_{CMAX\_H,c}$  specified in subclause 6.2.5 shall apply to UE supporting UL-MIMO, where

- $P_{PowerClass}$  and  $\Delta T_{C,c}$  are specified in subclause 6.2.2B;
- MPR<sub>c</sub> is specified in subclause 6.2.3B;
- A-MPR<sub>c</sub> is specified in subclause 6.2.4B.

The measured configured maximum output power  $P_{UMAX,c}$  for serving cell c shall be within the following bounds:

 $P_{CMAX\_L,c} - MAX\{T_L, T_{LOW}(P_{CMAX\_L,c})\} \le P_{UMAX,c} \le P_{CMAX\_H,c} + T_{HIGH}(P_{CMAX\_H,c})$ 

where  $T_{LOW}(P_{CMAX\_L,c})$  and  $T_{HIGH}(P_{CMAX\_H,c})$  are defined as the tolerance and applies to  $P_{CMAX\_L,c}$  and  $P_{CMAX\_H,c}$  separately, while  $T_L$  is the absolute value of the lower tolerance in Table 6.2.2B-1 for the applicable operating band.

For UE with two transmit antenna connectors in closed-loop spatial amultiplexing scheme, the tolerance is specified in Table 6.2.5B-1. The requirements shall be met with UL-MIMO configurations specified in Table 6.2.2B-2.

| Р <sub>смах,с</sub><br>(dBm)   | Tolerance         Tolerance           TLOW(PCMAX_L,c) (dB)         THIGH(PCMAX_H,c) (dB) |     |  |  |
|--------------------------------|--|-----|--|--|
| $P_{CMAX,c} = 23$              | 3.0  | 2.0 |  |  |
| $22 \le P_{CMAX,c} < 23$       | 5.0  | 2.0 |  |  |
| $21 \leq P_{CMAX,c} < 22$      | 5.0 3.0  |     |  |  |
| 20 ≤ P <sub>CMAX,c</sub> < 21  | 6.0 4.0  |     |  |  |
| 16 ≤ P <sub>CMAX,c</sub> < 20  | 5.0  |     |  |  |
| 11 ≤ P <sub>CMAX,c</sub> < 16  | 6.0  |     |  |  |
| -40 ≤ P <sub>CMAX,c</sub> < 11 | 7.   | .0  |  |  |

Table 6.2.5B-1: P<sub>CMAX,c</sub> tolerance in closed-loop spatial multiplexing scheme

For single-antenna port scheme, the requirements in subclause 6.2.5 apply.

# 6.3 Output power dynamics

# 6.3.1 (Void)

## 6.3.2 Minimum output power

The minimum controlled output power of the UE is defined as the broadband transmit power of the UE, i.e. the power in the channel bandwidth for all transmit bandwidth configurations (resource blocks), when the power is set to a minimum value.

## 6.3.2.1 Minimum requirement

The minimum output power is defined as the mean power in one sub-frame (1ms). The minimum output power shall not exceed the values specified in Table 6.3.2.1-1.

|                          | Channel bandwidth / Minimum output power / Measurement<br>bandwidth |            |          |           |           |           |
|--------------------------|---|------------|----------|-----------|-----------|-----------|
|                          | 1.4<br>MHz  | 3.0<br>MHz | 5<br>MHz | 10<br>MHz | 15<br>MHz | 20<br>MHz |
| Minimum output<br>power  |   |            | -40 c    | lBm       |           |           |
| Measurement<br>bandwidth | 1.08 MHz  | 2.7 MHz    | 4.5 MHz  | 9.0 MHz   | 13.5 MHz  | 18 MHz    |

Table 6.3.2.1-1: Minimum output power

# 6.3.2A UE Minimum output power for CA

For intra-band contiguous carrier aggregation, the minimum controlled output power of the UE is defined as the transmit power of the UE per component carrier, i.e., the power in the channel bandwidth of each component carrier for all transmit bandwidth configurations (resource blocks), when the power on both component carriers are set to a minimum value.

#### 6.3.2A.1 Minimum requirement for CA

For intra-band contiguous carrier aggregation the minimum output power is defined as the mean power in one subframe (1ms). The minimum output power shall not exceed the values specified in Table 6.3.2A.1-1.

|                          | CC Channel bandwidth / Minimum output power / Measurement<br>bandwidth |            |          |           |           |           |
|--------------------------|--|------------|----------|-----------|-----------|-----------|
|                          | 1.4<br>MHz   | 3.0<br>MHz | 5<br>MHz | 10<br>MHz | 15<br>MHz | 20<br>MHz |
| Minimum output<br>power  |  |            | -40 c    | dBm       |           |           |
| Measurement<br>bandwidth |  |            |          | 9.0 MHz   | 13.5 MHz  | 18 MHz    |

Table 6.3.2A.1-1: Minimum output power for intra-band contiguous CA UE

# 6.3.2B UE Minimum output power for UL-MIMO

For UE supporting UL-MIMO, the minimum controlled output power is defined as the broadband transmit power of the UE, i.e. the sum of the power in the channel bandwidth for all transmit bandwidth configurations (resource blocks) at each transmit antenna connector, when the UE power is set to a minimum value.

#### 6.3.2B.1 Minimum requirement

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the minimum output power is defined as the sum of the mean power at each transmit connector in one sub-frame (1ms). The minimum output power shall not exceed the values specified in Table 6.3.2B.1-1.

Table 6.3.2B.1-1: Minimum output power

|                          | Channel bandwidth / Minimum output power / Measurement<br>bandwidth |            |          |           |           |           |
|--------------------------|---|------------|----------|-----------|-----------|-----------|
|                          | 1.4<br>MHz  | 3.0<br>MHz | 5<br>MHz | 10<br>MHz | 15<br>MHz | 20<br>MHz |
| Minimum output<br>power  | -40 dBm   |            |          |           |           |           |
| Measurement<br>bandwidth | 1.08 MHz  | 2.7 MHz    | 4.5 MHz  | 9.0 MHz   | 13.5 MHz  | 18 MHz    |

For single-antenna port scheme, the requirements in subclause 6.3.2 apply.

# 6.3.3 Transmit OFF power

Transmit OFF power is defined as the mean power when the transmitter is OFF. The transmitter is considered to be OFF when the UE is not allowed to transmit or during periods when the UE is not transmitting a sub-frame. During DTX and measurements gaps, the UE is not considered to be OFF.

## 6.3.3.1. Minimum requirement

The transmit OFF power is defined as the mean power in a duration of at least one sub-frame (1ms) excluding any transient periods. The transmit OFF power shall not exceed the values specified in Table 6.3.3.1-1.

|                          | Channel bandwidth / Transmit OFF power / Measurement<br>bandwidth |            |          |           |           |           |
|--------------------------|---|------------|----------|-----------|-----------|-----------|
|                          | 1.4<br>MHz  | 3.0<br>MHz | 5<br>MHz | 10<br>MHz | 15<br>MHz | 20<br>MHz |
| Transmit OFF<br>power    | -50 dBm   |            |          |           |           |           |
| Measurement<br>bandwidth | 1.08 MHz  | 2.7 MHz    | 4.5 MHz  | 9.0 MHz   | 13.5 MHz  | 18 MHz    |

Table 6.3.3.1-1: Transmit OFF power

# 6.3.3A UE Transmit OFF power for CA

For intra-band contiguous carrier aggregation, transmit OFF power is defined as the mean power per component carrier when the transmitter is OFF on both component carriers. The transmitter is considered to be OFF when the UE is not allowed to transmit or during periods when the UE is not transmitting a sub-frame. During measurements gaps, the UE is not considered to be OFF.

## 6.3.3A.1 Minimum requirement for CA

For intra-band contiguous carrier aggregation the transmit OFF power is defined as the mean power in a duration of at least one sub-frame (1ms) excluding any transient periods. The transmit OFF power shall not exceed the values specified in Table 6.3.3A.1-1.

|                          | Channel bandwidth / Transmit OFF power / Measurement<br>bandwidth |            |          |           |           |           |
|--------------------------|---|------------|----------|-----------|-----------|-----------|
|                          | 1.4<br>MHz  | 3.0<br>MHz | 5<br>MHz | 10<br>MHz | 15<br>MHz | 20<br>MHz |
| Transmit OFF<br>power    |   |            | -50 c    | lBm       |           |           |
| Measurement<br>bandwidth |   |            |          | 9.0 MHz   | 13.5 MHz  | 18 MHz    |

Table 6.3.3A.1-1: Transmit OFF power for intra-band contiguous CA UE

# 6.3.3B UE Transmit OFF power for UL-MIMO

For UE supporting UL-MIMO, the transmit OFF power is defined as the mean power at each transmit antenna connector when the transmitter is OFF at all transmit antenna connectors. The transmitter is considered to be OFF when the UE is not allowed to transmit or during periods when the UE is not transmitting a sub-frame. During DTX and measurements gaps, the UE is not considered to be OFF.

## 6.3.3B.1 Minimum requirement

The transmit OFF power is defined as the mean power at each transmit antenna connector in a duration of at least one sub-frame (1ms) excluding any transient periods. The transmit OFF power at each transmit antenna connector shall not exceed the values specified in Table 6.3.3B.1-1.

|                          | Channel bandwidth / Transmit OFF power/ Measurement<br>bandwidth |            |          |           |           |           |
|--------------------------|--|------------|----------|-----------|-----------|-----------|
|                          | 1.4<br>MHz   | 3.0<br>MHz | 5<br>MHz | 10<br>MHz | 15<br>MHz | 20<br>MHz |
| Transmit OFF<br>power    |  |            | -50 c    | IBm       |           |           |
| Measurement<br>bandwidth | 1.08 MHz   | 2.7 MHz    | 4.5 MHz  | 9.0 MHz   | 13.5 MHz  | 18 MHz    |

 Table 6.3.3B.1-1: Transmit OFF power per antenna port

# 6.3.4 ON/OFF time mask

## 6.3.4.1 General ON/OFF time mask

The General ON/OFF time mask defines the observation period between Transmit OFF and ON power and between Transmit ON and OFF power. ON/OFF scenarios include; the beginning or end of DTX, measurement gap, contiguous, and non contiguous transmission

The OFF power measurement period is defined in a duration of at least one sub-frame excluding any transient periods. The ON power is defined as the mean power over one sub-frame excluding any transient period.

There are no additional requirements on UE transmit power beyond that which is required in subclause 6.2.2 and subclause 6.6.2.3

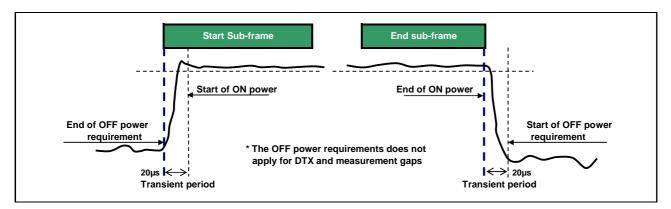


Figure 6.3.4.1-1: General ON/OFF time mask

## 6.3.4.2 PRACH and SRS time mask

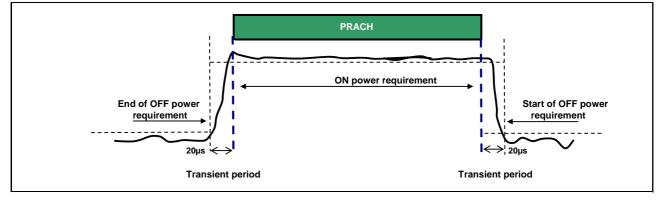
#### 6.3.4.2.1 PRACH time mask

The PRACH ON power is specified as the mean power over the PRACH measurement period excluding any transient periods as shown in Figure 6.3.4.2-1. The measurement period for different PRACH preamble format is specified in Table 6.3.4.2-1.

There are no additional requirements on UE transmit power beyond that which is required in subclause 6.2.2 and subclause 6.6.2.3

| PRACH preamble format | Measurement period (ms) |
|-----------------------|-------------------------|
| 0                     | 0.9031                  |
| 1                     | 1.4844                  |
| 2                     | 1.8031                  |
| 3                     | 2.2844                  |
| 4                     | 0.1479                  |

Table 6.3.4.2-1: PRACH ON power measurement period



#### Figure 6.3.4.2-1: PRACH ON/OFF time mask

#### 6.3.4.2.2 SRS time mask

In the case a single SRS transmission, the ON power is defined as the mean power over the symbol duration excluding any transient period. Figure 6.3.4.2.2-1

In the case a dual SRS transmission, the ON power is defined as the mean power for each symbol duration excluding any transient period. Figure 6.3.4.2.2-2

There are no additional requirements on UE transmit power beyond that which is required in subclause 6.2.2 and subclause 6.6.2.3

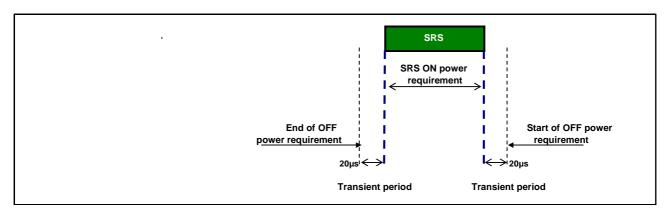


Figure 6.3.4.2.2-1: Single SRS time mask

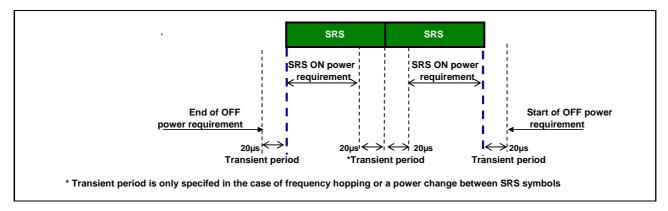
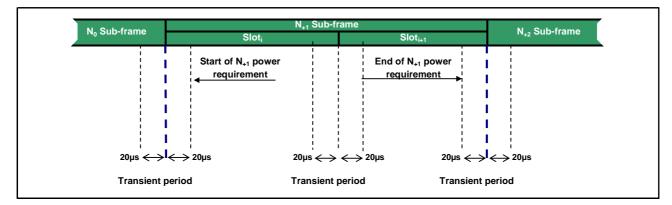


Figure 6.3.4.2.2-2: Dual SRS time mask for the case of UpPTS transmissions

## 6.3.4.3 Slot / Sub frame boundary time mask

The sub frame boundary time mask defines the observation period between the previous/subsequent sub–frame and the (reference) sub-frame. A transient period at a slot boundary within a sub-frame is only allowed in the case of Intra-sub frame frequency hopping. For the cases when the subframe contains SRS the time masks in subclause 6.3.4.4 apply.

There are no additional requirements on UE transmit power beyond that which is required in subclause 6.2.2 and subclause 6.6.2.3





## 6.3.4.4 PUCCH / PUSCH / SRS time mask

The PUCCH/PUSCH/SRS time mask defines the observation period between sounding reference symbol (SRS) and an adjacent PUSCH/PUCCH symbol and subsequent sub-frame.

There are no additional requirements on UE transmit power beyond that which is required in subclause 6.2.2 and subclause 6.6.2.3

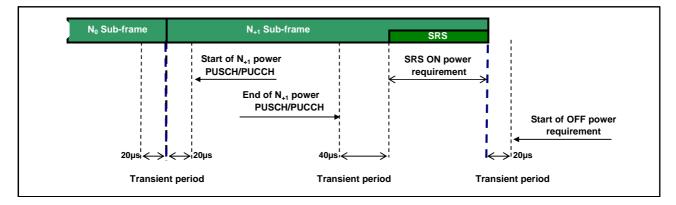


Figure 6.3.4.4-1: PUCCH/PUSCH/SRS time mask when there is a transmission before SRS but not after

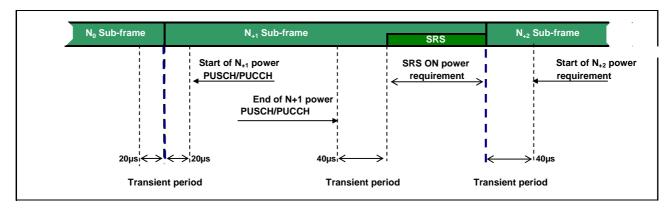


Figure 6.3.4.4-2: PUCCH/PUSCH/SRS time mask when there is transmission before and after SRS

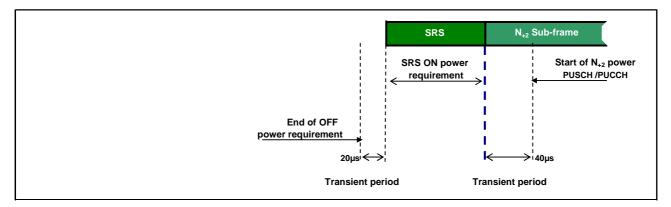


Figure 6.3.4.4-3: PUCCH/PUSCH/SRS time mask when there is a transmission after SRS but not before

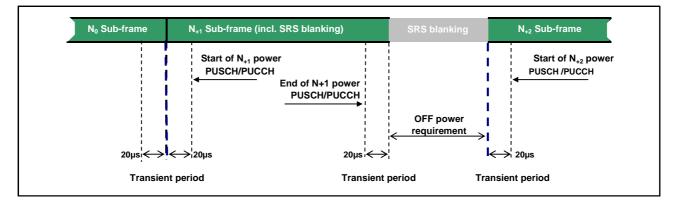


Figure 6.3.4.4-4: SRS time mask when there is FDD SRS blanking

# 6.3.4A ON/OFF time mask for CA

For intra-band contiguous carrier aggregation, the general output power ON/OFF time mask specified in subclause 6.3.4.1 is applicable for each component carrier during the ON power period and the transient periods. The OFF period as specified in subclause 6.3.4.1 shall only be applicable for each component carrier when all the component carriers are OFF.

# 6.3.4B ON/OFF time mask for UL-MIMO

For UE supporting UL-MIMO, the ON/OFF time mask requirements in subclause 6.3.4 apply at each transmit antenna connector.

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the general ON/OFF time mask requirements specified in subclause 6.3.4.1 apply to each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2.

For single-antenna port scheme, the requirements in subclause 6.3.4 apply.

# 6.3.5 Power Control

## 6.3.5.1 Absolute power tolerance

Absolute power tolerance is the ability of the UE transmitter to set its initial output power to a specific value for the first sub-frame at the start of a contiguous transmission or non-contiguous transmission with a transmission gap larger than 20ms. This tolerance includes the channel estimation error (the absolute RSRP accuracy requirement specified in subclause 9.1 of TS 36.133)

In the case of a PRACH transmission, the absolute tolerance is specified for the first preamble. The absolute power tolerance includes the channel estimation error (the absolute RSRP accuracy requirement specified in subclause 9.1 of TS 36.133).

#### 6.3.5.1.1 Minimum requirements

The minimum requirement for absolute power tolerance is given in Table 6.3.5.1.1-1 over the power range bounded by the Maximum output power as defined in subclause 6.2.2 and the Minimum output power as defined in subclause 6.3.2.

For operating bands under Note 2 in Table 6.2.2-1, the absolute power tolerance as specified in Table 6.3.5.1.1-1 is relaxed by reducing the lower limit by 1.5 dB when the transmission bandwidth is confined within  $F_{UL\_low}$  and  $F_{UL\_low} + 4$  MHz or  $F_{UL\_high} - 4$  MHz and  $F_{UL\_high}$ .

| Table 6.3.5.1.1-1: | Absolute | power | tolerance |
|--------------------|----------|-------|-----------|
|--------------------|----------|-------|-----------|

| Conditions | Tolerance |
|------------|-----------|
| Normal     | ± 9.0 dB  |
| Extreme    | ± 12.0 dB |

#### 6.3.5.2 Relative Power tolerance

The relative power tolerance is the ability of the UE transmitter to set its output power in a target sub-frame relatively to the power of the most recently transmitted reference sub-frame if the transmission gap between these sub-frames is  $\leq 20$  ms.

For PRACH transmission, the relative tolerance is the ability of the UE transmitter to set its output power relatively to the power of the most recently transmitted preamble. The measurement period for the PRACH preamble is specified in Table 6.3.4.2-1.

#### 6.3.5.2.1 Minimum requirements

The requirements specified in Table 6.3.5.2.1-1 apply when the power of the target and reference sub-frames are within the power range bounded by the Minimum output power as defined in subclause 6.3.2 and the measured PUMAX as defined in subclause 6.2.5 (i.e, the actual power as would be measured assuming no measurement error). This power shall be within the power limits specified in subclause 6.2.5.

To account for RF Power amplifier mode changes 2 exceptions are allowed for each of two test patterns. The test patterns are a monotonically increasing power sweep and a monotonically decreasing power sweep over a range bounded by the requirements of minimum power and maximum power specified in subclauses 6.3.2 and 6.2.2. For these exceptions the power tolerance limit is a maximum of  $\pm 6.0$  dB in Table 6.3.5.2.1-1

| Power step ∆P<br>(Up or down)<br>[dB] |   | All combinations<br>of PUSCH and<br>PUCCH<br>transitions [dB] | All combinations of<br>PUSCH/PUCCH and<br>SRS transitions<br>between sub-<br>frames [dB] | PRACH [dB]  |
|---------------------------------------|---|---|--|---|
| ΔP <                                  | < 2   | ±2.5 (Note 3)   | ±3.0   | ±2.5  |
| 2 ≤ ΔF                                | <b>'</b> < 3  | ±3.0  | ±4.0   | ±3.0  |
| 3 ≤ ΔF                                | <b>°</b> < 4  | ±3.5  | ±5.0   | ±3.5  |
| 4 ≤ ∆P                                | ≤ 10  | ±4.0  | ±6.0   | ±4.0  |
| 10 ≤ ∆F                               | <b>°</b> < 15   | ±5.0  | ±8.0   | ±5.0  |
| 15 ≤                                  | ΔP  | ±6.0  | ±9.0   | ±6.0  |
| NOTE 2:                               | <ul> <li>NOTE 1: For extreme conditions an additional ± 2.0 dB relaxation is allowed</li> <li>NOTE 2: For operating bands under Note 2 in Table 6.2.2-1, the relative power tolerance is relaxed by increasing the upper limit by 1.5 dB if the transmission bandwidth of the reference sub-frames is confined within F<sub>UL_low</sub> and F<sub>UL_low</sub> + 4 MHz or F<sub>UL_high</sub> – 4 MHz and F<sub>UL_high</sub> and the targe sub-frame is not confined within any one of these frequency ranges; if the transmission bandwidth of the target sub-frame is confined within F<sub>UL_low</sub> and F<sub>UL_low</sub> + 4 MHz or F<sub>UL_high</sub> – 4 MHz and F<sub>UL_high</sub> and the transmission bandwidth of the target sub-frame is confined within F<sub>UL_low</sub> and F<sub>UL_low</sub> + 4 MHz or F<sub>UL_high</sub> – 4 MHz and F<sub>UL_high</sub> and the reference sub-frame is not confined within any one of these frequency ranges, then the tolerance is relaxed by reducing the lower limit by 1.5 dB.</li> </ul> |   |  | relative power<br>5 dB if the<br>confined within<br>high and the target<br>tency ranges; if<br>confined within<br>high and the<br>hese frequency<br>ower limit by 1.5 |
| NOTE 3:                               | For PUSCH to PUSCH transitions with the allocated resource blocks<br>fixed in frequency and no transmission gaps other than those generated<br>by downlink subframes, DwPTS fields or Guard Periods for TDD: for a<br>power step $\Delta P \le 1$ dB, the relative power tolerance for transmission is<br>±1.0 dB.  |   |  | those generated s for TDD: for a  |

Table 6.3.5.2.1-1 Relative power tolerance for transmission (normal conditions)

The power step ( $\Delta P$ ) is defined as the difference in the calculated setting of the UE Transmit power between the target and reference sub-frames with the power setting according to subclause 5.1 of [TS 36.213]. The error is the difference between  $\Delta P$  and the power change measured at the UE antenna port with the power of the cell-specific reference signals kept constant. The error shall be less than the relative power tolerance specified in Table 6.3.5.2.1-1.

For sub-frames not containing an SRS symbol, the power change is defined as the relative power difference between the mean power of the original reference sub-frame and the mean power of the target subframe not including transient durations. The mean power of successive sub-frames shall be calculated according to Figure 6.3.4.3-1 and Figure 6.3.4.1-1 if there is a transmission gap between the reference and target sub-frames.

If at least one of the sub-frames contains an SRS symbol, the power change is defined as the relative power difference between the mean power of the last transmission within the reference sub-frame and the mean power of the first transmission within the target sub-frame not including transient durations. A transmission is defined as PUSCH, PUCCH or an SRS symbol. The mean power of the reference and target sub-frames shall be calculated according to Figures 6.3.4.1-1, 6.3.4.2-1, 6.3.4.4-1, 6.3.4.4-2 and 6.3.4.4-3 for these cases.

#### 6.3.5.3 Aggregate power control tolerance

Aggregate power control tolerance is the ability of a UE to maintain its power in non-contiguous transmission within 21 ms in response to 0 dB TPC commands with respect to the first UE transmission, when the power control parameters specified in TS 36.213 are constant.

#### 6.3.5.3.1 Minimum requirement

The UE shall meet the requirements specified in Table 6.3.5.3.1-1 for aggregate power control over the power range bounded by the minimum output power as defined in subclause 6.3.2 and the maximum output power as defined in subclause 6.2.2.

| TPC command UL cl  |  | UL channel | Aggregate power tolerance within 21 ms |
|--|--|------------|--|
| 0 dB   |  | PUCCH      | ±2.5 dB                                |
| 0 dB   |  | PUSCH      | ±3.5 dB                                |
| NOTE: The UE transmission gap is 4 ms. TPC command is transmitted via PDCCH 4 subframes preceding each PUCCH/PUSCH transmission. |  |            |  |

Table 6.3.5.3.1-1: Aggregate power control tolerance

## 6.3.5A Power control for CA

The requirements apply for one single PUCCH, PUSCH or SRS transmission of contiguous PRB allocation per component carrier with power setting in accordance with Clause 5.1 of [6].

#### 6.3.5A.1 Absolute power tolerance

The absolute power tolerance is the ability of the UE transmitter to set its initial output power to a specific value for the first sub-frame at the start of a contiguous transmission or non-contiguous transmission with a transmission gap on each active component carriers larger than 20ms. The requirement can be tested by time aligning any transmission gaps on the component carriers.

#### 6.3.5A.1.1 Minimum requirements

For intra-band contiguous carrier aggregation bandwidth classe C the absolute power control tolerance per component carrier is given in Table 6.3.5.1.1-1.

## 6.3.5A.2 Relative power tolerance

#### 6.3.5A.2.1 Minimum requirements

The requirements apply when the power of the target and reference sub-frames on each component carrier exceed -20 dBm and the total power is limited by  $P_{UMAX}$  as defined in subclause 6.2.5A. For the purpose of these requirements, the power in each component carrier is specified over only the transmitted resource blocks.

For intra-band contiguous carrier aggregation bandwidth classe C, the UE shall meet the following requirements for transmission on both assigned component carriers when the average transmit power per PRB is aligned across both assigned carriers in the reference sub-frame:

a) for all possible combinations of PUSCH and PUCCH transitions per component carrier, the corresponding requirements given in Table 6.3.5.2.1-1:

b) for SRS transitions on each component carrier, the requirements for combinations of PUSCH/PUCCH and SRS transitions given in Table 6.3.5.2.1-1 with simultaneous SRS of constant SRS bandwidth allocated in the target and reference subrames:

c) for RACH on the primary component carrier, the requirements given in Table 6.3.5.2.1-1 for PRACH

For a) and b) above, the power step  $\Delta P$  between the reference and target subframes shall be set by a TPC command and/or an uplink scheduling grant transmitted by means of an appropriate DCI Format.

For a), b) and c) above, two exceptions are allowed for each component carrier for a power per carrier ranging from -20 dBm to  $P_{UMAX,c}$  as defined in subclause 6.2.5. For these exceptions the power tolerance limit is ±6.0 dB in Table 6.3.5.2.1-1..

#### 6.3.5A.3 Aggregate power control tolerance

Aggregate power control tolerance is the ability of a UE to maintain its power in non-contiguous transmission within 21 ms in response to 0 dB TPC commands with respect to the first UE transmission, when the power control parameters specified in [6] are constant on all active component carriers.

#### 6.3.5A.3.1 Minimum requirements

For intra-band contiguous carrier aggregation bandwidth classe C, the aggregate power tolerance per component carrier is given in Table 6.3.5.3.1-1 with either simultaneous PUSCH or simultaneous PUCCH-PUSCH (if supported by the UE) configured. The average power per PRB shall be aligned across both assigned carriers before the start of the test. The requirement can be tested with the transmission gaps time aligned between component carriers.

# 6.3.5B Power control for UL-MIMO

For UE supporting UL-MIMO, the power control tolerance applies to the sum of output power at each transmit antenna connector.

The power control requirements specified in subclause 6.3.5 apply to UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme. The requirements shall be met with UL-MIMO configurations specified in Table 6.2.2B-2, wherein

- The Maximum output power requirements for UL-MIMO are specified in subclause 6.2.2B
- The Minimum output power requirements for UL-MIMO are specified in subclause 6.3.2B
- The requirements for configured transmitted power for UL-MIMO are specified in subclause 6.2.5B.

For single-antenna port scheme, the requirements in subclause 6.3.5 apply.

# 6.4 Void

# 6.5 Transmit signal quality

## 6.5.1 Frequency error

The UE modulated carrier frequency shall be accurate to within  $\pm 0.1$  PPM observed over a period of one time slot (0.5 ms) compared to the carrier frequency received from the E-UTRA Node B

# 6.5.1A Frequency error for CA

For intra-band contiguous carrier aggregation the UE modulated carrier frequencies per band shall be accurate to within  $\pm 0.1$  PPM observed over a period of one timeslot compared to the carrier frequency of primary component carrier received from the E-UTRA in the corresponding band.

# 6.5.1B Frequency error for UL-MIMO

For UE(s) supporting UL-MIMO, the UE modulated carrier frequency at each transmit antenna connector shall be accurate to within  $\pm 0.1$  PPM observed over a period of one time slot (0.5 ms) compared to the carrier frequency received from the E-UTRA Node B.

# 6.5.2 Transmit modulation quality

Transmit modulation quality defines the modulation quality for expected in-channel RF transmissions from the UE. The transmit modulation quality is specified in terms of:

- Error Vector Magnitude (EVM) for the allocated resource blocks (RBs)
- EVM equalizer spectrum flatness derived from the equalizer coefficients generated by the EVM measurement process
- Carrier leakage (caused by IQ offset)
- In-band emissions for the non-allocated RB

All the parameters defined in subclause 6.5.2 are defined using the measurement methodology specified in Annex F.

#### 6.5.2.1 Error Vector Magnitude

The Error Vector Magnitude is a measure of the difference between the reference waveform and the measured waveform. This difference is called the error vector. Before calculating the EVM the measured waveform is corrected by the sample timing offset and RF frequency offset. Then the IQ origin offset shall be removed from the measured waveform before calculating the EVM.

The measured waveform is further modified by selecting the absolute phase and absolute amplitude of the Tx chain. The EVM result is defined after the front-end IDFT as the square root of the ratio of the mean error vector power to the mean reference power expressed as a %.

The basic EVM measurement interval in the time domain is one preamble sequence for the PRACH and is one slot for the PUCCH and PUSCH in the time domain. When the PUSCH or PUCCH transmission slot is shortened due to multiplexing with SRS, the EVM measurement interval is reduced by one symbol, accordingly. The PUSCH or PUCCH EVM measurement interval is also reduced when the mean power, modulation or allocation between slots is expected to change. In the case of PUSCH transmission, the measurement interval is reduced by a time interval equal to the sum of 5  $\mu$ s and the applicable exclusion period defined in subclause 6.3.4, adjacent to the boundary where the power change is expected to occur. The PUSCH exclusion period is applied to the signal obtained after the front-end IDFT. In the case of PUCCH transmission with power change, the PUCCH EVM measurement interval is reduced by one symbol adjacent to the boundary where the power change is expected to occur.

#### 6.5.2.1.1 Minimum requirement

The RMS average of the basic EVM measurements for 10 sub-frames excluding any transient period for the average EVM case, and 60 sub-frames excluding any transient period for the reference signal EVM case, for the different modulations schemes shall not exceed the values specified in Table 6.5.2.1.1-1 for the parameters defined in Table 6.5.2.1.1-2. For EVM evaluation purposes, [all PRACH preamble formats 0-4 and] all PUCCH formats 1, 1a, 1b, 2, 2a and 2b are considered to have the same EVM requirement as QPSK modulated.

| Parameter    | Unit | Average EVM Level | Reference Signal EVM<br>Level |
|--------------|------|-------------------|-------------------------------|
| QPSK or BPSK | %    | 17.5              | 17.5                          |
| 16QAM        | %    | 12.5              | 12.5                          |

| Parameter            | Unit | Level             |
|----------------------|------|-------------------|
| UE Output Power      | dBm  | ≥ -40             |
| Operating conditions |      | Normal conditions |

#### 6.5.2.2 Carrier leakage

Carrier leakage (The IQ origin offset) is an additive sinusoid waveform that has the same frequency as the modulated waveform carrier frequency. The measurement interval is one slot in the time domain.

#### 6.5.2.2.1 Minimum requirements

The relative carrier leakage power is a power ratio of the additive sinusoid waveform and the modulated waveform. The relative carrier leakage power shall not exceed the values specified in Table 6.5.2.2.1-1.

| Parameters                       | Relative limit (dBc) | Applicable frequencies           |
|----------------------------------|----------------------|----------------------------------|
| Output power >10 dBm             | -28                  | Carrier center frequency < 1 GHz |
|                                  | -25                  | Carrier center frequency ≥ 1 GHz |
| 0 dBm ≤ Output power ≤10 dBm     | -25                  |                                  |
| -30 dBm ≤ Output power ≤0 dBm    | -20                  |                                  |
| -40 dBm ≤ Output power < -30 dBm | -10                  |                                  |

 Table 6.5.2.2.1-1: Minimum requirements for relative carrier leakage power

## 6.5.2.3 In-band emissions

The in-band emission is defined as the average across 12 sub-carrier and as a function of the RB offset from the edge of the allocated UL transmission bandwidth. The in-band emission is measured as the ratio of the UE output power in a non–allocated RB to the UE output power in an allocated RB.

The basic in-band emissions measurement interval is defined over one slot in the time domain. When the PUSCH or PUCCH transmission slot is shortened due to multiplexing with SRS, the in-band emissions measurement interval is reduced by one SC-FDMA symbol, accordingly.

#### 6.5.2.3.1 Minimum requirements

The relative in-band emission shall not exceed the values specified in Table 6.5.2.3.1-1.

| Parameter description | Unit | Limit (Note 1)  |  | Applicable<br>Frequencies     |
|-----------------------|------|---|--|-------------------------------|
| General               | dB   | $\max \left\{ \begin{array}{l} -25 - 10 \cdot \log_{10} \left( N_{RB} / L_{CRB} \right), \\ 20 \cdot \log_{10} EVM - 3 - 5 \cdot \left( \left  \Delta_{RB} \right  - 1 \right) / L_{CRB}, \\ -57 \ dBm \ / 180 \ kHz - P_{RB} \right\} \end{array}$ |  | Any non-allocated<br>(Note 2) |
| IQ Image              | dB   | -28   | Image frequencies when carrier center frequency<br>< 1 GHz and Output power > 10 dBm | Imaga                         |
|                       |      | -25   | Image frequencies when carrier center frequency < 1 GHz and Output power ≤ 10 dBm    | Image<br>frequencies          |
|                       |      | -25   | Image frequencies when carrier center frequency<br>≥ 1 GHz                           | (Notes 2, 3)                  |
| Carrier<br>leakage    | dBc  | -28   | Output power > 10 dBm and carrier center<br>frequency < 1 GHz                        |                               |
|                       |      | -25   | Output power > 10 dBm and carrier center<br>frequency ≥ 1 GHz                        | Carrier frequency             |
|                       |      | -25   | 0 dBm ≤ Output power ≤10 dBm   | (Notes 4, 5)                  |
|                       |      | -20   | -30 dBm ≤ Output power ≤ 0 dBm   |                               |
|                       |      | -10   | -40 dBm ≤ Output power < -30 dBm   |                               |

#### Table 6.5.2.3.1-1: Minimum requirements for in-band emissions

| NOTE 1:  | An in-band emissions combined limit is evaluated in each non-allocated RB. For each such RB, the minimum requirement is calculated as the higher of $P_{RB}$ - 30 dB and the power sum of all limit values                     |
|----------|--|
|          | (General, IQ Image or Carrier leakage) that apply. $P_{RB}$ is defined in Note 10.   |
| NOTE 2:  | The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-<br>allocated RB to the measured average power per allocated RB, where the averaging is done across all<br>allocated RBs. |
| NOTE 3:  | The applicable frequencies for this limit are those that are enclosed in the reflection of the allocated<br>bandwidth, based on symmetry with respect to the centre carrier frequency, but excluding any allocated<br>RBs.     |
| NOTE 4:  | The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-<br>allocated RB to the measured total power in all allocated RBs.  |
| NOTE 5:  | The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC   |
|          | frequency if $N_{\rm RB}$ is odd, or in the two RBs immediately adjacent to the DC frequency if $N_{\rm RB}$ is even, but excluding any allocated RB.  |
| NOTE 6:  | $L_{\it CRB}$ is the Transmission Bandwidth (see Figure 5.6-1).  |
| NOTE 7:  | $N_{\scriptscriptstyle RB}$ is the Transmission Bandwidth Configuration (see Figure 5.6-1).  |
| NOTE 8:  | EVM is the limit specified in Table 6.5.2.1.1-1 for the modulation format used in the allocated RBs.   |
| NOTE 9:  | $\Delta_{\it RB}$ is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g.  |
|          | $\Delta_{\rm \tiny RB}=1$ or $\Delta_{\rm \tiny RB}=-1$ for the first adjacent RB outside of the allocated bandwidth.  |
| NOTE 10: | $P_{\scriptscriptstyle RB}$ is the transmitted power per 180 kHz in allocated RBs, measured in dBm.  |
|          |  |

# 6.5.2.4 EVM equalizer spectrum flatness

The zero-forcing equalizer correction applied in the EVM measurement process (as described in Annex F) must meet a spectral flatness requirement for the EVM measurement to be valid. The EVM equalizer spectrum flatness is defined in terms of the maximum peak-to-peak ripple of the equalizer coefficients (dB) across the allocated uplink block. The basic measurement interval is the same as for EVM.

## 6.5.2.4.1 Minimum requirements

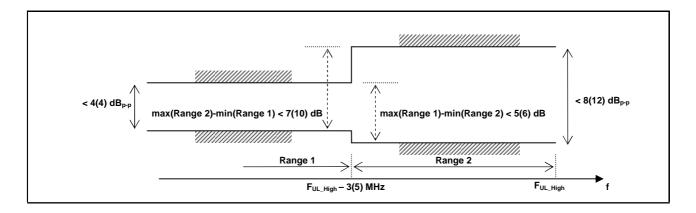
The peak-to-peak variation of the EVM equalizer coefficients contained within the frequency range of the uplink allocation shall not exceed the maximum ripple specified in Table 6.5.2.4.1-1 for normal conditions. For uplink allocations contained within both Range 1 and Range 2, the coefficients evaluated within each of these frequency ranges shall meet the corresponding ripple requirement and the following additional requirement: the relative difference between the maximum coefficient in Range 1 and the minimum coefficient in Range 2 must not be larger than 5 dB, and the relative difference between the maximum coefficient in Range 2 and the minimum coefficient in Range 1 must not be larger than 7 dB (see Figure 6.5.2.4.1-1).

The EVM equalizer spectral flatness shall not exceed the values specified in Table 6.5.2.4.1-2 for extreme conditions. For uplink allocations contained within both Range 1 and Range 2, the coefficients evaluated within each of these frequency ranges shall meet the corresponding ripple requirement and the following additional requirement: the relative difference between the maximum coefficient in Range 1 and the minimum coefficient in Range 2 must not be larger than 6 dB, and the relative difference between the maximum coefficient in Range 2 and the minimum coefficient in Range 1 must not be larger than 10 dB (see Figure 6.5.2.4.1-1).

| Frequency range   | Maximum ripple [dB] |
|---|---------------------|
| $F_{UL\_Meas} - F_{UL\_Low} \ge 3 \text{ MHz} \text{ and } F_{UL\_High} - F_{UL\_Meas} \ge 3 \text{ MHz}$         | 4 (p-p)             |
| (Range 1)   |                     |
| F <sub>UL_Meas</sub> – F <sub>UL_Low</sub> < 3 MHz or F <sub>UL_High</sub> – F <sub>UL_Meas</sub> < 3 MHz         | 8 (p-p)             |
| (Range 2)   |                     |
| NOTE 1: F <sub>UL_Meas</sub> refers to the sub-carrier frequency for which the equalizer coefficient is evaluated |                     |
| NOTE 2: F <sub>UL_Low</sub> and F <sub>UL_High</sub> refer to each E-UTRA frequency band specified in Table 5.5-1 |                     |

Table 6.5.2.4.1-2: Minimum requirements for EVM equalizer spectrum flatness (extreme conditions)

|                     | Frequency range  | Maximum Ripple [dB]          |
|---------------------|--|------------------------------|
| F <sub>UL_Mea</sub> | s – $F_{UL_{Low}} \ge 5 \text{ MHz}$ and $F_{UL_{High}} - F_{UL_{Meas}} \ge 5 \text{ MHz}$ | 4 (p-p)                      |
|                     | (Range 1)  |                              |
| F <sub>UL_Mea</sub> | as – F <sub>UL_Low</sub> < 5 MHz or F <sub>UL_High</sub> – F <sub>UL_Meas</sub> < 5 MHz    | 12 (p-p)                     |
|                     | (Range 2)  |                              |
| NOTE 1:             | $F_{\text{UL}\_\text{Meas}}$ refers to the sub-carrier frequency for which evaluated       | the equalizer coefficient is |
| NOTE 2:             | $F_{UL\_Low}$ and $F_{UL\_High}$ refer to each E-UTRA frequency 5.5-1                      | band specified in Table      |



# Figure 6.5.2.4.1-1: The limits for EVM equalizer spectral flatness with the maximum allowed variation of the coefficients indicated (the ETC minimum requirement within brackets).

# 6.5.2A Transmit modulation quality for CA

The requirements in this clause apply with PCC and SCC in the UL configured and activated: PCC with PRB allocation and SCC without PRB allocation and without CSI reporting and SRS configured.

#### 6.5.2A.1 Error Vector Magnitude

For the intra-band contiguous carrier aggregation, the Error Vector Magnitude requirement should be defined for each component carrier. Requirements only apply with PRB allocation in one of the component carriers.

When a single component carrier is configured Table 6.5.2.1.1-1 apply.

The EVM requirements are according to Table 6.5.2A.1-1 if CA is configured in uplink.

| Parameter    | Unit | Average EVM Level per<br>CC | Reference Signal EVM<br>Level |
|--------------|------|-----------------------------|-------------------------------|
| QPSK or BPSK | %    | 17.5                        | 17.5                          |
| 16QAM        | %    | 12.5                        | 12.5                          |

## 6.5.2A.2 Carrier leakage for CA

Carrier leakage (The IQ origin offset) is an additive sinusoid waveform that has the same frequency as the modulated waveform carrier frequency. Carrier leakage is defined for each component carrier and is measured on the carrier with PRBs allocated. The measurement interval is one slot in the time domain.

### 6.5.2A.2.1 Minimum requirements

The relative carrier leakage power is a power ratio of the additive sinusoid waveform and the modulated waveform. The relative carrier leakage power shall not exceed the values specified in Table 6.5.2A.2.1-1.

#### Table 6.5.2A.2.1-1: Minimum requirements for Relative Carrier Leakage Power

| Parameters                       | Relative Limit (dBc) |
|----------------------------------|----------------------|
| Output power >0 dBm              | -25                  |
| -30 dBm ≤ Output power ≤0 dBm    | -20                  |
| -40 dBm ≤ Output power < -30 dBm | -10                  |

### 6.5.2A.3 In-band emissions

#### 6.5.2A.3.1 Minimum requirement for CA

For intra-band contiguous carrier aggregation bandwidth class C, the requirements in Table 6.5.2A.3.1-1 and 6.5.2A.3.1-2 apply within the aggregated transmission bandwidth configuration with both component carrier (s) active and one single contiguous PRB allocation of bandwidth  $L_{CRB}$  at the edge of the aggregated transmission bandwidth configuration.

The inband emission is defined as the interference falling into the non allocated resource blocks for all component carriers. The measurement method for the inband emissions in the component carrier with PRB allocation is specified in annex F. For a non allocated component carrier a spectral measurement is specified.

| Paramete | r Unit  |  | Limit   | Applicable Frequencies  |  |  |
|----------|---|--|---|---|--|--|
|          |   | _  | $25 - 10 \cdot \log_{10} (N_{RB} / L_{CRB}),$   |   |  |  |
| General  | dB  | $20 \cdot \log_{10}$   | $EVM - 3 - 5 \cdot ( \Delta_{RB}  - 1) / L_{CRB}$ ,   | Any non-allocated (Note 1)  |  |  |
|          |   | – 57 dBm   | $/180  kHz - P_{RB}$  |   |  |  |
| IQ Image | dB  |  | -25   | Exception for IQ image<br>(Note 2)  |  |  |
| Carrier  |   | -25  | Output power > 0 dBm  | Exception for Carrier frequency   |  |  |
| leakage  | dBc   | -20  | $-30 \text{ dBm} \le \text{Output power} \le 0 \text{ dBm}$   | (Note 3)  |  |  |
|          |   | -10  | -40 dBm ≤ Output power < -30 dBm  |   |  |  |
|          | minimum requireme<br>(General, IQ Image<br>non-allocated RB. 1          | ent is calculate<br>or Carrier lea<br>The measurem<br>Ilocated RB to | imit is evaluated in each non-allocated F<br>ed as the higher of $P_{RB}$ - 30 dB and the p<br>kage) that apply. $P_{RB}$ is defined in Note<br>nent bandwidth is 1 RB and the limit is en<br>the measured average power per allocations. | oower sum of all limit values<br>8. The limit is evaluated in each<br>xpressed as a ratio of measured |  |  |
| NOTE 2:  | Exceptions to the g   | eneral limit are   | e allowed for up to $L_{\scriptscriptstyle CRBs}$ +1 RBs within   | a contiguous width of $L_{{\it CRBs}}$ +1   |  |  |
| NOTE 3:  | Exceptions to the g<br>bandwidth is 1 RB a<br>measured total pow        | eneral limit are<br>and the limit is<br>ver in all alloca            |   | er in the non-allocated RB to the   |  |  |
| NOTE 4:  | $L_{\it CRB}$ is the Transr   | nission Bandw  | vidth (see Figure 5.6-1) not exceeding  | $N_{RB}/2-1$  |  |  |
|          | $N_{\scriptscriptstyle RB}$ is the Transmallocated.                     | ission Bandw   | idth Configuration (see Figure 5.6-1) of t  | the component carrier with RBs  |  |  |
| NOTE 6:  | EVM is the limit  | specified in Ta  | ble 6.5.2.1.1-1 for the modulation forma  | t used in the allocated RBs.  |  |  |
| NOTE 7:  | $\Delta_{\it RB}$ is the starting                                       | frequency offs   | set between the allocated RB and the m  | easured non-allocated RB (e.g.  |  |  |
|          | $\Delta_{\scriptscriptstyle RB}=1$ or $\Delta_{\scriptscriptstyle RB}=$ | = $-1$ for the fi  | rst adjacent RB outside of the allocated  | bandwidth.  |  |  |
| NOTE 8:  | $P_{\scriptscriptstyle RB}$ is the transmit                             | ted power per  | 180 kHz in allocated RBs, measured in   | dBm.  |  |  |

#### Table 6.5.2A.3.1-1: Minimum requirements for in-band emissions (allocated component carrier)

| Para-<br>meter     | Unit                   | Meas BW<br>Note 1                     |                      | Limit   | remark  | Applicable<br>Frequencies  |
|--------------------|------------------------|---------------------------------------|----------------------|---|---|--|
| General            | dB                     | BW of 1 RB<br>(180KHz<br>rectangular) | $20 \cdot \log_{10}$ | $25 - 10 \cdot \log_{10} (N_{RB} / L_{CRB}),$<br>$EVM - 3 - 5 \cdot ( \Delta_{RB}  - 1) / L_{CRB},$<br>$n / 180  kHz - P_{RB} \}$ | The<br>reference<br>value is the<br>average<br>power per<br>allocated<br>RB in the<br>allocated<br>component<br>carrier | Any RB in the<br>non allocated<br>component<br>carrier.<br>The frequency<br>raster of the<br>RBs is derived<br>when this<br>component<br>carrier is<br>allocated with<br>RBs |
| IQ Image           | dB                     | BW of 1 RB<br>(180KHz<br>rectangular) |                      | -25<br>Note 2   | The<br>reference<br>value is the<br>average<br>power per<br>allocated<br>RB in the<br>allocated<br>component<br>carrier | The frequencies of the $L_{CRB}$ contiguous non-allocated RBs are unknown. The frequency raster of the RBs is derived when this component carrier is allocated with          |
|                    |                        | BW of 1 RB<br>(180KHz                 |                      | Note 3  | The reference   | RBs<br>The<br>frequencies of   |
|                    |                        | rectangular)                          | -25                  | Output power > 0 dBm  | value is the<br>total power<br>of the   | the up to 2<br>non-allocated<br>RBs are  |
| Carrier<br>leakage | dBc                    |                                       | -20                  | -30 dBm ≤ Output power ≤ 0<br>dBm   | allocated<br>RBs in the<br>allocated<br>component<br>carrier  | unknown.<br>The frequency<br>raster of the<br>RBs is derived<br>when this  |
|                    |                        |                                       | -10                  | -40 dBm ≤ Output power < -30<br>dBm   | camor   | component<br>carrier is<br>allocated with<br>RBs   |
|                    | Resolutio<br>bandwidtł |                                       | han the me           | easurement BW may be integrated   | to achieve the r  | neasurement  |
|                    |                        |                                       | limit is are         | allowed for up to $L_{\it CRB}$ +1 RBs wit  | hin a contiguou   | is width of $L_{\scriptscriptstyle CRB}$   |
| NOTE 3:            | Two Exce               |                                       |                      | are allowed for up to two contiguous  |   | RBs  |

#### Table 6.5.2A.3.1-2: Minimum requirements for in-band emissions (not allocated component carrier)

NOTE 4: Note 4 to note 8 from Table 6.5.2A.3.1-1 apply for Table 6.5.2A.3.1-2 as well.

# Transmit modulation quality for UL-MIMO For UE supporting UL-MIMO, the transmit modulation quality requirements are specified at each transmit antenna

connector.

For single-antenna port scheme, the requirements in subclause 6.5.2 apply.

The transmit modulation quality is specified in terms of:

6.5.2B

- Error Vector Magnitude (EVM) for the allocated resource blocks (RBs)
- EVM equalizer spectrum flatness derived from the equalizer coefficients generated by the EVM measurement process

- Carrier leakage (caused by IQ offset)
- In-band emissions for the non-allocated RB

### 6.5.2B.1 Error Vector Magnitude

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the Error Vector Magnitude requirements specified in Table 6.5.2.1.1-1 which is defined in subclause 6.5.2.1 apply at each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2.

### 6.5.2B.2 Carrier leakage

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the Relative Carrier Leakage Power requirements specified in Table 6.5.2.2.1-1 which is defined in subclause 6.5.2.2 apply at each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2.

### 6.5.2B.3 In-band emissions

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the In-band Emission requirements specified in Table 6.5.2.3.1-1 which is defined in subclause 6.5.2.3 apply at each transmit antenna connector. The requirements shall be met with the uplink MIMO configurations specified in Table 6.2.2B-2.

### 6.5.2B.4 EVM equalizer spectrum flatness for UL-MIMO

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the EVM Equalizer Spectrum Flatness requirements specified in Table 6.5.2.4.1-1 and Table 6.5.2.4.1-2 which are defined in subclause 6.5.2.4 apply at each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2.

# 6.6 Output RF spectrum emissions

The output UE transmitter spectrum consists of the three components; the emission within the occupied bandwidth (channel bandwidth), the Out Of Band (OOB) emissions and the far out spurious emission domain.

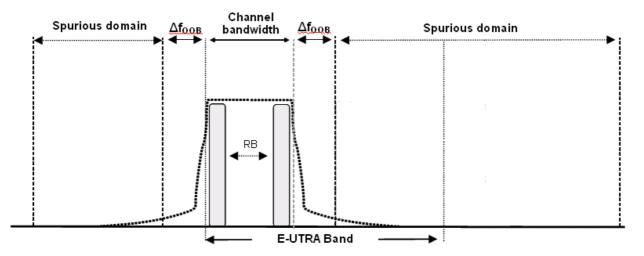


Figure 6.6-1: Transmitter RF spectrum

# 6.6.1 Occupied bandwidth

Occupied bandwidth is defined as the bandwidth containing 99 % of the total integrated mean power of the transmitted spectrum on the assigned channel. The occupied bandwidth for all transmission bandwidth configurations (Resources Blocks) shall be less than the channel bandwidth specified in Table 6.6.1-1

|                            | Occupied channel bandwidth / Channel bandwidth |            |          |           |           |           |  |
|----------------------------|--|------------|----------|-----------|-----------|-----------|--|
|                            | 1.4<br>MHz                                     | 3.0<br>MHz | 5<br>MHz | 10<br>MHz | 15<br>MHz | 20<br>MHz |  |
| Channel bandwidth<br>(MHz) | 1.4  | 3          | 5        | 10        | 15        | 20        |  |

Table 6.6.1-1: Occupied channel bandwidth

# 6.6.1A Occupied bandwidth for CA

For intra-band contiguous carrier aggregation the occupied bandwidth is a measure of the bandwidth containing 99 % of the total integrated power of the transmitted spectrum. The OBW shall be less than the aggregated channel bandwidth defined in subclause 5.6A.

# 6.6.1B Occupied bandwidth for UL-MIMO

For UE supporting UL-MIMO, the requirements for occupied bandwidth is specified at each transmit antenna connector. The occupied bandwidth is defined as the bandwidth containing 99 % of the total integrated mean power of the transmitted spectrum on the assigned channel at each transmit antenna connector.

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the occupied bandwidth at each transmitter antenna shall be less than the channel bandwidth specified in Table 6.6.1B-1. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2.

| Table 6.6.1B-1: | Occupied | channel | bandwidth |
|-----------------|----------|---------|-----------|
|-----------------|----------|---------|-----------|

|                            | Occupied channel bandwidth / Channel bandwidth |            |          |           |           |           |
|----------------------------|--|------------|----------|-----------|-----------|-----------|
|                            | 1.4<br>MHz                                     | 3.0<br>MHz | 5<br>MHz | 10<br>MHz | 15<br>MHz | 20<br>MHz |
| Channel bandwidth<br>(MHz) | 1.4  | 3          | 5        | 10        | 15        | 20        |

For single-antenna port scheme, the requirements in subclause 6.6.1 apply.

# 6.6.2 Out of band emission

The Out of band emissions are unwanted emissions immediately outside the assigned channel bandwidth resulting from the modulation process and non-linearity in the transmitter but excluding spurious emissions. This out of band emission limit is specified in terms of a spectrum emission mask and an Adjacent Channel Leakage power Ratio.

### 6.6.2.1 Spectrum emission mask

The spectrum emission mask of the UE applies to frequencies ( $\Delta f_{OOB}$ ) starting from the ± edge of the assigned E-UTRA channel bandwidth. For frequencies greater than ( $\Delta f_{OOB}$ ) as specified in Table 6.6.2.1.1-1 the spurious requirements in subclause 6.6.3 are applicable.

#### 6.6.2.1.1 Minimum requirement

The power of any UE emission shall not exceed the levels specified in Table 6.6.2.1.1-1 for the specified channel bandwidth.

|                            | Spectrum emission limit (dBm)/ Channel bandwidth |            |          |           |           |           |                          |  |  |  |
|----------------------------|--|------------|----------|-----------|-----------|-----------|--------------------------|--|--|--|
| Δf <sub>оов</sub><br>(MHz) | 1.4<br>MHz                                       | 3.0<br>MHz | 5<br>MHz | 10<br>MHz | 15<br>MHz | 20<br>MHz | Measurement<br>bandwidth |  |  |  |
| ± 0-1                      | -10  | -13        | -15      | -18       | -20       | -21       | 30 kHz                   |  |  |  |
| ± 1-2.5                    | -10  | -10        | -10      | -10       | -10       | -10       | 1 MHz                    |  |  |  |
| ± 2.5-2.8                  | -25  | -10        | -10      | -10       | -10       | -10       | 1 MHz                    |  |  |  |
| ± 2.8-5                    |  | -10        | -10      | -10       | -10       | -10       | 1 MHz                    |  |  |  |
| ± 5-6                      |  | -25        | -13      | -13       | -13       | -13       | 1 MHz                    |  |  |  |
| ± 6-10                     |  |            | -25      | -13       | -13       | -13       | 1 MHz                    |  |  |  |
| ± 10-15                    |  |            |          | -25       | -13       | -13       | 1 MHz                    |  |  |  |
| ± 15-20                    |  |            |          |           | -25       | -13       | 1 MHz                    |  |  |  |
| ± 20-25                    |  |            |          |           |           | -25       | 1 MHz                    |  |  |  |

Table 6.6.2.1.1-1: General E-UTRA spectrum emission mask

NOTE: As a general rule, the resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. However, to improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

### 6.6.2.1A Spectrum emission mask for CA

For intra-band contiguous carrier aggregation the spectrum emission mask of the UE applies to frequencies ( $\Delta f_{OOB}$ ) starting from the ± edge of the aggregated channel bandwidth (Table 5.6A-1) For intra-band contiguous carrier aggregation the bandwidth class C, the power of any UE emission shall not exceed the levels specified in Table 6.6.2.1A-1 for the specified channel bandwidth.

|                   | Spectrum emission limit [dBm]/BW <sub>Channel_CA</sub> |            |           |             |             |             |  |  |  |
|-------------------|--|------------|-----------|-------------|-------------|-------------|--|--|--|
| Δf <sub>OOB</sub> | 25RB+100RB   | 50RB+100RB | 75RB+75RB | 75RB+100RB  | 100RB+100RB | Measurement |  |  |  |
| (MHz)             | (24.95 MHz)  | (29.9 MHz) | (30 MHz)  | (34.85 MHz) | (39.8 MHz)  | bandwidth   |  |  |  |
| ± 0-1             | -22  | -22.5      | -22.5     | -23.5       | -24         | 30 kHz      |  |  |  |
| ± 1-5             | -10  | -10        | -10       | -10         | -10         | 1 MHz       |  |  |  |
| ± 5-24.95         | -13  | -13        | -13       | -13         | -13         | 1 MHz       |  |  |  |
| ± 24.95-29.9      | -25  | -13        | -13       | -13         | -13         | 1 MHz       |  |  |  |
| ± 29.9-29.95      | -25  | -25        | -13       | -13         | -13         | 1 MHz       |  |  |  |
| ± 29.95-30        |  | -25        | -13       | -13         | -13         | 1 MHz       |  |  |  |
| ± 30-34.85        |  | -25        | -25       | -13         | -13         | 1 MHz       |  |  |  |
| ± 34.85-34.9      |  | -25        | -25       | -25         | -13         | 1 MHz       |  |  |  |
| ± 34.9-35         |  |            | -25       | -25         | -13         | 1 MHz       |  |  |  |
| ± 35-39.8         |  |            |           | -25         | -13         | 1 MHz       |  |  |  |
| ± 39.8-39.85      |  |            |           | -25         | -25         | 1 MHz       |  |  |  |
| ± 39.85-44.8      |  |            |           |             | -25         | 1 MHz       |  |  |  |

#### Table 6.6.2.1A-1: General E-UTRA CA spectrum emission mask for Bandwidth Class C

#### 6.6.2.2 Additional spectrum emission mask

This requirement is specified in terms of an "additional spectrum emission" requirement.

#### 6.6.2.2.1 Minimum requirement (network signalled value "NS\_03", "NS\_11", and "NS\_20")

Additional spectrum emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

When "NS\_03", "NS\_11" or "NS\_20" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.2.2.1-1.

|                            | Spectrum emission limit (dBm)/ Channel bandwidth |            |          |           |           |           |                          |  |  |
|----------------------------|--|------------|----------|-----------|-----------|-----------|--------------------------|--|--|
| ∆f <sub>оов</sub><br>(MHz) | 1.4<br>MHz                                       | 3.0<br>MHz | 5<br>MHz | 10<br>MHz | 15<br>MHz | 20<br>MHz | Measurement<br>bandwidth |  |  |
| ± 0-1                      | -10  | -13        | -15      | -18       | -20       | -21       | 30 kHz                   |  |  |
| ± 1-2.5                    | -13  | -13        | -13      | -13       | -13       | -13       | 1 MHz                    |  |  |
| ± 2.5-2.8                  | -25  | -13        | -13      | -13       | -13       | -13       | 1 MHz                    |  |  |
| ± 2.8-5                    |  | -13        | -13      | -13       | -13       | -13       | 1 MHz                    |  |  |
| ± 5-6                      |  | -25        | -13      | -13       | -13       | -13       | 1 MHz                    |  |  |
| ± 6-10                     |  |            | -25      | -13       | -13       | -13       | 1 MHz                    |  |  |
| ± 10-15                    |  |            |          | -25       | -13       | -13       | 1 MHz                    |  |  |
| ± 15-20                    |  |            |          |           | -25       | -13       | 1 MHz                    |  |  |
| ± 20-25                    |  |            |          |           |           | -25       | 1 MHz                    |  |  |

Table 6.6.2.2.1-1: Additional requirements

NOTE: As a general rule, the resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. However, to improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

#### 6.6.2.2.2 Minimum requirement (network signalled value "NS\_04")

Additional spectrum emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

When "NS\_04" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.2.2.2-1.

|                            |            | Spectrum emission limit (dBm)/ Channel bandwidth |          |           |           |           |                          |  |  |
|----------------------------|------------|--|----------|-----------|-----------|-----------|--------------------------|--|--|
| Δf <sub>OOB</sub><br>(MHz) | 1.4<br>MHz | 3.0<br>MHz                                       | 5<br>MHz | 10<br>MHz | 15<br>MHz | 20<br>MHz | Measurement<br>bandwidth |  |  |
| ± 0-1                      | -10        | -13  | -15      | -18       | -20       | -21       | 30 kHz                   |  |  |
| ± 1-2.5                    | -13        | -13  | -13      | -13       | -13       | -13       | 1 MHz                    |  |  |
| ± 2.5-2.8                  | -25        | -13  | -13      | -13       | -13       | -13       | 1 MHz                    |  |  |
| ± 2.8-5.5                  |            | -13  | -13      | -13       | -13       | -13       | 1 MHz                    |  |  |
| ± 5.5-6                    |            | -25  | -25      | -25       | -25       | -25       | 1 MHz                    |  |  |
| ± 6-10                     |            |  | -25      | -25       | -25       | -25       | 1 MHz                    |  |  |
| ± 10-15                    |            |  |          | -25       | -25       | -25       | 1 MHz                    |  |  |
| ± 15-20                    |            |  |          |           | -25       | -25       | 1 MHz                    |  |  |
| ± 20-25                    |            |  |          |           |           | -25       | 1 MHz                    |  |  |

Table 6.6.2.2.2-1: Additional requirements

Note: As a general rule, the resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. However, to improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

#### 6.6.2.2.3 Minimum requirement (network signalled value "NS\_06" or "NS\_07")

Additional spectrum emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

When "NS\_06" or "NS\_07" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.2.2.3-1.

|                            | Spectru    | Spectrum emission limit (dBm)/ Channel bandwidth |          |           |                          |  |  |  |  |
|----------------------------|------------|--|----------|-----------|--------------------------|--|--|--|--|
| Δf <sub>ООВ</sub><br>(MHz) | 1.4<br>MHz | 3.0<br>MHz                                       | 5<br>MHz | 10<br>MHz | Measurement<br>bandwidth |  |  |  |  |
| ± 0-0.1                    | -13        | -13  | -15      | -18       | 30 kHz                   |  |  |  |  |
| ± 0.1-1                    | -13        | -13  | -13      | -13       | 100 kHz                  |  |  |  |  |
| ± 1-2.5                    | -13        | -13  | -13      | -13       | 1 MHz                    |  |  |  |  |
| ± 2.5-2.8                  | -25        | -13  | -13      | -13       | 1 MHz                    |  |  |  |  |
| ± 2.8-5                    |            | -13  | -13      | -13       | 1 MHz                    |  |  |  |  |
| ± 5-6                      |            | -25  | -13      | -13       | 1 MHz                    |  |  |  |  |
| ± 6-10                     |            |  | -25      | -13       | 1 MHz                    |  |  |  |  |
| ± 10-15                    |            |  |          | -25       | 1 MHz                    |  |  |  |  |

#### Table 6.6.2.2.3-1: Additional requirements

NOTE: As a general rule, the resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. However, to improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

### 6.6.2.2A Additional Spectrum Emission Mask for CA

This requirement is specified in terms of an "additional spectrum emission" requirement.

#### 6.6.2.2A.1 Minimum requirement (network signalled value "CA\_NS\_04")

Additional spectrum emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

When "CA\_NS\_04" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.2.2A-1.

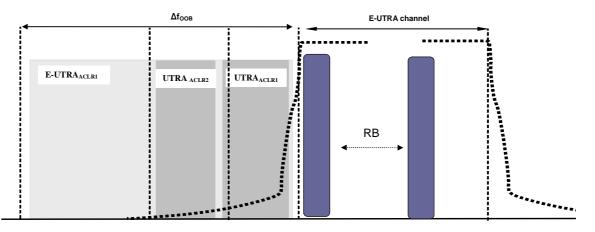
|   | Spectrum emission limit [dBm]/BW <sub>Channel_CA</sub> |                        |                    |                         |                         |                          |  |  |  |  |
|---|--|------------------------|--------------------|-------------------------|-------------------------|--------------------------|--|--|--|--|
|   | Δf <sub>oob</sub><br>(MHz)                             | 50+100RB<br>(29.9 MHz) | 75+75B<br>(30 MHz) | 75+100RB<br>(34.85 MHz) | 100+100RB<br>(39.8 MHz) | Measurement<br>bandwidth |  |  |  |  |
| Γ | ± 0-1  | -22.5                  | -22.5              | -23.5                   | -24                     | 30 kHz                   |  |  |  |  |
|   | ± 1-5.5  | -13                    | -13                | -13                     | -13                     | 1 MHz                    |  |  |  |  |
|   | $\pm 5.5-34.9$   | -25                    | -25                | -25                     | -25                     | 1 MHz                    |  |  |  |  |
|   | $\pm$ 34.9-35  |                        | -25                | -25                     | -25                     | 1 MHz                    |  |  |  |  |
|   | $\pm 35 - 39.85$                                       |                        |                    | -25                     | -25                     | 1 MHz                    |  |  |  |  |
|   | ± 39.85-44.8   |                        |                    |                         | -25                     | 1 MHz                    |  |  |  |  |

#### Table 6.6.2.2A-1: Additional requirements

Note: As a general rule, the resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. However, to improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

#### 6.6.2.3 Adjacent Channel Leakage Ratio

Adjacent Channel Leakage power Ratio (ACLR) is the ratio of the filtered mean power centred on the assigned channel frequency to the filtered mean power centred on an adjacent channel frequency. ACLR requirements for one E-UTRA carrier are specified for two scenarios for an adjacent E-UTRA and /or UTRA channel as shown in Figure 6.6.2.3-1.





#### 6.6.2.3.1 Minimum requirement E-UTRA

E-UTRA Adjacent Channel Leakage power Ratio (E-UTRA<sub>ACLR</sub>) is the ratio of the filtered mean power centred on the assigned channel frequency to the filtered mean power centred on an adjacent channel frequency at nominal channel spacing. The assigned E-UTRA channel power and adjacent E-UTRA channel power are measured with rectangular filters with measurement bandwidths specified in Table 6.6.2.3.1-1 and Table 6.6.2.3.1-2. If the measured adjacent channel power is greater than -50dBm then the E-UTRA<sub>ACLR</sub> shall be higher than the value specified in Table 6.6.2.3.1-1 and Table 6.6.2.3.1-2.

|  | Char        | Channel bandwidth / E-UTRA <sub>ACLR1</sub> / Measurement bandwidth |          |           |           |           |  |  |  |
|--|-------------|---|----------|-----------|-----------|-----------|--|--|--|
|  | 1.4<br>MHz  | 3.0<br>MHz  | 5<br>MHz | 10<br>MHz | 15<br>MHz | 20<br>MHz |  |  |  |
| E-UTRA <sub>ACLR1</sub>                    | 30 dB       | 30 dB   | 30 dB    | 30 dB     | 30 dB     | 30 dB     |  |  |  |
| E-UTRA channel<br>Measurement<br>bandwidth | 1.08<br>MHz | 2.7<br>MHz  | 4.5 MHz  | 9.0 MHz   | 13.5 MHz  | 18 MHz    |  |  |  |
| Adjacent channel                           | +1.4        | +3.0  | +5       | +10       | +15       | +20       |  |  |  |
| centre frequency                           | /           | /   | /        | /         | /         | /         |  |  |  |
| offset [MHz]                               | -1.4        | -3.0  | -5       | -10       | -15       | -20       |  |  |  |

Table 6.6.2.3.1-1: General requirements for E-UTRA<sub>ACLR</sub>

|                         | Char   | Channel bandwidth / E-UTRA <sub>ACLR1</sub> / Measurement bandwidth |         |         |     |     |  |  |  |
|-------------------------|--|---|---------|---------|-----|-----|--|--|--|
|                         | 1.4  | 3.0   | 5       | 10      | 15  | 20  |  |  |  |
|                         | MHz  | MHz   | MHz     | MHz     | MHz | MHz |  |  |  |
| E-UTRA <sub>ACLR1</sub> |  |   | 37 dB   | 37 dB   |     |     |  |  |  |
| E-UTRA channel          |  |   |         |         |     |     |  |  |  |
| Measurement             |  |   | 4.5 MHz | 9.0 MHz |     |     |  |  |  |
| bandwidth               |  |   |         |         |     |     |  |  |  |
| Adjacent channel        |  |   | +5      | +10     |     |     |  |  |  |
| centre frequency        |  |   | /       | /       |     |     |  |  |  |
| offset [MHz]            |  |   | -5      | -10     |     |     |  |  |  |
| NOTE 1: E-UTRAAC        | NOTE 1: E-UTRA <sub>ACLR1</sub> shall be applicable for >23dBm |   |         |         |     |     |  |  |  |

### 6.6.2.3.1A Void

#### 6.6.2.3.2 Minimum requirements UTRA

UTRA Adjacent Channel Leakage power Ratio (UTRA<sub>ACLR</sub>) is the ratio of the filtered mean power centred on the assigned E-UTRA channel frequency to the filtered mean power centred on an adjacent(s) UTRA channel frequency.

UTRA Adjacent Channel Leakage power Ratio is specified for both the first UTRA adjacent channel (UTRA<sub>ACLR1</sub>) and the 2<sup>nd</sup> UTRA adjacent channel (UTRA<sub>ACLR2</sub>). The UTRA channel power is measured with a RRC bandwidth filter with roll-off factor  $\alpha$  =0.22. The assigned E-UTRA channel power is measured with a rectangular filter with measurement bandwidth specified in Table 6.6.2.3.2-1. If the measured UTRA channel power is greater than –50dBm then the UTRA<sub>ACLR</sub> shall be higher than the value specified in Table 6.6.2.3.2-1.

|   |                                | Channel bandwidth / UTRA <sub>ACLR1/2</sub> / Measurement bandwidth |   |   |   |   |  |  |  |  |
|---|--------------------------------|---|---|---|---|---|--|--|--|--|
|   | 1.4                            | 3.0   |   |   |   | 20  |  |  |  |  |
|   | MHz                            | MHz   | MHz   | MHz   | MHz   | MHz   |  |  |  |  |
| UTRA <sub>ACLR1</sub>   | 33 dB                          | 33 dB   | 33 dB   | 33 dB   | 33 dB   | 33 dB   |  |  |  |  |
| Adjacent<br>channel<br>centre                                     | 0.7+BW <sub>UTRA</sub> /2<br>/ | 1.5+BW <sub>UTRA</sub> /2<br>/                                      | +2.5+BW <sub>UTRA</sub> /2  | +5+BW <sub>UTRA</sub> /2                                      | +7.5+BW <sub>UTRA</sub> /2  | +10+BW <sub>UTRA</sub> /2                                       |  |  |  |  |
| frequency<br>offset [MHz]   | -0.7-<br>BW <sub>UTRA</sub> /2 | -1.5-<br>BW <sub>UTRA</sub> /2                                      | /<br>-2.5-BW <sub>UTRA</sub> /2                                   | /<br>-5-BW <sub>UTRA</sub> /2                                 | /<br>-7.5-BW <sub>UTRA</sub> /2                                   | /<br>-10-BW <sub>UTRA</sub> /2                                  |  |  |  |  |
| UTRA <sub>ACLR2</sub>   | -                              | -   | 36 dB   | 36 dB   | 36 dB   | 36 dB   |  |  |  |  |
| Adjacent<br>channel<br>centre<br>frequency<br>offset [MHz]        | -                              | -   | +2.5+3*BW <sub>UTRA</sub> /2<br>/<br>-2.5-3*BW <sub>UTRA</sub> /2 | +5+3*BW <sub>UTRA</sub> /2<br>/<br>-5-3*BW <sub>UTRA</sub> /2 | +7.5+3*BW <sub>UTRA</sub> /2<br>/<br>-7.5-3*BW <sub>UTRA</sub> /2 | +10+3*BW <sub>UTRA</sub> /2<br>/<br>-10-3*BW <sub>UTRA</sub> /2 |  |  |  |  |
| E-UTRA<br>channel<br>Measurement<br>bandwidth                     | 1.08 MHz                       | 2.7 MHz   | 4.5 MHz   | 9.0 MHz   | 13.5 MHz  | 18 MHz  |  |  |  |  |
| UTRA 5MHz<br>channel<br>Measurement<br>bandwidth<br>(Note 1)      | 3.84 MHz                       | 3.84 MHz  | 3.84 MHz  | 3.84 MHz  | 3.84 MHz  | 3.84 MHz  |  |  |  |  |
| UTRA<br>1.6MHz<br>channel<br>measurement<br>bandwidth<br>(Note 2) | 1.28 MHz                       | 1.28 MHz  | 1.28 MHz  | 1.28MHz   | 1.28MHz   | 1.28MHz   |  |  |  |  |
|   |                                |   | nce with UTRA FDD   |   |   |   |  |  |  |  |

| Table 6.6.2.3.2-1: Requir | rements for UTRA <sub>ACLR1/2</sub> |
|---------------------------|-------------------------------------|
|---------------------------|-------------------------------------|

#### 6.6.2.3.2A Minimum requirement UTRA for CA

For intra-band contiguous carrier aggregation the UTRA Adjacent Channel Leakage power Ratio (UTRA<sub>ACLR</sub>) is the ratio of the filtered mean power centred on the aggregated channel bandwidth to the filtered mean power centred on an adjacent(s) UTRA channel frequency.

UTRA Adjacent Channel Leakage power Ratio is specified for both the first UTRA adjacent channel (UTRA<sub>ACLR1</sub>) and the 2<sup>nd</sup> UTRA adjacent channel (UTRA<sub>ACLR2</sub>). The UTRA channel power is measured with a RRC bandwidth filter with roll-off factor  $\alpha$  =0.22. The assigned aggregated channel bandwidth power is measured with a rectangular filter with measurement bandwidth specified in Table 6.6.2.3.2A-1. If the measured UTRA channel power is greater than –50dBm then the UTRA<sub>ACLR</sub> shall be higher than the value specified in Table 6.6.2.3.2A-1.

|   | CA bandwidth class / UTRA <sub>ACLR1/2</sub> / measurement bandwidth  |
|---|---|
|   | CA bandwidth class C  |
| UTRA <sub>ACLR1</sub>                                 | 33 dB   |
| Adjacent channel centre<br>frequency offset (in MHz)  | + BW <sub>Channel_CA</sub> /2 + BW <sub>UTRA</sub> /2<br>/<br>- BW <sub>Channel_CA</sub> / 2 - BW <sub>UTRA</sub> /2    |
| UTRA <sub>ACLR2</sub>                                 | 36 dB   |
| Adjacent channel centre frequency offset (in MHz)     | + BW <sub>Channel_CA</sub> /2 + 3*BW <sub>UTRA</sub> /2<br>/<br>- BW <sub>Channel_CA</sub> /2 - 3*BW <sub>UTRA</sub> /2 |
| CA E-UTRA channel<br>Measurement bandwidth            | BW <sub>Channel_CA</sub> - 2* BW <sub>GB</sub>  |
| UTRA 5MHz channel<br>Measurement bandwidth (Note 1)   | 3.84 MHz  |
| UTRA 1.6MHz channel<br>measurement bandwidth (Note 2) | 1.28 MHz  |
|   | DD co-existence with UTRA FDD in paired spectrum.<br>DD co-existence with UTRA TDD in unpaired spectrum.                |

#### Table 6.6.2.3.2A-1: Requirements for UTRA<sub>ACLR1/2</sub>

#### 6.6.2.3.3A Minimum requirements for CA E-UTRA

For intra-band contiguous carrier aggregation the carrier aggregation E-UTRA Adjacent Channel Leakage power Ratio (CA E-UTRA<sub>ACLR</sub>) is the ratio of the filtered mean power centred on the aggregated channel bandwidth to the filtered mean power centred on an adjacent aggregated channel bandwidth at nominal channel spacing. The assigned aggregated channel bandwidth power are measured with rectangular filters with measurement bandwidths specified in Table 6.6.2.3.3A-1. If the measured adjacent channel power is greater than – 50dBm then the E-UTRA<sub>ACLR</sub> shall be higher than the value specified in Table 6.6.2.3.3A-1.

|   | CA bandwidth class / CA E-UTRA <sub>ACLR</sub> / Measurement<br>bandwidth<br>CA bandwidth class C |
|---|---|
| CA E-UTRA <sub>ACLR</sub>                         | 30 dB   |
| CA E-UTRA channel<br>Measurement bandwidth        | BW <sub>Channel_CA</sub> - 2* BW <sub>GB</sub>  |
| Adjacent channel centre frequency offset (in MHz) | + BW <sub>Channel_CA</sub><br>/<br>- BW <sub>Channel_CA</sub>                                     |

6.6.2.4 Void

6.6.2.4.1 Void

## 6.6.2A Void

<reserved for future use>

# 6.6.2B Out of band emission for UL-MIMO

For UE supporting UL-MIMO, the requirements for Out of band emissions resulting from the modulation process and non-linearity in the transmitters are specified at each transmit antenna connector.

For UEs with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the requirements in subclause 6.6.2 apply to each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2.

For single-antenna port scheme, the requirements in subclause 6.6.3 apply.

# 6.6.3 Spurious emissions

Spurious emissions are emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emissions, intermodulation products and frequency conversion products, but exclude out of band emissions unless otherwise stated. The spurious emission limits are specified in terms of general requirements inline with SM.329 [2] and E-UTRA operating band requirement to address UE co-existence.

To improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

### 6.6.3.1 Minimum requirements

Unless otherwise stated, the spurious emission limits apply for the frequency ranges that are more than FOOB (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth. The spurious emission limits in Table 6.6.3.1-2 apply for all transmitter band configurations (NRB) and channel bandwidths.

#### Table 6.6.3.1-1: Boundary between E-UTRA out of band and spurious emission domain

| Channel                                   | 1.4 | 3.0 | 5   | 10  | 15  | 20  |
|---|-----|-----|-----|-----|-----|-----|
| bandwidth                                 | MHz | MHz | MHz | MHz | MHz | MHz |
| ООВ<br>boundary<br>F <sub>OOB</sub> (MHz) | 2.8 | 6   | 10  | 15  | 20  | 25  |

NOTE: In order that the measurement of spurious emissions falls within the frequency ranges that are more than  $F_{OOB}$  (MHz) from the edge of the channel bandwidth, the minimum offset of the measurement frequency from each edge of the channel should be  $F_{OOB} + MBW/2$ . MBW denotes the measurement bandwidth defined in Table 6.6.3.1-2.

| Frequency Range  | Maximum<br>Level   | Measurement<br>bandwidth | Note |
|--|--------------------|--------------------------|------|
| 9 kHz ≤ f < 150 kHz  | -36 dBm            | 1 kHz                    |      |
| 150 kHz ≤ f < 30 MHz   | -36 dBm            | 10 kHz                   |      |
| 30 MHz ≤ f < 1000 MHz  | -36 dBm            | 100 kHz                  |      |
| 1 GHz ≤ f < 12.75 GHz  | -30 dBm            | 1 MHz                    |      |
| 12.75 GHz ≤ f < 5 <sup>th</sup><br>harmonic of the upper<br>frequency edge of the<br>UL operating band in<br>GHz | -30 dBm            | 1 MHz                    | 1    |
| NOTE 1: Applies for Bar  | nd 22, Band 42 and | Band 43                  |      |

Table 6.6.3.1-2: Spurious emissions limits

### 6.6.3.1A Minimum requirements for CA

For intra-band contiguous carrier aggregation the spurious emission limits apply for the frequency ranges that are more than FOOB (MHz) in Table 6.6.3.1A-1 from the edge of the aggregated channel bandwidth (Table 5.6A-1). For frequencies  $\Delta$ fOOB greater than FOOB as specified in Table 6.6.3.1A-1 the spurious emission requirements in Table 6.6.3.1-2 are applicable.

#### Table 6.6.3.1A-1: Boundary between E-UTRA out of band and spurious emission domain for intraband contiguous carrier aggregation

| CA Bandwidth Class | ООВ boundary F <sub>оов</sub><br>(MHz) |
|--------------------|--|
| A                  | Table 6.6.3.1-1                        |
| В                  | FFS                                    |
| C                  | BW <sub>Channel_CA</sub> + 5           |

NOTE: In order that the measurement of spurious emissions falls within the frequency ranges that are more than  $F_{OOB}$  (MHz) from the edge of the channel bandwidth, the minimum offset of the measurement frequency from each edge of the aggregated channel should be  $F_{OOB} + MBW/2$ . MBW denotes the measurement bandwidth defined in Table 6.6.3.1-2.

#### 6.6.3.2 Spurious emission band UE co-existence

This clause specifies the requirements for the specified E-UTRA band, for coexistence with protected bands

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

|                |   | Spurious            | s em         | ission               |                           |              |            |
|----------------|---|---------------------|--------------|----------------------|---------------------------|--------------|------------|
| E-UTRA<br>Band | Protected band  |                     | ency<br>(MHz | range<br>:)          | Maximum<br>Level<br>(dBm) | MBW<br>(MHz) | Note       |
| 1              | E-UTRA Band 1, 7, 8, 11, 18, 19, 20, 21, 22, 26, 27, 28, 38, 40, 41, 42, 43, 44 | $F_{DL_{low}}$      | _            | $F_{DL_high}$        | -50                       | 1            |            |
|                | E-UTRA Band 3, 34   | F <sub>DL_low</sub> | -            | FDL_high             | -50                       | 1            | 15         |
|                | Frequency range   | 1880                |              | 1895                 | -40                       | 1            | 15,27      |
|                | Frequency range   | 1895                |              | 1915                 | -15.5                     | 5            | 15, 26, 27 |
|                | Frequency range   | 1915                |              | 1920                 | +1.6                      | 5            | 15, 26, 27 |
|                | Frequency range   | 1839.9              | -            | 1879.9               | -50                       | 1            | 15         |
| 2              | E-UTRA Band 4, 5, 10, 12, 13, 14, 17, 22, 23, 24, 26, 27, 28, 29, 41, 42        | F <sub>DL_low</sub> | -            | $F_{DL_high}$        | -50                       | 1            |            |
|                | E-UTRA Band 2, 25   | $F_{DL_{low}}$      | -            | $F_{DL_high}$        | -50                       | 1            | 15         |
|                | E-UTRA Band 43  | $F_{DL_{low}}$      | -            | $F_{DL_high}$        | -50                       | 1            | 2          |
| 3              | E-UTRA Band 1, 7, 8, 20, 26, 27, 28, 33, 34, 38, 41, 43, 44                     | $F_{DL\_low}$       | -            | $F_{DL\_high}$       | -50                       | 1            |            |
|                | E-UTRA Band 3   | F <sub>DL_low</sub> | -            | F <sub>DL_high</sub> | -50                       | 1            | 15         |
|                | E-UTRA Band 11, 18, 19, 21  | F <sub>DL_low</sub> | -            | $F_{DL_high}$        | -50                       | 1            | 13         |
|                | E-UTRA Band 22, 42  | F <sub>DL_low</sub> | -            | $F_{DL_high}$        | -50                       | 1            | 2          |
| 4              | Frequency range<br>E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17,                     | 1884.5              | -            | 1915.7               | -41<br>-50                | 0.3          | 13         |
|                | 23, 24, 25, 26, 27, 28, 29, 41, 43  | F <sub>DL_low</sub> | -            | F <sub>DL_high</sub> |                           |              |            |
|                | E-UTRA Band 42  | F <sub>DL_low</sub> | -            | $F_{DL_high}$        | -50                       | 1            | 2          |
| 5              | E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 23, 24, 25, 28, 29,42, 43              | $F_{DL_{low}}$      | -            | $F_{DL_high}$        | -50                       | 1            |            |
|                | E-UTRA Band 41  | F <sub>DL_low</sub> | -            | $F_{DL_high}$        | -50                       | 1            | 2          |
|                | E-UTRA Band 26  | 859                 | -            | 869                  | -27                       | 1            |            |
| 6              | E-UTRA Band 1, 9, 11, 34  | F <sub>DL_low</sub> | -            | $F_{DL_high}$        | -50                       | 1            |            |
|                | Frequency range   | 860                 | -            | 875                  | -37                       | 1            |            |
|                | Frequency range   | 875                 | -            | 895                  | -50                       | 1            |            |
|                |   | 1884.5              | -            | 1919.6               | -41                       | 0.3          | 7          |
|                | Frequency range   | 1884.5              | -            | 1915.7               |                           |              | 8          |
| 7              | E-UTRA Band 1, 3, 7, 8, 20, 22, 27, 28, 29, 33, 34, 40, 42, 43                  | $F_{DL_{low}}$      | -            | $F_{DL_high}$        | -50                       | 1            |            |
|                | Frequency range   | 2570                | -            | 2575                 | +1.6                      | 5            | 15, 21, 26 |
|                | Frequency range   | 2575                | -            | 2595                 | -15.5                     | 5            | 15, 21, 26 |
|                | Frequency range   | 2595                | -            | 2620                 | -40                       | 1            | 15, 21     |
| 8              | E-UTRA Band 1, 20, 28, 33, 34, 38, 39, 40                                       | $F_{DL_{low}}$      | -            | $F_{DL_{high}}$      | -50                       | 1            |            |
|                | E-UTRA band 3   | F <sub>DL_low</sub> | -            | $F_{DL_high}$        | -50                       | 1            | 2          |
|                | E-UTRA band 7   | F <sub>DL_low</sub> | -            | $F_{DL_high}$        | -50                       | 1            | 2          |
|                | E-UTRA Band 8   | F <sub>DL_low</sub> | -            | $F_{DL_high}$        | -50                       | 1            | 15         |
|                | E-UTRA Band 22, 41, 42, 43  | F <sub>DL_low</sub> | -            | $F_{DL_high}$        | -50                       | 1            | 2          |
|                | E-UTRA Band 11, 21  | F <sub>DL_low</sub> | -            | $F_{DL_high}$        | -50                       | 1            | 23         |
|                | Frequency range   | 860                 | -            | 890                  | -40                       | 1            | 15, 23     |
|                | Frequency range   | 1884.5              | -            | 1915.7               | -41                       | 0.3          | 8, 23      |
| 9              | E-UTRA Band 1, 11, 18, 19, 21, 26, 28,<br>34                                    | F <sub>DL_low</sub> | -            | $F_{DL_high}$        | -50                       | 1            |            |
|                | Frequency range   | 1884.5              | -            | 1915.7               | -41                       | 0.3          | 8          |
|                | Frequency range   | 945                 | -            | 960                  | -50                       | 1            |            |
|                | Frequency range   | 1839.9              | <u> </u>     | 1879.9               | -50                       | 1            |            |
|                | Frequency range   | 2545                | -            | 2575                 | -50                       | 1            |            |
| 10             | E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 23, 24, 25, 26, 27, 28, 29, 41, 43     | $F_{DL_{low}}$      | _            | $F_{DL_high}$        | -50                       | 1            |            |
|                | E-UTRA Band 22, 42  | F <sub>DL_low</sub> | L -          | F <sub>DL_high</sub> | -50                       | 1            | 2          |
| 11             | E-UTRA Band 1, 11, 18, 19, 21, 28, 34   | F <sub>DL_low</sub> | _            | F <sub>DL_high</sub> | -50                       | 1            |            |
|                | Frequency range   | 1884.5              | -            | 1915.7               | -41                       | 0.3          | 8          |
|                | Frequency range   | 945                 | -            | 960                  | -50                       | 1            |            |
|                | Frequency range   | 1839.9              | -            | 1879.9               | -50                       | 1            |            |

# Table 6.6.3.2-1: Requirements

|          |  | 05.45  | 1                                    | 0575  | 50   | 4                                      | [                 |
|----------|--|--|--------------------------------------|---|--|--|-------------------|
| 10       | E-UTRA Band 2, 5, 13, 14, 17, 23, 24,  | 2545   | -                                    | 2575  | -50  | 1                                      |                   |
| 12       | 25, 26, 27, 41   | F <sub>DL low</sub>  | -                                    | $F_{DL_high}$   | -50  | 1                                      |                   |
|          | E-UTRA Band 4, 10  | F <sub>DL_low</sub>  | -                                    | F <sub>DL_high</sub>  | -50  | 1                                      | 2                 |
|          | E-UTRA Band 12   |  | -                                    | F <sub>DL high</sub>  | -50  | 1                                      | 15                |
| 13       | E-UTRA Band 2, 4, 5, 10, 12, 13, 17, 23,   | F <sub>DL_low</sub>  | -                                    | DL_high   |  |  | 10                |
| 10       | 25, 26, 27, 29, 41   | F <sub>DL low</sub>  | -                                    | $F_{DL_high}$   | -50  | 1                                      |                   |
|          | Frequency range  | 769  | -                                    | 775   | -35  | 0.00625                                | 15                |
|          | Frequency range  | 799  | -                                    | 805   | -35  | 0.00625                                | 11, 15            |
|          | E-UTRA Band 14   | F <sub>DL low</sub>  | -                                    | F <sub>DL_high</sub>  | -50  | 1                                      | 15                |
|          | E-UTRA Band 24   | F <sub>DL low</sub>  | -                                    | F <sub>DL_high</sub>  | -50  | 1                                      | 2                 |
| 14       | E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17,   | · DL_IOW   |                                      | • DL_nign   |  |  |                   |
|          | 23, 24, 25, 26, 27, 29, 41   | $F_{DL_{low}}$   | -                                    | $F_{DL_high}$   | -50  | 1                                      |                   |
|          | Frequency range  | 769  | -                                    | 775   | -35  | 0.00625                                | 12, 15            |
|          | Frequency range  | 799  | -                                    | 805   | -35  | 0.00625                                | 11, 12, 15        |
| 17       | E-UTRA Band 2, 5, 13, 14, 17, 23, 24,  |  |                                      |   | -50  | 1                                      |                   |
|          | 25, 26, 27, 41   | F <sub>DL_low</sub>  | -                                    | $F_{DL_high}$   |  |  |                   |
|          | E-UTRA Band 4, 10  | F <sub>DL_low</sub>  | -                                    | $F_{DL_high}$   | -50  | 1                                      | 2                 |
|          | E-UTRA Band 12   | $F_{DL_{low}}$   | -                                    | $F_{DL_high}$   | -50  | 1                                      | 15                |
| 18       | E-UTRA Band 1, 11, 21, 34  | $F_{DL\_low}$  | -                                    | $F_{DL_high}$   | -50  | 1                                      |                   |
|          | Frequency range  | 860  | -                                    | 890   | -40  | 1                                      |                   |
|          | Frequency range  | 1884.5   | -                                    | 1915.7  | -41  | 0.3                                    | 8                 |
|          | Frequency range  | 758  | -                                    | 799   | -50  | 1                                      |                   |
|          | Frequency range  | 799  | -                                    | 803   | -40  | 1                                      | 15                |
|          | Frequency range  | 945  | -                                    | 960   | -50  | 1                                      |                   |
|          | Frequency range  | 1839.9   | -                                    | 1879.9  | -50  | 1                                      |                   |
|          | Frequency range  | 2545   | -                                    | 2575  | -50  | 1                                      |                   |
| 19       | E-UTRA Band 1, 11, 21, 28, 34  | F <sub>DL_low</sub>  | _                                    | F <sub>DL_high</sub>  | -50  | 1                                      |                   |
|          | Frequency range  | 1884.5   | -                                    | 1915.7  | -41  | 0.3                                    | 8                 |
|          | Frequency range  | 945  | -                                    | 960   | -50  | 1                                      |                   |
|          | Frequency range  | 1839.9   | -                                    | 1879.9  | -50  | 1                                      |                   |
|          | Frequency range  | 2545   | -                                    | 2575  | -50  | 1                                      |                   |
| 20       | E-UTRA Band 1, 3, 7, 8, 20, 22, 33, 34,  | _  |                                      | _   | -50  | 1                                      |                   |
|          | 40, 43   | F <sub>DL_low</sub>  | -                                    | F <sub>DL_high</sub>  | 50   | 4                                      | 45                |
|          | E-UTRA Band 20   | F <sub>DL_low</sub>  | -                                    | F <sub>DL_high</sub>  | -50  | 1                                      | 15                |
|          | E-UTRA Band 38, 42   | F <sub>DL_low</sub>  | -                                    | F <sub>DL_high</sub>  | -50  | 1                                      | 2                 |
|          | Frequency range  | 758  | -                                    | 788   | -50  | 1                                      |                   |
| 21       | E-UTRA Band 1, 18, 19, 28, 34  | F <sub>DL_low</sub>  | -                                    | $F_{DL_high}$   | -50  | 1                                      |                   |
|          | Frequency range  | 1884.5   | -                                    | 1915.7  | -41  | 0.3                                    | 8                 |
|          | Frequency range  | 945  | -                                    | 960   | -50  | 1                                      |                   |
|          | Frequency range<br>Frequency range   | 1839.9<br>2545   | -                                    | 1879.9<br>2575  | -50<br>-50   | 1                                      |                   |
| 22       | E-UTRA Band 1, 3, 7, 8, 20, 26, 27, 28,  | 2040   | -                                    | 2075  | -50  |  |                   |
| ~~~      | 33, 34, 38, 39, 40, 43   | $F_{DL_{low}}$   | -                                    | F <sub>DL_high</sub>  | -50  | 1                                      |                   |
|          | Frequency range  | 3510   | _                                    | 3525  | -40  | 1                                      | 15                |
|          | Frequency range  | 3525   | -                                    | 3590  | -50  | 1                                      |                   |
| 23       | E-UTRA Band 4, 5, 10, 12, 13, 14, 17,  | 0020   |                                      | 0000  |  |  |                   |
|          | 23, 24, 26, 27, 29, 41   | $F_{DL_{low}}$   | -                                    | $F_{DL_{high}}$   | -50  | 1                                      |                   |
| 24       | E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17,   | _  |                                      | _   | -50  | 1                                      |                   |
|          | 23, 24, 25, 26, 29, 41   | F <sub>DL_low</sub>  | -                                    | $F_{DL_high}$   |  |  |                   |
| 05       |  |  |                                      | 1   | 50   | 1                                      |                   |
| 25       | E-UTRA Band 4, 5, 10,12, 13, 14, 17, 23,<br>24, 26, 27, 28, 29, 41, 42   | Free   | -                                    | Fourte  | -50  | -                                      |                   |
| 25       | 24, 26, 27, 28, 29, 41, 42   | F <sub>DL_low</sub>  | -                                    | F <sub>DL_high</sub>  |  |  | 15                |
| 25       | 24, 26, 27, 28, 29, 41, 42<br>E-UTRA Band 2  | F <sub>DL_low</sub>  | -                                    | $F_{DL_high}$   | -50  | 1                                      | 15<br>15          |
| 25       | 24, 26, 27, 28, 29, 41, 42<br>E-UTRA Band 2<br>E-UTRA Band 25  | F <sub>DL_low</sub>  | -<br>-                               | $F_{DL_high}$<br>$F_{DL_high}$  | -50<br>-50   | 1                                      | 15                |
|          | 24, 26, 27, 28, 29, 41, 42<br>E-UTRA Band 2<br>E-UTRA Band 25<br>E-UTRA Band 43  | F <sub>DL_low</sub>  | -<br>-<br>-                          | $F_{DL_high}$   | -50  | 1                                      | -                 |
| 25<br>26 | 24, 26, 27, 28, 29, 41, 42<br>E-UTRA Band 2<br>E-UTRA Band 25  | F <sub>DL_low</sub>  |                                      | $F_{DL_high}$<br>$F_{DL_high}$  | -50<br>-50   | 1                                      | 15                |
|          | 24, 26, 27, 28, 29, 41, 42         E-UTRA Band 2         E-UTRA Band 25         E-UTRA Band 43         E-UTRA Band 1, 2, 3, 4, 5, 10, 11, 12, 13, 14, 17, 18, 19, 21, 23, 24, 25, 26, 29, 34, 40, 42, 43   | F <sub>DL_low</sub><br>F <sub>DL_low</sub><br>F <sub>DL_low</sub>  |                                      | F <sub>DL_high</sub><br>F <sub>DL_high</sub><br>F <sub>DL_high</sub>  | -50<br>-50<br>-50                                    | 1<br>1<br>1                            | 15                |
|          | 24, 26, 27, 28, 29, 41, 42         E-UTRA Band 2         E-UTRA Band 25         E-UTRA Band 43         E-UTRA Band 1, 2, 3, 4, 5, 10, 11, 12, 13, 14, 17, 18, 19, 21, 23, 24, 25, 26, 29,  | F <sub>DL_low</sub><br>F <sub>DL_low</sub><br>F <sub>DL_low</sub>  | -<br>-<br>-<br>-<br>-<br>-           | F <sub>DL_high</sub><br>F <sub>DL_high</sub><br>F <sub>DL_high</sub>  | -50<br>-50<br>-50<br>-50                             | 1<br>1<br>1<br>1                       | 15<br>2           |
|          | 24, 26, 27, 28, 29, 41, 42<br>E-UTRA Band 2<br>E-UTRA Band 25<br>E-UTRA Band 43<br>E-UTRA Band 1, 2, 3, 4, 5, 10, 11, 12,<br>13, 14, 17, 18,19, 21, 23, 24, 25, 26, 29,<br>34, 40, 42, 43<br>E-UTRA Band 41<br>Frequency range                     | F <sub>DL_low</sub><br>F <sub>DL_low</sub><br>F <sub>DL_low</sub><br>F <sub>DL_low</sub>   | -<br>-<br>-                          | F <sub>DL_high</sub><br>F <sub>DL_high</sub><br>F <sub>DL_high</sub><br>F <sub>DL_high</sub>  | -50<br>-50<br>-50<br>-50<br>-50                      | 1<br>1<br>1<br>1<br>1                  | 15<br>2<br>2      |
|          | 24, 26, 27, 28, 29, 41, 42         E-UTRA Band 2         E-UTRA Band 25         E-UTRA Band 43         E-UTRA Band 1, 2, 3, 4, 5, 10, 11, 12, 13, 14, 17, 18, 19, 21, 23, 24, 25, 26, 29, 34, 40, 42, 43         E-UTRA Band 41                    | F <sub>DL</sub> low<br>F <sub>DL</sub> low<br>F <sub>DL</sub> low<br>F <sub>DL</sub> low<br>F <sub>DL</sub> low<br>1884.5<br>703   | -<br>-<br>-<br>-                     | $F_{DL\_high}$ $F_{DL\_high}$ $F_{DL\_high}$ $F_{DL\_high}$ $F_{DL\_high}$ $1915.7$ $799$   | -50<br>-50<br>-50<br>-50<br>-50<br>-41               | 1<br>1<br>1<br>1<br>1<br>0.3           | 15<br>2<br>2      |
|          | 24, 26, 27, 28, 29, 41, 42<br>E-UTRA Band 2<br>E-UTRA Band 25<br>E-UTRA Band 43<br>E-UTRA Band 1, 2, 3, 4, 5, 10, 11, 12,<br>13, 14, 17, 18, 19, 21, 23, 24, 25, 26, 29,<br>34, 40, 42, 43<br>E-UTRA Band 41<br>Frequency range<br>Frequency range | F <sub>DL</sub> low           1884.5           703           799 | -<br>-<br>-<br>-<br>-                | $\label{eq:poly_prod} \begin{split} & F_{DL\_high} \\ & 1915.7 \\ & 799 \\ & 803 \end{split}$ | -50<br>-50<br>-50<br>-50<br>-50<br>-41<br>-50        | 1<br>1<br>1<br>1<br>1<br>0.3<br>1      | 15<br>2<br>2<br>8 |
|          | 24, 26, 27, 28, 29, 41, 42<br>E-UTRA Band 2<br>E-UTRA Band 25<br>E-UTRA Band 43<br>E-UTRA Band 1, 2, 3, 4, 5, 10, 11, 12,<br>13, 14, 17, 18,19, 21, 23, 24, 25, 26, 29,<br>34, 40, 42, 43<br>E-UTRA Band 41<br>Frequency range                     | F <sub>DL</sub> low<br>F <sub>DL</sub> low<br>F <sub>DL</sub> low<br>F <sub>DL</sub> low<br>F <sub>DL</sub> low<br>1884.5<br>703   | -<br>-<br>-<br>-<br>-<br>-<br>-<br>- | $F_{DL\_high}$ $F_{DL\_high}$ $F_{DL\_high}$ $F_{DL\_high}$ $F_{DL\_high}$ $1915.7$ $799$   | -50<br>-50<br>-50<br>-50<br>-50<br>-41<br>-50<br>-40 | 1<br>1<br>1<br>1<br>1<br>0.3<br>1<br>1 | 15<br>2<br>2<br>8 |

|    | 14, 17, 23, 25, 26, 27, 29, 38, 41, 42, 43   |                               |   |  |       |         |            |
|----|--|-------------------------------|---|--|-------|---------|------------|
|    | Frequency range  | 799                           | - | 805  | -35   | 0.00625 |            |
|    | E-UTRA Band 28   | F <sub>DL_low</sub>           | - | 790  | -50   | 1       |            |
| 28 | E-UTRA Band 2, 3, 5, 7, 8, 18, 19, 25, 26, 27, 34, 38, 41  | F <sub>DL_low</sub>           | - | F <sub>DL_high</sub>                         | -50   | 1       |            |
|    | E-UTRA Band 1, 4, 10, 22, 42, 43   | $F_{DL_{low}}$                | - | $F_{DL_high}$                                | -50   | 1       | 2          |
|    | E-UTRA Band 11, 21   | $F_{DL\_low}$                 | - | F <sub>DL_high</sub>                         | -50   | 1       | 19, 24     |
|    | E-UTRA Band 1  | F <sub>DL_low</sub>           | - | F <sub>DL_high</sub>                         | -50   | 1       | 19, 25     |
|    | Frequency range  | 686                           | - | 694  | -42   | 8       | 15, 32     |
|    | Frequency range  | 470                           | - | 710  | -26.2 | 6       | 31         |
|    | Frequency range  | 758                           | - | 773  | -32   | 1       | 15         |
|    | Frequency range  | 773                           | - | 803  | -50   | 1       | -          |
|    |  |                               | - | 694  | -26.2 | 6       | 15         |
|    | Frequency range  | 662                           | - | 1915.7                                       | -41   | 0.3     | 8, 19      |
|    | Frequency range  | 1884.5                        |   |  |       |         | 0, 10      |
|    | Frequency range  | 1839.9                        | - | 1879.9                                       | -50   | 1       |            |
|    |  |                               |   |  |       |         |            |
| 33 | E-UTRA Band 1, 7, 8, 20, 22, 28, 34, 38, 40, 42, 43  | $F_{DL\_low}$                 | - | $F_{DL_{high}}$                              | -50   | 1       | 5          |
|    | E-UTRA Band 3  | $F_{DL_{low}}$                | - | $F_{DL_high}$                                | -50   | 1       | 15         |
| 34 | E-UTRA Band 1, 3, 7, 8, 11, 18, 19, 20,<br>21, 22, 26, 28, 33, 38,39, 40, 41, 42, 43,<br>44            | F                             |   | E  | -50   | 1       | 5          |
|    | Frequency range  | F <sub>DL_low</sub><br>1884.5 | - | F <sub>DL_high</sub><br>1915.7               | -41   | 0.3     | 8          |
|    | Frequency range  | 1839.9                        | - | 1879.9                                       | -50   | 1       | 0          |
| 35 |  |                               |   |  |       |         |            |
| 36 |  |                               |   |  |       |         |            |
| 37 |  |                               | _ |  |       |         |            |
| 38 | E-UTRA Band 1,3, 8, 20, 22, 27, 28, 29, 33, 34, 40, 42, 43   | F <sub>DL low</sub>           | - | $F_{DL_{high}}$                              | -50   | 1       |            |
|    | Frequency range  | 2620                          | - | 2645   | -15.5 | 5       | 15, 22, 26 |
|    | Frequency range  | 2645                          | - | 2690   | -40   | 1       | 15, 22     |
| 39 | E-UTRA Band 22, 34, 40, 41, 42, 44   | $F_{DL_{low}}$                | - | F <sub>DL_high</sub>                         | -50   | 1       |            |
| 40 | E-UTRA Band 1, 3, 7, 8, 20, 22, 26, 27, 28, 33, 34, 38, 39, 41, 42, 43, 44                             | F <sub>DL_low</sub>           | - | F <sub>DL_high</sub>                         | -50   | 1       |            |
| 41 | E-UTRA Band 1, 2, 3, 4, 5, 8, 10, 12, 13,<br>14, 17, 23, 24, 25, 26, 27, 28, 29, 34, 39,<br>40, 42, 44 | $F_{DL_{low}}$                | - | $F_{DL_{high}}$                              | -50   | 1       |            |
|    | E-UTRA Band 9, 11, 18, 19, 21  | F <sub>DL_low</sub>           | - | F <sub>DL_high</sub>                         | -50   | 1       | 30         |
|    | Frequency range  | 1839.9                        |   | 1879.9                                       | -50   | 1       | 30         |
|    | Frequency range  | 1884.5                        |   | 1915.7                                       | -41   | 0.3     | 8, 30      |
| 42 | E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 10, 20,<br>25, 26, 27, 28, 33, 34, 38, 40, 41, 44                     |                               |   |  | -50   | 1       |            |
| 43 | E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 10, 20, 25, 26, 27, 28, 33, 34, 38, 40                                | F <sub>DL_low</sub>           | _ | F <sub>DL_high</sub>                         | -50   | 1       |            |
|    | E-UTRA Band 22   | F <sub>DL_low</sub>           | - | F <sub>DL_high</sub>                         | [-50] | [1]     | 3          |
| 44 | E-UTRA Band 3, 5, 8, 34, 39, 41  | F <sub>DL_low</sub>           | - | F <sub>DL_high</sub><br>F <sub>DL_high</sub> | -50   | 1       | Ŭ          |
| 44 |  |                               |   | • DL High                                    |       | 1 1     | 1          |

NOTE 1: FDL\_low and FDL\_high refer to each E-UTRA frequency band specified in Table 5.5-1 NOTE 2: As exceptions, measurements with a level up to the applicable requirements defined in Table 6.6.3.1-2 are permitted for each assigned E-UTRA carrier used in the measurement due to 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> [or 5<sup>th</sup>] harmonic spurious emissions. Due to spreading of the harmonic emission the exception is also allowed for the first 1 MHz frequency range immediately outside the harmonic emission on both sides of the harmonic emission. This results in an overall exception interval centred at the harmonic emission of (2MHz + N x L<sub>CRB</sub> x 180kHz), where N is 2, 3, 4, [5] for the 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> [or 5<sup>th</sup>] harmonic respectively. The exception is allowed if the measurement bandwidth (MBW) totally or partially overlaps the overall exception interval. NOTE 3: To meet these requirements some restriction will be needed for either the operating band or protected band NOTE 4: N/A NOTE 5: For non synchronised TDD operation to meet these requirements some restriction will be needed for either the operating band or protected band NOTE 6: N/A. NOTE 7: Applicable when co-existence with PHS system operating in 1884.5-1919.6MHz. NOTE 8: Applicable when co-existence with PHS system operating in 1884.5 -1915.7MHz. NOTE 9: N/A. NOTE 10: N/A. NOTE 11: Whether the applicable frequency range should be 793-805MHz instead of 799-805MHz is TBD NOTE 12: The emissions measurement shall be sufficiently power averaged to ensure a standard deviation < 0.5 dB NOTE 13: This requirement applies for 5, 10, 15 and 20 MHz E-UTRA channel bandwidth allocated within 1744.9MHz and 1784.9MHz. NOTE 14: N/A. NOTE 15: These requirements also apply for the frequency ranges that are less than FOOB (MHz) in Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the channel bandwidth. NOTE 16: N/A. NOTE 17: N/A NOTE 18: N/A NOTE 19: Applicable when the assigned E-UTRA carrier is confined within 718 MHz and 748 MHz and when the channel bandwidth used is 5 or 10 MHz. NOTE 20: N/A. NOTE 21: This requirement is applicable for any channel bandwidths within the range 2500 - 2570 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 2560.5 - 2562.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 2552 - 2560 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB. NOTE 22: This requirement is applicable for any channel bandwidths within the range 2570 - 2615 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 2605.5 - 2607.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 2597 - 2605 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB. For carriers with channel bandwidth overlapping the frequency range 2615 - 2620 MHz the requirement applies with the maximum output power configured to +19 dBm in the IE *P-Max*. NOTE 23 This requirement is applicable only for the following cases: - for carriers of 5 MHz channel bandwidth when carrier centre frequency (F<sub>c</sub>) is within the range 902.5 MHz  $\leq$  F<sub>c</sub> < 907.5 MHz with an uplink transmission bandwidth less than or equal to 20 RB - for carriers of 5 MHz channel bandwidth when carrier centre frequency (F<sub>c</sub>) is within the range 907.5 MHz  $\leq$  F<sub>c</sub>  $\leq$  912.5 MHz without any restriction on uplink transmission bandwidth. - for carriers of 10 MHz channel bandwidth when carrier centre frequency (F<sub>c</sub>) is F<sub>c</sub> = 910 MHz with an uplink transmission bandwidth less than or equal to 32 RB with  $RB_{start} > 3$ . NOTE 24: As exceptions, measurements with a level up to the applicable requirement of -38 dBm/MHz is permitted for each assigned E-UTRA carrier used in the measurement due to 2<sup>nd</sup> harmonic spurious emissions. An exception is allowed if there is at least one individual RB within the transmission bandwidth (see Figure 5.6-1) for which the 2<sup>nd</sup> harmonic totally or partially overlaps the measurement bandwidth (MBW). NOTE 25: As exceptions, measurements with a level up to the applicable requirement of -36 dBm/MHz is permitted for each assigned E-UTRA carrier used in the measurement due to 3<sup>rd</sup> harmonic spurious emissions. An exception is allowed if there is at least one individual RB within the transmission bandwidth (see Figure 5.6-1) for which the 3<sup>rd</sup> harmonic totally or partially overlaps the measurement bandwidth (MBW). NOTE 26: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band. NOTE 27: This requirement is applicable for any channel bandwidths within the range 1920 - 1980 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 1927.5 - 1929.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 1930 - 1938 MHz the requirement is applicable only for an uplink

| 1<br>NOTE 28: I | transmission bandwidth less than or equal to 54 RB.<br>N/A   |
|-----------------|--|
| NOTE 29: 1      |  |
| NOTE 30:        | This requirement applies when the E-UTRA carrier is confined within 2545-2575 MHz and the channel bandwidth is 10 or 20 MHz.   |
| -               | This requirement is applicable for 5 and 10 MHz E-UTRA channel bandwidth allocated within 718-728MHz. For carriers of 10 MHz bandwidth, this requirement applies for an uplink transmission bandwidth less than or equal to 30 RB with RBstart > 1 and RBstart<48. |
| NOTE 32:        | This requirement is applicable in the case of a 10 MHz E-UTRA carrier confined within 703 MHz and 733 MHz, otherwise the requirement of -25 dBm with a measurement bandwidth of 8 MHz applies.   |
|                 |  |
|                 |  |

### 6.6.3.2A Spurious emission band UE co-existence for CA

This clause specifies the requirements for the specified carrier aggregation configurations for coexistence with protected bands

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

| E-                                       | Spurious emission   |                          |   |                      |                           |              |                 |
|--|---|--------------------------|---|----------------------|---------------------------|--------------|-----------------|
| UTRA<br>CA<br>Config<br>uration          | Protected band  | Frequency range<br>(MHz) |   |                      | Maximum<br>Level<br>(dBm) | MBW<br>(MHz) | Note            |
| CA_1C                                    | E-UTRA Band 1, 3, 7, 8, 11, 18, 19, 20, 21, 22, 26, 27, 28, 38, 40, 41, 42, 43, 44  | $F_{DL_{low}}$           | - | $F_{DL_high}$        | -50                       | 1            |                 |
|  | E-UTRA band 34  | $F_{DL\_low}$            | - | $F_{DL_high}$        | -50                       | 1            | 4, 6, 7         |
|  | Frequency range   | 1880                     | - | 1895                 | -40                       | 1            | 7, 10           |
|  | Frequency range   | 1895                     | - | 1915                 | -15.5                     | 5            | 7, 10, 12       |
|  | Frequency range   | 1900                     | - | 1915                 | -15.5                     | 5            | 6, 7, 10,<br>12 |
|  | Frequency range   | 1915                     | - | 1920                 | +1.6                      | 5            | 6, 7, 10,<br>12 |
|  | Frequency range   | 1884.5                   | - | 1915.7               | -41                       | 0.3          | 4, 5            |
|  | Frequency range   | 1839.9                   | - | 1879.9               | -50                       | 1            |                 |
| CA_7C                                    | E-UTRA Band 1, 3, 7, 8, 20, 22, 27, 28, 29, 33, 34, 40, 42, 43  | F <sub>DL_low</sub>      | - | $F_{DL_high}$        | -50                       | 1            |                 |
|  | Frequency range   | 2570                     | - | 2575                 | +1.6                      | 5            | 8, 12           |
|  | Frequency range   | 2575                     | - | 2595                 | -15.5                     | 5            | 8, 12           |
| CA_38C                                   | Frequency range<br>E-UTRA Band 1,3, 8, 20, 22, 27, 28, 29,  | 2595                     | - | 2620                 | -40                       | 1            | 8               |
| CA_36C                                   | 33, 34, 40, 42, 43  | F <sub>DL_low</sub>      | - | $F_{DL_high}$        | -50                       | 1            | 9, 10,          |
|  | Frequency range   | 2620                     | - | 2645                 | -15.5                     | 5            | 11, 12          |
|  | Frequency range   | 2645                     | - | 2690                 | -40                       | 1            | 9, 10, 11       |
| CA_40C                                   | E-UTRA Band 1, 3, 7, 8, 20, 22, 26, 27, 33, 34, 38, 39, 41, 42, 43, 44  | F <sub>DL_low</sub>      | - | $F_{DL_high}$        | -50                       | 1            |                 |
| CA_41C                                   | E-UTRA Band 1, 2, 3, 4, 5, 8, 10, 12, 13,<br>14, 17, 23, 24, 25, 26, 27, 28, 29, 34, 39,<br>40, 42, 44  | $F_{DL\_low}$            | - | F <sub>DL high</sub> | -50                       | 1            |                 |
| NOTE 8:<br>NOTE 9:<br>NOTE 10<br>NOTE 11 | <ul> <li>IOTE 1: F<sub>DL_low</sub> and F<sub>DL_high</sub> refer to each E-UTRA frequency band specified in Table 5.5-1</li> <li>IOTE 2: As exceptions, measurements with a level up to the applicable requirements defined in Table 6.6.3.1-2 are permitted for each assigned E-UTRA carrier used in the measurement due to 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> [or 5<sup>th</sup>] harmonic spurious emissions. Due to spreading of the harmonic emission the exception is also allowed for the first 1 MHz frequency range immediately outside the harmonic emission on both sides of the harmonic emission. This results in an overall exception interval centred at the harmonic emission of (2MHz + N x L<sub>CRB</sub> x 180kHz), where N is 2, 3, 4, [5] for the 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> [or 5<sup>th</sup>] harmonic respectively. The exception is allowed if the measurement bandwidth (MBW) totally or partially overlaps the overall exception interval. NOTE 3: To meet these requirements some restriction will be needed for either the operating band or protected band</li> <li>IOTE 4: Applicable when CA_NS_01 in subclause 6.6.3.3A.1 is signalled by the network.</li> <li>IOTE 5: Applicable when co-existence with PHS system operating in 1884.5 -1915.7MHz.</li> </ul> |                          |   |                      |                           |              |                 |

#### Table 6.6.3.2A-1: Requirements for intra-band contiguous CA

### 6.6.3.3 Additional spurious emissions

These requirements are specified in terms of an additional spectrum emission requirement. Additional spurious emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

#### 6.6.3.3.1 Minimum requirement (network signalled value "NS\_05")

When "NS\_05" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.1-1. This requirement also applies for the frequency ranges that are less than FOOB (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

| Frequency band<br>(MHz)  | Channel bandwidth / Spectrum<br>emission limit (dBm) |           |           |           | Measurement<br>bandwidth | Note |
|--|--|-----------|-----------|-----------|--------------------------|------|
|  | 5<br>MHz   | 10<br>MHz | 15<br>MHz | 20<br>MHz |                          |      |
| 1884.5 ≤ f ≤1915.7   | -41  | -41       | -41       | -41       | 300 KHz                  | 1    |
| NOTE 1: Applicable when the lower edge of the assigned E-UTRA UL channel<br>bandwidth frequency is larger than or equal to the upper edge of PHS band<br>(1915.7 MHz) + 4 MHz + the channel BW assigned, where channel BW is as<br>defined in subclause 5.6. Additional restrictions apply for operations below<br>this point. |  |           |           |           |                          |      |

Table 6.6.3.3.1-1: Additional requirements (PHS)

The requirements in Table 6.6.3.3.1-1 apply with the additional restrictions specified in Table 6.6.3.3.1-2 when the lower edge of the assigned E-UTRA UL channel bandwidth frequency is less than the upper edge of PHS band (1915.7 MHz) + 4 MHz + the channel BW assigned.

| 15 MHz channel bandwidth with $f_c = 1932.5$ MHz |   |                                      |       |  |  |  |  |
|--|---|--------------------------------------|-------|--|--|--|--|
| RB <sub>start</sub>                              | 0-7   | 8-66                                 | 67-74 |  |  |  |  |
| L <sub>CRB</sub>                                 | N/A   | ≤ MIN(30, 67 – RB <sub>start</sub> ) | N/A   |  |  |  |  |
|  | 20 MHz channel bandwidth with f <sub>c</sub> = 1930 MHz |                                      |       |  |  |  |  |
| RB <sub>start</sub>                              | 0-23  | 24-75                                | 76-99 |  |  |  |  |
| L <sub>CRB</sub>                                 | N/A   | ≤ MIN(24, 76 – RB <sub>start</sub> ) | N/A   |  |  |  |  |

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth (300 kHz).

### 6.6.3.3.2 Minimum requirement (network signalled value "NS\_07")

When "NS\_07" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.2-1. This requirement also applies for the frequency ranges that are less than FOOB (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

| Frequency band   | Channel bandwidth / Spectrum | Measurement |  |  |
|--|------------------------------|-------------|--|--|
| (MHz)  | emission limit (dBm)         | bandwidth   |  |  |
|  | 10 MHz                       |             |  |  |
| 769 ≤ f ≤ 775  | -57                          | 6.25 kHz    |  |  |
| NOTE: The emissions measurement shall be sufficiently power averaged to ensure standard standard deviation < 0.5 dB. |                              |             |  |  |

| Table 6.6.3.3.2-1: | Additional | requirements |
|--------------------|------------|--------------|
|--------------------|------------|--------------|

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth (6.25 kHz).

#### 6.6.3.3.3 Minimum requirement (network signalled value "NS\_08")

When "NS 08" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.3-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

| Frequency<br>band | Channel ban | oandwidth / Spectrum emission limit<br>(dBm) |       | Measurement<br>bandwidth |
|-------------------|-------------|--|-------|--------------------------|
| (MHz)             | 5MHz        | 10MHz  | 15MHz |                          |
| 860 ≤ f ≤ 890     | -40         | -40  | -40   | 1 MHz                    |

Table 6.6.3.3.3-1: Additional requirement

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth (1 MHz).

#### 6.6.3.3.4 Minimum requirement (network signalled value "NS\_09")

When "NS 09" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.4-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

| Frequency band<br>(MHz) | Channel bandwidth / Spectrum emission<br>limit (dBm) |       | Measurement<br>bandwidth |       |
|-------------------------|--|-------|--------------------------|-------|
|                         | 5MHz   | 10MHz | 15MHz                    |       |
| 1475.9 ≤ f ≤ 1510.9     | -35  | -35   | -35                      | 1 MHz |

- NOTE 1: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth (1 MHz).
- NOTE 2: To improve measurement accuracy, A-MPR values for NS\_09 specified in Table 6.2.4-1 in subclause 6.2.4 are derived based on both the above NOTE 1 and 100 kHz RBW.

#### 6.6.3.3.5 Minimum requirement (network signalled value "NS\_12")

When "NS 12" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.5-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

| Frequency band<br>(MHz)  | Channel bandwidth /<br>Spectrum emission limit<br>(dBm) | Measurement<br>bandwidth |  |
|--|---|--------------------------|--|
|  | 1.4 MHz, 3 MHz, 5 MHz                                   |                          |  |
| 806 ≤ f ≤ 813.5  | -42   | 6.25 kHz                 |  |
| NOTE 1: The requirement applies for E-UTRA carriers with lower channel edge at or  |   |                          |  |
| above 814.2 MHz.   |   |                          |  |
| NOTE 2: The emissions measurement shall be sufficiently power averaged to ensure a |   |                          |  |
| standard deviation < 0.5 dB.   |   |                          |  |

#### 6.6.3.3.6 Minimum requirement (network signalled value "NS\_13")

When "NS 13" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.6-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

| Frequency band<br>(MHz)   | Channel bandwidth /<br>Spectrum emission limit<br>(dBm) | Measurement<br>bandwidth |  |
|---|---|--------------------------|--|
|   | 5 MHz   |                          |  |
| 806 ≤ f ≤ 816   | -42   | 6.25 kHz                 |  |
| NOTE 1: The requirement applies for E-UTRA carriers with lower channel edge at or above 819 MHz.                |   |                          |  |
| NOTE 2: The emissions measurement shall be sufficiently power averaged to ensure a standard deviation < 0.5 dB. |   |                          |  |

Table 6.6.3.3.6-1: Additional requirements

#### 6.6.3.3.7 Minimum requirement (network signalled value "NS\_14")

When "NS 14" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.7-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

| Frequency band<br>(MHz)   | Channel bandwidth /<br>Spectrum emission limit<br>(dBm) | Measurement<br>bandwidth |  |
|---|---|--------------------------|--|
|   | 10 MHz, 15 MHz  |                          |  |
| 806 ≤ f ≤ 816   | -42   | 6.25 kHz                 |  |
| NOTE 1: The requirement applies for E-UTRA carriers with lower channel edge at or above 824 MHz.                |   |                          |  |
| NOTE 2: The emissions measurement shall be sufficiently power averaged to ensure a standard deviation < 0.5 dB. |   |                          |  |

Table 6.6.3.3.7-1: Additional requirements

#### 6.6.3.3.8 Minimum requirement (network signalled value "NS\_15")

When "NS 15" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.8-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

| Frequency band<br>(MHz)   | Channel bandwidth /<br>Spectrum emission limit<br>(dBm)<br>1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz | Measurement<br>bandwidth |  |
|---|--|--------------------------|--|
| 851 ≤ f ≤ 859   | -53  | 6.25 kHz                 |  |
| NOTE 1: The emissions measurement shall be sufficiently power averaged to ensure a standard deviation < 0.5 dB. |  |                          |  |

#### 6.6.3.3.9 Minimum requirement (network signalled value "NS\_16")

When "NS\_16" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.9-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

| Frequency<br>band<br>(MHz) | Channel bandwidth / Spectrum<br>emission limit (dBm)<br>1.4, 3, 5, 10 MHz | Measurement<br>bandwidth | Note |
|----------------------------|---|--------------------------|------|
| 790 ≤ f ≤ 803              | -32   | 1 MHz                    |      |

#### Table 6.6.3.3.9-1: Additional requirements

### 6.6.3.3.10 Minimum requirement (network signalled value "NS\_17")

When "NS\_17" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.10-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.3.1-1 from the edge of the channel bandwidth.

| Frequency<br>band<br>(MHz)  | Channel bandwidth / Spectrum<br>emission limit (dBm)<br>5, 10 MHz | Measurement<br>bandwidth | Note |  |
|---|---|--------------------------|------|--|
| 470 ≤ f ≤ 710   | -26.2   | 6 MHz                    | 1    |  |
| NOTE 1: Applicable when the assigned E-UTRA carrier is confined within 718 MHz<br>and 748 MHz and when the channel bandwidth used is 5 or 10 MHz. |   |                          |      |  |

#### Table 6.6.3.3.10-1: Additional requirements

#### 6.6.3.3.11 Minimum requirement (network signalled value "NS\_18")

When "NS\_18" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.11-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.11-1: Additional requirements

| Frequency<br>band<br>(MHz) | Channel bandwidth / Spectrum<br>emission limit (dBm)<br>5, 10, 15, 20 MHz | Measurement<br>bandwidth | Note |
|----------------------------|---|--------------------------|------|
| 692-698                    | -26.2   | 6 MHz                    |      |

#### 6.6.3.3.12 Minimum requirement (network signalled value "NS\_19")

When "NS\_19" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.12-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

| Table 6.6.3.3.12-1: | Additional | requirements |
|---------------------|------------|--------------|
|---------------------|------------|--------------|

| Frequency<br>band<br>(MHz) | Channel bandwidth / Spectrum<br>emission limit (dBm)<br>3, 5, 10, 15, 20 MHz | Measurement<br>bandwidth | Note |
|----------------------------|--|--------------------------|------|
| 662 ≤ f ≤ 694              | -25  | 8 MHz                    |      |

#### 6.6.3.3.13 Minimum requirement (network signalled value "NS\_11")

When "NS\_11" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.13-1. These requirements also apply for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the channel bandwidth.

| Frequency<br>band<br>(MHz) | Channel bandwidth / Spectrum<br>emission limit (dBm)<br>1.4, 3, 5, 10, 15, 20 MHz | Measurement<br>bandwidth |
|----------------------------|---|--------------------------|
| E-UTRA Band 2              | -50   | 1 MHz                    |
| 1998 ≤ f ≤ 1999            | -21   | 1 MHz                    |
| 1997 ≤ f < 1998            | -27   | 1 MHz                    |
| 1996 ≤ f < 1997            | -32   | 1 MHz                    |
| 1995 ≤ f < 1996            | -37   | 1 MHz                    |
| 1990 ≤ f < 1995            | -40   | 1 MHz                    |

Table 6.6.3.3.13-1: Additional requirements

#### 6.6.3.3.14 Minimum requirement (network signalled value " NS\_20")

When "NS\_20" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.14-1. These requirements also apply for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the channel bandwidth.

| Frequency<br>band<br>(MHz)  | Channel bandwidth / Spectrum<br>emission limit (dBm)<br>5, 10, 15, 20 MHz | Measurement<br>bandwidth |  |  |  |  |
|---|---|--------------------------|--|--|--|--|
| 1990 ≤ f < 1999   | -40   | 1 MHz                    |  |  |  |  |
| 1999 ≤ f ≤ 2000   | -40   | Note 1                   |  |  |  |  |
| Note 1: The measurement bandwidth is 1% of the applicable E-UTRA channel bandwidth. |   |                          |  |  |  |  |

Table 6.6.3.3.14-1: Additional requirements

#### 6.6.3.3.15 Minimum requirement (network signalled value " NS\_22")

When "NS 22" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.15-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

| Frequency band<br>(MHz)   |  |  |       |  |  |  |
|---|--|--|-------|--|--|--|
|   |  | 5, 10, 15, 20 MHz                              |       |  |  |  |
| 3400  | ≤ f ≤ 3800   | -23 (Note 1, Note 3)                           | 5 MHz |  |  |  |
|   |  | -40 (Note 2)                                   | 1 MHz |  |  |  |
| Note 1:   |  | nent applies within an offset between 5 MHz an |       |  |  |  |
|   |  | r and from the upper edge of the channel band  |       |  |  |  |
| Note 2:   |  | nent applies from 3400 MHz up to 25 MHz belo   |       |  |  |  |
|   | E-UTRA channel edge and from 25 MHz above the upper E-UTRA |  |       |  |  |  |
|   | channel edge up to 3800 MHz.                               |  |       |  |  |  |
| Note 3: This emission limit might imply risk of harmful interference to UE(s) operating |  |  |       |  |  |  |
|   | in the protect   | ed operating band.                             |       |  |  |  |

Table 6.6.3.3.15-1: Additional requirement

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth.

## 6.6.3.3A Additional spurious emissions for CA

These requirements are specified in terms of an additional spectrum emission requirement. Additional spurious emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell reconfiguration message.

#### 6.6.3.3A.1 Minimum requirement for CA\_1C (network signalled value "CA\_NS\_01")

When "CA\_NS\_01" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3A.1-1. This requirement also applies for the frequency ranges that are less than FOOB (MHz) in Table 6.6.3.1A-1 from the edge of the aggregated channel bandwidth.

| Protected band  | Frequenc       | cy ra | inge (MHz) | Maximum Level (dBm) | MBW (MHz) | Note |  |  |  |  |  |
|---|----------------|-------|------------|---------------------|-----------|------|--|--|--|--|--|
| E-UTRA band 34  | FDL_low        | -     | FDL_high   | -50                 | 1         |      |  |  |  |  |  |
| Frequency range         1884.5         -         1915.7         -41         0.3         1 |                |       |            |                     |           |      |  |  |  |  |  |
| NOTE 1: Applicable v  | vhen the aggre |       |            |                     |           |      |  |  |  |  |  |

Table 6.6.3.3A.1-1: Additional requirements (PHS)

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth (300 kHz).

#### 6.6.3.3A.2 Minimum requirement for CA\_1C (network signalled value "CA\_NS\_02")

When "CA\_NS\_02" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3A.2-1. This requirement also applies for the frequency ranges that are less than FOOB (MHz) in Table 6.6.3.1A-1 from the edge of the aggregated channel bandwidth.

| Protected band  | Frequency range (MHz) |   | nge (MHz)     | Maximum Level (dBm) | MBW (MHz) |  |
|-----------------|-----------------------|---|---------------|---------------------|-----------|--|
| E-UTRA band 34  | $F_{DL_{low}}$        | - | $F_{DL_high}$ | -50                 | 1         |  |
| Frequency range | 1900                  | - | 1915          | -15.5               | 5         |  |
| Frequency range | 1915                  | - | 1920          | +1.6                | 5         |  |

Table 6.6.3.3A.2-1: Additional requirements

## 6.6.3.3A.3 Minimum requirement for CA\_1C (network signalled value "CA\_NS\_03")

When "CA\_NS\_03" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3A.3-1. This requirement also applies for the frequency ranges that are less than FOOB (MHz) in Table 6.6.3.1A-1 from the edge of the aggregated channel bandwidth.

| Protected band  | Frequency range (MHz) |   | nge (MHz)      | Maximum Level (dBm) | MBW (MHz) |
|-----------------|-----------------------|---|----------------|---------------------|-----------|
| E-UTRA band 34  | $F_{DL\_low}$         | - | $F_{DL\_high}$ | -50                 | 1         |
| Frequency range | 1880                  | - | 1895           | -40                 | 1         |
| Frequency range | 1895                  | - | 1915           | -15.5               | 5         |
| Frequency range | 1915 - 1920           |   | 1920           | +1.6                | 5         |

Table 6.6.3.3A.3-1: Additional requirements

#### 6.6.3.3A.4 Minimum requirement for CA\_38C (network signalled value "CA\_NS\_05")

When "CA\_NS\_05" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3A.4-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1A-1 from the edge of the aggregated channel bandwidth. This requirement is applicable for carriers with aggregated channel bandwidths confined in 2570 - 2615 MHz.

| Protected band  | Frequence | ;y rar | nge (MHz) | Maximum Level (dBm) | MBW (MHz) |
|-----------------|-----------|--------|-----------|---------------------|-----------|
| Frequency range | 2620      | -      | 2645      | -15.5               | 5         |
| Frequency range | 2645      | -      | 2690      | -40                 | 1         |

#### Table 6.6.3.3A.4-1: Additional requirements

#### 6.6.3.3A.5 Minimum requirement for CA\_7C (network signalled value "CA\_NS\_06")

When "CA\_NS\_06" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3A.5-1. This requirement also applies for the frequency ranges that are less than  $F_{OOB}$  (MHz) in Table 6.6.3.1A-1 from the edge of the aggregated channel bandwidth.

| Protected band  | Frequency range (MHz) |   |      | Maximum Level (dBm) | MBW (MHz) |
|-----------------|-----------------------|---|------|---------------------|-----------|
| Frequency range | 2570                  | - | 2575 | +1.6                | 5         |
| Frequency range | 2575                  | - | 2595 | -15.5               | 5         |
| Frequency range | 2595                  | - | 2620 | -40                 | 1         |

Table 6.6.3.3A.5-1: Additional requirements

## 6.6.3A Void

<reserved for future use>

# 6.6.3B Spurious emission for UL-MIMO

For UE supporting UL-MIMO, the requirements for Spurious emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emissions, intermodulation products and frequency conversion products are specified at each transmit antenna connector.

For UEs with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the requirements in subclause 6.6.3 apply to each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-1.

For single-antenna port scheme, the general requirements in subclause 6.6.3 apply.

# 6.6A Void

6.6B Void

# 6.7 Transmit intermodulation

The transmit intermodulation performance is a measure of the capability of the transmitter to inhibit the generation of signals in its non linear elements caused by presence of the wanted signal and an interfering signal reaching the transmitter via the antenna.

## 6.7.1 Minimum requirement

User Equipment(s) transmitting in close vicinity of each other can produce intermodulation products, which can fall into the UE, or eNode B receive band as an unwanted interfering signal. The UE intermodulation attenuation is defined by

the ratio of the mean power of the wanted signal to the mean power of the intermodulation product when an interfering CW signal is added at a level below the wanted signal at each of the transmitter antenna port with the other antenna port(s) if any is terminated. Both the wanted signal power and the intermodulation product power are measured through E-UTRA rectangular filter with measurement bandwidth shown in Table 6.7.1-1.

The requirement of transmitting intermodulation is prescribed in Table 6.7.1-1.

| BW Channel (UL)                         | 5MHz   |        | 10MHz  |        | 15MHz   |         | 20MHz  |        |
|---|--------|--------|--------|--------|---------|---------|--------|--------|
| Interference Signal<br>Frequency Offset | 5MHz   | 10MHz  | 10MHz  | 20MHz  | 15MHz   | 30MHz   | 20MHz  | 40MHz  |
| Interference CW Signal<br>Level         | -40dBc |        |        |        |         |         |        |        |
| Intermodulation Product                 | -29dBc | -35dBc | -29dBc | -35dBc | -29dBc  | -35dBc  | -29dBc | -35dBc |
| Measurement bandwidth                   | 4.5MHz | 4.5MHz | 9.0MHz | 9.0MHz | 13.5MHz | 13.5MHz | 18MHz  | 18MHz  |

Table 6.7.1-1: Transmit Intermodulation

# 6.7.1A Minimum requirement for CA

User Equipment(s) transmitting in close vicinity of each other can produce intermodulation products, which can fall into the UE, or eNode B receive band as an unwanted interfering signal. The UE intermodulation attenuation is defined by the ratio of the mean power of the wanted signal to the mean power of the intermodulation product on both component carriers when an interfering CW signal is added at a level below the wanted signal at each of the transmitter antenna port with the other antenna port(s) if any is terminated. Both the wanted signal power and the intermodulation product power are measured through rectangular filter with measurement bandwidth shown in Table 6.7.1A-1.

For intra-band contiguous carrier aggregation the requirement of transmitting intermodulation is specified in Table 6.7.1A-1.

| CA bandwidth class(UL)                  |  | С                          |  |
|---|--|----------------------------|--|
| Interference Signal<br>Frequency Offset | BW <sub>Channel_CA</sub>                       | 2*BW <sub>Channel_CA</sub> |  |
| Interference CW Signal<br>Level         | -40dBc   |                            |  |
| Intermodulation Product                 | -29dBc   | -35dBc                     |  |
| Measurement bandwidth                   | BW <sub>Channel_CA</sub> - 2* BW <sub>GB</sub> |                            |  |

Table 6.7.1A-1: Transmit Intermodulation

# 6.7.1B Minimum requirement for UL-MIMO

For UE supporting UL-MIMO, the transmit intermodulation requirements are specified at each transmit antenna connector and the wanted signal is defined as the sum of output power at each transmit antenna connector.

For UEs with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the requirements in subclause 6.7.1 apply to each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2.

For single-antenna port scheme, the requirements in subclause 6.7.1 apply.

- 6.8 Void
- 6.8.1 Void
- 6.8A Void

# 6.8B Time alignment error for UL-MIMO

For UE(s) with multiple transmit antenna connectors supporting UL-MIMO, this requirement applies to frame timing differences between transmissions on multiple transmit antenna connectors in the closed-loop spatial multiplexing scheme.

The time alignment error (TAE) is defined as the average frame timing difference between any two transmissions on different transmit antenna connectors.

### 6.8B.1 Minimum Requirements

For UE(s) with multiple transmit antenna connectors, the Time Alignment Error (TAE) shall not exceed 130 ns.

# 7 Receiver characteristics

# 7.1 General

Unless otherwise stated the receiver characteristics are specified at the antenna connector(s) of the UE. For UE(s) with an integral antenna only, a reference antenna(s) with a gain of 0 dBi is assumed for each antenna port(s). UE with an integral antenna(s) may be taken into account by converting these power levels into field strength requirements, assuming a 0 dBi gain antenna. For UEs with more than one receiver antenna connector, identical interfering signals shall be applied to each receiver antenna port if more than one of these is used (diversity).

The levels of the test signal applied to each of the antenna connectors shall be as defined in the respective sections below.

With the exception of subclause 7.3, the requirements shall be verified with the network signalling value NS\_01 configured (Table 6.2.4-1).

All the parameters in clause 7 are defined using the UL reference measurement channels specified in Annexes A.2.2 and A.2.3, the DL reference measurement channels specified in Annex A.3.2 and using the set-up specified in Annex C.3.1.

For the additional requirements for intra-band non-contiguous carrier aggregation of two component carriers (one component carrier per sub-block), an in-gap test refers to the case when the interfering signalis located at a negative offset with respect to the assigned channel frequency of the highest carrier frequency and located at a positive offset with respect to the assigned channel frequency of the lowest carrier frequency.

For the additional requirements for intra-band non-contiguous carrier aggregation of two component carriers (one component carrier per sub-block), an out-of-gap test refers to the case when the interfering signal(s) is (are) located at a positive offset with respect to the assigned channel frequency of the highest carrier frequency, or located at a negative offset with respect to the assigned channel frequency of the lowest carrier frequency.

For the additional requirements for intra-band non-contiguous carrier aggregation of two component carriers with channel bandwidth larger than or equal to 5 MHz (one component carrier per sub-block), the existing adjacent channel selectivity requirements, in-band blocking requirements (for each case), and narrow band blocking requirements apply for in-gap tests only if the corresponding interferer frequency offsets with respect to the two measured carriers satisfy the following condition in relation to the sub-block gap size  $W_{gap}$  for at least one of these carriers j, j = 1,2, so that the interferer frequency position does not change the nature of the core requirement tested:

 $W_{gap} \geq 2 \cdot |F_{Interferer \; (offset), j}| - B W_{Channel(j)}$ 

where  $F_{\text{Interferer (offset)},j}$  is the interferer frequency offset with respect to carrier *j* as specified in subclause 7.5.1, subclause 7.6.1 and subclause 7.6.3 for the respective requirement and BW<sub>Channel(j)</sub> the channel bandwidth of carrier *j*. The interferer frequency offsets for adjacent channel selectivity, each in-band blocking case and narrow- band blocking shall be tested separately with a single in-gap interferer at a time.

# 7.2 Diversity characteristics

The requirements in Section 7 assume that the receiver is equipped with two Rx port as a baseline. These requirements apply to all UE categories unless stated otherwise. Requirements for 4 ports are FFS. With the exception of subclause 7.9 all requirements shall be verified by using both (all) antenna ports simultaneously.

# 7.3 Reference sensitivity power level

The reference sensitivity power level REFSENS is the minimum mean power applied to both the UE antenna ports at which the throughput shall meet or exceed the requirements for the specified reference measurement channel.

# 7.3.1 Minimum requirements (QPSK)

The throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.3.1-1 and Table 7.3.1-2

| Channel bandwidth |                                   |              |                    |                         |                             |             |                |  |  |
|-------------------|-----------------------------------|--------------|--------------------|-------------------------|-----------------------------|-------------|----------------|--|--|
| E-UTRA            | 1.4 MHz                           | 3 MHz        | 5 MHz              | 10 MHz                  | 15 MHz                      | 20 MHz      | Duplex         |  |  |
| Band              | (dBm)                             | (dBm)        | (dBm)              | (dBm)                   | (dBm)                       | (dBm)       | Mode           |  |  |
| 1                 |                                   |              | -100               | -97                     | -95.2                       | -94         | FDD            |  |  |
| 2                 | -102.7                            | -99.7        | -98                | -95                     | -93.2                       | -92         | FDD            |  |  |
| 3                 | -101.7                            | -98.7        | -97                | -94                     | -92.2                       | -91         | FDD            |  |  |
| 4                 | -104.7                            | -101.7       | -100               | -97                     | -95.2                       | -94         | FDD            |  |  |
| 5                 | -103.2                            | -100.2       | -98                | -95                     |                             |             | FDD            |  |  |
| 6                 |                                   |              | -100               | -97                     |                             |             | FDD            |  |  |
| 7                 |                                   |              | -98                | -95                     | -93.2                       | -92         | FDD            |  |  |
| 8                 | -102.2                            | -99.2        | -97                | -94                     |                             |             | FDD            |  |  |
| 9                 |                                   |              | -99                | -96                     | -94.2                       | -93         | FDD            |  |  |
| 10                |                                   |              | -100               | -97                     | -95.2                       | -94         | FDD            |  |  |
| 11                |                                   |              | -100               | -97                     |                             | • •         | FDD            |  |  |
| 12                | -101.7                            | -98.7        | -97                | -94                     |                             |             | FDD            |  |  |
| 13                | 101.1                             | 00.7         | -97                | -94                     |                             |             | FDD            |  |  |
| 13                |                                   |              | -97                | -94                     |                             |             | FDD            |  |  |
|                   |                                   |              | -31                | -34                     |                             |             | 100            |  |  |
| <br>17            |                                   |              | -97                | -94                     |                             |             | FDD            |  |  |
| 17                |                                   |              | -100 <sup>7</sup>  | -94<br>-97 <sup>7</sup> | -95.2 <sup>7</sup>          |             | FDD            |  |  |
| 19                |                                   |              | -100               | -97                     | -95.2                       |             | FDD            |  |  |
| 20                |                                   |              | -97                | -94                     | -91.2                       | -90         | FDD            |  |  |
| 20                |                                   |              | -97                | -94<br>-97              | -91.2                       | -90         | FDD            |  |  |
|                   |                                   |              |                    |                         | -92.2                       | -91         |                |  |  |
| 22                | 4047                              | 404 7        | -97                | -94                     | -92.2                       | -91         | FDD            |  |  |
| 23                | -104.7                            | -101.7       | -100               | -97                     | -95.2                       | -94         | FDD            |  |  |
| 24                | 404.0                             |              | -100               | -97                     | 01.7                        | -90.5       | FDD            |  |  |
| 25                | -101.2                            | -98.2        | -96.5              | -93.5                   | -91.7<br>-92.7 <sup>6</sup> | -90.5       | FDD            |  |  |
| 26                | -102.7                            | -99.7        | -97.5 <sup>6</sup> | -94.5 <sup>6</sup>      | -92.7                       |             | FDD            |  |  |
| 27                | -103.2                            | -100.2       | -98                | -95                     | 00.7                        | 04          | FDD            |  |  |
| 28                |                                   | -100.2       | -98.5              | -95.5                   | -93.7                       | -91         | FDD            |  |  |
|                   |                                   |              |                    |                         |                             |             |                |  |  |
| 33                |                                   |              | -100               | -97                     | -95.2                       | -94         | TDD            |  |  |
| 34                |                                   |              | -100               | -97                     | -95.2                       |             | TDD            |  |  |
| 35                | -106.2                            | -102.2       | -100               | -97                     | -95.2                       | -94         | TDD            |  |  |
| 36                | -106.2                            | -102.2       | -100               | -97                     | -95.2                       | -94         | TDD            |  |  |
| 37                |                                   |              | -100               | -97                     | -95.2                       | -94         | TDD            |  |  |
| 38                |                                   |              | -100               | -97                     | -95.2                       | -94         | TDD            |  |  |
| 39                |                                   |              | -100               | -97                     | -95.2                       | -94         | TDD            |  |  |
| 40                |                                   |              | -100               | -97                     | -95.2                       | -94         | TDD            |  |  |
| 41                |                                   |              | -98                | -95                     | -93.2                       | -92         | TDD            |  |  |
| 42                |                                   |              | -99                | -96                     | -94.2                       | -93         | TDD            |  |  |
| 43                |                                   |              | -99                | -96                     | -94.2                       | -93         | TDD            |  |  |
| 44                |                                   | [-100.2]     | [-98]              | [-95]                   | [-93.2]                     | [-92]       | TDD            |  |  |
|                   | he transmitter                    |              |                    |                         |                             |             |                |  |  |
|                   | Reference meas<br>Pattern OP.1 FE |              |                    |                         |                             |             | NG .           |  |  |
|                   | The signal powe                   |              |                    |                         |                             |             |                |  |  |
| NOTE 4: F         | or the UE whic                    |              |                    |                         | d 9 the ref                 | erence sen  | sitivity       |  |  |
|                   | evel is FFS.                      | h            |                    |                         | and 04.4                    |             | a na statu sta |  |  |
|                   | or the UE whic                    | n supports   | both Band          | 11 and Ba               | ind 21 the i                | reterence s | ensitivity     |  |  |
|                   | indicates that t                  | he reauirem  | nent is mo         | dified bv -0            | .5 dB wher                  | the carrie  | r              |  |  |
| fr                | equency of the                    | assigned E   | E-UTRA cl          | hannel ban              | dwidth is w                 | ithin 865-8 | 94 MHz.        |  |  |
|                   | or a UE that su                   |              |                    |                         |                             | ence sensi  | tivity level   |  |  |
| fo                | or Band 26 app                    | lies for the | applicable         | channel ba              | andwidths.                  |             |                |  |  |

| Table 7.3.1-1: Reference sensitivity QPSK PREFSENS | Table 7.3.1-1: | Reference | sensitivity | QPSK | PREFSENS |
|--|----------------|-----------|-------------|------|----------|
|--|----------------|-----------|-------------|------|----------|

The reference receive sensitivity (REFSENS) requirement specified in Table 7.3.1-1 shall be met for an uplink transmission bandwidth less than or equal to that specified in Table 7.3.1-2.

NOTE: Table 7.3.1-2 is intended for conformance tests and does not necessarily reflect the operational conditions of the network, where the number of uplink and downlink allocated resource blocks will be practically constrained by other factors. Typical receiver sensitivity performance with HARQ retransmission enabled and using a residual BLER metric relevant for e.g. Speech Services is given in the Annex G (informative).

For the UE which supports inter-band carrier aggregation configuration in Table 7.3.1-1A with uplink in one E-UTRA band, the minimum requirement for reference sensitivity in Table 7.3.1-1 shall be increased by the amount given in  $\Delta R_{IB,c}$  in Table7.3.1-1A for the applicable E-UTRA bands.

| Inter-band CA<br>Configuration | E-UTRA Band                                  | ΔR <sub>IB,c</sub> [dB]                 |  |  |
|--------------------------------|--|---|--|--|
| CA_1A-5A                       | 1  | 0                                       |  |  |
| 04_14-34                       | 5  | 0                                       |  |  |
| CA_1A-18A                      | 1  | 0                                       |  |  |
|                                | 18   | 0                                       |  |  |
| CA_1A-19A                      | 1  | 0                                       |  |  |
| _                              | 19   | 0                                       |  |  |
| CA_1A-21A                      | 21   | 0                                       |  |  |
|                                | 21   | 0                                       |  |  |
| CA_2A-17A                      | 17   | 0.5                                     |  |  |
|                                | 3  | 0                                       |  |  |
| CA_3A-5A                       | 5  | 0                                       |  |  |
| 04 04 74                       | 3  | 0                                       |  |  |
| CA_3A-7A                       | 7  | 0                                       |  |  |
| CA_3A-8A                       | 3  | 0                                       |  |  |
| CA_3A-6A                       | 8  | 0                                       |  |  |
| CA_3A-20A                      | 3  | 0                                       |  |  |
| 0/(_0/(20/(                    | 20   | 0                                       |  |  |
| CA_4A-5A                       | 4  | 0                                       |  |  |
|                                | 5  | 0                                       |  |  |
| CA_4A-7A                       | 4  | 0.5                                     |  |  |
|                                | 7 4  | 0.5                                     |  |  |
| CA_4A-12A                      | 12   | 0.5                                     |  |  |
|                                | 4  | 0.5                                     |  |  |
| CA_4A-13A                      | 13   | 0                                       |  |  |
|                                | 4  | 0                                       |  |  |
| CA_4A-17A                      | 17   | 0.5                                     |  |  |
| 0.0.50.400                     | 5  | 0.5                                     |  |  |
| CA_5A-12A                      | 12   | 0.3                                     |  |  |
| CA_5A-17A                      | 5  | 0.5                                     |  |  |
| <u>CA_5A-17A</u>               | 17   | 0.3                                     |  |  |
| CA_7A-20A                      | 7  | 0                                       |  |  |
|                                | 20   | 0                                       |  |  |
| CA_8A-20A                      | 8  | 0                                       |  |  |
| _                              | 20   | 0                                       |  |  |
| CA_11A-18A                     | 11   | 0                                       |  |  |
| NOTE 1. The ak                 | 18<br>pove additional tolerances are only ap | 0<br>plicable for the E LITRA operating |  |  |
|                                | that belong to the supported inter-bar       |   |  |  |
|                                | urations                                     | a carrier aggregation                   |  |  |
|                                | oove additional tolerances also apply i      | n intra-band CA and non-                |  |  |
|                                | ated operation for the supported E-U         |   |  |  |
|                                | oported inter-band carrier aggregation       |   |  |  |
| NOTE 3: In case                | e the UE supports more than one of th        | e above inter-band carrier              |  |  |
|                                | ation configurations and a E-UTRA o          |   |  |  |
|                                | er-band carrier aggregation configura        |   |  |  |
|                                | hen the E-UTRA operating band freq           |   |  |  |
|                                | plicable additional tolerance shall be       |   |  |  |
|                                | able 7.3.1-1A, truncated to one decim        | 1 11 2                                  |  |  |
|                                | perating band among the supported CA         |   |  |  |
|                                | rmonic relation between low band Ul          | •                                       |  |  |
|                                | aximum tolerance among the differen          |   |  |  |
|                                | nfigurations involving such band sha         |   |  |  |
|                                | hen the E-UTRA operating band freq           |   |  |  |
|                                | plicable additional tolerance shall be       |   |  |  |
| 7.                             | 3.1-1A that would apply for that oper        | ating band among the supported          |  |  |

Table 7.3.1-1A: ΔR<sub>IB,c</sub>

CA configurations

NOTE : The above additional tolerances do not apply to supported UTRA operating bands with frequency range below 1 GHz that correspond to the E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations when such bands are belonging only to band combination(s) where one band is <1GHz and another band is >1.7GHz and there is no harmonic relationship between the low band UL and high band DL. Otherwise the above additional tolerances also apply to supported UTRA operating bands that correspond to the E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations.

| E-UTRA Band / Channel bandwidth / N <sub>RB</sub> / Duplex mode   |                             |       |                 |                 |                 |                 |        |  |
|---|-----------------------------|-------|-----------------|-----------------|-----------------|-----------------|--------|--|
| E-UTRA  | 1.4 MHz                     | 3 MHz | 5 MHz           | 10 MHz          | 15 MHz          | 20 MHz          | Duplex |  |
| Band  |                             |       |                 |                 |                 |                 | Mode   |  |
| 1   |                             |       | 25              | 50              | 75              | 100             | FDD    |  |
| 2   | 6                           | 15    | 25              | 50              | 50 <sup>1</sup> | 50 <sup>1</sup> | FDD    |  |
| 3   | 6                           | 15    | 25              | 50              | 50 <sup>1</sup> | 50 <sup>1</sup> | FDD    |  |
| 4   | 6                           | 15    | 25              | 50              | 75              | 100             | FDD    |  |
| 5   | 6                           | 15    | 25              | 25 <sup>1</sup> |                 |                 | FDD    |  |
| 6   |                             |       | 25              | 25 <sup>1</sup> |                 |                 | FDD    |  |
| 7   |                             |       | 25              | 50              | 75              | 75 <sup>1</sup> | FDD    |  |
| 8   | 6                           | 15    | 25              | 25 <sup>1</sup> |                 |                 | FDD    |  |
| 9   |                             |       | 25              | 50              | 50 <sup>1</sup> | 50 <sup>1</sup> | FDD    |  |
| 10  |                             |       | 25              | 50              | 75              | 100             | FDD    |  |
| 11  |                             |       | 25              | 25 <sup>1</sup> |                 |                 | FDD    |  |
| 12  | 6                           | 15    | 20 <sup>1</sup> | 20 <sup>1</sup> |                 |                 | FDD    |  |
| 13  |                             |       | 20 <sup>1</sup> | 20 <sup>1</sup> |                 |                 | FDD    |  |
| 14  |                             |       | 15 <sup>1</sup> | 15 <sup>1</sup> |                 |                 | FDD    |  |
|   |                             |       |                 |                 |                 |                 |        |  |
| 17  |                             |       | 20 <sup>1</sup> | 20 <sup>1</sup> |                 |                 | FDD    |  |
| 18  |                             |       | 25              | 25 <sup>1</sup> | 25 <sup>1</sup> |                 | FDD    |  |
| 19  |                             |       | 25              | 25 <sup>1</sup> | 25 <sup>1</sup> |                 | FDD    |  |
| 20  |                             |       | 25              | 20 <sup>1</sup> | 20 <sup>3</sup> | 20 <sup>3</sup> | FDD    |  |
| 21  |                             |       | 25              | 25 <sup>1</sup> | 25 <sup>1</sup> |                 | FDD    |  |
| 22  |                             |       | 25              | 50              | 50 <sup>1</sup> | 50 <sup>1</sup> | FDD    |  |
| 23  | 6                           | 15    | 25              | 50              | 75              | 100             | FDD    |  |
| 24  |                             |       | 25              | 50              |                 |                 | FDD    |  |
| 25  | 6                           | 15    | 25              | 50              | 50 <sup>1</sup> | 50 <sup>1</sup> | FDD    |  |
| 26  | 6                           | 15    | 25              | 25 <sup>1</sup> | 25 <sup>1</sup> |                 | FDD    |  |
| 27  | 6                           | 15    | 25              | 25 <sup>1</sup> |                 |                 | FDD    |  |
| 28  | -                           | 15    | 25              | 25 <sup>1</sup> | 25 <sup>1</sup> | 25 <sup>1</sup> | FDD    |  |
|   |                             | -     | _               | -               |                 |                 |        |  |
| 33  |                             |       | 25              | 50              | 75              | 100             | TDD    |  |
| 34  |                             |       | 25              | 50              | 75              |                 | TDD    |  |
| 35  | 6                           | 15    | 25              | 50              | 75              | 100             | TDD    |  |
| 36  | 6                           | 15    | 25              | 50              | 75              | 100             | TDD    |  |
| 37  |                             |       | 25              | 50              | 75              | 100             | TDD    |  |
| 38  |                             |       | 25              | 50              | 75              | 100             | TDD    |  |
| 39  | 1                           |       | 25              | 50              | 75              | 100             | TDD    |  |
| 40  | 1                           |       | 25              | 50              | 75              | 100             | TDD    |  |
| 41  | 1                           |       | 25              | 50              | 75              | 100             | TDD    |  |
| 42  |                             |       | 25              | 50              | 75              | 100             | TDD    |  |
| 43  |                             |       | 25              | 50              | 75              | 100             | TDD    |  |
| 43  |                             | 15    | 25              | 50              | 75              | 100             | TDD    |  |
| <ul> <li>NOTE 1: <sup>1</sup> refers to the UL resource blocks shall be located as close as possible to the downlink operating band but confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.6-1).</li> <li>NOTE 2: For the UE which supports both Band 11 and Band 21 the uplink configuration for reference sensitivity is FFS.</li> <li>NOTE 3: <sup>3</sup> refers to Band 20; in the case of 15MHz channel bandwidth, the UL</li> </ul> |                             |       |                 |                 |                 |                 |        |  |
|   | resource blo<br>channel bar |       |                 |                 |                 |                 |        |  |

 Table 7.3.1-2: Uplink configuration for reference sensitivity

Unless given by Table 7.3.1-3, the minimum requirements specified in Tables 7.3.1-1 and 7.3.1-2 shall be verified with the network signalling value NS\_01 (Table 6.2.4-1) configured.

| E-UTRA<br>Band | Network<br>Signalling<br>value |
|----------------|--------------------------------|
| 2              | NS_03                          |
| 4              | NS_03                          |
| 10             | NS_03                          |
| 12             | NS_06                          |
| 13             | NS_06                          |
| 14             | NS_06                          |
| 17             | NS_06                          |
| 19             | NS_08                          |
| 21             | NS_09                          |
| 23             | NS_03                          |

# 7.3.1A Minimum requirements (QPSK) for CA

For inter-band carrier aggregation with uplink assigned to one E-UTRA band the throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.3.1-1 and Table 7.3.1-2. The reference sensitivity is defined to be met with both downlink component carriers active and either of the uplink carriers active. The UE shall meet the requirements specified in subclause 7.3.1 with the following exceptions.

For the UE that supports any of the E-UTRA CA configurations given in Table 7.3.1A-0a, exceptions to the aforementioned requirements are allowed when the uplink active in the lower-frequency operating band is within a specified frequency range as noted in Table 7.3.1A-0a. For these exceptions, the UE shall meet the requirements specified in Table 7.3.1A-0a and Table 7.3.1A-0b.

| Channel bandwidth   |               |                  |                |                |                 |                 |                 |                |  |
|---|---------------|------------------|----------------|----------------|-----------------|-----------------|-----------------|----------------|--|
| EUTRA CA<br>Configuration   | EUTRA<br>band | 1.4 MHz<br>(dBm) | 3 MHz<br>(dBm) | 5 MHz<br>(dBm) | 10 MHz<br>(dBm) | 15 MHz<br>(dBm) | 20 MHz<br>(dBm) | Duplex<br>mode |  |
| CA_3A-8A <sup>4</sup>   | 3             |                  |                |                | N/A             | N/A             | N/A             | FDD            |  |
| CA_SA-6A  | 8             |                  |                | N/A            | N/A             |                 |                 | FUU            |  |
| CA_4A-12A <sup>5,6</sup>  | 4             | -89.2            | -89.2          | -90            | -89.5           |                 |                 | FDD            |  |
| CA_4A-12A   | 12            |                  |                | -96.5          | -93.5           |                 |                 | FUU            |  |
| CA_4A-17A <sup>5,6</sup>  | 4             |                  |                | -90            | -89.5           |                 |                 | FDD            |  |
|   |               |                  |                | -96.5          | -93.5           |                 |                 | FDD            |  |
| NOTE 1: The transmitter shall be set to $P_{UMAX}$ as defined in subclause 6.2.5A.<br>NOTE 2: Reference measurement channel is A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1<br>NOTE 3: The signal power is specified per port<br>NOTE 4: No requirements apply when there is at least one individual RE within the uplink transmission bandwidth of the low band for which the 2nd transmitter harmonic is within the downlink transmission bandwidth of the high band. The reference sensitivity is only verified when this is not the case (the requirements specified in clause 7.3.1 apply).<br>NOTE 5: These requirements apply when there is at least one individual RE within the uplink transmission bandwidth of the low band for which the 3rd transmitter harmonic is within the downlink transmission bandwidth of the low band for which the 3rd transmitter harmonic is within the uplink transmission bandwidth of the low band for which the 3rd transmitter harmonic is within the transmission bandwidth of the low band for which the 3rd transmitter harmonic is within the downlink transmission bandwidth of the high band.<br>NOTE 6: The requirements should be verified for UL EARFCN of the low band (superscript LB) such that $f_{UL}^{LB} = \left[ f_{DL}^{HB} / 0.3 \right] 0.1$ in MHz and $F_{UL_{Low}}^{LB} + BW_{Channel}^{LB} / 2 < f_{UL_{high}}^{LB} - BW_{Channel}^{LB} / 2$ with $f_{DL}^{HB}$ the carrier frequency of the high band in MHz and $BW_{Channel}^{LB}$ the channel bandwidth configured in the |               |                  |                |                |                 |                 |                 |                |  |

| E-UTRA Band / Channel bandwidth of the high band / $N_{RB}$ / Duplex mode  |         |         |       |       |        |        |        |                |  |
|--|---------|---------|-------|-------|--------|--------|--------|----------------|--|
| EUTRA CA<br>Configuration  | UL band | 1.4 MHz | 3 MHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz | Duplex<br>mode |  |
| CA_4A-12A  | 12      | 2       | 5     | 8     | 16     |        |        | FDD            |  |
| CA_4A-17A  | 17      |         |       | 8     | 16     |        |        | FDD            |  |
| <ul> <li>NOTE 1: refers to the UL resource blocks, which shall be centred within the transmission bandwidth configuration for the channel bandwidth.</li> <li>NOTE 2: the UL configuration applies regardless of the channel bandwidth of the low band unless the UL resource blocks exceed that specified in Table 7.3.1-2 for the uplink bandwidth in which case the allocation according to Table 7.3.1-2 applies.</li> </ul> |         |         |       |       |        |        |        |                |  |

Table 7.3.1A-0b: Uplink configuration for the low band (exceptions)

For band combinations including operating bands without uplink band (as noted in Table 5.5-1), the requirements are specified in Table 7.3.1A-0d and Table 7.3.1A-0e.

| Channel bandwidth  |               |                  |                |                |                 |                 |                 |                |  |
|--|---------------|------------------|----------------|----------------|-----------------|-----------------|-----------------|----------------|--|
| EUTRA CA<br>Configuration  | EUTRA<br>band | 1.4 MHz<br>(dBm) | 3 MHz<br>(dBm) | 5 MHz<br>(dBm) | 10 MHz<br>(dBm) | 15 MHz<br>(dBm) | 20 MHz<br>(dBm) | Duplex<br>mode |  |
|  | 2             |                  |                | -98            | -95             |                 |                 | FDD            |  |
| CA_2A-29A  | 29            |                  | -98.7          | -97            | -94             |                 |                 |                |  |
|  | 4 -100 -97    |                  |                |                |                 |                 |                 |                |  |
| CA_4A-29A  | 29            |                  | -98.7          | -97            | -94             |                 |                 | FDD            |  |
| NOTE 1: The transmitter shall be set to P <sub>UMAX</sub> as defined in subclause 6.2.5A.         NOTE 2: Reference measurement channel is A.3.2 with one sided dynamic OCNG Pattern OP.1         FDD/TDD as described in Annex A.5.1.1/A.5.2.1         NOTE 3: The signal power is specified per port |               |                  |                |                |                 |                 |                 |                |  |

Table 7.3.1A-0d: Reference sensitivity QPSK PREFSENS

| Table 7.3.1A-0e: | Uplink configuration for | reference sensitivity |
|------------------|--------------------------|-----------------------|
|------------------|--------------------------|-----------------------|

| E-UTRA Band / Channel bandwidth / N <sub>RB</sub> / Duplex mode |               |                  |                |                |                 |                 |                 |                |  |
|---|---------------|------------------|----------------|----------------|-----------------|-----------------|-----------------|----------------|--|
| EUTRA CA<br>Configuration                                       | EUTRA<br>band | 1.4 MHz<br>(dBm) | 3 MHz<br>(dBm) | 5 MHz<br>(dBm) | 10 MHz<br>(dBm) | 15 MHz<br>(dBm) | 20 MHz<br>(dBm) | Duplex<br>mode |  |
|   | 2             |                  |                | 25             | 50              |                 |                 |                |  |
| CA_2A-29A   | 29            |                  | N/A            | N/A            | N/A             |                 |                 | FDD            |  |
|   | 4             |                  |                | 25             | 50              |                 | FDD             |                |  |
| CA_4A-29A   | 29            |                  | N/A            | N/A            | N/A             |                 |                 | FDD            |  |

In all cases for single uplink inter-band CA, unless given by Table 7.3.1-3 for the band with the active uplink carrier, the applicable reference sensitivity requirements shall be verified with the network signalling value NS\_01 (Table 6.2.4-1) configured.

For intra-band contiguous carrier aggregation the throughput of each component carrier shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.3.1-1 and Table 7.3.1A-1. Table 7.3.1A-1 specifies the maximum number of allocated uplink resource blocks for which the intra-band contiguous carrier aggregation reference sensitivity requirement shall be met. The PCC and SCC allocations follow Table 7.3.1A-1 and form a contiguous allocation where TX–RX frequency separations are as defined in Table 5.7.4-1. For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2 and the downlink PCC carrier center frequency shall be configured closer to uplink operating band than the downlink SCC center frequency. Unless given by Table 7.3.1-3, the reference sensitivity requirements shall be verified with the network signalling value NS\_01 (Table 6.2.4-1) configured.

|   | CA configuration / CC combination / $N_{RB_agg}$ / Duplex mode |             |           |           |               |                        |              |             |         |  |
|---|--|-------------|-----------|-----------|---------------|------------------------|--------------|-------------|---------|--|
|   | 100RB  | 100RB+50RB  |           | 75RB+75RB |               | 100RB+75RB             |              | +100RB      | Duplex  |  |
| CA configuration                          | PCC  | SCC         | PCC       | SCC       | PCC           | SCC                    | PCC          | SCC         | Mode    |  |
| CA_1C                                     | N/A  | N/A         | 75        | 54        | N/A           | N/A                    | 100          | 30          | FDD     |  |
| CA_7C                                     | N/A  | N/A         | 75        | 0         | N/A           | N/A                    | 75           | 0           | FDD     |  |
| CA_38C                                    |  |             | 75        | 75        |               |                        | 100          | 100         | TDD     |  |
| CA_40C                                    | 100  | 50          | 75        | 75        | N/A           | N/A                    | 100          | 100         | TDD     |  |
| CA_41C                                    | 100  | 50          | 75        | 75        | 100           | 75                     | 100          | 100         | TDD     |  |
| NOTE 1: The carrier<br>NOTE 2: The transm | nitted powe  | r over both | n PCC and | d SCC sha | all be set to | o P <sub>UMAX</sub> as | defined in a | subclause 6 | 5.2.5A. |  |

#### Table 7.3.1A-1: Intra-band contiguous CA uplink configuration for reference sensitivity

NOTE 3: The UL resource blocks in both PCC and SCC shall be confined within the transmission bandwidth

configuration for the channel bandwidth (Table 5.6-1).

NOTE 4: The UL resource blocks in PCC shall be located as close as possible to the downlink operating band, while the UL resource blocks in SCC shall be located as far as possible from the downlink operating band.

For intra-band non-contiguous carrier aggregation with one uplink carrier and two downlink carriers, the throughput of each downlink component carrier shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with both downlink carriers active and parameters specified in Table 7.3.1-1 and Table 7.3.1A-3 with the power level in Table 7.3.1-1 increased by  $\Delta_{IBNC}$  given in Table 7.3.1A-3 for the SCC. Unless given by Table 7.3.1-3, the reference sensitivity requirements shall be verified with the network signalling value NS\_01 (Table 6.2.4-1) configured.

| CA<br>configuration   | Aggregated<br>channel<br>bandwidth<br>(PCC+SCC)   | W <sub>gap</sub> /[MHz]  | UL PCC allocation   | ΔR <sub>iBNC</sub><br>(dB)  | Duplex<br>mode            |
|---|---|--|---|-----------------------------|---------------------------|
|   | 25RB+25RB   | $30.0 < W_{gap} \le 55.0$  | 10 <sup>1</sup>   | 5.0                         |                           |
|   | 2010-2010   | $0.0 < W_{gap} \le 30.0$   | 25 <sup>1</sup>   | 0.0                         |                           |
|   | 25RB+50RB   | $25.0 < W_{gap} \le 50.0$  | 10 <sup>1</sup>   | 4.5                         |                           |
| CA 25A-25A  | 2568+5068   | $0.0 < W_{gap} \le 25.0$   | 25 <sup>1</sup>   | 0.0                         | FDD                       |
| CA_23A-23A  | 50RB+25RB   | 15.0 < W <sub>gap</sub> ≤ 50.0   | 10 <sup>4</sup>   | 5.5                         | FUU                       |
|   | 50KB+25KB   | $0.0 < W_{gap} \le 15.0$ $32^1$  |   | 0.0                         |                           |
|   | 50RB+50RB   | 10.0 < W <sub>gap</sub> ≤ 45.0   | 10 <sup>4</sup>   | 5.0                         |                           |
|   | SUKB+SUKB   | $0.0 < W_{gap} \le 10.0$   | 0.0   |                             |                           |
| CA_41A-41A  | NOTE 6  | NOTE 7   | 0.0   | TDD                         |                           |
| operat<br>NOTE 2: W <sub>gap</sub> is<br>NOTE 3: The ca<br>operat<br>NOTE 4: <sup>4</sup> refer<br>NOTE 5: For the<br>only in<br>NOTE 6: All cor<br>NOTE 7: All app | ting band but confi<br>s the sub-block gap<br>arrier center freque<br>ting band.<br>s to the UL resource<br>e TDD intra-band r<br>a synchronized ope<br>nbinations of chan<br>blicable sub-block<br>CC allocation is sa | ce blocks shall be located as c<br>ned within the transmission.<br>p between the two sub-blocks.<br>ency of PCC in the UL operatir<br>ce blocks shall be located at R<br>non-contiguous CA configuration<br>eration between all component<br>nel bandwidths defined in Tab<br>gap sizes.<br>une as Transmission bandwidt | ng band is conf<br>B <sub>start</sub> =33.<br>ons, the minim<br>carriers.<br>le 5.6A.1-3. | igured close<br>um requirem | r to the DL<br>ents apply |

# Table 7.3.1A-3: Intra-band non-contiguous CA uplink configuration for reference sensitivity with one uplink

## 7.3.1B Minimum requirements (QPSK) for UL-MIMO

For UE with two transmitter antenna connectors in closed-loop spatial multiplexing scheme, the minimum requirements in Clause 7.3.1 shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2. For UL-MIMO, the parameter  $P_{UMAX}$  is the total transmitter power over the two transmit antenna connectors.

## 7.3.2 Void

## 7.4 Maximum input level

This is defined as the maximum mean power received at the UE antenna port, at which the specified relative throughput shall meet or exceed the minimum requirements for the specified reference measurement channel.

## 7.4.1 Minimum requirements

The throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.4.1-1

| Rx Parameter  | Rx Parameter Units Channel bandwidth |            |          |          |           |           |           |
|---|--------------------------------------|------------|----------|----------|-----------|-----------|-----------|
|   |                                      | 1.4<br>MHz | 3<br>MHz | 5<br>MHz | 10<br>MHz | 15<br>MHz | 20<br>MHz |
| Power in Transmission<br>Bandwidth Configuration  | dBm                                  | -25        |          |          |           |           |           |
| <ul> <li>Bandwidth Configuration</li> <li>NOTE 1: The transmitter shall be set to 4dB below PCMAX_L at the minimum uplink configuration specified in Table 7.3.1-2 with PCMAX_L as defined in subclause 6.2.5.</li> <li>NOTE 2: Reference measurement channel is Annex A.3.2: 64QAM, R=3/4 variant with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.</li> </ul> |                                      |            |          |          |           |           |           |

 Table 7.4.1-1: Maximum input level

## 7.4.1A Minimum requirements for CA

For inter-band carrier aggregation with uplink assigned to one E-UTRA band the maximum input level is defined with the uplink active on the band other than the band whose downlink is being tested. The UE shall meet the requirements specified in subclause 7.4.1 for each component carrier while both downlink carriers are active.

For intra-band contiguous carrier aggregation maximum input level is defined as the powers received at the UE antenna port over the Transmission bandwidth configuration of each CC, at which the specified relative throughput shall meet or exceed the minimum requirements for the specified reference measurement channel over each component carrier.

The downlink SCC shall be configured at nominal channel spacing to the PCC with the PCC configured closest to the uplink band. Downlink PCC and SCC are both activated. The uplink output power shall be set as specified in Table 7.4.1A-1 with the uplink configuration set according to Table 7.3.1A-1 for the applicable carrier aggregation configuration. For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2.

The throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channels over each component carrier as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.4.1A-1.

For intra-band non-contiguous carrier aggregation with two downlink carriers each carrier shall meet the requirements specified in Table 7.4.1-1 while all downlink carriers are active.

The throughput shall be  $\geq$  95% of the maximum throughput of the specified reference measurement channel as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1) over each carrier. For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.1A-3.

| Rx Parameter Units CA Bandwidth Cla   |           |             |             |  |            |            |   |
|---|-----------|-------------|-------------|--|------------|------------|---|
|   |           | Α           | В           | С  | D          | E          | F |
| Power in largest<br>Transmission Bandwidth<br>Configuration CC                          | dBm       |             |             | -25  |            |            |   |
| Power in each other CC  | dBm       |             |             | -25 +<br>10log(N<br><sup>RB,c</sup><br>/N <sub>RB,larg<br/>est BW)</sub> |            |            |   |
| NOTE 1: The transmitter sha<br>6.2.5A.<br>NOTE 2: Reference measure<br>dynamic OCNG Pat | ment chan | nel is Anne | ex A.3.2: 6 | 4QAM, R=3  | 3/4 varian | t with one |   |

Table 7.4.1A-1: Maximum input level for intra-band contiguous CA

### 7.4.1B Minimum requirements for UL-MIMO

For UE with two transmitter antenna connectors in closed-loop spatial multiplexing, the minimum requirements in Clause 7.4.1 shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2. For UL-MIMO, the parameter  $P_{CMAX_L}$  is defined as the total transmitter power over the two transmit antenna connectors.

## 7.4A Void

7.4A.1 Void

## 7.5 Adjacent Channel Selectivity (ACS)

Adjacent Channel Selectivity (ACS) is a measure of a receiver's ability to receive a E-UTRA signal at its assigned channel frequency in the presence of an adjacent channel signal at a given frequency offset from the centre frequency of the assigned channel. ACS is the ratio of the receive filter attenuation on the assigned channel frequency to the receive filter attenuation on the adjacent channel(s).

### 7.5.1 Minimum requirements

The UE shall fulfil the minimum requirement specified in Table 7.5.1-1 for all values of an adjacent channel interferer up to -25 dBm. However it is not possible to directly measure the ACS, instead the lower and upper range of test parameters are chosen in Table 7.5.1-2 and Table 7.5.1-3 where the throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1).

|              |       |            | Channel bandwidth |          |           |           |           |  |  |  |
|--------------|-------|------------|-------------------|----------|-----------|-----------|-----------|--|--|--|
| Rx Parameter | Units | 1.4<br>MHz | 3<br>MHz          | 5<br>MHz | 10<br>MHz | 15<br>MHz | 20<br>MHz |  |  |  |
| ACS          | dB    | 33.0       | 33.0              | 33.0     | 33.0      | 30        | 27        |  |  |  |

| Rx Parameter         | Units       |                    |                 | Channel ba        | andwidth         |                   |                |  |  |  |  |
|----------------------|-------------|--------------------|-----------------|-------------------|------------------|-------------------|----------------|--|--|--|--|
|                      |             | 1.4 MHz            | 3 MHz           | 5 MHz             | 10 MHz           | 15 MHz            | 20 MHz         |  |  |  |  |
| Power in             | dBm         |                    |                 |                   |                  |                   |                |  |  |  |  |
| Transmission         |             |                    |                 |                   |                  |                   |                |  |  |  |  |
| Bandwidth            |             |                    | REFSENS + 14 dB |                   |                  |                   |                |  |  |  |  |
| Configuration        |             |                    |                 |                   |                  |                   |                |  |  |  |  |
|                      | dBm         | REFSENS            | REFSENS         | REFSENS           | REFSENS          | REFSENS           | REFSENS        |  |  |  |  |
| PInterferer          |             | +45.5dB            | +45.5dB         | +45.5dB           | +45.5dB          | +42.5dB           | +39.5dB        |  |  |  |  |
| BWInterferer         | MHz         | 1.4                | 3               | 5                 | 5                | 5                 | 5              |  |  |  |  |
| FInterferer (offset) | MHz         | 1.4+0.0025         | 3+0.0075        | 5+0.0025          | 7.5+0.0075       | 10+0.0125         | 12.5+0.0025    |  |  |  |  |
|                      |             | /                  | /               | /                 | /                | /                 | /              |  |  |  |  |
|                      |             | -1.4-0.0025        | -3-0.0075       | -5-0.0025         | -7.5-0.0075      | -10-0.0125        | -12.5-         |  |  |  |  |
|                      |             |                    |                 |                   |                  |                   | 0.0025         |  |  |  |  |
| NOTE 1: The tra      | insmitter s | hall be set to 4d  | B below PCMAX   | ⊥ at the minimum  | uplink configura | ation specified i | n Table 7.3.1- |  |  |  |  |
| 2 with               | PCMAX_L as  | defined in subcla  | ause 6.2.5.     |                   |                  | -                 |                |  |  |  |  |
| NOTE 2: The int      | erferer co  | nsists of the Refe | erence measur   | ement channel sp  | pecified in Anne | x A.3.2 with one  | e sided        |  |  |  |  |
| dynam                | ic OCNG I   | Pattern OP.1 FD    | D/TDD as desc   | cribed in Annex A | .5.1.1/A.5.2.1 a | nd set-up accor   | ding to Annex  |  |  |  |  |
| C.3.1                |             |                    |                 |                   |                  |                   | -              |  |  |  |  |

| Rx Parameter   | Units       |                   |               | Channel b                            | andwidth         |                   |             |  |  |  |  |
|--|-------------|-------------------|---------------|--------------------------------------|------------------|-------------------|-------------|--|--|--|--|
|  |             | 1.4 MHz           | 3 MHz         | 5 MHz                                | 10 MHz           | 15 MHz            | 20 MHz      |  |  |  |  |
| Power in<br>Transmission<br>Bandwidth<br>Configuration | dBm         | -56.5             | -56.5         | -56.5                                | -56.5            | -53.5             | -50.5       |  |  |  |  |
| PInterferer  | dBm         |                   | -25           |                                      |                  |                   |             |  |  |  |  |
| <b>BW</b> Interferer                                   | MHz         | 1.4               | 3             | 5                                    | 5                | 5                 | 5           |  |  |  |  |
| F <sub>Interferer</sub> (offset)                       | MHz         | 1.4+0.0025        | 3+0.0075      | 5+0.0025                             | 7.5+0.0075       | 10+0.0125         | 12.5+0.0025 |  |  |  |  |
|  |             | /                 | /             | /                                    | /                | /                 | /           |  |  |  |  |
|  |             | -1.4-0.0025       | -3-0.0075     | -5-0.0025                            | -7.5-0.0075      | -10-0.0125        | -12.5-      |  |  |  |  |
|  |             |                   |               |                                      |                  |                   | 0.0025      |  |  |  |  |
| NOTE 1: The tra  | insmitter s | hall be set to 24 | dB below PCMA | x_L at the minimu                    | m uplink configu | iration specified | in Table    |  |  |  |  |
|  |             | x_L as defined in |               |                                      |                  | ·                 |             |  |  |  |  |
|  |             |                   |               | ement channel sp<br>Annex A.5.1.1/A. |                  |                   |             |  |  |  |  |

Table 7.5.1-3: Test parameters for Adjacent channel selectivity, Case 2

## 7.5.1A Minimum requirements for CA

For inter-band carrier aggregation with uplink assigned to one E-UTRA band, the adjacent channel requirements are defined with the uplink active on the band other than the band whose downlink is being tested. The UE shall meet the requirements specified in subclause 7.5.1 for each component carrier while both downlink carriers are active. For E-UTRA CA configurations including an operating band without uplink band (as noted in Table 5.5-1), the requirements for both downlinks shall be met with the uplink active in the band capable of UL operation. For E-UTRA CA configurations listed in Table 7.3.1A-0a under conditions for which reference sensitivity for the operating band being tested is N/A, the adjacent channel requirements of subclause 7.5.1A do not apply.

For intra-band contiguous carrier aggregation the downlink SCC shall be configured at nominal channel spacing to the PCC with the PCC configured closest to the uplink band. Downlink PCC and SCC are both activated. The uplink output power shall be set as specified in Table 7.5.1A-2 and Table 7.5.1A-3 with the uplink configuration set according to Table 7.3.1A-1 for the applicable carrier aggregation configuration. For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2. The UE shall fulfil the minimum requirement specified in Table 7.5.1A-1 for an adjacent channel interferer on either side of the aggregated downlink signal at a specified frequency offset and for an interferer power up to -25 dBm. The throughput of each carrier shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.5.1A-2 and 7.5.1A-3.

For intra-band non-contiguous carrier aggregation with one uplink carrier and two downlink carriers, each larger than or equal to 5 MHz, the adjacent channel selectivity requirements are defined with the uplink configuration in accordance with Table 7.3.1A-3. For this uplink configuration, the UE shall meet the requirements specified in subclause 7.5.1 for each component carrier subject to in-gap and out-of-gap interferers while both downlink carriers are active. The interferer powerP<sub>interferer</sub> for Case 1 in Table 7.5.1-2 shall be set to the maximum of the levels given by the two downlink carriers. For both Case 1 and Case 2 (Table 7.5.1-3), the wanted signal power level of each carrier shall be set in accordance with the ACS requirement (Clause 7.5.1) relative to the interferer power P<sub>interferer</sub>.

|              |       | CA Bandwidth Class |    |   |   |   |  |  |  |  |
|--------------|-------|--------------------|----|---|---|---|--|--|--|--|
| Rx Parameter | Units | В                  | С  | D | E | F |  |  |  |  |
| ACS          | dB    |                    | 24 |   |   |   |  |  |  |  |

| Rx Parameter                            | Units        | CA Bandwidth Class    |                            |                  |                  |              |  |  |
|---|--------------|-----------------------|----------------------------|------------------|------------------|--------------|--|--|
|   |              | В                     | С                          | D                | E                | F            |  |  |
| Pw in Transmission Bandwidth            |              |                       | REFSENS +                  |                  |                  |              |  |  |
| Configuration, per CC                   |              |                       | 14 dB                      |                  |                  |              |  |  |
|   | dBm          |                       | Aggregated                 |                  |                  |              |  |  |
|   |              |                       | power + 22.5               |                  |                  |              |  |  |
| PInterferer                             |              |                       | dB                         |                  |                  |              |  |  |
| BWInterferer                            | MHz          |                       | 5                          |                  |                  |              |  |  |
| F <sub>Interferer</sub> (offset)        | MHz          |                       | 2.5 + F <sub>offset</sub>  |                  |                  |              |  |  |
|   |              |                       | /                          |                  |                  |              |  |  |
|   |              |                       | -2.5 - F <sub>offset</sub> |                  |                  |              |  |  |
| NOTE 1: The transmitter shall be        | e set to 4dB | below P <sub>CM</sub> | AX L, OT PCMAX_L a         | as defined in s  | ubclause 6.2.5   | iΑ.          |  |  |
| NOTE 2: The interferer consists of      | of the Refer | ence meas             | urement channe             | I specified in A | nnex A.3.2 wi    | th one sided |  |  |
| dynamic OCNG Pattern                    | OP.1 FDD     | /TDD as de            | escribed in Annex          | x A.5.1.1/A.5.2  | 2.1 and set-up   | according to |  |  |
| Annex C.3.1                             |              |                       |                            |                  |                  |              |  |  |
| NOTE 3: The Finterferer (offset) is the | he frequenc  | y separatio           | on of the center fr        | requency of th   | e carrier close  | st to the    |  |  |
| interferer and the cente                | r frequency  | of the adja           | cent channel inte          | erferer and sha  | all be further a | djusted to   |  |  |
| $F_{interferer} / 0.015 + 0.5 0.4$      | 015 + 0.007  | 5 MHz to b            | e offset from the          | sub-carrier ra   | ster.            |              |  |  |

Table 7.5.1A-2: Test parameters for Adjacent channel selectivity, Case 1

| Table 7.5.1A-3: Test parameters for | Adjacent channel selectivity, Case 2 |
|-------------------------------------|--------------------------------------|

| Rx Parameter   | Units       |                | CA  | CA Bandwidth Class |                   |          |  |  |
|--|-------------|----------------|---|--------------------|-------------------|----------|--|--|
|  |             | В              | С   | D                  | E                 | F        |  |  |
| Pw in Transmission Bandwidth<br>Configuration, per CC  | dBm         |                | -47.5+10<br>log <sub>10</sub> (N <sub>RB,c</sub> /<br>N <sub>RB agg</sub> ) |                    |                   |          |  |  |
| PInterferer  | dBm         |                |   | -25                |                   |          |  |  |
| BWInterferer   | MHz         |                | 5   |                    |                   |          |  |  |
| F <sub>Interferer</sub> (offset)   | MHz         |                | 2.5+ F <sub>offset</sub>  |                    |                   |          |  |  |
|  |             |                | /   |                    |                   |          |  |  |
|  |             |                | -2.5- F <sub>offset</sub>   |                    |                   |          |  |  |
| NOTE 1: The transmitter shall be<br>NOTE 2: The interferer consists<br>dynamic OCNG Pattern<br>Annex C.3.1     | of the Refe | erence measu   | rement channel s  | pecified in Ar     | nnex 3.2 with or  | ne sided |  |  |
| NOTE 3: The F <sub>interferer</sub> (offset) is t interferer and the cente $F_{interferer} / 0.015 + 0.5 ] 0.$ | r frequenc  | y of the adjac | ent channel interf  | erer and shal      | I be further adju |          |  |  |

## 7.5.1B Minimum requirements for UL-MIMO

For UE(s) with two transmitter antenna connectors in closed-loop spatial multiplexing scheme, the minimum requirements in Clause 7.5.1 shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2. For UL-MIMO, the parameter  $P_{CMAX_L}$  is defined as the total transmitter power over the two transmit antenna connectors.

## 7.6 Blocking characteristics

The blocking characteristic is a measure of the receiver's ability to receive a wanted signal at its assigned channel frequency in the presence of an unwanted interferer on frequencies other than those of the spurious response or the adjacent channels, without this unwanted input signal causing a degradation of the performance of the receiver beyond a specified limit. The blocking performance shall apply at all frequencies except those at which a spurious response occur.

## 7.6.1 In-band blocking

In-band blocking is defined for an unwanted interfering signal falling into the UE receive band or into the first 15 MHz below or above the UE receive band at which the relative throughput shall meet or exceed the minimum requirement for the specified measurement channels..

#### 7.6.1.1 Minimum requirements

The throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.6.1.1-1 and 7.6.1.1-2.

| Rx parameter     | Units      |                  |                 | Channel b          | andwidth         |                 |            |
|------------------|------------|------------------|-----------------|--------------------|------------------|-----------------|------------|
|                  |            | 1.4 MHz          | 3 MHz           | 5 MHz              | 10 MHz           | 15 MHz          | 20 MHz     |
| Power in         |            |                  | REFSENS         | + channel band     | width specific v | alue below      |            |
| Transmission     | dBm        |                  |                 |                    |                  |                 |            |
| Bandwidth        | ubiii      | 6                | 6               | 6                  | 6                | 7               | 9          |
| Configuration    |            |                  |                 |                    |                  |                 |            |
| BWInterferer     | MHz        | 1.4              | 3               | 5                  | 5                | 5               | 5          |
| Floffset, case 1 | MHz        | 2.1+0.0125       | 4.5+0.0075      | 7.5+0.0125         | 7.5+0.0025       | 7.5+0.0075      | 7.5+0.0125 |
| Floffset, case 2 | MHz        | 3.5+0.0075       | 7.5+0.0075      | 12.5+0.0075        | 12.5+0.012       | 12.5+0.002      | 12.5+0.007 |
|                  |            |                  |                 |                    | 5                | 5               | 5          |
| NOTE 1: The tra  | nsmitter   | shall be set to  | 4dB below Pcr   | MAX_L at the minii | mum uplink co    | nfiguration spe | cified in  |
| Table 7          | '.3.1-2 wi | th PCMAX_L as c  | defined in subc | lause 6.2.5.       |                  |                 |            |
| NOTE 2: The inte | erferer co | onsists of the R | Reference mea   | surement chanr     | nel specified in | Annex A.3.2 w   | ith one    |
| sided d          | ynamic C   | OCNG Pattern     | OP.1 FDD/TD     | D as described i   | in Annex A.5.1   | .1/A.5.2.1 and  | set-up     |
| accordi          | ng to An   | nex C.3.1        |                 |                    |                  |                 | -          |

| E-UTRA   | Parameter   | Unit                            | Case 1  | Case 2  | Case 3 | Case 4 | Case 5                  |
|--|---|---------------------------------|---|---|--------|--------|-------------------------|
| band   | PInterferer   | dBm                             | -56   | -44   |        |        | -38                     |
|  | F <sub>Interferer</sub><br>(offset)                                       | MHz                             | =-BW/2 - F <sub>loffset,case 1</sub><br>&<br>=+BW/2 + F <sub>loffset,case 1</sub>   | ≤-BW/2 - F <sub>loffset,case 2</sub><br>&<br>≥+BW/2 + F <sub>loffset,case 2</sub> |        |        | -BW/2 - 11              |
| $\begin{array}{c} 1,2,3,4,5,\\ 6,7,8,9,\\ 10,11,12,\\ 13,14,17,\\ 18,19,20,\\ 21,22,23,\\ 25,26,27,\\ 28,31,33,\\ 34,35,36,\\ 37,38,39,\\ 40,41,42,\\ 43,44 \end{array}$ | FInterferer   | MHz                             | (Note 2)  | F <sub>DL_low</sub> − 15<br>to<br>F <sub>DL_high</sub> + 15                       | Void   | Void   |                         |
| 30   | F <sub>Interferer</sub>   | MHz                             | (Note 2)  | F <sub>DL_low</sub> – 15<br>to<br>F <sub>DL_high</sub> + 15                       |        |        | F <sub>DL_low</sub> -11 |
| the<br>NOTE 2: Fo  | e first 15 MHz b<br>or each carrier f<br>a. the carrier<br>b. the carrier | elow or<br>requency<br>frequenc | above the UE receive I<br>/ the requirement is va<br>y -BW/2 - F <sub>loffset, case 1</sub> a<br>y +BW/2 + F <sub>loffset, case 1</sub> | rfering signal may not fa<br>band<br>lid for two frequencies:                     |        |        | d, but within           |

#### Table 7.6.1.1-2: In-band blocking

For the UE which supports inter band CA configuration in Table 7.3.1-1A,  $P_{Interferer}$  power defined in Table 7.6.1.1-2 is increased by the amount given by  $\Delta R_{IB,c}$  in Table 7.3.1-1A.

#### 7.6.1.1A Minimum requirements for CA

For inter-band carrier aggregation with uplink assigned to one E-UTRA band the in-band blocking requirements are defined with the uplink active on the band other than the band whose downlink is being tested. The UE shall meet the requirements specified in subclause 7.6.1.1 for each component carrier while both downlink carriers are active. For the UE which supports inter band CA configuration in Table 7.3.1-1A,  $P_{Interferer}$  power defined in Table 7.6.1.1-2 is increased by the amount given by  $\Delta R_{IB,c}$  in Table 7.3.1-1A. For E-UTRA CA configurations including an operating

band without uplink band (as noted in Table 5.5-1), the requirements for both downlinks shall be met with the uplink in the band capable of UL operation.. The requirements for the component carrier configured in the operating band without uplink band are specified in Table 7.6.1.1-1 and Table 7.6.1.1A-0.

| Table 7.6.1.1A-0: In-I | band blocking for addition | nal operating bands for | carrier aggregation |
|------------------------|----------------------------|-------------------------|---------------------|
|                        |                            |                         |                     |

| E-UTRA band            | Parameter                                | Unit                       | Case 1  | Case 2  |
|------------------------|--|----------------------------|---|---|
|                        | PInterferer                              | dBm                        | -56   | -44   |
|                        | F <sub>Interferer</sub><br>(offset)      | MHz                        | =-BW/2 - F <sub>loffset,case 1</sub><br>&<br>=+BW/2 + F <sub>loffset,case 1</sub> | ≤-BW/2 – F <sub>loffset,case 2</sub><br>&<br>≥+BW/2 + F <sub>loffset,case 2</sub> |
| 29                     | FInterferer                              | MHz                        | (Note 2)  | F <sub>DL_low</sub> – 15<br>to<br>F <sub>DL_high</sub> + 15                       |
| NOTE 1: For cer        | rtain bands, the ur                      | nwanted mo                 | dulated interfering signal r  | nay not fall inside the   |
| NOTE 2: For ea<br>a. t | ch carrier frequen<br>he carrier frequen | cy the requi<br>cy -BW/2 - |   |   |
|                        | •  |                            | <ul> <li>Floffset, case 1</li> <li>modulated interfering signal</li> </ul>        | al are interferer center  |

For E-UTRA CA configurations listed in Table 7.3.1A-0a under conditions for which reference sensitivity for the operating band being tested is N/A, the in-band blocking requirements of subclause 7.6.1.1A do not apply.

For intra-band contiguous carrier aggregation the downlink SCC shall be configured at nominal channel spacing to the PCC with the PCC configured closest to the uplink band. Downlink PCC and SCC are both activated. The uplink output power shall be set as specified in Table 7.6.1.1A-1 with the uplink configuration set according to Table 7.3.1A-1 for the applicable carrier aggregation configuration. For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2. The UE shall fulfil the minimum requirement in presence of an interfering signal specified in Tables 7.6.1.1A-1 and Tables 7.6.1.1A-2 being on either side of the aggregated signal. The throughput of each carrier shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.6.1.1A-2.

For intra-band non-contiguous carrier aggregation with one uplink carrier and two downlink carriers, each larger than or equal to 5 MHz, the in-band blocking requirements are defined with the uplink configuration in accordance with Table 7.3.1A-3. For this uplink configuration, the UE shall meet the requirements specified in subclause 7.6.1.1 for each component carrier subject to in-gap and out-of-gap interferers while both downlink carriers are active.

| Rx Parameter          | Units       |                    | CA   | Bandwidth Cla      | iss               |        |  |  |
|-----------------------|-------------|--------------------|--|--------------------|-------------------|--------|--|--|
|                       |             | В                  | С  | D                  | E                 | F      |  |  |
| Pw in Transmission    |             | R                  | EFSENS + CA B  | pecific value belo | ow.               |        |  |  |
| Bandwidth             | dBm         |                    | 12   |                    |                   |        |  |  |
| Configuration, per CC |             |                    | 12   |                    |                   |        |  |  |
| BWInterferer          | MHz         |                    | 5  |                    |                   |        |  |  |
| Floffset, case 1      | MHz         |                    | 7.5  |                    |                   |        |  |  |
| Floffset, case 2      | MHz         |                    | 12.5   |                    |                   |        |  |  |
| NOTE 1: The transmit  | ter shall b | be set to 4dB bel  | OW PCMAX_L OF PC   | MAX_L_CA as defin  | ed in subclause 6 | 6.2.5A |  |  |
| NOTE 2: The interfere | er consiste | s of the Reference | of the Reference measurement channel specified in Annex A.3.2 with one sided |                    |                   |        |  |  |
| dynamic OC            | NG Patte    | rn OP.1 FDD/TD     | OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 and set-up according to   |                    |                   |        |  |  |
| Annex C.3.1           |             |                    |  |                    |                   | -      |  |  |

| Table | 7.6.1 | .1A-1: | In band | blocking | parameters |
|-------|-------|--------|---------|----------|------------|
|-------|-------|--------|---------|----------|------------|

| CA      | configuration  | Parameter                           | Unit                       | Case 1  | Case 2  |
|---------|--|-------------------------------------|----------------------------|---|---|
|         |  | PInterferer                         | dBm                        | -56   | -44   |
|         |  | F <sub>Interferer</sub><br>(offset) | MHz                        | =-F <sub>offset</sub> - F <sub>loffset,case 1</sub><br>&<br>=+F <sub>offset</sub> + F <sub>loffset,case 1</sub> | ≤-F <sub>offset</sub> − F <sub>loffset,case 2</sub><br>&<br>≥+F <sub>offset</sub> + F <sub>loffset,case 2</sub> |
| _       | 5, CA_7C, CA_38C,<br>_40C, CA_41C                          | F <sub>Interferer</sub><br>(Range)  | MHz                        | (Note 2)  | F <sub>DL_low</sub> – 15<br>to<br>F <sub>DL_high</sub> + 15   |
|         | band, but within the first<br>For each carrier freque      | at 15 MHz below<br>ancy the require | / or above<br>ment is vali | d for two frequencies:  | inside the UE receive   |
|         | a. the carrier freque<br>b. the carrier freque             | ency +Foffset + Flo                 | offset, case 1             |   |   |
| NOTE 3: | F <sub>offset</sub> is the frequency aggregated channel ba |                                     | enter frequ                | ency of the CC being te   | sted to the edge of   |
| NOTE 4: | the interferer and the c                                   | enter frequency                     | of the inte                | f the center frequency of<br>rferer tested and shall be<br>ffset from the sub-carrier                           | e further adjusted to   |

Table 7.6.1.1A-2: In-band blocking

## 7.6.2 Out-of-band blocking

Out-of-band band blocking is defined for an unwanted CW interfering signal falling more than 15 MHz below or above the UE receive band. For the first 15 MHz below or above the UE receive band the appropriate in-band blocking or adjacent channel selectivity in subclause 7.5.1 and subclause 7.6.1 shall be applied.

### 7.6.2.1 Minimum requirements

The throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.6.2.1-1 and 7.6.2.1-2.

For Table 7.6.2.1-2 in frequency range 1, 2 and 3, up to  $\max(24, 6 \cdot \lceil N_{RB} / 6 \rceil)$  exceptions are allowed for spurious

response frequencies in each assigned frequency channel when measured using a 1MHz step size, where  $N_{RB}$  is the number of resource blocks in the downlink transmission bandwidth configuration (see Figure 5.6-1). For these exceptions the requirements of subclause 7.7 Spurious response are applicable.

For Table 7.6.2.1-2 in frequency range 4, up to  $\max(8, \left[ (N_{RB} + 2 \cdot L_{CRBs})/8 \right])$  exceptions are allowed for spurious

response frequencies in each assigned frequency channel when measured using a 1MHz step size, where  $N_{RB}$  is the number of resource blocks in the downlink transmission bandwidth configurations (see Figure 5.6-1) and  $L_{CRBs}$  is the number of resource blocks allocated in the uplink. For these exceptions the requirements of clause 7.7 spurious response are applicable.

| Rx Parameter         | rameter Units Channel bandwidth   |            |             |            |            |             |           |  |
|----------------------|---|------------|-------------|------------|------------|-------------|-----------|--|
|                      |   | 1.4<br>MHz | 3 MHz       | 5 MHz      | 10<br>MHz  | 15<br>MHz   | 20<br>MHz |  |
|                      |   |            |             |            |            |             |           |  |
| Power in             | REFSENS + channel bandwidth specific value below                        |            |             |            |            |             | e below   |  |
| Transmission         | alDura  |            |             |            |            |             |           |  |
| Bandwidth            | dBm   | 6          | 6           | 6          | 6          | 7           | 9         |  |
| Configuration        |   | _          | -           | -          | -          |             | -         |  |
| NOTE 1: The transmit | The transmitter shall be set to 4dB below PCMAX_L at the minimum uplink |            |             |            |            |             |           |  |
| configuration        | specified   | in Table 7 | 7.3.1-2 wit | h PCMAX_L  | as define  | d in subcla | ause      |  |
| 6.2.5.               | 5   |            |             |            |            |             |           |  |
|                      | eference measurement channel is specified in Annex A.3.2 with one sided |            |             |            |            |             |           |  |
| dynamic OC           | NG Patterr  | OP.1 FE    | DD/TDD a    | s describe | ed in Anne | x A.5.1.1/  | A.5.2.    |  |

Table 7.6.2.1-1: Out-of-band blocking parameters

| E-UTRA band  | Parameter                       | Units | Frequency  |   |   |                  |  |  |
|--|---------------------------------|-------|--|---|---|------------------|--|--|
|  |                                 |       | Range 1  | Range 2   | Range 3                                   | Range 4          |  |  |
|  | PInterferer                     | dBm   | -44  | -30   | -15                                       | -15              |  |  |
| 1, 2, 3, 4, 5, 6,<br>7, 8, 9, 10, 11,  |                                 |       | F <sub>DL_low</sub> -15 to<br>F <sub>DL_low</sub> -60    | F <sub>DL_low</sub> -60 to<br>F <sub>DL_low</sub> -85   | F <sub>DL_low</sub> -85 to<br>1 MHz       | -                |  |  |
| 12, 13, 14, 17,<br>18, 19, 20, 21,<br>22, 23, 24, 25,<br>26, 27, 28, 33,<br>34, 35, 36, 37,<br>38, 39, 40, 41,<br>42, 43, 44 | F <sub>Interferer</sub><br>(CW) | MHz   | F <sub>DL_high</sub> +15 to<br>F <sub>DL_high</sub> + 60 | F <sub>DL_high</sub> +60 to<br>F <sub>DL_high</sub> +85 | F <sub>DL_high</sub> +85 to<br>+12750 MHz | -                |  |  |
| 2, 5, 12, 17   | FInterferer                     | MHz   | _  | _   | -   | FUL_low - FUL_hi |  |  |

Table 7.6.2.1-2: Out of band blocking

7.6.2.1A Minimum requirements for CA

For inter-band carrier aggregation with the uplink assigned to one E-UTRA band, the out-of-band blocking requirements are defined with the uplink active on the band other than the band whose downlink is being tested. The throughput in the downlink measured shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.6.2.1-1 and 7.6.2.1A-0. The UE shall meet these requirements for each component carrier while both downlink carriers are active. For E-UTRA CA configurations including an operating band without uplink band (as noted in Table 5.5-1), the requirements for both downlinks shall be met with the uplink active in the band capable of UL operation. For E-UTRA CA configurations listed in Table 7.3.1A-0a under conditions for which reference sensitivity for the operating band being tested is N/A, the out-of-band blocking requirements of subclause 7.6.2.1A do not apply.

| Paramete    | er Unit   | nit Range 1 Range 2 Range 3   |   |                                   |  |  |  |  |
|-------------|---|---|---|-----------------------------------|--|--|--|--|
| Pw          | dBm   | Table 7.6.  | Table 7.6.2.1-1 for both component carriers |                                   |  |  |  |  |
| Pinterferer | dBm   | -44 + ΔR <sub>IB,c</sub>  | -30 + ΔR <sub>IB,c</sub>                    | -15 + ΔR <sub>IB,c</sub>          |  |  |  |  |
| Finterferer | MHz   | $-60 < f - F_{DL_{Low(1)}} < -15$   | $-85 < f - F_{DL_{Low(1)}} \le -60$         | $1 \le f \le F_{DL\_Low(1)} - 85$ |  |  |  |  |
| (CW)        |   | or  | or  | or                                |  |  |  |  |
|             |   | $-60 < f - F_{DL_{Low(2)}} < -15$   | $-85 < f - F_{DL_{Low(2)}} \le -60$         | $F_{DL_{High(1)}} + 85 \le f$     |  |  |  |  |
|             |   | or  | or  | $\leq F_{DL\_Low(2)} - 85$        |  |  |  |  |
|             |   | $15 < f - F_{DL_{High(1)}} < 60$  | $60 \leq f - F_{DL_{High(1)}} < 85$         | or                                |  |  |  |  |
|             |   | or  | or  | $F_{DL_{High(2)}} + 85 \le f$     |  |  |  |  |
|             |   | $15 < f - F_{DL_{High(2)}} < 60$  | $60 \leq f - F_{DL_{High(2)}} < 85$         | ≤ 12750                           |  |  |  |  |
| NOTE 1:     |   | nd F <sub>DL_High(1)</sub> denote the respec  |   |                                   |  |  |  |  |
|             | operating b   | and, $F_{DL\_Low(2)}$ and $F_{DL\_High(2)}$ the second seco | ne respective lower and up                  | per frequency limits of the       |  |  |  |  |
|             | upper oper  | 5   |   |                                   |  |  |  |  |
| NOTE 2:     |   | $_{(2)} - F_{DL_High(1)} < 145 \text{ MHz and}$   |   |                                   |  |  |  |  |
|             | in both Rar   | nge 1 and Range 2. Then the l   | ower of the P <sub>Interferer</sub> applies | i.                                |  |  |  |  |
| NOTE 3:     | NOTE 3: For $F_{DL\_Low(1)} - 15$ MHz $\leq f \leq F_{DL\_High(1)} + 15$ MHz and $F_{DL\_Low(2)} - 15$ MHz $\leq f \leq F_{DL\_High(2)} + 15$ |   |   |                                   |  |  |  |  |
|             | MHz the appropriate adjacent channel selectivity and in-band blocking in the respective   |   |   |                                   |  |  |  |  |
|             | subclauses  | 7.5.1A and 7.6.1.1A shall be  | applied.                                    |                                   |  |  |  |  |
| NOTE 4:     | $\Delta R_{IB,c}$ acco  | rding to Table 7.3.1-1A applies   | s when serving cell <i>c</i> is me          | asured.                           |  |  |  |  |

Table 7.6.2.1A-0: out-of-band blocking for inter-band carrier aggregation with one active uplink

For Table 7.6.2.1A-0 in frequency ranges 1, 2 and 3, up to  $\max(24,6 \cdot \lceil N_{RB} \cdot /6 \rceil)$  exceptions per downlink are allowed for spurious response frequencies when measured using a step size of 1 MHz. For these exceptions the requirements in clause 7.7.1A apply.

For intra-band contiguous carrier aggreagations the downlink SCC shall be configured at nominal channel spacing to the PCC with the PCC configured closest to the uplink band. Downlink PCC and SCC are both activated. The uplink output power shall be set as specified in Table 7.6.2.1A-1 with the uplink configuration set according to Table 7.3.1A-1 for the applicable carrier aggregation configuration. For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2.

The UE shall fulfil the minimum requirement in presence of an interfering signal specified in Tables 7.6.2.1A-1 and Tables 7.6.2.1A-2 being on either side of the aggregated signal. The throughput of each carrier shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.6.2.1A-1 and 7.6.2.1A-2.

For Table 7.6.2.1A-2 in frequency range 1, 2 and 3, up to  $\max(24,6 \cdot \lceil N_{RB} \cdot /6 \rceil)$  exceptions are allowed for spurious response frequencies in each assigned frequency channel when measured using a 1MHz step size. For these exceptions the requirements of subclause 7.7 Spurious response are applicable.

#### Table 7.6.2.1A-1: Out-of-band blocking parameters

| Rx Parameter   |  | CA Bandwidth Class |   |   |   |   |  |
|--|--|--------------------|---|---|---|---|--|
|  |  | В                  | С | D | E | F |  |
| Pw in Transmission Bandwidth Configuration, per CC   | REFSENS + CA Bandwidth Class specific value<br>below |                    |   |   |   |   |  |
|  |  |                    | 9 |   |   |   |  |
| NOTE 1: The transmitter shall be set to 4dB below PCMAX_L,c or PCMAX_L as defined in subclause 6.2.5A.<br>NOTE 2: Reference measurement channel is specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1<br>FDD/TDD as described in Annex A.5.1.1/A.5.2. |  |                    |   |   |   |   |  |

| Table | 7.6.2.1 | A-2: | Out  | of  | band  | blocking    |
|-------|---------|------|------|-----|-------|-------------|
|       |         |      | •••• | ••• | Naila | ale en ling |

| CA configuration  | Parameter                       | Units | Frequency   |  |   |
|---|---------------------------------|-------|---|--|---|
|   |                                 |       | Range 1   | Range 2  | Range 3   |
|   | PInterferer                     | dBm   | -44   | -30  | -15   |
|   | <b>E</b>                        |       | F <sub>DL_low</sub> -15 to<br>F <sub>DL_low</sub> -60 | F <sub>DL_low</sub> -60 to<br>F <sub>DL_low</sub> -85      | F <sub>DL_low</sub> -85 to<br>1 MHz             |
| CA_1C, <u>CA_3C</u> , CA_7C , CA_38C, CA_40C,<br>CA_41C | F <sub>Interferer</sub><br>(CW) | MHz   | $F_{DL_{high}} + 15$<br>to<br>$F_{DL_{high}} + 60$    | F <sub>DL_high</sub> +60<br>to<br>F <sub>DL_high</sub> +85 | F <sub>DL_high</sub> +85<br>to<br>+12750<br>MHz |

For intra-band non-contiguous carrier aggregation with one uplink carrier and two downlink carriers, the out-of-band blocking requirements are defined with the uplink configuration in accordance with table 7.3.1A-3. For this uplink configuration, the UE shall meet the requirements specified in subclause 7.6.2.1 for each component carrier while both downlink carriers are active.

For Table 7.6.2.1-2 in frequency range 1, 2 and 3, up to  $\max(24,6 \cdot \lceil N_{RB} \cdot /6 \rceil)$  exceptions per assigned E-UTRA channel per sub-block of the E-UTRA CA configuration are allowed for spurious response frequencies when measured using a 1MHz step size. For these exceptions the requirements of subclause 7.7 spurious response are applicable.

For Table 7.6.2.1-2 in frequency range 4, up to  $\max(8, \left[ (N_{RB} + 2 \cdot L_{CRBs})/8 \right])$  exceptions per assigned E-UTRA channel

per sub-block of the E-UTRA CA configuration are allowed for spurious response frequencies when measured using a 1MHz step size. For these exceptions the requirements of clause 7.7 spurious response are applicable.

## 7.6.3 Narrow band blocking

This requirement is measure of a receiver's ability to receive a E-UTRA signal at its assigned channel frequency in the presence of an unwanted narrow band CW interferer at a frequency, which is less than the nominal channel spacing.

#### 7.6.3.1 Minimum requirements

The relative throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.6.3.1-1

| Parameter  | Unit  | Channel Bandwidth |   |        |        |        |         |  |  |
|--|---|-------------------|---|--------|--------|--------|---------|--|--|
| Farameter  | Unit  | 1.4 MHz           | 3 MHz   | 5 MHz  | 10 MHz | 15 MHz | 20 MHz  |  |  |
| Р  | dDm   | P <sub>R</sub>    | P <sub>REFSENS</sub> + channel-bandwidth specific value below |        |        |        |         |  |  |
| Pw   | dBm   | 22                | 18  | 16     | 13     | 14     | 16      |  |  |
| P <sub>uw</sub> (CW)   | dBm   | -55               | -55   | -55    | -55    | -55    | -55     |  |  |
| $F_{uw}$ (offset for<br>$\Delta f = 15 \text{ kHz}$ )  | MHz   | 0.9075            | 1.7025  | 2.7075 | 5.2125 | 7.7025 | 10.2075 |  |  |
| $F_{uw}$ (offset for<br>$\Delta f = 7.5 \text{ kHz}$ )MHz  |   |                   |   |        |        |        |         |  |  |
| NOTE 1: The transmitter shall be set a 4 dB below PCMAX_L at the minimum uplink configuration specified in Table 7.3.1-2 with PCMAX_L as defined in subclause 6.2.5. |   |                   |   |        |        |        |         |  |  |
|  | NOTE 2: Reference measurement channel is specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1. |                   |   |        |        |        |         |  |  |

For the UE which supports inter-band CA configuration in Table 7.3.1-1A,  $P_{UW}$  power defined in Table 7.6.3.1-1 is increased by the amount given by  $\Delta R_{IB,c}$  in Table 7.3.1-1A.

#### 7.6.3.1A Minimum requirements for CA

For inter-band carrier aggregation with uplink assigned to one E-UTRA band the narrow-band blocking requirements are defined with the uplink active on the band other than the band whose downlink is being tested. The UE shall meet the requirements specified in subclause 7.6.3.1 for each component carrier while both downlink carriers are active. For E-UTRA CA configurations including an operating band without uplink band (as noted in Table 5.5-1), the requirements for both downlinks shall be met with the uplink active in the band capable of UL operation. For E-UTRA CA configurations listed in Table 7.3.1A-0a under conditions for which reference sensitivity for the operating band being tested is N/A, the narrow-band blocking requirements of subclause 7.6.3.1A do not apply.

For intra-band contiguous carrier aggregation the downlink SCC shall be configured at nominal channel spacing to the PCC with the PCC configured closest to the uplink band. Downlink PCC and SCC are both activated. The uplink output power shall be set as specified in Table 7.6.3.1A-1 with the uplink configuration set according to Table 7.3.1A-1 for the applicable carrier aggregation configuration. For UE(s) supporting one uplink, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2. The UE shall fulfil the minimum requirement in presence of an interfering signal specified in Table 7.6.3.1A-1 being on either side of the aggregated signal. The throughput of each carrier shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.6.3.1A-1.

For intra-band non-contiguous carrier aggregation with one uplink carrier and two downlink carriers, the narrow band blocking requirements are defined with the uplink configuration in accordance with Table 7.3.1A-3. For this uplink configuration, the UE shall meet the requirements specified in subclause 7.6.3.1 for each component carrier subject to in-gap and out-of-gap interferers while both downlink carriers are active.

| Deremeter                           | Unit   | CA Bandwidth Class |                             |              |               |          |  |  |
|-------------------------------------|--|--------------------|-----------------------------|--------------|---------------|----------|--|--|
| Parameter                           | Unit   | В                  | С                           | D            | E             | F        |  |  |
| Pw in Transmission Bandwidth        | dDm  | REF                | SENS + CA Band              | width Class  | specific valu | e below  |  |  |
| Configuration, per CC               | dBm  |                    | 16 <sup>4</sup>             |              |               |          |  |  |
| P <sub>uw</sub> (CW)                | dBm  |                    | -55                         |              |               |          |  |  |
| Fuw (offset for                     |  |                    | - F <sub>offset</sub> – 0.2 |              |               |          |  |  |
| $\Delta f = 15 \text{ kHz}$         | MHz  |                    | /                           |              |               |          |  |  |
| $\Delta l = 15 \text{ KHZ})$        |  |                    | + F <sub>offset</sub> + 0.2 |              |               |          |  |  |
| F <sub>uw</sub> (offset for         | MHz  |                    |                             |              |               |          |  |  |
| $\Delta f = 7.5 \text{ kHz}$        |  |                    |                             |              |               |          |  |  |
| NOTE 1: The transmitter shall be se | et to 4dB below F  | CMAX_L,c Or F      | PCMAX_L as defined          | in subclause | e 6.2.5A.     |          |  |  |
| NOTE 2: Reference measurement       | channel is specifi   | ied in Annex       | A.3.2 with one sid          | led dynamic  | OCNG Patte    | ern OP.1 |  |  |
| FDD/TDD as described in             | FDD/TDD as described in Annex A.5.1.1/A.5.2.1.   |                    |                             |              |               |          |  |  |
|                                     | E 3: The F <sub>uw</sub> (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and |                    |                             |              |               |          |  |  |
| the center frequency of th          | the center frequency of the interfererand shall be further adjusted to $ F_{interferer}/0.015 + 0.5 0.015 + 0.0075$ MHz            |                    |                             |              |               |          |  |  |
| to be offset from the sub-          | carrier raster.  |                    |                             |              | -             |          |  |  |
| NOTE 4: The requirement is applie   | d for the band co  | mbinations         | whose component             | carriers' BW | '>5 MHz.      |          |  |  |

#### Table 7.6.3.1A-1: Narrow-band blocking

## 7.6A Void

<Reserved for future use>

# 7.6B Blocking characteristics for UL-MIMO

For UE with two transmitter antenna connectors in closed-loop spatial multiplexing scheme, the minimum requirements in subclause 7.6 shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2. For UL-MIMO, the parameter  $P_{CMAX_L}$  is defined as the total transmitter power over the two transmit antenna connectors.

## 7.7 Spurious response

Spurious response is a measure of the receiver's ability to receive a wanted signal on its assigned channel frequency without exceeding a given degradation due to the presence of an unwanted CW interfering signal at any other frequency at which a response is obtained i.e. for which the out of band blocking limit as specified in subclause 7.6.2 is not met.

## 7.7.1 Minimum requirements

The throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.7.1-1 and 7.7.1-2.

| Rx parameter   | Ax parameter   Units   Channel bandwidth |         |       |       |        |        |        |
|--|--|---------|-------|-------|--------|--------|--------|
|  |  | 1.4 MHz | 3 MHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz |
| Power in REFSENS + channel bandwidth specific value below  |  |         |       |       |        | low    |        |
| Transmission<br>Bandwidth<br>Configuration   | dBm                                      | 6       | 6     | 6     | 6      | 7      | 9      |
| NOTE 1: The transmitter shall be set to 4dB below PCMAX_L at the minimum uplink configuration specified in Table 7.3.1-2.                                  |  |         |       |       |        |        |        |
| N OTE 2: Reference measurement channel is specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1. |  |         |       |       |        |        |        |

|  | Table 7.7.1-1: | Spurious | response | parameters |
|--|----------------|----------|----------|------------|
|--|----------------|----------|----------|------------|

| Parameter                       | Unit | Level                         |  |  |
|---------------------------------|------|-------------------------------|--|--|
| P <sub>Interferer</sub><br>(CW) | dBm  | -44                           |  |  |
| FInterferer                     | MHz  | Spurious response frequencies |  |  |

For the UE which supports inter-band CA configuration in Table 7.3.1-1A,  $P_{interferer}$  power defined in Table 7.7.1-2 is increased by the amount given by  $\Delta R_{IB,c}$  in Table 7.3.1-1A.

### 7.7.1A Minimum requirements for CA

For inter-band carrier aggregation with uplink assigned to one E-UTRA band the spurious response requirements are defined with the uplink active on the band other than the band whose downlink is being tested. The throughput measured in each downlink with  $F_{interferer}$  in Table 7.6.2.1A-0 at spurious response frequencies shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.7.1-1 and 7.7.1-2. The UE shall meet these requirements for each component carrier while both downlink carriers are active. For E-UTRA CA configurations including an operating band without uplink band (as noted in Table 5.5-1), the requirements for both downlinks shall be met with the uplink active in the band capable of UL operation. For E-UTRA CA configurations listed in Table 7.3.1A-0a under conditions for which reference sensitivity for the operating band being tested is N/A, the spurious response requirements of subclause 7.7.1A do not apply.

For intra-band contiguous carrier aggregation the downlink SCC shall be configured at nominal channel spacing to the PCC with the PCC configured closest to the uplink band. Downlink PCC and SCC are both activated. The uplink output power shall be set as specified in Table 7.7.1A-1 with the uplink configuration set according to Table 7.3.1A-1 for the applicable carrier aggregation configuration. For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2. The throughput of each carrier shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.7.1A-1 and 7.7.1A-2.

For intra-band non-contiguous carrier aggregation with one uplink carrier and two downlink carriers, the spurious response requirements are defined with the uplink configuration in accordance with Table 7.3.1A-3. For this uplink configuration, the UE shall meet the requirements specified in clause 7.7.1 for each component carrier while both downlink carriers are active.

| Rx Parameter   | Units  | CA Bandwidth Class |   |   |   |   |  |
|--|--|--------------------|---|---|---|---|--|
|  |  | В                  | С | D | E | F |  |
| Pw in Transmission Bandwidth   | Transmission Bandwidth dBm REFSENS + CA Bandwidth Class specific value below |                    |   |   |   |   |  |
| Configuration, per CC  |  |                    | 9 |   |   |   |  |
| NOTE 1: The transmitter shall be set to 4dB below PCMAX_L,c or PCMAX_L as defined in subclause 6.2.5A. |  |                    |   |   |   |   |  |
| NOTE 2: Reference measurement channel is specified in Annex A.3.2 with one sided dynamic OCNG Pattern  |  |                    |   |   |   |   |  |
| OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.  |  |                    |   |   |   |   |  |

| Table 7.7.1A-1: | Spurious | response | parameters |
|-----------------|----------|----------|------------|
|-----------------|----------|----------|------------|

| Parameter                       | Unit | Level                         |  |
|---------------------------------|------|-------------------------------|--|
| P <sub>Interferer</sub><br>(CW) | dBm  | -44                           |  |
| F <sub>Interferer</sub>         | MHz  | Spurious response frequencies |  |

## 7.7.1B Minimum requirements for UL-MIMO

For UE with two transmitter antenna connectors in closed-loop spatial multiplexing scheme, the minimum requirements in Clause 7.7.1 shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2. For UL-MIMO, the parameter  $P_{CMAX_L}$  is defined as the total transmitter power over the two transmit antenna connectors.

## 7.8 Intermodulation characteristics

Intermodulation response rejection is a measure of the capability of the receiver to receiver a wanted signal on its assigned channel frequency in the presence of two or more interfering signals which have a specific frequency relationship to the wanted signal.

## 7.8.1 Wide band intermodulation

The wide band intermodulation requirement is defined following the same principles using modulated E-UTRA carrier and CW signal as interferer.

### 7.8.1.1 Minimum requirements

The throughput shall be  $\geq$  95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.8.1.1 for the specified wanted signal mean power in the presence of two interfering signals

| Rx Para   | meter   | Units | Channel bandwidth  |  |   |       |        |        |        |
|---|---|-------|--|--|---|-------|--------|--------|--------|
|   |   |       | 1.4 MHz 3 MHz  |  |   | 5 MHz | 10 MHz | 15 MHz | 20 MHz |
| Power in  |   |       | REFSENS + channel bandwidth specific value below                                   |  |   |       |        |        |        |
| Transmissi<br>Bandwidth<br>Configurati  |   | dBm   | 12 8   |  | 6 | 6     | 7      | 9      |        |
| P <sub>Interferer 1</sub><br>(CW)   |   | dBm   | -46  |  |   |       |        |        |        |
| P <sub>Interferer 2</sub><br>(Modulated   | d)  | dBm   | -46  |  |   |       |        |        |        |
| BW Interferer 2   | 2   |       | 1.4 3 5  |  |   |       |        |        |        |
| F <sub>Interferer 1</sub><br>(Offset)   |   | MHz   | -BW/2 -2.1 -BW/2 -4.5 -BW/2 -7.5<br>/ / / /<br>+BW/2 + 2.1 +BW/2 + 4.5 +BW/2 + 7.5 |  |   |       |        |        |        |
| F <sub>Interferer 2</sub><br>(Offset)   |   | MHz   | 2*FInterferer 1  |  |   |       |        |        |        |
| <ul> <li>NOTE 1: The transmitter shall be set to 4dB below PCMAX_L at the minimum uplink configuration specified in Table 7.3.1-2 with PCMAX_L as defined in subclause 6.2.5.</li> <li>NOTE 2: Reference measurement channel is specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.</li> </ul> |   |       |  |  |   |       |        |        |        |
|   | NOTE 3: The modulated interferer consists of the Reference measurement channel specified in Annex<br>A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex<br>A.5.1.1/A.5.2.1 with set-up according to Annex C.3.1The interfering modulated signal is 5MHz E-<br>UTRA signal as described in Annex D for channel bandwidth ≥5MHz |       |  |  |   |       |        |        |        |

Table 7.8.1.1-1: Wide band intermodulation

For the UE which supports inter band CA configuration in Table 7.3.1-1A,  $P_{interferer1}$  and  $P_{interferer2}$  powers defined in Table 7.8.1.1-1 are increased by the amount given by  $\Delta R_{IB,c}$  in Table 7.3.1-1A.

## 7.8.1A Minimum requirements for CA

For inter-band carrier aggregation with uplink assigned to one E-UTRA band the wide band intermodulation requirements are defined with the uplink active on the band other than the band whose downlink is being tested. The UE shall meet the requirements specified in subclause 7.8.1.1 for each component carrier while both downlink carriers are active. For E-UTRA CA configurations including an operating band without uplink band (as noted in Table 5.5-1), the requirements for both downlinks shall be met with the uplink active in the band capable of UL operation. For E-UTRA

CA configurations listed in Table 7.3.1A-0a under conditions for which reference sensitivity for the operating band being tested is N/A, the wideband intermodulation requirements of subclause 7.8.1A do not apply.

For intra-band contiguous carrier aggegation the downlink SCC shall be configured at nominal channel spacing to the PCC with the PCC configured closest to the uplink band. Downlink PCC and SCC are both activated. The uplink output power shall be set as specified in Table 7.8.1A-1 with the uplink configuration set according to Table 7.3.1A-1 for the applicable carrier aggreagation configuration. For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2. The UE shall fulfil the minimum requirement in presence of an interfering signal specified in Table 7.8.1A-1 being on either side of the aggregated signal. The throughput of each carrier shall be  $\geq 95\%$  of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.8.1A-1

| Rx para                               | meter  | Units   | ts CA Bandwidth Class   |                                 |                 |                  |                 |  |
|---------------------------------------|--|---|---|---------------------------------|-----------------|------------------|-----------------|--|
|                                       |  |   | В   | С                               | D               | E                | F               |  |
| Pw in                                 |  |   | REFSENS + CA Bandwidth Class specific value below                         |                                 |                 |                  |                 |  |
| Transmiss                             |  |   |   |                                 |                 |                  |                 |  |
| Bandwidth                             | -  | dBm   |   | 12                              |                 |                  |                 |  |
| Configura<br>CC                       | tion, per  |   |   |                                 |                 |                  |                 |  |
| PInterferer 1                         |  | dBm   |   |                                 | -46             |                  | 1               |  |
| (CW)                                  |  |   |   |                                 | -40             |                  |                 |  |
| PInterferer 2                         |  | dBm   |   |                                 | -46             |                  |                 |  |
| (Modulate                             | /  |   |   | _                               |                 |                  |                 |  |
| BWInterferer                          | 2  | MHz   |   | 5                               |                 |                  |                 |  |
| FInterferer 1                         |  | MHz   |   | -F <sub>offset</sub> -7.5       |                 |                  |                 |  |
| (Offset)                              |  |   |   | /<br>+ F <sub>offset</sub> +7.5 |                 |                  |                 |  |
| F <sub>Interferer 2</sub><br>(Offset) |  | MHz   | 2*FInterferer 1   |                                 |                 |                  |                 |  |
| · · · /                               | The trans  | smitter sha   | all be set to 4dE   | B below PCMAX L,c               | or PCMAX L as d | efined in subcla | use 6.2.5A.     |  |
|                                       |  |   |   | is specified in Ar              | -               |                  |                 |  |
|                                       |  |   |   | ed in Annex A.5.                |                 |                  |                 |  |
| NOTE 3:                               | The mod  | ulated inte   | erferer consists  | of the Reference                | measurement     | channel specifie | ed in Annex     |  |
|                                       |  |   | ed dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex                |                                 |                 |                  |                 |  |
| NOTE                                  |  |   | th set-up according to Annex C.3.1.                                       |                                 |                 |                  |                 |  |
| NOTE 4:                               |  | •   | odulated signal is 5MHz E-UTRA signal as described in Annex D for channel |                                 |                 |                  |                 |  |
|                                       |  | h ≥5MHz.  |   |                                 |                 |                  |                 |  |
| NOTE 5:                               |  | he F <sub>interferer 1</sub> (offset) is the frequency separation of the center frequency of the carrier closest to<br>the interferer and the center frequency of the CW interferer and F <sub>interferer 2</sub> (offset) is the frequency |   |                                 |                 |                  |                 |  |
|                                       | separation of the center frequency of the carrier closest to the interferer and the center frequency |   |   |                                 |                 |                  |                 |  |
|                                       |  | odulated in   |   | of the barrier of               |                 |                  | since inequency |  |

Table 7.8.1A-1: Wide band intermodulation

For intra-band non-contiguous carrier aggregation with one uplink carrier and two downlink carriers, the wide band intermodulation requirements are defined with the uplink configuration in accordance with Table 7.3.1A-3. For this uplink configuration, the UE shall meet the requirements specified in subclause 7.8.1.1 for each component carrier while both downlink carriers are active. The wide band intermodulation requirements shall be supported for out-of-gap test only.

## 7.8.1B Minimum requirements for UL-MIMO

For UE(s) with two transmitter antenna connectors in closed-loop spatial multiplexing scheme, the minimum requirements in subclause 7.8.1 shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2. For UL-MIMO, the parameter  $P_{CMAX_L}$  is defined as the total transmitter power over the two transmit antenna connectors.

## 7.8.2 Void

# 7.9 Spurious emissions

The spurious emissions power is the power of emissions generated or amplified in a receiver that appear at the UE antenna connector.

## 7.9.1 Minimum requirements

The power of any narrow band CW spurious emission shall not exceed the maximum level specified in Table 7.9.1-1

Table 7.9.1-1: General receiver spurious emission requirements

| Frequency band  | Measurement<br>bandwidth | Maximum<br>level | Note |  |  |
|---|--------------------------|------------------|------|--|--|
| 30MHz ≤ f < 1GHz  | 100 kHz                  | -57 dBm          |      |  |  |
| $1$ GHz $\leq$ f $\leq$ 12.75 GHz   | 1 MHz                    | -47 dBm          |      |  |  |
| 12.75 GHz $\leq$ f $\leq$ 5 <sup>th</sup> harmonic<br>of the upper frequency edge<br>of the DL operating band in<br>GHz   | 1 MHz                    | -47 dBm          | 1    |  |  |
| NOTE 1: Applies only for Band 22, Band 42 and Band 43<br>NOTE 2: Unused PDCCH resources are padded with resource element groups with power level given<br>by PDCCH_RA/RB as defined in Annex C.3.1. |                          |                  |      |  |  |

# 7.10 Receiver image

## 7.10.1 Void

## 7.10.1A Minimum requirements for CA

Receiver image rejection is a measure of a receiver's ability to receive the E-UTRA signal on one component carrier while it is also configured to receive an adjacent aggregated carrier. Receiver image rejection ratio is the ratio of the wanted received power on a sub-carrier being measured to the unwanted image power received on the same sub-carrier when both sub-carriers are received with equal power at the UE antenna connector.

For intra-band contiguous carrier aggregation the UE shall fulfil the minimum requirement specified in Table 7.10.1A-1 for all values of aggregated input signal up to -22 dBm.

|                             | CA bandwidth class |   |   |    |   |   |   |
|-----------------------------|--------------------|---|---|----|---|---|---|
| Rx parameter                | Units              | Α | В | С  | D | E | F |
| Receiver image<br>rejection | dB                 |   |   | 25 |   |   |   |

## 8 Performance requirement

This clause contains performance requirements for the physical channels specified in TS 36.211 [4]. The performance requirements for the UE in this clause are specified for the measurement channels specified in Annex A.3, the propagation conditions in Annex B and the downlink channels in Annex C.3.2.

Note: For the requirements in the following sections, similar Release 8 and 9 requirements apply for time domain measurements restriction under colliding CRS.

### 8.1 General

#### 8.1.1 Dual-antenna receiver capability

The performance requirements are based on UE(s) that utilize a dual-antenna receiver.

For all test cases, the SNR is defined as

$$SNR = \frac{\hat{E}_{s}^{(1)} + \hat{E}_{s}^{(2)}}{N_{oc}^{(1)} + N_{oc}^{(2)}}$$

where the superscript indicates the receiver antenna connector. The above SNR definition assumes that the REs are not precoded. The SNR definition does not account for any gain which can be associated to the precoding operation. The relative power of physical channels transmitted is defined in Table C.3.2-1. The SNR requirement applies for the UE categories and CA capabilities given for each test.

For enhanced performance requirements type A, the SINR is defined as

$$SINR = \frac{\hat{E}_{s}^{(1)} + \hat{E}_{s}^{(2)}}{N_{oc}^{(1)'} + N_{oc}^{(2)'}}$$

where the superscript indicates the receiver antenna connector. The above SINR definition assumes that the REs are not precoded. The SINR definition does not account for any gain which can be associated to the precoding operation. The relative power of physical channels transmitted is defined in Table C.3.2-1. The SINR requirement applies for the UE categories given for each test.

#### Table 8.1.1-1: Void

- 8.1.1.1 Simultaneous unicast and MBMS operations
- 8.1.1.2 Dual-antenna receiver capability in idle mode
- 8.1.2 Applicability of requirements

#### 8.1.2.1 Applicability of requirements for different channel bandwidths

In Clause 8 the test cases may be defined with different channel bandwidth to verify the same target FRC conditions with the same propagation conditions, correlation matrix and antenna configuration.

#### 8.1.2.2 Definition of CA capability

The definition with respect to CA capabilities for 2CCs is given as in Table 8.1.2.2-1.

| CA<br>Capability  | CA Capability Description    |
|---|------------------------------|
| CA_C  | Intra-band contiguous CA     |
| CA_A_2  | Inter-band CA                |
| CA_N  | Intra-band non-contiguous CA |
| Note 1: CA_C corresponds to E-UTRA CA configurations and bandwidth<br>combination sets defined in Table 5.6A.1-1. CA_A_2 corresponds to E-<br>UTRA CA configurations and bandwidth combination sets defined in Ta<br>5.6A.1-2. CA_N corresponds to E-UTRA CA configurations and bandwi<br>combination sets defined in Table 5.6A.1-3. |                              |

Table 8.1.2.2-1: Definition of CA capability with 2DL CCs

The supported testable aggregated CA bandwidth combinations for 2CCs for each CA capability are listed in Table 8.1.2.2-2.

# Table 8.1.2.2-2: Supported testable aggregated CA bandwidth combinations for different CA capability with 2DL CCs

| CA<br>Capability  | Bandwidth combination<br>for FDD CA | Bandwidth combination<br>for TDD CA |  |  |  |
|---|-------------------------------------|-------------------------------------|--|--|--|
| CA_C  | 20+20MHz                            | 20+20MHz                            |  |  |  |
| CA_A_2  | 10+10MHz, 10+15MHz,                 | NA                                  |  |  |  |
|   | 10+20MHz, 15+20MHz,                 |                                     |  |  |  |
|   | 20+20MHz                            |                                     |  |  |  |
| CA_N  | 10+10MHz                            | 20+20MHz                            |  |  |  |
| Note 1: This table is only for information and applicability and test rules |                                     |                                     |  |  |  |
| of CA performance requirements are specified in 8.1.2.3 and                 |                                     |                                     |  |  |  |
| 9.1.  | 1.2.                                |                                     |  |  |  |

For test cases with more than one component carrier, "Fraction of Maximum Throughput" in the performance requirement refers to the ratio of the sum of throughput values of all component carriers to the sum of the nominal maximum throughput values of all component carriers, unless otherwise stated.

# 8.1.2.3 Applicability and test rules for different CA configurations and bandwidth combination sets

For tests defined in Table 8.2.1.8.1-2, the tests are applied to CA\_3A-3A defined in Table 5.6A.1-3.

The performance requirement for CA UE demodulation tests in Clause 8 are defined independent of CA configurations and bandwidth combination sets specified in Clause 5.6A.1. For UEs supporting different CA configurations and bandwidth combination sets, the applicability and test rules are defined for the tests for 2 DL CCs in Table 8.1.2.3-1. For simplicity, CA configuration below refers to combination of CA configuration and bandwidth combination set.

| Tests  | CA capability<br>where the<br>tests apply   | CA configuration from<br>the selected CA capbility<br>where the tests apply   | CA Bandwidth<br>combination to be<br>tested in priority order | No. of the<br>supported<br>bandwidth<br>combinations<br>to be tested<br>from each<br>selected CA<br>configuration |
|--|---|---|---|---|
| CA tests with<br>2CCs in Clause<br>8.2.1.1.1,<br>8.2.1.4.3 | Any one of the<br>supported CA<br>capabilities  | Any one of the supported<br>FDD CA configurations   | 10+10 MHz, 20+20 MHz  | 1   |
| CA tests with<br>2CCs in Clause<br>8.2.1.3.1               | Each supported<br>CA capability   | Any one of the supported<br>FDD CA configurations in<br>each CA capability  | 10+10 MHz, 20+20 MHz  | 1   |
| CA tests with<br>2CCs in Clause<br>8.2.1.3.1A, 8.7.1       | Any one of the<br>supported CA<br>capabilities with<br>largest<br>aggregated CA<br>bandwidth<br>combination | Any one of the supported<br>FDD CA configurations<br>with largest aggregated CA<br>bandwidth combination                          | Largest aggregated CA bandwidth combination                   | 1   |
| CA tests with<br>2CCs in Clause<br>8.2.1.7.1               | CA_C  | Supported FDD intra-band<br>contiguous CA<br>configurations covering the<br>lowest and highest<br>operating bands                 | Largest aggregated CA bandwidth combinations                  | 1   |
| CA tests with<br>2CCs in Clause<br>8.2.2.1.1,<br>8.2.2.4.3 | Any one of the<br>supported CA<br>capabilities with<br>largest<br>aggregated CA<br>bandwidth<br>combination | Any one of the supported<br>TDD CA configurations<br>with largest aggregated CA<br>bandwidth combination                          | Largest aggregated CA bandwidth combination                   | 1   |
| CA tests with<br>2CCs in Clause<br>8.2.2.3.1               | Each supported<br>CA capability   | Any one of the supported<br>TDD CA configurations in<br>each CA capability with<br>largest aggregated CA<br>bandwidth combination | Largest aggregated CA bandwidth combination                   | 1   |
| CA tests with<br>2CCs in Clause<br>8.2.2.3.1A, 8.7.2       | Any one of the<br>supported CA<br>capabilities with<br>largest<br>aggregated CA<br>bandwidth                | Any one of the supported<br>TDD CA configurations<br>with largest aggregated CA<br>bandwidth combination                          | Largest aggregated CA bandwidth combination                   | 1   |
| CA tests with 2CCs in 8.2.2.7.1                            | CA_C  | Supported TDD intra-band<br>contiguous CA<br>configurations<br>covering the lowest and<br>highest operating bands                 | Largest aggregated CA bandwidth combinations                  | 1   |
| CA tests with<br>2CCs in Clause<br>8.2.1.8.1               | CA_N  | CA_3A-3A defined in Table<br>5.6A.1-3   | 10+10 MHz   | 1   |

| Table 8.1.2.3-1: Applicability and test rules | for CA UE demodulation tests with 2 DL CCs |
|---|--|
|---|--|

Note 1: The applicability and test rules are specified in this table, unless otherwise stated.

#### 8.1.2.4 Test coverage for different number of component carriers

For FDD tests specified in 8.2.1.1.1, 8.2.1.3.1, 8.2.1.4.3, and 8.7.1, if corresponding CA tests are tested, the test coverage can be considered fulfilled without executing single carrier tests.

For TDD tests specified in 8.2.2.1.1, 8.2.2.3.1, 8.2.2.4.3, and 8.7.2, if corresponding CA tests are tested, the test coverage can be considered fulfilled without executing single carrier tests.

# 8.2 Demodulation of PDSCH (Cell-Specific Reference Symbols)

## 8.2.1 FDD (Fixed Reference Channel)

The parameters specified in Table 8.2.1-1 are valid for all FDD tests unless otherwise stated.

| Parameter  | Unit         | Value  |
|--|--------------|--|
| Inter-TTI Distance   |              | 1  |
| Number of HARQ<br>processes per<br>component carrier         | Processes    | 8  |
| Maximum number of<br>HARQ transmission                       |              | 4  |
| Redundancy version<br>coding sequence                        |              | {0,1,2,3} for QPSK and 16QAM<br>{0,0,1,2} for 64QAM  |
| Number of OFDM<br>symbols for PDCCH per<br>component carrier | OFDM symbols | 4 for 1.4 MHz bandwidth, 3 for 3 MHz and<br>5 MHz bandwidths,<br>2 for 10 MHz, 15 MHz and 20 MHz<br>bandwidths |
| Cyclic Prefix  |              | Normal   |
| Cell_ID  |              | 0  |
| Cross carrier scheduling                                     |              | Not configured   |

#### Table 8.2.1-1: Common Test Parameters (FDD)

### 8.2.1.1 Single-antenna port performance

The single-antenna performance in a given multi-path fading environments is determined by the SNR for which a certain relative information bit throughput of the reference measurement channels in Annex A.3.3 is achieved. The purpose of these tests is to verify the single-antenna performance with different channel models and MCS. The QPSK and 64QAM cases are also used to verify the performance for all bandwidths specified in Table 5.6.1-1.

#### 8.2.1.1.1 Minimum Requirement

For single carrier the requirements are specified in Table 8.2.1.1.1-2, with the addition of the parameters in Table 8.2.1.1.1-1 and the downlink physical channel setup according to Annex C.3.2. For CA the requirements are specified in Table 8.2.1.1.1-4, with the addition of the parameters in Table 8.2.1.1.1-3 and the downlink physical channel setup according to Annex C.3.2.

| Parameter   |                               | Unit      | Test 1- 5        | Test 6- 8        | Test 9- 15       | Test 16- 18      | Test 19          |  |
|---|-------------------------------|-----------|------------------|------------------|------------------|------------------|------------------|--|
| Develiek eeus   | $\rho_{A}$                    | dB        | 0                | 0                | 0                | 0                | 0                |  |
| Downlink power<br>allocation  | $\rho_{\scriptscriptstyle B}$ | dB        | 0 (Note 1)       |  |
|   | σ                             | dB        | 0                | 0                | 0                | 0                | 0                |  |
| $N_{\it oc}$ at ante  | nna port                      | dBm/15kHz | -98              | -98              | -98              | -98              | -98              |  |
| Symbols for ur  | used PRBs                     |           | OCNG<br>(Note 2) |  |
| Modula  | tion                          |           | QPSK             | 16QAM            | 64QAM            | 16QAM            | QPSK             |  |
| PDSCH transm  | ission mode                   |           | 1                | 1                | 1                | 1                | 1                |  |
| Note 1: $P_B =$   | 0.                            |           |                  |                  |                  |                  |                  |  |
| Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. |                               |           |                  |                  |                  |                  |                  |  |
| Note 3: Void.   |                               |           |                  |                  |                  |                  |                  |  |
| Note 4: Void.   |                               |           |                  |                  |                  |                  |                  |  |

#### Table 8.2.1.1.1-1: Test Parameters

|                            |                |                      |                 |                                    | Correlation                      | Reference                                   | value       |                    |
|----------------------------|----------------|----------------------|-----------------|------------------------------------|----------------------------------|---|-------------|--------------------|
| Test<br>num.               | Band-<br>width | Reference<br>channel | OCNG<br>pattern | Propa-<br>gation<br>condi-<br>tion | matrix and<br>antenna<br>config. | Fraction of<br>maximum<br>throughput<br>(%) | SNR<br>(dB) | UE<br>cate<br>gory |
| 1                          | 10 MHz         | R.2 FDD              | OP.1 FDD        | EVA5                               | 1x2 Low                          | 70  | -1.0        | ≥1                 |
| 2                          | 10 MHz         | R.2 FDD              | OP.1 FDD        | ETU70                              | 1x2 Low                          | 70  | -0.4        | ≥1                 |
| 3                          | 10 MHz         | R.2 FDD              | OP.1 FDD        | ETU300                             | 1x2 Low                          | 70  | 0.0         | ≥1                 |
| 4                          | 10 MHz         | R.2 FDD              | OP.1 FDD        | HST                                | 1x2                              | 70  | -2.4        | ≥1                 |
| 5                          | 1.4 MHz        | R.4 FDD              | OP.1 FDD        | EVA5                               | 1x2 Low                          | 70  | 0.0         | ≥1                 |
| 6                          | 10 MHz         | R.3 FDD              | OP.1 FDD        | EVA5                               | 1x2 Low                          | 70  | 6.7         | ≥2                 |
| 0                          | 5 MHz          | R.3-1 FDD            | OP.1 FDD        | EVA5                               | 1x2 Low                          | 70  | 6.7         | 1                  |
| 7                          | 10 MHz         | R.3 FDD              | OP.1 FDD        | ETU70                              | 1x2 Low                          | 30  | 1.4         | ≥2                 |
|                            | 5 MHz          | R.3-1 FDD            | OP.1 FDD        | ETU70                              | 1x2 Low                          | 30  | 1.4         | 1                  |
| 8                          | 10 MHz         | R.3 FDD              | OP.1 FDD        | ETU300                             | 1x2 High                         | 70  | 9.4         | ≥2                 |
| 8                          | 5 MHz          | R.3-1 FDD            | OP.1 FDD        | ETU300                             | 1x2 High                         | 70  | 9.4         | 1                  |
| 9                          | 3 MHz          | R.5 FDD              | OP.1 FDD        | EVA5                               | 1x2 Low                          | 70  | 17.6        | ≥1                 |
| 40                         | 5 MHz          | R.6 FDD              | OP.1 FDD        | EVA5                               | 1x2 Low                          | 70  | 17.4        | ≥2                 |
| 10                         | 5 MHz          | R.6-1 FDD            | OP.1 FDD        | EVA5                               | 1x2 Low                          | 70  | 17.5        | 1                  |
| 44                         | 10 MHz         | R.7 FDD              | OP.1 FDD        | EVA5                               | 1x2 Low                          | 70  | 17.7        | ≥2                 |
| 11                         | 10 MHz         | R.7-1 FDD            | OP.1 FDD        | EVA5                               | 1x2 Low                          | 70  | 16.7        | 1                  |
| 12                         | 10 MHz         | R.7 FDD              | OP.1 FDD        | ETU70                              | 1x2 Low                          | 70  | 19.0        | ≥2                 |
| 12                         | 10 MHz         | R.7-1 FDD            | OP.1 FDD        | ETU70                              | 1x2 Low                          | 70  | 18.1        | 1                  |
| 13                         | 10 MHz         | R.7 FDD              | OP.1 FDD        | EVA5                               | 1x2 High                         | 70  | 19.1        | ≥2                 |
| 13                         | 10 MHz         | R.7-1 FDD            | OP.1 FDD        | EVA5                               | 1x2 High                         | 70  | 17.8        | 1                  |
| 14                         | 15 MHz         | R.8 FDD              | OP.1 FDD        | EVA5                               | 1x2 Low                          | 70  | 17.7        | ≥2                 |
| 14                         | 15 MHz         | R.8-1 FDD            | OP.1 FDD        | EVA5                               | 1x2 Low                          | 70  | 16.8        | 1                  |
|                            | 20 MHz         | R.9 FDD              | OP.1 FDD        | EVA5                               | 1x2 Low                          | 70  | 17.6        | ≥3                 |
| 15                         | 20 MHz         | R.9-2 FDD            | OP.1 FDD        | EVA5                               | 1x2 Low                          | 70  | 17.3        | 2                  |
|                            | 20 MHz         | R.9-1 FDD            | OP.1 FDD        | EVA5                               | 1x2 Low                          | 70  | 16.7        | 1                  |
| 16                         | 3 MHz          | R.0 FDD              | OP.1 FDD        | ETU70                              | 1x2 Low                          | 30  | 1.9         | ≥1                 |
| 17                         | 10 MHz         | R.1 FDD              | OP.1 FDD        | ETU70                              | 1x2 Low                          | 30  | 1.9         | ≥1                 |
| 18                         | 20 MHz         | R.1 FDD              | OP.1 FDD        | ETU70                              | 1x2 Low                          | 30  | 1.9         | ≥1                 |
| 19                         | 10 MHz         | R.41 FDD             | OP.1 FDD        | EVA5                               | 1x2 Low                          | 70  | -5.4        | ≥1                 |
| Note 1<br>Note 2<br>Note 3 | : Void.        |                      |                 |                                    |                                  |   |             |                    |

Table 8.2.1.1.1-2: Minimum performance (FRC)

| Table 8.2.1.1.1-3: Test Pa | arameters for CA |
|----------------------------|------------------|
|----------------------------|------------------|

| Parameter   |  | Unit               | Test 1-2                      |  |  |  |
|---|--|--------------------|-------------------------------|--|--|--|
| Downlink  | $ ho_{\scriptscriptstyle A}$   | dB                 | 0                             |  |  |  |
| power   | $ ho_{\scriptscriptstyle B}$   | dB                 | 0 (Note 1)                    |  |  |  |
| allocation  | σ  | dB                 | 0                             |  |  |  |
| N <sub>oc</sub> a   | t antenna port   | dBm/15kHz          | -98                           |  |  |  |
| Symbols   | for unused PRBs  |                    | OCNG (Note 2)                 |  |  |  |
| N   | lodulation   |                    | QPSK                          |  |  |  |
| PDSCH t   | ansmission mode  |                    | 1                             |  |  |  |
| Note 1: $P_B$   | = 0.   |                    |                               |  |  |  |
| Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. |  |                    |                               |  |  |  |
|   | PUCCH format 1b with channel selection is used to feedback ACK/NACK. |                    |                               |  |  |  |
| Note 4: The   | same PDSCH transmis  | sion mode is appli | ed to each component carrier. |  |  |  |

| Table 8.2.1.1.1-4: Minimum | performance | (FRC) | ) for CA |
|----------------------------|-------------|-------|----------|
|----------------------------|-------------|-------|----------|

|              |                |                      |                 | Propa-                   | Correlation                      | Reference                            | ce value |                  |
|--------------|----------------|----------------------|-----------------|--------------------------|----------------------------------|--------------------------------------|----------|------------------|
| Test<br>num. | Band-<br>width | Reference<br>channel | OCNG<br>pattern | gation<br>condi-<br>tion | matrix and<br>antenna<br>config. | Fraction of<br>maximum<br>throughput | SNR (dB) | UE cate-<br>gory |

|        |   |          |                         |      |         | (%) |      |                |
|--------|---|----------|-------------------------|------|---------|-----|------|----------------|
| 1      | 2x10 MHz  | R.2 FDD  | OP.1<br>FDD<br>(Note 1) | EVA5 | 1x2 Low | 70  | -1.1 | ≥3<br>(Note 2) |
| 2      | 2x20 MHz  | R.42 FDD | OP.1<br>FDD<br>(Note 1) | EVA5 | 1x2 Low | 70  | -1.3 | ≥5             |
| Note 1 | Note 1: The OCNG pattern applies for each CC.   |          |                         |      |         |     |      |                |
| Note 2 | Note 2: 30usec timing difference between two CCs is applied in inter-band CA case.                                  |          |                         |      |         |     |      |                |
| Note 3 | Note 3: The applicability of requirements for different CA configurations and bandwidth combination sets is defined |          |                         |      |         |     |      |                |
|        | in 8.1.2.3.   |          |                         |      |         |     |      |                |

- 8.2.1.1.2 Void
- 8.2.1.1.3 Void

#### 8.2.1.1.4 Minimum Requirement 1 PRB allocation in presence of MBSFN

The requirements are specified in Table 8.2.1.1.4-2, with the addition of the parameters in Table 8.2.1.1.4-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the single-antenna performance with a single PRB allocated at the lower band edge in presence of MBSFN.

| Parameter                              |   | Unit      | Test 1           |  |  |  |
|--|---|-----------|------------------|--|--|--|
|  | $ ho_{\scriptscriptstyle A}$  | dB        | 0                |  |  |  |
| Downlink power<br>allocation           | $ ho_{\scriptscriptstyle B}$  | dB        | 0 (Note 1)       |  |  |  |
|  | σ   | dB        | 0                |  |  |  |
| $N_{\scriptscriptstyle oc}$ at antenna | port  | dBm/15kHz | -98              |  |  |  |
| Symbols for MBSFN<br>MBSFN subframes   |   |           | OCNG (Note 3)    |  |  |  |
| PDSCH transmission                     | on mode   |           | 1                |  |  |  |
| Note 1: $P_B = 0$<br>Note 2: The MBSF  | N portion of  |           | no comprisos tho |  |  |  |
|  | The MBSFN portion of an MBSFN subframe comprises the whole MBSFN subframe except the first two symbols in the first slot.   |           |                  |  |  |  |
| QPSK mod<br>not inserted               | The MBSFN portion of the MBSFN subframes shall contain<br>QPSK modulated data. Cell-specific reference signals are<br>not inserted in the MBSFN portion of the MBSFN subframes,<br>QPSK modulated MBSFN data is used instead. |           |                  |  |  |  |

 Table 8.2.1.1.4-2: Minimum performance 1PRB (FRC)

| ſ | Test   | Bandwidth | Reference | OCNG     | Propagation | Correlation                            | Reference                                   | value       | UE       |
|---|--------|-----------|-----------|----------|-------------|--|---|-------------|----------|
|   | number |           | Channel   | Pattern  | Condition   | Matrix and<br>Antenna<br>Configuration | Fraction of<br>Maximum<br>Throughput<br>(%) | SNR<br>(dB) | Category |
|   | 1      | 10 MHz    | R.29 FDD  | OP.3 FDD | ETU70       | 1x2 Low                                | 30  | 2.0         | ≥1       |

#### 8.2.1.2 Transmit diversity performance

#### 8.2.1.2.1 Minimum Requirement 2 Tx Antenna Port

The requirements are specified in Table 8.2.1.2.1-2, with the addition of the parameters in Table 8.2.1.2.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmitter antennas.

#### Table 8.2.1.2.1-1: Test Parameters for Transmit diversity Performance (FRC)

| Parameter                              |                              | Unit      | Test 1-2    |  |  |  |
|--|------------------------------|-----------|-------------|--|--|--|
|  | $ ho_{\scriptscriptstyle A}$ | dB        | -3          |  |  |  |
| Downlink power<br>allocation           | $ ho_{\scriptscriptstyle B}$ | dB        | -3 (Note 1) |  |  |  |
|  | σ                            | dB        | 0           |  |  |  |
| $N_{\scriptscriptstyle oc}$ at antenna | port                         | dBm/15kHz | -98         |  |  |  |
| PDSCH transmissio                      | on mode                      |           | 2           |  |  |  |
| Note 1: $P_B = 1$ .                    |                              |           |             |  |  |  |

| Test   |        |            | OCNG     | Propagation | Correlation                            | Reference                                       | value       | UE       |
|--------|--------|------------|----------|-------------|--|---|-------------|----------|
| number | width  | Channel    | Pattern  | Condition   | Matrix and<br>Antenna<br>Configuration | Fraction<br>of<br>Maximum<br>Throughp<br>ut (%) | SNR<br>(dB) | Category |
| 1      | 10 MHz | R.11 FDD   | OP.1 FDD | EVA5        | 2x2 Medium                             | 70  | 6.8         | ≥2       |
|        | 5 MHz  | R.11-2 FDD | OP.1 FDD | EVA5        | 2x2 Medium                             | 70  | 5.9         | 1        |
| 2      | 10 MHz | R.10 FDD   | OP.1 FDD | HST         | 2x2                                    | 70  | -2.3        | ≥1       |

#### 8.2.1.2.2 Minimum Requirement 4 Tx Antenna Port

The requirements are specified in Table 8.2.1.2.2-2, with the addition of the parameters in Table 8.2.1.2.2-1 and the downlink physical channel setup according Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC-FSTD) with 4 transmitter antennas.

| Parameter                              |                              | Unit      | Test 1-2    |
|--|------------------------------|-----------|-------------|
|  | $ ho_{\scriptscriptstyle A}$ | dB        | -3          |
| Downlink power<br>allocation           | $ ho_{\scriptscriptstyle B}$ | dB        | -3 (Note 1) |
|  | σ                            | dB        | 0           |
| $N_{\scriptscriptstyle oc}$ at antenna | port                         | dBm/15kHz | -98         |
| PDSCH transmission                     | on mode                      |           | 2           |
| Note 1: $P_B = 1$ .                    |                              |           |             |

| Test   | st Band- Reference ( |          | OCNG     | Propagation | Correlation                            | Reference v                                 | UE          |          |
|--------|----------------------|----------|----------|-------------|--|---|-------------|----------|
| number | width                | Channel  | Pattern  | Condition   | Matrix and<br>Antenna<br>Configuration | Fraction of<br>Maximum<br>Throughput<br>(%) | SNR<br>(dB) | Category |
| 1      | 1.4 MHz              | R.12 FDD | OP.1 FDD | EPA5        | 4x2 Medium                             | 70  | 0.6         | ≥1       |
| 2      | 10 MHz               | R.13 FDD | OP.1 FDD | ETU70       | 4x2 Low                                | 70  | -0.9        | ≥1       |

Table 8.2.1.2.2-2: Minimum performance Transmit Diversity (FRC)

# 8.2.1.2.3 Minimum Requirement 2 Tx Antenna Ports (demodulation subframe overlaps with aggressor cell ABS)

The requirements are specified in Table 8.2.1.2.3-2, with the addition of parameters in Table 8.2.1.2.3-1 and the downlink physical channel setup according to Annex C.3.2 and Annex C.3.3. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmit antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell. In Table 8.2.1.2.3-1, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

| Parameter   |   | Unit   | Cell 1   | Cell 2   |
|---|---|--|--|--|
|   | $ ho_{\scriptscriptstyle A}$  | dB   | -3   | -3   |
| Downlink power allocation   | $ ho_{\scriptscriptstyle B}$  | dB   | -3 (Note 1)  | -3   |
|   | σ   | dB   | 0  | N/A  |
|   | N <sub>oc1</sub>  | dBm/15kHz  | -102 (Note 2)  | N/A  |
| $N_{oc}$ at antenna port  | N <sub>oc2</sub>  | dBm/15kHz  | -98 (Note 3)   | N/A  |
|   | N <sub>oc3</sub>  | dBm/15kHz  | -94.8 (Note 4)   | N/A  |
| $\widehat{E}_s/N_{oc2}$   |   | dB   | Reference Value in<br>Table 8.2.1.2.3-2                        | 6  |
| BW <sub>Channel</sub>   |   | MHz  | 10   | 10   |
| Subframe Configura  | ation   |  | Non-MBSFN  | Non-MBSFN  |
| Time Offset between   | Cells   | μs   | 2.5 (synchron  | nous cells)  |
| Cell Id   |   |  | 0  | 1  |
| ABS pattern (Note   | 5)  |  | N/A  | 11000100<br>11000000<br>11000000<br>11000000<br>11000000 |
| RLM/RRM Measurement<br>Pattern (Note 6)   |   |  | 1000000<br>1000000<br>1000000<br>1000000<br>1000000<br>1000000 | N/A  |
|   | C <sub>CSI,0</sub>  |  | 11000100<br>11000000<br>11000000<br>11000000<br>11000000       | N/A  |
| CSI Subframe Sets (Note7)   | C <sub>CSI,1</sub>  |  | 00111011<br>00111111<br>00111111<br>00111111<br>00111111       | N/A  |
| Number of control OFDN  | l symbols   |  | 2  |  |
| PDSCH transmission  | mode  |  | 2  | N/A  |
| Cyclic prefix   |   |  | Normal   | Normal   |
| overlapping with the Note 3: This noise is appli ABS.                                 | ne aggressor A<br>ed in OFDM s                                      | ymbols #0, #4, #7, #11 of a  | a subframe overlapping   | with the aggressor                                       |
| Note 5:ABS pattern as deNote 6:Time-domain meaNote 7:As configured accmeasurements de | fined in [9].<br>surement reso<br>ording to the ti<br>fined in [7]. | I symbols of a subframe o<br>purce restriction pattern for<br>me-domain measurement<br>s the aggressor cell. The n | PCell measurements as resource restriction patt                | s defined in [7]<br>ern for CSI                          |

Table 8.2.1.2.3-1: Test Parameters for Transmit diversity Performance (FRC)

Note 8: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.

Note 9: SIB-1 will not be transmitted in Cell2 in this test.

| Test<br>Number     | Reference<br>Channel   |                      | OCNG Propagation<br>Pattern Conditions<br>(Note 1) |            | Correlation<br>Matrix and<br>Antenna | Matrix and Antenna  |  | UE<br>Category             |         |
|--------------------|--|----------------------|--|------------|--------------------------------------|---------------------|--|----------------------------|---------|
|                    |  | Cell 1               | Cell 2   | Cell 1     | Cell 2                               | Configurati<br>on   | Fraction of<br>Maximum<br>Throughput<br>(%) (Note 5) | SNR<br>(dB)<br>(Note<br>2) |         |
| 1                  | R.11-4<br>FDD (Note<br>4)  | OP.1<br>FDD          | OP.1<br>FDD  | EVA5       | EVA 5                                | 2x2 Medium          | 70   | 3.4                        | ≥2      |
| Note 1:            |  |                      |  |            | Cell2 are                            | statistically indep | bendent.   |                            |         |
| Note 2:            | SNR correspo   | nds to $\widehat{E}$ | $s/N_{oc2}$  | of cell 1. |                                      |                     |  |                            |         |
| Note 3:<br>Note 4: | The correlation matrix and antenna configuration apply for Cell 1 and Cell 2.<br>Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated<br>PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the<br>ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel. |                      |  |            |                                      |                     |  |                            |         |
| Note 5:            | The maximum  | Through              | put is cal   | culated fi | rom the tota                         | al Payload in 9 s   | ubframes, avera                                      | aged ove                   | r 40ms. |

Table 8.2.1.2.3-2: Minimum Performance Transmit Diversity (FRC)

# 8.2.1.2.3A Minimum Requirement 2 Tx Antenna Ports (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements are specified in Table 8.2.1.2.3A-2, with the addition of parameters in Table 8.2.1.2.3A-1. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmit antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cells with CRS assistance information. In Table 8.2.1.2.3A-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

| Parameter  |                              | Unit      | Cell 1   | Cell 2   | Cell 3   |  |  |  |
|--|------------------------------|-----------|--|--|--|--|--|--|
| i urumotor   | $ ho_{\scriptscriptstyle A}$ | dB        | -3   | -3   | -3   |  |  |  |
| Downlink power<br>allocation   | $\rho_{B}$                   | dB        | -3 (Note 1)  | -3 (Note 1)  | -3 (Note 1)  |  |  |  |
| anocation  | σ                            | dB        | 0  | N/A  | N/A  |  |  |  |
|  | N <sub>oc1</sub>             | dBm/15kHz | -98 (Note 2)   | N/A  | N/A  |  |  |  |
| $N_{oc}$ at antenna port   | N <sub>oc2</sub>             | dBm/15kHz | -98 (Note 3)   | N/A  | N/A  |  |  |  |
|  | N <sub>oc3</sub>             | dBm/15kHz | -93 (Note 4)   | N/A  | N/A  |  |  |  |
| $\hat{E}_s/N_{oc2}$  |                              | dB        | Reference<br>Value in<br>Table8.2.1.2.3A-<br>2           | 12   | 10   |  |  |  |
| BW <sub>Channel</sub>  |                              | MHz       | 10   | 10   | 10   |  |  |  |
| Subframe Configu   | ration                       |           | Non-MBSFN  | Non-MBSFN  | Non-MBSFN  |  |  |  |
| Time Offset betwee   | n Cells                      | μs        | N/A  | 3  | -1   |  |  |  |
| Frequency shift betwe  | en Cells                     | Hz        | N/A  | 300  | -100   |  |  |  |
| Cell Id  |                              |           | 0  | 126  | 1  |  |  |  |
| ABS pattern (Not   | e 5)                         |           | N/A  | 11000000<br>11000000<br>11000000<br>11000000<br>11000000 | 11000000<br>11000000<br>11000000<br>11000000<br>11000000 |  |  |  |
| RLM/RRM Measur<br>Subframe Pattern (f  |                              |           | 10000000<br>10000000<br>10000000<br>10000000<br>1000000  | N/A  | N/A  |  |  |  |
| CSI Subframe Sets  | C <sub>CSI,0</sub>           |           | 11000000<br>11000000<br>11000000<br>11000000<br>11000000 | N/A  | N/A  |  |  |  |
| (Note7)  | C <sub>CSI,1</sub>           |           | 00111111<br>00111111<br>00111111<br>00111111<br>00111111 | N/A  | N/A  |  |  |  |
| Number of control of symbols   | OFDM                         |           | 2  | Note 8   | Note 8   |  |  |  |
| PDSCH transmissio  | n mode                       |           | 2  | Note 9   | Note 9   |  |  |  |
| Cyclic prefix  |                              |           | Normal   | Normal   | Normal   |  |  |  |
| <ul> <li>Note 2: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10, #12, #13 of a subframe overlapping with the aggressor ABS.</li> <li>Note 3: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.</li> <li>Note 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS Note 5: ABS pattern as defined in [9].</li> <li>Note 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]</li> <li>Note 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].</li> <li>Note 8: The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by "0" of ABS pattern.</li> <li>Note 9: Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying</li> </ul> |                              |           |  |  |  |  |  |  |
| Note 9: Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.<br>Note 10: The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.<br>Note 11: SIB-1 will not be transmitted in Cell 2 and Cell 3 in this test.  |                              |           |  |  |  |  |  |  |

 Table 8.2.1.2.3A-1: Test Parameters for Transmit diversity Performance (FRC)

| Test<br>Number     | Reference<br>Channel               | OC  |             |           | Correlation<br>Matrix and | Reference | UE<br>Cate |                                      |  |                            |       |
|--------------------|------------------------------------|---|-------------|-----------|---------------------------|-----------|------------|--------------------------------------|--|----------------------------|-------|
|                    |                                    | Cell 1  | Cell 2      | Cell<br>3 | Cell 1                    | Cell 2    | Cell 3     | Antenna<br>Configuration<br>(Note 2) | Fraction of<br>Maximum<br>Throughput<br>(%) Note 5 | SNR<br>(dB)<br>(Note<br>3) | gory  |
| 1                  | R.11-4 FDD<br>Note 4               | OP.1<br>FDD   |             |           |                           |           |            |                                      | 70   | 3.4                        | ≥2    |
| Note 1:<br>Note 2: | The propagation<br>The correlation |   |             |           |                           |           |            | y independent.<br>2 and Cell 3.      |  |                            |       |
| Note 3:            | SNR correspo                       | SNR corresponds to $\hat{E}_s / N_{oc2}$ of cell 1. |             |           |                           |           |            |                                      |  |                            |       |
| Note 4:            |                                    | the servir  | ng cell sul | bframe v  | when the s                | ubframe i | s overlap  | and its associate ped with the ABS   |  |                            | l and |

Table 8.2.1.2.3A-2: Minimum Performance Transmit Diversity (FRC)

Note 5: The maximum Throughput is calculated from the total Payload in 9 subframes, averaged over 40ms.

# 8.2.1.2.4 Enhanced Performance Requirement Type A - 2 Tx Antenna Ports with TM3 interference model

The requirements are specified in Table 8.2.1.2.4-2, with the addition of parameters in Table 8.2.1.2.4-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of two dominant interfering cells applying transmission mode 3 interference model defined in clause B.5.2. In Table 8.2.1.2.4-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

| Parameter  |                              | Unit      | Cell 1               | Cell 2                          | Cell 3                          |  |  |  |
|--|------------------------------|-----------|----------------------|---------------------------------|---------------------------------|--|--|--|
|  | $ ho_{\scriptscriptstyle A}$ | dB        | -3                   | -3                              | -3                              |  |  |  |
| Downlink power allocation  | $ ho_{\scriptscriptstyle B}$ | dB        | -3 (Note 1)          | -3                              | -3                              |  |  |  |
|  | σ                            | dB        | 0                    | 0                               | 0                               |  |  |  |
| Cell-specific reference  | signals                      |           | Antenna ports<br>0,1 | Antenna ports<br>0,1            | Antenna ports<br>0,1            |  |  |  |
| $N_{oc}$ at antenna po   | ort                          | dBm/15kHz | -98                  | N/A                             | N/A                             |  |  |  |
| DIP (Note 2)   |                              | dB        | N/A                  | -2.23                           | -8.06                           |  |  |  |
| BW <sub>Channel</sub>  |                              | MHz       | 10                   | 10                              | 10                              |  |  |  |
| Cyclic Prefix  |                              |           | Normal               | Normal                          | Normal                          |  |  |  |
| Cell Id  |                              |           | 0                    | 1                               | 2                               |  |  |  |
| Number of control OFDM   | symbols                      |           | 2                    | 2                               | 2                               |  |  |  |
| PDSCH transmission   |                              |           | 2                    | N/A                             | N/A                             |  |  |  |
| Interference mod   | el                           |           | N/A                  | As specified in<br>clause B.5.2 | As specified in<br>clause B.5.2 |  |  |  |
| Probability of occurrence of   | Rank 1                       | %         | N/A                  | 80                              | 80                              |  |  |  |
| transmission rank in<br>interfering cells  | Rank 2                       | %         | N/A                  | 20                              | 20                              |  |  |  |
| Reporting interva  | al                           | ms        | 5                    | N/A                             | N/A                             |  |  |  |
| Reporting mode   |                              |           | PUCCH 1-0            | N/A                             | N/A                             |  |  |  |
| Note 1: $P_B = 1$  |                              |           |                      |                                 |                                 |  |  |  |
| Note 2: The respective received power spectral density of each interfering cell relative to $N_{oc}$ is defined by   |                              |           |                      |                                 |                                 |  |  |  |
| <ul> <li>its associated DIP value as specified in clause B.5.1.</li> <li>Note 3: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.</li> <li>Note 4: Cell 2 transmission is delayed with respect to Cell 1 by 0.33 ms and Cell 3 transmission is delayed with respect to Cell 1 by 0.67 ms.</li> </ul> |                              |           |                      |                                 |                                 |  |  |  |

# Table 8.2.1.2.4-1: Test Parameters for Transmit diversity Performance (FRC) with TM3 interference model

# Table 8.2.1.2.4-2: Enhanced Performance Requirement Type A, Transmit Diversity (FRC) with TM3 interference model

| Test<br>Number | Reference<br>Channel   | OCI       | NG Pat    | tern      | Propagation<br>Conditions |           | Correlation<br>Matrix and |                                       |   |                             |      |
|----------------|--|-----------|-----------|-----------|---------------------------|-----------|---------------------------|---------------------------------------|---|-----------------------------|------|
|                |  | Cell<br>1 | Cell<br>2 | Cell<br>3 | Cell<br>1                 | Cell<br>2 | Cell<br>3                 | Antenna<br>Configurati<br>on (Note 3) | Fraction of<br>Maximum<br>Throughput<br>(%) | SINR<br>(dB)<br>(Note<br>2) | gory |
| 1              | R.46 FDD   | OP.       | N/A       | N/A       | EV                        | EV        | EV                        | 2x2 Low                               | 70  | -1.1                        | ≥1   |
|                |  | 1         |           |           | A70                       | A70       | A70                       |                                       |   |                             |      |
|                |  | FD        |           |           |                           |           |                           |                                       |   |                             |      |
|                |  | D         |           |           |                           |           |                           |                                       |   |                             |      |
| Note 1:        |  |           |           |           |                           |           |                           |                                       |   |                             |      |
| Note 2:        | Note 2: SINR corresponds to $\hat{E}_s/N_{oc}$ of Cell 1 as defined in clause 8.1.1. |           |           |           |                           |           |                           |                                       |   |                             |      |
| Note 3:        | Correlation ma   | trix and  | anten     | na conf   | iguratic                  | on para   | meters                    | apply for each o                      | f Cell 1, Cell 2 a                          | nd Cell 3.                  |      |

### 8.2.1.3 Open-loop spatial multiplexing performance

#### 8.2.1.3.1 Minimum Requirement 2 Tx Antenna Port

For single carrier the requirements are specified in Table 8.2.1.3.1-2, with the addition of the parameters in Table 8.2.1.3.1-1 and the downlink physical channel setup according to Annex C.3.2. For CA the requirements are specified in Table 8.2.1.3.1-4, with the addition of the parameters in Table 8.2.1.3.1-3 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

| Parameter                    |                              | Unit      | Test 1-2    |
|------------------------------|------------------------------|-----------|-------------|
| Downlink nowor               | $ ho_{\scriptscriptstyle A}$ | dB        | -3          |
| Downlink power<br>allocation | $ ho_{\scriptscriptstyle B}$ | dB        | -3 (Note 1) |
|                              | σ                            | dB        | 0           |
| $N_{_{oc}}$ at antenna       | port                         | dBm/15kHz | -98         |
| PDSCH transmissio            | on mode                      |           | 3           |
| Note 1: $P_B = 1$ .          |                              |           |             |
| Note 2: Void                 |                              |           |             |
| Note 3: Void                 |                              |           |             |

Table 8.2.1.3.1-1: Test Parameters for Large Delay CDD (FRC)

| Table 8.2.1.3.1-2: Minimum performance Large Delay CDD (FRC) | Table 8.2.1.3.1-2: Minimum | performance Larg | ge Delay CDD | (FRC) |
|--|----------------------------|------------------|--------------|-------|
|--|----------------------------|------------------|--------------|-------|

|             |   |                      |                 | Brono                              | Correlation                      | Reference value                             |             |                |  |
|-------------|---|----------------------|-----------------|------------------------------------|----------------------------------|---|-------------|----------------|--|
| Test<br>num | Bandwidth   | Reference<br>channel | OCNG<br>pattern | Propa-<br>gation<br>condi-<br>tion | matrix and<br>antenna<br>config. | Fraction of<br>maximum<br>Throughput<br>(%) | SNR<br>(dB) | UE<br>category |  |
| 1           | 10 MHz  | R.11 FDD             | OP.1 FDD        | EVA70                              | 2x2 Low                          | 70  | 13.0        | ≥2             |  |
| 2           | 10 MHz  | R.35 FDD             | OP.1 FDD        | EVA200                             | 2x2 Low                          | 70  | 20.2        | ≥2             |  |
| 3           | 10 MHz  | R.35-4<br>FDD        | OP.1 FDD        | ETU300                             | 2x2 Low                          | 70  | 19.7        | ≥2             |  |
| Note 1:     | Void.   |                      |                 |                                    |                                  |   |             |                |  |
| Note 2:     | Test 1 may not be executed for UE-s for which Test 1 or 2 in Table 8.2.1.3.1-4 is applicable. |                      |                 |                                    |                                  |   |             |                |  |

Table 8.2.1.3.1-3: Test Parameters for Large Delay CDD (FRC) for CA

| Parameter                    |                              | Unit      | Test 1-3    |  |  |  |
|------------------------------|------------------------------|-----------|-------------|--|--|--|
| Downlink nowor               | $ ho_{\scriptscriptstyle A}$ | dB        | -3          |  |  |  |
| Downlink power<br>allocation | $ ho_{\scriptscriptstyle B}$ | dB        | -3 (Note 1) |  |  |  |
|                              | σ                            | dB        | 0           |  |  |  |
| $N_{\it oc}$ at antenna      | port                         | dBm/15kHz | -98         |  |  |  |
| PDSCH transmission           | on mode                      |           | 3           |  |  |  |
| Note 1: $P_B = 1$ .          |                              |           |             |  |  |  |
| feedback /                   | feedback ACK/NACK.           |           |             |  |  |  |
|                              | component carrier.           |           |             |  |  |  |

|              |                        |   |                         | Propa-                   | Correlation                      | Reference                                   |             |                  |  |  |
|--------------|------------------------|---|-------------------------|--------------------------|----------------------------------|---|-------------|------------------|--|--|
| Test<br>num. | Band-<br>width         | Reference<br>channel  | OCNG<br>pattern         | gation<br>condi-<br>tion | matrix and<br>antenna<br>config. | Fraction of<br>maximum<br>Throughput<br>(%) | SNR<br>(dB) | UE cate-<br>gory |  |  |
| 1            | 2x10 MHz               | R.11 FDD  | OP.1<br>FDD<br>(Note 1) | EVA70                    | 2x2 Low                          | 70  | 13.7        | ≥3               |  |  |
| 2            | 2x20 MHz               | R.30 FDD  | OP.1<br>FDD<br>(Note 1) | EVA70                    | 2x2 Low                          | 70  | 13.2        | ≥5               |  |  |
| Note 1:      | The OCNC               | The OCNG pattern applies for each CC.   |                         |                          |                                  |   |             |                  |  |  |
| Note 2:      | Void.                  |   |                         |                          |                                  |   |             |                  |  |  |
| Note 3:      | The applic in 8.1.2.3. | The applicability of requirements for different CA configurations and bandwidth combination sets is defined |                         |                          |                                  |   |             |                  |  |  |

### 8.2.1.3.1A Soft buffer management test

For CA the requirements are specified in Table 8.2.1.3.1A-2, with the addition of the parameters in Table 8.2.1.3.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the UE performance with proper instantaneous buffer implementation. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified inTable 8.2.1.3.1A-3.

| Parameter                              |   | Unit      | Test 1-7    |  |  |  |
|--|---|-----------|-------------|--|--|--|
| Downlink nowor                         | $ ho_{\scriptscriptstyle A}$  | dB        | -3          |  |  |  |
| Downlink power<br>allocation           | $ ho_{\scriptscriptstyle B}$  | dB        | -3 (Note 1) |  |  |  |
|  | σ   | dB        | 0           |  |  |  |
| $N_{\scriptscriptstyle oc}$ at antenna | port  | dBm/15kHz | -98         |  |  |  |
| PDSCH transmissi                       | on mode   |           | 3           |  |  |  |
| Note 1: $P_B = 1$ .                    | Note 1: $P_{\rm R} = 1$ .   |           |             |  |  |  |
| selection i                            | For CA test cases, PUCCH format 1b with channel selection is used to feedback ACK/NACK.   |           |             |  |  |  |
|  | For CA test cases, the same PDSCH transmission mode is applied to each component carrier. |           |             |  |  |  |

#### Table 8.2.1.3.1A-1: Test Parameters for soft buffer management test (FRC) for CA

#### Table 8.2.1.3.1A-2: Minimum performance soft buffer management test (FRC) for CA

|                               |   |                            |                      | Propa-                   |  | Referenc                                    | e value  |  |
|-------------------------------|---|----------------------------|----------------------|--------------------------|--|---|----------|--|
| Test<br>num                   | Bandwi<br>dth   | Reference<br>channel       | OCNG<br>pattern      | gation<br>condi-<br>tion | Correlation<br>matrix and<br>antenna config. | Fraction of<br>maximum<br>Throughput<br>(%) | SNR (dB) |  |
| 1                             | 2x20<br>MHz   | R.30 FDD                   | OP.1 FDD<br>(Note 1) | EVA70                    | 2x2 Low                                      | 70  | 13.2     |  |
| 2                             | 15MHz +   | R.35-2 FDD for<br>15MHz CC | OP.1 FDD<br>(Note 1) | EVA5                     | 2x2 Low                                      | 70  | 15.1     |  |
|                               | 10MHz   | R.35-3 FDD for<br>10MHz CC | OP.1 FDD<br>(Note 1) | EVAS 2x2 LOW             | 70   | 15.1  |          |  |
| 3                             | 20MHz +   | R.30 FDD for<br>20MHz CC   | OP.1 FDD<br>(Note 1) | EVA70                    | 2x2 Low                                      | 70  | 13.5     |  |
| 5                             | 10MHz   | R.11 FDD for<br>10MHz CC   | OP.1 FDD<br>(Note 1) | EVAID                    | ZXZ LOW                                      | 70  | 13.5     |  |
| 4                             | 20MHz +   | R.30 FDD for<br>20MHz CC   | 20MHz CC (Note 1)    | EVA70                    | 2x2 Low                                      | 70  | 13.5     |  |
| 4                             | 15MHz   | R.30-1 FDD for<br>15MHz CC | OP.1 FDD<br>(Note 1) | EVATU                    | ZXZ LOW                                      | 70  | 13.5     |  |
| 5                             | 2x20<br>MHz   | R.35-1 FDD                 | OP.1 FDD<br>(Note 1) | EVA5                     | 2x2 Low                                      | 70  | 15.8     |  |
| 6                             | 20MHz +   | R.35-1 FDD for<br>20MHz CC | OP.1 FDD<br>(Note 1) | EVA5                     | 2x2 Low                                      | 70  | 15.9     |  |
| 0                             | 10MHz   | R.35-3 FDD for<br>10MHz CC | OP.1 FDD<br>(Note 1) | EVAS                     | ZXZ LOW                                      | 70  | 15.9     |  |
| 7                             | 20MHz +   | R.35-1 FDD for<br>20MHz CC | OP.1 FDD<br>(Note 1) |                          | 2×2 L ovy                                    | 70  | 15.9     |  |
| /                             | 15MHz   | R.35-2 FDD for<br>15MHz CC | OP.1 FDD<br>(Note 1) | EVA5                     | 2x2 Low                                      | 70  | 15.9     |  |
| Note 1:<br>Note 2:<br>Note 3: | Note 1:For CA test cases, the OCNG pattern applies for each CC.Note 2:For Test 2, 3, 4, 6, 7 the Fraction of maximum Throughput applies to each CC. |                            |                      |                          |  |   |          |  |

| LIE optogony   | Bandwidth combination with maximum aggregated bandwidth (Note 1) |             |             |             |  |  |
|--|--|-------------|-------------|-------------|--|--|
| UE category  | 2x20MHz  | 15MHz+10MHz | 20MHz+10MHz | 20MHz+15MHz |  |  |
| 3  | 1  | 2           | 3           | 4           |  |  |
| 4 5  |  | N/A         | 6           | 7           |  |  |
| Note 1: Maximum over all supported CA configurations and bandwidth combination sets according to Table 5.6A.1- |  |             |             |             |  |  |
| 1and Table   | e 5.6A.1-2.  | -           |             | -           |  |  |

Table 8.2.1.3.1A-3: Test points for soft buffer management tests for CA

#### 8.2.1.3.2 Minimum Requirement 4 Tx Antenna Port

The requirements are specified in Table 8.2.1.3.2-2, with the addition of the parameters in Table 8.2.1.3.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 4 transmitter antennas.

| Parameter                              |                              | Unit      | Test 1      |
|--|------------------------------|-----------|-------------|
| Develielenewer                         | $ ho_{\scriptscriptstyle A}$ | dB        | -6          |
| Downlink power<br>allocation           | $ ho_{\scriptscriptstyle B}$ | dB        | -6 (Note 1) |
|  | σ                            | dB        | 3           |
| $N_{\scriptscriptstyle oc}$ at antenna | port                         | dBm/15kHz | -98         |
| PDSCH transmission                     | on mode                      |           | 3           |
| Note 1: $P_B = 1$                      |                              |           |             |

| Test   | Band-  | Reference | OCNG     | Propagation | Correlation                            | Reference v                                 | alue        | UE       |
|--------|--------|-----------|----------|-------------|--|---|-------------|----------|
| number | width  | Channel   | Pattern  | Condition   | Matrix and<br>Antenna<br>Configuration | Fraction of<br>Maximum<br>Throughput<br>(%) | SNR<br>(dB) | Category |
| 1      | 10 MHz | R.14 FDD  | OP.1 FDD | EVA70       | 4x2 Low                                | 70  | 14.3        | ≥2       |

# 8.2.1.3.3 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)

The requirements for non-MBSFN ABS are specified in Table 8.2.1.3.3-2, with the addition of parameters in Table 8.2.1.3.3-1 and the downlink physical channel setup according to Annex C.3.2 and Annex C.3.3.

The requirements for MBSFN ABS are specified in Table 8.2.1.3.3-4, with the addition of parameters in Table 8.2.1.3.3-3 and the downlink physical channel setup according to Annex C.3.2 and Annex C.3.3.

The purpose is to verify the performance of large delay CDD with 2 transmitter antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell. In Tables 8.2.1.3.3-1 and 8.2.1.3.3-3, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

| Parameter   |   | Unit  | Cell 1  | Cell 2   |  |
|---|---|---|---|--|--|
|   | $ ho_{\scriptscriptstyle A}$  | dB  | -3  | -3   |  |
| Downlink power allocation   | $ ho_{\scriptscriptstyle B}$  | dB  | -3 (Note 1)   | -3   |  |
|   | σ   | dB  | 0   | N/A  |  |
|   | N <sub>oc1</sub>  | dBm/15kHz   | -102 (Note 2)   | N/A  |  |
| $N_{oc}$ at antenna port  | $N_{oc2}$   | dBm/15kHz   | -98 (Note 3)  | N/A  |  |
|   | $N_{oc3}$   | dBm/15kHz   | -94.8 (Note 4)  | N/A  |  |
| $\widehat{E}_{s}/N_{oc2}$   |   | dB  | Reference Value in Table 8.2.1.3.3-2  | 6  |  |
| BW <sub>Channel</sub>   |   | MHz   | 10  | 10   |  |
| Subframe Configura  | ation   |   | Non-MBSFN   | Non-MBSFN  |  |
| Cell Id   |   |   | 0   | 1  |  |
| Time Offset between   | Cells   | μs  | 2.5 (synchror   | nous cells)  |  |
| ABS pattern (Note   | 5)  |   | N/A   | 11000100,<br>11000000,<br>11000000,<br>11000000,<br>11000000     |  |
| RLM/RRM Measurement Subframe<br>Pattern(Note 6)   |   |   | 10000000<br>10000000<br>10000000<br>10000000<br>1000000   | N/A  |  |
| CSI Subframe Sets (Note   | C <sub>CSI,0</sub>  |   | 11000100<br>11000000<br>11000000<br>11000000<br>11000000  | N/A  |  |
| 7)  | C <sub>CSI,1</sub>  |   | 00111011<br>00111111<br>00111111<br>00111111<br>00111111  | N/A  |  |
| Number of control OFDN  |   |   | 2   |  |  |
| PDSCH transmission  | mode  |   | 3<br>Normal   | N/A  |  |
| Cyclic prefixNote 1: $P_B = 1$ .  |   | <u> </u>  | Normal  | Normal   |  |
| Note 2:This noise is appli<br>overlapping with tNote 3:This noise is appli<br>aggressor ABS.Note 4:This noise is appli<br>Note 5:ABS pattern as de<br>Note 6:Time-domain meat<br>Mote 7:Note 7:As configured acc<br>measurements de | he aggressor A<br>red in OFDM sy<br>red in all OFDM<br>offined in [9].<br>asurement resc<br>ording to the ti<br>fined in [7].<br>ng cell. Cell 2 is | ymbols #1, #2, #3, #5, #6,<br>ABS.<br>ymbols #0, #4, #7, #11 of<br>A symbols of a subframe of<br>purce restriction pattern fo<br>me-domain measurement<br>s the aggressor cell. The r | a subframe overlapping<br>overlapping with aggress<br>r PCell measurements a<br>t resource restriction pa | y with the<br>sor non-ABS<br>as defined in [7].<br>ttern for CSI |  |
| Note 9: SIB-1 will not be transmitted in Cell2 in this test.  |   |   |   |  |  |

### Table 8.2.1.3.3-1: Test Parameters for Large Delay CDD (FRC) – Non-MBSFN ABS

| Test Reference<br>Number Channel |                                  | OCNG Pattern            |                         | Propagation<br>Conditions<br>(Note 1) |                        | Correlation<br>Matrix and<br>Antenna   | Reference Value                                      |                            | UE<br>Category |
|----------------------------------|----------------------------------|-------------------------|-------------------------|---------------------------------------|------------------------|--|--|----------------------------|----------------|
|                                  |                                  | Cell 1                  | Cell 2                  | Cell 1                                | Cell 2                 | Configuration  | Fraction of<br>Maximum<br>Throughput<br>(%) (Note 5) | SNR<br>(dB)<br>(Note<br>2) |                |
| 1                                | R.11 FDD<br>(Note 4)             | OP.1<br>FDD             | OP.1<br>FDD             | EVA 5                                 | EVA 5                  | 2x2 Low  | 70   | 13.3                       | ≥2             |
| Note 1:                          | The propagati                    | on condit               | ions for C              | ell 1 and                             | Cell2 are              | statistically indepe   | endent.  |                            |                |
| Note 2:                          | SNR correspo                     | onds to $\widehat{E}$   | $N_{oc2}$               | of cell 1.                            |                        |  |  |                            |                |
| Note 3:<br>Note 4:               | Cell 1 Referer<br>are transmitte | nce chann<br>d in the s | el is mod<br>erving cel | ified: PDS                            | SCH other<br>e when th | pply for Cell 1 and<br>than SIB1/paging<br>subframe is over<br>definition of the ref | and its associa<br>rlapped with the                  | ABS sub                    |                |
| Note 5:                          |                                  |                         |                         |                                       |                        | al Payload in 9 su   |  |                            | 10ms.          |

Table 8.2.1.3.3-2: Minimum Performance Large Delay CDD (FRC) – Non-MBSFN ABS

| Parameter  |  | Unit   | Cell 1   | Cell 2  |
|--|--|--|--|---|
|  | $ ho_{\scriptscriptstyle A}$   | dB   | -3   | -3  |
| Downlink power allocation  | $ ho_{\scriptscriptstyle B}$   | dB   | -3 (Note 1)  | -3  |
|  | σ  | dB   | 0  | N/A   |
|  | N <sub>oc1</sub>   | dBm/15kHz  | -102 (Note 2)  | N/A   |
| $N_{oc}$ at antenna port   | $N_{oc2}$  | dBm/15kHz  | -98 (Note 3)   | N/A   |
|  | $N_{oc3}$  | dBm/15kHz  | -94.8 (Note 4)   | N/A   |
| $\widehat{E}_{s}/N_{oc2}$  |  | dB   | Reference Value in Table 8.2.1.3.3-4   | 6   |
| BW <sub>Channel</sub>  |  | MHz  | 10   | 10  |
| Subframe Configura   | ation  |  | Non-MBSFN  | MBSFN   |
| Cell Id  |  |  | 0  | 126   |
| Time Offset between  | Cells  | μs   | 2.5 (synchror  | nous cells)   |
| ABS pattern (Note 5)   |  |  | N/A  | 0001000000<br>0100000010<br>0000001000<br>0000000   |
| RLM/RRM Measurement<br>Pattern (Note 6   |  |  | 000100000<br>010000010<br>000001000<br>000000000   | N/A   |
| CSI Subframe Sets (Note  | C <sub>CSI,0</sub>   |  | 000100000<br>010000010<br>000001000<br>000000000   | N/A   |
| 7)   | C <sub>CSI,1</sub>   |  | 1110111111<br>1011111101<br>1111110111<br>1111111  | N/A   |
| MBSFN Subframe Allocation (Note 10)  |  |  | N/A  | 001000<br>100001<br>000100<br>000000  |
| Number of control OFDN   |  |  | 2  |   |
| PDSCH transmission<br>Cyclic prefix  | mode   |  | 3<br>Normal  | N/A<br>Normal   |
| subframe overlap<br>Note 3: This noise is appl<br>Note 4: This noise is appl<br>Note 5: ABS pattern as de<br>MBSFN ABS subt<br>Note 6: Time-domain mea<br>Note 7: As configured acc<br>measurements de<br>Note 8: Cell 1 is the servit<br>Cell2 is the same<br>Note 9: SIB-1 will not be t | ping with the ag<br>ied in OFDM sy<br>ied in all OFDM<br>afined in [9]. The<br>frames.<br>asurement resc<br>cording to the ti<br>offined in [7].<br>Ing cell. Cell 2 is<br>ransmitted in C | ymbol #0 of a subframe of<br>I symbols of a subframe of<br>the 4 <sup>th</sup> , 12 <sup>th</sup> , 19 <sup>th</sup> and 27 <sup>th</sup> s<br>purce restriction pattern fo<br>me-domain measurement<br>is the aggressor cell. The i | verlapping with the aggress<br>overlapping with aggress<br>subframes indicated by A<br>or PCell measurements a<br>t resource restriction par<br>number of the CRS port | ressor ABS.<br>sor non-ABS.<br>ABS pattern are<br>as defined in [7].<br>ttern for CSI<br>s in Cell1 and |
| subframe allocation<br>Note 11: The maximum nu   | on.<br>mber of uplink  | HARQ transmission is lim<br>ptected by MBSFN ABS in  | nited to 2 so that each P  |   |

Table 8.2.1.3.3-3: Test Parameters for Large Delay CDD (FRC) – MBSFN ABS

| Test<br>Number   | Reference<br>Channel | OCNG                  | Pattern          | Cond        | gation<br>itions<br>te 2) | Correlation<br>Matrix and<br>Antenna | Reference Value                                      |                            | UE<br>Category |
|--|----------------------|-----------------------|------------------|-------------|---------------------------|--------------------------------------|--|----------------------------|----------------|
|  |                      | Cell 1                | Cell 2           | Cell 1      | Cell 2                    | Configuration                        | Fraction of<br>Maximum<br>Throughput<br>(%) (Note 5) | SNR<br>(dB)<br>(Note<br>2) |                |
| 1  | R.11 FDD<br>(Note 4) | OP.1<br>FDD           | OP.1<br>FDD      | EVA 5       | EVA 5                     | 2x2 Low                              | 70   | 12.0                       | ≥2             |
| Note 1:  |                      |                       |                  |             | Cell2 are                 | statistically indepe                 | endent.  | •                          | •              |
| Note 2:  | SNR correspo         | onds to $\widehat{E}$ | $_{s}/N_{oc2}$ c | of cell 1.  |                           |                                      |  |                            |                |
| Note 3: The correlation matrix and antenna configuration apply for Cell 1 and Cell 2.<br>Note 4: Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH<br>are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of<br>aggressor cell and the subframe is available in the definition of the reference channel. |                      |                       |                  |             |                           |                                      |  |                            |                |
| Note 5:  | The maximum          | n Through             | put is calo      | culated fro | om the tota               | al Payload in 4 su                   | bframes, averag                                      | ed over 4                  | l0ms.          |

 Table 8.2.1.3.3-4: Minimum Performance Large Delay CDD (FRC) – MBSFN ABS

# 8.2.1.3.4 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements for non-MBSFN ABS are specified in Table 8.2.1.3.4-2, with the addition of parameters in Table 8.2.1.3.4-1. The purpose is to verify the performance of large delay CDD with 2 transmit antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cells with CRS assistance information. In Table 8.2.1.3.4-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 ad Cell3.

| Parameter  |                              | Unit      | Cell 1   | Cell 2   | Cell 3   |  |  |  |
|--|------------------------------|-----------|--|--|--|--|--|--|
|  | $ ho_{\scriptscriptstyle A}$ | dB        | -3   | -3   | -3   |  |  |  |
| Downlink power<br>allocation   | $\rho_{B}$                   | dB        | -3 (Note 1)  | -3 (Note 1)  | -3 (Note 1)  |  |  |  |
| anocation  | σ                            | dB        | 0  | N/A  | N/A  |  |  |  |
|  | N <sub>oc1</sub>             | dBm/15kHz | -98 (Note 2)   | N/A  | N/A  |  |  |  |
| $N_{oc}$ at antenna port   | N <sub>oc2</sub>             | dBm/15kHz | -98 (Note 3)   | N/A  | N/A  |  |  |  |
|  | N <sub>oc3</sub>             | dBm/15kHz | -93 (Note 4)   | N/A  | N/A  |  |  |  |
| $\hat{E}_s/N_{oc2}$  |                              | dB        | Reference Value in<br>Table 8.2.1.3.4-2                  | Reference<br>Value in<br>Table<br>8.2.1.3.4-2            | Reference<br>Value in<br>Table<br>8.2.1.3.4-2            |  |  |  |
| BW <sub>Channel</sub>  |                              | MHz       | 10   | 10   | 10   |  |  |  |
| Subframe Configu   | ration                       |           | Non-MBSFN  | Non-MBSFN  | Non-MBSFN  |  |  |  |
| Time Offset betwee   | n Cells                      | μs        | N/A  | 3  | -1   |  |  |  |
| Frequency shift betwe  | en Cells                     | Hz        | N/A  | 300  | -100   |  |  |  |
| Cell Id  |                              |           | 0  | 1  | 126  |  |  |  |
| ABS pattern (No  | te 5)                        |           | N/A  | 11000000<br>11000000<br>11000000<br>11000000<br>11000000 | 11000000<br>11000000<br>11000000<br>11000000<br>11000000 |  |  |  |
| RLM/RRM Measur<br>Subframe Pattern (I  |                              |           | 10000000<br>10000000<br>10000000<br>10000000<br>1000000  | N/A  | N/A  |  |  |  |
| CSI Subframe Sets  | C <sub>CSI,0</sub>           |           | 11000000<br>11000000<br>11000000<br>11000000<br>11000000 | N/A  | N/A  |  |  |  |
| (Note7)  | C <sub>CSI,1</sub>           |           | 00111111<br>00111111<br>00111111<br>00111111<br>00111111 | N/A  | N/A  |  |  |  |
| Number of control<br>symbols   | OFDM                         |           | 2  | Note 8   | Note 8   |  |  |  |
| PDSCH transmissio  | n mode                       |           | 3  | Note 9   | Note 9   |  |  |  |
| Cyclic prefix  |                              |           | Normal   | Normal   | Normal   |  |  |  |
| <ul> <li>Note 1: P<sub>B</sub> = 1.</li> <li>Note 2: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.</li> <li>Note 3: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.</li> <li>Note 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS Note 5: ABS pattern as defined in [9].</li> <li>Note 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].</li> <li>Note 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].</li> </ul> |                              |           |  |  |  |  |  |  |
| indicated by Note 9: Downlink ph   | "0" of ABS                   | pattern.  | s not available for ABS<br>2 and Cell 3 in accorda       |  |  |  |  |  |
|  |                              |           | Cell 2 and Cell 3 is the                                 | same.  |  |  |  |  |

### Table 8.2.1.3.4-1: Test Parameters for Large Delay CDD (FRC) – Non-MBSFN ABS

Note 11: SIB-1 will not be transmitted in Cell 2 and Cell 3 in this test.

ETSI

| Test<br>Numb       | Refer<br>ence  | $\widehat{E}_s/$ | N <sub>oc2</sub> | 00          | NG Patt                 | ern         |            | opagatio   |           | Correlatio<br>n Matrix                          | Reference   | e Value                    | UE<br>Cate |
|--------------------|--|------------------|------------------|-------------|-------------------------|-------------|------------|------------|-----------|---|---|----------------------------|------------|
| er                 | Chan<br>nel  | Cell<br>2        | Cell<br>3        | Cell 1      | Cell 2                  | Cell 3      | Cell 1     | Cell 2     | Cell 3    | and<br>Antenna<br>Configurat<br>ion (Note<br>2) | Fraction<br>of<br>Maximu<br>m<br>Through<br>put (%)<br>Note 5 | SNR<br>(dB)<br>(Note<br>3) | gory       |
| 1                  | R.11<br>FDD<br>Note<br>4   | 9                | 7                | OP.1<br>FDD | OP.1<br>FDD             | OP.1<br>FDD | EVA5       | EVA5       | EVA5      | 2x2 Low   | 70  | 13.9                       | ≥2         |
| 2                  | R.35<br>FDD<br>Note<br>4   | 9                | 1                | OP.1<br>FDD | OP.1<br>FDD             | OP.1<br>FDD | EVA5       | EVA5       | EVA5      | 2x2 Low   | 70  | 22.6                       | ≥2         |
| Note 1:            | •  |                  |                  |             |                         |             |            |            | •         | ependent.                                       |   |                            |            |
| Note 2:<br>Note 3: |  |                  |                  |             | $\frac{1}{2}$ of cell 1 | •           | n apply f  | or Cell 1, | Cell 2 ar | nd Cell 3.                                      |   |                            |            |
| Note 4:            | 4: Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel. |                  |                  |             |                         |             |            |            |           |   |   |                            |            |
| Note 5:            | The m  | aximun           | n Throu          | ighput is   | calculate               | d from th   | e total Pa | ayload in  | 9 subfrai | mes, averaged                                   | over 40ms.  |                            |            |

### Table 8.2.1.3.4-2: Minimum Performance Large Delay CDD (FRC) – Non-MBSFN ABS

# 8.2.1.4 Closed-loop spatial multiplexing performance

## 8.2.1.4.1 Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Port

The requirements are specified in Table 8.2.1.4.1-2, with the addition of the parameters in Table 8.2.1.4.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with wideband and frequency selective precoding.

| Parameter  |                              | Unit      | Test 1      | Test 2      |  |  |  |
|--|------------------------------|-----------|-------------|-------------|--|--|--|
| Downlink nowor   | $ ho_{\scriptscriptstyle A}$ | dB        | -3          | -3          |  |  |  |
| Downlink power<br>allocation   | $ ho_{\scriptscriptstyle B}$ | dB        | -3 (Note 1) | -3 (Note 1) |  |  |  |
|  | σ                            | dB        | 0           | 0           |  |  |  |
| $N_{\scriptscriptstyle oc}$ at antenna   | port                         | dBm/15kHz | -98         | -98         |  |  |  |
| Precoding granul   | arity                        | PRB       | 6           | 50          |  |  |  |
| PMI delay (Note  | e 2)                         | ms        | 8           | 8           |  |  |  |
| Reporting inter  | val                          | ms        | 1           | 1           |  |  |  |
| Reporting mod  | le                           |           | PUSCH 1-2   | PUSCH 3-1   |  |  |  |
| CodeBookSubsetR<br>on bitmap   | estricti                     |           | 001111      | 001111      |  |  |  |
| PDSCH transmis<br>mode   | sion                         |           | 4           | 4           |  |  |  |
| Note 1: $P_{R} = 1$ .  |                              |           |             |             |  |  |  |
| <ul> <li>Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).</li> </ul> |                              |           |             |             |  |  |  |

| Table 8.2.1.4.1-1: Test Parameters for S | ngle-Layer Spatial Multiplexing (FRC) |
|--|---------------------------------------|
|--|---------------------------------------|

| Test   | Band-  | Reference | OCNG     | Propagation | Correlation                            | Reference v                                 | alue        | UE       |
|--------|--------|-----------|----------|-------------|--|---|-------------|----------|
| number | width  | Channel   | Pattern  | Condition   | Matrix and<br>Antenna<br>Configuration | Fraction of<br>Maximum<br>Throughput<br>(%) | SNR<br>(dB) | Category |
| 1      | 10 MHz | R.10 FDD  | OP.1 FDD | EVA5        | 2x2 Low                                | 70  | -2.5        | ≥1       |
| 2      | 10 MHz | R.10 FDD  | OP.1 FDD | EPA5        | 2x2 High                               | 70  | -2.3        | ≥1       |

 Table 8.2.1.4.1-2: Minimum performance Single-Layer Spatial Multiplexing (FRC)

#### 8.2.1.4.1A Minimum Requirement Single-Layer Spatial Multiplexing 4 Tx Antenna Port

The requirements are specified in Table 8.2.1.4.1A-2, with the addition of the parameters in Table 8.2.1.4.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with wideband and frequency selective precoding.

| Parameter   |                              | Unit      | Test 1   |  |  |  |
|---|------------------------------|-----------|--|--|--|--|
| Downlink nowor  | $ ho_{\scriptscriptstyle A}$ | dB        | -6   |  |  |  |
| Downlink power<br>allocation  | $ ho_{\scriptscriptstyle B}$ | dB        | -6 (Note 1)                                    |  |  |  |
|   | σ                            | dB        | 3  |  |  |  |
| $N_{_{oc}}$ at antenna p  | ort                          | dBm/15kHz | -98  |  |  |  |
| Precoding granula   | arity                        | PRB       | 6  |  |  |  |
| PMI delay (Note   | 2)                           | ms        | 8  |  |  |  |
| Reporting interv  | al                           | ms        | 1  |  |  |  |
| Reporting mode  | e                            |           | PUSCH 1-2                                      |  |  |  |
| CodeBookSubsetRe<br>on bitmap   | estricti                     |           | 00000000000000000<br>00000000000000000<br>0000 |  |  |  |
| PDSCH transmiss   | sion                         |           | 4  |  |  |  |
| mode  |                              |           |  |  |  |  |
| Note 1: $P_{B} = 1$ .   |                              |           |  |  |  |  |
| Note 2: If the UE reports in an available uplink reporting instanc<br>at subrame SF#n based on PMI estimation at a downlin<br>SF not later than SF#(n-4), this reported PMI cannot be<br>applied at the eNB downlink before SF#(n+4). |                              |           |  |  |  |  |

Table 8.2.1.4.1A-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC)

| Test   | Band-  | Reference | OCNG     | Propagation | Correlation                            | Reference value                             |             | UE       |
|--------|--------|-----------|----------|-------------|--|---|-------------|----------|
| number | width  | Channel   | Pattern  | Condition   | Matrix and<br>Antenna<br>Configuration | Fraction of<br>Maximum<br>Throughput<br>(%) | SNR<br>(dB) | Category |
| 1      | 10 MHz | R.13 FDD  | OP.1 FDD | EVA5        | 4x2 Low                                | 70  | -3.2        | ≥1       |

### 8.2.1.4.1B Enhanced Performance Requirement Type A - Single-Layer Spatial Multiplexing 2 Tx Antenna Port with TM4 interference model

The requirements are specified in Table 8.2.1.4.1B-2, with the addition of the parameters in Table 8.2.1.4.1B-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rankone performance with wideband precoding with two transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of two dominant interfering cells applying transmission mode 4 interference model defined in clause B.5.3. In Table 8.2.1.4.1B-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

| Parameter  |  | Unit                               | Cell 1                            | Cell 2                          | Cell 3                          |
|--|--|------------------------------------|-----------------------------------|---------------------------------|---------------------------------|
|  | $ ho_{\scriptscriptstyle A}$                           | dB                                 | -3                                | -3                              | -3                              |
| Downlink power allocation  | $ ho_{\scriptscriptstyle B}$                           | dB                                 | -3 (Note 1)                       | -3                              | -3                              |
|  | σ  | dB                                 | 0                                 | 0                               | 0                               |
| Cell-specific reference  | signals  |                                    | Antenna ports<br>0,1              | Antenna ports<br>0,1            | Antenna ports<br>0,1            |
| $N_{oc}$ at antenna po   | ort  | dBm/15kHz                          | -98                               | N/A                             | N/A                             |
| DIP (Note 2)   |  | dB                                 | N/A                               | -1.73                           | -8.66                           |
| BW <sub>Channel</sub>  |  | MHz                                | 10                                | 10                              | 10                              |
| Cyclic Prefix  |  |                                    | Normal                            | Normal                          | Normal                          |
| Cell Id  |  |                                    | 0                                 | 1                               | 2                               |
| Number of control OFDM   | l symbols  |                                    | 2                                 | 2                               | 2                               |
| PDSCH transmission   |  |                                    | 6                                 | N/A                             | N/A                             |
| Interference mod   |  |                                    | N/A                               | As specified in<br>clause B.5.3 | As specified in<br>clause B.5.3 |
| Probability of occurrence of   | Rank 1   | %                                  | N/A                               | 80                              | 80                              |
| transmission rank in<br>interfering cells  | Rank 2   | %                                  | N/A                               | 20                              | 20                              |
| Precoding granula  | rity   | PRB                                | 50                                | 6                               | 6                               |
| PMI delay (Note  |  | ms                                 | 8                                 | N/A                             | N/A                             |
| Reporting interva  | al   | ms                                 | 5                                 | N/A                             | N/A                             |
| Reporting mode   |  |                                    | PUCCH 1-1                         | N/A                             | N/A                             |
| CodeBookSubsetRestrict   | on bitmap  |                                    | 001111                            | N/A                             | N/A                             |
| Note 1: $P_{R} = 1$  |  |                                    |                                   |                                 |                                 |
| Note 2: The respective red   | ceived power   | spectral density of                | of each interfering               | cell relative to $N_a$          | $_{c}$ is defined by            |
| its associated DIP<br>Note 3: Cell 1 is the servir<br>Note 4: If the UE reports in<br>at a downlink SF r<br>before SF#(n+4).<br>Note 5: All cells are time-s | ng cell. Cell 2,<br>n an available<br>not later than s | 3 are the interferuplink reporting | ring cells.<br>instance at subrar |                                 |                                 |

# Table 8.2.1.4.1B-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC) with TM4 interference model

# Table 8.2.1.4.1B-2: Enhanced Performance Requirement Type A, Single-Layer Spatial Multiplexing (FRC) with TM4 interference model

| Test<br>Number | Reference<br>Channel   | OCI                 | NG Pat    | tern      |           | opagat<br>onditio |           | Correlation<br>Matrix and             | Reference                                   | Value UE<br>Cate            |      |
|----------------|--|---------------------|-----------|-----------|-----------|-------------------|-----------|---------------------------------------|---|-----------------------------|------|
|                |  | Cell<br>1           | Cell<br>2 | Cell<br>3 | Cell<br>1 | Cell<br>2         | Cell<br>3 | Antenna<br>Configurati<br>on (Note 3) | Fraction of<br>Maximum<br>Throughput<br>(%) | SINR<br>(dB)<br>(Note<br>2) | gory |
| 1              | R.47 FDD   | OP.<br>1<br>FD<br>D | N/A       | N/A       | EV<br>A5  | EV<br>A5          | EV<br>A5  | 2x2 Low                               | 70  | 0.8                         | ≥1   |
| Note 1:        |  |                     |           |           |           |                   |           | e statistically inc                   | dependent.                                  |                             |      |
| Note 2:        | Note 2: SINR corresponds to $\hat{E}_s / N_{oc}$ of Cell 1 as defined in clause 8.1.1. |                     |           |           |           |                   |           |                                       |   |                             |      |
| Note 3:        | Correlation ma   | trix and            | anten     | na conf   | iguratic  | on para           | meters    | apply for each o                      | f Cell 1, Cell 2 a                          | nd Cell 3.                  |      |

# 8.2.1.4.1C Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Ports (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements are specified in Table 8.2.1.4.1C-2, with the addition of parameters in Table 8.2.1.4.1C-1. The purpose is to verify the closed loop rank-one performance with wideband precoding if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell with CRS assistance information. In Table 8.2.1.4.1C-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

| Parameter                             |                              | Unit      | Cell 1   | Cell 2   | Cell 3   |
|---------------------------------------|------------------------------|-----------|--|--|--|
|                                       | $ ho_{\scriptscriptstyle A}$ | dB        | -3   | -3   | -3   |
| Downlink power<br>allocation          | $ ho_{\scriptscriptstyle B}$ | dB        | -3 (Note 1)  | -3 (Note 1)  | -3 (Note 1)  |
| anocation                             | σ                            | dB        | 0  | N/A  | N/A  |
|                                       | N <sub>oc1</sub>             | dBm/15kHz | -98 (Note 2)   | N/A  | N/A  |
| $N_{oc}$ at antenna port              | $N_{oc2}$                    | dBm/15kHz | -98 (Note 3)   | N/A  | N/A  |
|                                       | N <sub>oc3</sub>             | dBm/15kHz | -93 (Note 4)   | N/A  | N/A  |
| $\widehat{E}_{s}/N_{oc2}$             |                              | dB        | Reference Value in Table 8.2.1.4.1C-2                    | 12   | 10   |
| BW <sub>Channel</sub>                 |                              | MHz       | 10   | 10   | 10   |
| Subframe Configu                      | ration                       |           | Non-MBSFN  | Non-MBSFN  | Non-MBSFN  |
| Time Offset betwee                    | n Cells                      | μs        | N/A  | 3  | -1   |
| Frequency shift betwe                 | en Cells                     | Hz        | N/A  | 300  | -100   |
| Cell Id                               |                              |           | 0  | 126  | 1  |
| ABS pattern (Note 5)                  |                              |           | N/A  | 11000000<br>11000000<br>11000000<br>11000000<br>11000000 | 11000000<br>11000000<br>11000000<br>11000000<br>11000000 |
| RLM/RRM Measur<br>Subframe Pattern (I |                              |           | 10000000<br>10000000<br>10000000<br>10000000<br>1000000  | N/A  | N/A  |
| CSI Subframe Sets                     | C <sub>CSI,0</sub>           |           | 11000000<br>11000000<br>11000000<br>11000000<br>11000000 | N/A  | N/A  |
| (Note7)                               | C <sub>CSI,1</sub>           |           | 00111111<br>00111111<br>00111111<br>00111111<br>00111111 | N/A  | N/A  |
| Number of control of symbols          | OFDM                         |           | 2  | Note 8   | Note 8   |
| PDSCH transmission mode               |                              |           | 6  | Note 9   | Note 9   |
| Precoding granularity                 |                              | PRB       | 50   | N/A  | N/A  |
| PMI delay (Note                       |                              | ms        | 8  | N/A  | N/A  |
| Reporting inter                       |                              | ms        | 1  | N/A  | N/A  |
| Peporting mod                         |                              |           | PUSCH 3-1  | N/A  | N/A  |
| CodeBookSubsetRe<br>bitmap            |                              |           | 1111   | N/A  | N/A  |
| Cyclic prefix                         |                              |           | Normal   | Normal   | Normal   |

Table 8.2.1.4.1C-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC) – Non-MBSFN ABS

| Note 1:  | $P_B = 1$ .  |
|----------|--|
| Note 2:  | This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe |
|          | overlapping with the aggressor ABS.  |
| Note 3:  | This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the     |
|          | aggressor ABS.   |
| Note 4:  | This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS   |
| Note 5:  | ABS pattern as defined in [9].   |
| Note 6:  | Time-domain measurement resource restriction pattern for PCell measurements as defined in    |
|          | [7]  |
| Note 7:  | As configured according to the time-domain measurement resource restriction pattern for CSI  |
|          | measurements defined in [7].   |
| Note 8:  | The number of control OFDM symbols is not available for ABS and is 2 for the subframe        |
|          | indicated by "0" of ABS pattern.   |
| Note 9:  | Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying |
|          | OCNG pattern as defined in Annex A.5.  |
| Note 10: | If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI     |
|          | estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at  |
|          | the eNB downlink before SF#(n+4).  |
| Note 11: | The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.                        |
| Note 12: |  |

#### Table 8.2.1.4.1C-2: Minimum Performance Single-Layer Spatial Multiplexing (FRC)- Non-MBSFN ABS

| Test<br>Number | Reference<br>Channel  | 00                | NG Patt                  | G Pattern Propagation<br>Conditions (Note1) |           |           | Correlation Reference Value Matrix and |                                       |  | UE<br>Cate                 |      |
|----------------|---|-------------------|--------------------------|---|-----------|-----------|--|---------------------------------------|--|----------------------------|------|
|                |   | Cell 1            | Cell 2                   | Cell 3                                      | Cell 1    | Cell 2    | Cell 3                                 | Antenna<br>Configurati<br>on (Note 2) | Fraction of<br>Maximum<br>Throughput<br>(%) Note 5 | SNR<br>(dB)<br>(Note<br>3) | gory |
| 1              | R.11 FDD  | OP.1              | OP.1                     | OP.1  | EPA5      | EPA5      | EPA5                                   | 2x2 High                              | 70   | 6.1                        | ≥2   |
|                | Note 4  | FDD               | FDD                      | FDD   |           |           |  |                                       |  |                            |      |
| Note 1:        |   |                   |                          |   |           |           |  | ally independen                       |  |                            |      |
| Note 2:        |   |                   |                          |   | iguration | apply for | Cell 1, C                              | cell 2 and Cell 3.                    |  |                            |      |
| Note 3:        | SNR correspo  | onds to $\hat{I}$ | $\hat{E}_s / N_{oc2}$ of | of cell 1.                                  |           |           |  |                                       |  |                            |      |
| Note 4:        | Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel. |                   |                          |   |           |           |  |                                       |  |                            |      |
| Note 5:        | The maximun   | n Throug          | hput is ca               | alculated                                   | from the  | total Pay | load in 9                              | subframes, ave                        | raged over 40ms                                    | S.                         |      |

### 8.2.1.4.2 Minimum Requirement Multi-Layer Spatial Multiplexing 2 Tx Antenna Port

The requirements are specified in Table 8.2.1.4.2-2, with the addition of the parameters in Table 8.2.1.4.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

| Parameter   |                              | Unit      | Test 1-2    |  |  |  |
|---|------------------------------|-----------|-------------|--|--|--|
| Downlink nower  | $ ho_{\scriptscriptstyle A}$ | dB        | -3          |  |  |  |
| Downlink power<br>allocation  | $ ho_{\scriptscriptstyle B}$ | dB        | -3 (Note 1) |  |  |  |
|   | σ                            | dB        | 0           |  |  |  |
| $N_{_{oc}}$ at antenna  | port                         | dBm/15kHz | -98         |  |  |  |
| Precoding granu   | Ilarity                      | PRB       | 50          |  |  |  |
| PMI delay (Not  | e 2)                         | ms        | 8           |  |  |  |
| Reporting inte  | rval                         | ms        | 1           |  |  |  |
| Reporting mo  | de                           |           | PUSCH 3-1   |  |  |  |
| CodeBookSubsetRo<br>bitmap  | estriction                   |           | 110000      |  |  |  |
| PDSCH transmission  | on mode                      |           | 4           |  |  |  |
| Note 1: $P_B = 1$ .   |                              |           |             |  |  |  |
| Note 2: If the UE reports in an available uplink reporting instance<br>at subrame SF#n based on PMI estimation at a downlink<br>SF not later than SF#(n-4), this reported PMI cannot be<br>applied at the eNB downlink before SF#(n+4). |                              |           |             |  |  |  |

Table 8.2.1.4.2-1: Test Parameters for Multi-Layer Spatial Multiplexing (FRC)

| Test   | Band-  | Reference | OCNG     | Propagation | Correlation                            | Reference value                             |             | UE       |
|--------|--------|-----------|----------|-------------|--|---|-------------|----------|
| number | width  | Channel   | Pattern  | Condition   | Matrix and<br>Antenna<br>Configuration | Fraction of<br>Maximum<br>Throughput<br>(%) | SNR<br>(dB) | Category |
| 1      | 10 MHz | R.35 FDD  | OP.1 FDD | EPA5        | 2x2 Low                                | 70  | 18.9        | ≥2       |
| 2      | 10 MHz | R.11 FDD  | OP.1 FDD | ETU70       | 2x2 Low                                | 70  | 14.3        | ≥2       |

### 8.2.1.4.3 Minimum Requirement Multi-Layer Spatial Multiplexing 4 Tx Antenna Port

For single carrier the requirements are specified in Table 8.2.1.4.3-2, with the addition of the parameters in Table 8.2.1.4.3-1 and the downlink physical channel setup according to Annex C.3.2. For CA the requirements are specified in Table 8.2.1.4.3-4, with the addition of the parameters in Table 8.2.1.4.3-3 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

Table 8.2.1.4.3-1: Test Parameters for Multi-Layer Spatial Multiplexing (FRC)

| Parameter                    |                              | Unit | Test 1      |
|------------------------------|------------------------------|------|-------------|
| Downlink nower               | $ ho_{\scriptscriptstyle A}$ | dB   | -6          |
| Downlink power<br>allocation | $ ho_{\scriptscriptstyle B}$ | dB   | -6 (Note 1) |
|                              | σ                            | dB   | 3           |

| $N_{\scriptscriptstyle oc}$ at antenna port  | dBm/15kHz | -98                                     |  |  |  |
|--|-----------|---|--|--|--|
| Precoding granularity  | PRB       | 6                                       |  |  |  |
| PMI delay (Note 2)   | ms        | 8                                       |  |  |  |
| Reporting interval   | ms        | 1                                       |  |  |  |
| Reporting mode   |           | PUSCH 1-2                               |  |  |  |
| CodeBookSubsetRestrictio   |           | 000000000000000000000000000000000000000 |  |  |  |
| n bitmap   |           | 000000111111111111111100                |  |  |  |
|  |           | 0000000000000                           |  |  |  |
| PDSCH transmission mode  |           | 4                                       |  |  |  |
| Note 1: $P_B = 1$ .  |           |   |  |  |  |
| Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4). |           |   |  |  |  |
| Note 3: Void.  |           |   |  |  |  |
| Note 4: Void.  |           |   |  |  |  |
| Note 5: Void.  |           |   |  |  |  |

| Table 8.2.1.4.3-2: Minimum pe | erformance Multi-Layer | Spatial Multiplexing (FRC) |
|-------------------------------|------------------------|----------------------------|
|-------------------------------|------------------------|----------------------------|

|              |                |                  |                                       | Propa- | Correlation                      | Reference v                                 |             |                     |
|--------------|----------------|------------------|---------------------------------------|--------|----------------------------------|---|-------------|---------------------|
| Test<br>num. | Band-<br>width | Referencechannel | OCNG gation<br>pattern condi-<br>tion |        | matrix and<br>antenna<br>config. | Fraction of<br>maximum<br>throughput<br>(%) | SNR<br>(dB) | UE<br>cate-<br>gory |
| 1            | 10<br>MHz      | R.36 FDD         | OP.1<br>FDD                           | EPA5   | 4x2 Low                          | 70  | 14.7        | ≥2                  |
| Note 1       | : Void         |                  |                                       |        |                                  |   |             |                     |

# Table 8.2.1.4.3-3: Test Parameters for Multi-Layer Spatial Multiplexing (FRC) for CA

| Parameter  |   | Unit               | Test 1              | Test 2              |  |  |  |
|--|---|--------------------|---------------------|---------------------|--|--|--|
| Deverliek zewer  | $ ho_{\scriptscriptstyle A}$  | dB                 | -6                  | -6                  |  |  |  |
| Downlink power<br>allocation   | $ ho_{\scriptscriptstyle B}$  | dB                 | -6 (Note 1)         | -6 (Note 1)         |  |  |  |
|  | σ   | dB                 | 3                   | 3                   |  |  |  |
| $N_{\it oc}$ at antenna  | port  | dBm/15kHz          | -98                 | -98                 |  |  |  |
| Precoding granu  | Ilarity   | PRB                | 6                   | 8                   |  |  |  |
| PMI delay (Not   | e 2)  | ms                 | 8                   | 8                   |  |  |  |
| Reporting inter  | rval  | ms                 | 1                   | 1                   |  |  |  |
| Reporting mo   | de  |                    | PUSCH 1-2           | PUSCH 1-2           |  |  |  |
| CodeBookSubsetRe   | estriction  |                    | 000000000000000000  | 000000000000000000  |  |  |  |
| bitmap   |   |                    | 000000000000000000  | 0000000000000000000 |  |  |  |
|  |   |                    | 0000001111111       | 0000001111111       |  |  |  |
|  |   |                    | 1111111110000       | 1111111110000       |  |  |  |
|  |   |                    | 000000000000        | 000000000000        |  |  |  |
| CSI request field (  | Note 3)   |                    | '1                  | 0'                  |  |  |  |
| PDSCH transmission   | on mode   |                    | 4                   |                     |  |  |  |
| Note 1: $P_B = 1$ .  |   |                    |                     |                     |  |  |  |
| Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4). |   |                    |                     |                     |  |  |  |
| Note 3: Multiple Collayers.  | Multiple CC-s under test are configured as the 1 <sup>st</sup> set of serving cells by higher |                    |                     |                     |  |  |  |
|  |   |                    |                     |                     |  |  |  |
| Note 5: The same   | PDSCH tra   | insmission mode is | applied to each con | nponent carrier.    |  |  |  |

|              |   |                  |                         | Bropo                              | Propa- Correlation               | Reference                                   |             |                  |
|--------------|---|------------------|-------------------------|------------------------------------|----------------------------------|---|-------------|------------------|
| Test<br>num. | Band-<br>width                                | Referencechannel | OCNG<br>pattern         | Propa-<br>gation<br>condi-<br>tion | matrix and<br>antenna<br>config. | Fraction of<br>maximum<br>throughput<br>(%) | SNR<br>(dB) | UE cate-<br>gory |
| 1            | 2x10<br>MHz                                   | R.14 FDD         | OP.1<br>FDD<br>(Note 1) | EVA5                               | 4x2 Low                          | 70  | 10.8        | ≥3               |
| 2            | 2x20<br>MHz                                   | R.14-3 FDD       | OP.1<br>FDD<br>(Note 1) | EVA5                               | 4x2 Low                          | 70  | 10.9        | ≥5               |
| Note 1:      | Note 1: The OCNG pattern applies for each CC. |                  |                         |                                    |                                  |   |             |                  |
| Note 2       |   |                  |                         |                                    |                                  |   |             |                  |
|              | in 8.1.2                                      | 2.3.             |                         |                                    |                                  |   |             |                  |

Table 8.2.1.4.3-4: Minimum performance Multi-Layer Spatial Multiplexing (FRC) for CA

#### 8.2.1.5 MU-MIMO

# 8.2.1.6 [Control channel performance: D-BCH and PCH]

# 8.2.1.7 Carrier aggregation with power imbalance

The requirements in this section verify the ability of an intraband adjancent carrier aggregation UE to demodulate the signal transmitted by the PCell in the presence of a stronger SCell signal on an adjacent frequency. Throughput is measured on the PCell only.

#### 8.2.1.7.1 Minimum Requirement

For CA the requirements are specified in Table 8.2.1.7.1-2, with the addition of the parameters in Table 8.2.1.7.1-1 and the downlink physical channel setup according to Annex C.3.2.

| Paramete  | er                           | Unit      | Test 1           |  |
|---|------------------------------|-----------|------------------|--|
| Develiates  | $ ho_{\scriptscriptstyle A}$ | dB        | 0                |  |
| Downlink power<br>allocation  | $ ho_{\scriptscriptstyle B}$ | dB        | 0 (Note 1)       |  |
|   | σ                            | dB        | 0                |  |
| $\hat{E}_{s}$ – $^{PCell}$ at anten PCell   | na port of                   | dBm/15kHz | -85              |  |
| $\hat{E}_{s}$ _SCell at anten Scell   | na port of                   | dBm/15kHz | -79              |  |
| $N_{oc}$ at antenn  | a port                       | dBm/15kHz | Off (Note 2)     |  |
| Symbols for unus  | ed PRBs                      |           | OCNG<br>(Note 3) |  |
| Modulatio   | n                            |           | 64 QAM           |  |
| Maximum number<br>transmissio   |                              |           | 1                |  |
| Redundancy versi sequence   | •                            |           | {0}              |  |
| PDSCH transmiss<br>of PCell   |                              |           | 1                |  |
| PDSCH tramsmiss<br>of SCell   | sion mode                    |           | 3                |  |
| Note 1: $P_{B} = 0$ .   |                              |           |                  |  |
| Note 2:No external noise sources are appliedNote 3:These physical resource blocks are assigned to<br>an arbitrary number of virtual UEs with one<br>PDSCH per virtual UE; the data transmitted over<br>the OCNG PDSCHs shall be uncorrelated.<br>pseudo random data, which is QPSK modulated.Note 4:Void. |                              |           |                  |  |

Table 8.2.1.7.1-1: Test Parameters for CA

| Table 8.2.1.7.1-2: Minimum | performance | (FRC) for CA |
|----------------------------|-------------|--------------|
|----------------------------|-------------|--------------|

| Test<br>Number     | Band-<br>width |  | rence<br>nnel | OCNG        | OCNG Pattern |       | Pattern Propagation<br>Conditions |       | Correlation<br>Matrix and<br>Antenna |       | Reference value<br>Fraction of<br>Maximum<br>Throughput (%) |    | UE<br>Category |
|--------------------|----------------|--|---------------|-------------|--------------|-------|-----------------------------------|-------|--------------------------------------|-------|---|----|----------------|
|                    |                | PCell  | SCell         | PCell       | SCell        | PCell | SCell                             | PCell | SCell                                | PCell | SCell   |    |                |
| 1                  | 2x20M<br>Hz    | R.49<br>FDD  | NA            | OP.1<br>FDD | OP.5<br>FDD  | AWGN  | Clause<br>B.1                     | 1x2   | 2x2                                  | 85%   | NA  | ≥5 |                |
| Note 1:<br>Note 2: | the cor        | CNG pattern for PCell is used to fill the control channel. The OCNG pattern for SCell is used to fill ntrol channel and PDSCH.<br>pplicability of requirements for different CA configurations and bandwidth combination sets is defined |               |             |              |       |                                   |       |                                      |       |   |    |                |

# 8.2.1.8 Intra-band non-contiguous carrier aggregation with timing offset

The requirements in this section verify the ability of an intraband non-contiguous carrier aggregation UE to demodulate the signal transmitted by the PCell and SCell in the presence of timing offset between the cells. Throughput is measured on both cells.

### 8.2.1.8.1 Minimum Requirement

For CA the requirements are specified in Table 8.2.1.8.1-2, with the addition of the parameters in Table 8.2.1.8.1-1 and the downlink physical channel setup according to Annex C.3.2.

| Paramete                              | er   | Unit      | Test 1      |  |  |
|---------------------------------------|--|-----------|-------------|--|--|
| Downlink nowor                        | $ ho_{\scriptscriptstyle A}$                                       | dB        | -3          |  |  |
| Downlink power<br>allocation          | $ ho_{\scriptscriptstyle B}$                                       | dB        | -3 (Note 1) |  |  |
|                                       | σ  | dB        | 0           |  |  |
| $N_{\scriptscriptstyle oc}$ at antenn | a port   | dBm/15kHz | -98         |  |  |
| Modulatio                             | n  |           | 64 QAM      |  |  |
| Maximum number<br>transmissio         |  |           | 4           |  |  |
| Redundancy versions sequence          | -  |           | {0,0,1,2}   |  |  |
| PDSCH transmiss<br>of PCell           | ion mode   |           | 3           |  |  |
| PDSCH tramsmiss<br>of SCell           | sion mode  |           | 3           |  |  |
| Note 1: $P_B = 1$ .                   | $P_{\rm B} = 1$ .  |           |             |  |  |
| Note 2: The OC                        | The OCNG pattern is used to fill unused control channel and PDSCH. |           |             |  |  |

| <b>T</b>      |            | <b>-</b>   |        |
|---------------|------------|------------|--------|
| Table 8.2.1.8 | .1-1: Test | Parameters | tor CA |

Table 8.2.1.8.1-2: Minimum performance (FRC) for CA

| Test<br>Number | Cell  | Band-<br>width | Reference<br>Channel | OCNG<br>Pattern | Propagati<br>on | Correlati<br>on Matrix | Refence va                                  | alue        | Timing relative to | UE<br>Catego |  |
|----------------|-------|----------------|----------------------|-----------------|-----------------|------------------------|---|-------------|--------------------|--------------|--|
|                |       |                |                      |                 | Conditions      | and<br>Antenna         | Fraction of<br>Maximum<br>Throughput<br>(%) | SNR<br>(dB) | PCell<br>(µs)      | ry           |  |
| 1              | PCell | 10MH<br>z      | R.YY<br>FDD          | OP.1            | EPA200          | 2x2 Low                | 70  | [21.1<br>5] | N/A                | ≥3           |  |
|                | SCell | 10MH<br>z      | R.35-3<br>FDD        | FDD             | EPA200          | 2x2 Low                | 60  | [15.1<br>8] | -30.26             |              |  |

NOTE: The EPA200 propagation channels applied to PCell and SCell are statistically independent.

# 8.2.2 TDD (Fixed Reference Channel)

The parameters specified in Table 8.2.2-1 are valid for all TDD tests unless otherwise stated.

| Parameter  | Unit   | Value  |
|--|--|--|
| Uplink downlink<br>configuration (Note 1)                    |  | 1  |
| Special subframe configuration (Note 2)                      |  | 4  |
| Cyclic prefix  |  | Normal   |
| Cell ID  |  | 0  |
| Inter-TTI Distance   |  | 1  |
| Number of HARQ<br>processes per<br>component carrier         | Processes                                      | 7  |
| Maximum number of<br>HARQ transmission                       |  | 4  |
| Redundancy version<br>coding sequence                        |  | {0,1,2,3} for QPSK and 16QAM<br>{0,0,1,2} for 64QAM  |
| Number of OFDM<br>symbols for PDCCH per<br>component carrier | OFDM symbols                                   | 4 for 1.4 MHz bandwidth, 3 for 3 MHz and<br>5 MHz bandwidths,<br>2 for 10 MHz, 15 MHz and 20 MHz<br>bandwidths |
| Cross carrier scheduling                                     |  | Not configured   |
|  | Table 4.2-2 in TS 36.<br>Table 4.2-1 in TS 36. |  |

#### Table 8.2.2-1: Common Test Parameters (TDD)

# 8.2.2.1 Single-antenna port performance

The single-antenna performance in a given multi-path fading environments is determined by the SNR for which a certain relative information bit throughput of the reference measurement channels in Annex A.3.4 is achieved. The purpose of these tests is to verify the single-antenna performance with different channel models and MCS. The QPSK and 64QAM cases are also used to verify the performance for all bandwidths specified in Table 5.6.1-1.

### 8.2.2.1.1 Minimum Requirement

For single carrier the requirements are specified in Table 8.2.2.1.1-2, with the addition of the parameters in Table 8.2.2.1.1-1 and the downlink physical channel setup according to Annex C.3.2. For CA the requirements are specified in Table 8.2.2.1.1-4, with the addition of the parameters in Table 8.2.2.1.1-3 and the downlink physical channel setup according to Annex C.3.2.

| Paramete            | r                            | Unit | Test 1- 5  | Test 6-8   | Test 9- 15 | Test 16- 18 | Test 19    |
|---------------------|------------------------------|------|------------|------------|------------|-------------|------------|
| Downlink            | $ ho_{\scriptscriptstyle A}$ | dB   | 0          | 0          | 0          | 0           | 0          |
| power<br>allocation | $ ho_{\scriptscriptstyle B}$ | dB   | 0 (Note 1) | 0 (Note 1) | 0 (Note 1) | 0 (Note 1)  | 0 (Note 1) |

#### Table 8.2.2.1.1-1: Test Parameters

|                  | σ   | dB             | 0              | 0               | 0              | 0                | 0            |  |
|------------------|---|----------------|----------------|-----------------|----------------|------------------|--------------|--|
| $N_{oc}$ at ante | enna  | dBm/15kHz      | -98            | -98             | -98            | -98              | -98          |  |
| port             | ,   |                | 0010           | 0010            | 0010           | 00110            | 00110        |  |
| Symbols          |   |                | OCNG           | OCNG            | OCNG           | OCNG             | OCNG         |  |
| unused Pl        | RBs   |                | (Note 2)       | (Note 2)        | (Note 2)       | (Note 2)         | (Note 2)     |  |
| Modulati         | on  |                | QPSK           | 16QAM           | 64QAM          | 16QAM            | QPSK         |  |
| ACK/NA           | CK  |                | Multiplexing   | Multiplexing    | Multiplexing   | Multiplexing     | Multiplexing |  |
| feedback n       | node  |                |                |                 |                |                  |              |  |
| PDSCH            | 1   |                | 1              | 1               | 1              | 1                | 1            |  |
| transmission     | mode  |                |                |                 |                |                  |              |  |
| Note 1: P        | =0  |                |                |                 |                |                  |              |  |
| Note 2: Th       | ese phy   | sical resource | blocks are ass | igned to an arl | oitrary number | of virtual UEs v | with one     |  |
| PI               | PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated |                |                |                 |                |                  |              |  |
|                  | pseudo random data, which is QPSK modulated.  |                |                |                 |                |                  |              |  |
|                  | oid.  |                |                |                 |                |                  |              |  |
| Note 4: Vo       | oid.  |                |                |                 |                |                  |              |  |

| Table 8.2.2.1.1-2: | Minimum | performance | (FRC) |
|--------------------|---------|-------------|-------|
|                    |         |             |       |

| Test   | Bandwidth | Reference | OCNG        | Propagation | Correlation                            | Reference v                                 | value       | UE       |
|--------|-----------|-----------|-------------|-------------|--|---|-------------|----------|
| number |           | Channel   | Pattern     | Condition   | Matrix and<br>Antenna<br>Configuration | Fraction of<br>Maximum<br>Throughput<br>(%) | SNR<br>(dB) | Category |
| 1      | 10 MHz    | R.2 TDD   | OP.1<br>TDD | EVA5        | 1x2 Low                                | 70  | -1.2        | ≥1       |
| 2      | 10 MHz    | R.2 TDD   | OP.1<br>TDD | ETU70       | 1x2 Low                                | 70  | -0.6        | ≥1       |
| 3      | 10 MHz    | R.2 TDD   | OP.1<br>TDD | ETU300      | 1x2 Low                                | 70  | -0.2        | ≥1       |
| 4      | 10 MHz    | R.2 TDD   | OP.1<br>TDD | HST         | 1x2                                    | 70  | -2.6        | ≥1       |
| 5      | 1.4 MHz   | R.4 TDD   | OP.1<br>TDD | EVA5        | 1x2 Low                                | 70  | 0.0         | ≥1       |
| 6      | 10 MHz    | R.3 TDD   | OP.1<br>TDD | EVA5        | 1x2 Low                                | 70  | 6.7         | ≥2       |
|        | 5 MHz     | R.3-1 TDD | OP.1<br>TDD | EVA5        | 1x2 Low                                | 70  | 6.7         | 1        |
| 7      | 10 MHz    | R.3 TDD   | OP.1<br>TDD | ETU70       | 1x2 Low                                | 30  | 1.4         | ≥2       |
|        | 5 MHz     | R.3-1 TDD | OP.1<br>TDD | ETU70       | 1x2 Low                                | 30  | 1.4         | 1        |
| 8      | 10 MHz    | R.3 TDD   | OP.1<br>TDD | ETU300      | 1x2 High                               | 70  | 9.3         | ≥2       |
|        | 5 MHz     | R.3-1 TDD | OP.1<br>TDD | ETU300      | 1x2 High                               | 70  | 9.3         | 1        |
| 9      | 3 MHz     | R.5 TDD   | OP.1<br>TDD | EVA5        | 1x2 Low                                | 70  | 17.6        | ≥1       |
| 10     | 5 MHz     | R.6 TDD   | OP.1<br>TDD | EVA5        | 1x2 Low                                | 70  | 17.6        | ≥2       |
|        | 5 MHz     | R.6-1 TDD | OP.1<br>TDD | EVA5        | 1x2 Low                                | 70  | 17.6        | 1        |
| 11     | 10 MHz    | R.7 TDD   | OP.1<br>TDD | EVA5        | 1x2 Low                                | 70  | 17.6        | ≥2       |
|        | 10 MHz    | R.7-1 TDD | OP.1<br>TDD | EVA5        | 1x2 Low                                | 70  | 17.6        | 1        |
| 12     | 10 MHz    | R.7 TDD   | OP.1<br>TDD | ETU70       | 1x2 Low                                | 70  | 19.1        | ≥2       |
|        | 10 MHz    | R.7-1 TDD | OP.1<br>TDD | ETU70       | 1x2 Low                                | 70  | 19.1        | 1        |
| 13     | 10 MHz    | R.7 TDD   | OP.1<br>TDD | EVA5        | 1x2 High                               | 70  | 19.1        | ≥2       |
|        | 10 MHz    | R.7-1 TDD | OP.1<br>TDD | EVA5        | 1x2 High                               | 70  | 19.1        | 1        |

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| 14      | 15 MHz   | R.8 TDD    | OP.1<br>TDD | EVA5  | 1x2 Low | 70 | 17.8 | ≥2 |
|---------|----------|------------|-------------|-------|---------|----|------|----|
|         |          |            |             |       |         |    |      |    |
|         | 15 MHz   | R.8-1 TDD  | OP.1        | EVA5  | 1x2 Low | 70 | 17.8 | 1  |
|         |          |            | TDD         |       |         |    |      |    |
| 15      | 20 MHz   | R.9 TDD    | OP.1        | EVA5  | 1x2 Low | 70 | 17.7 | ≥3 |
|         |          |            | TDD         |       |         |    |      |    |
|         | 20 MHz   | R.9-2 TDD  | OP.1        | EVA5  | 1x2 Low | 70 | 17.7 | 2  |
|         |          |            | TDD         |       |         |    |      | _  |
|         | 20 MHz   | R.9-1 TDD  | OP.1        | EVA5  | 1x2 Low | 70 | 17.7 | 1  |
|         | 20 10112 | 14.5 1 100 | TDD         | LVNO  |         | 70 |      | I  |
| 16      | 3 MHz    | R.0 TDD    | OP.1        | ETU70 | 1x2 Low | 30 | 2.1  | ≥1 |
|         |          |            | TDD         |       |         |    |      |    |
| 17      | 10 MHz   | R.1 TDD    | OP.1        | ETU70 | 1x2 Low | 30 | 2.0  | ≥1 |
|         |          |            | TDD         |       |         |    |      |    |
| 18      | 20 MHz   | R.1 TDD    | OP.1        | ETU70 | 1x2 Low | 30 | 2.1  | ≥1 |
|         |          |            | TDD         |       |         |    |      |    |
| 19      | 10 MHz   | R.41 TDD   | OP.1        | EVA5  | 1x2 Low | 70 | -5.3 | ≥1 |
|         |          |            | TDD         |       |         |    |      |    |
| Note 1: | Void     | •          |             | •     |         | -  |      |    |
|         |          |            |             |       |         |    |      |    |

# Table 8.2.2.1.1-3: Test Parameters for CA

|                   | Parameter   | Unit              | Test 1  |  |  |  |  |  |
|-------------------|---|-------------------|---|--|--|--|--|--|
| Downlink<br>power | $\rho_{\scriptscriptstyle A}$   | dB                | 0   |  |  |  |  |  |
| allocation        | $ ho_{\scriptscriptstyle B}$  | dB                | 0 (Note 1)  |  |  |  |  |  |
|                   | σ   | dB                | 0   |  |  |  |  |  |
| N                 | $T_{oc}$ at antenna port  | dBm/15kHz         | -98   |  |  |  |  |  |
| Symb              | ools for unused PRBs  |                   | OCNG (Note 2)                                     |  |  |  |  |  |
|                   | Modulation  |                   | QPSK  |  |  |  |  |  |
| ACK/N             | NACK feedback mode  |                   | PUCCH format 1b with channel selection            |  |  |  |  |  |
| PDSC              | H transmission mode   |                   | 1   |  |  |  |  |  |
| Note 1:           | $P_B = 0$   |                   |   |  |  |  |  |  |
| Note 2:           | These physical resource blo   | ocks are assigned | ed to an arbitrary number of virtual UEs with one |  |  |  |  |  |
|                   | PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated |                   |   |  |  |  |  |  |
|                   | pseudo random data, which   | is QPSK modu      | lated.  |  |  |  |  |  |
| Note 3:           | The same PDSCH transmis   | sion mode is ap   | pplied to each component carrier.                 |  |  |  |  |  |

# Table 8.2.2.1.1-4: Minimum performance (FRC) for CA

|                | Bandwidth    | Reference<br>Channel   | OCNG<br>Pattern      |                          | Correlation                            | Reference value                             |          |             |  |  |
|----------------|--------------|--|----------------------|--------------------------|--|---|----------|-------------|--|--|
| Test<br>number |              |  |                      | Propagation<br>Condition | Matrix and<br>Antenna<br>Configuration | Fraction of<br>Maximum<br>Throughput<br>(%) | SNR (dB) | UE Category |  |  |
| 1              | 2x20MHz      | R.42 TDD   | OP.1 TDD<br>(Note 1) | EVA5                     | 1x2 Low                                | 70  | -1.2     | ≥5          |  |  |
| Note 1:        | •            | attern applies   |                      |                          |  |   |          |             |  |  |
| Note 2:        | The applicab | he applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3. |                      |                          |  |   |          |             |  |  |

- 8.2.2.1.2 Void
- 8.2.2.1.3 Void

8.2.2.1.4 Minimum Requirement 1 PRB allocation in presence of MBSFN

The requirements are specified in Table 8.2.2.1.4-2, with the addition of the parameters in Table 8.2.2.1.1.4-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the single-antenna performance with a single PRB allocated at the lower band edge in presence of MBSFN.

| Parameter   |                              | Unit              | Test 1        |  |  |  |
|---|------------------------------|-------------------|---------------|--|--|--|
|   | $ ho_{\scriptscriptstyle A}$ | dB                | 0             |  |  |  |
| Downlink power<br>allocation  | $ ho_{\scriptscriptstyle B}$ | dB                | 0 (Note 1)    |  |  |  |
|   | σ                            | dB                | 0             |  |  |  |
| $N_{\scriptscriptstyle oc}$ at antenna  | port                         | dBm/15kHz         | -98           |  |  |  |
| Symbols for MBSFN<br>MBSFN subframes  |                              |                   | OCNG (Note 3) |  |  |  |
| ACK/NACK feedbac  | ck mode                      |                   | Multiplexing  |  |  |  |
| PDSCH transmissio   | on mode                      |                   | 1             |  |  |  |
| Note 1: $P_B = 0$ Note 2:The MBSFN portion of an MBSFN subframe comprises the<br>whole MBSFN subframe except the first two symbols in the<br>first slot.Note 3:The MBSFN portion of the MBSFN subframes shall contain<br>QPSK modulated data. Cell-specific reference signals are<br>not inserted in the MBSFN portion of the MBSFN |                              |                   |               |  |  |  |
|   |                              | ulated MBSFN data |               |  |  |  |

### Table 8.2.2.1.4-1: Test Parameters for Testing 1 PRB allocation

Table 8.2.2.1.4-2: Minimum performance 1PRB (FRC)

| Test   | Bandwidth | Reference | erence OCNG | Propagation | Correlation                            | Reference                                   | UE          |          |
|--------|-----------|-----------|-------------|-------------|--|---|-------------|----------|
| number |           | Channel   | Pattern     | Condition   | Matrix and<br>Antenna<br>Configuration | Fraction of<br>Maximum<br>Throughput<br>(%) | SNR<br>(dB) | Category |
| 1      | 10 MHz    | R.29 TDD  | OP.3 TDD    | ETU70       | 1x2 Low                                | 30  | 2.0         | ≥1       |

# 8.2.2.2 Transmit diversity performance

### 8.2.2.2.1 Minimum Requirement 2 Tx Antenna Port

The requirements are specified in Table 8.2.2.2.1-2, with the addition of the parameters in Table 8.2.2.2.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmitter antennas.

| Parameter                              |                              | Unit      | Test 1-2     |  |  |  |  |
|--|------------------------------|-----------|--------------|--|--|--|--|
|  | $ ho_{\scriptscriptstyle A}$ | dB        | -3           |  |  |  |  |
| Downlink power<br>allocation           | $ ho_{\scriptscriptstyle B}$ | dB        | -3 (Note 1)  |  |  |  |  |
|  | σ                            | dB        | 0            |  |  |  |  |
| $N_{\scriptscriptstyle oc}$ at antenna | port                         | dBm/15kHz | -98          |  |  |  |  |
| ACK/NACK feedba                        | ck mode                      |           | Multiplexing |  |  |  |  |
| PDSCH transmission                     | on mode                      |           | 2            |  |  |  |  |
| Note 1: $P_B = 1$                      |                              |           |              |  |  |  |  |

 Table 8.2.2.2.1-1: Test Parameters for Transmit diversity Performance (FRC)

| Test   | Bandw  | Reference  | OCNG     | Propagation | Correlation                            | Reference value                             |             | UE       |  |
|--------|--------|------------|----------|-------------|--|---|-------------|----------|--|
| number | idth   | Channel    | Pattern  | Condition   | Matrix and<br>Antenna<br>Configuration | Fraction of<br>Maximum<br>Throughput<br>(%) | SNR<br>(dB) | Category |  |
| 1      | 10 MHz | R.11 TDD   | OP.1 TDD | EVA5        | 2x2 Medium                             | 70  | 6.8         | ≥2       |  |
| I      | 5 MHz  | R.11-2 TDD | OP.1 TDD | EVA5        | 2x2 Medium                             | 70  | 6.8         | 1        |  |
| 2      | 10 MHz | R.10 TDD   | OP.1 TDD | HST         | 2x2                                    | 70  | -2.3        | ≥1       |  |

# 8.2.2.2.2 Minimum Requirement 4 Tx Antenna Port

The requirements are specified in Table 8.2.2.2.2-2, with the addition of the parameters in Table 8.2.2.2.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC-FSTD) with 4 transmitter antennas.

Table 8.2.2.2.1: Test Parameters for Transmit diversity Performance (FRC)

| Parameter                    |                              | Unit      | Test 1-2     |  |  |  |  |
|------------------------------|------------------------------|-----------|--------------|--|--|--|--|
|                              | $ ho_{\scriptscriptstyle A}$ | dB        | -3           |  |  |  |  |
| Downlink power<br>allocation | $ ho_{\scriptscriptstyle B}$ | dB        | -3 (Note 1)  |  |  |  |  |
|                              | σ                            | dB        | 0            |  |  |  |  |
| $N_{oc}$ at antenna          | port                         | dBm/15kHz | -98          |  |  |  |  |
| ACK/NACK feedba              | ck mode                      |           | Multiplexing |  |  |  |  |
| PDSCH transmission           | on mode                      |           | 2            |  |  |  |  |
| Note 1: $P_B = 1$            |                              |           |              |  |  |  |  |

| Table 8.2.2.2.2-2: Minimum performance | Transmit Diversity (FRC) |
|--|--------------------------|
|--|--------------------------|

| Test   | Band-   | Reference | OCNG     | Propagation | Correlation                            | Reference value                             |             | UE       |  |
|--------|---------|-----------|----------|-------------|--|---|-------------|----------|--|
| number | width   | Channel   | Pattern  | Condition   | Matrix and<br>Antenna<br>Configuration | Fraction of<br>Maximum<br>Throughput<br>(%) | SNR<br>(dB) | Category |  |
| 1      | 1.4 MHz | R.12 TDD  | OP.1 TDD | EPA5        | 4x2 Medium                             | 70  | 0.2         | ≥1       |  |
| 2      | 10 MHz  | R.13 TDD  | OP.1 TDD | ETU70       | 4x2 Low                                | 70  | -0.5        | ≥1       |  |

# 8.2.2.2.3 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)

The requirements are specified in Table 8.2.2.3-2, with the addition of parameters in Table 8.2.2.3-1 and the downlink physical channel setup according to Annex C.3.2 and Annex C.3.3. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmit antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell. In Table 8.2.2.3-1, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

|                        | Parameter  |                               | Unit   | Cell 1  | Cell 2                   |
|------------------------|--|-------------------------------|--|---|--------------------------|
|                        | downlink confi                                     |                               |  | 1   | 1                        |
| Special                | subframe con                                       | figuration                    |  | 4   | 4                        |
|                        |  | $ ho_{\scriptscriptstyle A}$  | dB   | -3  | -3                       |
|                        | nk power<br>cation                                 | $ ho_{\scriptscriptstyle B}$  | dB   | -3 (Note 1)                                   | -3 (Note 1)              |
|                        |  | σ                             | dB   | 0   | N/A                      |
|                        |  | N <sub>oc1</sub>              | dBm/15kHz  | -102 (Note 2)                                 | N/A                      |
| $N_{oc}$ at an         | ntenna port  | $N_{oc2}$                     | dBm/15kHz  | -98 (Note 3)                                  | N/A                      |
|                        |  | $N_{oc3}$                     | dBm/15kHz  | -94.8 (Note<br>4)                             | N/A                      |
|                        | $\widehat{E}_{s}/N_{oc2}$                          |                               | dB   | Reference<br>Value in<br>Table<br>8.2.2.2.3-2 | 6                        |
|                        | BW <sub>Channel</sub>                              |                               | MHz  | 10  | 10                       |
| Sub                    | frame Configu                                      | ration                        |  | Non-MBSFN                                     | Non-MBSFN                |
| Time                   | Offset betwee                                      | n Cells                       | μs   | 2.5 (synch                                    | ronous cells)            |
|                        | Cell Id  |                               |  | 0   | 1                        |
| AE                     | 3S pattern (No                                     | te 5)                         |  | N/A   | 0000010001<br>0000000001 |
|                        | / Measuremer<br>Pattern (Note                      |                               |  | 0000000001<br>0000000001                      | N/A                      |
| CSI Subf               | frame Sets   | C <sub>CSI,0</sub>            |  | 0000010001<br>0000000001                      | N/A                      |
|                        | ote 7)   | C <sub>CSI,1</sub>            |  | 1100101000<br>1100111000                      | N/A                      |
| Number                 | of control OFD                                     | M symbols                     |  | 2   |                          |
|                        | NACK feedbac                                       |                               |  | Multiplexing                                  |                          |
|                        | CH transmissio                                     |                               |  | 2   | N/A                      |
|                        | Cyclic prefix                                      |                               |  | Normal  | Normal                   |
| Note 2: 1<br>Note 3: 1 | subframe overl<br>This noise is a                  | apping with the oplied in OFD | И symbols #1, #2, #3, #5,<br>e aggressor ABS.<br>И symbols #0, #4, #7, #1 <sup>-</sup> |   |                          |
| Note 4:                | he aggressor /<br>This noise is ap<br>non-ABS.     |                               | DM symbols of a subfrar  | ne overlapping v                              | vith aggressor           |
| Note 6:                | ABS pattern as<br>Fime-domain n<br>defined in [7]. |                               | esource restriction patter   | n for PCell meas                              | urements as              |
| Note 7:                |  |                               | e time-domain measuren   | nent resource re                              | striction pattern        |
| Note 8: 0              |  | rving cell. Cell              | 2 is the aggressor cell. T   | he number of the                              | e CRS ports in           |
|                        |  |                               | in Cell2 in this test.   |   |                          |

| Table 8.2.2.3-1: Test Parameters for Transmit divers | ity Performance (FRC) |
|--|-----------------------|
|--|-----------------------|

| Test<br>Number     | Reference<br>Channel   | eene anon eegan              |                          | itions      | Correlation<br>Matrix and<br>Antenna | Reference Value      |  | UE<br>Category             |       |
|--------------------|--|------------------------------|--------------------------|-------------|--------------------------------------|----------------------|--|----------------------------|-------|
|                    |  | Cell 1                       | Cell 2                   | Cell 1      | Cell 2                               | Configuration        | Fraction of<br>Maximum<br>Throughput<br>(%) (Note 5) | SNR<br>(dB)<br>(Note<br>2) |       |
| 1                  | R.11-4<br>TDD (Note<br>4)  | OP.1<br>TDD                  | OP.1<br>TDD              | EVA5        | EVA5                                 | 2x2 Medium           | 70   | 3.8                        | ≥2    |
| Note 1:            | The propagat   | ion condit                   | ions for C               | ell 1 and 0 | Cell2 are                            | statistically indepe | endent.  |                            | •     |
| Note 2:            | SNR correspo   | onds to $\widehat{	ilde{E}}$ | $\hat{Z}_s / N_{oc2}$ of | of cell 1.  |                                      |                      |  |                            |       |
| Note 3:<br>Note 4: | The correlation matrix and antenna configuration apply for Cell 1 and Cell 2.<br>Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated<br>PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the<br>ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel. |                              |                          |             |                                      |                      |  |                            |       |
| Note 5:            | The maximur  | n Through                    | put is cal               | culated fro | om the tota                          | al Payload in 2 su   | bframes, averag                                      | ged over :                 | 20ms. |

Table 8.2.2.3-2: Minimum Performance Transmit Diversity (FRC)

# 8.2.2.2.3A Minimum Requirement 2 Tx Antenna Ports (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements are specified in Table 8.2.2.2.3A-2, with the addition of parameters in Table 8.2.2.2.3A-1. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmit antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell with CRS assistance information. In Table 8.2.2.2.3A-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

| Parameter                     |   |                              | Unit               | Cell 1   | Cell 2                   | Cell 3                   |  |  |  |
|-------------------------------|---|------------------------------|--------------------|--|--------------------------|--------------------------|--|--|--|
| Uplink downlink configuration |   |                              |                    | 1  | 1                        | 1                        |  |  |  |
| Special subframe              | e con   | figuration                   |                    | 4  | 4                        | 4                        |  |  |  |
|                               | $\rho_A$  |                              | dB                 | -3   | -3                       | -3                       |  |  |  |
| Downlink powe<br>allocation   | Downlink power<br>allocation  | $ ho_{\scriptscriptstyle B}$ | dB                 | -3 (Note 1)  | -3 (Note 1)              | -3 (Note 1)              |  |  |  |
| allocation                    |   | σ                            | dB                 | 0  | N/A                      | N/A                      |  |  |  |
|                               |   | N <sub>oc1</sub>             | dBm/15kHz          | -98 (Note 2)   | N/A                      | N/A                      |  |  |  |
| N <sub>oc</sub> at antenna p  | οπ  | $N_{oc2}$                    | dBm/15kHz          | -98 (Note 3)   | N/A                      | N/A                      |  |  |  |
|                               |   | N <sub>oc3</sub>             | dBm/15kHz          | -93 (Note 4)   | N/A                      | N/A                      |  |  |  |
| $\widehat{E}_s/N$             | oc2   |                              | dB                 | Reference<br>Value in Table<br>8.2.2.2.3A-2              | 12                       | 10                       |  |  |  |
| BW <sub>Cha</sub>             | annel   |                              | MHz                | 10   | 10                       | 10                       |  |  |  |
| Subframe Co                   | nfigu   | ration                       |                    | Non-MBSFN  | Non-MBSFN                | Non-MBSFN                |  |  |  |
| Time Offset be                | twee  | n Cells                      | μs                 | N/A  | 3                        | -1                       |  |  |  |
| Frequency shift               | betwe   | en Cells                     | Hz                 | N/A  | 300                      | -100                     |  |  |  |
| Cell                          | Cell Id   |                              |                    | 0  | 126                      | 1                        |  |  |  |
| ABS patterr                   | ABS pattern (Note 5)  |                              |                    | N/A  | 0000000001<br>0000000001 | 0000000001<br>0000000001 |  |  |  |
|                               | RLM/RRM Measurement<br>Subframe Pattern (Note 6)  |                              |                    | 0000000001<br>0000000001                                 | N/A                      | N/A                      |  |  |  |
| CSI Subframe S                |   | C <sub>CSI,0</sub>           |                    | 000000001<br>0000000001                                  | N/A                      | N/A                      |  |  |  |
| (Note7)                       |   | C <sub>CSI,1</sub>           |                    | 1100111000<br>1100111000                                 | N/A                      | N/A                      |  |  |  |
| Number of con<br>symb         |   | OFDM                         |                    | 2  | Note 8                   | Note 8                   |  |  |  |
| ACK/NACK fee                  |   | k mode                       |                    | Multiplexing   | N/A                      | N/A                      |  |  |  |
| PDSCH transm                  |   |                              |                    | 2  | Note 9                   | Note 9                   |  |  |  |
| Cyclic p                      |   |                              |                    | Normal   | Normal                   | Normal                   |  |  |  |
| Note 1: $P_B = 1$             |   |                              |                    |  | •                        |                          |  |  |  |
| Note 2: This no<br>subfrar    | ise is<br>ne ov   | verlapping v<br>s applied in | vith the aggresso  | #1, #2, #3, #5, #6, #<br>or ABS.<br>#0, #4, #7, #11 of a |                          |                          |  |  |  |
| Note 4: This no               | ise is  | applied in                   |                    | ols of a subframe ov                                     | verlapping with age      | gressor non-ABS          |  |  |  |
|                               |   | as defined                   |                    | striction nottorn for                                    |                          | nte ac defined in        |  |  |  |
|                               | Note 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in   |                              |                    |  |                          |                          |  |  |  |
| Note 7: As con                | <ul> <li>[7]</li> <li>Note 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].</li> </ul> |                              |                    |  |                          |                          |  |  |  |
| Note 8: The nu                | mber  | of control (                 | OFDM symbols is    | s not available for A                                    | BS and is 2 for the      | e subframe               |  |  |  |
| Note 9: Downli                | nk ph   |                              |                    | 2 and Cell 3 in acc                                      | ordance with Anne        | ex C.3.3 applying        |  |  |  |
| Note 10: The nu               | mber  | of the CRS                   | S ports in Cell 1, | Cell 2 and Cell 3 is<br>id Cell 3 in this test.          |                          |                          |  |  |  |

 Table 8.2.2.2.3A-1: Test Parameters for Transmit diversity Performance (FRC)

| Test<br>Number                | Reference<br>Channel  | 00          | NG Patt     | ern         | F      |        | Propagation<br>Conditions (Note 1) |                                      | Reference Value                                    |                            | UE<br>Cate |
|-------------------------------|---|-------------|-------------|-------------|--------|--------|------------------------------------|--------------------------------------|--|----------------------------|------------|
|                               |   | Cell 1      | Cell 2      | Cell 3      | Cell 1 | Cell 2 | Cell 3                             | Antenna<br>Configuration<br>(Note 2) | Fraction of<br>Maximum<br>Throughput<br>(%) Note 5 | SNR<br>(dB)<br>(Note<br>3) | gory       |
| 1                             | R.11-4<br>TDD Note<br>4   | OP.1<br>TDD | OP.1<br>TDD | OP.1<br>TDD | EVA5   | EVA5   | EVA5                               | 2x2 Medium                           | 70   | 3.5                        | ≥2         |
| Note 1:<br>Note 2:<br>Note 3: | Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3  |             |             |             |        |        |                                    |                                      |  |                            |            |
| Note 4:<br>Note 5:            | Note 4: Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel. |             |             |             |        |        |                                    |                                      |  |                            |            |

| Table 8.2.2.2.3A-2: Minimum Performance | ce Transmit Diversity (FRC) |
|---|-----------------------------|
|---|-----------------------------|

# 8.2.2.2.4 Enhanced Performance Requirement Type A – 2 Tx Antenna Ports with TM3 interference model

The requirements are specified in Table 8.2.2.2.4-2, with the addition of parameters in Table 8.2.2.2.4-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of two dominant interfering cells applying transmission mode 3 interference model defined in clause B.5.2. In Table 8.2.2.2.4-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

| Parameter   |                              | Unit         | Cell 1               | Cell 2                          | Cell 3                          |  |  |
|---|------------------------------|--------------|----------------------|---------------------------------|---------------------------------|--|--|
|   | $ ho_{\scriptscriptstyle A}$ | dB           | -3                   | -3                              | -3                              |  |  |
| Downlink power allocation   | $ ho_{\scriptscriptstyle B}$ | dB           | -3 (Note 1)          | -3                              | -3                              |  |  |
|   | σ                            | dB           | 0                    | 0                               | 0                               |  |  |
| Cell-specific reference   | signals                      |              | Antenna ports<br>0,1 | Antenna ports<br>0,1            | Antenna ports<br>0,1            |  |  |
| $N_{oc}$ at antenna po  | ort                          | dBm/15kHz    | -98                  | N/A                             | N/A                             |  |  |
| DIP (Note 2)  |                              | dB           | N/A                  | -1.73                           | -8.66                           |  |  |
| BW <sub>Channel</sub>   |                              | MHz          | 10                   | 10                              | 10                              |  |  |
| Cyclic Prefix   |                              |              | Normal               | Normal                          | Normal                          |  |  |
| Cell Id   | Cell Id                      |              |                      | 1                               | 2                               |  |  |
| Number of control OFDM  | symbols                      |              | 2                    | 2                               | 2                               |  |  |
| PDSCH transmission  |                              |              | 2                    | N/A                             | N/A                             |  |  |
| Interference mod  | el                           |              | N/A                  | As specified in<br>clause B.5.2 | As specified in<br>clause B.5.2 |  |  |
| Probability of occurrence of  | Rank 1                       | %            | N/A                  | 80                              | 80                              |  |  |
| transmission rank in<br>interfering cells   | Rank 2                       | %            | N/A                  | 20                              | 20                              |  |  |
| Reporting interva   | d                            | ms           | 5                    | N/A                             | N/A                             |  |  |
| Reporting mode  |                              |              | PUCCH 1-0            | N/A                             | N/A                             |  |  |
| ACK/NACK feedback   |                              | Multiplexing | N/A                  | N/A                             |                                 |  |  |
| Note 1: $P_B = 1$<br>Note 2: The respective received power spectral density of each interfering cell relative to $N_{oc}$ is defined by   |                              |              |                      |                                 |                                 |  |  |
| its associated DIP value as specified in clause B.5.1.         Note 3:       Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.         Note 4:       All cells are time-synchronous. |                              |              |                      |                                 |                                 |  |  |

# Table 8.2.2.2.4-1: Test Parameters for Transmit diversity Performance (FRC) with TM3 interference model

# Table 8.2.2.2.4-2: Enhanced Performance Requirement Type A, Transmit Diversity (FRC) with TM3 interference model

| Test<br>Number | Reference<br>Channel  | OCNG Pattern |           | Propagation<br>Conditions |           | Correlation<br>Matrix and | Reference | Value                                 | UE<br>Cate                                  |                             |      |
|----------------|---|--------------|-----------|---------------------------|-----------|---------------------------|-----------|---------------------------------------|---|-----------------------------|------|
|                |   | Cell<br>1    | Cell<br>2 | Cell<br>3                 | Cell<br>1 | Cell<br>2                 | Cell<br>3 | Antenna<br>Configurati<br>on (Note 3) | Fraction of<br>Maximum<br>Throughput<br>(%) | SINR<br>(dB)<br>(Note<br>2) | gory |
| 1              | R.46 TDD  | OP.          | N/A       | N/A                       | EV        | EV                        | EV        | 2x2 Low                               | 70  | -1.4                        | ≥1   |
|                |   | 1            |           |                           | A70       | A70                       | A70       |                                       |   |                             |      |
|                |   | TD           |           |                           |           |                           |           |                                       |   |                             |      |
|                |   | D            |           |                           |           |                           |           |                                       |   |                             |      |
|                | Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent. |              |           |                           |           |                           |           |                                       |   |                             |      |
| Note 2:        | lote 2: SINR corresponds to $\hat{E}_s/N_{oc}$ of Cell 1 as defined in clause 8.1.1.            |              |           |                           |           |                           |           |                                       |   |                             |      |
| Note 3:        | Correlation ma  | trix and     | d anten   | na conf                   | iguratic  | on parai                  | meters    | apply for each o                      | f Cell 1, Cell 2 a                          | nd Cell 3.                  |      |

# 8.2.2.3 Open-loop spatial multiplexing performance

# 8.2.2.3.1 Minimum Requirement 2 Tx Antenna Port

For single carrier the requirements are specified in Table 8.2.2.3.1-2, with the addition of the parameters in Table 8.2.2.3.1-1 and the downlink physical channel setup according to Annex C.3.2. For CA the requirements are specified in Table 8.2.2.3.1-4, with the addition of the parameters in Table 8.2.2.3.1-3 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

| Parameter                    | -                            | Unit      | Test 1-2    |
|------------------------------|------------------------------|-----------|-------------|
| Downlink nowor               | $ ho_{\scriptscriptstyle A}$ | dB        | -3          |
| Downlink power<br>allocation | $ ho_{\scriptscriptstyle B}$ | dB        | -3 (Note 1) |
|                              | σ                            | dB        | 0           |
| $N_{_{oc}}$ at antenna       | a port                       | dBm/15kHz | -98         |
| ACK/NACK feedba              | ck mode                      |           | Bundling    |
| PDSCH transmissi             | on mode                      |           | 3           |
| Note 1: $P_B = 1$            |                              |           |             |
| Note 2: Void.                |                              |           |             |
| Note 3: Void.                |                              |           |             |

Table 8.2.2.3.1-1: Test Parameters for Large Delay CDD (FRC)

| Test Bandwidth |        | Reference     | OCNG        | Propagation | Correlation                            | Reference v                                 | UE          |              |
|----------------|--------|---------------|-------------|-------------|--|---|-------------|--------------|
| num<br>ber     |        | Channel       | Pattern     | Condition   | Matrix and<br>Antenna<br>Configuration | Fraction of<br>Maximum<br>Throughput<br>(%) | SNR<br>(dB) | Cate<br>gory |
| 1              | 10 MHz | R.11-1<br>TDD | OP.1<br>TDD | EVA70       | 2x2 Low                                | 70  | 13.1        | ≥2           |
| 2              | 10 MHz | R.35 TDD      | OP.1<br>TDD | EVA200      | 2x2 Low                                | 70  | 20.3        | ≥2           |
| 3              | 10 MHz | R.35-2<br>TDD | OP.1<br>TDD | ETU300      | 2x2 Low                                | 70  | 20.3        | ≥2           |
| Note 1:        | : Void | •             |             |             |  |   |             |              |

Table 8.2.2.3.1-3: Test Parameters for Large Delay CDD (FRC) for CA

| Parameter  |                              | Unit      | Test 1                                    |  |  |  |  |
|--|------------------------------|-----------|---|--|--|--|--|
| Develiate a surra  | $ ho_{\scriptscriptstyle A}$ | dB        | -3  |  |  |  |  |
| Downlink power<br>allocation   | $ ho_{\scriptscriptstyle B}$ | dB        | -3 (Note 1)                               |  |  |  |  |
|  | σ                            | dB        | 0   |  |  |  |  |
| $N_{_{oc}}$ at antenna   | port                         | dBm/15kHz | -98                                       |  |  |  |  |
| ACK/NACK feedba  | ck mode                      |           | PUCCH format 1b with channel<br>selection |  |  |  |  |
| PDSCH transmission   | on mode                      |           | 3   |  |  |  |  |
| Note 1: $P_{R} = 1$  |                              |           |   |  |  |  |  |
| Note 2: The same PDSCH transmission mode is applied to each component carrier. |                              |           |   |  |  |  |  |

Table 8.2.2.3.1-4: Minimum performance Large Delay CDD (FRC) for CA

|                    |  |                      |                         |                          | Correlation                            | Referenc                                    |          |                |  |  |
|--------------------|--|----------------------|-------------------------|--------------------------|--|---|----------|----------------|--|--|
| Test<br>num<br>ber | Bandwidth  | Reference<br>Channel | OCNG<br>Pattern         | Propagation<br>Condition | Matrix and<br>Antenna<br>Configuration | Fraction of<br>Maximum<br>Throughput<br>(%) | SNR (dB) | UE<br>Category |  |  |
| 1                  | 2x20 MHz   | R.30-1<br>TDD        | OP.1<br>TDD<br>(Note 1) | EVA70                    | 2x2 Low                                | 70  | 13.7     | ≥5             |  |  |
| Note 1             | Note 1: The OCNG pattern applies for each CC.  |                      |                         |                          |  |   |          |                |  |  |
| Note 2             | Note 2: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in |                      |                         |                          |  |   |          |                |  |  |
|                    | 8.1.2.3.   |                      |                         |                          |  |   |          |                |  |  |

### 8.2.2.3.1A Soft buffer management test

For CA the requirements are specified in Table 8.2.2.3.1A-2, with the addition of the parameters in Table 8.2.2.3.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify UE performance with proper instantaneous buffer implementation.

| Parameter   |  | Unit      | Test 1-2      |  |  |  |  |  |
|---|--|-----------|---------------|--|--|--|--|--|
| Downlink nowor  | $ ho_{\scriptscriptstyle A}$   | dB        | -3            |  |  |  |  |  |
| Downlink power<br>allocation  | $ ho_{\scriptscriptstyle B}$   | dB        | -3 (Note 1)   |  |  |  |  |  |
|   | σ  | dB        | 0             |  |  |  |  |  |
| $N_{\scriptscriptstyle oc}$ at antenna  | port   | dBm/15kHz | -98           |  |  |  |  |  |
| ACK/NACK feedba   | ck mode  |           | -<br>(Note 2) |  |  |  |  |  |
| PDSCH transmission  | on mode  |           | 3             |  |  |  |  |  |
| Note 1: $P_B = 1$   |  |           |               |  |  |  |  |  |
| Note 2: PUCCH fo  | Note 2: PUCCH format 1b with channel selection is used to feedback ACK/NACK. |           |               |  |  |  |  |  |
| Note 3: For CA test cases, the same PDSCH transmission mode is applied to each component carrier. |  |           |               |  |  |  |  |  |

Table 8.2.2.3.1A-1: Test Parameters for soft buffer management test (FRC) for CA

| Test       | Bandwidth  | Reference         | OCNG                    | Propagation      | Correlation                            | Reference v                                 | value       | UE           | CA              |  |
|------------|--|-------------------|-------------------------|------------------|--|---|-------------|--------------|-----------------|--|
| num<br>ber |  | Channel           | Pattern                 | Condition        | Matrix and<br>Antenna<br>Configuration | Fraction of<br>Maximum<br>Throughput<br>(%) | SNR<br>(dB) | Cate<br>gory | capabil<br>ity  |  |
| 1          | 2x20 MHz   | R.30-2<br>TDD     | OP.1<br>TDD<br>(Note 1) | EVA70            | 2x2 Low                                | 70  | 13.2        | 3            | CL_C,<br>CL_A-A |  |
| 2          | 2x20 MHz   | R.35-1<br>TDD     | OP.1<br>TDD<br>(Note 1) | EVA5             | 2x2 Low                                | 70  | 15.7        | 4            | CL_C,<br>CL_A-A |  |
| Note 1     | Note 1: For CA test cases, the OCNG pattern applies for each CC. |                   |                         |                  |  |   |             |              |                 |  |
| Note 2     | : The applical 8.1.2.3.  | bility of require | ments for dif           | ferent CA config | jurations and band                     | lwidth combinati                            | on sets is  | s defined    | in              |  |

### 8.2.2.3.2 Minimum Requirement 4 Tx Antenna Port

The requirements are specified in Table 8.2.2.3.2-2, with the addition of the parameters in Table 8.2.2.3.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 4 transmitter antennas.

| Parameter                              |                              | Unit      | Test 1      |
|--|------------------------------|-----------|-------------|
| Deurslink neuron                       | $ ho_{\scriptscriptstyle A}$ | dB        | -6          |
| Downlink power<br>allocation           | $ ho_{\scriptscriptstyle B}$ | dB        | -6 (Note 1) |
|  | σ                            | dB        | 3           |
| $N_{\scriptscriptstyle oc}$ at antenna | port                         | dBm/15kHz | -98         |
| ACK/NACK feedba                        | ck mode                      |           | Bundling    |
| PDSCH transmission                     | on mode                      |           | 3           |
| Note 1: $P_B = 1$ .                    |                              |           |             |

| Т   | est  | Bandwidth | Reference | OCNG        | OCNG Propagation Correlation |  | Reference v                                 | UE          |          |
|-----|------|-----------|-----------|-------------|------------------------------|--|---|-------------|----------|
| nur | nber |           | Channel   | Pattern     | Condition                    | Matrix and<br>Antenna<br>Configuration | Fraction of<br>Maximum<br>Throughput<br>(%) | SNR<br>(dB) | Category |
|     | 1    | 10 MHz    | R.14 TDD  | OP.1<br>TDD | EVA70                        | 4x2 Low                                | 70  | 14.2        | ≥2       |

Table 8.2.2.3.2-2: Minimum performance Large Delay CDD (FRC)

# 8.2.2.3.3 Minimum Requirement 2Tx antenna port (demodulation subframe overlaps with aggressor cell ABS)

The requirements for non-MBSFN ABS are specified in Table 8.2.2.3.3-2, with the addition of parameters in Table 8.2.2.3.3-1 and the downlink physical channel setup according to Annex C.3.2 and Annex C.3.3.

The requirements for MBSFN ABS are specified in Table 8.2.2.3.3-4, with the addition of parameters in Table 8.2.2.3.3-3 and the downlink physical channel setup according to Annex C.3.2 and Annex C.3.3.

The purpose is to verify the performance of large delay CDD with 2 transmitter antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell. In Tables 8.2.2.3.3-1 and 8.2.2.3.3-3, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

|  | Parameter  |                                    | Unit                   | Cell 1                               | Cell 2                    |  |  |
|--|--|------------------------------------|------------------------|--------------------------------------|---------------------------|--|--|
| Uplink do  | wnlink config                                    | guration                           |                        | 1                                    | 1                         |  |  |
|  | ubframe conf                                     |                                    |                        | 4                                    | 4                         |  |  |
|  |  | $ ho_{\scriptscriptstyle A}$       | dB                     | -3                                   | -3                        |  |  |
| Downlink power<br>allocation   |  | $ ho_{\scriptscriptstyle B}$       | dB -3 (Note 1)         |                                      | -3 (Note 1)               |  |  |
|  |  |                                    | dB                     | 0                                    | N/A                       |  |  |
|  |  | N <sub>oc1</sub>                   | dBm/15kHz              | -102 (Note 2)                        | N/A                       |  |  |
| $N_{oc}$ at ante   | enna port  | N <sub>oc2</sub>                   | dBm/15kHz              | -98 (Note 3)                         | N/A                       |  |  |
|  |  | $N_{oc3}$                          | dBm/15kHz              | -94.8 (Note 4)                       | N/A                       |  |  |
|  | $\widehat{E}_{s}/N_{oc2}$                        |                                    | dB                     | Reference Value in Table 8.2.2.3.3-2 | 6                         |  |  |
|  | BW <sub>Channel</sub>                            |                                    | MHz                    | 10                                   | 10                        |  |  |
| Subfra   | ame Configui                                     | ation                              |                        | Non-MBSFN                            | Non-MBSFN                 |  |  |
|  | Cell Id  |                                    |                        | 0                                    | 1                         |  |  |
| Time O   | Time Offset between Cells                        |                                    |                        | 2.5 (synchroi                        | nous cells)               |  |  |
| ABS  | ABS pattern (Note 5)                             |                                    |                        | N/A                                  | 0000010001,<br>0000000001 |  |  |
|  | RLM/RRM Measurement Subframe<br>Pattern (Note 6) |                                    |                        | 0000000001,<br>0000000001            | N/A                       |  |  |
| CSI Subfra   | ime Sets   | C <sub>CSI,0</sub>                 |                        | 0000010001,<br>0000000001            | N/A                       |  |  |
| (Note  | e 7)   | C <sub>CSI,1</sub>                 |                        | 1100101000<br>1100111000             | N/A                       |  |  |
| Number of  | control OFDI                                     | V symbols                          |                        | 2                                    |                           |  |  |
|  | CK feedbac                                       |                                    |                        | Multiplexing                         |                           |  |  |
| PDSCH  | transmission                                     | n mode                             |                        | 3                                    | N/A                       |  |  |
|  | Cyclic prefix                                    |                                    |                        | Normal                               | Normal                    |  |  |
| <ul> <li>Note 1: P<sub>B</sub> = 1.</li> <li>Note 2: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.</li> <li>Note 3: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.</li> <li>Note 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.</li> </ul> |  |                                    |                        |                                      |                           |  |  |
|  |  | defined in [9]                     |                        | attorn for DCall massi               | romante as defined        |  |  |
| Note 6: Tir<br>in  |  |                                    | esource restriction    | pattern for PCell measu              | rements as defined        |  |  |
| Note 7: As   | configured a                                     | according to th<br>ents defined in |                        | surement resource rest               | riction pattern for       |  |  |
| Note 8: Ce   |  | ving cell. Cell                    |                        | cell. The number of the              | CRS ports in Cell1        |  |  |
|  |  |                                    | in Cell2 in this test. |                                      |                           |  |  |

# Table 8.2.2.3.3-1: Test Parameters for Large Delay CDD (FRC) – Non-MBSFN ABS

| Test<br>Number     | Reference<br>Channel       | OCNG   | Pattern                |             | gation<br>itions<br>te 1) | Correlation<br>Matrix and<br>Antenna |  |                            | UE<br>Category |  |
|--------------------|----------------------------|--|------------------------|-------------|---------------------------|--------------------------------------|--|----------------------------|----------------|--|
|                    |                            | Cell 1   | Cell 2                 | Cell 1      | Cell 2                    | Configuration                        | Fraction of<br>Maximum<br>Throughput<br>(%) (Note 5) | SNR<br>(dB)<br>(Note<br>2) |                |  |
| 1                  | R.11 TDD<br>(Note 4)       | OP.1<br>TDD  | OP.1<br>TDD            | EVA 5       | EVA 5                     | 2x2 Low                              | 70   | 14.0                       | ≥2             |  |
| Note 1:            | The propagat               | tion condit  | ions for C             | ell 1 and 0 | Cell2 are                 | statistically indepe                 | endent.  |                            |                |  |
| Note 2:            | SNR corresp                | onds to $\widehat{E}$  | $\hat{Z}_s/N_{oc2}$ of | of cell 1.  |                           |                                      |  |                            |                |  |
| Note 3:<br>Note 4: | Cell 1 Refere<br>PDCCH/PCF | The correlation matrix and antenna configuration apply for Cell 1 and Cell 2.<br>Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated<br>PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the<br>ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel. |                        |             |                           |                                      |  |                            |                |  |
| Note 5:            |                            |  |                        |             |                           | al Payload in 2 su                   |  |                            |                |  |

Table 8.2.2.3.3-2: Minimum Performance Large Delay CDD (FRC) – Non-MBSFN ABS

| Parameter  |                                | Unit  | Cell 1  | Cell 2                   |  |  |
|--|--------------------------------|---|---|--------------------------|--|--|
| Uplink downlink config   |                                |   | 1   | 1                        |  |  |
| Special subframe conf  | iguration                      |   | 4   | 4                        |  |  |
|  | $ ho_{\scriptscriptstyle A}$   | dB  | -3  | -3                       |  |  |
| Downlink power<br>allocation                                   | $ ho_{\scriptscriptstyle B}$   | dB  | -3 (Note 1)   | -3 (Note 1)              |  |  |
|  | σ                              | dB  | 0   | N/A                      |  |  |
|  | N <sub>oc1</sub>               | dBm/15kHz                                       | -102 (Note 2)   | N/A                      |  |  |
| $N_{oc}$ at antenna port                                       | $N_{oc2}$                      | dBm/15kHz                                       | -98 (Note 3)  | N/A                      |  |  |
|  | $N_{oc3}$                      | dBm/15kHz                                       | -94.8 (Note 4)  | N/A                      |  |  |
| $\widehat{E}_{s}/N_{oc2}$                                      |                                | dB  | Reference Value in<br>Table 8.2.2.3.3-4                         | 6                        |  |  |
| BW <sub>Channel</sub>  |                                | MHz   | 10  | 10                       |  |  |
| Subframe Configur  | ation                          |   | Non-MBSFN   | MBSFN                    |  |  |
| Cell Id  |                                |   | 0   | 126                      |  |  |
| Time Offset betweer  | n Cells                        | μs  | 2.5 (synchro  | nous cells)              |  |  |
| ABS pattern (Not   | e 5)                           |   | N/A   | 0000000001<br>0000000001 |  |  |
| RLM/RRM Measurement<br>Pattern (Note 6                         |                                |   | 0000000001<br>0000000001  | N/A                      |  |  |
| CSI Subframe Sets  | C <sub>CSI,0</sub>             |   | 0000000001<br>0000000001  | N/A                      |  |  |
| (Note 7)   | C <sub>CSI,1</sub>             |   | 1100111000<br>1100111000  | N/A                      |  |  |
| MBSFN Subframe Alloca<br>10)                                   | ation (Note                    |   | N/A   | 000010                   |  |  |
| Number of control OFD  | V symbols                      |   | 2   |                          |  |  |
| ACK/NACK feedback  | k mode                         |   | Multiplexing  |                          |  |  |
| PDSCH transmissior   | n mode                         |   | 3   | N/A                      |  |  |
| Cyclic prefix  |                                |   | Normal  | Normal                   |  |  |
| Note 1: $P_B = 1$ .  |                                |   |   |                          |  |  |
| #13 of a subfrai   | me overlappir                  | ig with the aggresso                            | 3, #4, #5, #6, #7, #8, #9<br>or ABS.<br>bframe overlapping with |                          |  |  |
|  | plied in all OF                | DM symbols of a si                              | ubframe overlapping wit   | th aggressor non-        |  |  |
|  |                                | . The 10 <sup>th</sup> and 20 <sup>th</sup> s   | subframes indicated by  | ABS pattern are          |  |  |
|  |                                | esource restriction                             | pattern for PCell measu   | rements as defined       |  |  |
|  |                                |   | surement resource rest  | riction pattern for      |  |  |
| CSI measureme<br>Note 8: Cell 1 is the ser<br>and Cell2 is the | ving cell. Cell                |   | cell. The number of the   | CRS ports in Cell1       |  |  |
| Note 9: SIB-1 will not be                                      | e transmitted<br>me Allocation | in Cell2 in this test.<br>as defined in [7], or | ne frame with 6 bits is cl                                      | hosen for MBSFN          |  |  |

| Test<br>Number     | Reference<br>Channel   |                       |                        | Propagation<br>Conditions<br>(Note 1) |             | Correlation<br>Matrix and<br>Antenna | Reference Value                                     |                            | UE<br>Category |
|--------------------|--|-----------------------|------------------------|---------------------------------------|-------------|--------------------------------------|---|----------------------------|----------------|
|                    |  | Cell 1                | Cell 2                 | Cell 1                                | Cell 2      | Configuration                        | Fraction of<br>Maximum<br>Throughput<br>(%) Note 5) | SNR<br>(dB)<br>(Note<br>2) |                |
| 1                  | R.11 TDD<br>(Note 4)   | OP.1<br>TDD           | OP.1<br>TDD            | EVA 5                                 | EVA 5       | 2x2 Low                              | 70  | 12.2                       | ≥2             |
| Note 1:            |  |                       |                        |                                       | Cell2 are s | statistically indepe                 | ndent.  |                            |                |
| Note 2:            | SNR correspo   | onds to $\widehat{E}$ | $\hat{C}_s/N_{oc2}$ of | of cell 1.                            |             |                                      |   |                            |                |
| Note 3:<br>Note 4: | The correlation matrix and antenna configuration apply for Cell 1 and Cell 2.<br>Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated<br>PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the<br>ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel. |                       |                        |                                       |             |                                      |   |                            |                |
| Note 5:            |  |                       |                        |                                       |             | al Payload in 2 sul                  |   |                            |                |

#### Table 8.2.2.3.3-4: Minimum Performance Large Delay CDD (FRC) – MBSFN ABS

# 8.2.2.3.4 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements for non-MBSFN ABS are specified in Table 8.2.2.3.4-2, with the addition of parameters in Table 8.2.2.3.4-1. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell with CRS assistance information. In Table 8.2.2.3.4-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

| Parameter   |                              | Unit      | Cell 1  | Cell 2                                     | Cell 3  |  |  |
|---|------------------------------|-----------|---|--|---|--|--|
| Uplink downlink confi   | guration                     |           | 1   | 1  | 1   |  |  |
| Special subframe con  | figuration                   |           | 4   | 4  | 4   |  |  |
|   | $ ho_{\scriptscriptstyle A}$ | dB        | -3  | -3   | -3  |  |  |
| Downlink power<br>allocation  | $ ho_{\scriptscriptstyle B}$ | dB        | -3 (Note 1)                                       | -3 (Note 1)                                | -3 (Note 1)                                   |  |  |
|   | σ                            | dB        | 0   | N/A  | N/A   |  |  |
|   | N <sub>oc1</sub>             | dBm/15kHz | -98 (Note 2)                                      | N/A  | N/A   |  |  |
| $N_{oc}$ at antenna port  | N <sub>oc2</sub>             | dBm/15kHz | -98 (Note 3)                                      | N/A  | N/A   |  |  |
|   | $N_{oc3}$                    | dBm/15kHz | -93 (Note 4)                                      | N/A  | N/A   |  |  |
| $\widehat{E}_s/N_{oc2}$   |                              | dB        | Reference Value<br>in Table<br>8.2.2.3.4-2        | Reference<br>Value in Table<br>8.2.2.3.4-2 | Reference<br>Value in<br>Table<br>8.2.2.3.4-2 |  |  |
| BW <sub>Channel</sub>   |                              | MHz       | 10  | 10   | 10  |  |  |
| Subframe Configu  | ration                       |           | Non-MBSFN   | Non-MBSFN                                  | Non-MBSFN                                     |  |  |
| Time Offset betwee  | n Cells                      | μs        | N/A   | 3  | -1  |  |  |
| Frequency shift betwe   | en Cells                     | Hz        | N/A   | 300  | -100  |  |  |
| Cell Id   |                              |           | 0   | 1  | 126   |  |  |
| ABS pattern (Not  | te 5)                        |           | N/A   | 0000000001<br>0000000001                   | 0000000001<br>0000000001                      |  |  |
| RLM/RRM Measur<br>Subframe Pattern (I   |                              |           | 0000000001<br>0000000001                          | N/A  | N/A   |  |  |
| CSI Subframe Sets   | C <sub>CSI,0</sub>           |           | 0000000001<br>0000000001                          | N/A  | N/A   |  |  |
| (Note7)   | C <sub>CSI,1</sub>           |           | 1100111000<br>1100111000                          | N/A  | N/A   |  |  |
| Number of control symbols   | OFDM                         |           | 2   | Note 8                                     | Note 8  |  |  |
| ACK/NACK feedbac  | k mode                       |           | Multiplexing                                      | N/A  | N/A   |  |  |
| PDSCH transmissio   |                              |           | 3   | Note 9                                     | Note 9  |  |  |
| Cyclic prefix   |                              |           | Normal  | Normal                                     | Normal  |  |  |
| <ul> <li>Note 1: P<sub>B</sub> = 1.</li> <li>Note 2: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.</li> <li>Note 3: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.</li> <li>Note 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS ABS pattern as defined in [9].</li> <li>Note 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]</li> <li>Note 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].</li> <li>Note 8: The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by "0" of ABS pattern.</li> <li>Note 9: Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying</li> </ul> |                              |           |   |  |   |  |  |
| Note 10: The number   | of the CRS                   |           | Cell2 and Cell 3 is the<br>d Cell 3 in this test. | e same.                                    |   |  |  |

# Table 8.2.2.3.4-1: Test Parameters for Large Delay CDD (FRC) – Non-MBSFN ABS

| Test<br>Num | Refer<br>ence   | $\hat{E}_s/s$ | N <sub>oc2</sub> | 00                        | NG Patt     | ern         |            | ropagations (N |            | Correlation<br>Matrix and             | Reference   | Value                      | UE<br>Cate |
|-------------|---|---------------|------------------|---------------------------|-------------|-------------|------------|----------------|------------|---------------------------------------|---|----------------------------|------------|
| ber         | Chan<br>nel   | Cell<br>2     | Cell<br>3        | Cell 1                    | Cell 2      | Cell 3      | Cell 1     | Cell 2         | Cell 3     | Antenna<br>Configurati<br>on (Note 2) | Fraction<br>of<br>Maximum<br>Throughp<br>ut (%)<br>Note 5 | SNR<br>(dB)<br>(Note<br>3) | gory       |
| 1           | R.11<br>TDD<br>Note<br>4  | 9             | 7                | OP.1<br>TDD               | OP.1<br>TDD | OP.1<br>TDD | EVA5       | EVA5           | EVA5       | 2x2 Low                               | 70  | 14.2                       | ≥2         |
| 2           | R.35<br>TDD<br>Note<br>4  | 9             | 1                | OP.1<br>TDD               | OP.1<br>TDD | OP.1<br>TDD | EVA5       | EVA5           | EVA5       | 2x2 Low                               | 70  | 22.7                       | ≥2         |
| Note 1:     |   |               |                  |                           |             |             |            |                |            | pendent.                              |   |                            |            |
| Note 2:     |   |               |                  |                           |             |             | apply to   | r Cell 1,      | Cell 2 and | d Cell 3.                             |   |                            |            |
| Note 3:     |   |               |                  | $\widehat{E}_{s}/N_{oc2}$ |             |             |            |                |            |                                       |   |                            |            |
| Note 4:     | Note 4: Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are<br>transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and<br>the subframe is available in the definition of the reference channel. |               |                  |                           |             |             |            |                |            |                                       |   |                            |            |
| Note 5:     | The n   | naximun       | n Throu          | ghput is c                | alculated   | from the    | e total Pa | yload in 2     | 2 subfram  | es, averaged ov                       | /er 20ms.   |                            |            |

### Table 8.2.2.3.4-2: Minimum Performance Large Delay CDD (FRC) – Non-MBSFN ABS

# 8.2.2.4 Closed-loop spatial multiplexing performance

# 8.2.2.4.1 Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Port

The requirements are specified in Table 8.2.2.4.1-2, with the addition of the parameters in Table 8.2.2.4.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with wideband and frequency selective precoding.

| Parameter  |                              | Unit                    | Test 1                    | Test 2             |  |  |  |  |
|--|------------------------------|-------------------------|---------------------------|--------------------|--|--|--|--|
| Downlink nower   | $ ho_{\scriptscriptstyle A}$ | dB                      | -3                        | -3                 |  |  |  |  |
| Downlink power<br>allocation   | $ ho_{\scriptscriptstyle B}$ | dB                      | -3 (Note 1)               | -3 (Note 1)        |  |  |  |  |
|  | σ                            | dB                      | 0                         | 0                  |  |  |  |  |
| $N_{\scriptscriptstyle oc}$ at antenna po  | ort                          | dBm/15kHz               | -98                       | -98                |  |  |  |  |
| Precoding granular   | ity                          | PRB                     | 6                         | 50                 |  |  |  |  |
| PMI delay (Note 2  | 2)                           | ms                      | 10 or 11                  | 10 or 11           |  |  |  |  |
| Reporting interva  |                              | ms                      | 1 or 4 (Note 3)           | 1 or 4 (Note 3)    |  |  |  |  |
| Reporting mode   |                              |                         | PUSCH 1-2                 | PUSCH 3-1          |  |  |  |  |
| CodeBookSubsetRest   | riction                      |                         | 001111                    | 001111             |  |  |  |  |
| bitmap   |                              |                         |                           |                    |  |  |  |  |
| ACK/NACK feedback  | mode                         |                         | Multiplexing              | Multiplexing       |  |  |  |  |
| PDSCH transmission   | mode                         |                         | 4                         | 4                  |  |  |  |  |
| Note 1: $P_B = 1$ .  |                              |                         |                           |                    |  |  |  |  |
| Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4). |                              |                         |                           |                    |  |  |  |  |
| Note 3: For Uplink - c<br>and 4ms.   | lownlink                     | configuration 1 the rep | orting interval will alte | ernate between 1ms |  |  |  |  |

Table 8.2.2.4.1-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC)

| Test   | Bandwidth | Reference | OCNG        | Propagation | Correlation                            | Reference value                             |             | UE       |
|--------|-----------|-----------|-------------|-------------|--|---|-------------|----------|
| number |           | Channel   | Pattern     | Condition   | Matrix and<br>Antenna<br>Configuration | Fraction of<br>Maximum<br>Throughput<br>(%) | SNR<br>(dB) | Category |
| 1      | 10 MHz    | R.10 TDD  | OP.1<br>TDD | EVA5        | 2x2 Low                                | 70  | -3.1        | ≥1       |
| 2      | 10 MHz    | R.10 TDD  | OP.1<br>TDD | EPA5        | 2x2 High                               | 70  | -2.8        | ≥1       |

 Table 8.2.2.4.1-2: Minimum performance Single-Layer Spatial Multiplexing (FRC)

#### 8.2.2.4.1A Minimum Requirement Single-Layer Spatial Multiplexing 4 Tx Antenna Port

The requirements are specified in Table 8.2.2.4.1A-2, with the addition of the parameters in Table 8.2.2.4.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with wideband and frequency selective precoding.

| Table 8.2.2.4.1A-1: Test Parameters for S | Single-Layer Spatial Multiplexing (FRC) |
|---|---|
|---|---|

| Parameter                              |   | Unit               | Test 1                   |  |  |  |  |  |
|--|---|--------------------|--------------------------|--|--|--|--|--|
| Downlink nowor                         | $ ho_{\scriptscriptstyle A}$                          | dB                 | -6                       |  |  |  |  |  |
| Downlink power<br>allocation           | $ ho_{\scriptscriptstyle B}$                          | dB                 | -6 (Note 1)              |  |  |  |  |  |
|  | σ   | dB                 | 3                        |  |  |  |  |  |
| $N_{\scriptscriptstyle oc}$ at antenna | port  | dBm/15kHz          | -98                      |  |  |  |  |  |
| Precoding granul                       | arity   | PRB                | 6                        |  |  |  |  |  |
| PMI delay (Note                        | e 2)  | ms                 | 10 or 11                 |  |  |  |  |  |
| Reporting inter-                       | val   | ms                 | 1 or 4 (Note 3)          |  |  |  |  |  |
| Reporting mod                          | le  |                    | PUSCH 1-2                |  |  |  |  |  |
| CodeBookSubsetR                        | estricti  |                    | 00000000000000000        |  |  |  |  |  |
| on bitmap                              |   |                    | 00000000000000000        |  |  |  |  |  |
|  |   |                    | 0000000000000111         |  |  |  |  |  |
|  |   |                    | 1111111111111            |  |  |  |  |  |
| ACK/NACK feed                          | oack  |                    | Multiplexing             |  |  |  |  |  |
| mode                                   |   |                    |                          |  |  |  |  |  |
| PDSCH transmis                         | sion  |                    | 4                        |  |  |  |  |  |
| mode                                   |   |                    |                          |  |  |  |  |  |
| Note 1: $P_B = 1$ .                    |   |                    |                          |  |  |  |  |  |
| Note 2: If the UE                      | reports   | in an available up | link reporting instance  |  |  |  |  |  |
|  | at subrame SF#n based on PMI estimation at a downlink |                    |                          |  |  |  |  |  |
| SF not la                              | iter than   | SF#(n-4), this rep | orted PMI cannot be      |  |  |  |  |  |
|  |   | B downlink before  |                          |  |  |  |  |  |
|  |   |                    | 1 the reporting interval |  |  |  |  |  |
|  |   | ween 1ms and 4m    |                          |  |  |  |  |  |

| Test   | Bandwidth | Reference | OCNG        | Propagation | Correlation                            | Reference value                             |             | UE       |
|--------|-----------|-----------|-------------|-------------|--|---|-------------|----------|
| number |           | Channel   | Pattern     | Condition   | Matrix and<br>Antenna<br>Configuration | Fraction of<br>Maximum<br>Throughput<br>(%) | SNR<br>(dB) | Category |
| 1      | 10 MHz    | R.13 TDD  | OP.1<br>TDD | EVA5        | 4x2 Low                                | 70  | -3.5        | ≥1       |

# 8.2.2.4.1B Enhanced Performance Requirement Type A – Single-Layer Spatial Multiplexing 2 Tx Antenna Port with TM4 interference model

The requirements are specified in Table 8.2.2.4.1B-2, with the addition of the parameters in Table 8.2.2.4.1B-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-

one performance with wideband precoding with two transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of two dominant interfering cells applying transmission mode 4 interference model defined in clause B.5.3. In Table 8.2.2.4.1B-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

| Table 8.2.2.4.1B-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC) with TM4 interference |
|---|
| model   |

| Parameter   |                              | Unit      | Cell 1               | Cell 2                          | Cell 3                          |
|---|------------------------------|-----------|----------------------|---------------------------------|---------------------------------|
|   | $ ho_{\scriptscriptstyle A}$ | dB        | -3                   | -3                              | -3                              |
| Downlink power allocation   | $ ho_{\scriptscriptstyle B}$ | dB        | -3 (Note 1)          | -3                              | -3                              |
|   | σ                            | dB        | 0                    | 0                               | 0                               |
| Cell-specific reference   | signals                      |           | Antenna ports<br>0,1 | Antenna ports<br>0,1            | Antenna ports<br>0,1            |
| $N_{oc}$ at antenna po  | ort                          | dBm/15kHz | -98                  | N/A                             | N/A                             |
| DIP (Note 2)  |                              | dB        | N/A                  | -1.73                           | -8.66                           |
| BW <sub>Channel</sub>   |                              | MHz       | 10                   | 10                              | 10                              |
| Cyclic Prefix   |                              |           | Normal               | Normal                          | Normal                          |
| Cell Id   |                              |           | 0                    | 1                               | 2                               |
| Number of control OFDM  | symbols                      |           | 2                    | 2                               | 2                               |
| PDSCH transmission  |                              |           | 6                    | N/A                             | N/A                             |
| Interference mode   | əl                           |           | N/A                  | As specified in<br>clause B.5.3 | As specified in<br>clause B.5.3 |
| Probability of occurrence of  | Rank 1                       | %         | N/A                  | 80                              | 80                              |
| transmission rank in<br>interfering cells                             | Rank 2                       | %         | N/A                  | 20                              | 20                              |
| Precoding granula   | ity                          | PRB       | 50                   | 6                               | 6                               |
| PMI delay (Note 4   |                              | ms        | 10 or 11             | N/A                             | N/A                             |
| Reporting interva   | 1                            | ms        | 5                    | N/A                             | N/A                             |
| Reporting mode  |                              |           | PUCCH 1-1            | N/A                             | N/A                             |
| CodeBookSubsetRestricti   | on bitmap                    |           | 001111               | N/A                             | N/A                             |
| ACK/NACK feedback   | mode                         |           | Multiplexing         | N/A                             | N/A                             |
| Note 1: $P_B = 1$<br>Note 2: The respective rec<br>its associated DIP |                              |           |                      | cell relative to $N_{a}$        | $c_{c}$ is defined by           |

its associated DIP value as specified in clause B.5.1. Note 3: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.

Note 4: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).
 Note 5: All cells are time-synchronous.

# Table 8.2.2.4.1B-2: Enhanced Performance Requirement Type A, Single-Layer Spatial Multiplexing (FRC) with TM4 interference model

| Test<br>Number | Reference<br>Channel  | OCNG Pattern        |           |           | Propagation<br>Conditions |           |           | Correlation<br>Matrix and             | Reference Value                             |                             | UE<br>Cate |
|----------------|---|---------------------|-----------|-----------|---------------------------|-----------|-----------|---------------------------------------|---|-----------------------------|------------|
|                |   | Cell<br>1           | Cell<br>2 | Cell<br>3 | Cell<br>1                 | Cell<br>2 | Cell<br>3 | Antenna<br>Configurati<br>on (Note 3) | Fraction of<br>Maximum<br>Throughput<br>(%) | SINR<br>(dB)<br>(Note<br>2) | gory       |
| 1              | R.47 TDD  | OP.<br>1<br>TD<br>D | N/A       | N/A       | EV<br>A5                  | EV<br>A5  | EV<br>A5  | 2x2 Low                               | 70  | 1.1                         | ≥1         |
| Note 1:        | Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent. |                     |           |           |                           |           |           |                                       |   |                             |            |
| Note 2:        | SINR corresponds to $\hat{E}_s/N_{oc}$ of Cell 1 as defined in clause 8.1.1.                    |                     |           |           |                           |           |           |                                       |   |                             |            |
| Note 3:        |   |                     |           |           |                           |           |           |                                       | of Cell 1, Cell 2 a                         | nd Cell 3.                  |            |

# 8.2.2.4.1C Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Ports (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements are specified in Table 8.2.2.4.1C-2, with the addition of parameters in Table 8.2.2.4.1C-1. The purpose is to verify the closed loop rank-one performance with wideband precoding if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell with CRS assistance information. In Table 8.2.2.4.1C-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

| Para                                 | ameter   |                              | Unit                                   | Cell 1  | Cell 2                   | Cell 3                   |  |  |  |  |
|--------------------------------------|--|------------------------------|--|---|--------------------------|--------------------------|--|--|--|--|
| Uplink downli                        |  |                              |  | 1   | 1                        | 1                        |  |  |  |  |
| Special subfra                       | me con   | figuration                   |  | 4   | 4                        | 4                        |  |  |  |  |
| <b>_</b>                             |  | $ ho_{\scriptscriptstyle A}$ | dB                                     | -3  | -3                       | -3                       |  |  |  |  |
| Downlink po<br>allocatior            |  | $ ho_{\scriptscriptstyle B}$ | dB                                     | -3 (Note 1)   | -3 (Note 1)              | -3 (Note 1)              |  |  |  |  |
|                                      |  | σ                            | dB                                     | 0   | N/A                      | N/A                      |  |  |  |  |
|                                      |  | N <sub>oc1</sub>             | dBm/15kHz                              | -98 (Note 2)  | N/A                      | N/A                      |  |  |  |  |
| $N_{oc}$ at antenn                   | a port   | N <sub>oc2</sub>             | dBm/15kHz                              | -98 (Note 3)  | N/A                      | N/A                      |  |  |  |  |
|                                      |  | N <sub>oc3</sub>             | dBm/15kHz                              | -93 (Note 4)  | N/A                      | N/A                      |  |  |  |  |
| $\widehat{E}_s$                      | $/N_{oc2}$   |                              | dB                                     | Reference Value in Table 8.2.2.4.1C-2               | 12                       | 10                       |  |  |  |  |
| BW                                   | Channel  |                              | MHz                                    | 10  | 10                       | 10                       |  |  |  |  |
| Subframe                             | Configu  | iration                      |  | Non-MBSFN   | Non-MBSFN                | Non-MBSFN                |  |  |  |  |
| Time Offset                          | betwee   | en Cells                     | μs                                     | N/A   | 3                        | -1                       |  |  |  |  |
| Frequency sh                         | ift betwe  | een Cells                    | Hz                                     | N/A   | 300                      | -100                     |  |  |  |  |
| С                                    | ell Id   |                              |  | 0   | 126                      | 1                        |  |  |  |  |
| ABS patt                             | ern (No  | te 5)                        |  | N/A   | 0000000001<br>0000000001 | 0000000001<br>0000000001 |  |  |  |  |
|                                      | RLM/RRM Measurement<br>Subframe Pattern (Note 6)   |                              |  | 0000000001<br>0000000001                            | N/A                      | N/A                      |  |  |  |  |
| CSI Subframe                         | Sets   | C <sub>CSI,0</sub>           |  | 0000000001<br>0000000001                            | N/A                      | N/A                      |  |  |  |  |
| (Note7)                              |  |                              |  | 1100111000<br>1100111000                            | N/A                      | N/A                      |  |  |  |  |
| Number of                            | control<br>mbols   | OFDM                         |  | 2   | Note 8                   | Note 8                   |  |  |  |  |
| ACK/NACK                             |  | k mode                       |  | Multiplexing  | N/A                      | N/A                      |  |  |  |  |
| PDSCH tran                           |  |                              |  | 6   | Note 9                   | Note 9                   |  |  |  |  |
| Precoding                            | g granul   | larity                       | PRB                                    | 50  | N/A                      | N/A                      |  |  |  |  |
| PMI dela                             | y (Note  | 10)                          | ms                                     | 10 or 11  | N/A                      | N/A                      |  |  |  |  |
| Reporti                              | ng inter   | val                          | ms                                     | 1 or 4 (Note 11)                                    | N/A                      | N/A                      |  |  |  |  |
|                                      | ing mod  |                              |  | PUSCH 3-1   | N/A                      | N/A                      |  |  |  |  |
| CodeBookSu                           |  |                              |  | 1111  | N/A                      | N/A                      |  |  |  |  |
|                                      | ic prefix  |                              |  | Normal  | Normal                   | Normal                   |  |  |  |  |
| Note 1: $P_{R}$ =                    | =1.  |                              |  |   |                          |                          |  |  |  |  |
| Note 2: This<br>over<br>Note 3: This | noise is<br>lapping<br>noise is  | with the ag<br>s applied in  | gressor ÁBS.                           | #1, #2, #3, #5, #6, #8,<br>#0, #4, #7, #11 of a sul |                          |                          |  |  |  |  |
|                                      | essor A<br>noise is  |                              | all OFDM symbo                         | ols of a subframe overla                            | apping with agor         | essor non-ARS            |  |  |  |  |
|                                      |  | as defined                   |  |   | PPing min aggi           |                          |  |  |  |  |
| Note 6: Time                         |  |                              |  | striction pattern for PCe                           | ell measurement          | s as defined in          |  |  |  |  |
|                                      |  |                              |  | nain measurement resc                               | ource restriction        | pattern for CSI          |  |  |  |  |
| Note 8: The                          | number   |                              | OFDM symbols i                         | s not available for ABS                             | and is 2 for the         | subframe                 |  |  |  |  |
| Note 9: Dow                          | indicated by "0" of ABS pattern.<br>Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying |                              |  |   |                          |                          |  |  |  |  |
|                                      |  |                              | ed in Annex A.5.<br>available uplink r | eporting instance at sul                            | orame SF#n bas           | ed on PMI                |  |  |  |  |
| estir                                | nation a   | at a downlin                 |  | an SF#(n-4), this reported                          |                          |                          |  |  |  |  |
|                                      | Uplink -   |                              |  | e reporting interval will a                         | alternate betwee         | n 1ms and                |  |  |  |  |
|                                      |  | of the CRS                   | Sports in Cell 1,                      | Cell 2 and Cell 3 is the                            | same.                    |                          |  |  |  |  |

### Table 8.2.2.4.1C-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC) – Non-MBSFN ABS

Note 13: SIB-1 will not be transmitted in Cell 2 and Cell 3 in this test.

| Test<br>Number | Reference<br>Channel                                 | OCNG Pattern |            | Propagation<br>Conditions (Note1) |            | Correlation<br>Matrix and | Reference Value |                                      | UE<br>Cate   |                            |      |
|----------------|--|--------------|------------|-----------------------------------|------------|---------------------------|-----------------|--------------------------------------|--|----------------------------|------|
|                |  | Cell 1       | Cell 2     | Cell 3                            | Cell 1     | Cell 2                    | Cell 3          | Antenna<br>Configuration<br>(Note 2) | Fraction of<br>Maximum<br>Throughput<br>(%) Note 5 | SNR<br>(dB)<br>(Note<br>3) | gory |
| 1              | R.11 TDD   | OP.1         | OP.1       | OP.1                              | EPA5       | EPA5                      | EPA5            | 2x2 High                             | 70   | 6.4                        | ≥2   |
|                | Note 4   | TDD          | FDD        | TDD                               |            |                           |                 |                                      |  |                            |      |
| Note 1:        | The propagation                                      | on conditi   | ons for C  | ell 1, Cel                        | ll 2 and C | ell 3 are                 | statistica      | lly independent.                     |  |                            |      |
| Note 2:        | The correlation                                      | n matrix a   | nd anten   | na config                         | juration a | pply for (                | Cell 1, Ce      | ell 2 and Cell 3.                    |  |                            |      |
| Note 3:        | : SNR corresponds to $\hat{E}_s/N_{ac^2}$ of cell 1. |              |            |                                   |            |                           |                 |                                      |  |                            |      |
| Note 4:        | 37 002   |              |            |                                   |            |                           |                 |                                      |  |                            |      |
| Note 5:        | The maximum  | Through      | out is cal | culated fr                        | om the to  | otal Paylo                | oad in 2 s      | ubframes, averag                     | ed over 20ms.                                      |                            |      |

#### Table 8.2.2.4.1C-2: Minimum Performance Single-Layer Spatial Multiplexing (FRC)– Non-MBSFN ABS

#### 8.2.2.4.2 Minimum Requirement Multi-Layer Spatial Multiplexing 2 Tx Antenna Port

The requirements are specified in Table 8.2.2.4.2-2, with the addition of the parameters in Table 8.2.2.4.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

| Parameter                               |  | Unit                             | Test 1-2           |  |  |
|---|--|----------------------------------|--------------------|--|--|
| Downlink nowor                          | $ ho_{\scriptscriptstyle A}$   | dB                               | -3                 |  |  |
| Downlink power<br>allocation            | $ ho_{\scriptscriptstyle B}$   | dB                               | -3 (Note 1)        |  |  |
|   | σ  | dB                               | 0                  |  |  |
| $N_{_{oc}}$ at antenna                  | port   | dBm/15kHz                        | -98                |  |  |
| Precoding granu                         | Ilarity  | PRB                              | 50                 |  |  |
| PMI delay (Not                          | e 2)   | ms                               | 10 or 11           |  |  |
| Reporting inte                          | rval   | ms                               | 1 or 4 (Note 3)    |  |  |
| Reporting mo                            | de   |                                  | PUSCH 3-1          |  |  |
| ACK/NACK feedba                         | ck mode  |                                  | Bundling           |  |  |
| CodeBookSubsetR                         | estriction   |                                  | 110000             |  |  |
| bitmap                                  |  |                                  |                    |  |  |
| PDSCH transmission                      | on mode  |                                  | 4                  |  |  |
| Note 1: $P_B = 1$ .                     |  |                                  |                    |  |  |
| subrame S<br>not later th<br>applied at | 2: If the UE reports in an available uplink reporting instance at<br>subrame SF#n based on PMI estimation at a downlink SF<br>not later than SF#(n-4), this reported PMI cannot be<br>applied at the eNB downlink before SF#(n+4). |                                  |                    |  |  |
|   |  | configuration 1 the 1ms and 4ms. | reporting interval |  |  |

Table 8.2.2.4.2-1: Test Parameters for Multi-Layer Spatial Multiplexing (FRC)

#### Table 8.2.2.4.2-2: Minimum performance Multi-Layer Spatial Multiplexing (FRC)

| Те  | st       | Band-  | Reference  | OCNG     | Propagation | Correlation                            | Reference v                                 | /alue       | UE       |
|-----|----------|--------|------------|----------|-------------|--|---|-------------|----------|
| num | iber     | width  | Channel    | Pattern  | Condition   | Matrix and<br>Antenna<br>Configuration | Fraction of<br>Maximum<br>Throughput<br>(%) | SNR<br>(dB) | Category |
| 1   |          | 10 MHz | R.35 TDD   | OP.1 TDD | EPA5        | 2x2 Low                                | 70  | 19.5        | ≥2       |
| 2   | <u>)</u> | 10 MHz | R.11-1 TDD | OP.1 TDD | ETU70       | 2x2 Low                                | 70  | 13.9        | ≥2       |

#### 8.2.2.4.3 Minimum Requirement Multi-Layer Spatial Multiplexing 4 Tx Antenna Port

For single carrier the requirements are specified in Table 8.2.2.4.3-2, with the addition of the parameters in Table 8.2.2.4.3-1 and the downlink physical channel setup according to Annex C.3.2. For CA the requirements are specified in Table 8.2.2.4.3-4, with the addition of the parameters in Table 8.2.2.4.3-3 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

| Paramete  | r                            | Unit      | Test 1                                  |  |  |  |
|---|------------------------------|-----------|---|--|--|--|
| Downlink power  | $ ho_{\scriptscriptstyle A}$ | dB        | -6                                      |  |  |  |
| Downlink power<br>allocation  | $ ho_{\scriptscriptstyle B}$ | dB        | -6 (Note 1)                             |  |  |  |
|   | σ                            | dB        | 3                                       |  |  |  |
| $N_{_{oc}}$ at antenna  | a port                       | dBm/15kHz | -98                                     |  |  |  |
| Precoding gran  | ularity                      | PRB       | 6                                       |  |  |  |
| PMI delay (No   | te 2)                        | ms        | 10 or 11                                |  |  |  |
| Reporting inte  | erval                        | ms        | 1 or 4 (Note 3)                         |  |  |  |
| Reporting mo  | ode                          |           | PUSCH 1-2                               |  |  |  |
| ACK/NACK feedba   | ack mode                     |           | Bundling                                |  |  |  |
| CodeBookSubsetR   | estriction                   |           | 000000000000000000000000000000000000000 |  |  |  |
| bitmap  |                              |           | 0000011111111111111111000000            |  |  |  |
|   |                              |           | 000000000                               |  |  |  |
| PDSCH transmissi  | on mode                      |           | 4                                       |  |  |  |
| Note 1: $P_B = 1$ .   |                              |           |   |  |  |  |
| Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4) |                              |           |   |  |  |  |
| Note 3: For Uplink - downlink configuration 1 the reporting interval will alternate between 1ms and 4ms.  |                              |           |   |  |  |  |
| Note 4: Void.   |                              |           |   |  |  |  |
| Note 5: Void.   |                              |           |   |  |  |  |
| Note 6: Void.   |                              |           |   |  |  |  |

Table 8.2.2.4.3-1: Test Parameters for Multi-Layer Spatial Multiplexing (FRC)

| Test    | Band-  | Reference | OCNG     | Propagatio     | Correlation                            | Reference v                                 | value       | UE       |
|---------|--------|-----------|----------|----------------|--|---|-------------|----------|
| number  | width  | Channel   | Pattern  | n<br>Condition | Matrix and<br>Antenna<br>Configuration | Fraction of<br>Maximum<br>Throughput<br>(%) | SNR<br>(dB) | Category |
| 1       | 10 MHz | R.36 TDD  | OP.1 TDD | EPA5           | 4x2 Low                                | 70  | 15.7        | ≥2       |
| Note 1: | Void   |           |          |                |  |   |             |          |

| Parameter                    |                              | Unit | Test 1      |
|------------------------------|------------------------------|------|-------------|
| Downlink power<br>allocation | $ ho_{\scriptscriptstyle A}$ | dB   | -6          |
|                              | $ ho_{\scriptscriptstyle B}$ | dB   | -6 (Note 1) |
|                              | σ                            | dB   | 3           |

| $N_{oc}$ at antenna port  | dBm/15kHz              | -98                                       |  |  |  |  |
|---|------------------------|---|--|--|--|--|
| Precoding granularity   | PRB                    | 8   |  |  |  |  |
| PMI delay (Note 2)  | ms                     | 10 or 11                                  |  |  |  |  |
| Reporting interval  | ms                     | 1 or 4 (Note 3)                           |  |  |  |  |
| Reporting mode  |                        | PUSCH 1-2                                 |  |  |  |  |
| ACK/NACK feedback mo  | de                     | PUCCH format 1b with channel<br>selection |  |  |  |  |
| CodeBookSubsetRestricti   | on                     | 000000000000000000000000000000000000000   |  |  |  |  |
| bitmap  |                        | 0000111111111111111100000000              |  |  |  |  |
|   |                        | 0000000                                   |  |  |  |  |
| CSI request field (Note 4   | .)                     | '10'                                      |  |  |  |  |
| PDSCH transmission mo   | de                     | 4   |  |  |  |  |
| Note 1: $P_B = 1$ .   |                        |   |  |  |  |  |
| Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4) |                        |   |  |  |  |  |
| between 1ms an  |                        |   |  |  |  |  |
| Note 4: Multiple CC-s ur<br>layers.   |                        |   |  |  |  |  |
| Note 5: The same PDSC   | H transmission mode is | applied to each component carrier.        |  |  |  |  |

#### Table 8.2.2.4.3-4: Minimum performance Multi-Layer Spatial Multiplexing (FRC) for CA

| Test               | Band-       | Reference                          | OCNG                 | Propagatio      | Correlation                            | Reference                                   | ce value          | UE Cate    |
|--------------------|-------------|------------------------------------|----------------------|-----------------|--|---|-------------------|------------|
| number             | width       | Channel                            | Pattern              | n<br>Condition  | Matrix and<br>Antenna<br>Configuration | Fraction of<br>Maximum<br>Throughput<br>(%) | SNR (dB)          |            |
| 1                  | 2x20<br>MHz | R.43 TDD                           | OP.1 TDD<br>(Note 1) | EVA5            | 4x2 Low                                | 70  | 11.1              | ≥5         |
| Note 1:<br>Note 2: |             | pattern applies bility of requiren |                      | ent CA configur | ations and bandwi                      | idth combination                            | sets is defined i | n 8.1.2.3. |

#### 8.2.2.5 MU-MIMO

#### 8.2.2.6 [Control channel performance: D-BCH and PCH]

### 8.2.2.7 Carrier aggregation with power imbalance

The requirements in this section verify the ability of an intraband adjancent carrier aggregation UE to demodulate the signal transmitted by the PCell in the presence of a stronger SCell signal on an adjacent frequency. Throughput is measured on the PCell only.

#### 8.2.2.7.1 Minimum Requirement

For CA the requirements are specified in Table 8.2.2.7.1-2, with the addition of the parameters in Table 8.2.2.7.1-1 and the downlink physical channel setup according to Annex C.3.2.

| Paramet   | er                           | Unit      | Test 1           |  |
|---|------------------------------|-----------|------------------|--|
| Develiele e erre  | $ ho_{\scriptscriptstyle A}$ | dB        | 0                |  |
| Downlink power<br>allocation  | $ ho_{\scriptscriptstyle B}$ | dB        | 0 (Note 1)       |  |
|   | σ                            | dB        | 0                |  |
| $\hat{E}_{s} - {}^{PCell}$ at anter PCell   | nna port of                  | dBm/15kHz | -85              |  |
| $\hat{E}_{s}$ _ <i>SCell</i> at anter Scell   | nna port of                  | dBm/15kHz | -79              |  |
| $N_{oc}$ at anteni  | na port                      | dBm/15kHz | Off (Note 2)     |  |
| Symbols for unus  | sed PRBs                     |           | OCNG<br>(Note 3) |  |
| Modulatio   | n                            |           | 64 QAM           |  |
| Maximum numbe<br>transmiss  |                              |           | 1                |  |
| Redundancy vers<br>sequence   | 0                            |           | {0}              |  |
| PDSCH transmis<br>of PCel   | sion mode                    |           | 1                |  |
| PDSCH transmis<br>of SCel   |                              |           | 3                |  |
| Note 1: $P_B = 0$   |                              |           |                  |  |
| <ul> <li>Note 2: No external noise sources are applied.</li> <li>Note 3: These physical resource blocks are assigned to<br/>an arbitrary number of virtual UEs with one<br/>PDSCH per virtual UE; the data transmitted over<br/>the OCNG PDSCHs shall be uncorrelated<br/>pseudo random data.</li> <li>Note 4: Void.</li> </ul> |                              |           |                  |  |

Table 8.2.2.7.1-1: Test Parameters for CA

| Table 8.2.2.7.1-2: Minimum | performance | (FRC) for CA |
|----------------------------|-------------|--------------|
|----------------------------|-------------|--------------|

| Test<br>Number | Band-<br>width  | Reference<br>Channel |            | OCNG Pattern |             |          | gation<br>itions | Matri     | lation<br>x and<br>anna | Fract<br>Maxi | ce value<br>ion of<br>mum<br>hput (%) | UE<br>Category |
|----------------|---|----------------------|------------|--------------|-------------|----------|------------------|-----------|-------------------------|---------------|---------------------------------------|----------------|
|                |   | PCell                | SCell      | PCell        | SCell       | PCell    | SCell            | PCell     | SCell                   | PCell         | SCell                                 |                |
|                |   |                      |            |              |             |          |                  |           |                         |               |                                       |                |
| 1              | 2x20M<br>Hz   | R.49<br>TDD          | NA         | OP.1<br>TDD  | OP.5<br>TDD | AWGN     | Clause<br>B.1    | 1x2       | 2x2                     | 85%           | NA                                    | ≥5             |
| Note 1:        | The OCNG pattern for PCell is used to fill the control channel. The OCNG pattern for SCell is used to fill the control channel and PDSCH. |                      |            |              |             |          |                  |           |                         |               |                                       |                |
| Note 2:        | The ap<br>in 8.1.   |                      | / of requi | rements f    | or differ   | ent CA d | configura        | ations ar | nd band                 | width comb    | ination set                           | s is defined   |

# 8.3 Demodulation of PDSCH (User-Specific Reference Symbols)

### 8.3.1 FDD

The parameters specified in Table 8.3.1-1 are valid for FDD unless otherwise stated.

| Parameter                              | Unit         | Value  |
|--|--------------|--|
| Cyclic prefix                          |              | Normal   |
| Cell ID                                |              | 0  |
| Inter-TTI Distance                     |              | 1  |
| Number of HARQ<br>processes            | Processes    | 8  |
| Maximum number of<br>HARQ transmission |              | 4  |
| Redundancy version<br>coding sequence  |              | {0,1,2,3} for QPSK and 16QAM<br>{0,0,1,2} for 64QAM                            |
| Number of OFDM<br>symbols for PDCCH    | OFDM symbols | 2  |
| Precoder update<br>granularity         |              | Frequency domain: 1 PRG for<br>Transmission mode 9 and 10<br>Time domain: 1 ms |
| Note 1: Void.<br>Note 2: Void.         | ·            |  |

#### Table 8.3.1-1: Common Test Parameters for User-specific Reference Symbols

#### 8.3.1.1 Single-layer Spatial Multiplexing

For single-layer transmission on antenna ports 7 or 8 upon detection of a PDCCH with DCI format 2C, the requirements are specified in Table 8.3.1.1-1 and 8.3.1.1-2, with the addition of the parameters in Table 8.3.1.1-3 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify rank-1 performance on one of the antenna ports 7 or 8 with and without a simultaneous transmission on the other antenna port, and to verify rate matching with multiple CSI reference symbol configurations with non-zero and zero transmission power.

| paramete   | r                            | Unit                  | Test 1                           | Test 2                  |  |  |  |  |
|--|------------------------------|-----------------------|----------------------------------|-------------------------|--|--|--|--|
|  | $ ho_{\scriptscriptstyle A}$ | dB                    | 0                                | 0                       |  |  |  |  |
| Downlink power<br>allocation   | $ ho_{\scriptscriptstyle B}$ | dB                    | 0 (Note 1)                       | 0 (Note 1)              |  |  |  |  |
|  | σ                            | dB                    | -3                               | -3                      |  |  |  |  |
| Beamforming r  | nodel                        |                       | Annex B.4.1                      | Annex B.4.1             |  |  |  |  |
| Cell-specific ref  | erence                       |                       | Antenna ports 0,1                |                         |  |  |  |  |
| CSI reference s  | ignals                       |                       | Antenna ports<br>15,,18          | Antenna ports<br>15,,18 |  |  |  |  |
| CSI-RS periodic<br>subframe of<br>$T_{CSI-RS} / \Delta_{CS}$                                   | set<br>-RS                   | Subframes             | 5/2                              | 5/2                     |  |  |  |  |
| CSI reference configuration  |                              |                       | 0                                | 3                       |  |  |  |  |
| Zero-power CS<br>configuratio<br><i>I</i> <sub>CSI-RS</sub> /<br><i>ZeroPower</i> CS<br>bitmap | SI-RS<br>on                  | Subframes<br>/ bitmap | 3 /<br>00010000000000000000      | 3 /<br>0001000000000000 |  |  |  |  |
| $N_{\scriptscriptstyle oc}$ at antenna   | a port                       | dBm/15kHz             | -98                              | -98                     |  |  |  |  |
| Symbols for ur<br>PRBs   | used                         |                       | OCNG (Note 4)                    | OCNG (Note 4)           |  |  |  |  |
| Number of allo<br>resource blocks  |                              | PRB                   | 50                               | 50                      |  |  |  |  |
| Simultaneo<br>transmissio  |                              |                       | No                               | Yes (Note 3, 5)         |  |  |  |  |
| PDSCH transm<br>mode   | ission                       |                       | 9                                | 9                       |  |  |  |  |
| Note 1: $P_B = 1$ Note 2:The momentport 7 ofNote 3:Modulaport (7Note 4:ThesevirtualOCNG        | $P_B = 1$ .                  |                       |                                  |                         |  |  |  |  |
|  |                              |                       | ties $n_{\rm SCID}$ are set to 0 |                         |  |  |  |  |
| DM RS  | with inte                    | errering simultai     | neous transmission test          | t cases.                |  |  |  |  |

#### Table 8.3.1.1-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with multiple CSI-RS configurations

 
 Table 8.3.1.1-2: Minimum performance for CDM-multiplexed DM RS without simultaneous transmission (FRC) with multiple CSI-RS configurations

| Test   | Test Bandwidt      |          | OCNG     | Propagation | Correlation                            | Reference            | UE |          |
|--------|--------------------|----------|----------|-------------|--|----------------------|----|----------|
| number | h and<br>MCS       | Channel  | Pattern  | Condition   | Matrix and<br>Antenna<br>Configuration | Antenna Maximum (dB) |    | Category |
| 1      | 10 MHz<br>QPSK 1/3 | R.43 FDD | OP.1 FDD | EVA5        | 2x2 Low                                | 70                   | -1 | ≥1       |

| Test    | Bandwidth           | Reference | OCNG     | Propagation | Correlation                            | Reference v          | UE   |          |  |  |  |
|---------|---------------------|-----------|----------|-------------|--|----------------------|------|----------|--|--|--|
| number  | and MCS             | Channel   | Pattern  | Condition   | Matrix and<br>Antenna<br>Configuration | Antenna Maximum (dB) |      | Category |  |  |  |
| 2       | 10 MHz<br>64QAM 1/2 | R.50 FDD  | OP.1 FDD | EPA5        | 2x2 Low                                | 70                   | 21.9 | ≥2       |  |  |  |
| Note 1: |                     |           |          |             |  |                      |      |          |  |  |  |

#### Table 8.3.1.1-3: Minimum performance for CDM-multiplexed DM RS with interfering simultaneous transmission (FRC) with multiple CSI-RS configurations

# 8.3.1.1A Enhanced Performance Requirement Type A – Single-layer Spatial Multiplexing with TM9 interference model

The requirements are specified in Table 8.3.1.1A-2, with the addition of the parameters in Table 8.3.1.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed loop rank one performance on one of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell when the PDSCH transmission in the serving cell is interfered by PDSCH of one dominant interfering cell applying transmission mode 9 interference model defined in clause B.5.4. In 8.3.1.1A-1, Cell 1 is the serving cell, and Cell 2 is the interfering cell. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1 and Cell 2, respectively.

| paramete  | r                            | Unit             | Cell 1   | Cell 2                          |
|---|------------------------------|------------------|--|---------------------------------|
| Downlink nower                                      | $ ho_{\scriptscriptstyle A}$ | dB               | 0  | 0                               |
| Downlink power<br>allocation                        | $ ho_{\scriptscriptstyle B}$ | dB               | 0 (Note 1)   | 0                               |
| anooanon  | σ                            | dB               | -3   | -3                              |
| Cell-specific referen                               | nce signals                  |                  | Antenna ports 0,1  | Antenna ports 0,1               |
| CSI reference s                                     | •                            |                  | Antenna ports<br>15,,18  | N/A                             |
| CSI-RS periodic<br>subframe offset T <sub>CSI</sub> | -RS / $\Delta$ CSI-RS        | Subframes        | 5/2  | N/A                             |
| CSI reference configuration                         |                              |                  | 0  | N/A                             |
| $N_{\scriptscriptstyle oc}$ at antenn               | a port                       | dBm/15kH<br>z    | -98  | N/A                             |
| DIP (Note :   | 2)                           | dB               | N/A  | -1.73                           |
| BW <sub>Channel</sub>                               |                              | MHz              | 10   | 10                              |
| Cyclic Pref   | ïx                           |                  | Normal   | Normal                          |
| Cell Id   |                              |                  | 0  | 126                             |
| Number of contro<br>symbols                         | I OFDM                       |                  | 2  | 2                               |
| PDSCH transmiss                                     | ion mode                     |                  | 9  | N/A                             |
| Beamforming r                                       | model                        |                  | As specified in<br>clause B.4.3<br>(Note 4, 5)   | N/A                             |
| Interference m                                      | nodel                        |                  | N/A  | As specified in<br>clause B.5.4 |
| Probability of<br>occurrence of                     | Rank 1                       |                  | N/A  | 70                              |
| transmission rank<br>in interfering cells           | Rank 2                       |                  | N/A  | 30                              |
| Precoder update g                                   | ranularity                   | PRB              | 50   | 6                               |
| PMI delay (No                                       | ote 5)                       | Ms               | 8  | N/A                             |
| Reporting inte                                      | erval                        | Ms               | 5  | N/A                             |
| Reporting m   | ode                          |                  | PUCCH 1-1  | N/A                             |
| CodeBookSubsetF<br>bitmap                           | Restriction                  |                  | 00000000000000000<br>0000000000000000<br>00000   | N/A                             |
| Symbols for unus                                    | ed PRBs                      |                  | OCNG (Note 6)  | N/A                             |
| Simultaneous tran                                   | smission                     |                  | No simultaneous<br>transmission on the<br>other antenna port in<br>(7 or 8) not used for<br>the input signal<br>under test | N/A                             |
| Note 1: $P_{R} = 1$                                 |                              | I                |  |                                 |
| Note 2: The respe                                   |                              |                  | tral density of each inter<br>P value as specified in c  | -                               |
| Note 3: The mode<br>antenna p                       | ulation symb<br>port 7 or 8. | ols of the signa | al under test in Cell 1 are  | e mapped onto                   |
| Note 5: If the UE                                   | reports in ar                | n available upli | nk reporting instance at a not later than SF#(n-4),  | subrame SF#n based              |

# Table 8.3.1.1A-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with TM9 interference model

ETSI

|         | cannot be applied at the eNB downlink before SF#(n+4).                            |
|---------|---|
| Note 6: | These physical resource blocks are assigned to an arbitrary number of virtual UEs |
|         | with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs          |
|         | shall be uncorrelated pseudo random data, which is QPSK modulated.                |
| Note 7: | All cells are time-synchronous.   |

## Table 8.3.1.1A-2: Enhanced Performance Requirement Type A, CDM-multiplexed DM RS with TM9 interference model

| Test<br>Number | Referenc<br>e  |             | NG<br>tern |            | gation<br>itions | Correlatio<br>n Matrix                          | Reference V   | alue        | UE<br>Categor |
|----------------|--|-------------|------------|------------|------------------|---|---|-------------|---------------|
|                | Channel  | Cell 1      | Cell 2     | Cell 1     | Cell 2           | and<br>Antenna<br>Configurat<br>ion (Note<br>3) | Fraction of<br>MaximumSINR<br>(dB)Throughput (%)(Note<br>2) |             | У             |
| 1              | R.48 FDD   | OP.1<br>FDD | N/A        | EVA5       | EVA5             | 4x2 Low   | 70  | -1.1        | ≥1            |
| Note 1:        |  |             |            |            |                  |   | ly independent.   |             |               |
| Note 2:        | SINR corresponds to $\hat{E}_s/N_{oc}$ of Cell 1 as defined in clause 8.1.1. |             |            |            |                  |   |   |             |               |
| Note 3:        | Correlation  | matrix ar   | nd antenr  | na configu | uration pa       | arameters appl                                  | y for each of Cell 1  | and Cell 2. |               |

# 8.3.1.1B Single-layer Spatial Multiplexing (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements are specified in Table 8.3.1.1B -2, with the addition of parameters in Table 8.3.1.1B -1. The purpose is to verify the performance of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell with CRS assistance information. In Table 8.3.1.1B -1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

| Parameter   |                                       | Unit                  | Cell 1   | Cell 2   | Cell 3   |
|---|---------------------------------------|-----------------------|--|--|--|
| Falameter   | 0                                     | dB                    | 0  | -3   | -3   |
| Downlink power  | $\rho_A$                              | dB                    | 0 (Note 1)   | -3 (Note 1)  | -3 (Note 1)  |
| allocation  | $ ho_{\scriptscriptstyle B}$ $\sigma$ | dB                    | -3   | N/A  | N/A  |
|   | N <sub>oc1</sub>                      | dBm/15kHz             | -  | N/A  | N/A  |
| N at antonna port   | $N_{oc1}$ $N_{oc2}$                   | dBm/15kHz             | -98 (Note 2)<br>-98 (Note 3)                             | N/A<br>N/A   | N/A<br>N/A   |
| $N_{oc}$ at antenna port  | N <sub>oc3</sub>                      | dBm/15kHz             | -93 (Note 4)   | N/A  | N/A  |
| $\widehat{E}_{s}/N_{oc2}$   | 1 v oc3                               | dB                    | Reference Value  | 12   | 10   |
| BW <sub>Channel</sub>   |                                       | MHz                   | in Table 2<br>10   | 10   | 10   |
| Subframe Configu  | ration                                |                       | Non-MBSFN  | Non-MBSFN  | Non-MBSFN  |
| -   |                                       |                       |  |  |  |
| Time Offset betwee  |                                       | μs                    | N/A  | 3  | -1   |
| Frequency shift betwe   | en Cells                              | Hz                    | N/A  | 300  | -100   |
| Cell Id   |                                       |                       | 0  | 1  | 126  |
| Cell-specific reference   | e signals                             |                       |  | ntenna ports 0,1   |  |
| CSI reference sig   |                                       |                       | Antenna ports<br>15,16                                   | N/A  | N/A  |
| CSI-RS periodicity<br>subframe offse<br>$T_{CSI-RS} / \Delta_{CSI-R}$ | et                                    | Subframes             | 5 / 2  | N/A  | N/A  |
| CSI reference sig<br>configuration                                    |                                       |                       | 8  | N/A  | N/A  |
| Zero-power CSI-<br>configuration                                      | -RS                                   | Subframes /<br>bitmap | [3 /<br>0010000000000<br>00]                             | N/A  | N/A  |
| ABS pattern (Not  | te 5)                                 |                       | N/A  | 11000000<br>11000000<br>11000000<br>11000000<br>11000000 | 11000000<br>11000000<br>11000000<br>11000000<br>11000000 |
| RLM/RRM Measur<br>Subframe Pattern (I                                 |                                       |                       | 10000000<br>10000000<br>10000000<br>10000000<br>1000000  | N/A  | N/A  |
| CSI Subframe Sets   | C <sub>CSI,0</sub>                    |                       | 11000000<br>11000000<br>11000000<br>11000000<br>11000000 | N/A  | N/A  |
| (Note7)   | C <sub>CSI,1</sub>                    |                       | 00111111<br>00111111<br>00111111<br>00111111<br>00111111 | N/A  | N/A  |
| Number of control<br>symbols  | OFDM                                  |                       | 2  | Note 8   | Note 8   |
| PDSCH transmissio   | n mode                                |                       | TM9-1layer   | Note 9   | Note 9   |
| Precoding granul  |                                       |                       | Frequency<br>domain: 1 PRG<br>Time domain: 1<br>ms       | N/A  | N/A  |
| Beamforming mo  |                                       |                       | Annex B.4.1  | N/A  | N/A  |
| Cyclic prefix   |                                       |                       | Normal   | Normal   | Normal   |

### Table 8.3.1.1B-1: Test parameters of TM9-Single-Layer (2 CSI-RS ports) – Non-MBSFN ABS

| Note 1:  | $P_B = 1$ .   |
|----------|---|
| Note 2:  | This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a             |
|          | subframe overlapping with the aggressor ABS.  |
| Note 3:  | This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the        |
| Note 4   | aggressor ABS.  |
| Note 4:  | This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-<br>ABS. |
| Note 5:  | ABS pattern as defined in [9]. PDSCH other than SIB1/paging and its associated                  |
|          | PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is                  |
|          | overlapped with the ABS subframe of aggressor cell and the subframe is available in the         |
|          | definition of the reference channel.  |
| Note 6:  | Time-domain measurement resource restriction pattern for PCell measurements as defined          |
|          | in [7].   |
| Note 7:  | As configured according to the time-domain measurement resource restriction pattern for         |
|          | CSI measurements defined in [7].  |
| Note 8:  | The number of control OFDM symbols is not available for ABS and is 2 for the subframe           |
|          | indicated by "0" of ABS pattern.  |
| Note 9:  | Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3             |
|          | applying OCNG pattern as defined in Annex A.5.  |
| Note 10: | If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI        |
|          | estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at     |
|          | the eNB downlink before SF#(n+4).   |
|          | · · · · · · · · · · · · · · · · · · ·   |
| Note 12: |   |
| Note 13: | The modulation symbols of the signal under test are mapped onto antenna port 7 or 8.            |
|          |   |

Table 8.3.1.1B-2: Minimum Performance of TM9-Single-Layer (2 CSI-RS ports) – Non-MBSFN ABS

| Test<br>Number                | Reference<br>Channel | 00          | NG Patt  | ern         | Conditions (Note1)<br>Cell 1 Cell 2 Cell 3 |  | Correlation<br>Matrix and             | Reference Value                             |                            | UE<br>Cate |  |
|-------------------------------|----------------------|-------------|--|-------------|--|--|---------------------------------------|---|----------------------------|------------|--|
|                               |                      | Cell 1      | Cell 2   | Cell 3      |  |  | Antenna<br>Configurati<br>on (Note 2) | Fraction of<br>Maximum<br>Throughput<br>(%) | SNR<br>(dB)<br>(Note<br>3) | gory       |  |
| 1                             | R.51 FDD             | OP.1<br>FDD | OP.1<br>FDD  | OP.1<br>FDD | EVA5                                       |  | 2x2 Low                               | 70  | 7.8                        | ≥2         |  |
| Note 1:<br>Note 2:<br>Note 3: | The correlation      | on matrix   | n conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.<br>matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.<br>Inds to $\hat{E}_s/N_{ac2}$ of cell 1. |             |  |  |                                       |   |                            |            |  |

### 8.3.1.2 Dual-Layer Spatial Multiplexing

For dual-layer transmission on antenna ports 7 and 8 upon detection of a PDCCH with DCI format 2C, the requirements are specified in Table 8.3.1.2-2, with the addition of the parameters in Table 8.3.1.2-1 where Cell 1 is the serving cell and Cell 2 is the interfering cell. The downlink physical channel setup is set according to Annex C.3.2. The purpose of these tests is to verify the rank-2 performance for full RB allocation, to verify rate matching with multiple CSI reference symbol configurations with non-zero and zero transmission power, and to verify that the UE correctly estimate SNR.

#### Table 8.3.1.2-1: Test Parameters for Testing CDM-multiplexed DM RS (dual layer) with multiple CSI-RS configurations

| parameter                    |                              | Unit | Test 1     |        |  |  |  |
|------------------------------|------------------------------|------|------------|--------|--|--|--|
|                              |                              | Unit | Cell 1     | Cell 2 |  |  |  |
| Downlink nower               | $ ho_{\scriptscriptstyle A}$ | dB   | 4          | 0      |  |  |  |
| Downlink power<br>allocation | $ ho_{\scriptscriptstyle B}$ | dB   | 4 (Note 1) | 0      |  |  |  |
|                              | σ                            | dB   | -3         | -3     |  |  |  |

| Cell-specific reference signals  |                       | Antenna ports 0 and                   | Antenna ports 0 and |  |  |  |  |  |
|--|-----------------------|---------------------------------------|---------------------|--|--|--|--|--|
| Cell ID  |                       | 0                                     | 126                 |  |  |  |  |  |
| CSI reference signals  |                       | Antenna ports 15,16                   | NA                  |  |  |  |  |  |
| Beamforming model  |                       | Annex B.4.2                           | NA                  |  |  |  |  |  |
| CSI-RS periodicity and<br>subframe offset<br>$T_{CSI-RS} / \Delta_{CSI-RS}$  | Subframes             | 5/2                                   | NA                  |  |  |  |  |  |
| CSI reference signal<br>configuration  |                       | 8                                     | NA                  |  |  |  |  |  |
| Zero-power CSI-RS<br>configuration<br>I <sub>CSI-RS</sub> /<br>ZeroPowerCSI-RS<br>bitmap   | Subframes<br>/ bitmap | 3 /<br>001000000000000000             | NA                  |  |  |  |  |  |
| $N_{\it oc}$ at antenna port   | dBm/15kHz             | -98                                   | -98                 |  |  |  |  |  |
| $\widehat{E}_s/N_{oc}$   |                       | Reference Value in<br>Table 8.3.1.2-2 | 7.25dB              |  |  |  |  |  |
| Symbols for unused<br>PRBs   |                       | OCNG (Note 2)                         | NA                  |  |  |  |  |  |
| Number of allocated resource blocks (Note 2)   | PRB                   | 50                                    | NA                  |  |  |  |  |  |
| Simultaneous<br>transmission   |                       | No                                    | NA                  |  |  |  |  |  |
| PDSCH transmission<br>mode   |                       | 9                                     | Blanked             |  |  |  |  |  |
| Note 1: $P_{\scriptscriptstyle B} = 1$ Note 2:These physical resource blocks are assigned to an arbitrary number of<br>virtual UEs with one PDSCH per virtual UE; the data transmitted over the<br>OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK<br>modulated. |                       |                                       |                     |  |  |  |  |  |

Table 8.3.1.2-2: Minimum performance for CDM-multiplexed DM RS (FRC) with multiple CSI-RS configurations

| Test<br>number     | Bandwidth<br>and MCS  |                    |             |           |           |           | gation<br>dition             | Correlation<br>Matrix and                   | Reference value |     | UE<br>Categ |
|--------------------|---|--------------------|-------------|-----------|-----------|-----------|------------------------------|---|-----------------|-----|-------------|
|                    |   |                    | Cell1       | Cell<br>2 | Cell<br>1 | Cell<br>2 | Antenna<br>Configurati<br>on | Fraction of<br>Maximum<br>Throughput<br>(%) | SNR<br>(dB)     | ory |             |
| 1                  | 10 MHz<br>16QAM 1/2   | R.51 FDD           | OP.1<br>FDD | N/A       | ETU5      | ETU5      | 2x2 Low                      | 70  | [14.2]          | 2-8 |             |
| Note 1:<br>Note 2: | 2: Correlation matrix and antenna configuration parameters apply for each of Cell 1 and Cell 2. |                    |             |           |           |           |                              |   |                 |     |             |
| Note 3:            | SNR correspon   | ds to $E_s/N_{oc}$ | of Cell     | 1.        |           |           |                              |   |                 |     |             |

# 8.3.1.3 Performance requirements for DCI format 2D and non Quasi Co-located Antenna Ports

#### 8.3.1.3.1 Minimum requirement with Same Cell ID (with single NZP CSI-RS resource)

The requirements are specified in Table 8.3.1.3.1-3, with the additional parameters in Table 8.3.1.3.1-1 and Table 8.3.1.3.1-2. The purpose of this test is to verify the UE capability of supporting non quasi-colocated antenna ports when the UE receives DCI format 2D in a scenario where the two transmission point share the same Cell ID. In particular the test verifies that the UE, configured with quasi co-location type B, performs correct tracking and compensation of the timing difference between two transmission points, channel parameters estimation and rate matching according to the 'PDSCH RE Mapping and Quasi-Co-Location Indicator' (PQI) signalling defined in [6], configured according to Table 8.3.1.3.1-2. In Table 8.3.1.3.1-1 and 8.3.1.3.1-2, transmission point 1 (TP 1) is the serving cell and transmission point 2

(TP 2) transmits PDSCH. The downlink physical channel setup for TP 1 is according to Table C.3.4-1 and for TP 2 according to Table C.3.4-2.

| Paramete   | r   | Unit                           | TP 1  | TP 2                                   |
|--|---|--------------------------------|---|--|
| Downlink power   | $ ho_{\scriptscriptstyle A}$                      | dB                             | 0   | 0                                      |
| allocation   | $ ho_{\scriptscriptstyle B}$                      | dB                             | 0 (Note 1)  | 0                                      |
|  | σ   | dB                             | -3  | -3                                     |
| Cell-specific referer  | ice signals                                       |                                | Antenna ports 0,1   | (Note 2)                               |
| CSI-RS 0 antenr  | na ports  |                                | NA  | Port {15,16}                           |
| qcl-CSI-RS-Configl<br>CSI-RS 0 period<br>subframe offset T <sub>CSI</sub>          | icity and<br><sub>-RS</sub> / ∆ <sub>CSI-RS</sub> | Subframes                      | NA  | 5/2                                    |
| qcl-CSI-RS-Configl<br>CSI-RS 0 config  |   |                                | NA  | 8                                      |
| csi-RS-ConfigZPId<br>power CSI-RS 0 co<br>I <sub>CSI-RS</sub> /<br>ZeroPower CSI-R | <i>r11,</i> Zero-<br>nfiguration                  |                                | NA  | 2/<br>000001000000000                  |
| $N_{\scriptscriptstyle oc}$ at antenn  | a port  | dBm/15kH<br>z                  | -98   | -98                                    |
| $\widehat{E}_{s}/N_{oc}$   | $\widehat{E}_{s}/N_{oc}$                          |                                | Reference point in Table 8.3.1.3.1-3  | Reference point in Table 8.3.1.3.1-3   |
| BW <sub>Channel</sub>  |   | MHz                            | 10  | 10                                     |
| Cyclic Prefix  |   |                                | Normal  | Normal                                 |
| Cell Id  |   |                                | 0   | 0                                      |
| Number of contro<br>symbols  | I OFDM  |                                | 2   | 2                                      |
| PDSCH transmiss  | ion mode  |                                | Blanked   | 10                                     |
| Number of alloca   | ted PRB   | PRB                            | NA  | 50                                     |
| <i>qcl-Operation, '</i> PE<br>Mapping and Qu<br>Location Indic                     | asi-Co-   |                                | Туре  | B, '00'                                |
| Time offset betwe  | een TPs   | μs                             | NA  | Reference point in Table 8.3.1.3.1-3   |
| Frequency error be   | tween TPs   | Hz                             | NA  | 0                                      |
| Beamforming I  | model   |                                | NA  | As specified in<br>clause B.4.1        |
| Symbols for unus   | ed PRBs   |                                | NA  | OCNG (Note 3)                          |
| Note 1: $P_B = 1$  |   |                                |   |  |
| Noet 2: REs for a<br>Note 3: These ph<br>with one                                  | ysical resou<br>PDSCH per                         | rce blocks are virtual UE; the | zero transmission powe<br>assigned to an arbitrary<br>data transmitted over th<br>n data, which is QPSK r | number of virtual UEs<br>e OCNG PDSCHs |

Table 8.3.1.3.1-1: Test Parameters for quasi co-location type B: same Cell ID

|  | Table 8.3.1.3.1-2 Configurations of PQI and DL | transmission hypothesis for each PQI set |
|--|--|--|
|--|--|--|

| PQI set<br>index | Parameter                                | DL transmission<br>hypothesis for each<br>PQI Set |         |       |
|------------------|--|---|---------|-------|
|                  | NZP CSI-RS Index (For quasi co-location) | ZP CSI-RS configuration                           | TP 1    | TP 2  |
| PQI set 0        | CSI-RS 0                                 | ZP CSI-RS 0                                       | Blanked | PDSCH |

| Test<br>Number | Reference OGCN<br>Channel pattern                   |          |             |              | tions     | Correlation<br>Matrix and<br>Antenna | Reference \               | UE<br>Category                              |                            |          |
|----------------|---|----------|-------------|--------------|-----------|--------------------------------------|---------------------------|---|----------------------------|----------|
|                |   | TP 1     | TP 2        | TPs (μs)     | TP 1      | TP 2                                 | Configuration<br>(Note 2) | Fraction of<br>Maximum<br>Throughput<br>(%) | SNR<br>(dB)<br>(Note<br>3) |          |
| 1              | R.52 FDD  | NA       | OP.1<br>FDD | 2            | EPA       | EPA                                  | 2x2 Low                   | 70  | 12.1                       | ≥2       |
| 2              | R.52 FDD  | NA       | OP.1<br>FDD | -0.5         | EPA       | EPA                                  | 2x2 Low                   | 70  | 12.6                       | ≥2       |
| Note 2:        | The propagation<br>The correlation<br>SNR correspon | n matrix | and ante    | nna configur | ation app | ly for TF                            | 1 and TP 2.               |   |                            | <u>.</u> |

Table 8.3.1.3.1-3: Minimum performance for quasi co-location type B: same Cell ID

#### 8.3.1.3.2 Minimum requirements with Same Cell ID (with multiple NZP CSI-RS resources)

The requirements are specified in Table 8.3.1.3.2-3, with the additional parameters in Table 8.3.1.3.2-1 and 8.3.1.3.2-2. The purpose of this test is to verify the UE capability of supporting non quasi-colocated antenna ports when the UE receives DCI format 2D in a scenario where the two transmission point share the same Cell ID. In particular the test verifies that the UE, configured with quasi co-location type B, performs correct tracking and compensation of the timing difference between two transmission points, channel parameters estimation and rate matching according to the 'PDSCH RE Mapping and Quasi-Co-Location Indicator' (PQI) signalling defined in [6]. In 8.3.1.3.2-1 and 8.3.1.3.2-2, transmission point 1 (TP 1) is the serving cell transmitting PDCCH, synchronization signals and PBCH, and transmission point 2 (TP 2) has same Cell ID as TP 1. Multiple NZP CSI-RS resources and ZP CSI-RS resources are configured. In each sub-frame, DL PDSCH transmission is dynamically switched between 2 TPs with multiple PDSCH RE Mapping and Quasi-Co-Location Indicator configuration (PQI). Configurations of PDSCH RE Mapping and Quasi-Co-Location Indicator configuration (PQI). Configurations of PDSCH RE Mapping and Quasi-Co-Location Indicator configuration (PQI). Configurations of PDSCH RE Mapping and Quasi-Co-Location Indicator configuration (PQI). Configurations of PDSCH RE Mapping and Quasi-Co-Location Indicator configuration (PQI). Configurations of PDSCH RE Mapping and Quasi-Co-Location Indicator and downlink transmission hypothesis are defined in Table 8.3.1.3.2-2. The downlink physical channel setup for TP 1 is according to Table C.3.4-1 and for TP 2 according to Table C.3.4-2.

| paramete                     | r                            | Unit | TP 1       | TP 2 |
|------------------------------|------------------------------|------|------------|------|
| Downlink power<br>allocation | $ ho_{\scriptscriptstyle A}$ | dB   | 0          | 0    |
|                              | $ ho_{\scriptscriptstyle B}$ | dB   | 0 (Note 1) | 0    |
|                              | σ                            | dB   | -3         | -3   |

| Beamforming model  |                      | N/A   | As specified in<br>clause B.4.1         |
|--|----------------------|---|---|
| Cell-specific reference signals  |                      | Antenna ports 0,1                           | (Note 2)                                |
| CSI reference signals 0  |                      | Antenna ports<br>{15,16}                    | N/A                                     |
| CSI-RS 0 periodicity and subframe offset $T_{CSI-RS} / \Delta_{CSI-RS}$                              | Subframes            | 5/2   | N/A                                     |
| CSI reference signal 0<br>configuration  |                      | 0   | N/A                                     |
| CSI reference signals 1  |                      | N/A   | Antenna ports<br>{15,16}                |
| CSI-RS 1 periodicity and subframe offset $T_{CSI-RS} / \Delta_{CSI-RS}$                              | Subframes            | N/A   | 5/2                                     |
| CSI reference signal 1<br>configuration  |                      | N/A   | 8                                       |
| Zero-power CSI-RS 0<br>configuration<br>I <sub>CSI-RS</sub> /<br>ZeroPower CSI-RS bitmap             | Subframes<br>/bitmap | 2/<br>0010000000000000000000000000000000000 | N/A                                     |
| Zero-power CSI-RS1<br>configuration<br>I <sub>CSI-RS</sub> /<br>ZeroPower CSI-RS bitmap <sub>S</sub> | Subframes<br>/bitmap | N/A   | 2/<br>000001000000000                   |
| $\widehat{E}_{s}/N_{oc}$   | dB                   | Reference Value in<br>Table 8.3.1.3.2-3     | Reference Value in<br>Table 8.3.1.3.2-3 |
| $N_{_{oc}}$ at antenna port  | dBm/15kH<br>z        | -98   | -98                                     |
| BW <sub>Channel</sub>  | MHz                  | 10  | 10                                      |
| Cyclic Prefix  |                      | Normal                                      | Normal                                  |
| Cell Id  |                      | 0   | 0                                       |
| Number of control OFDM<br>symbols  |                      | 2   | 2                                       |
| Timing offset between TPs  |                      | N/A   | Reference Value in<br>Table 8.3.1.3.2-3 |
| Frequency offset between TPs   | Hz                   | N/A   | 0                                       |
| Number of allocated resource blocks  | PRB                  | 50  | 50                                      |
| PDSCH transmission mode  |                      | 10  | 10                                      |
| Probability of occurrence of PDSCH transmission(Note 3)  | %                    | 30  | 70                                      |
| Symbols for unused PRBs  |                      | OCNG (Note 4)                               | OCNG (Note 4)                           |

Note 2: REs for antenna ports 0 and 1 have zero transmission power.

Note 3: PDSCH transmission from TPs shall be randomly determined independently for each subframe. Probabilities of occurrence of PDSCH transmission from TPs are specified.

Note 4: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

| PQI set<br>index | Parameter                                   | DL transmission<br>hypothesis for<br>each PQI Set |         |         |
|------------------|---|---|---------|---------|
|                  | NZP CSI-RS Index (For quasi<br>co-location) | ZP CSI-RS configuration                           | TP 1    | TP 2    |
| PQI set 0        | CSI-RS 0                                    | ZP CSI-RS 0                                       | PDSCH   | Blanked |
| PQI set 1        | CSI-RS 1                                    | ZP CSI-RS 1                                       | Blanked | PDSCH   |

#### Table 8.3.1.3.2-2 Configurations of PQI and DL transmission hypothesis for each PQI set

#### Table 8.3.1.3.2-3 Performance Requirements for timing offset compensation with DPS transmission

| Test<br>Number                | Timing<br>offset(us)  | Reference<br>Channel |             | OCNG Propagation<br>Pattern Conditions |      | Correlation Reference Value<br>Matrix and |                                      |   | UE<br>Category             |    |
|-------------------------------|---|----------------------|-------------|--|------|---|--------------------------------------|---|----------------------------|----|
|                               |   |                      | TP 1        | TP 2                                   | TP 1 | TP 2                                      | Antenna<br>Configuration<br>(Note 2) | Fraction of<br>Maximum<br>Throughput<br>(%) | SNR<br>(dB)<br>(Note<br>3) |    |
| 1                             | 2   | R.53<br>FDD          | OP.1<br>FDD | OP.1<br>FDD                            | EPA5 | EPA5                                      | 2x2 Low                              | 70  | 12.2                       | ≥2 |
| 2                             | -0.5  | R.53<br>FDD          | OP.1<br>FDD | OP.1<br>FDD                            | EPA5 | EPA5                                      | 2x2 Low                              | 70  | 12.5                       | ≥2 |
| Note 1:<br>Note 2:<br>Note 3: | <ul> <li>The propagation conditions for TP 1 and TP 2 are statistically independent.</li> <li>Correlation matrix and antenna configuration parameters apply for each of TP 1 and TP 2.</li> </ul> |                      |             |  |      |   |                                      |   |                            |    |

#### 8.3.1.3.3 Minimum requirement with Different Cell ID and Colliding CRS (with single NZP CSI-RS resource)

The requirements are specified in Table 8.3.1.3.3-2, with the additional parameters in Table 8.3.1.3.3-1. The purpose of this test is to verify the UE capability of supporting non quasi-colocated antenna ports when the UE receives DCI format 2D in a scenario where the two transmission points have different Cell ID and colliding CRS. In particular the test verifies that the UE, configured with quasi co-location type B, performs correct tracking and compensation of the frequency difference between two transmission points, channel parameters estimation and rate matching behaviour according to the 'PDSCH RE Mapping and Quasi-Co-Location Indicator' signalling defined in [6]. In 8.3.1.3.3-1, transmission point 1 (TP 1) is serving cell transmitting PDCCH, synchronization signals and PBCH, and transmission point 2 (TP 2) transmits PDSCH with different Cell ID. The downlink physical channel setup for TP 1 is according to Table C.3.4-1 and for TP 2 according to Table C.3.4-2.

| parameter                 |                              | Unit | TP 1       | TP 2 |
|---------------------------|------------------------------|------|------------|------|
| Downlink power allocation | $ ho_{\scriptscriptstyle A}$ | dB   | 0          | 0    |
|                           | $ ho_{\scriptscriptstyle B}$ | dB   | 0 (Note 1) | 0    |
|                           | σ                            | dB   | -3         | -3   |

| Beamforming model  |                      | N/A  | As specified in<br>clause B.4.2      |  |  |  |  |  |
|--|----------------------|--|--------------------------------------|--|--|--|--|--|
| Cell-specific reference signals  |                      | Antenna ports 0,1                                | Antenna ports 0,1                    |  |  |  |  |  |
| CSI reference signals 0  |                      | N/A  | Antenna ports<br>{15,16}             |  |  |  |  |  |
| CSI-RS 0 periodicity and subframe offset $T_{CSI-RS} / \Delta_{CSI-RS}$  | Subframes            | N/A  | 5 / 2                                |  |  |  |  |  |
| CSI reference signal 0<br>configuration  |                      | N/A  | 0                                    |  |  |  |  |  |
| Zero-power CSI-RS 0<br>configuration<br>I <sub>CSI-RS</sub> /<br>ZeroPower CSI-RS bitmap   | Subframes<br>/bitmap | N/A  | 2/<br>00100000000000000              |  |  |  |  |  |
| $\widehat{E}_{s}/N_{oc}$   | dB                   | Reference point in<br>Table 8.3.1.3.3-2 +<br>4dB | Reference Value in Table 8.3.1.3.3-2 |  |  |  |  |  |
| $N_{_{oc}}$ at antenna port  | dBm/15kH<br>z        | -98  | -98                                  |  |  |  |  |  |
| BW <sub>Channel</sub>  | MHz                  | 10   | 10                                   |  |  |  |  |  |
| Cyclic Prefix  |                      | Normal   | Normal                               |  |  |  |  |  |
| Cell Id  |                      | 0  | 126                                  |  |  |  |  |  |
| Number of control OFDM<br>symbols  |                      | 1  | 2                                    |  |  |  |  |  |
| Timing offset between TPs  | us                   | N/A  | 0                                    |  |  |  |  |  |
| Frequency offset between TPs   | Hz                   | N/A  | 200                                  |  |  |  |  |  |
| <i>qcl-Operation, '</i> PDSCH RE<br>Mapping and Quasi-Co-<br>Location Indicator'   |                      | Туре   | B, '00'                              |  |  |  |  |  |
| PDSCH transmission mode  |                      | Blank  | 10                                   |  |  |  |  |  |
| Number of allocated resource<br>block  |                      | N/A  | 50                                   |  |  |  |  |  |
| Symbols for unused PRBs  |                      | N/A  | OCNG(Note2)                          |  |  |  |  |  |
| Note 1: $P_B = 1$<br>Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. |                      |  |                                      |  |  |  |  |  |

#### Table 8.3.1.3.3-2 Performance Requirements for quasi co-location type B with different Cell ID and Colliding CRS

| Test<br>Number                | Reference<br>Channel |           | NG<br>tern  | Cond      | gation<br>itions<br>te1) | Correlation<br>Matrix and<br>Antenna                             | Reference                                   | Reference Value         |    |
|-------------------------------|----------------------|-----------|-------------|-----------|--------------------------|--|---|-------------------------|----|
|                               |                      | TP 1      | TP 2        | TP 1      | TP 2                     | Configuration<br>(Note 2)  | Fraction of<br>Maximum<br>Throughput<br>(%) | SNR<br>(dB)<br>(Note 3) |    |
| 1                             | R.54 FDD             | N/A       | OP.1<br>FDD | EPA5      | ETU5                     | 2x2 Low  | 70  | 14.4                    | ≥2 |
| Note 1:<br>Note 2:<br>Note 3: | Correlation m        | atrix and | antenna     | configura | ation para               | e statistically indep<br>ameters apply for<br>d in clause 8.1.1. |   | d TP 2.                 |    |

### 8.3.2 TDD

The parameters specified in Table 8.3.2-1 are valid for TDD unless otherwise stated.

Table 8.3.2-1: Common Test Parameters for User-specific Reference Symbols

| Parameter                                 | Unit   | Value   |
|---|--|---|
| Uplink downlink<br>configuration (Note 1) |  | 1   |
| Special subframe configuration (Note 2)   |  | 4   |
| Cyclic prefix                             |  | Normal  |
| Cell ID                                   |  | 0   |
| Inter-TTI Distance                        |  | 1   |
| Number of HARQ<br>processes               | Processes                                      | 7   |
| Maximum number of<br>HARQ transmission    |  | 4   |
| Redundancy version<br>coding sequence     |  | {0,1,2,3} for QPSK and 16QAM<br>{0,0,1,2} for 64QAM   |
| Number of OFDM<br>symbols for PDCCH       | OFDM symbols                                   | 2   |
| Precoder update<br>granularity            |  | Frequency domain: 1 PRB for<br>Transmission mode 8, 1 PRG for<br>Transmission mode 9 and 10Time<br>domain: 1 ms |
| ACK/NACK feedback<br>mode                 |  | Multiplexing  |
|   | Table 4.2-2 in TS 36.<br>Table 4.2-1 in TS 36. |   |

### 8.3.2.1 Single-layer Spatial Multiplexing

For single-layer transmission on antenna port 5, the requirements are specified in Table 8.3.2.1-2, with the addition of the parameters in Table 8.3.2.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the demodulation performance using user-specific reference signals with full RB or single RB allocation.

| Parameter  |                              | Unit     | Test 1                | Test 2           | Test 3           | Test 4           |  |  |
|--|------------------------------|----------|-----------------------|------------------|------------------|------------------|--|--|
| Downlink power   | $ ho_{\scriptscriptstyle A}$ | dB       | 0                     | 0                | 0                | 0                |  |  |
| Downlink power<br>allocation   | $ ho_{\scriptscriptstyle B}$ | dB       | 0 (Note 1) 0 (Note 1) |                  | 0 (Note 1)       | 0 (Note 1)       |  |  |
|  | σ                            | dB       | 0                     | 0                | 0                | 0                |  |  |
| Cell-specific refere<br>signals  | ence                         |          |                       | Antenn           | a port 0         |                  |  |  |
| Beamforming mo   | del                          |          | Annex B.4.1           |                  |                  |                  |  |  |
| $N_{_{oc}}$ at antenna p   | oort                         | dB/15kHz | -98                   | -98              | -98              | -98              |  |  |
| Symbols for unused   | PRBs                         |          | OCNG<br>(Note 2)      | OCNG<br>(Note 2) | OCNG<br>(Note 2) | OCNG<br>(Note 2) |  |  |
| PDSCH transmiss<br>mode  | sion                         |          | 7                     | 7                | 7                | 7                |  |  |
| Note 1: $P_{B} = 0$ .  |                              |          |                       |                  |                  |                  |  |  |
| Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with on PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. |                              |          |                       |                  |                  |                  |  |  |

| Test   | Bandwidth           | Reference     | OCNG     | Propagation | Correlation                            | Reference                                   | value       | UE       |
|--------|---------------------|---------------|----------|-------------|--|---|-------------|----------|
| number | and MCS             | Channel       | Pattern  | Condition   | Matrix and<br>Antenna<br>Configuration | Fraction of<br>Maximum<br>Throughput<br>(%) | SNR<br>(dB) | Category |
| 1      | 10 MHz<br>QPSK 1/3  | R.25 TDD      | OP.1 TDD | EPA5        | 2x2 Low                                | 70  | -0.8        | ≥1       |
| 2      | 10 MHz<br>16QAM 1/2 | R.26 TDD      | OP.1 TDD | EPA5        | 2x2 Low                                | 70  | 7.0         | ≥2       |
|        | 5MHz<br>16QAM 1/2   | R.26-1<br>TDD | OP.1 TDD | EPA5        | 2x2 Low                                | 70  | 7.0         | 1        |
| 3      | 10 MHz<br>64QAM 3/4 | R.27 TDD      | OP.1 TDD | EPA5        | 2x2 Low                                | 70  | 17.0        | ≥2       |
|        | 10 MHz<br>64QAM 3/4 | R.27-1<br>TDD | OP.1 TDD | EPA5        | 2x2 Low                                | 70  | 17.0        | 1        |
| 4      | 10 MHz<br>16QAM 1/2 | R.28 TDD      | OP.1 TDD | EPA5        | 2x2 Low                                | 30  | 1.7         | ≥1       |

Table 8.3.2.1-2: Minimum performance DRS (FRC)

For single-layer transmission on antenna ports 7 or 8 upon detection of a PDCCH with DCI format 2B, the requirements are specified in Table 8.3.2.1-4 and 8.3.2.1-5, with the addition of the parameters in Table 8.3.2.1-3 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify rank-1 performance on one of the antenna ports 7 or 8 with and without a simultaneous transmission on the other antenna port.

| Parameter                                  |   | Unit  | Test 1           | Test 2           | Test 3           | Test 4             | Test 5             |
|--|---|---|------------------|------------------|------------------|--------------------|--------------------|
| Downlink power                             | $ ho_{\scriptscriptstyle A}$  | dB  | 0                | 0                | 0                | 0                  | 0                  |
| allocation                                 | $ ho_{\scriptscriptstyle B}$  | dB  | 0 (Note 1)       | 0 (Note 1)       | 0 (Note 1)       | 0 (Note 1)         | 0 (Note 1)         |
|  | σ   | dB  | -3               | -3               | -3               | -3                 | -3                 |
| Cell-specific reference signals            | e   |   |                  | Antenna p        | port 0 and ant   | enna port 1        |                    |
| Beamforming mode                           | l   |   |                  |                  | Annex B.4.1      |                    |                    |
| $N_{\scriptscriptstyle oc}$ at antenna por | t   | dBm/15kHz                                   | -98              | -98              | -98              | -98                | -98                |
| Symbols for unused PF                      | Symbols for unused PRBs   |   | OCNG<br>(Note 4) | OCNG<br>(Note 4) | OCNG<br>(Note 4) | OCNG<br>(Note 4)   | OCNG<br>(Note 4)   |
| Simultaneous transmis                      | sion  |   | No               | No               | No               | Yes<br>(Note 3, 5) | Yes<br>(Note 3, 5) |
| PDSCH transmission m                       | ode   |   | 8                | 8                | 8                | 8                  | 8                  |
|  | mbols   | bols of the sigr<br>of an interferei<br>st. |                  |                  |                  |                    | t used for the     |
| per virtual UE                             | These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. |   |                  |                  |                  |                    |                    |
| Note 5: The two UEs'                       | 5: The two UEs' scrambling identities $n_{\rm SCID}$ are set to 0 for CDM-multiplexed DM RS with interfering  |   |                  |                  |                  |                    |                    |
| simultaneous                               | transm  | ission test cas                             | es.              |                  |                  |                    |                    |

 Table 8.3.2.1-3: Test Parameters for Testing CDM-multiplexed DM RS (single layer)

| Test   | Bandwidt            | Reference     | OCNG     | Propagation | Correlation                            | Reference                                    | value       | UE       |
|--------|---------------------|---------------|----------|-------------|--|--|-------------|----------|
| number | h and<br>MCS        | Channel       | Pattern  | Condition   | Matrix and<br>Antenna<br>Configuration | Fraction of<br>Maximum<br>Throughpu<br>t (%) | SNR<br>(dB) | Category |
| 1      | 10 MHz<br>QPSK 1/3  | R.31 TDD      | OP.1 TDD | EVA5        | 2x2 Low                                | 70   | -1.0        | ≥1       |
| 2      | 10 MHz<br>16QAM 1/2 | R.32 TDD      | OP.1 TDD | EPA5        | 2x2 Medium                             | 70   | 7.7         | ≥2       |
|        | 5MHz<br>16QAM 1/2   | R.32-1<br>TDD | OP.1 TDD | EPA5        | 2x2 Medium                             | 70   | 7.7         | 1        |
| 3      | 10 MHz<br>64QAM 3/4 | R.33 TDD      | OP.1 TDD | EPA5        | 2x2 Low                                | 70   | 17.7        | ≥2       |
|        | 10 MHz<br>64QAM 3/4 | R.33-1<br>TDD | OP.1 TDD | EPA5        | 2x2 Low                                | 70   | 17.7        | 1        |

### Table 8.3.2.1-4: Minimum performance for CDM-multiplexed DM RS without simultaneous transmission (FRC)

# Table 8.3.2.1-5: Minimum performance for CDM-multiplexed DM RS with interfering simultaneous transmission (FRC)

| Test    | Bandwidth        | Reference      | OCNG            | Propagation       | Correlation                            | Reference v                                 | UE          |          |
|---------|------------------|----------------|-----------------|-------------------|--|---|-------------|----------|
| number  | and MCS          | Channel        | Pattern         | Condition         | Matrix and<br>Antenna<br>Configuration | Fraction of<br>Maximum<br>Throughput<br>(%) | SNR<br>(dB) | Category |
| 4       | 10 MHz           | R.32 TDD       | OP.1 TDD        | EPA5              | 2x2 Medium                             | 70  | 21.9        | ≥2       |
|         | 16QAM 1/2        | (Note 1)       |                 |                   |  |   |             |          |
| 5       | 10 MHz           | R.34 TDD       | OP.1 TDD        | EPA5              | 2x2 Low                                | 70  | 22.0        | ≥2       |
|         | 64QAM 1/2        | (Note 1)       |                 |                   |  |   |             |          |
| Note 1: | The reference of | channel applie | s to both the i | input signal unde | er test and the inte                   | rfering signal.                             |             |          |

### 8.3.2.1A Single-layer Spatial Multiplexing (with multiple CSI-RS configurations)

For single-layer transmission on antenna ports 7 or 8 upon detection of a PDCCH with DCI format 2C, the requirements are specified in Table 8.3.2.1A-2 and 8.3.2.1A-3, with the addition of the parameters in Table 8.3.2.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify rank-1 performance on one of the antenna ports 7 or 8 with and without a simultaneous transmission on the other antenna port, and to verify rate matching with multiple CSI reference symbol configurations with non-zero and zero transmission power.

| Parameter   |                              | Unit                  | Test 1   | Test 2                    |  |  |  |
|---|------------------------------|-----------------------|--|---------------------------|--|--|--|
| Davaslintenan   | $ ho_{\scriptscriptstyle A}$ | dB                    | 0  | 0                         |  |  |  |
| Downlink power<br>allocation  | $ ho_{\scriptscriptstyle B}$ | dB                    | 0 (Note 1)   | 0 (Note 1)                |  |  |  |
|   | σ                            | dB                    | -3   | -3                        |  |  |  |
| Cell-specific refere<br>signals   | nce                          |                       | Antenna  | ports 0,1                 |  |  |  |
| CSI reference sigr  | nals                         |                       | Antenna ports<br>15,,22                                    | Antenna ports<br>15,,18   |  |  |  |
| Beamforming mo  | del                          |                       | Annex B.4.1  | Annex B.4.1               |  |  |  |
| CSI-RS periodicity<br>subframe offse<br>T <sub>CSI-RS</sub> / Δ <sub>CSI-RS</sub>   | t                            | Subframes             | 5 / 4  | 5 / 4                     |  |  |  |
| CSI reference sig<br>configuration  | nal                          |                       | 1  | 3                         |  |  |  |
| Zero-power CSI-I<br>configuration<br>I <sub>CSI-RS</sub> /<br>ZeroPowerCSI-F<br>bitmap  |                              | Subframes<br>/ bitmap | 4 /<br>0010000100000000                                    | 4 /<br>001000000000000000 |  |  |  |
| $N_{\scriptscriptstyle oc}$ at antenna p  | ort                          | dBm/15kHz             | -98  | -98                       |  |  |  |
| Symbols for unus<br>PRBs  | ed                           |                       | OCNG (Note 4)  | OCNG (Note 4)             |  |  |  |
| Number of allocat<br>resource blocks (No  |                              | PRB                   | 50   | 50                        |  |  |  |
| Simultaneous<br>transmission  |                              |                       | No   | Yes (Note 3, 5)           |  |  |  |
| PDSCH transmiss<br>mode   | ion                          |                       | 9  | 9                         |  |  |  |
| Note 1: $P_{\scriptscriptstyle B} = 1$ .Note 2:The modu<br>port 7 or 8Note 3:Modulation<br>port (7 orNote 4:These ph<br>virtual UE<br>OCNG PI |                              |                       |  |                           |  |  |  |
|   |                              |                       | ties $n_{ m SCID}$ are set to 0<br>neous transmission test |                           |  |  |  |

# Table 8.3.2.1A-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with multiple CSI-RS configurations

Table 8.3.2.1A-2: Minimum performance for CDM-multiplexed DM RS without simultaneous transmission (FRC) with multiple CSI-RS configurations

| Test   | Bandwidt           | Reference | OCNG     | Propagation | Correlation                            | Reference value                              |             | UE       |
|--------|--------------------|-----------|----------|-------------|--|--|-------------|----------|
| number | h and<br>MCS       | Channel   | Pattern  | Condition   | Matrix and<br>Antenna<br>Configuration | Fraction of<br>Maximum<br>Throughpu<br>t (%) | SNR<br>(dB) | Category |
| 1      | 10 MHz<br>QPSK 1/3 | R.50 TDD  | OP.1 TDD | EVA5        | 2x2 Low                                | 70   | -0.6        | ≥1       |

| Test    | Bandwidth           |                |               | Propagation       | Correlation                            | Reference v                                 | UE          |          |
|---------|---------------------|----------------|---------------|-------------------|--|---|-------------|----------|
| number  | and MCS             | Channel        | Pattern       | Condition         | Matrix and<br>Antenna<br>Configuration | Fraction of<br>Maximum<br>Throughput<br>(%) | SNR<br>(dB) | Category |
| 2       | 10 MHz<br>64QAM 1/2 | R.44 TDD       | OP.1 TDD      | EPA5              | 2x2 Low                                | 70  | 22.1        | ≥2       |
| Note 1: | The reference of    | channel applie | s to both the | input signal unde | er test and the inte                   | rfering signal.                             |             |          |

#### Table 8.3.2.1A-3: Minimum performance for CDM-multiplexed DM RS with interfering simultaneous transmission (FRC) with multiple CSI-RS configurations

# 8.3.2.1B Enhanced Performance Requirement Type A – Single-layer Spatial Multiplexing with TM9 interference model

The requirements are specified in Table 8.3.2.1B-2, with the addition of the parameters in Table 8.3.2.1B-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed-loop rank one performance on one of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell when the PDSCH transmission in the serving cell is interfered by PDSCH of one dominant interfering cell applying transmission mode 9 interference model defined in clause B.5.4. In 8.3.2.1B-1, Cell 1 is the serving cell, and Cell 2 is the interfering cell. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1 and Cell 2, respectively.

|  | r                                   | Unit          | Cell 1   | Cell 2  |
|--|-------------------------------------|---------------|--|---|
| Downlink news  | $ ho_{\scriptscriptstyle A}$        | dB            | 0  | 0   |
| Downlink power -<br>allocation                       | $ ho_{\scriptscriptstyle B}$        | dB            | 0 (Note 1)   | 0   |
|  | σ                                   | dB            | -3   | -3  |
| Cell-specific referen                                | ce signals                          |               | Antenna ports 0,1  | Antenna ports 0,1   |
| CSI reference s                                      | ignals                              |               | Antenna ports<br>15,,18  | N/A   |
| CSI-RS periodic<br>subframe offset T <sub>CSI-</sub> | $_{\rm RS}$ / $\Delta_{\rm CSI-RS}$ | Subframes     | 5 / 4  | N/A   |
| CSI reference s<br>configuratio                      |                                     |               | 0  | N/A   |
| $N_{\scriptscriptstyle oc}$ at antenna               | a port                              | dBm/15kH<br>z | -98  | N/A   |
| DIP (Note 2  | 2)                                  | dB            | N/A  | -1.73   |
| BW <sub>Channel</sub>                                |                                     | MHz           | 10   | 10  |
| Cyclic Prefi   | x                                   |               | Normal   | Normal  |
| Cell Id  |                                     |               | 0  | 126   |
| Number of contro<br>symbols                          | IOFDM                               |               | 2  | 2   |
| PDSCH transmissi                                     | on mode                             |               | 9  | 0<br>0<br>-3<br>Antenna ports 0,1<br>N/A<br>N/A<br>N/A<br>N/A<br>10<br>N/A<br>126<br>2<br>126<br>2<br>N/A<br>126<br>2<br>N/A<br>N/A<br>N/A<br>As specified in<br>clause B.5.4<br>70<br>30<br>6<br>N/A<br>N/A<br>N/A<br>N/A<br>N/A<br>N/A  |
| Beamforming model                                    |                                     |               | As specified in<br>clause B.4.3<br>(Note 4, 5)   | N/A   |
| Interference model                                   |                                     |               | N/A  |   |
| Probability of<br>occurrence of                      | Rank 1                              |               | N/A  | 70  |
| transmission rank<br>in interfering cells            | Rank 2                              |               | N/A  | 30  |
| Precoder update g                                    | ranularity                          | PRB           | 50   | 6   |
| PMI delay (No  | te 5)                               | ms            | 10 or 11   | N/A   |
| Reporting inte                                       | erval                               | ms            | 5  | N/A   |
| Reporting mo   | ode                                 |               | PUCCH 1-1  | N/A   |
| CodeBookSubsetR<br>bitmap                            | estriction                          |               | 0000000000000000<br>0000000000000000<br>000000   | N/A   |
| Symbols for unuse                                    | ed PRBs                             |               | OCNG (Note 6)  | N/A           -1.73           10           Normal           126           2           N/A           N/A |
| Simultaneous trans                                   | smission                            |               | No simultaneous<br>transmission on the<br>other antenna port in<br>(7 or 8) not used for<br>the input signal | N/A   |

# Table 8.3.2.1B-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with TM9 interference model

Note 4: The precoder in clause B.4.3 follows OE recommended PMI. Note 5: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI

|         | cannot be applied at the eNB downlink before SF#(n+4).                            |
|---------|---|
| Note 6: | These physical resource blocks are assigned to an arbitrary number of virtual UEs |
|         | with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs          |
|         | shall be uncorrelated pseudo random data, which is QPSK modulated.                |
| Note 7: | All cells are time-synchronous.   |

## Table 8.3.2.1B-2: Enhanced Performance Requirement Type A, CDM-multiplexed DM RS with TM9 interference model

| Test<br>Number | Referenc<br>e |             | NG<br>tern      |               | gation<br>itions | Correlatio<br>n Matrix                          | Reference Value                          |                             | UE<br>Categor |
|----------------|---------------|-------------|-----------------|---------------|------------------|---|--|-----------------------------|---------------|
|                | Channel       | Cell 1      | Cell 2          | Cell 1        | Cell 2           | and<br>Antenna<br>Configurat<br>ion (Note<br>3) | Fraction of<br>Maximum<br>Throughput (%) | SINR<br>(dB)<br>(Note<br>2) | У             |
| 1              | R.48 TDD      | OP.1<br>TDD | N/A             | EVA5          | EVA5             | 4x2 Low   | 70                                       | -1.0                        | ≥1            |
| Note 1:        |               |             |                 |               |                  |   | ly independent.                          |                             |               |
| Note 2:        | SINR corres   | sponds to   | $\hat{E}_s/N_a$ | $_{pc}$ of Ce | ll 1 as de       | fined in clause                                 | 8.1.1.                                   |                             |               |
| Note 3:        | Correlation   | matrix ar   | nd antenr       | na configu    | uration pa       | arameters appl                                  | y for each of Cell 1                     | and Cell 2                  |               |

# 8.3.2.1C Single-layer Spatial Multiplexing (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements are specified in Table 8.3.2.1.C -2, with the addition of parameters in Table 8.3.2.1.C -1. The purpose is to verify the performance of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell with CRS assistance information. In Table 8.3.2.1.C -1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

| Parameter   |                              | Unit                  | Cell 1   | Cell 2                    | Cell 3                   |  |
|---|------------------------------|-----------------------|--|---------------------------|--------------------------|--|
| Uplink downlink Conf  | iguration                    |                       | 1  | 1                         | 1                        |  |
| Special subframe con  | figuration                   |                       | 4  | 4                         | 4                        |  |
|   | $ ho_{\scriptscriptstyle A}$ | dB                    | 0  | -3                        | -3                       |  |
| Downlink power<br>allocation  | $ ho_{\scriptscriptstyle B}$ | dB                    | 0 (Note 1)   | -3 (Note 1)               | -3 (Note 1)              |  |
| anooatori   | σ                            | dB                    | -3   | N/A                       | N/A                      |  |
|   | N <sub>oc1</sub>             | dBm/15kHz             | -98 (Note 2)                                       | N/A                       | N/A                      |  |
| $N_{oc}$ at antenna port  | N <sub>oc2</sub>             | dBm/15kHz             | -98 (Note 3)                                       | N/A                       | N/A                      |  |
|   | N <sub>oc3</sub>             | dBm/15kHz             | -93 (Note 4)                                       | N/A                       | N/A                      |  |
| $\widehat{E}_s/N_{oc2}$   |                              | dB                    | Reference Value<br>in Table 2                      | 12                        | 10                       |  |
| BW <sub>Channel</sub>   |                              | MHz                   | 10   | 10                        | 10                       |  |
| Subframe Configu  | ration                       |                       | Non-MBSFN  | Non-MBSFN                 | Non-MBSFN                |  |
| Time Offset betwee  | n Cells                      | μs                    | N/A  | 3                         | -1                       |  |
| Frequency shift betwe   | een Cells                    | Hz                    | N/A  | 300                       | -100                     |  |
| Cell Id   |                              |                       | 0  | 1                         | 126                      |  |
| Cell-specific reference   | e signals                    |                       | A  | ntenna ports 0,1          |                          |  |
| CSI reference sig   | inals                        |                       | Antenna ports<br>15,16                             | N/A                       | N/A                      |  |
| CSI-RS periodicit<br>subframe offs<br>$T_{CSI-RS} / \Delta_{CSI-R}$         | et                           | Subframes             | 5/4  | N/A                       | N/A                      |  |
| CSI reference si<br>configuratior   | gnal                         |                       | 8  | N/A                       | N/A                      |  |
| Zero-power CSI<br>configuratior<br>I <sub>CSI-RS</sub> / ZeroPowe<br>bitmap | -RS                          | Subframes /<br>bitmap | [4 /<br>0010000000000<br>00]                       | N/A                       | N/A                      |  |
| ABS pattern (No   | te 5)                        |                       | N/A  | 0000000001<br>00000000001 | 0000000001<br>0000000001 |  |
| RLM/RRM Measur<br>Subframe Pattern (  |                              |                       | 0000000001<br>0000000001                           | N/A                       | N/A                      |  |
| CSI Subframe Sets   | C <sub>CSI,0</sub>           |                       | 0000000001<br>0000000001                           | N/A                       | N/A                      |  |
| (Note7)   | C <sub>CSI,1</sub>           |                       | 1100111000<br>1100111000                           | N/A                       | N/A                      |  |
| Number of control symbols   | OFDM                         |                       | 2  | Note 8                    | Note 8                   |  |
| PDSCH transmissio   | n mode                       |                       | TM9-1layer   | Note 9                    | Note 9                   |  |
| Precoding granu   | arity                        |                       | Frequency<br>domain: 1 PRG<br>Time domain: 1<br>ms | N/A                       | N/A                      |  |
| Beamforming m   |                              |                       | Annex B.4.1  | N/A                       | N/A                      |  |
| Cyclic prefix   |                              |                       | Normal   | Normal                    | Normal                   |  |

### Table 8.3.2.1.C-1: Test parameters of TM9-Single-Layer (2 CSI-RS ports) – Non-MBSFN ABS

|          | $P_{\rm B}=1$ .  |
|----------|--|
| Nata Or  |  |
|          | This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a  |
|          | subframe overlapping with the aggressor ABS.   |
|          | This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.  |
|          | This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.  |
|          | ABS pattern as defined in [9]. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel. |
|          | Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].   |
|          | As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].   |
|          | The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by "0" of ABS pattern.   |
| Note 9:  | Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.   |
| Note 10: | If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).   |
| Note 11: | For Uplink - downlink configuration 1 the reporting interval will alternate between 1ms and 4ms.   |
| Note 12: | The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.  |
|          | SIB-1 will not be transmitted in Cell 2 and Cell 3 in this test.   |
|          | The modulation symbols of the signal under test are mapped onto antenna port 7 or 8.   |

#### Table 8.3.2.1.C-2: Minimum Performance of TM9-Single-Layer (2 CSI-RS ports) – Non-MBSFN ABS

| Test<br>Number                | Reference<br>Channel | 00        | NG Patt  | ern      | Propagation<br>Conditions (Note1) |      | Correlation<br>Matrix and | Reference Value                       |   | UE<br>Cate                 |      |
|-------------------------------|----------------------|-----------|----------|----------|-----------------------------------|------|---------------------------|---------------------------------------|---|----------------------------|------|
|                               |                      | Cell 1    | Cell 2   | Cell 3   | Cell 1                            |      |                           | Antenna<br>Configurati<br>on (Note 2) | Fraction of<br>Maximum<br>Throughput<br>(%) | SNR<br>(dB)<br>(Note<br>3) | gory |
| 1                             | R.51 TDD             | OP.1      | OP.1     | OP.1     |                                   | EVA5 |                           | 2x2 Low                               | 70  | 8.5                        | ≥2   |
|                               |                      | TDD       | TDD      | TDD      |                                   |      |                           |                                       |   |                            |      |
| Note 1:<br>Note 2:<br>Note 3: |                      | on matrix | and ante | nna conf |                                   |      |                           | ally independen<br>Cell 2 and Cell 3. |   |                            |      |

### 8.3.2.2 Dual-Layer Spatial Multiplexing

For dual-layer transmission on antenna ports 7 and 8 upon detection of a PDCCH with DCI format 2B, the requirements are specified in Table 8.3.2.2-2, with the addition of the parameters in Table 8.3.2.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the rank-2 performance for full RB allocation.

| Parame                           | ter                          | Unit   | Test 1                                  | Test 2           |
|----------------------------------|------------------------------|--|---|------------------|
| Downlink                         | $ ho_{\scriptscriptstyle A}$ | dB   | 0                                       | 0                |
| power                            | $ ho_{\scriptscriptstyle B}$ | dB   | 0 (Note 1)                              | 0 (Note 1)       |
| allocation                       | σ                            | dB   | -3                                      | -3               |
| Cell-spe<br>referend<br>symbol   | ce                           |  | Antenna port 0 ar<br>1                  | nd antenna port  |
| Beamforn<br>mode                 |                              |  | Annex                                   | B.4.2            |
| $N_{_{oc}}$ at ant port          | enna                         | dBm/15kHz  | -98                                     | -98              |
| Symbols<br>unused P              |                              |  | OCNG<br>(Note 2)                        | OCNG<br>(Note 2) |
| Number<br>allocate<br>resource b | ed                           | PRB  | 50                                      | 50               |
| PDSCI<br>transmiss<br>mode       | sion                         |  | 8                                       | 8                |
| Note 1:                          | $P_{R} = 1$                  |  |   |                  |
| Note 2:                          | These<br>numbe<br>transm     | physical resource blocks<br>or of virtual UEs with one<br>hitted over the OCNG PD<br>n data, which is QPSK m | PDSCH per virtual<br>SCHs shall be unco | UE; the data     |

#### Table 8.3.2.2-1: Test Parameters for Testing CDM-multiplexed DM RS (dual layer)

Table 8.3.2.2-2: Minimum performance for CDM-multiplexed DM RS (FRC)

| Test   | Bandwidth           | Reference | OCNG     | Propagation | Correlation                            | Reference value                             |             | UE       |  |
|--------|---------------------|-----------|----------|-------------|--|---|-------------|----------|--|
| number | and MCS             | Channel   | Pattern  | Condition   | Matrix and<br>Antenna<br>Configuration | Fraction of<br>Maximum<br>Throughput<br>(%) | SNR<br>(dB) | Category |  |
| 1      | 10 MHz<br>QPSK 1/3  | R.31 TDD  | OP.1 TDD | EVA5        | 2x2 Low                                | 70  | 4.5         | ≥2       |  |
| 2      | 10 MHz<br>16QAM 1/2 | R.32 TDD  | OP.1 TDD | EPA5        | 2x2 Medium                             | 70  | 21.7        | ≥2       |  |

### 8.3.2.3 Dual-Layer Spatial Multiplexing (with multiple CSI-RS configurations)

For dual-layer transmission on antenna ports 7 and 8 upon detection of a PDCCH with DCI format 2C, the requirements are specified in Table 8.3.2.3-2, with the addition of the parameters in Table 8.3.2.3-1 where Cell 1 is the serving cell and Cell 2 is the interfering cell. The downlink physical channel setup is set according to Annex C.3.2. The purpose of these tests is to verify the rank-2 performance for full RB allocation, to verify rate matching with multiple CSI reference symbol configurations with non-zero and zero transmission power, and to verify that the UE correctly estimate SNR.

#### Table 8.3.2.3-1: Test Parameters for Testing CDM-multiplexed DM RS (dual layer) with multiple CSI-RS configurations

| parameter                    |                              | Unit | Test 1     |        |  |  |
|------------------------------|------------------------------|------|------------|--------|--|--|
|                              |                              | Unit | Cell 1     | Cell 2 |  |  |
| Downlink nowor               | $ ho_{\scriptscriptstyle A}$ | dB   | 4          | 0      |  |  |
| Downlink power<br>allocation | $ ho_{\scriptscriptstyle B}$ | dB   | 4 (Note 1) | 0      |  |  |
| anooanon                     | σ                            | dB   | -3         | -3     |  |  |

| PDSCH transmission<br>mode  |                       | 9                                     | NA<br>Blanked            |
|---|-----------------------|---------------------------------------|--------------------------|
| Number of allocated<br>resource blocks (Note 2)<br>Simultaneous                               | PRB                   | 50                                    | NA                       |
| Symbols for unused<br>PRBs  |                       | OCNG (Note 2)                         | NA                       |
| $\widehat{E}_s/N_{oc}$  |                       | Reference Value in<br>Table 8.3.2.3-2 | Test specific,<br>7.25dB |
| $N_{oc}$ at antenna port  | dBm/15kHz             | -98                                   | -98                      |
| Zero-power CSI-RS<br>configuration<br>I <sub>CSI-RS</sub> /<br>ZeroPowerCSI-RS<br>bitmap      | Subframes<br>/ bitmap | 4 /<br>001000000000000000             | NA                       |
| CSI reference signal configuration  |                       | 8                                     | NA                       |
| CSI-RS periodicity and<br>subframe offset<br><i>T</i> <sub>CSI-RS</sub> / Δ <sub>CSI-RS</sub> | Subframes             | 5 / 4                                 | NA                       |
| Beamforming model   |                       | Annex B.4.2                           | NA                       |
| CSI reference signals   |                       | Antenna ports<br>15,16                | NA                       |
| Cell ID   |                       | 0                                     | 126                      |
| Cell-specific reference<br>signals  |                       | Antenna ports 0<br>and 1              | Antenna ports 0 and 1    |

Table 8.3.2.3-2: Minimum performance for CDM-multiplexed DM RS (FRC) with multiple CSI-RS configurations

| Test<br>number                | Bandwidth<br>and MCS                                   | Reference<br>Channel |             | NG<br>tern |        | gation<br>dition | Correlation<br>Matrix and    | Reference                                   | Reference value |      |
|-------------------------------|--|----------------------|-------------|------------|--------|------------------|------------------------------|---|-----------------|------|
|                               |  |                      | Cell 1      | Cell 2     | Cell 1 | Cell 2           | Antenna<br>Configurati<br>on | Fraction of<br>Maximum<br>Throughput<br>(%) | SNR<br>(dB)     | gory |
| 1                             | 10 MHz<br>16QAM 1/2                                    | R.51 TDD             | OP.1<br>TDD | N/A        | ETU5   | ETU5             | 2x2 Low                      | 70  | [14.8]          | 2-8  |
| Note 1:<br>Note 2:<br>Note 3: | The propagation<br>Correlation mater<br>SNR correspond | ix and antenna       | a configui  | ration par |        |                  |                              | nd Cell 2.                                  |                 |      |

#### 8.3.2.4 Performance requirements for DCI format 2D and non Quasi Co-located Antenna Ports

#### 8.3.2.4.1 Minimum requirement with Same Cell ID (with single NZP CSI-RS resource)

The requirements are specified in Table 8.3.2.4.1-3, with the additional parameters in Table 8.3.2.4.1-1 and Table 8.3.2.4.1-2. The purpose of this test is to verify the UE capability of supporting non quasi-colocated antenna ports when the UE receives DCI format 2D in a scenario where the two transmission point share the same Cell ID. In particular the test verifies that the UE, configured with quasi co-location type B, performs correct tracking and compensation of the timing difference between two transmission points, channel parameters estimation and rate matching according to the

'PDSCH RE Mapping and Quasi-Co-Location Indicator' (PQI) signalling defined in [6], configured according to Table 8.3.2.4.1-2. In Table 8.3.2.4.1-1 and 8.3.2.4.1-2, transmission point 1 (TP 1) is the serving cell and transmission point 2 (TP 2) transmits PDSCH. The downlink physical channel setup for TP 1 is according to Table C.3.4-1 and for TP 2 according to Table C.3.4-2.

| Paramete   | r                            | Unit                           | TP 1   | TP 2                                    |
|--|------------------------------|--------------------------------|--|---|
| Deurslink neuron   | Downlink power $\rho_A$      |                                | 0  | 0                                       |
| allocation   | $ ho_{\scriptscriptstyle B}$ | dB                             | 0 (Note 1)   | 0                                       |
|  | σ                            | dB                             | -3   | -3                                      |
| Cell-specific referer  | nce signals                  |                                | Antenna ports 0,1  | (Note 2)                                |
| CSI-RS 0 antenr  | na ports                     |                                | NA   | Port {15,16}                            |
| qcl-CSI-RS-Configl<br>CSI-RS 0 period<br>subframe offset T <sub>CSI</sub>          | icity and<br>-Rs / ∆csi-Rs   | Subframes                      | NA   | 5/4                                     |
| qcl-CSI-RS-Configl<br>CSI-RS 0 config  |                              |                                | NA   | 8                                       |
| csi-RS-ConfigZPId<br>power CSI-RS 0 co<br>I <sub>CSI-RS</sub> /<br>ZeroPower CSI-R | nfiguration                  |                                | NA   | 4/<br>0000010000000000                  |
| $N_{\scriptscriptstyle oc}$ at antenn  | a port                       | dBm/15kH<br>z                  | -98  | -98                                     |
| $\widehat{E}_{s}/N_{oc}$   |                              | dB                             | Reference point in Table 8.3.2.4.1-3   | Reference point in Table 8.3.2.4.1-3    |
| BW <sub>Channe</sub>   | I                            | MHz                            | 10   | 10                                      |
| Cyclic Pref  | ïx                           |                                | Normal   | Normal                                  |
| Cell Id  |                              |                                | 0  | 0                                       |
| Number of contro<br>symbols  | OFDM                         |                                | 2  | 2                                       |
| PDSCH transmiss  | ion mode                     |                                | Blanked  | 10                                      |
| Number of alloca   | ted PRB                      | PRB                            | NA   | 50                                      |
| <i>qcl-Operation, '</i> PD<br>Mapping and Qu<br>Location Indic                     | iasi-Co-                     |                                | Туре   | B, '00'                                 |
| Time offset betwo  | een TPs                      | μs                             | NA   | Reference point in<br>Table 8.3.2.4.1-3 |
| Frequency error be   | tween TPs                    | Hz                             | NA   | 0                                       |
| Beamforming  | model                        |                                | NA   | As specified in<br>clause B.4.1         |
| Symbols for unus   | ed PRBs                      |                                | NA   | OCNG (Note 3)                           |
| Note 3: These ph<br>with one   | ysical resou<br>PDSCH per    | rce blocks are virtual UE; the | zero transmission powe<br>assigned to an arbitrary<br>data transmitted over th | number of virtual UEs<br>e OCNG PDSCHs  |

shall be uncorrelated pseudo random data, which is QPSK modulated.

| PQI set<br>index | Parameter                                   | DL transmissior<br>hypothesis for ea<br>PQI Set |         |       |
|------------------|---|---|---------|-------|
|                  | NZP CSI-RS Index (For quasi<br>co-location) | ZP CSI-RS configuration                         | TP 1    | TP 2  |
| PQI set 0        | CSI-RS 0                                    | ZP CSI-RS 0                                     | Blanked | PDSCH |

#### Table 8.3.2.4.1-2 Configurations of PQI and DL transmission hypothesis for each PQI set

#### Table 8.3.2.4.1-3: Minimum performance for quasi co-location type B: same Cell ID

| Test<br>Number     | Reference<br>Channel  |            | iCN<br>tern    | Time<br>offset<br>between | offset Conditions |          | Correlation<br>Matrix and<br>Antenna | Reference Value                             |                            | UE<br>Category |
|--------------------|---|------------|----------------|---------------------------|-------------------|----------|--------------------------------------|---|----------------------------|----------------|
|                    |   | TP 1       | TP 2           | TPs (μs)                  | TP 1              | TP 2     | Configuration<br>(Note 2)            | Fraction of<br>Maximum<br>Throughput<br>(%) | SNR<br>(dB)<br>(Note<br>3) |                |
| 1                  | R.52 TDD  | NA         | OP.1<br>TDD    | 2                         | EPA               | EPA      | 2x2 Low                              | 70  | 12                         | ≥2             |
| 2                  | R.52 TDD  | NA         | OP.1<br>TDD    | -0.5                      | EPA               | EPA      | 2x2 Low                              | 70  | 12.4                       | ≥2             |
| Note 1:<br>Note 2: | The correlation matrix and antenna configuration apply for TP 1 and TP 2. |            |                |                           |                   |          |                                      |   |                            |                |
| Note 3:            | SNR correspo  | nds to $E$ | $E_s / N_{oc}$ | of TP 2 as de             | efined in o       | clause 8 | .1.1.                                |   |                            |                |

#### 8.3.2.4.2 Minimum requirements with Same Cell ID (with multiple NZP CSI-RS resources)

The requirements are specified in Table 8.3.2.4.2-3, with the additional parameters in Table 8.3.2.4.2-1 and 8.3.2.4.2-2. The purpose of this test is to verify the UE capability of supporting non quasi-colocated antenna ports when the UE receives DCI format 2D in a scenario where the two transmission point share the same Cell ID. In particular the test verifies that the UE, configured with quasi co-location type B, performs correct tracking and compensation of the timing difference between two transmission points, channel parameters estimation and rate matching according to the 'PDSCH RE Mapping and Quasi-Co-Location Indicator' (PQI) signalling defined in [6]. In8.3.2.4.2-1 and 8.3.2.4.2-2, transmission point 1 (TP 1) is the serving cell transmitting PDCCH, synchronization signals and PBCH, and transmission point 2 (TP 2) has same Cell ID as TP 1. Multiple NZP CSI-RS resources and ZP CSI-RS resources are configured. In each sub-frame, DL PDSCH transmission is dynamically switched between 2 TPs with multiple PDSCH RE Mapping and Quasi-Co-Location Indicator configuration (PQI). Configurations of PDSCH RE Mapping and Quasi-Co-Location Indicator configuration (PQI). Configurations of PDSCH RE Mapping and Quasi-Co-Location Indicator configuration (PQI). Configurations of PDSCH RE Mapping and Quasi-Co-Location Indicator configuration (PQI). Configurations of PDSCH RE Mapping and Quasi-Co-Location Indicator configuration (PQI). Configurations of PDSCH RE Mapping and Quasi-Co-Location Indicator configuration (PQI). Configurations of PDSCH RE Mapping and Quasi-Co-Location Indicator configuration (PQI). Configurations of PDSCH RE Mapping and Quasi-Co-Location Indicator and downlink transmission hypothesis are defined in Table 8.3.2.4.2-2. The downlink physical channel setup for TP 1 is according to Table C.3.4-1 and for TP 2 according to Table C.3.4-2.

| paramete  | r                                   | Unit                 | TP 1  | TP 2                                    |
|---|-------------------------------------|----------------------|---|---|
| Downlink power $\rho_A$   |                                     | dB                   | 0   | 0                                       |
| allocation  | $ ho_{\scriptscriptstyle B}$        | dB                   | 0 (Note 1)                                  | 0                                       |
|   | σ                                   | dB                   | -3  | -3                                      |
| Beamforming model   |                                     |                      | N/A   | As specified in<br>clause B.4.1         |
| Cell-specific referen   | ce signals                          |                      | Antenna ports 0,1                           | (Note 2)                                |
| CSI reference signa   |                                     |                      | Antenna ports<br>{15,16}                    | N/A                                     |
| CSI-RS 0 periodicity<br>subframe offset T <sub>CSI</sub>                        | $_{\rm RS}$ / $\Delta_{\rm CSI-RS}$ | Subframes            | 5 / 4                                       | N/A                                     |
| CSI reference signa<br>configuration  | 0                                   |                      | 0   | N/A                                     |
| CSI reference signa   | ls 1                                |                      | N/A   | Antenna ports<br>{15,16}                |
| CSI-RS 1 periodicity<br>subframe offset T <sub>CSI</sub>                        |                                     | Subframes            | N/A   | 5 / 4                                   |
| CSI reference signa<br>configuration  | 1                                   |                      | N/A   | 8                                       |
| Zero-power CSI-RS<br>configuration<br>I <sub>CSI-RS</sub> /<br>ZeroPower CSI-RS | bitmap                              | Subframes<br>/bitmap | 4/<br>0010000000000000000000000000000000000 | N/A                                     |
| Zero-power CSI-RS<br>configuration<br>I <sub>CSI-RS</sub> /<br>ZeroPower CSI-RS |                                     | Subframes<br>/bitmap | N/A   | 4/<br>000001000000000                   |
| $\widehat{E}_{s}/N_{oc}$  | ·                                   | dB                   | Reference Value in<br>Table 8.3.2.4.2-3     | Reference Value in<br>Table 8.3.2.4.2-3 |
| $N_{\scriptscriptstyle oc}$ at antenna port                                     |                                     | dBm/15kH<br>z        | -98   | -98                                     |
| BW <sub>Channel</sub>   |                                     | MHz                  | 10  | 10                                      |
| Cyclic Prefix   |                                     |                      | Normal                                      | Normal                                  |
| Cell Id   |                                     |                      | 0   | 0                                       |
| Number of control O<br>symbols  | FDM                                 |                      | 2   | 2                                       |
| Timing offset betwee  | en TPs                              |                      | N/A   | Reference Value in<br>Table 8.3.2.4.2-3 |
| Frequency offset be   | tween TPs                           | Hz                   | N/A   | 0                                       |
| Number of allocated<br>blocks   | resource                            | PRB                  | 50  | 50                                      |
| PDSCH transmissio   | n mode                              |                      | 10  | 10                                      |
| Probability of occurrence of<br>PDSCH transmission(Note 3)                      |                                     | %                    | 30  | 70                                      |
|   |                                     |                      | OCNG (Note 4)                               | OCNG (Note 4)                           |

#### Table 8.3.2.4.2-1 Test Parameters for timing offset compensation with DPS transmission

Note 3: PDSCH transmission from TPs shall be randomly determined independently for each subframe. Probabilities of occurrence of PDSCH transmission from TPs are specified. Note 4: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

| PQI set<br>index | Parameter                                   | DL transmission<br>hypothesis for<br>each PQI Set |         |         |
|------------------|---|---|---------|---------|
|                  | NZP CSI-RS Index (For quasi<br>co-location) | ZP CSI-RS configuration                           | TP 1    | TP 2    |
| PQI set 0        | CSI-RS 0                                    | ZP CSI-RS 0                                       | PDSCH   | Blanked |
| PQI set 1        | CSI-RS 1                                    | ZP CSI-RS 1                                       | Blanked | PDSCH   |

#### Table 8.3.2.4.2-2 Configurations of PQI and DL transmission hypothesis for each PQI set

| Test<br>Number                | Timing<br>offset(us) | Reference<br>Channel |             |             | Propa<br>Cond | gation<br>itions | Correlation<br>Matrix and            | Reference Value                             |                            | UE<br>Category |
|-------------------------------|----------------------|----------------------|-------------|-------------|---------------|------------------|--------------------------------------|---|----------------------------|----------------|
|                               |                      |                      | TP 1        | TP 2        | TP 1          | TP 2             | Antenna<br>Configuration<br>(Note 2) | Fraction of<br>Maximum<br>Throughput<br>(%) | SNR<br>(dB)<br>(Note<br>3) |                |
| 1                             | 2                    | R.53 TDD             | OP.1<br>TDD | OP.1<br>TDD | EPA5          | EPA5             | 2x2 Low                              | 70  | 12.3                       | ≥2             |
| 2                             | -0.5                 | R.53 TDD             | OP.1<br>TDD | OP.1<br>TDD | EPA5          | EPA5             | 2x2 Low                              | 70  | 12.5                       | ≥2             |
| Note 1:<br>Note 2:<br>Note 3: |                      |                      |             |             |               |                  |                                      |   |                            |                |

# 8.3.2.4.3 Minimum requirement with Different Cell ID and Colliding CRS (with single NZP CSI-RS resource)

The requirements are specified in Table 8.3.2.4.3-2, with the additional parameters in Table 8.3.2.4.3-1. The purpose of this test is to verify the UE capability of supporting non quasi-colocated antenna ports when the UE receives DCI format 2D in a scenario where the two transmission points have different Cell ID and colliding CRS. In particular the test verifies that the UE, configured with quasi co-location type B, performs correct tracking and compensation of the frequency difference between two transmission points, channel parameters estimation and rate matching behaviour according to the 'PDSCH RE Mapping and Quasi-Co-Location Indicator' signalling defined in [6]. In 8.3.2.4.3-1, transmission point 1 (TP 1) is serving cell transmitting PDCCH, synchronization signals and PBCH, and transmission point 2 (TP 2) transmits PDSCH with different Cell ID. The downlink physical channel setup for TP 1 is according to Table C.3.4-1 and for TP 2 according to Table C.3.4-2.

| Table 8.3.2.4.3-1 | <b>Test Parameters for</b> | quasi co-location ty | pe B with different Cell ID | and Colliding CRS |
|-------------------|----------------------------|----------------------|-----------------------------|-------------------|
|-------------------|----------------------------|----------------------|-----------------------------|-------------------|

| parameter                    |                              | Unit | TP 1       | TP 2 |  |
|------------------------------|------------------------------|------|------------|------|--|
| Downlink power<br>allocation | $ ho_{\scriptscriptstyle A}$ | dB   | 0          | 0    |  |
|                              | $ ho_{\scriptscriptstyle B}$ | dB   | 0 (Note 1) | 0    |  |
|                              | σ                            | dB   | -3         | -3   |  |

| Beamforming model   |                      | N/A  | As specified in<br>clause B.4.2      |  |  |  |  |
|---|----------------------|--|--------------------------------------|--|--|--|--|
| Cell-specific reference signals   |                      | Antenna ports 0,1                                | Antenna ports 0,1                    |  |  |  |  |
| CSI reference signals 0   |                      | N/A  | Antenna ports<br>{15,16}             |  |  |  |  |
| CSI-RS 0 periodicity and subframe offset $T_{CSI-RS} / \Delta_{CSI-RS}$   | Subframes            | N/A  | 5 / 4                                |  |  |  |  |
| CSI reference signal 0<br>configuration   |                      | N/A  | 0                                    |  |  |  |  |
| Zero-power CSI-RS 0<br>configuration<br>I <sub>CSI-RS</sub> /<br>ZeroPower CSI-RS bitmap  | Subframes<br>/bitmap | N/A  | 4/<br>001000000000000000             |  |  |  |  |
| $\widehat{E}_s/N_{oc}$  | dB                   | Reference point in<br>Table 8.3.2.4.3-2 +<br>4dB | Reference Value in Table 8.3.2.4.3-2 |  |  |  |  |
| $N_{_{oc}}$ at antenna port   | dBm/15kH<br>z        | -98  | -98                                  |  |  |  |  |
| BW <sub>Channel</sub>   | MHz                  | 10   | 10                                   |  |  |  |  |
| Cyclic Prefix   |                      | Normal   | Normal                               |  |  |  |  |
| Cell Id   |                      | 0  | 126                                  |  |  |  |  |
| Number of control OFDM<br>symbols   |                      | 1  | 2                                    |  |  |  |  |
| Timing offset between TPs   | us                   | N/A  | 0                                    |  |  |  |  |
| Frequency offset between TPs  | Hz                   | N/A  | 200                                  |  |  |  |  |
| <i>qcl-Operation, '</i> PDSCH RE<br>Mapping and Quasi-Co-<br>Location Indicator'  |                      | Туре   | B, '00'                              |  |  |  |  |
| PDSCH transmission mode   |                      | Blank  | 10                                   |  |  |  |  |
| Number of allocated resource<br>block   |                      | N/A  | 50                                   |  |  |  |  |
| Symbols for unused PRBs   |                      | N/A  | OCNG(Note2)                          |  |  |  |  |
| Note 1: $P_B = 1$ Note 2:       These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. |                      |  |                                      |  |  |  |  |

#### Table 8.3.2.4.3-2 Performance Requirements for quasi co-location type B with different Cell ID and Colliding CRS

| Test<br>Number                | Reference<br>Channel   |      | NG<br>tern  |      |      | Correlation<br>Matrix and<br>Antenna | Reference                                   | UE<br>Category          |    |
|-------------------------------|--|------|-------------|------|------|--------------------------------------|---|-------------------------|----|
|                               |  | TP 1 | TP 2        | TP 1 | TP 2 | Configuration<br>(Note 2)            | Fraction of<br>Maximum<br>Throughput<br>(%) | SNR<br>(dB)<br>(Note 3) |    |
| 1                             | R.54 TDD   | N/A  | OP.1<br>TDD | EPA5 | ETU5 | 2x2 Low                              | 70  | 14.7                    | ≥2 |
| Note 1:<br>Note 2:<br>Note 3: | Note 1:       The propagation conditions for TP 1 and TP 2 are statistically independent.         Note 2:       Correlation matrix and antenna configuration parameters apply for each of TP 1 and TP 2. |      |             |      |      |                                      |   |                         |    |

### 8.4 Demodulation of PDCCH/PCFICH

The receiver characteristics of the PDCCH/PCFICH are determined by the probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg). PDCCH and PCFICH are tested jointly, i.e. a miss detection of PCFICH implies a miss detection of PDCCH

### 8.4.1 FDD

The parameters specified in Table 8.4.1-1 are valid for all FDD tests unless otherwise stated.

| Parame                       | eter   | Unit      | Single antenna<br>port | Transmit<br>diversity |
|------------------------------|--|-----------|------------------------|-----------------------|
| Number of PDC                | CH symbols                                   | symbols   | 2                      | 2                     |
| Number of PHICH              | H groups ( <i>N</i> g)                       |           | 1                      | 1                     |
| PHICH du                     | ration                                       |           | Normal                 | Normal                |
| Unused RE-s a                | and PRB-s                                    |           | OCNG                   | OCNG                  |
| Cell I                       | D  |           | 0                      | 0                     |
| Downlink power<br>allocation | PDCCH_RA<br>PHICH_RA<br>OCNG_RA              | dB        | 0                      | -3                    |
|                              | PCFICH_RB<br>PDCCH_RB<br>PHICH_RB<br>OCNG_RB | dB        | 0                      | -3                    |
| $N_{_{oc}}$ at antenna port  |  | dBm/15kHz | -98                    | -98                   |
| Cyclic p                     | refix  |           | Normal                 | Normal                |

#### Table 8.4.1-1: Test Parameters for PDCCH/PCFICH

#### 8.4.1.1 Single-antenna port performance

For the parameters specified in Table 8.4.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.1-1. The downlink physical setup is in accordance with Annex C.3.2.

#### Table 8.4.1.1-1: Minimum performance PDCCH/PCFICH

| Test   | Bandwidth | Aggregation | Reference | OCNG     | Propagation | Antenna       | Referen    | ce value |
|--------|-----------|-------------|-----------|----------|-------------|---------------|------------|----------|
| number |           | level       | Channel   | Pattern  | Condition   | configuration | Pm-dsg (%) | SNR (dB) |
|        |           |             |           |          |             | and           |            |          |
|        |           |             |           |          |             | correlation   |            |          |
|        |           |             |           |          |             | Matrix        |            |          |
| 1      | 10 MHz    | 8 CCE       | R.15 FDD  | OP.1 FDD | ETU70       | 1x2 Low       | 1          | -1.7     |

8.4.1.2 Transmit diversity performance

#### 8.4.1.2.1 Minimum Requirement 2 Tx Antenna Port

For the parameters specified in Table 8.4.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

| Test  | Bandwidth | Aggregation | Reference | OCNG     | Propagation | Antenna                                    | Reference value |          |
|-------|-----------|-------------|-----------|----------|-------------|--|-----------------|----------|
| numbe |           | level       | Channel   | Pattern  | Condition   | configuration<br>and correlation<br>Matrix | Pm-dsg (%)      | SNR (dB) |
| 1     | 10 MHz    | 4 CCE       | R.16 FDD  | OP.1 FDD | EVA70       | 2 x 2 Low                                  | 1               | -0.6     |

#### Table 8.4.1.2.1-1: Minimum performance PDCCH/PCFICH

#### 8.4.1.2.2 Minimum Requirement 4 Tx Antenna Port

For the parameters specified in Table 8.4.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

| Test   | Bandwidth | Aggregation | Reference | OCNG     | Propagation | Antenna                                    | Reference     | ce value    |
|--------|-----------|-------------|-----------|----------|-------------|--|---------------|-------------|
| number |           | level       | Channel   | Pattern  | Condition   | configuration<br>and correlation<br>Matrix | Pm-dsg<br>(%) | SNR<br>(dB) |
| 1      | 5 MHz     | 2 CCE       | R.17 FDD  | OP.1 FDD | EPA5        | 4 x 2 Medium                               | 1             | 6.3         |

#### Table 8.4.1.2.2-1: Minimum performance PDCCH/PCFICH

# 8.4.1.2.3 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)

For the parameters for non-MBSFN ABS specified in Table 8.4.1-1 and Table 8.4.1.2.3-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.3-2. The downlink physical setup is in accordance with Annex C.3.2 and Annex C.3.3. In Table 8.4.1.2.3-1, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

For the parameters for MBSFN ABS specified in Table 8.4.1-1 and Table 8.4.1.2.3-3, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.3-4. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

| Paramete   | r  | Unit                           | Cell 1   | Cell 2   |  |  |  |
|--|--|--------------------------------|--|--|--|--|--|
| 1 didinoto   | PDCCH_RA   | onit                           |  |  |  |  |  |
| Downlink power   | PHICH_RA<br>OCNG_RA  | dB                             | -3   | -3   |  |  |  |
| allocation   | PCFICH_RB<br>PDCCH_RB<br>PHICH_RB<br>OCNG_RB   | dB                             | -3   | -3   |  |  |  |
|  | N <sub>oc1</sub>   | dBm/15kHz                      | -100.5 (Note 1)  | N/A  |  |  |  |
| $N_{ac}$ at antenna port   | N <sub>oc2</sub>   | N <sub>oc2</sub> dBm/15kHz -98 |  | N/A  |  |  |  |
|  | N <sub>oc3</sub>   | dBm/15kHz                      | -95.3 (Note 3)   | N/A  |  |  |  |
| $\widehat{E}_s/N_{oc2}$  |  | dB                             | Reference Value<br>in Table 8.4.1.2.3-<br>2                          | 1.5  |  |  |  |
| BW <sub>Channel</sub>  |  | MHz                            | 10   | 10   |  |  |  |
| Subframe Config  | uration  |                                | Non-MBSFN  | Non-MBSFN  |  |  |  |
| Time Offset betwe  | en Cells   | μs                             | 2.5 (synchro   | nous cells)  |  |  |  |
| Cell Id  |  |                                | 0  | 1  |  |  |  |
| ABS pattern (N   | ote 4)   |                                | N/A  | 00000100<br>00000100<br>00000100<br>01000100<br>00000100 |  |  |  |
| RLM/RRM Measureme<br>Pattern (Note   |  |                                | 00000100<br>00000100<br>00000100<br>00000100<br>00000100             | N/A  |  |  |  |
| CSI Subframe Sets  | C <sub>CSI,0</sub>   |                                | 00000100<br>00000100<br>00000100<br>01000100<br>00000100             | N/A  |  |  |  |
| (Note 6)   | C <sub>CSI,1</sub>   |                                | 11111011<br>11111011<br>11111011<br>10111011<br>10111011<br>11111011 | N/A  |  |  |  |
| Number of control OF   |  |                                | 3  |  |  |  |  |
| Number of PHICH g  |  |                                | 1<br>Extended  |  |  |  |  |
| PHICH durat<br>Unused RE-s and   |  |                                | Extended<br>OCNG   |  |  |  |  |
| Cyclic prefi   |  |                                | Normal   | Normal   |  |  |  |
| Note 1: This noise is a<br>overlapping wit<br>Note 2: This noise is a<br>aggressor ABS | <ul> <li>e 1: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10, #12, #13 of a subframe overlapping with the aggressor ABS.</li> <li>e 2: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.</li> </ul> |                                |  |  |  |  |  |
| Note 4: ABS pattern as<br>are transmitted<br>subframe of ag                            | ABS pattern as defined in [9]. PDCCH/PCFICH other than that associated with SIB1/Paging<br>are transmitted in the serving cell subframe when the subframe is overlapped with the ABS<br>subframe of aggressor cell.  |                                |  |  |  |  |  |
| [7];   | [7];   |                                |  |  |  |  |  |
| measurements<br>Note 7: Cell 1 is the se   | measurements defined in [7];<br>Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1   |                                |  |  |  |  |  |
|  | and Cell2 is the same.<br>8: SIB-1 will not be transmitted in Cell2 in the test.   |                                |  |  |  |  |  |

Table 8.4.1.2.3-1: Test Parameters for PDCCH/PCFICH – Non-MBSFN ABS

| Test<br>Numb<br>er | Aggregati<br>on Level | Referen<br>ce<br>Channel                          | OCNG Pattern Propagation<br>Conditions<br>(Note 1) |             | Correlation<br>Matrix and<br>Antenna |            | rence<br>lue      |                   |                            |
|--------------------|-----------------------|---|--|-------------|--------------------------------------|------------|-------------------|-------------------|----------------------------|
|                    |                       |   | Cell 1   | Cell 2      | Cell 1                               | Cell 2     | Configuration     | Pm-<br>dsg<br>(%) | SNR<br>(dB)<br>(Note<br>2) |
| 1                  | 8 CCE                 | R15-1<br>FDD                                      | OP.1<br>FDD  | OP.1<br>FDD | EVA5                                 | EVA5       | 2x2 Low           | 1                 | -3.9                       |
| Note 1:            |                       |   |  |             | Cell 2 are                           | statistica | Ily independent.  |                   |                            |
| Note 2:            | SNR corresp           | SNR corresponds to $\hat{E}_s/N_{oc2}$ of cell 1. |  |             |                                      |            |                   |                   |                            |
| Note 3:            | The correlat          | ion matrix ar                                     | nd antenn  | a configu   | iration ap                           | ply for Ce | ell 1 and Cell 2. |                   |                            |

Table 8.4.1.2.3-2: Minimum performance PDCCH/PCFICH – Non-MBSFN ABS

| Paramet                            | er   | Unit      | Cell 1  | Cell 2  |
|------------------------------------|--|-----------|---|---|
| Downlink power                     | PCFICH_RA<br>PDCCH_RA<br>PHICH_RA<br>OCNG_RA | dB        | -3  | -3  |
| allocation                         | PCFICH_RB<br>PDCCH_RB<br>PHICH_RB<br>OCNG_RB | dB        | -3  | -3  |
|                                    | $N_{oc1}$                                    | dBm/15kHz | -100.5 (Note 1)                                   | N/A   |
| $N_{oc}$ at antenna port           | N <sub>oc2</sub>                             | dBm/15kHz | -98 (Note 2)                                      | N/A   |
|                                    | N <sub>oc3</sub>                             | dBm/15kHz | -95.3 (Note 3)                                    | N/A   |
| $\widehat{E}_s/N_{ot}$             |  | dB        | Reference Value<br>in Table 8.4.1.2.3-<br>4       | 1.5   |
| BW <sub>Chanr</sub>                | nel  | MHz       | 10  | 10  |
| Subframe Conf                      | iguration                                    |           | Non-MBSFN   | MBSFN   |
| Time Offset betw                   | veen Cells                                   | μs        | 2.5 (synchro                                      | nous cells)                                       |
| Cell Id                            |  |           | 0   | 126   |
| ABS pattern (                      | ABS pattern (Note 4)                         |           | N/A   | 0001000000<br>0100000010<br>0000001000<br>0000000 |
| RLM/RRM Measuren<br>Pattern (No    |  |           | 0001000000<br>010000010<br>000001000<br>00000000  | N/A   |
| CSI Subframe Sets                  | C <sub>CSI,0</sub>                           |           | 000100000<br>010000010<br>000001000<br>000000000  | N/A   |
| (Note 6)                           | C <sub>CSI,1</sub>                           |           | 1110111111<br>1011111101<br>1111110111<br>1111111 | N/A   |
| MBSFN Subframe Allocation (Note 9) |  |           | N/A   | 001000<br>100001<br>000100<br>000000              |
| Number of control O                |  |           | 3   |   |
| Number of PHICH                    |  |           | 1   |   |
| PHICH dur                          |  |           | extended  |   |
| Unused RE-s ar                     |  |           | OCNG  |   |
| Cyclic pre                         | TIX  | l         | Normal  | Normal  |

Table 8.4.1.2.3-3: Test Parameters for PDCCH/PCFICH – MBSFN ABS

| Note 1:  | This noise is applied in OFDM symbols #1, #2, #3, #4, #5, #6, #7, #8, #9, #10, #11, #12, #13 of a subframe overlapping with the aggressor ABS.  |
|----------|---|
| Note 2:  | This noise is applied in OFDM symbols #0 of a subframe overlapping with the aggressor ABS.  |
| Note 3:  | This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS  |
| Note 4:  | ABS pattern as defined in [9]. The 4 <sup>th</sup> , 12 <sup>th</sup> , 19 <sup>th</sup> and 27 <sup>th</sup> subframes indicated by ABS pattern<br>are MBSFN ABS subframes. PDSCH other than SIB1/paging and its associated<br>PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is<br>overlapped with the MBSFN ABS subframe of aggressor cell and the subframe is available in<br>the definition of the reference channel. |
| Note 5:  | Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].  |
| Note 6:  | As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].  |
| Note 7:  | Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.   |
| Note 8:  | SIB-1 will not be transmitted in Cell2 in this test.  |
| Note 9:  | MBSFN Subframe Allocation as defined in [7], four frames with 24 bits is chosen for MBSFN subframe allocation.  |
| Note 10: | The maximum number of uplink HARQ transmission is limited to 2 so that each PHICH channel transmission is in a subframe protected by MBSFN ABS in this test.  |

Table 8.4.1.2.3-4: Minimum performance PDCCH/PCHICH – MBSFN ABS

| Test<br>Numb<br>er | Aggregati<br>on Level                               | Reference<br>Channel |             | NG<br>tern  | n Conditions<br>(Note 1)<br>Cell 2 Cell 1 Cell 2 |             | Conditions<br>(Note 1) |                   | Conditions<br>(Note 1)  |  | nditions Matrix and |  | Reference Value |  |
|--------------------|---|----------------------|-------------|-------------|--|-------------|------------------------|-------------------|-------------------------|--|---------------------|--|-----------------|--|
|                    |   |                      | Cell 1      | Cell 2      |  |             | Configurati<br>on      | Pm-<br>dsg<br>(%) | SNR<br>(dB)<br>(Note 2) |  |                     |  |                 |  |
| 1                  | 8 CCE   | R15-1 FDD            | OP.1<br>FDD | OP.1<br>FDD | EVA5   | EVA5        | 2x2 Low                | 1                 | -4.2                    |  |                     |  |                 |  |
| Note 1:            |   | ation conditions     |             |             | II2 are st                                       | atistically | independent.           |                   |                         |  |                     |  |                 |  |
| Note 2:            | SNR corresponds to $\hat{E}_s / N_{oc2}$ of cell 1. |                      |             |             |  |             |                        |                   |                         |  |                     |  |                 |  |
| Note 3:            | The correlat  | ion matrix and       | antenna     | configura   | tion appl  | y for Cell  | 1 and Cell 2.          |                   |                         |  |                     |  |                 |  |

# 8.4.1.2.4 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

For the parameters for non-MBSFN ABS specified in Table 8.4.1-1 and Table 8.4.1.2.4-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.4-2.

For the parameters for MBSFN ABS specified in Table 8.4.1-1 and Table 8.4.1.2.4-3, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.4-4.

In Tables 8.4.1.2.4-1 and 8.4.1.2.4-3, Cell 1 is the serving cell, and Cell 2 and Cell3are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

| Param   | eter   | Unit  | Cell 1   | Cell 2   | Cell 3   |  |  |
|---|--|---|--|--|--|--|--|
|   | PDCCH_RA   |   |  |  |  |  |  |
| Downlink power  | PHICH_RA<br>OCNG_RA<br>PCFICH_RB                 | dB  | -3   | -3   | -3   |  |  |
| allocation  | PDCCH_RB<br>PHICH_RB<br>OCNG_RB                  |   | -3   | -3   | -3   |  |  |
|   | N <sub>oc1</sub>                                 | dBm/15kHz                                     | -98(Note 1)  | N/A  | N/A  |  |  |
| N <sub>oc</sub> at antenna port   | $N_{oc2}$  | dBm/15kHz                                     | -98 (Note 2)   | N/A  | N/A  |  |  |
| pon   | $N_{oc3}$  | dBm/15kHz                                     | -93 (Note 3)   | N/A  | N/A  |  |  |
| $\hat{E}_s/N$   | l oc2  | dB  | Reference<br>Value in Table<br>8.4.1.2.4-2                           | 5  | 3  |  |  |
| BW <sub>Ch</sub>  | annel  | MHz   | 10   | 10   | 10   |  |  |
| Subframe Co   | nfiguration                                      |   | Non-MBSFN  | Non-MBSFN  | Non-MBSFN  |  |  |
| Time Offset be  | etween Cells                                     | μs  | N/A  | 3  | -1   |  |  |
| Frequency shift   | between Cells                                    | Hz  | N/A  | 300  | -100   |  |  |
| Cell  | Id   |   | 0  | 126  | 1  |  |  |
| ABS pattern (Note 4)  |  |   | N/A  | 00000100<br>00000100<br>00000100<br>00000100<br>00000100 | 00000100<br>00000100<br>00000100<br>00000100<br>00000100 |  |  |
|   | RLM/RRM Measurement<br>Subframe Pattern (Note 5) |   | 00000100<br>00000100<br>00000100<br>00000100<br>00000100             | N/A  | N/A  |  |  |
| CSI Subframe  | C <sub>CSI,0</sub>                               |   | 00000100<br>00000100<br>00000100<br>00000100<br>00000100             | N/A  | N/A  |  |  |
| Sets (Note 6)   | C <sub>CSI,1</sub>                               |   | 11111011<br>11111011<br>11111011<br>11111011<br>11111011<br>11111011 | N/A  | N/A  |  |  |
| Number of control   |  |   | 2  | Note 7   | Note 7   |  |  |
| Number of PHIC  |  |   | 1  | N/A  | N/A  |  |  |
| PHICH d<br>Unused RE-s  |  |   | Normal<br>OCNG   | N/A<br>OCNG  | N/A<br>OCNG  |  |  |
| Cyclic p  |  |   | Normal   | Normal   | Normal   |  |  |
| Note 1: This noi  | se is applied in O                               | L<br>FDM symbols #1, #2<br>essor ABS.         |  |  |  |  |  |
| <ul> <li>overlapping with the aggressor ABS.</li> <li>Note 2: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.</li> <li>Note 3: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS</li> <li>Note 4: ABS pattern as defined in [9]. PDCCH/PCFICH other than that associated with SIB1/Paging are transmitted in the serving cell subframe when the subframe is overlapped with the ABS</li> </ul> |  |   |  |  |  |  |  |
| Note 5: Time-do<br>[7];   |  | ent resource restriction                      |  |  |  |  |  |
| measure   | ements defined in                                |   |  |  |  |  |  |
|   | nber of control OF<br>d by "0" of ABS pa         | DM symbols is not attern.                     | available for ABS a  | and is 2 for the su                                      | ubframe  |  |  |
| Note 8: The nur   | nber of the CRS p                                | oorts in Cell1, Cell2 a ted in Cell2 and Cell |  | me.  |  |  |  |

Table 8.4.1.2.4-1: Test Parameters for PDCCH/PCFICH – Non-MBSFN ABS

| Test<br>Number | Aggregati<br>on Level   | Reference<br>Channel       | OCNG Pattern |             | Propagation<br>Conditions (Note 1) |            |              | Correlation<br>Matrix and | Reference Value                      |                   |                         |
|----------------|---|----------------------------|--------------|-------------|------------------------------------|------------|--------------|---------------------------|--------------------------------------|-------------------|-------------------------|
|                |   |                            | Cell 1       | Cell 2      | Cell 3                             | Cell 1     | Cell 2       | Cell3                     | Antenna<br>Configuration<br>(Note 2) | Pm-<br>dsg<br>(%) | SNR<br>(dB)<br>(Note 3) |
| 1              | 8 CCE   | R.15-2<br>FDD              | OP.1<br>FDD  | OP.1<br>FDD | OP.1<br>FDD                        | EVA5       | EVA5         | EVA5                      | 2x2 Low                              | 1                 | -2.2                    |
| Note 1:        | The propagation   | on conditions f            | or Cell 1,   | Cell 2 ar   | nd Cell 3                          | are statis | stically ind | depender                  | nt.                                  |                   | •                       |
| Note 2:        | The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3. |                            |              |             |                                    |            |              |                           |                                      |                   |                         |
| Note 3:        | SNR correspon   | nds to $\hat{E}_s / N_{o}$ | of cell      | 1.          |                                    |            |              |                           |                                      |                   |                         |

Table 8.4.1.2.4-2: Minimum performance PDCCH/PCFICH – Non-MBSFN ABS

| Paran                              | neter  | Unit      | Cell 1  | Cell 2  | Cell 3  |
|------------------------------------|--|-----------|---|---|---|
| Downlink power                     | PDCCH_RA<br>PHICH_RA<br>OCNG_RA              | dB        | -3  | -3  | -3  |
| Downlink power<br>allocation       | PCFICH_RB<br>PDCCH_RB<br>PHICH_RB<br>OCNG_RB | dB        | -3  | -3  | -3  |
|                                    | N <sub>oc1</sub>                             | dBm/15kHz | -98(Note 1)                                       | N/A   | N/A   |
| $N_{oc}$ at antenna                | N <sub>oc2</sub>                             | dBm/15kHz | -98 (Note 2)                                      | N/A   | N/A   |
| port                               | N <sub>oc3</sub>                             | dBm/15kHz | -93 (Note 3)                                      | N/A   | N/A   |
| $\widehat{E}_s/N$                  |  | dB        | Reference<br>Value in<br>Table<br>8.4.1.2.4-4     | 5   | 3   |
| BW <sub>C</sub>                    | nannel                                       | MHz       | 10  | 10  | 10  |
| Subframe Co                        | onfiguration                                 |           | Non-MBSFN   | MBSFN   | MBSFN   |
| Time Offset between Cells          |  | μs        | N/A   | 3   | -1  |
| Frequency shift between Cells      |  | Hz        | N/A   | 300   | -100  |
| Cell Id                            |  |           | 0   | 126   | 1   |
| ABS patter                         | n (Note 4)                                   |           | N/A   | 0001000000<br>010000010<br>0000001000<br>00000000 | 0001000000<br>010000010<br>0000001000<br>00000000 |
| RLM/RRM Measu<br>Pattern (         |  |           | 0001000000<br>010000010<br>000001000<br>00000000  | N/A   | N/A   |
| CSI Subframe                       | C <sub>CSI,0</sub>                           |           | 0001000000<br>010000010<br>000001000<br>00000000  | N/A   | N/A   |
| Sets (Note 6)                      | C <sub>CSI,1</sub>                           |           | 1110111111<br>1011111101<br>1111110111<br>1111111 | N/A   | N/A   |
| MBSFN Subframe Allocation (Note 7) |  |           | N/A   | 001000<br>100001<br>000100<br>000000              | 001000<br>100001<br>000100<br>000000              |
| Number of contro                   |  |           | 2   | Note 8  | Note 8  |
| Number of PHIC                     |  |           | 1   | N/A   | N/A   |
| PHICH o<br>Unused RE-s             |  |           | Normal<br>OCNG                                    | N/A<br>OCNG                                       | N/A<br>OCNG                                       |
| Cyclic                             |  |           | Normal  | Normal  | Normal  |

Table 8.4.1.2.4-3: Test Parameters for PDCCH/PCFICH – MBSFN ABS

| Note 1:  | This noise is applied in OFDM symbols #1, #2, #3, #4, #5, #6, #7, #8, #9, #10, #11, #12, #13 of a subframe overlapping with the aggressor ABS.   |
|----------|--|
| Note 2:  | This noise is applied in OFDM symbols #0 of a subframe overlapping with the aggressor ABS.   |
| Note 3:  | This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS   |
| Note 3:  | ABS pattern as defined in [9]. The 4 <sup>th</sup> , 12 <sup>th</sup> , 19 <sup>th</sup> and 27 <sup>th</sup> subframes indicated by ABS pattern |
| Note 4.  |  |
|          | are MBSFN ABS subframes. PDSCH other than SIB1/paging and its associated   |
|          | PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped  |
|          | with the MBSFN ABS subframe of aggressor cell and the subframe is available in the definition  |
|          | of the reference channel.  |
| Note 5:  | Time-domain measurement resource restriction pattern for PCell measurements as defined in  |
|          | [7].   |
| Note 6:  | As configured according to the time-domain measurement resource restriction pattern for CSI  |
|          | measurements defined in [7].   |
| Note 7:  | MBSFN Subframe Allocation as defined in [7], four frames with 24 bits are chosen for MBSFN   |
|          | subframe allocation.   |
| Note 8:  | The number of control OFDM symbols is not available for ABS and is 2 for the subframe  |
| 11010 0. | indicated by "0" of ABS pattern.   |
| Note 9:  | The maximum number of uplink HARQ transmission is limited to 2 so that each PHICH channel  |
| Note 9.  |  |
| Nata 10  | transmission is in a subframe protected by MBSFN ABS in this test.   |
| Note 10: |  |
| Note 11: | SIB-1 will not be transmitted in Cell 2 and Cell 3 in this test.   |

Table 8.4.1.2.4-4: Minimum performance PDCCH/PCFICH – MBSFN ABS

| Test<br>Number                | 33 3 3  |               | OCNG Pattern |             |             | Propagation<br>Conditions (Note 1) |        |       | Correlation<br>Matrix and            | Reference Value   |                         |
|-------------------------------|---|---------------|--------------|-------------|-------------|------------------------------------|--------|-------|--------------------------------------|-------------------|-------------------------|
|                               |   |               | Cell 1       | Cell 2      | Cell 3      | Cell 1                             | Cell 2 | Cell3 | Antenna<br>Configuration<br>(Note 2) | Pm-<br>dsg<br>(%) | SNR<br>(dB)<br>(Note 3) |
| 1                             | 8 CCE   | R.15-2<br>FDD | OP.1<br>FDD  | OP.1<br>FDD | OP.1<br>FDD | EVA5                               | EVA5   | EVA5  | 2x2 Low                              | 1                 | -2.0                    |
| Note 1:<br>Note 2:<br>Note 3: | The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.<br>The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.<br>SNR corresponds to $\hat{E}_s/N_{oc2}$ of cell 1. |               |              |             |             |                                    |        |       |                                      |                   |                         |

## 8.4.2 TDD

The parameters specified in Table 8.4.2-1 are valid for all TDD tests unless otherwise stated.

| Parame                               | eter  | Unit      | Single antenna<br>port | Transmit<br>diversity |  |  |  |
|--------------------------------------|---|-----------|------------------------|-----------------------|--|--|--|
| Uplink downlink o<br>(Note           | •   |           | 0                      | 0                     |  |  |  |
| Special subframe<br>(Note            | •   |           | 4                      | 4                     |  |  |  |
| Number of PDC                        | CH symbols  | symbols   | 2                      | 2                     |  |  |  |
| Number of PHICH                      | l groups ( <i>N</i> g)                                |           | 1                      | 1                     |  |  |  |
| PHICH du                             | ration  |           | Normal                 | Normal                |  |  |  |
| Unused RE-s a                        | and PRB-s   |           | OCNG                   | OCNG                  |  |  |  |
| Cell II                              | D   |           | 0                      | 0                     |  |  |  |
| Downlink nowor                       | PDCCH_RA<br>PHICH_RA<br>OCNG_RA                       | dB        | 0                      | -3                    |  |  |  |
| Downlink power<br>allocation         | PCFICH_RB<br>PDCCH_RB<br>PHICH_RB<br>OCNG_RB          | dB        | 0                      | -3                    |  |  |  |
| $N_{\scriptscriptstyle oc}$ at anter | nna port  | dBm/15kHz | -98                    | -98                   |  |  |  |
| Cyclic pi                            | refix   |           | Normal                 | Normal                |  |  |  |
| ACK/NACK feed                        | back mode   |           | Multiplexing           | Multiplexing          |  |  |  |
|                                      | Note 1: as specified in Table 4.2-2 in TS 36.211 [4]. |           |                        |                       |  |  |  |

### Table 8.4.2-1: Test Parameters for PDCCH/PCFICH

## 8.4.2.1 Single-antenna port performance

For the parameters specified in Table 8.4.2-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

| Test   | Bandwidth | Aggregation | Reference | OCNG     | Propagation | Antenna                                       | Referen    |          |
|--------|-----------|-------------|-----------|----------|-------------|---|------------|----------|
| number |           | level       | Channel   | Pattern  | Condition   | configuration<br>and<br>correlation<br>Matrix | Pm-dsg (%) | SNR (dB) |
| 1      | 10 MHz    | 8 CCE       | R.15 TDD  | OP.1 TDD | ETU70       | 1x2 Low                                       | 1          | -1.6     |

## 8.4.2.2 Transmit diversity performance

## 8.4.2.2.1 Minimum Requirement 2 Tx Antenna Port

For the parameters specified in Table 8.4.2-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

#### Table 8.4.2.2.1-1: Minimum performance PDCCH/PCFICH

| Test   | Bandwidth | Aggregation | Reference | OCNG     | Propagation | Antenna                             | Referen    | ce value |
|--------|-----------|-------------|-----------|----------|-------------|-------------------------------------|------------|----------|
| number |           | level       | Channel   | Pattern  | Condition   | configuration<br>and<br>correlation | Pm-dsg (%) | SNR (dB) |
|        |           |             |           |          |             | Matrix                              |            |          |
| 1      | 10 MHz    | 4 CCE       | R.16 TDD  | OP.1 TDD | EVA70       | 2 x 2 Low                           | 1          | 0.1      |

## 8.4.2.2.2 Minimum Requirement 4 Tx Antenna Port

For the parameters specified in Table 8.4.2-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

| Test   | Bandwidth | Aggregation | Reference | OCNG        | Propagation | Antenna                                    | Reference     | e value     |
|--------|-----------|-------------|-----------|-------------|-------------|--|---------------|-------------|
| number |           | level       | Channel   | Pattern     | Condition   | configuration<br>and correlation<br>Matrix | Pm-dsg<br>(%) | SNR<br>(dB) |
| 1      | 5 MHz     | 2 CCE       | R.17 TDD  | OP.1<br>TDD | EPA5        | 4 x 2 Medium                               | 1             | 6.5         |

Table 8.4.2.2.2-1: Minimum performance PDCCH/PCFICH

# 8.4.2.2.3 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)

For the parameters for non-MBSFN ABS specified in Table 8.4.2-1 and Table 8.4.2.2.3-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2.3-2. The downlink physical setup is in accordance with Annex C.3.2 and Annex C.3.3.. In Table 8.4.2.2.3-1, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

For the parameters for MBSFN ABS specified in Table 8.4.2-1 and Table 8.4.2.3-3, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.3-4. The downlink physical channel setup for Cell 1 is according to Annex C3.2 and for Cell 2 is according to Annex C.3.3, respectively.

|                    | Paramete  | r   | Unit  | Cell 1                                     | Cell 2                   |  |
|--------------------|---|---|---|--|--------------------------|--|
| Uplii              |   |   |   | 1  | 1                        |  |
|                    |   |   |   | 4  | 4                        |  |
| Davuali            |   | PDCCH_RA<br>PHICH_RA<br>OCNG_RA                                 | dB  | -3   | -3                       |  |
|                    | Uplink downlink co<br>Special subframe of<br>Downlink power<br>allocation<br>$N_{oc}$ at antenna port<br>$\widehat{E}_s/N_{oc}$<br>BW <sub>Chann</sub><br>Subframe Conf<br>Time Offset betw<br>Cell Id<br>ABS pattern (<br>RLM/RRM Measuren<br>Pattern(No<br>CSI Subframe<br>Sets(Note 6)<br>Number of control O<br>ACK/NACK feedt<br>Number of PHICH<br>Unused RE-s ar<br>Cyclic pre<br>lote 1: This noise is<br>overlapping v<br>lote 2: This noise is<br>aggressor AB<br>lote 3: This noise is<br>are transmitte<br>subframe of a<br>lote 5: Time-domain | PCFICH_RB<br>PDCCH_RB<br>PHICH_RB<br>OCNG_RB                    | dB  | -3   | -3                       |  |
|                    |   | N <sub>oc1</sub>  | dBm/15kHz   | -100.5 (Note 1)                            | N/A                      |  |
| $N_{oc}$ at a      | ntenna port   | N <sub>oc2</sub>  | dBm/15kHz   | -98 (Note 2)                               | N/A                      |  |
|                    |   | N <sub>oc3</sub>  | dBm/15kHz   | -95.3 (Note 3)                             | N/A                      |  |
|                    | $\widehat{E}_s/N_{oc2}$   |   | dB  | Reference Value<br>in Table<br>8.4.2.2.3-2 | 1.5                      |  |
|                    | BW <sub>Channe</sub>  | l   | MHz   | 10   | 10                       |  |
| S                  | ubframe Config  | guration  |   | Non-MBSFN                                  | Non-MBSFN                |  |
| Tin                | ne Offset betwe   | en Cells  | μs  | 2.5 (synchronous cells)                    |                          |  |
|                    | Cell Id   |   |   | 0  | 1                        |  |
|                    | ABS pattern (N  | ote 4)  |   | N/A  | 0000010001<br>0000000001 |  |
| RLM/RI             | RM Measurem<br>Pattern(Note   |   |   | 0000000001<br>0000000001                   |                          |  |
| CSI S              | Subframe  | C <sub>CSI,0</sub>  |   | 0000010001<br>0000000001                   | N/A                      |  |
| Sets               | (Note 6)  | C <sub>CSI,1</sub>  |   | 1100101000<br>1100111000                   | N/A                      |  |
| Numbe              | er of control OF  | DM symbols  |   | 3  |                          |  |
| AC                 | K/NACK feedba   | ack mode  |   | Multiplexing                               |                          |  |
| Num                |   |   |   | 1  |                          |  |
|                    | PHICH dura  |   |   | extended                                   |                          |  |
| Ur                 |   |   |   | OCNG                                       |                          |  |
|                    | Cyclic pref   |   |   | Normal                                     | Normal                   |  |
| Note 1:<br>Note 2: | overlapping wi<br>This noise is a   | th the aggressor <i>i</i> pplied in OFDM s                      | ymbols #1, #2, #3, #5, #<br>ABS.<br>ymbols #0, #4, #7, #11 o                |  |                          |  |
|                    | This noise is a ABS pattern as are transmitted  | pplied in OFDM s<br>s defined in [9]. Pl<br>d in the serving ce | ymbols of a subframe ov<br>DCCH/PCFICH other the<br>Il subframe when the su | an that associated wi                      | th SIB1/Paging           |  |
| Note 5:            |   | .0  | ource restriction pattern   | for PCell measureme                        | ents as defined in       |  |
|                    |   |   | ime-domain measureme  | ent resource restrictio                    | n pattern for CSI        |  |
| Note 7:            |   | erving cell. Cell 2 i   | s the aggressor cell. The   | e number of the CRS                        | ports in Cell1           |  |
| Note 8:            |   | be transmitted in C   | Cell2 in the test.  |  |                          |  |

Table 8.4.2.2.3-1: Test Parameters for PDCCH/PCFICH – Non-MBSFN ABS

| Test<br>Numbe<br>r | Aggregatio<br>n Level                             | Referenc<br>e Channel | OCNG Pattern |             | Propagation<br>Conditions<br>(Note 1) |             | Correlation<br>Matrix and<br>Antenna | Reference<br>Value |                            |
|--------------------|---|-----------------------|--------------|-------------|---------------------------------------|-------------|--------------------------------------|--------------------|----------------------------|
|                    |   |                       | Cell 1       | Cell 2      | Cell 1                                | Cell 2      | Configuration                        | Pm-<br>dsg<br>(%)  | SNR<br>(dB)<br>(Note<br>2) |
| 1                  | 8 CCE   | R15-1<br>TDD          | OP.1<br>TDD  | OP.1<br>TDD | EVA5                                  | EVA5        | 2x2 Low                              | 1                  | -3.9                       |
| Note 1:            | The propagation                                   |                       |              |             | are statisti                          | cally indep | endent.                              |                    |                            |
| Note 2:            | SNR corresponds to $\hat{E}_s/N_{oc2}$ of cell 1. |                       |              |             |                                       |             |                                      |                    |                            |
| Note 3:            | The correlation                                   | n matrix and a        | ntenna co    | nfiguration | apply for                             | Cell 1 and  | Cell 2.                              |                    |                            |

Table 8.4.2.2.3-2: Minimum performance PDCCH/PCFICH – Non-MBSFN ABS

| Paramete  | er   | Unit   | Cell 1                  | Cell 2                   |  |  |
|---|--|--|-------------------------|--------------------------|--|--|
| Uplink downlink co  |  |  | 1                       | 1                        |  |  |
| Special subframe c  | onfiguration   |  | 4                       | 4                        |  |  |
| Downlink power  | PCFICH_RA<br>PDCCH_RA<br>PHICH_RA<br>OCNG_RA         | dB   | -3                      | -3                       |  |  |
| allocation  | PCFICH_RB<br>PDCCH_RB<br>PHICH_RB<br>OCNG_RB         | 1       1         PA       4         PA       4         PA       A         A       A         A       A         A       A         A       A         A       A         A       A         A       A         A       B         A       A         A       B         A       A         A       B         A       A         A       B         A       A         A       B         A       B         A       B | -3                      |                          |  |  |
|   | N <sub>oc1</sub>                                     | dBm/15kHz  | -100.5 (Note 1)         | N/A                      |  |  |
| $N_{oc}$ at antenna port  | N <sub>oc2</sub>                                     | dBm/15kHz  | -98 (Note 2)            | N/A                      |  |  |
|   | $N_{oc3}$  | dBm/15kHz  | -95.3 (Note 3)          | N/A                      |  |  |
| $\widehat{E}_s/N_{oc}$  | 2  | dB   | in Table                | 1.5                      |  |  |
| BW <sub>Channe</sub>  | 1  | MHz  |                         | 10                       |  |  |
| Subframe Config   | guration   |  | Non-MBSFN               | MBSFN                    |  |  |
| Time Offset betwe   | een Cells  | μS   | 2.5 (synchro            | onous cells)             |  |  |
| Cell Id   |  |  | 0                       | 126                      |  |  |
| ABS pattern (N  | lote 4)  |  | N/A                     | 0000000001<br>0000000001 |  |  |
| RLM/RRM Measurem<br>Pattern(Not   |  |  | 000000001               |                          |  |  |
| CSI Subframe  | C <sub>CSI,0</sub>                                   |  |                         | N/A                      |  |  |
| Sets(Note 6)  | C <sub>CSI,1</sub>                                   |  |                         | N/A                      |  |  |
| MBSFN Subframe Allo   |  |  |                         | 000010                   |  |  |
| Number of control OF  |  |  |                         |                          |  |  |
| ACK/NACK feedb  |  |  | Multiplexing            |                          |  |  |
| Number of PHICH   |  |  |                         |                          |  |  |
| PHICH dura  |  |  |                         |                          |  |  |
| Unused RE-s an<br>Cyclic pre  |  |  |                         | Normal                   |  |  |
|   |  | wmbolc #1 #2 #3 #4   |                         |                          |  |  |
| <ul> <li>Note 1: This noise is applied in OFDM symbols #1, #2, #3, #4, #5, #6, #7, #8, #9, #10, #11, #12, #13 of a subframe overlapping with the aggressor ABS.</li> <li>Note 2: This noise is applied in OFDM symbols #0 of a subframe overlapping with the aggressor ABS.</li> <li>Note 3: This noise is applied in OFDM symbols of a subframe overlapping with aggressor non-ABS</li> <li>Note 4: ABS pattern as defined in [9]. The 10<sup>th</sup> and 20<sup>th</sup> subframes indicated by ABS pattern are MBSFN ABS subframes.PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the MBSFN ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.</li> <li>Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].</li> </ul> |  |  |                         |                          |  |  |
| Note 6: As configured<br>measurement<br>Note 7: Cell 1 is the s<br>and Cell2 is th  | s defined in [7].<br>erving cell. Cell 2<br>ne same. | is the aggressor cell. Th  |                         |                          |  |  |
|   | ame Allocation as                                    |  | ne with 6 bits is chose | en for MBSFN             |  |  |

| Table 8.4.2.2.3-3: Test Parameters for PDCCH/PCFICH – MBSFN ABS |
|---|
|   |

| Test<br>Number | Aggregati<br>on Level | Reference<br>Channel           | OCNG               | Pattern     | Propage<br>Condition |            | Correlation<br>Matrix and    | Referen       | ce Value                |
|----------------|-----------------------|--------------------------------|--------------------|-------------|----------------------|------------|------------------------------|---------------|-------------------------|
|                |                       |                                | Cell 1             | Cell 2      | Cell 1               | Cell 2     | Antenna<br>Configurati<br>on | Pm-dsg<br>(%) | SNR<br>(dB)<br>(Note 2) |
| 1              | 8 CCE                 | R15-1 TDD                      | OP.1<br>TDD        | OP.1<br>TDD | EVA5                 | EVA5       | 2x2 Low                      | 1             | -4.1                    |
| Note 1:        | The propagation       |                                |                    |             | statistically in     | ndependen  | t.                           |               |                         |
| Note 2:        | SNR correspo          | nds to $\widehat{E}_{s}/N_{a}$ | $_{c2}$ of cell 1. |             |                      |            |                              |               |                         |
| Note 3:        | The correlation       | n matrix and ar                | ntenna confi       | guration ap | ply for Cell 1       | and Cell 2 |                              |               |                         |

Table 8.4.2.2.3-4: Minimum performance PDCCH/PCFICH – MBSFN ABS

# 8.4.2.2.4 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

For the parameters for non-MBSFN ABS specified in Table 8.4.2-1 and Table 8.4.2.2.4-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2.4-2.

For the parameters for MBSFN ABS specified in Table 8.4.2-1 and Table 8.4.2.2.4-3, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2.4-4.

In Tables 8.4.2.2.4-1 and 8.4.2.2.4-3, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

| Param  | eter   | Unit  | Cell 1                                     | Cell 2                   | Cell 3                   |
|--|--|---|--|--------------------------|--------------------------|
| Uplink downlink                              |  | •   | 1  | 1                        | 1                        |
| Special subframe                             |  |   | 4  | 4                        | 4                        |
| Downlink power                               | PDČCH_RA<br>PHICH_RA<br>OCNG_RA              | dB  | -3   | -3                       | -3                       |
| allocation                                   | PCFICH_RB<br>PDCCH_RB<br>PHICH_RB<br>OCNG_RB | dB  | -3   | -3                       | -3                       |
|  | N <sub>oc1</sub>                             | dBm/15kHz   | -98(Note 1)                                | N/A                      | N/A                      |
| $N_{oc}$ at antenna                          | N <sub>oc2</sub>                             | dBm/15kHz   | -98 (Note 2)                               | N/A                      | N/A                      |
| port   | N <sub>oc3</sub>                             | dBm/15kHz   | -93 (Note 3)                               | N/A                      | N/A                      |
| $\hat{E}_s/N$                                | $\widehat{E}_s/N_{oc2}$                      |   | Reference<br>Value in Table<br>8.4.2.2.4-2 | 5                        | 3                        |
| BW <sub>Ch</sub>                             | annel  | MHz   | 10   | 10                       | 10                       |
| Subframe Co                                  | nfiguration                                  |   | Non-MBSFN                                  | Non-MBSFN                | Non-MBSFN                |
| Time Offset be                               | tween Cells                                  | μs  | N/A  | 3                        | -1                       |
| Frequency shift                              | between Cells                                | Hz  | N/A  | 300                      | -100                     |
| Cell   | Id   |   | 0  | 126                      | 1                        |
| ABS patterr                                  |  |   | N/A  | 0000000001<br>0000000001 | 0000000001<br>0000000001 |
| RLM/RRM Me<br>Subframe Patt                  |  |   | 0000000001<br>0000000001                   | N/A                      | N/A                      |
| CSI Subframe                                 | C <sub>CSI,0</sub>                           |   | 0000000001<br>0000000001                   | N/A                      | N/A                      |
| Sets (Note 6)                                | C <sub>CSI,1</sub>                           |   | 1100111000<br>1100111000                   | N/A                      | N/A                      |
| Number of co<br>symb                         |  |   | 2  | Note 7                   | Note 7                   |
| ACK/NACK fee                                 | dback mode                                   |   | Multiplexing                               | N/A                      | N/A                      |
| Number of PHIC                               | H groups ( <i>N</i> <sub>q</sub> )           |   | 1  | N/A                      | N/A                      |
| PHICH d                                      |  |   | Normal                                     | N/A                      | N/A                      |
| Unused RE-s                                  | and PRB-s                                    |   | OCNG                                       | OCNG                     | OCNG                     |
| Cyclic p                                     |  |   | Normal                                     | Normal                   | Normal                   |
| overlap<br>Note 2: This no                   | ping with the agg<br>ise is applied in C     | 0FDM symbols #1, #<br>ressor ABS.<br>0FDM symbols #0, #               |  |                          |                          |
| Note 3: This no<br>Note 4: ABS pa<br>transmi | ttern as defined i                           | II OFDM symbols o<br>n [9]. PDCCH/PCFI<br>g cell subframe whe<br>ell. | CH other than that                         | associated with S        | SIB1/Paging are          |
| Note 5: Time-do<br>[7];                      | omain measurem                               | ent resource restric  |  |                          |                          |
|  | igured according<br>ements defined ir        | to the time-domain [7];   | measurement res                            | ource restriction p      | attern for CSI           |
| Note 7: The nur<br>indicate                  | mber of control O<br>d by "0" of ABS p       | FDM symbols is not<br>battern.  |  |                          | ubframe                  |
|  |  | ports in Cell1, Cell2<br>tted in Cell2 and Ce                         |  | ame.                     |                          |

| Table 8.4.2.2.4-1: Test Parameters for PDCCH/PCFICH – Non | -MBSFN ABS |
|---|------------|

| Test<br>Number                | Aggregati<br>on Level                              | Reference<br>Channel | 00          | NG Patte    | ern         |        | ropagati<br>itions (N |       | Correlation<br>Matrix and            | Reference Value   |                         |
|-------------------------------|--|----------------------|-------------|-------------|-------------|--------|-----------------------|-------|--------------------------------------|-------------------|-------------------------|
|                               |  |                      | Cell 1      | Cell 2      | Cell 3      | Cell 1 | Cell 2                | Cell3 | Antenna<br>Configuration<br>(Note 2) | Pm-<br>dsg<br>(%) | SNR<br>(dB)<br>(Note 3) |
| 1                             | 8 CCE  | R.15-2<br>TDD        | OP.1<br>TDD | OP.1<br>TDD | OP.1<br>TDD | EVA5   | EVA5                  | EVA5  | 2x2 Low                              | 1                 | -2.0                    |
| Note 1:<br>Note 2:<br>Note 3: | The propagation<br>The correlation<br>SNR correspo | n matrix and a       | ntenna co   | onfiguratio |             |        |                       |       |                                      |                   |                         |

Table 8.4.2.2.4-2: Minimum performance PDCCH/PCFICH – Non-MBSFN ABS

| Parar  | neter   | Unit   | Cell 1                                     | Cell 2                   | Cell 3                  |  |  |
|--|---|--|--|--------------------------|-------------------------|--|--|
| Uplink downlin   |   |  | 1  | 1                        | 1                       |  |  |
| Special subfram  |   |  | 4  | 4                        | 4                       |  |  |
| Downlink power   | PDCCH_RA<br>PHICH_RA<br>OCNG_RA   | dB   | -3   | -3                       | -3                      |  |  |
| allocation   | PCFICH_RB<br>PDCCH_RB<br>PHICH_RB<br>OCNG_RB  | dB   | -3   | -3                       | -3                      |  |  |
|  | N <sub>oc1</sub>  | dBm/15kHz  | -98(Note 1)                                | N/A                      | N/A                     |  |  |
| $N_{oc}$ at antenna  | N <sub>oc2</sub>  | dBm/15kHz  | -98 (Note 2)                               | N/A                      | N/A                     |  |  |
| port   | N <sub>oc3</sub>  | dBm/15kHz  | -93 (Note 3)                               | N/A                      | N/A                     |  |  |
| $\widehat{E}_s/l$  |   | dB   | Reference<br>Value in Table<br>8.4.2.2.4-4 | 5                        | 3                       |  |  |
| BWc  | hannel  | MHz  | 10   | 10                       | 10                      |  |  |
| Subframe C   | onfiguration  |  | Non-MBSFN                                  | MBSFN                    | MBSFN                   |  |  |
| Time Offset b  | etween Cells  | μs   | N/A  | 3                        | -1                      |  |  |
| Frequency shift  | between Cells   | Hz   | N/A  | 300                      | -100                    |  |  |
| Cel  | l ld  |  | 0  | 126                      | 1                       |  |  |
| ABS patter   | . ,   |  | N/A  | 0000000001<br>0000000001 | 000000001<br>0000000001 |  |  |
| RLM/RRM M<br>Subframe Pat  |   |  | 0000000001<br>0000000001                   | N/A                      | N/A                     |  |  |
| CSI Subframe   | C <sub>CSI,0</sub>  |  | 0000000001<br>0000000001                   | N/A                      | N/A                     |  |  |
| Sets (Note 6)  | C <sub>CSI,1</sub>  |  | 1100111000<br>1100111000                   | N/A                      | N/A                     |  |  |
| MBSFN Subfra<br>(Not   |   |  | N/A  | 000010                   | 000010                  |  |  |
| Number of contro   |   |  | 2  | Note 8                   | Note 8                  |  |  |
| ACK/NACK fe  |   |  | Multiplexing                               | N/A                      | N/A                     |  |  |
| Number of PHI  |   |  | 1  | N/A                      | N/A                     |  |  |
| PHICH  |   |  | Normal                                     | N/A                      | N/A                     |  |  |
| Unused RE-   |   |  | OCNG                                       | OCNG                     | OCNG                    |  |  |
| Cyclic   |   |  |  | Normal                   | Normal                  |  |  |
| a subfr<br>Note 2: This no<br>Note 3: This no<br>Note 4: ABS pa<br>MBSFN<br>are trai | Note 1:This noise is applied in OFDM symbols #1, #2, #3, #4, #5, #6, #7, #8, #9, #10, #11, #12, #13 of<br>a subframe overlapping with the aggressor ABS.Note 2:This noise is applied in OFDM symbols #0 of a subframe overlapping with the aggressor ABS.Note 3:This noise is applied in OFDM symbols of a subframe overlapping with aggressor non-ABSNote 4:ABS pattern as defined in [9]. The 10 <sup>th</sup> and 20 <sup>th</sup> subframes indicated by ABS pattern are<br>MBSFN ABS subframes. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH<br>are transmitted in the serving cell subframe when the subframe is overlapped with the MBSFN<br>ABS subframe of aggressor cell and the subframe is available in the definition of the reference |  |  |                          |                         |  |  |
| Note 5: Time-d<br>[7].   | omain measureme   | ent resource restricti                                 | ·  |                          |                         |  |  |
| measu  | rements defined in  | to the time-domain n<br>[7].<br>tion as defined in [7] |  |                          |                         |  |  |
| subfrar  | ne allocation.  | FDM symbols is not                                     |  |                          |                         |  |  |
| indicate<br>Note 9: Cell 1 i   | ed by "0" of ABS p<br>s the serving cell.   |  |  |                          |                         |  |  |
|  | s the same.<br>vill not be transmit   | ted in Cell2 in this te                                | st.  |                          |                         |  |  |

Table 8.4.2.2.4-3: Test Parameters for PDCCH/PCFICH – MBSFN ABS

| Test<br>Number                | Aggregati<br>on Level                              | Reference<br>Channel | 00          | NG Patt     | ern         |        | ropagati<br>litions (N |       | Correlation<br>Matrix and            | Refere            | nce Value               |
|-------------------------------|--|----------------------|-------------|-------------|-------------|--------|------------------------|-------|--------------------------------------|-------------------|-------------------------|
|                               |  |                      | Cell 1      | Cell 2      | Cell 3      | Cell 1 | Cell 2                 | Cell3 | Antenna<br>Configuration<br>(Note 2) | Pm-<br>dsg<br>(%) | SNR<br>(dB)<br>(Note 3) |
| 1                             | 8 CCE  | R.15-2<br>TDD        | OP.1<br>TDD | OP.1<br>TDD | OP.1<br>TDD | EVA5   | EVA5                   | EVA5  | 2x2 Low                              | 1                 | -1.8                    |
| Note 1:<br>Note 2:<br>Note 3: | The propagation<br>The correlation<br>SNR correspo | n matrix and a       | ntenna co   | onfigurati  |             |        |                        |       |                                      |                   | •                       |

Table 8.4.2.2.4-4: Minimum performance PDCCH/PCFICH – MBSFN ABS

## 8.5 Demodulation of PHICH

The receiver characteristics of the PHICH are determined by the probability of miss-detecting an ACK for a NACK (Pm-an). It is assumed that there is no bias applied to the detection of ACK and NACK (zero-threshold delection).

## 8.5.1 FDD

The parameters specified in Table 8.5.1-1 are valid for all FDD tests unless otherwise stated.

| Param                           | Parameter                                    |               | Single antenna<br>port   | Transmit<br>diversity |
|---------------------------------|--|---------------|--|-----------------------|
| Downlink power                  |  |               | 0  | -3                    |
| allocation                      | PCFICH_RB<br>PDCCH_RB<br>PHICH_RB<br>OCNG_RB | dB            | 0  | -3                    |
| PHICH duration                  |  |               | Normal   | Normal                |
| Number of PHICH groups (Note 1) |  |               | Ng = 1   | Ng = 1                |
| PDCCH Content                   |  |               | UL Grant should be included with the proper information aligned with A.3.6 |                       |
| Unused RE-s                     | and PRB-s                                    |               | OCNG   | OCNG                  |
| Cell                            | D  |               | 0  | 0                     |
| $N_{oc}$ at antenna port        |  | dBm/15kHz     | -98  | -98                   |
| Cyclic p                        | orefix                                       |               | Normal   | Normal                |
| Note 1: accordin                | g to Clause 6.9 in                           | TS 36.211 [4] |  |                       |

Table 8.5.1-1: Test Parameters for PHICH

## 8.5.1.1 Single-antenna port performance

For the parameters specified in Table 8.5.1-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.1.1-1. The downlink physical setup is in accordance with Annex C.3.2.

| Test   | Bandwidth | Reference | OCNG     | Propagation | Antenna                                       | Referen   | ce value |
|--------|-----------|-----------|----------|-------------|---|-----------|----------|
| number |           | Channel   | Pattern  | Condition   | configuration<br>and<br>correlation<br>Matrix | Pm-an (%) | SNR (dB) |
| 1      | 10 MHz    | R.18      | OP.1 FDD | ETU70       | 1 x 2 Low                                     | 0.1       | 5.5      |
| 2      | 10 MHz    | R.24      | OP.1 FDD | ETU70       | 1 x 2 Low                                     | 0.1       | 0.6      |

| Table 8.5.1.1-1:  | Minimum | performance | PHICH |
|-------------------|---------|-------------|-------|
| 1 abie 0.5.1.1-1. | willing | periormance | FINCH |

## 8.5.1.2 Transmit diversity performance

## 8.5.1.2.1 Minimum Requirement 2 Tx Antenna Port

For the parameters specified in Table 8.5.1-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.1.2-1. The downlink physical setup is in accordance with Annex C.3.2.

| Table 8.5.1.2.1-1: Minimum | performance PHICH |
|----------------------------|-------------------|
|----------------------------|-------------------|

| Test   | Bandwidth | Reference | OCNG     | Propagation | Antenna                                       | Referen   | ce value |
|--------|-----------|-----------|----------|-------------|---|-----------|----------|
| number |           | Channel   | Pattern  | Condition   | configuration<br>and<br>correlation<br>Matrix | Pm-an (%) | SNR (dB) |
| 1      | 10 MHz    | R.19      | OP.1 FDD | EVA70       | 2 x 2 Low                                     | 0.1       | 4.4      |

## 8.5.1.2.2 Minimum Requirement 4 Tx Antenna Port

For the parameters specified in Table 8.5.1-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.1.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

| Test   | Bandwidth | Reference | OCNG     | Propagation | Antenna                                       | Referen   | ce value |
|--------|-----------|-----------|----------|-------------|---|-----------|----------|
| number |           | Channel   | Pattern  | Condition   | configuration<br>and<br>correlation<br>Matrix | Pm-an (%) | SNR (dB) |
| 1      | 5 MHz     | R.20      | OP.1 FDD | EPA5        | 4 x 2 Medium                                  | 0.1       | 6.1      |

# 8.5.1.2.3 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)

For the parameters specified in Table 8.5.1-1 and Table 8.5.1.2.3-1, the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.1.2.3-2. The downlink physical setup is in accordance with Annex C.3.2 and Annex C.3.3. In Table 8.5.1.2.3-1, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

| Paramete  | r   | Unit   | Cell 1   | Cell 2  |
|---|---|--|--|---|
|   | PDCCH_RA  |  |  |   |
| Downlink power<br>allocation  | PHICH_RA<br>OCNG_RA   | dB   | -3   | -3  |
|   | PCFICH_RB<br>PDCCH_RB<br>PHICH_RB<br>OCNG_RB  | dB   | -3   | -3  |
| $N_{oc}$ at antenna port  | $N_{oc1}$   | dBm/15kHz  | -100.5 (Note 1)  | N/A   |
|   | N <sub>oc2</sub>  | dBm/15kHz  | -98 (Note 2)   | N/A   |
|   | N <sub>oc3</sub>  | dBm/15kHz  | -95.3 (Note 3)   | N/A   |
| $\widehat{E}_s/N_{oc2}$   | $\widehat{E}_s/N_{oc2}$   |  | Reference Value<br>in Table 8.5.1.2.3-<br>2  | 1.5   |
| BW <sub>Channe</sub>  | l   | MHz  | 10   | 10  |
| Subframe Config   | guration  |  | Non-MBSFN  | Non-MBSFN   |
| Time Offset betwe   | een Cells   | μs   | 2.5 (synchror  | ious cells)   |
| Cell Id   |   |  | 0  | 1   |
| ABS pattern (N  | lote 4)   |  | N/A  | 00000100<br>00000100<br>00000100<br>01000100<br>00000100  |
| RLM/RRM Measurem<br>Pattern (Not  |   |  | 00000100<br>00000100<br>00000100<br>00000100<br>00000100   | N/A   |
| CSI Subframe Sets<br>(Note 6)   | C <sub>CSI,0</sub>  |  | 00000100<br>00000100<br>00000100<br>01000100<br>00000100   | N/A   |
|   | C <sub>CSI,1</sub>  |  | 11111011<br>11111011<br>11111011<br>10111011<br>10111011<br>11111011   | N/A   |
| Number of control OF  |   |  | 3  |   |
| Number of PHICH of  |   |  | 1<br>ovtondod  |   |
| PHICH dura<br>Unused RE-s and   |   |  | extended<br>OCNG   | OCNG  |
| Cyclic pref   |   |  | Normal   | Normal  |
| overlapping wi<br>Note 2: This noise is a<br>aggressor ABS<br>Note 3: This noise is a<br>Note 4: ABS pattern as<br>subframe is ov<br>indicated by th<br>Note 5: Time-domain r<br>[7]<br>Note 6: As configured<br>measurements | A pplied in OFDM s<br>pplied in OFDM s<br>pplied in OFDM s<br>defined in [9]. Pl<br>erlapped with the<br>e ABS pattern.<br>neasurement reso<br>according to the t<br>defined in [7] | ymbols #1, #2, #3, #5, #<br>ABS<br>ymbols #0, #4, #7, #11 o<br>ymbols of a subframe ov<br>HICH is transmitted in th<br>ABS subframe of aggre<br>ource restriction pattern<br>ime-domain measureme<br>s the aggressor cell. The | of a subframe overlapp<br>verlapping with aggres<br>le serving cell subfram<br>ssor cell but not in the<br>for PCell measurement<br>ent resource restriction | bing with the<br>sor non-ABS<br>e when the<br>26 <sup>th</sup> subframe<br>its as defined in<br>pattern for CSI |
| Cell2 is the sa   | •   |  | · · · · · · · ·  |   |

| Table 8.5.1.2.3-1: | Test | <b>Parameters for PHICH</b> |  |
|--------------------|------|-----------------------------|--|
|--------------------|------|-----------------------------|--|

| Test<br>Number | Reference<br>Channel | OCNG                   | Pattern           | Cond        | gation<br>itions<br>te 1) | Antenna<br>Configuration<br>and | Reference Value |                      |
|----------------|----------------------|------------------------|-------------------|-------------|---------------------------|---------------------------------|-----------------|----------------------|
|                |                      | Cell 1                 | Cell 2            | Cell 1      | Cell 2                    | Correlation<br>Matrix           | Pm-an<br>(%)    | SNR (dB)<br>(Note 2) |
| 1              | R.19                 | OP.1<br>FDD            | OP.1<br>FDD       | EPA5        | EPA5                      | 2x2 Low                         | 0.1             | 4.6                  |
| Note 1:        |                      |                        |                   |             | ell 2 are s               | tatistically indepen            | dent.           |                      |
| Note 2:        | SNR correspor        | nds to $\widehat{E}_s$ | $/N_{\it oc2}$ of | cell 1.     |                           |                                 |                 |                      |
| Note 3:        | The correlation      | matrix ar              | nd antenna        | a configura | ation appl                | y for Cell 1 and Ce             | ll 2.           |                      |

Table 8.5.1.2.3-2: Minimum performance PHICH

# 8.5.1.2.4 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

For the parameters specified in Table 8.5.1-1 and Table 8.5.1.2.4-1, the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.1.2.4-2. In Table 8.5.1.2.4-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

| Downlink power                                   | PDCCH_RA<br>PHICH_RA<br>OCNG_RA<br>PCFICH_RB | dB        |  |  |  |
|--|--|-----------|--|--|--|
| allocation                                       | PCFICH_RB                                    |           | -3   | -3   | -3   |
|  | PDCCH_RB<br>PHICH_RB<br>OCNG_RB              | dB        | -3   | -3   | -3   |
|  | N <sub>oc1</sub>                             | dBm/15kHz | -98 (Note 1)   | N/A  | N/A  |
| N <sub>oc</sub> at antenna                       | N <sub>oc2</sub>                             | dBm/15kHz | -98 (Note 2)   | N/A  | N/A  |
| port   | N <sub>oc3</sub>                             | dBm/15kHz | -93 (Note 3)   | N/A  | N/A  |
| $\widehat{E}_s/N_{oc2}$                          |  | dB        | Reference Value<br>in Table 8.5.1.2.4-<br>2  | 5  | 3  |
| BW <sub>Channe</sub>                             | el   | MHz       | 10   | 10   | 10   |
| Subframe Confi                                   | iguration                                    |           | Non-MBSFN  | Non-MBSFN  | Non-MBSFN  |
| Time Offset betw                                 | veen Cells                                   | μs        | N/A  | 3  | -1   |
| Frequency shift bet                              | tween Cells                                  | Hz        | N/A  | 300  | -100   |
| Cell Id  |  |           | 0  | 126  | 1  |
| PDCCH Cor  | PDCCH Content                                |           | UL Grant should<br>be included with<br>the proper<br>information<br>aligned with<br>A.3.6. | N/A  | N/A  |
| ABS pattern (Note 4)                             |  |           | N/A  | 00000100<br>00000100<br>00000100<br>00000100<br>00000100 | 00000100<br>00000100<br>00000100<br>00000100<br>00000100 |
| RLM/RRM Measurement<br>Subframe Pattern (Note 5) |  |           | 00000100<br>00000100<br>00000100<br>00000100<br>00000100                                   | N/A  | N/A  |
| CSI Subframe                                     | C <sub>CSI,0</sub>                           |           | 00000100<br>00000100<br>00000100<br>00000100<br>00000100                                   | N/A  | N/A  |
| Sets (Note 6)                                    | C <sub>CSI,1</sub>                           |           | 11111011<br>11111011<br>11111011<br>11111011<br>11111011<br>11111011                       | N/A  | N/A  |
| Number of control Of                             |  |           | 2  | Note 7   | Note 7   |
| Number of PHICH                                  |  |           | 1  | N/A  | N/A  |
| PHICH dura                                       |  |           | Normal   | N/A  | N/A  |
| Unused RE-s an<br>Cyclic pre                     |  |           | OCNG<br>Normal   | OCNG<br>Normal   | OCNG<br>Normal   |

| Table 8.5.1.2.4-1: Test Parameters for PHICH |
|--|
|--|

| Note 1: | This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS   |
|---------|---|
| Note 2: | This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS  |
| Note 3: | This noise is applied in OFDM symbols of a subframe overlapping with aggressor non-ABS  |
| Note 4: | ABS pattern as defined in [9]. PHICH is transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell but not in the 26 <sup>th</sup> subframe indicated by the ABS pattern. |
| Note 5: | Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]   |
| Note 6: | As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]   |
| Note 7: | The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by "0" of ABS pattern.  |
| Note 8: | The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.   |
| Note 9: | SIB-1 will not be transmitted in Cell 2 and Cell 3 in the test.   |

Table 8.5.1.2.4-2: Minimum performance PHICH

| Test<br>Number                | Reference<br>Channel  | 00          | NG Patt     | ern         | Propagation<br>Conditions (Note 1) |        | Antenna<br>Configuration | Reference Value                    |              |                      |
|-------------------------------|---|-------------|-------------|-------------|------------------------------------|--------|--------------------------|------------------------------------|--------------|----------------------|
|                               |   | Cell 1      | Cell 2      | Cell 3      | Cell 1                             | Cell 2 | Cell 3                   | and Correlation<br>Matrix (Note 2) | Pm-an<br>(%) | SNR (dB)<br>(Note 3) |
| 1                             | R.19  | OP.1<br>FDD | OP.1<br>FDD | OP.1<br>FDD | EPA5                               | EVA5   | EVA5                     | 2x2 Low                            | 0.1          | 5.0                  |
| Note 1:<br>Note 2:<br>Note 3: | The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.<br>The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.<br>SNR corresponds to $\hat{E}_s/N_{oc2}$ of Cell 1. |             |             |             |                                    |        |                          |                                    |              |                      |

## 8.5.2 TDD

The parameters specified in Table 8.5.2-1 are valid for all TDD tests unless otherwise stated.

| Param                                       | eter   | Unit          | Single<br>antenna port | Transmit diversity                            |
|---|--|---------------|------------------------|---|
| Uplink downlink cor<br>1)                   |  |               | 1                      | 1   |
| Special subframe<br>(Note                   |  |               | 4                      | 4   |
|   | PDCCH_RA<br>PHICH_RA<br>OCNG_RA              | dB            | 0                      | -3  |
| Downlink power<br>allocation                | PCFICH_RB<br>PDCCH_RB<br>PHICH_RB<br>OCNG_RB | dB            | 0                      | -3  |
| PHICH du                                    | uration                                      |               | Normal                 | Normal  |
| Number of PHICH                             | groups (Note 3)                              |               | Ng = 1                 | Ng = 1  |
| PDCCH C                                     | Content                                      |               |                        | I be included with the on aligned with A.3.6. |
| Unused RE-s                                 |  |               | OCNG                   | OCNG  |
| Cell  | D  |               | 0                      | 0   |
| $N_{\scriptscriptstyle oc}$ at antenna port |  | dBm/15kHz     | -98                    | -98   |
| Cyclic prefix                               |  |               | Normal                 | Normal  |
| ACK/NACK fee                                |  |               | Multiplexing           | Multiplexing                                  |
|   | ied in Table 4.2-2                           |               |                        |   |
|   | ied in Table 4.2-1                           |               | .]                     |   |
| Note 3: accordin                            | g to Clause 6.9 in                           | 15 36.211 [4] |                        |   |

#### Table 8.5.2-1: Test Parameters for PHICH

## 8.5.2.1 Single-antenna port performance

For the parameters specified in Table 8.5.2-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

| Test   | Bandwidth | Reference | OCNG     | Propagation | Antenna                                       | Reference value |          |  |
|--------|-----------|-----------|----------|-------------|---|-----------------|----------|--|
| number |           | Channel   | Pattern  | Condition   | configuration<br>and<br>correlation<br>Matrix | Pm-an (%)       | SNR (dB) |  |
| 1      | 10 MHz    | R.18      | OP.1 TDD | ETU70       | 1 x 2 Low                                     | 0.1             | 5.8      |  |
| 2      | 10 MHz    | R.24      | OP.1 TDD | ETU70       | 1 x 2 Low                                     | 0.1             | 1.3      |  |

#### Table 8.5.2.1-1: Minimum performance PHICH

## 8.5.2.2 Transmit diversity performance

## 8.5.2.2.1 Minimum Requirement 2 Tx Antenna Port

For the parameters specified in Table 8.5.2-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.2.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

| Test   | Bandwidth | Reference | OCNG     | Propagation | Antenna                                       | Reference value |          |  |
|--------|-----------|-----------|----------|-------------|---|-----------------|----------|--|
| number |           | Channel   | Pattern  | Condition   | configuration<br>and<br>correlation<br>Matrix | Pm-an (%)       | SNR (dB) |  |
| 1      | 10 MHz    | R.19      | OP.1 TDD | EVA70       | 2 x 2 Low                                     | 0.1             | 4.2      |  |

#### Table 8.5.2.2.1-1: Minimum performance PHICH

### 8.5.2.2.2 Minimum Requirement 4 Tx Antenna Port

For the parameters specified in Table 8.5.2-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.2.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

| Test<br>number | Bandwidth | Reference<br>Channel | OCNG<br>Pattern | Propagation<br>Condition | Antenna<br>configuration<br>and<br>correlation<br>Matrix | Referen<br>Pm-an (%) | ce value<br>SNR (dB) |
|----------------|-----------|----------------------|-----------------|--------------------------|--|----------------------|----------------------|
| 1              | 5 MHz     | R.20                 | OP.1 TDD        | EPA5                     | 4 x 2 Medium   | 0.1                  | 6.2                  |

#### Table 8.5.2.2-1: Minimum performance PHICH

# 8.5.2.2.3 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)

For the parameters specified in Table 8.5.2-1 and Table 8.5.2.2.3-1, the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.2.2.3-2. The downlink physical setup is in accordance with Annex C.3.2 and Annex C.3.3, In Table 8.5.2.2.3-1, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

| Paramete   | er   | Unit                     | Cell 1  | Cell 2                   |  |  |
|--|--|--------------------------|---|--------------------------|--|--|
| Uplink downlink co   |  | •••••                    | 1   | 1                        |  |  |
| Special subframe co  |  |                          | 4   | 4                        |  |  |
| Deursliek neuron   | PDCCH_RA<br>PHICH_RA<br>OCNG_RA              | dB                       | -3  | -3                       |  |  |
| Downlink power<br>allocation   | PCFICH_RB<br>PDCCH_RB<br>PHICH_RB<br>OCNG_RB | dB                       | -3  | -3                       |  |  |
|  | N <sub>oc1</sub>                             | dBm/15kHz                | -100.5 (Note 1)                                   | N/A                      |  |  |
| $N_{oc}$ at antenna port   | N <sub>oc2</sub>                             | dBm/15kHz                | -98 (Note 2)                                      | N/A                      |  |  |
|  | N <sub>oc3</sub>                             | dBm/15kHz                | -95.3 (Note 3)                                    | N/A                      |  |  |
| $\widehat{E}_s/N_{occ}$  |  | dB                       | Reference Value in Table 8.5.2.2.3-2              | 1.5                      |  |  |
| BW <sub>Channe</sub>   | 1  | MHz                      | 10  | 10                       |  |  |
| Subframe Config  | guration                                     |                          | Non-MBSFN   | Non-MBSFN                |  |  |
| Time Offset betwe  | een Cells                                    | μs                       | 2.5 (synchrone                                    | ous cells)               |  |  |
| Cell Id  |  |                          | 0   | 1                        |  |  |
| ABS pattern (N   | lote 4)                                      |                          | N/A   | 0000010001<br>0000000001 |  |  |
| RLM/RRM Measurem<br>Pattern (Not   |  |                          | 000000001<br>0000000001                           | N/A                      |  |  |
| CSI Subframe Sets  | C <sub>CSI,0</sub>                           |                          | 0000010001<br>0000000001                          | N/A                      |  |  |
| (Note 6)   | C <sub>CSI,1</sub>                           |                          | 1100101000<br>1100111000                          | N/A                      |  |  |
| Number of control OF   | DM symbols                                   |                          | 3   |                          |  |  |
| ACK/NACK feedb   | ack mode                                     |                          | Multiplexing                                      |                          |  |  |
| Number of PHICH  |  |                          | 1   |                          |  |  |
| PHICH dura   |  |                          | extended  |                          |  |  |
| Unused RE-s an   |  |                          | OCNG  | OCNG                     |  |  |
| Cyclic pret  |  | 1 1 1/4 1/2 1/2 1/2      | Normal  | Normal                   |  |  |
| overlapping w  | ith the aggressor applied in OFDM s          | ÁBS                      | #6, #8, #9, #10,#12, #1<br>of a subframe overlapp |                          |  |  |
|  |  | symbols of a subframe of | overlapping with aggres                           | sor non-ABS              |  |  |
| Note 4: ABS pattern as defined in [9]. PHICH is transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell but not in subframe 5 |  |                          |   |                          |  |  |
| Note 5: Time-domain  |  |                          | n for PCell measuremen                            |                          |  |  |
| 5  | U U  | time-domain measurem     | nent resource restriction                         | pattern for CSI          |  |  |
|  | 0  | is the aggressor cell. T | he number of the CRS p                            | ports in Cell1 and       |  |  |
|  | be transmitted in                            | Cell2 in the test.       |   |                          |  |  |

Table 8.5.2.2.3-1: Test Parameters for PHICH

| Test<br>Number | Reference<br>Channel                              | OCNG        | Pattern     | Cond        | gation<br>itions<br>te 1) | Antenna<br>Configuration<br>and | Reference Value |                      |  |
|----------------|---|-------------|-------------|-------------|---------------------------|---------------------------------|-----------------|----------------------|--|
|                |   | Cell 1      | Cell 2      | Cell 1      | Cell 2                    | Correlation<br>Matrix           | Pm-an<br>(%)    | SNR (dB)<br>(Note 2) |  |
| 1              | R.19  | OP.1<br>TDD | OP.1<br>TDD | EPA5        | EPA5                      | 2x2 Low                         | 0.1             | 4.6                  |  |
| Note 1:        |   |             |             |             | ell 2 are s               | tatistically independent        | dent.           |                      |  |
| Note 2:        | SNR corresponds to $\hat{E}_s/N_{oc2}$ of cell 1. |             |             |             |                           |                                 |                 |                      |  |
| Note 3:        | The correlation                                   | matrix ar   | nd antenna  | a configura | ation appl                | y for Cell 1 and Ce             | ll 2.           |                      |  |

Table 8.5.2.2.3-2: Minimum performance PHICH

# 8.5.2.2.4 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

For the parameters specified in Table 8.5.2-1 and Table 8.5.2.2.4-1, the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.2.2.4-2. In Table 8.5.2.2.4-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

| Paran   | neter   | Unit   | Cell 1  | Cell 2  | Cell 3                                    |
|---|---|--|---|---|---|
| Uplink downlink   | c configuration   |  | 1   | 1   | 1   |
| Special subfram   |   |  | 4   | 4   | 4   |
| Downlink power  | PDCCH_RA<br>PHICH_RA<br>OCNG_RA   | dB   | -3  | -3  | -3  |
| allocation  | PCFICH_RB<br>PDCCH_RB<br>PHICH_RB<br>OCNG_RB  | dB   | -3  | -3  | -3  |
|   | $N_{oc1}$   | dBm/15kHz  | -98 (Note 1)  | N/A   | N/A                                       |
| $N_{oc}$ at antenna   | N <sub>oc2</sub>  | dBm/15kHz  | -98 (Note 2)  | N/A   | N/A                                       |
| port  | $N_{oc3}$   | dBm/15kHz  | -93 (Note 3)  | N/A   | N/A                                       |
| $\widehat{E}_s/N$   | V <sub>oc2</sub>  | dB   | Reference Value<br>in Table<br>8.5.2.2.4-2  | 5   | 3   |
| BW <sub>Cr</sub>  | nannel  | MHz  | 10  | 10  | 10  |
| Subframe Co   | onfiguration  |  | Non-MBSFN   | Non-MBSFN   | Non-<br>MBSFN                             |
| Time Offset b   | etween Cells  | μs   | N/A   | 3   | -1  |
| Frequency shift   | between Cells   | Hz   | N/A   | 300   | -100                                      |
| Cell  | ld  |  | 0   | 126   | 1   |
| PDCCH   | PDCCH Content   |  | UL Grant should<br>be included with<br>the proper<br>information<br>aligned with<br>A.3.6.  | N/A   | N/A                                       |
| ABS patter  | ABS pattern (Note 4)  |  | N/A   | 0000000001<br>0000000001  | 000000001                                 |
| RLM/RRM Measu   | amont Subframa  |  | 000000001   | 000000001   | 000000001                                 |
| Pattern (   |   |  | 0000000001<br>0000000001  | N/A   | N/A                                       |
| CSI Subframe  | C <sub>CSI,0</sub>  |  | 0000000001<br>0000000001  | N/A   | N/A                                       |
| Sets (Note 6)   | C <sub>CSI,1</sub>  |  | 1100111000<br>1100111000  | N/A   | N/A                                       |
| Number of contro  | OFDM symbols  |  | 2   | Note 7  | Note 7                                    |
| ACK/NACK fee  |   |  | Multiplexing  | N/A   | N/A                                       |
| Number of PHIC  |   |  | 1   | N/A   | N/A                                       |
| PHICH c   |   |  | Normal  | N/A   | N/A                                       |
| Unused RE-s   |   |  | OCNG  | OCNG  | OCNG                                      |
| Cyclic<br>Note 1: This noi  |   |  | Normal  | Normal  | Normal                                    |
| overlap<br>Note 2: This noi<br>aggress<br>Note 3: This noi<br>Note 4: ABS pa<br>subfram | ping with the aggre<br>se is applied in OF<br>or ABS<br>se is applied in OF<br>ttern as defined in<br>ne is overlapped wi | ssor ABS<br>DM symbols #0, #<br>DM symbols of a<br>[9]. PHICH is tran<br>th the ABS subfra | #2, #3, #5, #6, #8, #9<br>#4, #7, #11 of a subf<br>subframe overlappir<br>smitted in the servin<br>me of aggressor cel<br>tion pattern for PCel | rame overlapping<br>ng with aggressor<br>g cell subframe w<br>l but not in subfra | y with the<br>non-ABS<br>/hen the<br>me 5 |
| Note 6: As confi<br>measur<br>Note 7: The nur<br>indicate                               | ements defined in  <br>nber of control OFI<br>d by "0" of ABS pa  | [7]<br>DM symbols is not<br>ttern.   | measurement resou<br>t available for ABS a  | ind is 2 for the su   |   |
|   | nber of the CRS po<br>ill not be transmitte   |  | 2 and Cell 3 is the s<br>ell 3 in the test.   | ame.  |   |

### Table 8.5.2.2.4-1: Test Parameters for PHICH

| Test<br>Number                | Reference<br>Channel | 00   | NG Patt     | ern Propagation<br>Conditions (Note 1) |        | Antenna<br>Configuration | Reference Value |                                    |              |                      |
|-------------------------------|----------------------|--|-------------|--|--------|--------------------------|-----------------|------------------------------------|--------------|----------------------|
|                               |                      | Cell 1   | Cell 2      | Cell 3                                 | Cell 1 | Cell 2                   | Cell 3          | and Correlation<br>Matrix (Note 2) | Pm-an<br>(%) | SNR (dB)<br>(Note 3) |
| 1                             | R.19                 | OP.1<br>TDD  | OP.1<br>TDD | OP.1<br>TDD                            | EPA5   | EVA5                     | EVA5            | 2x2 Low                            | 0.1          | 5.7                  |
| Note 1:<br>Note 2:<br>Note 3: | The correlation      | agation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.<br>lation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.<br>esponds to $\hat{E}_s/N_{ac2}$ of Cell 1. |             |  |        |                          |                 |                                    |              |                      |

Table 8.5.2.2.4-2: Minimum performance PHICH

## 8.6 Demodulation of PBCH

The receiver characteristics of the PBCH are determined by the probability of miss-detection of the PBCH (Pm-bch), which is defined as

$$Pm - bch = 1 - \frac{A}{B}$$

Where A is the number of correctly decoded MIB PDUs and B is the Number of transmitted MIB PDUs (Redundancy versions for the same MIB are not counted separately).

## 8.6.1 FDD

Table 8.6.1-1: Test Parameters for PBCH

| Parame                | ter     | Unit                                       | Single antenna<br>port | Transmit<br>diversity |
|-----------------------|---------|--|------------------------|-----------------------|
|                       |         |  |                        |                       |
| Downlink power        | PBCH_RA | dB   | 0                      | -3                    |
| allocation            | PBCH_RB | dB   | 0                      | -3                    |
| $N_{\it oc}$ at anter | na port | dBm/15kHz                                  | -98                    | -98                   |
| Cyclic pr             | efix    |  | Normal                 | Normal                |
| Cell I                | )       |  | 0                      | 0                     |
|                       |         | 2-2 in TS 36.211 [4<br>2-1 in TS 36.211 [4 |                        |                       |

## 8.6.1.1 Single-antenna port performance

For the parameters specified in Table 8.6.1-1 the average probability of a miss-detecting PBCH (Pm-bch) shall be below the specified value in Table 8.6.1.1-1. The downlink physical setup is in accordance with Annex C.3.2.

 Table 8.6.1.1-1: Minimum performance PBCH

| Test   | Bandwidth | Reference | Propagation | Antenna                             | Referen    | ce value |
|--------|-----------|-----------|-------------|-------------------------------------|------------|----------|
| number |           | Channel   | Condition   | configuration<br>and<br>correlation | Pm-bch (%) | SNR (dB) |
|        |           |           |             | Matrix                              |            |          |
| 1      | 1.4 MHz   | R.21      | ETU70       | 1 x 2 Low                           | 1          | -6.1     |

## 8.6.1.2 Transmit diversity performance

## 8.6.1.2.1 Minimum Requirement 2 Tx Antenna Port

For the parameters specified in Table 8.6.1-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.1.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

| Test   | Bandwidth | Reference | Propagation | Antenna                                       | Referen    | ce value |
|--------|-----------|-----------|-------------|---|------------|----------|
| number |           | Channel   | Condition   | configuration<br>and<br>correlation<br>Matrix | Pm-bch (%) | SNR (dB) |
| 1      | 1 4 MHz   | R 22      | EPA5        | 2 x 2 L ow                                    | 1          | -4.8     |

### Table 8.6.1.2.1-1: Minimum performance PBCH

## 8.6.1.2.2 Minimum Requirement 4 Tx Antenna Port

For the parameters specified in Table 8.6.1-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.1.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

#### Table 8.6.1.2.2-1: Minimum performance PBCH

| Test   | Bandwidth | Reference | Propagation | Antenna       | Referen    | ce value |
|--------|-----------|-----------|-------------|---------------|------------|----------|
| number |           | Channel   | Condition   | configuration | Pm-bch (%) | SNR (dB) |
|        |           |           |             | and           |            |          |
|        |           |           |             | correlation   |            |          |
|        |           |           |             | Matrix        |            |          |
| 1      | 1.4 MHz   | R.23      | EVA5        | 4 x 2 Medium  | 1          | -3.5     |

### 8.6.1.2.3 Minimum Requirement 2 Tx Antenna Port under Time Domain Measurement Resource Restriction with CRS Assistance Information

For the parameters specified in Table 8.6.1.2.3-1 and Table 8.6.1.2.3-2, the averaged probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.1.2.3-2. Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, repectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

| Parameter   |                    | Unit      | Cell 1                                     | Cell 2   | Cell 3   |  |
|---|--------------------|-----------|--|--|--|--|
| Downlink power  | PBCH_RA<br>OCNG_RA | dB        | -3   | -3   | -3   |  |
| allocation  | PBCH_RB<br>OCNG_RB | dB        | -3   | -3   | -3   |  |
| $N_{oc}$ at an  | tenna port         | dBm/15kHz | -98  | N/A  | N/A  |  |
| <u>Ê</u><br>N,  | 5                  | dB        | Reference<br>Value in Table<br>8.6.1.2.3-2 | 4  | 2  |  |
| BWc   | hannel             | MHz       | 1.4  | 1.4  | 1.4  |  |
| Time Offset b   | etween Cells       | μs        | N/A  | 3  | -1   |  |
| Frequency shift   | between Cells      | Hz        | N/A  | 300  | -100   |  |
| Cel   | l ld               |           | 0  | 126  | 1  |  |
| ABS Patte   | rn (Note 4)        |           | N/A  | 01000000<br>01000000<br>01000000<br>01000000<br>01000000 | 01000000<br>01000000<br>01000000<br>01000000<br>01000000 |  |
| Unused RE-  | s and PRB-s        |           | OCNG                                       | OCNG   | OCNG   |  |
| Cyclic  | prefix             |           | Normal                                     | Normal   | Normal   |  |
| <ul> <li>Note 1: The number of the CRS ports in Cell1, Cell2 and Cell 3 is the same.</li> <li>Note 2: SIB-1 will not be transmitted in Cell2 and Cell 3 in the test.</li> <li>Note 3: The PBCH transmission from Cell 1, Cell 2 and Cell 3 overlap. The same PBCH transmission redundancy version is used for Cell 1, Cell 2 and Cell 3.</li> <li>Note 4: ABS pattern as defined in [9]. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.</li> </ul> |                    |           |  |  |  |  |

| Test    | Reference   | Propagation Conditions (Note 1) |                 | Antenna Configuration | Reference Value                    |               |                      |
|---------|---|---------------------------------|-----------------|-----------------------|------------------------------------|---------------|----------------------|
| Number  | Channel   | Cell 1                          | Cell 2          | Cell 3                | and Correlation Matrix<br>(Note 2) | Pm-bch<br>(%) | SNR (dB) (Note<br>3) |
| 1       | R.22  | ETU30                           | ETU30           | ETU30                 | 2x2 Low                            | 1             | -3.0                 |
| Note 1: |   |                                 |                 |                       | 3 are statistically independent    |               |                      |
| Note 2: | The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3. |                                 |                 |                       |                                    |               |                      |
| Note 3: | SNR correspo  | nds to $\hat{E}_s / N_o$        | $_c$ of cell 1. |                       |                                    |               |                      |

## 8.6.2 TDD

| Parame   | ter | Unit      | Single antenna port | Transmit<br>diversity |  |
|--|-----|-----------|---------------------|-----------------------|--|
| Uplink downlink o<br>(Note 1   |     |           | 1                   | 1                     |  |
| Special subframe configuration<br>(Note 2)   |     |           | 4                   | 4                     |  |
| Downlink power<br>allocation   |     |           | 0                   | -3                    |  |
| $N_{oc}$ at antenna port   |     | dBm/15kHz | -98                 | -98                   |  |
| Cyclic prefix  |     |           | Normal              | Normal                |  |
| Cell I   | )   |           | 0                   | 0                     |  |
| Note 1:as specified in Table 4.2-2 in TS 36.211 [4].Note 2:as specified in Table 4.2-1 in TS 36.211 [4]. |     |           |                     |                       |  |

## Table 8.6.2-1: Test Parameters for PBCH

## 8.6.2.1 Single-antenna port performance

For the parameters specified in Table 8.6.2-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

| Test   | Bandwidth | Reference | Propagation | Antenna                                       | Referen    | ce value |
|--------|-----------|-----------|-------------|---|------------|----------|
| number |           | Channel   | Condition   | configuration<br>and<br>correlation<br>Matrix | Pm-bch (%) | SNR (dB) |
| 1      | 1.4 MHz   | R.21      | ETU70       | 1 x 2 Low                                     | 1          | -6.4     |

## 8.6.2.2 Transmit diversity performance

## 8.6.2.2.1 Minimum Requirement 2 Tx Antenna Port

For the parameters specified in Table 8.6.2-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.2.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

| Test<br>number | Bandwidth | Reference<br>Channel | Propagation<br>Condition | Antenna<br>configuration<br>and<br>correlation<br>Matrix | Referen<br>Pm-bch (%) | ce value<br>SNR (dB) |
|----------------|-----------|----------------------|--------------------------|--|-----------------------|----------------------|
| 1              | 1.4 MHz   | R.22                 | EPA5                     | 2 x 2 Low  | 1                     | -4.8                 |

## 8.6.2.2.2 Minimum Requirement 4 Tx Antenna Port

For the parameters specified in Table 8.6.2-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.2.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

| Test   | Bandwidth | Reference | Propagation | Antenna                                       | Referen    | ce value |
|--------|-----------|-----------|-------------|---|------------|----------|
| number |           | Channel   | Condition   | configuration<br>and<br>correlation<br>Matrix | Pm-bch (%) | SNR (dB) |
| 1      | 1.4 MHz   | R.23      | EVA5        | 4 x 2 Medium                                  | 1          | -4.1     |

Table 8.6.2.2.2-1: Minimum performance PBCH

### 8.6.2.2.3 Minimum Requirement 2 Tx Antenna Port under Time Domain Measurement Resource Restriction with CRS Assistance Information

For the parameters specified in Table 8.6.2.2.3-1 and Table 8.6.2.2.3-2, the averaged probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.2.2.3-2. Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

| Parameter                     |  | Unit               | Cell 1    | Cell 2                                     | Cell 3                   |                          |  |  |
|-------------------------------|--|--------------------|-----------|--|--------------------------|--------------------------|--|--|
| Downlink p                    | oower  | PBCH_RA<br>OCNG_RA | dB        | -3   | -3                       | -3                       |  |  |
| allocatio                     | on   | PBCH_RB<br>OCNG_RB | dB        | -3   | -3                       | -3                       |  |  |
| N <sub>oc</sub>               | $_{c}$ at ante   | enna port          | dBm/15kHz | -98  | N/A                      | N/A                      |  |  |
|                               | $\frac{\widehat{E}_s}{N_{oc}}$   | ,                  | dB        | Reference<br>Value in Table<br>8.6.2.2.3-2 | 4                        | 2                        |  |  |
| BW <sub>Channel</sub>         |  |                    | MHz       | 1.4  | 1.4                      | 1.4                      |  |  |
| Time Offset between Cells     |  |                    | μs        | N/A 3                                      |                          | -1                       |  |  |
| Frequency shift between Cells |  |                    | Hz        | N/A  | N/A 300                  |                          |  |  |
| Cell Id                       |  |                    |           | 0 126                                      |                          | 1                        |  |  |
| ABS Pattern (Note 4)          |  |                    |           | N/A  | 0000000001<br>0000000001 | 0000000001<br>0000000001 |  |  |
| Unuse                         | ed RE-s  | and PRB-s          |           | OCNG                                       | OCNG                     | OCNG                     |  |  |
|                               | Cyclic p   |                    |           | Normal                                     | Normal                   | Normal                   |  |  |
| Note 2: 5<br>Note 3:          | <ul> <li>SIB-1 will not be transmitted in Cell2 and Cell 3 in the test.</li> <li>The PBCH transmission from Cell 1, Cell 2 and Cell 3 overlap. The same PBCH transmission redundancy version is used for Cell 1, Cell 2 and Cell 3.</li> </ul> |                    |           |  |                          |                          |  |  |
| F                             |  |                    |           |  |                          |                          |  |  |

## Table 8.6.2.2.3-1: Test Parameters for PBCH

| Test               | Reference  | Propagation | ropagation Conditions (Note 1) Antenna Config |        | Antenna Configuration              | Refe          | erence Value         |  |
|--------------------|--|-------------|---|--------|------------------------------------|---------------|----------------------|--|
| Number             | Channel  | Cell 1      | Cell 2  | Cell 3 | and Correlation Matrix<br>(Note 2) | Pm-bch<br>(%) | SNR (dB) (Note<br>3) |  |
| 1                  | R.22   | ETU30       | ETU30   | ETU30  | 2x2 Low                            | 1             | -3.0                 |  |
| Note 1:<br>Note 2: | · · · · · · · · · · · · · · · · · · ·              |             |   |        |                                    |               |                      |  |
| Note 3:            | SNR corresponds to $\hat{E}_s / N_{oc}$ of cell 1. |             |   |        |                                    |               |                      |  |

## 8.7 Sustained downlink data rate provided by lower layers

The purpose of the test is to verify that the Layer 1 and Layer 2 correctly process in a sustained manner the received packets corresponding to the maximum number of DL-SCH transport block bits received within a TTI for the UE category indicated. The sustained downlink data rate shall be verified in terms of the success rate of delivered PDCP SDU(s) by Layer 2. The test case below specifies the RF conditions and the required success rate of delivered TB by Layer 1 to meet the sustained data rate requirement. The size of the TB per TTI corresponds to the largest possible DL-SCH transport block for each UE category using the maximum number of layers for spatial multiplexing. Transmission modes 1 and 3 are used with radio conditions resembling a scenario where sustained maximum data rates are available. Test case is selected according to table 8.7-1 depending on UE capability for CA and EPDCCH.

#### Table 8.7-1: SDR test applicability

|     | Single carrier UE<br>not supporting<br>EPDCCH | CA UE not<br>supporting EPDCCH | Single carrier UE supporting EPDCCH | CA UE supporting<br>EPDCCH |
|-----|---|--------------------------------|-------------------------------------|----------------------------|
| FDD | 8.7.1   | 8.7.1                          | 8.7.3                               | 8.7.1, 8.7.3               |
| TDD | 8.7.2   | 8.7.2                          | 8.7.4                               | 8.7.2, 8.7.4               |

## 8.7.1 FDD

The parameters specified in Table 8.7.1-1 are valid for all FDD tests unless otherwise stated.

| Parameter  | Unit         | Value   |
|--|--------------|---|
| Cyclic prefix  |              | Normal  |
| Cell ID  |              | 0   |
| Inter-TTI Distance   |              | 1   |
| Number of HARQ<br>processes per<br>component carrier         | Processes    | 8   |
| Maximum number of<br>HARQ transmission                       |              | 4   |
| Redundancy version<br>coding sequence                        |              | {0,0,1,2} for 64QAM   |
| Number of OFDM<br>symbols for PDCCH per<br>component carrier | OFDM symbols | 1   |
| Cross carrier scheduling                                     |              | Not configured  |
| Propagation condition  |              | Static propagation condition<br>No external noise sources are applied |

## Table 8.7.1-1: Common Test Parameters (FDD)

The requirements are specified in Table 8.7.1-3, with the addition of the parameters in Table 8.7.1-2 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category, CA capability and bandwidth combination with maximum aggregated bandwidth as specified inTable 8.7.1-4. The TB success rate shall be sustained during at least 300 frames.

| Test    | Bandwidth Trans | Transmission    | Antenna           | Antenna Codebook |                              |                              | ower<br>(dB) | $\hat{E}_{_{s}}$ at         | Symbols<br>for |
|---------|-----------------|-----------------|-------------------|------------------|------------------------------|------------------------------|--------------|-----------------------------|----------------|
| Test    | (MHz)           | mode            | configuration     | restriction      | $ ho_{\scriptscriptstyle A}$ | $ ho_{\scriptscriptstyle B}$ | σ            | antenna port<br>(dBm/15kHz) | unused<br>PRBs |
| 1       | 10              | 1               | 1 x 2             | N/A              | 0                            | 0                            | 0            | -85                         | OP.6 FDD       |
| 2       | 10              | 3               | 2 x 2             | 10               | -3                           | -3                           | 0            | -85                         | OP.1 FDD       |
| 3,4,6   | 20              | 3               | 2 x 2             | 10               | -3                           | -3                           | 0            | -85                         | OP.1 FDD       |
| 3A      | 10              | 3               | 2 x 2             | 10               | -3                           | -3                           | 0            | -85                         | OP.1 FDD       |
| 3B, 4A  | 2x10            | 3               | 2 x 2             | 10               | -3                           | -3                           | 0            | -85                         | OP.1 FDD       |
| 3C, 4B  | 15              | 3               | 2 x 2             | 10               | -3                           | -3                           | 0            | -85                         | OP.1 FDD       |
| 6A      | 2x20            | 3               | 2 x 2             | 10               | -3                           | -3                           | 0            | -85                         | OP.1 FDD       |
| 6B      | 10+15           | 3               | 2 x 2             | 10               | -3                           | -3                           | 0            | -85                         | OP.1 FDD       |
| 6C      | 10+20           | 3               | 2 x 2             | 10               | -3                           | -3                           | 0            | -85                         | OP.1 FDD       |
| 6D      | 15+20           | 3               | 2 x 2             | 10               | -3                           | -3                           | 0            | -85                         | OP.1 FDD       |
| Note 1: | For CA test     | cases, PUCCH fo | rmat 1b with char | nnel selection   | is used t                    | to feedb                     | ack ACk      | K/NACK.                     |                |

## Table 8.7.1-3: Minimum requirement (FDD)

| Test    | Number of bits of a DL-SCH transport                          | Measurement channel   | Reference value  |
|---------|---|---|--|
|         | block received within a TTI                                   |   | TB success rate [%]                                      |
| 1       | 10296   | R.31-1 FDD  | 95   |
| 2       | 25456   | R.31-2 FDD  | 95   |
| 3       | 51024   | R.31-3 FDD  | 95   |
| 3A      | 36696 (Note 2)  | R.31-3A FDD   | 85   |
| 3B      | 25456   | R.31-2 FDD  | 95   |
| 3C      | 51024   | R.31-3C FDD   | 85   |
| 4       | 75376 (Note 3)  | R.31-4 FDD  | 85   |
| 4A      | 36696 (Note 2)  | R.31-3A FDD   | 85   |
| 4B      | 55056 (Note 5)  | R.31-4B FDD   | 85   |
| 6       | 75376 (Note 3)  | R.31-4 FDD  | 85   |
| 6A      | 75376 (Note 3)  | R.31-4 FDD  | 85   |
| 6B      | 36696 (Note 2) for 10MHz CC                                   | R.31-3A FDD for 10MHz CC  | 85   |
|         | 55056 for 15MHz CC  | R.31-5 FDD for 15MHz CC   |  |
| 6C      | 36696 (Note 2) for 10MHz CC                                   | R.31-3A FDD for 10MHz CC  | 85   |
|         | 75376 (Note 3) for 20MHz CC                                   | R.31-4 FDD for 20MHz CC   |  |
| 6D      | 55056 for 15MHz CC  | R.31-5 FDD for 15MHz CC   | 85   |
|         | 75376 (Note 3) for 20MHz CC                                   | R.31-4 FDD for 20MHz CC   |  |
| Note 1: | For 2 layer transmissions, 2 transport blocks                 | are received within a TTI.  |  |
| Note 2: | 35160 bits for sub-frame 5.                                   |   |  |
| Note 3: |   |   |  |
| Note 4: | The TB success rate is defined as TB succes                   | s rate = 100%*N <sub>DL_correct_rx</sub> / (N <sub>DL_newtx</sub> | + N <sub>DL_retx</sub> ), where N <sub>DL_newtx</sub> is |
|         | the number of newly transmitted DL transport                  | blocks, N <sub>DL_retx</sub> is the number of retra               | insmitted DL transport                                   |
|         | blocks, and N <sub>DL_correct_rx</sub> is the number of corre | ectly received DL transport blocks.                               |  |
| Note 5: | 52752bits for sub-frame 5.                                    |   |  |

| CA<br>config  | Maximum<br>supported<br>Bandwidth/<br>Bandwidth<br>combination<br>(MHz)   | Category<br>1 | Category<br>2 | Category 3          | Category 4          | Category 6 | Category 7 |
|---|---|---------------|---------------|---------------------|---------------------|------------|------------|
| Single  | 10  | 1             | 2             | 3A                  | ЗA                  | -          | -          |
| Single<br>carrier                                   | 15  | -             | -             | 3C                  | 4B                  | -          | -          |
| Carrier   | 20  | -             | -             | 3                   | 4                   | 6          | 6          |
|   | 10+10   | -             | -             | 3B                  | 4A                  | 4A         | 4A         |
| CA  | 10+15   | -             | -             | 3B                  | 4A                  | 6B         | 6B         |
| with  | 10+20   | -             | -             | 3B                  | 4A                  | 6C         | 6C         |
| 2CCs  | 15+20   | 5+20          |               | 3B                  | 4A                  | 6D         | 6D         |
| 2003  | 20+20   | -             | -             | 3B or 3<br>(Note 4) | 4A or 4<br>(Note 4) | 6A         | 6A         |
| Note 1:<br>Note 2:<br>Note 3:<br>Note 4:<br>Note 5: | <ul> <li>For non-CA UE, test is selected for maximum supported bandwidth.</li> <li>Void.</li> <li>If the intra-band contiguous CA is the only CA configuration supported by category 3 or 4 UE, the single carrier test is selecte, i.e., Test 3 for UE category 3 and Test 4 for UE category 4. Otherwise, Test 3B applies for category 3 UE and Test 4A applies for category 4 UE.</li> </ul> |               |               |                     |                     |            |            |

Table 8.7.1-4: Test points for sustained data rate (FRC)

## 8.7.2 TDD

The parameters specified in Table 8.7.2-1 are valid for all TDD tests unless otherwise stated.

| _  |              |   |  |  |  |  |
|--|--------------|---|--|--|--|--|
| Parameter  | Unit         | Value   |  |  |  |  |
| Special subframe<br>configuration (Note 1)                   |              | 4   |  |  |  |  |
| Cyclic prefix  |              | Normal  |  |  |  |  |
| Cell ID  |              | 0   |  |  |  |  |
| Inter-TTI Distance   |              | 1   |  |  |  |  |
| Maximum number of<br>HARQ transmission                       |              | 4   |  |  |  |  |
| Redundancy version<br>coding sequence                        |              | {0,0,1,2} for 64QAM   |  |  |  |  |
| Number of OFDM<br>symbols for PDCCH per<br>component carrier | OFDM symbols | 1   |  |  |  |  |
| Cross carrier scheduling                                     |              | Not configured  |  |  |  |  |
| Propagation condition  |              | Static propagation condition<br>No external noise sources are applied |  |  |  |  |
| Note 1: as specified in Table 4.2-1 in TS 36.211 [4].        |              |   |  |  |  |  |

### Table 8.7.2-1: Common Test Parameters (TDD)

The requirements are specified in Table 8.7.2-3, with the addition of the parameters in Table 8.7.2-2 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category, CA capability and bandwidth combination with maximum aggregated bandwidth as specified inTable 8.7.2-4. The TB success rate shall be sustained during at least 300 frames.

| Test    | Bandwidth<br>(MHz) | Transmission<br>mode | Antenna configuration | Codebook<br>subset<br>restriction |         | (UD)                         |     | power<br>allocation |               | $\hat{E}_s$ at antenna port (dBm/15kHz) | ACK/NACK<br>feedback<br>mode | Symbols for<br>unused<br>PRBs |
|---------|--------------------|----------------------|-----------------------|-----------------------------------|---------|------------------------------|-----|---------------------|---------------|---|------------------------------|-------------------------------|
|         |                    |                      |                       |                                   | $o_{A}$ | $ ho_{\scriptscriptstyle B}$ | σ   | ·                   |               |   |                              |                               |
| 1       | 10                 | 1                    | 1 x 2                 | N/A                               | 0       | 0                            | 0   | -85                 | Bundling      | OP.6 TDD                                |                              |                               |
| 2       | 10                 | 3                    | 2 x 2                 | 10                                | -<br>3  | -3                           | 0   | -85                 | Bundling      | OP.1 TDD                                |                              |                               |
| 3       | 20                 | 3                    | 2 x 2                 | 10                                | -<br>3  | -3                           | 0   | -85                 | Bundling      | OP.1 TDD                                |                              |                               |
| ЗA      | 15                 | 3                    | 2 x 2                 | 10                                | -<br>3  | -3                           | 0   | -85                 | Muliplexing   | OP.2 TDD                                |                              |                               |
| 4,6     | 20                 | 3                    | 2 x 2                 | 10                                | -<br>3  | -3                           | 0   | -85                 | Multiplexing  | OP.1 TDD                                |                              |                               |
| 6A      | 2x20               | 3                    | 2 x 2                 | 10                                | -<br>3  | -3                           | 0   | -85                 | -<br>(Note 1) | OP.1 TDD                                |                              |                               |
| Note 1: | PUCCH for          | mat 1b with chan     | nel selection is us   | sed to feedbac                    | k A     | CK/NA                        | CK. |                     |               |   |                              |                               |

| Table 8.7.2-2: test parameters | for sustained downlink data rate | (TDD) |
|--------------------------------|----------------------------------|-------|
|--------------------------------|----------------------------------|-------|

## Table 8.7.2-3: Minimum requirement (TDD)

| Test          | Number of bits of a DL-SCH<br>transport block received within<br>a TTI for normal/special sub-<br>frame | Measurement channel | Reference value<br>TB success rate [%] |  |
|---------------|---|---------------------|--|--|
| 1             | 10296/0   | R31-1 TDD           | 95                                     |  |
| 2             | 25456/0   | R31-2 TDD           | 95                                     |  |
| 3             | 51024/0   | R31-3 TDD           | 95                                     |  |
| ЗA            | 51024/0   | R31-3A TDD          | 85                                     |  |
| 4             | 75376/0 (Note 2)  | R31-4 TDD           | 85                                     |  |
| 6             | 75376/0 (Note 2)  | R.31-4 TDD          | 85                                     |  |
| 6A            | 75376/0 (Note 2)  | R.31-4 TDD          | 85                                     |  |
| Note 2: 71112 | ayer transmissions, 2 transport blocks are<br>bits for sub-frame 5.                                     |                     |  |  |

Note 3: The TB success rate is defined as TB success rate = 100%\*N<sub>DL\_correct\_rx</sub>/ (N<sub>DL\_newtx</sub> + N<sub>DL\_retx</sub>), where N<sub>DL\_newtx</sub> is the number of newly transmitted DL transport blocks, N<sub>DL\_retx</sub> is the number of retransmitted DL transport blocks, and N<sub>DL\_correct\_rx</sub> is the number of correctly received DL transport blocks.

| CA coi                                   | nfig  | Bandwidth/<br>Bandwidth<br>combination<br>(MHz) | Category 1 | Category 2 | Category 3 | Category 4 | Category 6 | Category 7 |  |  |
|--|---|---|------------|------------|------------|------------|------------|------------|--|--|
| Single carrier                           |   | 10  | 1          | 2          | -          | -          | -          | -          |  |  |
|  |   | 15  | -          | -          | ЗA         | ЗA         | -          | -          |  |  |
|  |   | 20  | -          | -          | 3          | 4          | 6          | 6          |  |  |
| CA with 2CCs                             |   | 20+20   |            | -          | 3 (Note 4) | 4 (Note 4) | 6A         | 6A         |  |  |
| Note 1:<br>Note 2:<br>Note 3:<br>Note 4: | te 2: For non-CA UE, test is selected for maximum supported bandwidth.<br>te 3: Void.                                   |   |            |            |            |            |            |            |  |  |
|  | selected.   |   |            |            |            |            |            |            |  |  |
| Note 5:                                  | The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3. |   |            |            |            |            |            |            |  |  |

## 8.7.3 FDD (EPDCCH scheduling)

The parameters specified in Table 8.7.3-1 are valid for all FDD tests unless otherwise stated.

#### Table 8.7.3-1: Common test parameters (FDD)

| Parameter                | Unit                                  | Value   |  |  |  |  |  |
|--------------------------|---------------------------------------|---|--|--|--|--|--|
| Cyclic prefix            |                                       | Normal  |  |  |  |  |  |
| Cell ID                  |                                       | 0   |  |  |  |  |  |
| Inter-TTI Distance       |                                       | 1   |  |  |  |  |  |
| Number of HARQ           |                                       |   |  |  |  |  |  |
| processes per            | Processes                             | 8   |  |  |  |  |  |
| component carrier        |                                       |   |  |  |  |  |  |
| Maximum number of        |                                       | 4   |  |  |  |  |  |
| HARQ transmission        |                                       | 4   |  |  |  |  |  |
| Redundancy version       |                                       | (0,0,1,2) for $640M$                                |  |  |  |  |  |
| coding sequence          |                                       | {0,0,1,2} for 64QAM                                 |  |  |  |  |  |
| Number of OFDM           |                                       |   |  |  |  |  |  |
| symbols for PDCCH per    | OFDM symbols                          | 1   |  |  |  |  |  |
| component carrier        | -                                     |   |  |  |  |  |  |
| Cross carrier scheduling |                                       | Not configured                                      |  |  |  |  |  |
| Number of EPDCCH         |                                       | 1   |  |  |  |  |  |
| sets                     |                                       | l<br>I  |  |  |  |  |  |
| EPDCCH transmission      |                                       | Localized   |  |  |  |  |  |
| type                     |                                       |   |  |  |  |  |  |
| Number of PRB per        |                                       | 2 PRB pairs   |  |  |  |  |  |
| EPDCCH set and           |                                       | 10MHz BW: Resource blocks n <sub>PRB</sub> = 48, 49 |  |  |  |  |  |
| EPDCCH PRB pair          |                                       | 15MHz BW: Resource blocks n <sub>PRB</sub> = 70, 71 |  |  |  |  |  |
| allocation               |                                       | 20MHz BW: Resource blocks n <sub>PRB</sub> = 98, 99 |  |  |  |  |  |
| EPDCCH Starting          |                                       | Derived from CFI (i.e. default behaviour)           |  |  |  |  |  |
| Symbol                   |                                       |   |  |  |  |  |  |
| ECCE Aggregation         |                                       | 2 ECCEs   |  |  |  |  |  |
| Level                    |                                       | 2 20020   |  |  |  |  |  |
| Number of EREGs per      |                                       | 4   |  |  |  |  |  |
| ECCE                     |                                       |   |  |  |  |  |  |
| EPDCCH scheduling        |                                       | EPDCCH candidate is randomly assigned               |  |  |  |  |  |
|                          |                                       | in each subframe                                    |  |  |  |  |  |
| EPDCCH precoder          |                                       | Fixed PMI 0   |  |  |  |  |  |
| (Note 1)                 |                                       |   |  |  |  |  |  |
| EPDCCH monitoring SF     |                                       | 111111111 000000000                                 |  |  |  |  |  |
| pattern                  |                                       | 111111111 000000000                                 |  |  |  |  |  |
| Timing advance           | μs                                    | 100   |  |  |  |  |  |
| Propagation condition    |                                       | Static propagation condition                        |  |  |  |  |  |
|                          | No external noise sources are applied |   |  |  |  |  |  |
|                          | oder parameters are o                 | defined for tests with 2 x 2 antenna                |  |  |  |  |  |
| configuration            |                                       |   |  |  |  |  |  |

The requirements are specified in Table 8.7.3-3, with the addition of the parameters in Table 8.7.3-2 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category, CA capability and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.3-4. The TB success rate shall be sustained during at least 300 frames.

| Table 8.7.3-2: Test parameters for SDR test for PDSCH scheduled by |                   |
|--|-------------------|
|  | y Ei DOOII (i DD) |

| Test      | Bandwidth | Transmission | nemission Antenna |             | Codebook<br>subset           |                              |   | $\hat{E}_{_{s}}$ at | Symbols<br>for              |                |
|-----------|-----------|--------------|-------------------|-------------|------------------------------|------------------------------|---|---------------------|-----------------------------|----------------|
| 1621      | (MHz)     | mode         | configuration     | restriction | $ ho_{\scriptscriptstyle A}$ | $ ho_{\scriptscriptstyle B}$ | σ | δ                   | antenna port<br>(dBm/15kHz) | unused<br>PRBs |
| 1         | 10        | 1            | 1 x 2             | N/A         | 0                            | 0                            | 0 | 0                   | -85                         | OP.6<br>FDD    |
| 2         | 10        | 3            | 2 x 2             | 10          | -3                           | -3                           | 0 | 3                   | -85                         | OP.1<br>FDD    |
| 3,4,6     | 20        | 3            | 2 x 2             | 10          | -3                           | -3                           | 0 | 3                   | -85                         | OP.1<br>FDD    |
| ЗA        | 10        | 3            | 2 x 2             | 10          | -3                           | -3                           | 0 | 3                   | -85                         | OP.1<br>FDD    |
| 3C,<br>4B | 15        | 3            | 2 x 2             | 10          | -3                           | -3                           | 0 | 3                   | -85                         | OP.1<br>FDD    |

| Test    | Number of bits of a DL-SCH transport                          | Measurement channel  | Reference value  |
|---------|---|--|--|
|         | block received within a TTI                                   |  | TB success rate [%]  |
| 1       | 10296   | R.31E-1 FDD  | 95   |
| 2       | 25456   | R.31E-2 FDD  | 95   |
| 3       | 51024   | R.31E-3 FDD  | 95   |
| ЗA      | 36696 (Note 2)  | R.31E-3A FDD   | 85   |
| 3C      | 51024   | R.31E-3C FDD   | 85   |
| 4       | 75376 (Note 3)  | R.31E-4 FDD  | 85   |
| 4B      | 55056 (Note 5)  | R.31E-4B FDD   | 85   |
| 6       | 75376 (Note 3)  | R.31E-4 FDD  | 85   |
| Note 1: | For 2 layer transmissions, 2 transport blocks                 | are received within a TTI.                                       |  |
| Note 2: | 35160 bits for sub-frame 5.                                   |  |  |
| Note 3: | 71112 bits for sub-frame 5.                                   |  |  |
| Note 4: | The TB success rate is defined as TB succes                   | s rate = 100%*N <sub>DL_correct_rx</sub> / (N <sub>DL_newt</sub> | x + N <sub>DL_retx</sub> ), where N <sub>DL_newtx</sub> is |
|         | the number of newly transmitted DL transport                  |  |  |
|         | blocks, and N <sub>DL_correct_rx</sub> is the number of corre | ectly received DL transport blocks.                              |  |
| Note 5: | 52752 bits for sub-frame 5.                                   |  |  |

Table 8.7.3-3: Minimum requirement (FDD)

| Table 8.7.3-4: 1 | Fest points fo | or sustained | data rate | (FRC) |
|------------------|----------------|--------------|-----------|-------|
|------------------|----------------|--------------|-----------|-------|

| CA<br>config  | Bandwidth (MHz) | Category<br>1 | Category<br>2 | Category 3 | Category 4 | Category 6 | Category 7 |
|---|-----------------|---------------|---------------|------------|------------|------------|------------|
| Cingle  | 10              | 1             | 2             | 3A         | 3A         | -          | -          |
| Single  | 15              | -             | -             | 3C         | 4B         | -          | -          |
| carrier   | 20              | -             | -             | 3          | 4          | 6          | 6          |
| Note 1: The test is selected for maximum supported bandwidth. |                 |               |               |            |            |            |            |

# 8.7.4 TDD (EPDCCH scheduling)

The parameters specified in Table 8.7.4-1 are valid for all TDD tests unless otherwise stated.

Table 8.7.4-1: Common test parameters (TDD)

| Parameter   | Unit         | Value   |  |  |  |  |  |
|---|--------------|---|--|--|--|--|--|
| Special subframe<br>configuration (Note 1)  |              | 4   |  |  |  |  |  |
| Cyclic prefix   |              | Normal  |  |  |  |  |  |
| Cell ID   |              | 0   |  |  |  |  |  |
| Inter-TTI Distance  |              | 1   |  |  |  |  |  |
| Maximum number of<br>HARQ transmission  |              | 4   |  |  |  |  |  |
| Redundancy version<br>coding sequence   |              | {0,0,1,2} for 64QAM   |  |  |  |  |  |
| Number of OFDM<br>symbols for PDCCH per<br>component carrier  | OFDM symbols | 1   |  |  |  |  |  |
| Cross carrier scheduling  |              | Not configured  |  |  |  |  |  |
| Number of EPDCCH<br>sets  |              | 1   |  |  |  |  |  |
| EPDCCH transmission<br>type   |              | Localized   |  |  |  |  |  |
| Number of PRB per<br>EPDCCH set and<br>EPDCCH PRB pair<br>allocation  |              | 2 PRB pairs<br>10MHz BW: Resource blocks $n_{PRB} = 48$ ,<br>49<br>15MHz BW: Resource blocks $n_{PRB} = 70$ ,<br>71<br>20MHz BW: Resource blocks $n_{PRB} = 98$ ,<br>99 |  |  |  |  |  |
| EPDCCH Starting<br>Symbol   |              | Derived from CFI (i.e. default behaviour)   |  |  |  |  |  |
| ECCE Aggregation<br>Level   |              | 2 ECCEs   |  |  |  |  |  |
| Number of EREGs per<br>ECCE   |              | 4 for normal subframe and 8 for special<br>subframe   |  |  |  |  |  |
| EPDCCH scheduling   |              | EPDCCH candidate is randomly assigned<br>in each subframe   |  |  |  |  |  |
| EPDCCH precoder<br>(Note 2)   |              | Fixed PMI 0   |  |  |  |  |  |
| EPDCCH monitoring SF<br>pattern   |              | UL-DL configuration 1: 1101111111<br>000000000<br>UL-DL configuration 5: 1100111001<br>0000000000   |  |  |  |  |  |
| Timing advance  | μs           | 100   |  |  |  |  |  |
| Propagation condition   |              | Static propagation condition<br>No external noise sources are applied   |  |  |  |  |  |
| Note 1:       As specified in Table 4.2-1 in TS 36.211 [4].         Note 2:       EPDCCH precoder parameters are defined for tests with 2 x 2 antenna configuration |              |   |  |  |  |  |  |

The requirements are specified in Table 8.7.4-3, with the addition of the parameters in Table 8.7.4-2 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category, CA capability and bandwidth combination with maximum aggregated bandwidth as specified inTable 8.7.4-4. The TB success rate shall be sustained during at least 300 frames.

| Test | Bandwidth<br>(MHz) | Transmission<br>mode | Antenn<br>a<br>configu | Codebook<br>subset | ante                         |                              | $\hat{E}_{_{s}}$ at antenna port | Symbols<br>for unused | ACK/NACK<br>feedback |          |              |
|------|--------------------|----------------------|------------------------|--------------------|------------------------------|------------------------------|----------------------------------|-----------------------|----------------------|----------|--------------|
|      | (1411 12)          | mode                 | ration                 | restriction        | $ ho_{\scriptscriptstyle A}$ | $ ho_{\scriptscriptstyle B}$ | σ                                | δ                     | (dBm/15kHz)          | PRBs     | mode         |
| 1    | 10                 | 1                    | 1 x 2                  | N/A                | 0                            | 0                            | 0                                | 0                     | -85                  | OP.6 TDD | Bundling     |
| 2    | 10                 | 3                    | 2 x 2                  | 10                 | -3                           | -3                           | 0                                | 3                     | -85                  | OP.1 TDD | Bundling     |
| 3    | 20                 | 3                    | 2 x 2                  | 10                 | -3                           | -3                           | 0                                | 3                     | -85                  | OP.1 TDD | Bundling     |
| ЗA   | 15                 | 3                    | 2 x 2                  | 10                 | -3                           | -3                           | 0                                | 3                     | -85                  | OP.2 TDD | Multiplexing |
| 4,6  | 20                 | 3                    | 2 x 2                  | 10                 | -3                           | -3                           | 0                                | 3                     | -85                  | OP.1 TDD | Multiplexing |

#### Table 8.7.4-2: Test parameters for SDR test for PDSCH scheduled by EPDCCH (TDD)

#### Table 8.7.4-3: Minimum requirement (TDD)

| Test  | Number of bits of a DL<br>transport block received<br>a TTI for normal/specia<br>frame | within   | Reference value<br>TB success rate [%] |  |
|---|--|--|--|--|
| 1   | 10296/0  | R.31E-1 TDD  | 95                                     |  |
| 2   | 25456/0  | R.31E-2 TDD  | 95                                     |  |
| 3   | 51024/0  | R.31E-3 TDD  | 95                                     |  |
| ЗA  | 51024/0  | R.31E-3A TDD   | 85                                     |  |
| 4   | 75376/0 (Note 2)   | R.31E-4 TDD  | 85                                     |  |
| 6   | 75376/0 (Note 2) R.31E-4 TDD 85  |  |  |  |
| Note 2: 71 <sup>2</sup><br>Note 3: The<br>the | number of newly transmitted DL tr  | blocks are received within a TTI.<br>success rate = 100%*N <sub>DL_correct_rx</sub> / (N <sub>DL_nev</sub><br>ansport blocks, N <sub>DL_retx</sub> is the number of re<br>of correctly received DL transport blocks. |  |  |

| CA<br>config   | Bandwidth/<br>Bandwidth<br>combination<br>(MHz)       | Category 1 | Category 2 | Category 3 | Category 4 | Category 6 | Category 7 |  |
|----------------|---|------------|------------|------------|------------|------------|------------|--|
| Single carrier | 10  | 1          | 2          | -          | -          | -          | -          |  |
|                | 15  | -          | -          | ЗA         | 3A         | -          | -          |  |
|                | 20  | -          | -          | 3          | 4          | 6          | 6          |  |
| Note 1:        | The test is selected for maximum supported bandwidth. |            |            |            |            |            |            |  |

The test is selected for maximum supported bandwidth. Note 1:

#### Demodulation of EPDCCH 8.8

The receiver characteristics of the EPDCCH are determined by the probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg). For the distributed transmission tests in 8.8.1, EPDCCH and PCFICH are tested jointly, i.e. a miss detection of PCFICH implies a miss detection of EPDCCH. For other tests, EPDCCH and PCFICH are not tested jointly.

#### **Distributed Transmission** 8.8.1

#### 8.8.1.1 FDD

The parameters specified in Table 8.8.1.1-1 are valid for all FDD distributed EPDCCH tests unless otherwise stated.

|  |                         |                              | 1             |  |  |  |
|--|-------------------------|------------------------------|---------------|--|--|--|
|  | Parame                  | Unit                         | Value         |  |  |  |
| Number of  | Number of PDCCH symbols |                              |               | 2 (Note 1)   |  |  |
| PHICH du   | ration                  |                              |               | Normal   |  |  |
|  | E-s and PRB             | -s                           |               | OCNG   |  |  |
| Cell ID  |                         |                              |               | 0  |  |  |
|  |                         | $ ho_{\scriptscriptstyle A}$ | dB            | -3   |  |  |
| Downlink p   | oower                   | $ ho_{\scriptscriptstyle B}$ | dB            | -3   |  |  |
| allocation   |                         | σ                            | dB            | 0  |  |  |
|  |                         | δ                            | dB            | 3  |  |  |
| $N_{\scriptscriptstyle oc}$ at and   | tenna port              |                              | dBm/15<br>kHz | -98  |  |  |
| Cyclic pret  | fix                     |                              |               | Normal   |  |  |
| Subframe   | Configuratio            | n                            |               | Non-MBSFN  |  |  |
| Precoder Update Granularity  |                         |                              | PRB           | 1  |  |  |
| Flecodel   | Spuale Gran             | ulanty                       | ms            | 1  |  |  |
| Beamform   | ing Pre-Cod             | er                           |               | Annex B. 4.4                                       |  |  |
| Cell Speci   | fic Reference           | e Signal                     |               | Port 0 and 1                                       |  |  |
| Number of  | FEPDCCH S               | ets Configured               |               | 2 (Note 2)   |  |  |
| Number of  | PRB per EF              | PDCCH Set                    |               | 4 (1 <sup>st</sup> Set)<br>8 (2 <sup>nd</sup> Set) |  |  |
| EPDCCH   | Subframe Me             | onitoring                    |               | NA   |  |  |
| PDSCH T  | М                       |                              |               | TM3  |  |  |
| DCI Forma  | at                      |                              |               | 2A   |  |  |
| <ul> <li>Note 1: The starting symbol for EPDCCH is derived from the PCFICH. RRC signalling <i>epdcch-StartSymbol-r11</i> is not configured.</li> <li>Note 2: The two sets are distributed EPDCCH sets and non-overlapping with PRB = {3, 17, 31, 45} for the first set and PRB = {0, 7, 14, 21, 28, 35, 42, 49} for the second set. EPDCCH is scheduled in the first set for Test 1 and second set for Test 2, respectively. Both sets are always configured.</li> </ul> |                         |                              |               |  |  |  |

 Table 8.8.1.1-1: Test Parameters for Distributed EPDCCH

For the parameters specified in Table 8.8.1.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.8.1.1-2. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.8.1.1-2: Minimum performance Distributed EPDCCH

| Test   | Bandwidth | Aggregatio | Reference | OCNG     | Propagation | Antenna                                    | Referenc      | e value     |
|--------|-----------|------------|-----------|----------|-------------|--|---------------|-------------|
| number |           | n level    | Channel   | Pattern  | Condition   | configuration<br>and correlation<br>Matrix | Pm-dsg<br>(%) | SNR<br>(dB) |
| 1      | 10 MHz    | 4 ECCE     | R.55 FDD  | OP.7 FDD | EVA5        | 2 x 2 Low                                  | 1             | 2.60        |
| 2      | 10 MHZ    | 16 ECCE    | R.56 FDD  | OP.7 FDD | EVA70       | 2 x 2 Low                                  | 1             | -3.20       |

8.8.1.1.1 Void

#### Table 8.8.1.1.1-1: Void

#### 8.8.1.2 TDD

The parameters specified in Table 8.8.1.2-1 are valid for all TDD distributed EPDCCH tests unless otherwise stated.

|                                   | _  |   |  |  |
|-----------------------------------|--|---|--|--|
|                                   | Parame                                   |   | Unit   | Value  |
|                                   | of PDCCH syr                             | nbols   | symbols  | 2 (Note 1)   |
| PHICH du                          |  |   |  | Normal   |
|                                   | RE-s and PRB                             | -S  |  | OCNG   |
| Cell ID                           |  |   |  | 0  |
|                                   |  | $ ho_{\scriptscriptstyle A}$  | dB   | -3   |
| Downlink<br>allocation            |  | $ ho_{\scriptscriptstyle B}$  | dB   | -3   |
| anocation                         | anoodion                                 | σ   | dB   | 0  |
|                                   | δ  | dB  | 3  |  |
| $N_{\scriptscriptstyle oc}$ at ar | ntenna port                              | dBm/15<br>kHz   | -98  |  |
| Cyclic pre                        | efix                                     |   | Normal   |  |
| Subframe                          | Configuratio                             | n   |  | Non-MBSFN  |
| Procodor                          | Update Gran                              | PRB   | 1  |  |
| TIECOUEI                          | Opuale Gran                              | ms  | 1  |  |
|                                   | ning Pre-Code                            |   | Annex B. 4.4                                   |  |
|                                   | ific Reference                           |   |  | Port 0 and 1                                       |
| Number c                          | of EPDCCH S                              | ets Configured  |  | 2 (Note 2)   |
| Number o                          | of PRB per EF                            | PDCCH Set   |  | 4 (1 <sup>st</sup> Set)<br>8 (2 <sup>nd</sup> Set) |
| EPDCCH                            | Subframe Me                              | onitoring   |  | NA   |
| PDSCH T                           | М  |   |  | TM3  |
| DCI Form                          | at                                       |   |  | 2A   |
| TDD UL/                           | DL Configurat                            | ion   |  | 0  |
| TDD Spe                           | cial Subframe                            | )   |  | 1 (Note 3)   |
| Note 1:<br>Note 2:<br>Note 3:     | PRB = {0, 7<br>EPDCCH is<br>set for Test | h-StartSymb<br>DCCH sets a<br>31, 45} for th<br>49} for the s<br>st set for Tes<br>n sets are all | ool-r11 is not<br>and non-<br>ne first set and |  |

 Table 8.8.1.2-1: Test Parameters for Distributed EPDCCH

For the parameters specified in Table 8.8.1.2-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.8.1.2-2. The downlink physical setup is in accordance with Annex C.3.2.

 Table 8.8.1.2-2: Minimum performance Distributed EPDCCH

| Test   | Bandwidth | Aggregation | Reference | OCNG     | Propagation | Antenna                                    | Reference value |             |
|--------|-----------|-------------|-----------|----------|-------------|--|-----------------|-------------|
| number |           | level       | Channel   | Pattern  | Condition   | configuration<br>and correlation<br>Matrix | Pm-dsg<br>(%)   | SNR<br>(dB) |
| 1      | 10 MHz    | 4 ECCE      | R.55 TDD  | OP.7 TDD | EVA5        | 2 x 2 Low                                  | 1               | 2.8         |
| 2      | 10 MHZ    | 16 ECCE     | R.56 TDD  | OP.7 TDD | EVA70       | 2 x 2 Low                                  | 1               | -3.10       |

8.8.1.2.1 Void

#### Table 8.8.1.2.1-1: Void

# 8.8.2 Localized Transmission with TM9

#### 8.8.2.1 FDD

The parameters specified in Table 8.8.2.1-1 are valid for all FDD TM9 localized ePDCCH tests unless otherwise stated.

| Param                                       | eter                           | Unit           | Value   |  |  |  |  |
|---|--------------------------------|----------------|---|--|--|--|--|
| Number of PDCCH sy                          | mbols                          | symbols        | 1 (Note 1)  |  |  |  |  |
| EPDCCH starting sym                         |                                | symbols        | 2 (Note 1)  |  |  |  |  |
| PHICH duration                              |                                |                | Normal  |  |  |  |  |
| Unused RE-s and PR                          | B-s                            |                | OCNG  |  |  |  |  |
| Cell ID                                     |                                |                | 0   |  |  |  |  |
|   | $ ho_{\scriptscriptstyle A}$   | dB             | 0   |  |  |  |  |
| Downlink power                              | $ ho_{\scriptscriptstyle B}$   | dB             | 0   |  |  |  |  |
| allocation                                  | σ                              | dB             | -3  |  |  |  |  |
|   | δ                              | dB             | 0   |  |  |  |  |
| $N_{\scriptscriptstyle oc}$ at antenna port |                                | dBm/15<br>kHz  | -98   |  |  |  |  |
| Cyclic prefix                               |                                |                | Normal  |  |  |  |  |
| Subframe Configuration                      | on                             |                | Non-MBSFN   |  |  |  |  |
| Brocodor Undato Gra                         | Precoder Update Granularity    |                | 1   |  |  |  |  |
| Frecouer Opuale Grai                        | lulanty                        | ms             | 1   |  |  |  |  |
| Beamforming Pre-Coo                         |                                |                | Annex B.4.5                                       |  |  |  |  |
| Cell Specific Reference                     |                                |                | Port 0 and 1                                      |  |  |  |  |
| CSI-RS Reference Sig                        |                                |                | Port 15 and 16                                    |  |  |  |  |
| CSI-RS reference sigr                       | nal resource                   |                | 0   |  |  |  |  |
| configuration                               |                                |                | 0   |  |  |  |  |
| CSI reference signal s                      | subframe                       |                | 2   |  |  |  |  |
| configuration I <sub>CSI-RS</sub>           |                                |                |   |  |  |  |  |
| ZP-CSI-RS configurat                        | ion bitmap                     |                | 00000100000000                                    |  |  |  |  |
| ZP-CSI-RS subframe                          | configuration I <sub>ZP-</sub> |                | 2   |  |  |  |  |
| CSI-RS<br>Number of EPDCCH S                | Sote                           |                | 2 (Note 2)  |  |  |  |  |
| EPDCCH Subframe M                           |                                |                |   |  |  |  |  |
| subframePatternConfi                        |                                |                | 1111110111 (Note 3)                               |  |  |  |  |
| PDSCH TM                                    | 9111                           |                | ТМ9   |  |  |  |  |
|   | a symbol for EPDC              | CH is signalle | d with epdcch-StartSymbol-r11. However, CFI is    |  |  |  |  |
| set to 1.                                   |                                |                |   |  |  |  |  |
|   | t is distributed trans         | mission with   | PRB = {0, 49} and the second set is localized     |  |  |  |  |
|   |                                |                | 5, 42, 49}. ePDCCH is scheduled in the second set |  |  |  |  |
| for all tests.                              |                                |                | · · · ·   |  |  |  |  |
|   |                                |                | equired to monitor ePDCCH for UE-specific search  |  |  |  |  |
| space only                                  | in SFs configured b            | y subframeP    | PatternConfig-r11. Legacy PDCCH is not scheduled. |  |  |  |  |
|   |                                |                |   |  |  |  |  |

Table 8.8.2.1-1: Test Parameters for Localized EPDCCH with TM9

For the parameters specified in Table 8.8.2.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.8.2.1-2. EPDCCH subframe monitoring is configured and the subframe monitoring requirement in EPDCCH restricted subframes is statDTX of 99.9%.

The downlink physical setup is in accordance with Annex C.3.2.

| Test  | Bandwidt | Aggregatio | Reference | OCNG     | Propagatio  | Antenna                                    | Referenc      | e value     |
|-------|----------|------------|-----------|----------|-------------|--|---------------|-------------|
| numbe | r h      | n level    | Channel   | Pattern  | n Condition | configuration<br>and correlation<br>Matrix | Pm-dsg<br>(%) | SNR<br>(dB) |
| 1     | 10 MHz   | 2 ECCE     | R.57 FDD  | OP.7 FDD | EVA5        | 2 x 2 Low                                  | 1             | 12.2        |
| 2     | 10 MHZ   | 8 ECCE     | R.58 FDD  | OP.7 FDD | EVA5        | 2 x 2 Low                                  | 1             | 2.5         |

#### 8.8.2.1.1 Void

#### Table 8.8.2.1.1-1: Void

8.8.2.1.2 Void

Table 8.8.2.1.2-1: Void

#### Table 8.8.2.1.2-2: Void

#### Table 8.8.2.1.2-3: Void

# 8.8.2.2 TDD

The parameters specified in Table 8.8.2.2-1 are valid for all TDD TM9 localized ePDCCH tests unless otherwise stated.

| Parame                                     | eter                            | Unit          | Value   |
|--|---------------------------------|---------------|---|
| Number of PDCCH syr                        | nbols                           | symbols       | 1 (Note 1)  |
| EPDCCH starting sym                        | loc                             | symbols       | 2 (Note 1)  |
| PHICH duration                             |                                 |               | Normal  |
| Unused RE-s and PRE                        | B-S                             |               | OCNG  |
| Cell ID                                    |                                 |               | 0   |
|  | $ ho_{\scriptscriptstyle A}$ dB |               | 0   |
| Downlink power                             | $ ho_{\scriptscriptstyle B}$    | dB            | 0   |
| allocation                                 | σ                               | dB            | -3  |
|  | δ                               | dB            | 0   |
| N of optoppo part                          | -                               | dBm/15        | -98   |
| $N_{_{oc}}$ at antenna port                |                                 | kHz           |   |
| Cyclic prefix                              |                                 |               | Normal  |
| Subframe Configuratio                      | n                               |               | Non-MBSFN   |
| Dropodor Undoto Crop                       | ulority                         | PRB           | 1   |
| Precoder Update Gran                       | ulanty                          | ms            | 1   |
| Beamforming Pre-Cod                        | er                              |               | Annex B.4.5   |
| Cell Specific Reference                    | e Signal                        |               | Port 0 and 1  |
| CSI-RS Reference Sig                       |                                 |               | Port 15 and 16  |
| CSI-RS reference sign                      | al resource                     |               | 0   |
| configuration                              |                                 |               |   |
| CSI reference signal su                    | ubtrame                         |               | 0   |
| configuration I <sub>CSI-RS</sub>          | an hitman                       |               | 000001000000000   |
| ZP-CSI-RS configuration                    | on billinap                     | -             |   |
| CSI-RS                                     | configuration IZP-              |               | 0   |
| Number of EPDCCH S                         | ets                             |               | 2 (Note 2)  |
|  | opitaring pattorn               |               | 1100011000 1100010000 1100011000  |
| EPDCCH Subframe M<br>subframePatternConfig |                                 |               | 1100001000 1100011000 1000011000  |
| subiramer allem Coning                     | <i>j</i> -1 1 1                 |               | 1100011000 (Note 3)   |
| PDSCH TM                                   |                                 |               | TM9   |
| TDD UL/DL Configurat                       |                                 |               | 0   |
| TDD Special Subframe                       |                                 |               | 1 (Note 4)  |
|  | symbol for EPDCC                | H is signalle | d with epdcch-StartSymbol-r11. However, CFI is  |
|  |                                 |               | PRB = {0, 49} and the second set is localized 5, 42, 49}. ePDCCH is scheduled in the second set       |
| Note 3: EPDCCH is space only i             | n SFs configured by             | y subframeF   | equired to monitor ePDCCH for UE-specific search<br>PatternConfig-r11. Legacy PDCCH is not scheduled. |
| Note 4: Demodulation                       | on performance is a             | veraged over  | er normal and special subframe.   |

#### Table 8.8.2.2-1: Test Parameters for Localized EPDCCH with TM9

For the parameters specified in Table 8.8.2.2-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.2.2.2-2. EPDCCH subframe monitoring is configured and the subframe monitoring requirement in EPDCCH restricted subframes is statDTX of 99.9%.

The downlink physical setup is in accordance with Annex C.3.2.

#### Table 8.8.2.2-2: Minimum performance Localized EPDCCH with TM9

| ſ | Test   | Bandwidth | Aggregation | Reference | OCNG     | Propagation | Antenna                                    | Reference     | e value     |
|---|--------|-----------|-------------|-----------|----------|-------------|--|---------------|-------------|
|   | number |           | level       | Channel   | Pattern  | Condition   | configuration<br>and correlation<br>Matrix | Pm-dsg<br>(%) | SNR<br>(dB) |
| ſ | 1      | 10 MHz    | 2 ECCE      | R.57 TDD  | OP.7 TDD | EVA5        | 2 x 2 Low                                  | 1             | 12.8        |
| ſ | 2      | 10 MHZ    | 8 ECCE      | R.58 TDD  | OP.7 TDD | EVA5        | 2 x 2 Low                                  | 1             | 2.0         |

8.8.2.2.1 Void

#### Table 8.8.2.2.1-1: Void

8.8.2.2.2 Void

Table 8.8.2.2.2-1: Void

Table 8.8.2.2.2-2: Void

#### Table 8.8.2.2.2-3: Void

### 8.8.3 Localized transmission with TM10 Type B quasi co-location type

#### 8.8.3.1 FDD

For the parameters specified in Table 8.8.3.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified values in Table 8.8.3.1-2. In Table 8.8.3.1-1, transmission point 1 (TP 1) is the serving cell. The downlink physical setup is in accordance with Annex C.3.2.

### Table 8.8.3.1-1: Test Parameters for Localized Transmission TM10 Type B quasi co-location type

|                                      |  | 11                | Te   | est 1                                     | Te  | st 2  |  |
|--------------------------------------|--|-------------------|--|---|---|---|--|
|                                      | rameter  | Unit              | TP 1   | TP 2                                      | TP 1  | TP 2  |  |
| PHICH durat                          |  |                   |  |   | ormal   |   |  |
| Downlink                             | $ ho_{\scriptscriptstyle A}$   | dB                |  |   | 0   |   |  |
| power                                | $ ho_{\scriptscriptstyle B}$   | dB                |  |   | 0   |   |  |
| allocation                           | σ  | dB                |  |   | -3  |   |  |
|                                      | δ  | dB                |  | 1   | 0   |   |  |
| $\hat{E}_s/N_{oc}$                   |  | dB                | 0dB power<br>imbalance is<br>considered<br>between TP 1<br>and TP 2, | Reference value<br>in Table 8.8.3.1-<br>2 | Reference value<br>in Table 8.8.3.1-<br>2                                   | Reference value<br>in Table 8.8.3.1-<br>2                                   |  |
| $N_{\scriptscriptstyle oc}$ at anten | na port  | dBm/<br>15kH<br>z |  | -   | 98  |   |  |
| Bandwidth                            |  | MHz               | 10   | 10  | 10  | 10  |  |
| Number of co<br>EPDCCH Se            |  |                   | 2 (N   | lote 1)                                   | 2 (N  | ote1)   |  |
| EPDCCH-PR<br>(setConfigId)           |  |                   | 0  | 1   | 0   | 1   |  |
| PRB-set                              | type of EPDCCH-  |                   | Localized  | Localized                                 | Localized   | Localized   |  |
| Number of Pl<br>EPDCCH-PR            | B-set  | PRB               | 8  | 8   | 8   | 8   |  |
|                                      | amforming model  |                   | Annex B.4.5<br>TM10  | Annex B.4.5<br>TM10                       | Annex B.4.5<br>TM10   | Annex B.4.5<br>TM10   |  |
|                                      | PDSCH transmission mode<br>PDSCH transmission<br>scheduling              |                   | Blanked in all the subframes   | Transmit in all the subframes             | Probability of<br>occurrence of<br>PDSCH<br>transmission is<br>30% (Note 3) | Probability of<br>occurrence of<br>PDSCH<br>transmission is<br>70% (Note 3) |  |
| Non-zero<br>power CSI                | CSI reference<br>signal<br>configuration                                 |                   | N/A  | 0   | N/A   | 0   |  |
| reference<br>signal<br>(NZPId=1)     | CSI reference<br>signal subframe<br>configuration<br>I <sub>CSI-RS</sub> |                   | N/A  | 2   | N/A   | 2   |  |
| Non-zero<br>power CSI                | CSI reference<br>signal<br>configuration                                 |                   | N/A  | N/A                                       | 10  | N/A   |  |
| reference<br>signal<br>(NZPId=2)     | CSI reference<br>signal subframe<br>configuration<br>I <sub>CSI-RS</sub> |                   | N/A  | N/A                                       | 2   | N/A   |  |
| Zero power<br>CSI<br>reference       | CSI-RS<br>Configuration list<br>(ZeroPowerCSI-<br>RS bitmap)             | Bitma<br>p        | N/A  | 0000010000000<br>000                      | N/A   | 1000010000000<br>000  |  |
| signal<br>(ZPId=1)                   | CSI-RS<br>subframe<br>configuration<br>I <sub>CSI-RS</sub>               |                   | N/A  | 2   | N/A   | 2   |  |
| Zero power<br>CSI<br>reference       | CSI-RS<br>Configuration list<br>(ZeroPowerCSI-<br>RS bitmap)             | Bitma<br>p        | N/A  | N/A                                       | 1000010000000<br>000  | N/A   |  |
| signal<br>(ZPId=2)                   | CSI-RS<br>subframe<br>configuration<br>I <sub>CSI-RS</sub>               |                   | N/A  | N/A                                       | 2   | N/A   |  |
| PQI set 0<br>(Note 4)                | Non-Zero power<br>CSI RS Identity<br>(NZPId)                             |                   | N/A  | 1   | N/A   | 1   |  |

|                    | Zero power CSI<br>RS Identity<br>(ZPId)   |  | N/A                            | 1                              | N/A                            | 1                              |  |  |  |
|--------------------|---|--|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--|--|--|
| PQI set 1          | Non-Zero power<br>CSI RS Identity<br>(NZPId)  |  | N/A                            | N/A                            | 2                              | N/A                            |  |  |  |
| (Note 4)           | Zero power CSI<br>RS Identity<br>(ZPId)   |  | N/A                            | N/A                            | 2                              | N/A                            |  |  |  |
| Number o           | f PDCCH symbols   | Symb<br>ols  |                                | 1 (Note 2)                     |                                |                                |  |  |  |
| EPDCCH             | starting position   |  | pdsch-Start-<br>r11=2 (Note 2) | pdsch-Start-<br>r11=2 (Note 2) | pdsch-Start-<br>r11=2 (Note 2) | pdsch-Start-<br>r11=2 (Note 2) |  |  |  |
| Subframe           | configuration   |  | Non-MBSFN                      | Non-MBSFN                      | Non-MBSFN                      | Non-MBSFN                      |  |  |  |
| Time offs          | et between TPs  | μs   | N/A                            | 2                              | N/A                            | 2                              |  |  |  |
| Frequenc           | y shift between TPs   | Hz   | N/A                            | 200                            | N/A                            | 200                            |  |  |  |
| Cell ID            |   |  | 0                              | 126                            | 0                              | 126                            |  |  |  |
| Note 1:<br>Note 2: | Note 1: Resource blocks n <sub>PRB</sub> =0, 7, 14, 21, 28, 35, 42, 49 are allocated for both the first set and the second set. |  |                                |                                |                                |                                |  |  |  |
| Note 3:            | Probabilities of occurre  | SCH is transmitted shall be randomly determined independently for each subframe.<br>ence of PDSCH transmission from TP 1 and TP 2 are specified. |                                |                                |                                |                                |  |  |  |
| Note 4:            | For PQI set 0, PDSCH<br>transmitted from TP1.   |  |                                |                                |                                | and EPDCCH are                 |  |  |  |

Table 8.8.3.1-2: Minimum Performance

| Test   | Aggregation | Reference | OCNG     | Propagation | Antenna                                    | Reference  | e value  |
|--------|-------------|-----------|----------|-------------|--|------------|----------|
| number | level       | Channel   | Pattern  | Condition   | configuration<br>and correlation<br>Matrix | Pm-dsg (%) | SNR (dB) |
| 1      | 2 ECCE      | R.59 FDD  | OP.7 FDD | EVA5        | 2 x 2 Low                                  | 1          | 13.4     |
| 2      | 2 ECCE      | R.59 FDD  | OP.7 FDD | EVA5        | 2 x 2 Low                                  | 1          | 13.4     |

### 8.8.3.2 TDD

For the parameters specified in Table 8.8.3.2-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified values in Table 8.8.3.2-2. In Table 8.8.3.2-1, transmission point 1 (TP1) is the serving cell. The downlink physical setup is in accordance with Annex C.3.2.

### Table 8.8.3.2-1: Test Parameters for Localized Transmission TM10 Type B quasi co-location type

| Deremeter                            |  | 11                | Τe   | est 1                                     | Tes   | st 2  |  |
|--------------------------------------|--|-------------------|--|---|---|---|--|
| -                                    | irameter   | Unit              | TP 1   | TP 2                                      | TP 1  | TP 2  |  |
| PHICH durat                          | ion  |                   |  | Nc  | ormal   |   |  |
| Devention                            | $ ho_{\scriptscriptstyle A}$   | dB                |  |   | 0   |   |  |
| Downlink<br>power                    | $ ho_{\scriptscriptstyle B}$   | dB                |  |   | 0   |   |  |
| allocation                           | σ  | dB                |  |   | -3  |   |  |
|                                      | δ  | dB                |  |   | 0   |   |  |
| $\hat{E}_s/N_{oc}$                   |  | dB                | 0dB power<br>imbalance is<br>considered<br>between TP 1<br>and TP 2, | Reference value<br>in Table 8.8.3.2-<br>2 | Reference value<br>in Table 8.8.3.2-<br>2                                   | Reference value<br>in Table 8.8.3.2-<br>2                                   |  |
| $N_{\scriptscriptstyle oc}$ at anter | ina port   | dBm/<br>15kH<br>z |  | -   | 98  |   |  |
| Bandwidth                            |  | MHz               | 10   | 10  | 10  | 10  |  |
|                                      | PDCCH Sets   |                   |  | lote 1)                                   | 2 (N  |   |  |
| EPDCCH-PR<br>(setConfigId)           | )  |                   | 0  | 1   | 0   | 1   |  |
| PRB-set                              | n type of EPDCCH-  |                   | Localized  | Localized                                 | Localized   | Localized   |  |
| Number of P<br>EPDCCH-PF             | RB-set   | PRB               | 8  | 8   | 8   | 8   |  |
|                                      | amforming model  |                   | Annex B.4.5  | Annex B.4.5                               | Annex B.4.5   | Annex B.4.5   |  |
| PDSCH tran                           | smission mode  |                   | TM10   | TM10                                      | TM10  | TM10  |  |
| PDSCH transmission scheduling        |  |                   | Blanked in all the subframes   | Transmit in all the subframes             | Probability of<br>occurrence of<br>PDSCH<br>transmission is<br>30% (Note 3) | Probability of<br>occurrence of<br>PDSCH<br>transmission is<br>70% (Note 3) |  |
| CSI reference<br>configuration       | s  |                   | Antenna ports<br>15,16   | Antenna ports<br>15,16                    | Antenna ports<br>15,16  | Antenna ports<br>15,16  |  |
| Non-zero<br>power CSI                | CSI reference<br>signal<br>configuration                                 |                   | N/A  | 0   | N/A   | 0   |  |
| reference<br>signal<br>(NZPId=1)     | CSI reference<br>signal subframe<br>configuration<br>I <sub>CSI-RS</sub> |                   | N/A  | 0   | N/A   | 0   |  |
| Non-zero<br>power CSI                | CSI reference<br>signal<br>configuration                                 |                   | N/A  | N/A                                       | 10  | N/A   |  |
| reference<br>signal<br>(NZPId=2)     | CSI reference<br>signal subframe<br>configuration<br>I <sub>CSI-RS</sub> |                   | N/A  | N/A                                       | 0   | N/A   |  |
| Zero power<br>CSI                    | CSI-RS<br>Configuration list<br>(ZeroPowerCSI-<br>RS bitmap)             | Bitma<br>p        | N/A  | 0000010000000<br>000                      | N/A   | 1000010000000<br>000  |  |
| reference<br>signal<br>(ZPId=1)      | CSI-RS<br>subframe<br>configuration<br>I <sub>CSI-RS</sub>               |                   | N/A  | 0   | N/A   | 0   |  |
| Zero power<br>CSI                    | CSI-RS<br>Configuration list<br>(ZeroPowerCSI-<br>RS bitmap)             | Bitma<br>p        | N/A  | N/A                                       | 1000010000000<br>000  | N/A   |  |
| reference<br>signal<br>(ZPId=2)      | CSI-RS<br>subframe<br>configuration<br>I <sub>CSI-RS</sub>               |                   | N/A  | N/A                                       | 0   | N/A   |  |

| PQI set 0  | Non-Zero power<br>CSI RS Identity<br>(NZPId)   |             | N/A                            | 1                              | N/A                            | 1                              |  |  |  |
|--|--|-------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--|--|--|
| (Note 4)   | Zero power CSI<br>RS Identity<br>(ZPId)  |             | N/A                            | 1                              | N/A                            | 1                              |  |  |  |
| Non-Źero power<br>CSI RS Identity<br>PQI set 1 (NZPId) |  |             | N/A                            | N/A                            | 2                              | N/A                            |  |  |  |
| (Note 4)   | Zero power CSI<br>RS Identity<br>(ZPId)  |             | N/A                            | N/A                            | 2                              | N/A                            |  |  |  |
| Number o   | f PDCCH symbols  | Symb<br>ols | 1 (Note 2)                     |                                |                                |                                |  |  |  |
| EPDCCH   | starting position  |             | pdsch-Start-<br>r11=2 (Note 2) | pdsch-Start-<br>r11=2 (Note 2) | pdsch-Start-<br>r11=2 (Note 2) | pdsch-Start-<br>r11=2 (Note 2) |  |  |  |
| Subframe   | configuration  |             | Non-MBSFN                      | Non-MBSFN                      | Non-MBSFN                      | Non-MBSFN                      |  |  |  |
| Time offs  | et between TPs   | μs          | N/A                            | 2                              | N/A                            | 2                              |  |  |  |
| Frequenc   | Frequency shift between TPs  |             | N/A                            | 200                            | N/A                            | 200                            |  |  |  |
| Cell ID  |  |             | 0                              | 126                            | 0                              | 126                            |  |  |  |
|  | DL configuration   |             | 0                              |                                |                                |                                |  |  |  |
| TDD spec   | cial subframe  |             | 1                              |                                |                                |                                |  |  |  |
| Note 1:  | Resource blocks n <sub>PRB</sub>   |             |                                |                                |                                |                                |  |  |  |
| Note 2:  | The starting OFDM sy   | mbol for I  | EPDCCH is deterr               | nined from the high            | er layer signalling p          | dsch-Start-r11.                |  |  |  |
| And CFI is set to 1.                                   |  |             |                                |                                |                                |                                |  |  |  |
| Note 3:  | Note 3: The TP from which PDSCH is transmitted shall be randomly determined independently for each subframe. |             |                                |                                |                                |                                |  |  |  |
|  | Probabilities of occurre   |             |                                |                                |                                |                                |  |  |  |
| Note 4:  | For PQI set 0, PDSCH   |             |                                |                                |                                | and EPDCCH are                 |  |  |  |
|  | transmitted from TP1. EPDCCH and PDSCH are transmitted from same TP.   |             |                                |                                |                                |                                |  |  |  |

Table 8.8.3.2-2: Minimum Performance

| ſ | Test   | Aggregation | Reference | OCNG     | Propagation | Antenna                                    | Reference  | e value  |
|---|--------|-------------|-----------|----------|-------------|--|------------|----------|
|   | number | level       | Channel   | Pattern  | Condition   | configuration<br>and correlation<br>Matrix | Pm-dsg (%) | SNR (dB) |
| ſ | 1      | 2 ECCE      | R.59 TDD  | OP.7 TDD | EVA5        | 2 x 2 Low                                  | 1          | 13.6     |
|   | 2      | 2 ECCE      | R.59 TDD  | OP.7 TDD | EVA5        | 2 x 2 Low                                  | 1          | 13.6     |

# 9 Reporting of Channel State Information

# 9.1 General

This section includes requirements for the reporting of channel state information (CSI). For all test cases in this section,

the definition of SNR is in accordance with the one given in clause 8.1.1, where SA

$$NR = \frac{\sum \hat{I}_{or}^{(j)}}{\sum N_{oc}^{(j)}}.$$

# 9.1.1 Applicability of requirements

### 9.1.1.1 Applicability of requirements for different channel bandwidths

In Clause 9 the test cases may be defined with different channel bandwidth to verify the same CSI requirement.

# 9.1.1.2 Applicability and test rules for different CA configurations and bandwidth combination sets

The performance requirement for CA CQI tests in Clause 9 are defined independent of CA configurations and bandwidth combination sets specified in Clause 5.6A.1. For UEs supporting different CA configurations and bandwidth combination sets, the applicability and test rules are defined for the tests for 2 DL CCs in Table 9.1.1.2-1. For simplicity, CA configuration below refers to combination of CA configuration and bandwidth combination set. The definition of CA capability is specified in 8.1.2.2.

| Tests                                      | CA capability<br>where the tests<br>apply  | CA configuration from<br>the selected CA capbility<br>where the tests apply                              | CA Bandwidth<br>combination to be<br>tested in priority<br>order | No. of the<br>supported<br>bandwidth<br>combinations<br>to be tested<br>from each<br>selected CA<br>configuration |
|--|--|--|--|---|
| CA tests with<br>2CCs in Clause<br>9.6.1.1 | Any of one of<br>the supported<br>CA capabilities  | Any one of the supported FDD CA configurations   | 10+10 MHz, 20+20<br>MHz  | 1   |
| CA tests with<br>2CCs in Clause<br>9.6.1.2 | Any of one of<br>the supported<br>CA capabilities<br>with largest<br>aggregated CA<br>bandwidth<br>combination | Any one of the supported<br>TDD CA configurations<br>with largest aggregated CA<br>bandwidth combination | Largest aggregated CA bandwidth combination                      | 1   |

# 9.2 CQI reporting definition under AWGN conditions

The reporting accuracy of the channel quality indicator (CQI) under frequency non-selective conditions is determined by the reporting variance and the BLER performance using the transport format indicated by the reported CQI median. The purpose is to verify that the reported CQI values are in accordance with the CQI definition given in TS 36.213 [6]. To account for sensitivity of the input SNR the reporting definition is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

# 9.2.1 Minimum requirement PUCCH 1-0 (Cell-Specific Reference Symbols)

#### 9.2.1.1 FDD

The following requirements apply to UE Category  $\geq 1$ . For the parameters specified in Table 9.2.1.1-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported CQI value according to RC.1 FDD in Table A.4-1 shall be in the range of  $\pm 1$  of the reported median more than 90% of the time. If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, the BLER using the transport format indicated by the median CQI + 1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, the BLER using transport format indicated by (median CQI – 1) shall be less than or equal to 0.1.

| Parameter   |                              | Unit                  | Te             | Test 1 Test 2 |                  |     |  |
|---|------------------------------|-----------------------|----------------|---------------|------------------|-----|--|
| Bandwidth   | Bandwidth                    |                       | 10             |               |                  |     |  |
| PDSCH transmission  | on mode                      |                       | 1              |               |                  |     |  |
| $\rho_A$  |                              | dB                    |                | 0             |                  |     |  |
| Downlink power<br>allocation  | $ ho_{\scriptscriptstyle B}$ | dB                    | 0              |               |                  |     |  |
|   | σ                            | dB                    |                |               | 0                |     |  |
| Propagation condit<br>antenna configur  |                              |                       |                | AWGN (1 x 2)  |                  |     |  |
| SNR (Note 2   | <u>/)</u>                    | dB                    | 0              | 1             | 6                | 7   |  |
| $\hat{I}_{or}^{(j)}$  |                              | dB[mW/15kHz]          | -98            | -97           | -92              | -91 |  |
| $N_{oc}^{(j)}$  |                              | dB[mW/15kHz]          | -98            |               | -                | -98 |  |
| Max number of H<br>transmission   |                              |                       |                |               | 1                |     |  |
| Physical channel f<br>reporting   | or CQI                       |                       | PUCCH Format 2 |               |                  |     |  |
| PUCCH Report  | Туре                         |                       | 4              |               |                  |     |  |
| Reporting period  | dicity                       | ms                    |                | Np            | <sub>d</sub> = 5 |     |  |
| cqi-pmi-Configurati   | onIndex                      |                       |                |               | 6                |     |  |
| Note 1:         Reference measurement channel RC.1 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.           Note 2:         For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) |                              |                       |                |               |                  |     |  |
| and the res   | spective wa                  | anted signal input le | vei.           |               |                  |     |  |

#### Table 9.2.1.1-1: PUCCH 1-0 static test (FDD)

#### 9.2.1.2 TDD

The following requirements apply to UE Category  $\geq 1$ . For the parameters specified in Table 9.2.1.2-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported CQI value according to RC.1 TDD in Table A.4-1 shall be in the range of  $\pm 1$  of the reported median more than 90% of the time. If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, the BLER using the transport format indicated by the median CQI + 1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, the BLER using transport format indicated by (median CQI – 1) shall be less than or equal to 0.1.

| Paramete   | r   | Unit                                      | Те               | Test 1 Test 2    |                 |           |  |  |
|--|---|---|------------------|------------------|-----------------|-----------|--|--|
| Bandwidth  | 1   | MHz                                       | 10               |                  |                 |           |  |  |
| PDSCH transmiss                                    | on mode   |   |                  | 1                |                 |           |  |  |
| Uplink downlink cor                                | figuration  |   |                  |                  | 2               |           |  |  |
| Special subfra                                     |   |   |                  |                  | 4               |           |  |  |
| configuratio                                       | n   |   |                  |                  | -               |           |  |  |
| Downlink power                                     | $ ho_{\scriptscriptstyle A}$  | dB  |                  |                  | 0               |           |  |  |
| allocation   | $ ho_{\scriptscriptstyle B}$  | dB  |                  |                  | 0               |           |  |  |
|  | σ   | dB  |                  |                  | 0               |           |  |  |
| Propagation condition and<br>antenna configuration |   |   |                  | AWGI             | N (1 x 2)       |           |  |  |
| SNR (Note  | 2)  | dB  | 0                | 1                | 6               | 7         |  |  |
| $\hat{I}_{or}^{(j)}$                               |   | dB[mW/15kHz]                              | -98              | -97              | -92             | -91       |  |  |
| $N_{oc}^{(j)}$                                     |   | dB[mW/15kHz]                              | -98 -98          |                  | 98              |           |  |  |
| Max number of<br>transmissio                       |   |   | 1                |                  |                 |           |  |  |
| Physical channel<br>reporting                      |   |   |                  | PUSCH            | H (Note 3)      |           |  |  |
| PUCCH Report                                       | Туре  |   | 4                |                  |                 |           |  |  |
| Reporting perio                                    |   | ms  | $N_{\rm pd} = 5$ |                  |                 |           |  |  |
| cqi-pmi-Configura                                  | tionIndex   |   |                  |                  | 3               |           |  |  |
| ACK/NACK feedba                                    |   |   | Multiplexing     |                  |                 |           |  |  |
| OCNG Pa  | attern OP.1   | ent channel RC.1 T<br>TDD as described ir | n Annex A.5.2    | 2.1.             |                 | -         |  |  |
|  |   | nimum requirements                        |                  | lled for at leas | t one of the tw | vo SNR(s) |  |  |
| Note 3: To avoid<br>PUSCH in                       | PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#7 |   |                  |                  |                 |           |  |  |

#### Table 9.2.1.2-1: PUCCH 1-0 static test (TDD)

#### 9.2.1.3 FDD (CSI measurements in case two CSI subframe sets are configured)

The following requirements apply to UE Category  $\geq 1$ . For the parameters specified in Table 9.2.1.3-1, and using the downlink physical channels specified in tables C.3.2-1 for Cell 1, C.3.3-1 for Cell 2 and C.3.2-2, the reported CQI value according to RC.2 FDD / RC.6 FDD in Table A.4-1 in subframes overlapping with aggressor cell ABS and non-ABS subframes shall be in the range of  $\pm 1$  of the reported median more than 90% of the time. If the PDSCH BLER in non-ABS subframes using the transport format indicated by median CQI obtained by reports in CSI subframe sets  $C_{CSI,1}$  is less than or equal to 0.1, the BLER in non-ABS subframes using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER in non-ABS subframes using the transport format indicated by the median CQI is greater than 0.1, the BLER in non-ABS subframes using transport format indicated by (median CQI - 1) shall be less than or equal to 0.1. The value of the median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  minus the median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  minus the median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  minus the median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  minus the median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  minus the median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  minus the median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  minus the median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  minus the median CQI obtained by reports in CSI subframe sets  $C_{CSI,1}$  shall be larger than or equal to 2 and less than or equal to 5 in Test 1 and shall be larger than or equal to 0 and less than or equal to 1 in Test 2.

| Desemator   |                              | Unit         |   | Tes                                  | st 1   |  | Te   | st 2   |
|---|------------------------------|--------------|---|--------------------------------------|--|--|--|--|
| Parameter   |                              |              | Ce  |                                      | Cell 2   | Ce   | ell 1  | Cell 2   |
| Bandwidth   |                              | MHz          |   | 1(                                   |  |  |  | 0  |
| PDSCH transmission  |                              |              | 2   |                                      | Note 10  |  | 2  | Note 10  |
| Downlink power  | $ ho_{\scriptscriptstyle A}$ | dB           |   | -3                                   |  |  |  | 3  |
| allocation  | $ ho_{\scriptscriptstyle B}$ | dB           |   | -3                                   |  |  |  | 3  |
|   | σ                            | dB           |   | 0                                    | )  |  |  | 0  |
| Propagation condit<br>antenna configu                     |                              |              | (   | Clause B                             | 3.1 (2x2)  |  | Clause I   | B.1 (2x2)  |
| $\widehat{E}_{s}/N_{oc2}$ (Not                            | te 1)                        | dB           | 4   | 5                                    | 6  | 4  | 5  | -12  |
| $\mathbf{r}(i)$   | $N_{oc1}^{(j)}$              | dBm/15kHz    | -102 (N   | lote 7)                              | N/A  |  | lote 7)  | N/A  |
| $N_{oc}^{(j)}$ at antenna                                 | $N_{oc2}^{(j)}$              | dBm/15kHz    | -98 (Note 8)  |                                      | N/A  | -98(N  | lote 8)  | N/A  |
| port  | $N_{oc3}^{(j)}$              | dBm/15kHz    | -94.8 (1  | Note 9)                              | N/A  | -98(N  | lote 9)  | N/A  |
| $\hat{I}_{or}^{(j)}$                                      |                              | dB[mW/15kHz] | -94   | -93                                  | -92  | -94  | -93  | -110   |
| Subframe Configu  | uration                      |              | Non-M   | BSFN                                 | Non-MBSFN  | Non-N  | /BSFN  | Non-MBSFN  |
| Cell Id   |                              |              | 0   |                                      | 1  |  | 0  | 1  |
| Time Offset betwee  | en Cells                     | μs           | 2.5   | (synchro                             | onous cells)   | 2.5  | 5 (synchr  | onous cells)   |
| ABS pattern (Note 2)                                      |                              |              | N/A   |                                      | 01010101<br>01010101<br>01010101<br>01010101<br>01010101<br>01010101 | N/A 010 <sup>-</sup><br>010 <sup>-</sup><br>010 <sup>-</sup> |  | 01010101<br>01010101<br>01010101<br>01010101<br>01010101<br>01010101 |
| RLM/RRM Measurement<br>Subframe Pattern (Note 4)          |                              |              | 00000100<br>00000100<br>00000100<br>00000100<br>00000100    |                                      | N/A  | 00000100<br>00000100<br>00000100<br>00000100<br>00000100     |  | N/A  |
| CSI Subframe Sets   | C <sub>CSI,0</sub>           |              | 01010<br>01010<br>01010<br>01010<br>01010<br>01010<br>01010 |                                      | N/A  | 0101<br>0101<br>0101<br>0101                                 | 10101<br>10101<br>10101<br>10101<br>10101<br>10101 | N/A  |
| (Note 3)  | C <sub>CSI,1</sub>           |              | 1010<br>1010<br>1010<br>1010<br>1010<br>1010                | 1010<br>1010<br>1010<br>1010<br>1010 | N/A  | 1010<br>1010<br>1010<br>1010                                 | 01010<br>01010<br>01010<br>01010<br>01010<br>01010 | N/A  |
| Number of control<br>symbols                              | OFDM                         |              | 3   |                                      | 5  |  | :  | 3  |
| Max number of F<br>transmission                           |                              |              |   | 1                                    |  |  |  | 1  |
| Physical channel for C <sub>CSI,0</sub> CQI<br>reporting  |                              |              | F   | PUCCH F                              | Format 2   |  | PUCCH  | Format 2   |
| Physical channel for C <sub>CSI,1</sub> CQI<br>reporting  |                              |              | F   | USCH (                               | Note 12)   |  | PUSCH  | (Note 12)  |
| PUCCH Report Type   |                              |              |   | 4                                    | ŀ  |  |  | 4  |
| Reporting perior  | dicity                       | Ms           |   | N <sub>pd</sub>                      | = 5  |  | N <sub>pd</sub>                                    | = 5  |
| cqi-pmi-Configurati<br>C <sub>CSI,0</sub> (Note 1         | 3)                           |              | 6   |                                      | N/A  |  | 6  | N/A  |
| <i>cqi-pmi-Configuratio</i><br>C <sub>CSI,1</sub> (Note 1 |                              |              | 5   |                                      | N/A  |  | 5  | N/A  |

| Table 9.2.1.3-1: PUCCH 1-0 static test (FDD) |
|--|
|--|

| Note 1:  | For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the   |
|----------|---|
|          | respective wanted signal input level.   |
| Note 2:  | ABS pattern as defined in [9].  |
| Note 3:  | Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]   |
| Note 4:  | As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]   |
| Note 5:  | Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]   |
| Note 6:  | Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.   |
| Note 7:  | This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.  |
| Note 8:  | This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.   |
| Note 9:  | This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.   |
| Note 10: | Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.1.5  |
| Note 11: | Reference measurement channel in Cell 1 RC.2 FDD according to Table A.4-1 for UE Cateogry 2-8 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1, and RC.6 FDD according to Table A.4-1 for Category 1 with one/two sided dynamic OCNG Pattern OP. 1/2 FDD as described in Annex A.5.1.1 and A.5.1.2. |
| Note 12: | To avoid collisions between HARQ-ACK and wideband CQI it is necessary to report both on PUSCH   |
|          | instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic   |
|          | CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.   |
| Note 13: |   |
| Note 14: | cqi-pmi-ConfigurationIndex2 is applied for C <sub>CSI,1</sub> .   |

#### 9.2.1.4 TDD (CSI measurements in case two CSI subframe sets are configured)

The following requirements apply to UE Category  $\geq 1$ . For the parameters specified in Table 9.2.1.4-1, and using the downlink physical channels specified in tables C.3.2-1 for Cell 1, C3.3-1 for Cell 2 and C.3.2-2, the reported CQI value according to RC.2 TDD / RC.6 TDD in Table A.4-1 in subframes overlapping with aggressor cell ABS and non-ABS subframes shall be in the range of  $\pm 1$  of the reported median more than 90% of the time. If the PDSCH BLER in non-ABS subframes using the transport format indicated by median CQI obtained by reports in CSI subframe sets  $C_{CSI,1}$  is less than or equal to 0.1, the BLER in non-ABS subframes using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER in non-ABS subframes using the transport format indicated by the median CQI is greater than 0.1, the BLER in non-ABS subframes using transport format indicated by the median CQI - 1) shall be less than or equal to 0.1. The value of the median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  minus the median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  minus the median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  minus the median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  minus the median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  minus the median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  minus the median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  minus the median CQI obtained by reports in CSI subframe sets than or equal to 5 in Test 1 and shall be larger than or equal to 0 and less than or equal to 1 in Test 2.

| Parameter                                    | Unit                         |              | Tes                      | st 1     | Test 2                   |                          |           |                          |  |
|--|------------------------------|--------------|--------------------------|----------|--------------------------|--------------------------|-----------|--------------------------|--|
|  |                              |              | Cell 1 Cell 2            |          |                          |                          | Cell 2    |                          |  |
| Bandwidth                                    |                              | MHz          |                          |          | 0                        |                          |           | 0                        |  |
| PDSCH transmission                           |                              |              | 2                        | 2        | Note 10                  |                          | 2         | Note 10                  |  |
| Uplink downlink cont                         |                              |              |                          |          | 1                        |                          |           | 1                        |  |
| Special subfra<br>configuration              |                              |              |                          | 4        | 1                        |                          |           | 4                        |  |
| Downlink power                               | $ ho_{\scriptscriptstyle A}$ | dB           |                          | -        | 3                        |                          | -         | 3                        |  |
| allocation                                   | $ ho_{\scriptscriptstyle B}$ | dB           |                          | -        | 3                        |                          | -         | 3                        |  |
|  | σ                            | dB           |                          | (        | )                        |                          |           | 0                        |  |
| Propagation condit<br>antenna configu        |                              |              |                          | Clause E | 3.1 (2x2)                |                          | Clause    | B.1 (2x2)                |  |
| $\widehat{E}_{s}/N_{oc2}$ (Note 1)           |                              | dB           | 4                        | 5        | 6                        | 4                        | 5         | -12                      |  |
|  | $N_{oc1}^{(j)}$              | dBm/15kHz    | -102 (1                  | Note 7)  | N/A                      | -98 (N                   | lote 7)   | N/A                      |  |
| $N_{\scriptscriptstyle oc}^{(j)}$ at antenna | $N_{oc2}^{(j)}$              | dBm/15kHz    | -98 (N                   | lote 8)  | N/A                      | -98 (Note 8)             |           | N/A                      |  |
| port   | $N_{oc3}^{(j)}$              | dBm/15kHz    | -94.8 (                  | Note 9)  | N/A                      | -98 (Note 9)             |           | N/A                      |  |
| $\hat{I}_{or}^{(j)}$                         |                              | dB[mW/15kHz] | -94                      | -93      | -92                      | -94                      | -93       | -110                     |  |
| Subframe Configuration                       |                              |              | Non-M                    | 1BSFN    | Non-MBSFN                | Non-M                    | IBSFN     | Non-MBSFN                |  |
| Cell Id                                      |                              |              | (                        | C        | 1                        |                          | C         | 1                        |  |
| Time Offset betwee                           | en Cells                     | μs           | 2.5 (synchr              |          | onous cells)             | 2.5                      | i (synchr | ronous cells)            |  |
| ABS pattern (No                              | ote 2)                       |              | N/A                      |          | 0100010001<br>0100010001 | N/A                      |           | 0100010001<br>0100010001 |  |
| RLM/RRM Measu<br>Subframe Pattern (          |                              |              | 0000000001<br>0000000001 |          | N/A                      | 000000001<br>0000000001  |           | N/A                      |  |
| CSI Subframe Sets                            | C <sub>CSI,0</sub>           |              | 01000<br>01000           | 10001    | N/A                      | 01000                    |           | N.A                      |  |
| (Note 3)                                     | C <sub>CSI,1</sub>           |              | 1000101000               |          | N/A                      | 1000101000<br>1000101000 |           | N/A                      |  |
| Number of control                            | OFDM                         |              |                          |          |                          |                          | 2         |                          |  |
| symbols                                      |                              |              | 3                        |          | 3                        |                          |           |                          |  |
| Max number of H<br>transmission              |                              |              | 1                        |          | 1                        |                          | 1         |                          |  |
| Physical channel for<br>reporting            |                              |              | PUCCH Format 2           |          | Format 2                 | PUCCH Format 2           |           | Format 2                 |  |
| Physical channel for                         | C <sub>CSI,1</sub> CQI       |              |                          | PUSCH    | (Note 12)                | PUSCH                    |           | SCH                      |  |
| reporting PUCCH Report Type                  |                              |              |                          | ,        | 4                        |                          |           | 4                        |  |
| Reporting periodicity                        |                              | ms           |                          |          | = 5                      |                          |           | +<br>  = 5               |  |
| cqi-pmi-ConfigurationIndex                   |                              |              |                          |          |                          | <u> </u>                 |           |                          |  |
| C <sub>CSI,0</sub> (Note 1                   | 3)                           |              |                          | 3        | N/A                      |                          | 3         | N/A                      |  |
| cqi-pmi-Configuratio                         | onIndex2                     |              | 4                        | 4        | N/A                      |                          | 4         | N/A                      |  |
| ACK/NACK feedba                              |                              |              |                          | Multip   | lexina                   | 1                        | Multir    | lexing                   |  |

Table 9.2.1.4-1: PUCCH 1-0 static test (TDD)

| Note 1:  | For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.  |
|----------|--|
| Note 2:  | ABS pattern as defined in [9].   |
| Note 3:  | Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]  |
| Note 4:  | As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].   |
| Note 5:  | Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]  |
| Note 6:  | Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.  |
| Note 7:  | This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.   |
| Note 8:  | This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS   |
| Note 9:  | This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.  |
| Note 10: | Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.2.5   |
| Note 11: | Reference measurement channel in Cell 1 RC.2 TDD according to Table A.4-1 for UE Category ≥2 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1, and RC.6 TDD according to Table |
|          | A.4-1 for Category 1 with one/two sided dynami OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1 and Annex A.5.2.2.  |
| Note 12: | To avoid collisions between HARQ-ACK and wideband CQI it is necessary to report both on PUSCH  |
|          | instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic  |
|          | CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.  |
| Note 13: |  |
| Note 14: | cqi-pmi-ConfigurationIndex2 is applied for C <sub>CSI,1.</sub>   |

# 9.2.1.5 FDD (CSI measurements in case two CSI subframe sets are configured and with CRS assistance information)

The following requirements apply to UE Category  $\geq 2$ . For the parameters specified in Table 9.2.1.5-1, and using the downlink physical channels specified in tables C.3.2-1 for Cell 1, C.3.3-2 for Cell 2 and Cell 3, and C.3.2-2, the reported CQI value according to RC.2 FDD in Table A.4-1 in subframes overlapping with aggressor cell ABS and non-ABS subframes shall be in the range of  $\pm 1$  of the reported median more than 90% of the time.

For test 1 and test 2, if the PDSCH BLER in ABS subframes using the transport format indicated by median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  is less than or equal to 0.1, the BLER in ABS subframes using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER in ABS subframes using the transport format indicated by the median CQI is greater than 0.1, the BLER in ABS subframes using transport format indicated by the set transport format indicated by the median CQI is greater than 0.1, the BLER in ABS subframes using transport format indicated by (median CQI – 1) shall be less than or equal to 0.1.

For test 2, if the PDSCH BLER in non-ABS subframes using the transport format indicated by median CQI obtained by reports in CSI subframe sets  $C_{CSI,1}$  is less than or equal to 0.1, the BLER in non-ABS subframes using the transport format indicated by the (median CQI + 2) shall be greater than 0.1. If the PDSCH BLER in non-ABS subframes using the transport format indicated by the median CQI is greater than 0.1, the BLER in non-ABS subframes using transport format indicated by the median CQI is greater than 0.1. If the PDSCH BLER in non-ABS subframes using transport format indicated by the median CQI is greater than 0.1. If the BLER in non-ABS subframes using transport format indicated by the median CQI is greater than 0.1. If the PDSCH BLER in non-ABS subframes using transport format indicated by the median CQI is greater than 0.1. If the PDSCH BLER in non-ABS subframes using transport format indicated by the median CQI is greater than 0.1. If the PDSCH BLER in non-ABS subframes using transport format indicated by the median CQI is greater than 0.1. If the PDSCH BLER in non-ABS subframes using transport format indicated by the median CQI is greater than 0.1. The BLER in non-ABS subframes using transport format indicated by (median CQI – 1) shall be less than or equal to 0.1.

|  |                              |           | Te   | st 1   | Te   | st 2   |
|--|------------------------------|-----------|--|--|--|--|
| Parameter  | ,                            | Unit      | Cell 1   | Cell 2 and 3   | Cell 1   | Cell 2 and 3   |
| Bandwidth  |                              | MHz       |  | 10   |  | 0  |
| PDSCH transmission mode                                  |                              |           | 2  | Note 10  | 2  | Note 10  |
| Downlink power   | $ ho_{\scriptscriptstyle A}$ | dB        |  | -3   | -  | 3  |
| allocation   | $ ho_{\scriptscriptstyle B}$ | dB        |  | -3   | -  | 3  |
|  | σ                            | dB        |  | 0  |  | 0  |
| Propagation condit<br>antenna configu                    |                              |           | Clause   | B.1 (2x2)  | Clause I   | B.1 (2x2)  |
| $\widehat{E}_{s}/N_{oc2}$ (Not                           |                              | dB        | 4 5  | Cell 2: 12<br>Cell 3: 10   | 13 14  | Cell 2: 12<br>Cell 3: 10   |
| $\mathbf{x}(i)$  | $N_{oc1}^{(j)}$              | dBm/15kHz | -98 (Note 7)   | N/A  | -98 (Note 7)   | N/A  |
| $N_{oc}^{(j)}$ at antenna port                           | $N_{oc2}^{(j)}$              | dBm/15kHz | -98 (Note 8)   | N/A  | -98 (Note 8)   | N/A  |
| ·  | $N_{oc3}^{(j)}$              | dBm/15kHz | -93 (Note 9)   | N/A  | -93 (Note 9)   | N/A  |
| Subframe Config  | uration                      |           | Non-MBSFN  | Non-MBSFN  | Non-MBSFN  | Non-MBSFN  |
| Cell Id  |                              |           | 0  | Cell 2: 6<br>Cell 3: 1   | 0  | Cell 2: 6<br>Cell 3: 1   |
| Time Offset betwee                                       | en Cells                     | μs        |  | : 3 usec   |  | 3 usec<br>-1usec   |
|  | <b>0</b> "                   |           |  | : 300Hz  |  | 300Hz  |
| Frequency Shift betw                                     | een Cells                    | Hz        |  | -100Hz   |  | -100Hz   |
| ABS pattern (Note 2)                                     |                              |           | N/A  | 01010101<br>01010101<br>01010101<br>01010101<br>01010101<br>01010101 | N/A  | 01010101<br>01010101<br>01010101<br>01010101<br>01010101<br>01010101 |
| RLM/RRM Measurement<br>Subframe Pattern (Note 4)         |                              |           | 00000100<br>00000100<br>00000100<br>00000100<br>00000100             | N/A  | 00000100<br>00000100<br>00000100<br>00000100<br>00000100             | N/A  |
| CSI Subframe Sets  | C <sub>CSI,0</sub>           |           | 01010101<br>01010101<br>01010101<br>01010101<br>01010101<br>01010101 | N/A  | 01010101<br>01010101<br>01010101<br>01010101<br>01010101<br>01010101 | N/A  |
| (Note 3)   | C <sub>CSI,1</sub>           |           | 10101010<br>10101010<br>10101010<br>10101010<br>10101010<br>10101010 | N/A  | 10101010<br>10101010<br>10101010<br>10101010<br>10101010<br>10101010 | N/A  |
| Number of control OFDM<br>symbols                        |                              |           |  | 3  | :  | 3  |
| Max number of HARQ<br>transmissions                      |                              |           |  | 1  |  | 1  |
| Physical channel for C <sub>CSI,0</sub> CQI<br>reporting |                              |           | PUCCH  | Format 2   | PUCCH  | Format 2   |
| Physical channel for C <sub>CSI,1</sub> CQI<br>reporting |                              |           | PUSCH  | (Note 12)  | PUSCH  | (Note 12)  |
| PUCCH Report Type  |                              |           |  | 4  |  | 4  |
| Reporting periodicity                                    |                              | Ms        | Npo  | <sub>1</sub> = 5   | N <sub>pd</sub>  | = 5  |
| cqi-pmi-Configurati<br>C <sub>CSI,0</sub> (Note 1        | 3)                           |           | 6  | N/A  | 6  | N/A  |
| cqi-pmi-Configuratio<br>C <sub>CSI,1</sub> (Note 1       |                              |           | 5  | N/A  | 5  | N/A  |

### Table 9.2.1.5-1: PUCCH 1-0 static test (FDD)

| Note 1:  | For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the        |
|----------|--|
|          | respective wanted signal input level.  |
| Note 2:  | ABS pattern as defined in [9].   |
| Note 3:  | Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]                |
| Note 4:  | As configured according to the time-domain measurement resource restriction pattern for CSI                  |
|          | measurements defined in [7]  |
| Note 5:  | Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]                |
| Note 6:  | Cell 1 is the serving cell. Cell 2 and Cell 3 are the aggressor cells. The number of the CRS ports in Cell1, |
|          | Cell2, and Cell3 are the same.   |
| Note 7:  | This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe                 |
|          | overlapping with the aggressor ABS.  |
| Note 8:  | This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor           |
|          | ABS.   |
| Note 9:  | This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.                  |
| Note 10: | Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG            |
|          | pattern as defined in Annex A.5.1.5  |
| Note 11: | Reference measurement channel in Cell 1 RC.2 FDD according to Table A.4-1 with one sided dynamic             |
|          | OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.   |
| Note 12: | To avoid collisions between HARQ-ACK and wideband CQI it is necessary to report both on PUSCH                |
|          | instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic          |
|          | CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.                                  |
| Note 13: | cqi-pmi-ConfigurationIndex is applied for C <sub>CSI,0</sub>   |
| Note 14: | $cqi$ -pmi-ConfigurationIndex2 is applied for $C_{CSI,1}$ .  |

# 9.2.1.6 TDD (CSI measurements in case two CSI subframe sets are configured and with CRS assistance information)

The following requirements apply to UE Category  $\geq 2$ . For the parameters specified in Table 9.2.1.6-1, and using the downlink physical channels specified in tables C.3.2-1 for Cell 1, C3.3-2 for Cell 2 and Cell 3, and C.3.2-2, the reported CQI value according to RC.2 TDD in Table A.4-1 in subframes overlapping with aggressor cell ABS and non-ABS subframes shall be in the range of  $\pm 1$  of the reported median more than 90% of the time.

For test 1 and test 2, if the PDSCH BLER in ABS subframes using the transport format indicated by median CQI obtained by reports in CSI subframe sets  $C_{CSI,0}$  is less than or equal to 0.1, the BLER in ABS subframes using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER in ABS subframes using the transport format indicated by the median CQI is greater than 0.1, the BLER in ABS subframes using transport format indicated by the set of the median CQI is greater than 0.1. If the PDSCH BLER in ABS subframes using transport format indicated by the median CQI is greater than 0.1. The BLER in ABS subframes using transport format indicated by the median CQI is greater than 0.1. If the PDSCH BLER in ABS subframes using transport format indicated by the median CQI is greater than 0.1. The BLER in ABS subframes using transport format indicated by (median CQI - 1) shall be less than or equal to 0.1.

For test 2, if the PDSCH BLER in non-ABS subframes using the transport format indicated by median CQI obtained by reports in CSI subframe sets  $C_{CSI,1}$  is less than or equal to 0.1, the BLER in non-ABS subframes using the transport format indicated by the (median CQI + 2) shall be greater than 0.1. If the PDSCH BLER in non-ABS subframes using the transport format indicated by the median CQI is greater than 0.1, the BLER in non-ABS subframes using transport format indicated by the median CQI is greater than 0.1, the BLER in non-ABS subframes using transport format indicated by the median CQI is greater than 0.1, the BLER in non-ABS subframes using transport format indicated by (median CQI – 1) shall be less than or equal to 0.1.

|  |                              |           |                                  | Tes      | st 1                            |                                  | Te       | st 2                     |  |
|--|------------------------------|-----------|----------------------------------|----------|---------------------------------|----------------------------------|----------|--------------------------|--|
| Parameter  |                              | Unit      | Ce                               |          | Cell 2 and 3                    | Ce                               | 11 1     | Cell 2 and 3             |  |
| Bandwidth  |                              | MHz       |                                  | 1        | 0                               |                                  | 1        | 0                        |  |
| PDSCH transmission                                       | on mode                      |           | 2                                | 2        | Note 10                         |                                  | 2        | Note 10                  |  |
| Uplink downlink con                                      | figuration                   |           |                                  |          | 1                               |                                  |          | 1                        |  |
| Special subfra<br>configuratio                           |                              |           |                                  | 2        | 4                               |                                  |          | 4                        |  |
|  | $ ho_{\scriptscriptstyle A}$ | dB        |                                  | -        | 3                               |                                  | -        | 3                        |  |
| Downlink power<br>allocation                             | $ ho_{\scriptscriptstyle B}$ | dB        |                                  | -        | 3                               |                                  | -        | 3                        |  |
|  | σ                            | dB        |                                  | (        | )                               |                                  |          | 0                        |  |
| Propagation condi<br>antenna configu                     |                              |           |                                  | Clause I | 3.1 (2x2)                       |                                  | Clause I | B.1 (2x2)                |  |
| $\widehat{E}_{s}/N_{oc2}$ (No                            |                              | dB        | 4                                | 5        | Cell 2: 12<br>Cell 3: 10        | 13                               | 14       | Cell 2: 12<br>Cell 3: 10 |  |
| (.)  | $N_{oc1}^{(j)}$              | dBm/15kHz | -98 (N                           | lote 7)  | N/A                             | -98 (N                           | lote 7)  | N/A                      |  |
| $N_{oc}^{(j)}$ at antenna                                | $N_{oc2}^{(j)}$              | dBm/15kHz | -98 (N                           | lote 8)  | N/A                             | -98 (N                           | lote 8)  | N/A                      |  |
| port   | $N_{oc3}^{(j)}$              | dBm/15kHz | -93 (N                           | lote 9)  | N/A                             | -93 (N                           | lote 9)  | N/A                      |  |
| Subframe Config  | uration                      |           | Non-MBSFN                        |          | Non-MBSFN                       | Non-MBSFN                        |          | Non-MBSFN                |  |
| Cell Id  |                              |           | 0                                |          | Cell 2: 6<br>Cell 3: 1          | 0                                |          | Cell 2: 6<br>Cell 3: 1   |  |
| Time Offset betwe  | en Cells                     | μs        | Cell 2: 3 usec<br>Cell 3: -1usec |          |                                 | Cell 2: 3 usec<br>Cell 3: -1usec |          |                          |  |
| Frequency shift betw                                     | een Cells                    | Hz        | Cell 2: 300Hz<br>Cell 3: -100Hz  |          | Cell 2: 300Hz<br>Cell 3: -100Hz |                                  | 300Hz    |                          |  |
| ABS pattern (No  | ote 2)                       |           | N/A                              |          | 0100010001<br>0100010001        | N/A                              |          | 0100010001<br>0100010001 |  |
| RLM/RRM Measu<br>Subframe Pattern                        |                              |           | 000000001<br>0000000001          |          | N/A                             | 000000001<br>0000000001          |          | N/A                      |  |
| CSI Subframe Sets  | C <sub>CSI,0</sub>           |           | 0100010001<br>0100010001         |          | N/A                             | 0100010001<br>0100010001         |          | N.A                      |  |
| (Note 3)   | C <sub>CSI,1</sub>           |           | 10001<br>10001                   |          | N/A                             | 1000101000<br>1000101000         |          | N/A                      |  |
| Number of control<br>symbols                             | OFDM                         |           | 3                                |          | 3                               |                                  | 3        |                          |  |
| Max number of H<br>transmission                          |                              |           |                                  |          | 1                               |                                  |          | 1                        |  |
| Physical channel for<br>reporting                        | C <sub>CSI,0</sub> CQI       |           | ł                                | PUCCH    | Format 2                        |                                  | PUCCH    | Format 2                 |  |
| Physical channel for C <sub>CSI,1</sub> CQI<br>reporting |                              |           | F                                | PUSCH    | (Note 12)                       |                                  | PUSCH    | (Note 12)                |  |
| PUCCH Report Type  |                              |           | 4                                |          | 4                               |                                  | 4        |                          |  |
| Reporting periodicity                                    |                              | ms        |                                  | Npd      | = 5                             | Np                               |          | d = 5                    |  |
| cqi-pmi-Configurata<br>C <sub>CSI,0</sub> (Note 1        |                              |           | 3                                |          | N/A                             | :                                | 3        | N/A                      |  |
| cqi-pmi-Configuratio                                     | onIndex2                     |           | 4                                | 1        | N/A                             |                                  | 4        | N/A                      |  |
| ACK/NACK feedba  |                              |           |                                  | Multip   | lexing                          |                                  | Multip   | lexing                   |  |

| Table 9.2.1.6-1: PUCCH | 1-0 static test ( | (TDD) |
|------------------------|-------------------|-------|
|------------------------|-------------------|-------|

| Note 1:  | For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.   |
|----------|---|
| Note 2:  | ABS pattern as defined in [9].  |
| Note 3:  | Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]   |
| Note 4:  | As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].  |
| Note 5:  | Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]   |
| Note 6:  | Cell 1 is the serving cell. Cell 2 and Cell 3 are the aggressor cells. The number of the CRS ports in Cell1, Cell2, and Cell3 is the same.  |
| Note 7:  | This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.  |
| Note 8:  | This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS  |
| Note 9:  | This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.   |
| Note 10: | Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.2.5   |
| Note 11: | Reference measurement channel in Cell 1 RC.2 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.   |
| Note 12: | To avoid collisions between HARQ-ACK and wideband CQI it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic |
|          | CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.   |
| Note 13: |   |
| Note 14: | cai-pmi-ConfigurationIndex2 is applied for Cost   |

# 9.2.2 Minimum requirement PUCCH 1-1 (Cell-Specific Reference Symbols)

The minimum requirements for dual codeword transmission are defined in terms of a reporting spread of the wideband CQI value for codeword #1, and their BLER performance using the transport format indicated by the reported CQI median of codeword #0 and codeword #1. The precoding used at the transmitter is a fixed precoding matrix specified by the bitmap parameter *codebookSubsetRestriction*. The propagation condition assumed for the minimum performance requirement is defined in subclause B.1.

#### 9.2.2.1 FDD

The following requirements apply to UE Category  $\geq 2$ . For the parameters specified in table 9.2.2.1-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband  $CQI_1$  = wideband  $CQI_0$  – Codeword 1 offset level

The wideband  $CQI_1$  shall be within the set {median  $CQI_1$  -1, median  $CQI_1$ , median  $CQI_1 +1$ } for more than 90% of the time, where the resulting wideband values  $CQI_1$  shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0 - 1$  and median  $CQI_1 - 1$  shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0 - 1$  and median  $CQI_1 - 1$  shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0 + 1$  and median  $CQI_1 + 1$  shall be greater than or equal to 0.1.

| Parameter   |                              | Unit         | Te             | st 1   | Te                | st 2 |  |  |
|---|------------------------------|--------------|----------------|--------|-------------------|------|--|--|
| Bandwidth   |                              | MHz          |                |        | 10                |      |  |  |
| PDSCH transmissio   | on mode                      |              |                |        | 4                 |      |  |  |
| Develiate a surray  | $ ho_{\scriptscriptstyle A}$ | dB           |                | -3     |                   |      |  |  |
| Downlink power<br>allocation  | $ ho_{\scriptscriptstyle B}$ | dB           |                | -3     |                   |      |  |  |
|   | σ                            | dB           |                |        | 0                 |      |  |  |
| Propagation condit<br>antenna configur  |                              |              |                | Clause | B.1 (2 x 2)       |      |  |  |
| CodeBookSubsetRe<br>bitmap  | estriction                   |              |                | 01     | 0000              |      |  |  |
| SNR (Note 2   | 2)                           | dB           | 10             | 11     | 16                | 17   |  |  |
| $\hat{I}^{(j)}_{or}$  |                              | dB[mW/15kHz] | -88            | -87    | -82               | -81  |  |  |
| $N_{oc}^{(j)}$  |                              | dB[mW/15kHz] | -98 -98        |        |                   | 98   |  |  |
| Max number of H<br>transmission   |                              |              | 1              |        |                   |      |  |  |
| Physical channel for<br>reporting   | CQI/PMI                      |              | PUCCH Format 2 |        |                   |      |  |  |
| PUCCH Report Ty<br>CQI/PMI  | /pe for                      |              | 2              |        |                   |      |  |  |
| PUCCH Report Typ  | e for RI                     |              |                |        | 3                 |      |  |  |
| Reporting period  | dicity                       | ms           |                | Np     | <sub>od</sub> = 5 |      |  |  |
| cqi-pmi-Configurati   | onIndex                      |              |                |        | 6                 |      |  |  |
| ri-ConfigInde   |                              |              |                |        | lote 3)           |      |  |  |
| Note 1:       Reference measurement channel RC.2 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.         Note 2:       For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level. |                              |              |                |        |                   |      |  |  |
| Note 3: It is intended to have UL collisions between RI reports and HARQ-ACK, since the RI reports shall not be used by the eNB in this test.   |                              |              |                |        |                   |      |  |  |

#### Table 9.2.2.1-1: PUCCH 1-1 static test (FDD)

#### 9.2.2.2 TDD

The following requirements apply to UE Category  $\geq 2$ . For the parameters specified in table 9.2.2.2-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband  $CQI_1$  = wideband  $CQI_0$  – Codeword 1 offset level

The wideband  $CQI_1$  shall be within the set {median  $CQI_1$ -1, median  $CQI_1$ , median  $CQI_1$ +1} for more than 90% of the time, where the resulting wideband values  $CQI_1$  shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0 - 1$  and median  $CQI_1 - 1$  shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0 - 1$  and median  $CQI_1 - 1$  shall be less than or equal to 0.1.

|  | Parameter   |                              | Unit                                       | Те               | st 1             | Те              | st 2         |  |  |
|--|---|------------------------------|--|------------------|------------------|-----------------|--------------|--|--|
|  | Bandwidth   |                              | MHz  |                  | 10               |                 |              |  |  |
| PDSCH  | l transmissic   | on mode                      |  |                  |                  | 4               |              |  |  |
| Uplink do  | ownlink conf  | iguration                    |  |                  |                  | 2               |              |  |  |
|  | ecial subfra  |                              |  |                  |                  | 4               |              |  |  |
| Downlin  | nk power  | $ ho_{\scriptscriptstyle A}$ | dB   |                  |                  | -3              |              |  |  |
|  | cation  | $ ho_{\scriptscriptstyle B}$ | dB   |                  |                  | -3              |              |  |  |
|  |   | σ                            | dB   |                  |                  | 0               |              |  |  |
|  | ation condit  |                              |  |                  | Clause E         | 3.1 (2 x 2)     |              |  |  |
|  | okSubsetRe<br>bitmap  |                              |  |                  | 010              | 0000            |              |  |  |
| 5  | SNR (Note 2   | )                            | dB   | 10               | 11               | 16              | 17           |  |  |
|  | $\hat{I}_{or}^{(j)}$  | /                            | dB[mW/15kHz]                               | -88              | -87              | -82             | -81          |  |  |
|  | $N_{oc}^{(j)}$  |                              | dB[mW/15kHz]                               | -98 -98          |                  |                 | 98           |  |  |
|  | number of H<br>ransmission  |                              |  | 1                |                  |                 |              |  |  |
| -  | channel for   | -                            |  |                  |                  |                 |              |  |  |
| Fliysical  | reporting   |                              |  | PUSCH (Note 3)   |                  |                 |              |  |  |
| PUC  | CH Report   | Туре                         |  |                  |                  | 2               |              |  |  |
|  | orting period   |                              | ms   | $N_{\rm pd} = 5$ |                  |                 |              |  |  |
| cqi-pmi  | i-Configurati   | onIndex                      |  |                  | ·                | 3               |              |  |  |
| n  | i-ConfigInde  | X                            |  |                  | 805 (I           | Note 4)         |              |  |  |
| ACK/NA   | ACK feedbad   | ck mode                      |  |                  | Multip           | olexing         |              |  |  |
| Note 1:  | OCNG Pat  | tern OP.1                    | ent channel RC.2 T<br>TDD as described ir  | n Annex A.5.2    | 2.1.             |                 |              |  |  |
| Note 2:  |   |                              | imum requirements                          |                  | lied for at leas | t one of the tw | vo SNR(s)    |  |  |
| Note 3:  |   |                              | anted signal input le<br>tween CQI/PMI rep |                  | Q-ACK it is ne   | ecessary to re  | port both on |  |  |
| PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and |   |                              |  |                  |                  |                 |              |  |  |
|  | #8 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink subframe |                              |  |                  |                  |                 |              |  |  |
|  | SF#7 and #2.  |                              |  |                  |                  |                 |              |  |  |
| Note 4:  |   |                              | s set to the maximur                       |                  |                  |                 |              |  |  |
|  |   |                              | and HARQ-ACK re                            |                  |                  |                 |              |  |  |
|  |   |                              | Il reports will be dro                     |                  |                  |                 |              |  |  |
|  | eNB, CQI ı  | report colle                 | ction shall be skippe                      | ed every 160     | ms during perf   | ormance veril   | fication.    |  |  |

#### Table 9.2.2.2-1: PUCCH 1-1 static test (TDD)

## 9.2.3 Minimum requirement PUCCH 1-1 (CSI Reference Symbols)

The minimum requirements for dual codeword transmission are defined in terms of a reporting spread of the wideband CQI value for codeword #1, and their BLER performance using the transport format indicated by the reported CQI median of codeword #0 and codeword #1. The precoding used at the transmitter is a fixed precoding matrix specified by the bitmap parameter *codebookSubsetRestriction*. The propagation condition assumed for the minimum performance requirement is defined in subclause B.1.

#### 9.2.3.1 FDD

The following requirements apply to UE Category  $\geq 2$ . For the parameters specified in table 9.2.3.1-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband  $CQI_1$  = wideband  $CQI_0$  – Codeword 1 offset level

The wideband  $CQI_1$  shall be within the set {median  $CQI_1$  -1, median  $CQI_1$ , median  $CQI_1 +1$ } for more than 90% of the time, where the resulting wideband values  $CQI_1$  shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0 - 1$  and median  $CQI_1 - 1$  shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER

using the transport format indicated by the respective median  $CQI_0 + 1$  and median  $CQI_1 + 1$  shall be greater than or equal to 0.1.

| Parameter                  |                              | Unit                         | Tes                  | st 1                          | Tes             | st 2             |             |  |
|----------------------------|------------------------------|------------------------------|----------------------|-------------------------------|-----------------|------------------|-------------|--|
| Bandwidth                  |                              | MHz                          |                      |                               | 10              |                  |             |  |
| PDSCH transmission mode    |                              |                              |                      |                               |                 | 9                |             |  |
|                            |                              | $ ho_{\scriptscriptstyle A}$ | dB                   | 0                             |                 |                  |             |  |
| Downlink p                 |                              | $ ho_{\scriptscriptstyle B}$ | dB                   |                               |                 | 0                |             |  |
| allocati                   | on                           | P <sub>c</sub>               | dB                   |                               |                 | -3               |             |  |
|                            |                              | σ                            | dB                   |                               |                 | -3               |             |  |
| Cell-speci                 | fic referen                  | ce signals                   |                      |                               | Antenna         | ports 0, 1       |             |  |
|                            | eference s                   |                              |                      |                               |                 | orts 15,,18      |             |  |
| CSI-RS per                 |                              |                              |                      |                               | •               |                  |             |  |
|                            | offset                       |                              |                      |                               | ţ               | 5/1              |             |  |
| Tc                         | $_{SI-RS}$ / $\Delta_{CSI-}$ | RS                           |                      |                               |                 |                  |             |  |
| CSI reference              | ce signal c                  | onfiguration                 |                      |                               |                 | 0                |             |  |
| Propagation                |                              |                              |                      |                               | Clause          | B.1 (4 x 2)      |             |  |
|                            | onfiguratio                  |                              |                      |                               |                 | · · ·            |             |  |
|                            | nforming N                   |                              |                      | As specified in Section B.4.3 |                 |                  |             |  |
| CodeBookSu                 |                              |                              |                      | 0x0000 0000 0100 0000         |                 |                  |             |  |
| S                          | NR (Note 2                   | 2)                           | dB                   | 7                             | 8               | 13               | 14          |  |
|                            | $\hat{I}^{(j)}_{or}$         |                              | dB[mW/15kHz]         | -91                           | -90             | -85              | -84         |  |
|                            | $N_{oc}^{(j)}$               |                              | dB[mW/15kHz]         | -98 -98                       |                 | 8                |             |  |
| Max number                 | of HARQ t                    | ransmissions                 |                      |                               |                 | 1                |             |  |
| Physical of                | hannel for                   | r CQI/PMI                    |                      |                               | DUDOI           | L (N = t = 0)    |             |  |
| ,                          | reporting                    |                              |                      |                               | PUSC            | H (Note3)        |             |  |
| PUCCH Re                   | oort Type                    | for CQI/PMI                  |                      |                               |                 | 2                |             |  |
| Physical ch                | annel for I                  | RI reporting                 |                      |                               | PUCCH           | Format 2         |             |  |
| PUCCH                      | Report Ty                    | pe for RI                    |                      |                               |                 | 3                |             |  |
| Repo                       | rting perio                  | dicity                       | ms                   |                               | Np              | <sub>d</sub> = 5 |             |  |
|                            | CQI delay                    |                              | ms                   |                               |                 | 8                |             |  |
| cqi-pmi-ConfigurationIndex |                              |                              |                      |                               |                 | 2                |             |  |
| ri-ConfigIndex 1           |                              |                              |                      |                               |                 |                  |             |  |
| Note 1: Re                 | ference m                    | easurement ch                | annel RC.7 TDD ac    | cording to Ta                 | ble A.4-1 with  | n one sided dyr  | namic OCNG  |  |
|                            |                              |                              | ibed in Annex A.5.1  |                               |                 |                  |             |  |
|                            |                              |                              | requirements shall   | be fulfilled for              | at least one of | of the two SNR   | (s) and the |  |
|                            |                              | anted signal inp             |                      |                               |                 |                  |             |  |
|                            |                              |                              | CQI/PMI reports an   |                               |                 |                  |             |  |
|                            |                              |                              | PDCCH DCI forma      |                               |                 |                  |             |  |
| allo                       | w periodic                   | CQI/PMI to m                 | ultiplex with the HA | RQ-ACK on H                   | 20SCH in upl    | INK SF#0 and #   | <i>‡</i> 5. |  |

Table 9.2.3.1-1: PUCCH 1-1 static test (FDD)

#### 9.2.3.2 TDD

The following requirements apply to UE Category  $\geq 2$ . For the parameters specified in table 9.2.3.2-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband  $CQI_1$  = wideband  $CQI_0$  – Codeword 1 offset level

The wideband  $CQI_1$  shall be within the set {median  $CQI_1$  -1, median  $CQI_1$ , median  $CQI_1$  +1} for more than 90% of the time, where the resulting wideband values  $CQI_1$  shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0 - 1$  and median  $CQI_1 - 1$  shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0 - 1$  and median  $CQI_1 - 1$  shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0 + 1$  and median  $CQI_1 + 1$  shall be greater than or equal to 0.1.

| Parameter  | •                            | Unit                  | Tes              | st 1            | Tes              | st 2         |  |
|--|------------------------------|-----------------------|------------------|-----------------|------------------|--------------|--|
| Bandwidth  |                              | MHz                   |                  |                 | 10               |              |  |
| PDSCH transmission   |                              |                       |                  |                 | 9                |              |  |
| Uplink downlink con  |                              |                       |                  |                 | 2                |              |  |
| Special subframe cor   | nfiguration                  |                       |                  |                 | 4                |              |  |
|  | $ ho_{\scriptscriptstyle A}$ | dB                    |                  |                 | 0                |              |  |
| Downlink power   | $ ho_{\scriptscriptstyle B}$ | dB                    |                  |                 | 0                |              |  |
| allocation   | $P_c$                        | dB                    |                  |                 | -6               |              |  |
|  | σ                            | dB                    |                  |                 | -3               |              |  |
| CRS reference s  | ignals                       |                       |                  | Antenna         | ports 0, 1       |              |  |
| CSI reference si   | gnals                        |                       |                  | Antenna p       | orts 15,,22      |              |  |
| CSI-RS periodicity and   | d subframe                   |                       |                  |                 |                  |              |  |
| offset   |                              |                       |                  | 5               | 5/3              |              |  |
| $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$   | RS                           |                       |                  |                 |                  |              |  |
| CSI reference signal c   | onfiguration                 |                       |                  |                 | 0                |              |  |
| Propagation condition a  |                              |                       |                  | Clause          | B.1 (8 x 2)      |              |  |
| configuratio   |                              |                       |                  |                 | · · ·            | _            |  |
| Beamforming N  |                              |                       |                  |                 | n Section B.4.   |              |  |
| CodeBookSubsetRestr  |                              |                       |                  |                 | 000 0000 000     |              |  |
| SNR (Note 2  | 2)                           | dB                    | 4                | 5               | 10               | 11           |  |
| $\hat{I}^{(j)}_{or}$   |                              | dB[mW/15kHz]          | -94              | -93             | -88              | -87          |  |
| $N_{oc}^{(j)}$   |                              | dB[mW/15kHz]          | -98              |                 | -9               | -98          |  |
| Max number of HARQ to  | ransmissions                 |                       |                  |                 | 1                |              |  |
| Physical channel for   | CQI/PMI                      |                       |                  | DUSC            | (Nata 2)         |              |  |
| reporting  |                              |                       |                  | PUSCE           | I (Note 3)       |              |  |
| PUCCH Report Type for<br>PMI   | r CQI/second                 |                       | 2b               |                 |                  |              |  |
| Physical channel for F   | RI reporting                 |                       | PUSCH            |                 |                  |              |  |
| PUCCH Report Type for  |                              |                       |                  |                 | 5                |              |  |
| Reporting perio  |                              | ms                    |                  | Np              | <sub>d</sub> = 5 |              |  |
| CQI delay  |                              | ms                    |                  |                 | or 11            |              |  |
| cqi-pmi-Configurati  |                              |                       |                  |                 | 3                |              |  |
| ri-ConfigInde  |                              |                       |                  | 805 (           | Note 4)          |              |  |
| ACK/NACK feedba  | ck mode                      |                       |                  | Multi           | plexing          |              |  |
| Note 1: Reference me   | easurement ch                | annel RC.7 TDD ac     | cording to Ta    | ble A.4-1 with  | n one sided dyr  | namic OCNG   |  |
| Pattern OP.1   | TDD as descri                | ibed in Annex A.5.2   | .1.              |                 |                  |              |  |
|  |                              | requirements shall    | be fulfilled for | at least one of | of the two SNR   | t(s) and the |  |
|  | anted signal inp             |                       |                  |                 |                  |              |  |
| Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on<br>PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to |                              |                       |                  |                 |                  |              |  |
|  |                              |                       |                  |                 |                  |              |  |
|  |                              | ultiplex with the HA  |                  |                 |                  |              |  |
|  |                              | the maximum allow     |                  |                 |                  |              |  |
|  |                              | K reports. In the cas |                  |                 |                  |              |  |
|  |                              | pped, while RI and H  |                  |                 | xed. At eNB, C   | QI report    |  |
| collection sha   | all be skipped e             | every 160ms during    | performance      | verification.   |                  |              |  |

# 9.2.4 Minimum requirement PUCCH 1-1 (With Single CSI Process)

The minimum requirements for dual codeword transmission are defined in terms of a reporting spread of the wideband CQI value for codeword #1, and their BLER performance using the transport format indicated by the reported CQI median of codeword #0 and codeword #1. The precoding used at the transmitter is a fixed precoding matrix specified by the bitmap parameter *codebookSubsetRestriction*. The propagation condition assumed for the minimum performance requirement is defined in subclause B.1.

#### 9.2.4.1 FDD

The following requirements apply to UE Category  $\geq 2$ . For the parameters specified in table 9.2.4.1-1, and using the downlink physical channels specified in tables C.3.4-1 and C.3.4-2, the reported offset level of the wideband spatial

differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

#### wideband $CQI_1$ = wideband $CQI_0$ – Codeword 1 offset level

The wideband  $CQI_1$  shall be within the set {median  $CQI_1$  -1, median  $CQI_1$ , median  $CQI_1$  +1} for more than 90% of the time, where the resulting wideband values  $CQI_1$  shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0 - 1$  and median  $CQI_1 - 1$  shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0 - 1$  and median  $CQI_1 - 1$  shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0 + 1$  and median  $CQI_1 + 1$  shall be greater than or equal to 0.1.

| Paramet  | er  | Unit   | Tes  |                        |          | Tes                        |                       |         |   |  |
|--|---|--|--|------------------------|----------|----------------------------|-----------------------|---------|---|--|
|  |   |  | TP1  | TP2                    |          | TP1                        | TF                    | 2       |   |  |
| Bandwid  |   | MHz  |  |                        |          | 10                         |                       |         |   |  |
| PDSCH transmis   | sion mode   |  | 1  |                        |          | 10                         |                       |         |   |  |
|  | $ ho_{\scriptscriptstyle A}$  | dB   | 0  | 0                      |          | 0                          |                       | 0       | 0 |  |
| Downlink power   | $ ho_{\scriptscriptstyle B}$  | dB   | 0  | 0                      | )        | 0                          | C                     | )       |   |  |
| allocation (Note 1)  | Pc  | dB   | -3   | -3                     | 2        | -3                         | -;                    | 3       |   |  |
|  | σ   | dB   | -3   | N/                     |          | -3                         | N/                    |         |   |  |
| 0-11.10  |   | UD UD  |  |                        | / \      |                            |                       | / \     |   |  |
| Cell ID  |   |  | C  | )                      |          | 0                          | )                     |         |   |  |
| Cell-specific refere   | ence signals  |  | Antenna ports<br>0, 1                      | (Not                   | e 2)     | Antenna ports<br>0, 1      | (Not                  | e 2)    |   |  |
| CSI reference  | signals   |  | Antenna ports<br>15,,18                    | N/                     | A        | Antenna ports<br>15,,18    | N/                    | Ά       |   |  |
| CSI-RS period subframe offset $T_{C}$  |   |  | 5/1  | N/                     | A        | 5/1                        | N/                    | Ά       |   |  |
| CSI-RS config  |   |  | 0  | N/                     | A        | 0                          | N/                    | Ά       |   |  |
| Zero-Power C<br>configurat<br>I <sub>CSI-RS</sub> / ZeroPow<br>bitmap        | ion<br>verCSI-RS  |  | 1 /<br>00100000000<br>0000                 | 1<br>100000<br>000     | 00000    | 1 /<br>00100000000<br>0000 | 1<br>100000<br>000    | 00000   |   |  |
| CSI-IM config<br>I <sub>CSI-RS</sub> / ZeroPow<br>bitmap                     | erCSI-RS  |  | 1 /<br>00100000000<br>0000                 | N/A                    |          | 1 /<br>00100000000<br>0000 | N/A                   |         |   |  |
| CSI process configuration<br>Signal/Interference/Reporting<br>mode           |   |  | CSI-RS/CSI-IN                              | SI-RS/CSI-IM/PUCCH 1-1 |          | CSI-RS/CSI-I               | //PUCCH               | 11-1    |   |  |
| Propagation condition and antenna configuration                              |   |  | Clause B.1<br>(4 x 2)                      | Claus<br>(2 x          |          | Clause B.1<br>(4 x 2)      | Clause B.1<br>(2 x 2) |         |   |  |
| CodeBookSubsetRestriction<br>bitmap  |   |  | 0x0000 0000<br>0100 0000                   | 100000                 |          |                            |                       | 000     |   |  |
| SNR (Note  |   | dB   | 20   | 6                      | 7        | 20                         | 14                    | 15      |   |  |
| $\hat{I}_{or}^{(j)}$   | -   | dB[mW/15kHz]   | -78  | -92                    | -91      | -78                        | -84                   | -83     |   |  |
| $N_{oc}^{(j)}$   |   | dB[mW/15kHz]   | -98  |                        | -98      |                            |                       |         |   |  |
| Modulation / Info  |   |  | (Note4)                                    | 4) QPSK / 4392         |          | (Note4)                    | QPSK / 4392           |         |   |  |
| Max number o<br>transmissi   | f HARQ  |  | 1  | N/A                    |          | 1                          | N/                    | Ά       |   |  |
| Physical channel f<br>reportin   | or CQI/PMI  |  | PUSCH<br>(Note5)                           | N/A                    |          | PUSCH<br>(Note5)           | N/A                   |         |   |  |
| PUCCH Report<br>CQI/PN   | Type for  |  | 2  | N/                     | A        | 2                          | N/                    | Ά       |   |  |
| PUCCH Report T   |   |  | 3  | N/                     | A        | 3                          | N/                    | Ά       |   |  |
| Reporting per  | iodicity  | ms   | $N_{\rm pd} = 5$                           | N/                     |          | $N_{\rm pd} = 5$           | N/                    |         |   |  |
| CQI Dela   | ay  | ms   | 8  | N/                     | A        | 8                          | N/                    | Ά       |   |  |
| cqi-pmi-ConfigurationIndex   |   |  | 2  | N/                     |          | 2                          | N/                    |         |   |  |
| ri-ConfigIndex   |   |  | 1  | N/                     | A        | 1                          | N/                    | Ά       |   |  |
| PDSCH scheduled sub-frames   |   |  | 1,2,3,4,                                   | 6,7,8,9                |          | 1,2,3,4,                   | 6,7,8,9               |         |   |  |
| Timing offset between TPs  |   | US   | C  | )                      |          | 0                          | )                     |         |   |  |
| Frequency offset b   |   | Hz   | C  | /                      |          | (                          | ,                     |         |   |  |
| OP.1 FD<br>Note 2: REs for a<br>Note 3: For each<br>wanted s<br>Note 4: Void | D as described<br>antenna ports (<br>test, the minir<br>ignal input lev | d in Annex A.5.1.1.<br>D and 1 CRS have<br>num requirements<br>el. | zero transmission<br>shall be fulfilled fo | power.<br>or at least  | one of t | one sided dynamic          | d the resp            | pective |   |  |
|  | collisions hat  | veen COI/PMI rend  | orts and HARQ-AC                           | .K it is ne            | cessarv  | to report both on I        |                       | heatad  |   |  |

Table 9.2.4.1-1: PUCCH 1-1 static test (FDD)

Note 5: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#0 and #5.

#### 9.2.4.2 TDD

The following requirements apply to UE Category  $\geq 2$ . For the parameters specified in table 9.2.4.2-1, and using the downlink physical channels specified in tables C.3.4-1 and C.3.4-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband  $CQI_1$  = wideband  $CQI_0$  – Codeword 1 offset level

The wideband  $CQI_1$  shall be within the set {median  $CQI_1$  -1, median  $CQI_1$ , median  $CQI_1$  +1} for more than 90% of the time, where the resulting wideband values  $CQI_1$  shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0 - 1$  and median  $CQI_1 - 1$  shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median  $CQI_0 - 1$  and median  $CQI_1 - 1$  shall be less than or equal to 0.1.

| Parameter   |                               | Unit         | Tes   | -                     |       | Tes   | -                     | _                           |  |
|---|-------------------------------|--------------|---|-----------------------|-------|---|-----------------------|-----------------------------|--|
|   |                               |              | TP1   | TP1 TP2               |       | TP1 TP2                                       |                       |                             |  |
| Bandwidt<br>PDSCH transmiss   |                               | MHz          | <u> </u>                                      |                       |       |   |                       |                             |  |
| Uplink downlink co  |                               |              |   |                       |       | 2   |                       |                             |  |
| Special subframe c  |                               |              |   | 4                     |       |   |                       |                             |  |
| opecial cubitatile c  |                               | dB           | 0   | 0                     |       | 0   | (                     | )                           |  |
| Downlink power  | $\rho_{\scriptscriptstyle A}$ | -            |   | -                     |       | _   |                       | -                           |  |
| allocation (Note 1)   | $ ho_{\scriptscriptstyle B}$  | dB           | 0   | 0                     |       | 0   |                       | 0                           |  |
|   | Pc                            | dB           | -6  | -6                    |       | -6  |                       | 6                           |  |
|   | σ                             | dB           | -3  | N/.                   | A     | -3  |                       | /A                          |  |
| Cell ID   |                               |              | C   |                       |       | C   | )                     |                             |  |
| Cell-specific refere  | nce signals                   |              | Antenna ports<br>0, 1                         | (Not                  | e 2)  | Antenna ports<br>0, 1                         | (No                   | te 2)                       |  |
| CSI reference   | signals                       |              | Antenna ports<br>15,,22                       | N/                    | A     | Antenna ports<br>15,,22                       | N                     | /A                          |  |
| CSI-RS periodi subframe offset $T_{CS}$                                 |                               |              | 5/3   | N/.                   | A     | 5/3   | Ν                     | /A                          |  |
| CSI-RS config   |                               |              | 0   | N/.                   | A     | 0   | Ν                     | /A                          |  |
| Zero-Power C<br>configurati<br>I <sub>CSI-RS</sub> / ZeroPow<br>bitmap  | ion                           |              | 3 /<br>00100000000<br>0000                    | 3<br>100001<br>000    | 00000 | 3 /<br>00100000000<br>0000                    | 10000                 | 3 /<br>10000100000<br>00000 |  |
| CSI-IM configuration<br>I <sub>CSI-RS</sub> / ZeroPowerCSI-RS<br>bitmap |                               |              | 3 /<br>00100000000<br>0000                    | N/A                   |       | 3 /<br>00100000000<br>0000                    | N/A                   |                             |  |
| CSI process configuration<br>Signal/Interference/Reporting<br>mode      |                               |              | CSI-RS/CSI-IN                                 | M/PUCCH 1-1           |       | CSI-RS/CSI-IN                                 |                       |                             |  |
| Propagation condition and<br>antenna configuration                      |                               |              | Clause B.1<br>(8 x 2)                         | Clause B.1<br>(2 x 2) |       | Clause B.1<br>(8 x 2)                         | Clause B.1<br>(2 x 2) |                             |  |
| CodeBookSubsetRestriction<br>bitmap                                     |                               |              | 0x0000 0000<br>0020 0000<br>0000 0001<br>0000 | 100000                |       | 0x0000 0000<br>0020 0000<br>0000 0001<br>0000 | 100000                |                             |  |
| SNR (Note   | e 3)                          | dB           | 17  | 6                     | 7     | 17  | 14                    | 15                          |  |
| $\hat{I}^{(j)}_{or}$  |                               | dB[mW/15kHz] | -81   | -92                   | -91   | -81   | -84                   | -83                         |  |
| $N_{oc}^{(j)}$  |                               | dB[mW/15kHz] | -9  | -98                   |       | -98   |                       |                             |  |
| Modulation / Infor<br>payload   |                               |              | (Note4)                                       | QPSK / 4392           |       | (Note4)                                       | QPSK / 4392           |                             |  |
| Max number of<br>transmissio  | ons                           |              | 1   | N/                    | A     | 1   | N/A                   |                             |  |
| Physical channel for reporting  | 9                             |              | PUSCH<br>(Note5)                              | N/.                   | A     | PUSCH<br>(Note5)                              | N                     | /A                          |  |
| PUCCH Report Type for<br>CQI/second PMI                                 |                               |              | 2b  | N/                    |       | 2b  |                       | /A                          |  |
| Physical channel for RI reporting                                       |                               |              | PUSCH   | N/A                   |       | PUSCH   | N                     | /A                          |  |
| PUCCH Report Type for RI/ first<br>PMI                                  |                               |              | 5   | N/.                   |       | 5   |                       | /A                          |  |
| Reporting periodicity   |                               | ms           | $N_{\rm pd} = 5$                              | N/.                   |       | $N_{\rm pd} = 5$                              |                       | /A                          |  |
| CQI Dela<br>cqi-pmi-Configura   |                               | ms           | 10 or 11<br>3                                 | N/.<br>N/.            |       | 10 or 11<br>3                                 |                       | /A<br>/A                    |  |
| ri-ConfigIn   |                               |              | 805 (Note 6)                                  | N/.                   |       | 805 (Note 6)                                  |                       | /A<br>/A                    |  |
| ACK/NACK feedb  |                               |              | Multiplexing                                  | N/                    |       | Multiplexing                                  |                       | /A<br>/A                    |  |
| PDSCH scheduled   |                               |              | 3,4,  |                       |       | 3,4,  |                       |                             |  |
| Timing offset bety  |                               | us           | 0, 1,   |                       |       | 0, 1,   |                       |                             |  |
| Frequency offset be   |                               | Hz           | C   |                       |       | C   |                       |                             |  |

## Table 9.2.4.2-1: PUCCH 1-1 static test (TDD)

| Note1:  | Reference measurement channel RC.10 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.   |
|---------|--|
| Note 2: | REs for antenna ports 0 and 1 CRS have zero transmission power.  |
| Note 3: | For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.  |
| Note 4: | Void   |
| Note 5: | To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead<br>of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI/PMI to<br>multiplex with the HARQ-ACK on PUSCH in uplink SF#7 and #2.  |
| Note 6: | RI reporting interval is set to the maximum allowable length of 160ms to minimise collisions between RI, CQI/PMI and HARQ-ACK reports. In the case when all three reports collide, it is expected that CQI/PMI reports will be dropped, while RI and HARQ-ACK will be multiplexed. At eNB, CQI report collection shall be skipped every 160ms during performance verification. |

# 9.3 CQI reporting under fading conditions

## 9.3.1 Frequency-selective scheduling mode

The accuracy of sub-band channel quality indicator (CQI) reporting under frequency selective fading conditions is determined by a double-sided percentile of the reported differential CQI offset level 0 per sub-band, and the relative increase of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest reported differential CQI offset level the corresponding transport format compared to the case for which a fixed format is transmitted on any sub-band in set *S* of TS 36.213 [6]. The purpose is to verify that preferred sub-bands can be used for frequently-selective scheduling. To account for sensitivity of the input SNR the sub-band CQI reporting under frequency selective fading conditions is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

#### 9.3.1.1 Minimum requirement PUSCH 3-0 (Cell-Specific Reference Symbols)

#### 9.3.1.1.1 FDD

For the parameters specified in Table 9.3.1.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.1.1-2 and by the following

a) a sub-band differential CQI offset level of 0 shall be reported at least  $\alpha$ % of the time but less than  $\beta$ % for each sub-band;

b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set *S* shall be  $\geq \gamma$ ;

c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.05.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD.

| Parameter                           |  | Unit         | Tes  | Test 1 Test 2 |     | st 2             |
|-------------------------------------|--|--------------|--|---------------|-----|------------------|
| Bandwidth                           |  | MHz          | 10 MHz   |               |     |                  |
| Transmission mode                   |  |              | 1 (port 0)   |               |     |                  |
| Downlink                            | $ ho_{\scriptscriptstyle A}$   | dB           | 0  |               |     |                  |
| power                               | $ ho_{\scriptscriptstyle B}$   | dB           | 0  |               |     |                  |
| allocation                          | σ  | dB           | 0  |               |     |                  |
| SNF                                 | (Note 3)   | dB           | 9  | 10            | 14  | 15               |
| $\hat{I}_{or}^{(j)}$                |  | dB[mW/15kHz] | -89  | -88           | -84 | -83              |
| $N_{oc}^{(j)}$                      |  | dB[mW/15kHz] | -98 -98  |               | 98  |                  |
| Propagation channel                 |  |              | Clause B.2.4 with $\tau_d = 0.45 \mu\text{s},$<br>$a = 1, \ f_D = 5 \text{Hz}$ |               |     | ).45 <i>μ</i> s, |
|                                     |  |              |  |               |     |                  |
| Antenna configuration               |  |              | 1 x 2  |               |     |                  |
| Reporting interval                  |  | ms           | 5  |               |     |                  |
| CQI delay                           |  | ms           | 8  |               |     |                  |
| Reporting mode                      |  |              | PUSCH 3-0  |               |     |                  |
| Sub-band size                       |  | RB           | 6 (full size)  |               |     |                  |
| Max number of HARQ<br>transmissions |  |              | 1  |               |     |                  |
| Note 1: If<br>S<br>S<br>Note 2: F   | <ul> <li>SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)</li> <li>Reference measurement channel RC.3 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in</li> </ul> |              |  |               |     |                  |
| Note 3: F                           | Annex A.5.1.1/2.<br>For each test, the minimum requirements shall be fulfilled for at least<br>one of the two SNR(s) and the respective wanted signal input level.   |              |  |               |     |                  |

#### Table 9.3.1.1.1-1 Sub-band test for single antenna transmission (FDD)

|             | Test 1 | Test 2 |
|-------------|--------|--------|
| α[%]        | 2      | 2      |
| β[%]        | 55     | 55     |
| γ           | 1.1    | 1.1    |
| UE Category | ≥1     | ≥1     |

#### 9.3.1.1.2 TDD

For the parameters specified in Table 9.3.1.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.1.2-2 and by the following

a) a sub-band differential CQI offset level of 0 shall be reported at least  $\alpha$ % of the time but less than  $\beta$ % for each sub-band;

b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set *S* shall be  $\geq \gamma$ ;

c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.05.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD.

| Parameter  |   | Unit         | Те                           | Test 1 Test |     | t 2 |
|--|---|--------------|------------------------------|-------------|-----|-----|
| Bandwidth  |   | MHz          | 10 MHz                       |             |     |     |
| Transmission mode  |   |              |                              | 1 (port 0)  |     |     |
| Downlink   | $ ho_{\scriptscriptstyle A}$  | dB           | 0                            |             |     |     |
| power  | $ ho_{\scriptscriptstyle B}$  | dB           |                              |             |     |     |
| allocation   | σ   | dB           | 0                            |             |     |     |
|  | downlink<br>uration   |              | 2                            |             |     |     |
| Special subframe configuration   |   |              | 4                            |             |     |     |
| SNR (Note 3)   |   | dB           | 9                            | 10          | 14  | 15  |
| $\hat{I}_{or}^{(j)}$   |   | dB[mW/15kHz] | -89                          | -88         | -84 | -83 |
| $N_{oc}^{(j)}$   |   | dB[mW/15kHz] | -98 -98                      |             |     | 8   |
|  |   |              | Clause B.2.4 with            |             |     | 1   |
| Propagatio   | on channel  |              | $	au_{d}=0.45\mu{ m s},a=1,$ |             |     |     |
|  |   |              | $f_D = 5 \text{ Hz}$ 1 x 2   |             |     |     |
| Antenna configuration  |   |              | 1 x 2                        |             |     |     |
| Reportin   | g interval  | ms           | 5                            |             |     |     |
| -  | delay   | ms           | 10 or 11                     |             |     |     |
| Reporting mode   |   |              | PUSCH 3-0                    |             |     |     |
| Sub-band size  |   | RB           | 6 (full size)                |             |     |     |
| Max number of HARQ   |   |              | 1                            |             |     |     |
| transmissions  |   |              | -                            |             |     |     |
|  | edback mode   |              | Multiplexing                 |             |     |     |
| Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4) |   |              |                              |             |     |     |
| Note 2: Ref<br>with<br>in A  | Reference measurement channel RC.3 TDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2. |              |                              |             |     |     |
|  | For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.         |              |                              |             |     |     |

 Table 9.3.1.1.2-1 Sub-band test for single antenna transmission (TDD)

| Table 9.3.1.1.2-2 | Minimum | requirement | (TDD) |
|-------------------|---------|-------------|-------|
|-------------------|---------|-------------|-------|

|             | Test 1 | Test 2 |
|-------------|--------|--------|
| α[%]        | 2      | 2      |
| β[%]        | 55     | 55     |
| γ           | 1.1    | 1.1    |
| UE Category | ≥1     | ≥1     |

# 9.3.1.1.3 FDD (CSI measurements in case two CSI subframe sets are configured and with CRS assistance information)

For the parameters specified in Table 9.3.1.1.3-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.1.3-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least  $\alpha$ % of the time but less than  $\beta$ % for each sub-band;
- b) the ratio of the throughput in ABS subframes obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set *S* shall be  $\geq \gamma$ ;

c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER in ABS subframes for the indicated transport formats shall be greater than or equal to  $\varepsilon$ .

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD.

| Parameter                           |                                       | Unit      |   | Tes                                  |  | Te   | est 2  |
|-------------------------------------|---------------------------------------|-----------|---|--------------------------------------|--|--|--|
|                                     |                                       |           | Cel                                       |                                      | Cell 2 and 3   | Cell 1   | Cell 2 and 3   |
| Bandwidth<br>PDSCH transmissio      | on mode                               | MHz       | 1   | 10                                   | Note 10  | 1  | 10<br>Note 10  |
|                                     | $\rho_A$                              | dB        |   | 0                                    |  | I  | 0  |
| Downlink power                      |                                       | dB        | 0   |                                      |  | 0  |  |
| allocation                          | $ ho_{\scriptscriptstyle B}$ $\sigma$ | dB        |   | 0                                    |  |  | 0  |
|                                     | 0                                     | QD        | Clause                                    | -                                    |  | Clause B.2.4   |  |
| Propagation con                     | dition                                |           | with Td<br>us, a =<br>5 H                 | = 0.45<br>1, fd =                    | EVA5<br>Low antenna<br>correlation                                   | with Td =<br>0.45 us, a =<br>1, fd = 5 Hz                            | EVA5<br>Low antenna<br>correlation                                   |
| Antenna configu                     | ration                                |           |   | 1x                                   |  | 1  | x2   |
| ${\widehat E}_{s} ig/ N_{oc2}$ (Not | e 1)                                  | dB        | 4   | 5                                    | Cell 2: 12<br>Cell 3: 10   | 14 15  | Cell 2: 12<br>Cell 3: 10   |
| ( <i>i</i> )                        | $N_{oc1}^{(j)}$                       | dBm/15kHz | -98 (No                                   | ote 7)                               | N/A  | -98 (Note 7)   | N/A  |
| $N_{oc}^{(j)}$ at antenna port      | $N_{oc2}^{(j)}$                       | dBm/15kHz | -98 (No                                   | ote 8)                               | N/A  | -98 (Note 8)   | N/A  |
| •                                   | $N_{oc3}^{(j)}$                       | dBm/15kHz | -93 (No                                   | ,                                    | N/A  | -93 (Note 9)   | N/A  |
| Subframe Config                     | uration                               |           | Non-M                                     | BSFN                                 | Non-MBSFN  | Non-MBSFN  | Non-MBSFN  |
| Cell Id                             |                                       |           | 0   |                                      | Cell 2: 6  | 0  | Cell 2: 6  |
|                                     |                                       |           | Cell 3: 1<br>Cell 2: 3 usec               |                                      | Cell 3: 1<br>Cell 2: 3 usec  |  |  |
| Time Offset betwee                  | en Cells                              | μs        | Cell 3: -1usec                            |                                      | Cell 3: -1usec   |  |  |
| Frequency Shift betw                | veen Cells                            | Hz        | Cell 2: 300Hz<br>Cell 3: -100Hz           |                                      | Cell 2: 300Hz<br>Cell 3: -100Hz                                      |  |  |
| ABS pattern (No                     | ote 2)                                |           | N/J                                       |                                      | 01010101<br>01010101<br>01010101<br>01010101<br>01010101<br>01010101 | N/A  | 01010101<br>01010101<br>01010101<br>01010101<br>01010101<br>01010101 |
| RLM/RRM Measu<br>Subframe Pattern   |                                       |           | 00000<br>00000<br>00000<br>00000<br>00000 | 0100<br>0100<br>0100                 | N/A  | 00000100<br>00000100<br>00000100<br>00000100<br>00000100             | N/A  |
| CSI Subframe Sets                   | C <sub>CSI,0</sub>                    |           | 01010<br>01010<br>01010<br>01010<br>01010 | 0101<br>0101<br>0101<br>0101<br>0101 | N/A  | 01010101<br>01010101<br>01010101<br>01010101<br>01010101<br>01010101 | N/A  |
| (Note 3)                            | C <sub>CSI,1</sub>                    |           | 10101<br>10101<br>10101<br>10101<br>10101 | 1010<br>1010<br>1010<br>1010         | N/A  | 10101010<br>10101010<br>10101010<br>10101010<br>10101010<br>10101010 | N/A  |
| Number of control OFDM<br>symbols   |                                       |           |   | 3                                    |  | 3  |  |
| Max number of HARQ<br>transmissions |                                       |           |   | 1                                    |  |  | 1  |
| CQI delay                           |                                       | ms        |   |                                      | 8  | 3  |  |
| Reporting interval (Note 13)        |                                       | ms        | 10  |                                      |  |  |  |
| Reporting mo                        |                                       |           | PUSCH 3-0                                 |                                      |  |  |  |
| Sub-band size                       |                                       | RB        |   |                                      | 6 (full  | size)  |  |

| Note 1:  | For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.   |
|----------|---|
| Note 2:  | ABS pattern as defined in [9].  |
| Note 3:  | Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]   |
| Note 4:  | As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]   |
| Note 5:  | Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]   |
| Note 6:  | Cell 1 is the serving cell. Cell 2 and Cell 3 are the aggressor cells. The number of the CRS ports in Cell1, Cell2, and Cell3 are the same.   |
| Note 7:  | This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.  |
| Note 8:  | This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.   |
| Note 9:  | This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.   |
| Note 10: | Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.1.5   |
| Note 11: | Reference measurement channel in Cell 1 RC.3 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.   |
| Note 12: | If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4). |
| No. 40.  |   |

Note 13: The CSI reporting is such that reference subframes belong to C<sub>csi,0</sub>.

|             | Test 1 | Test 2 |
|-------------|--------|--------|
| α[%]        | 2      | 2      |
| β[%]        | 55     | 55     |
| γ           | 1.1    | 1.1    |
| 3           | 0.01   | 0.01   |
| UE Category | ≥1     | ≥1     |

Table 9.3.1.1.3-2 Minimum requirement (FDD)

# 9.3.1.1.4 TDD (CSI measurements in case two CSI subframe sets are configured and with CRS assistance information)

For the parameters specified in Table 9.3.1.1.4-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.1.4-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least  $\alpha$ % of the time but less than  $\beta$ % for each sub-band;
- b) the ratio of the throughput in ABS subframes obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set *S* shall be  $\geq \gamma$ ;
- c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER in ABS subframes for the indicated transport formats shall be greater than or equal to  $\varepsilon$ .

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD.

| Parameter                                |                              | Unit      |                                     | Tes               |                                    |                                     |                   | st 2                               |
|--|------------------------------|-----------|-------------------------------------|-------------------|------------------------------------|-------------------------------------|-------------------|------------------------------------|
|  |                              |           | Ce                                  |                   | Cell 2 and 3                       | Ce                                  |                   | Cell 2 and 3                       |
| Bandwidth                                |                              | MHz       |                                     |                   | 0                                  |                                     |                   | 0                                  |
| PDSCH transmission                       |                              |           | 1                                   | -                 | Note 10                            |                                     | 1                 | Note 10                            |
| Uplink downlink conf                     | iguration                    |           |                                     |                   | 1                                  |                                     |                   | 1                                  |
| Special subframe<br>configuration        |                              |           |                                     | 2                 | 1                                  |                                     |                   | 4                                  |
| Downlink power                           | $ ho_{\scriptscriptstyle A}$ | dB        |                                     | (                 | )                                  |                                     |                   | )                                  |
| allocation                               | $ ho_{\scriptscriptstyle B}$ | dB        |                                     | (                 | )                                  |                                     |                   | )                                  |
|  | σ                            | dB        |                                     |                   | )                                  |                                     |                   | )                                  |
| Propagation conditio                     | n                            |           | Clause<br>with Td<br>us, a =<br>5 ł | = 0.45<br>1, fd = | EVA5<br>Low antenna<br>correlation | Clause<br>with Td<br>us, a =<br>5 l | = 0.45<br>1, fd = | EVA5<br>Low antenna<br>correlation |
| Antenna configuratio                     | n                            |           |                                     | 1:                | k2                                 |                                     | 1:                | k2                                 |
| $\widehat{E}_{s} \big/ N_{oc2}$ (Note 1) |                              | dB        | 4                                   | 5                 | Cell 2: 12<br>Cell 3: 10           | 14                                  | 15                | Cell 2: 12<br>Cell 3: 10           |
|  | $N_{oc1}^{(j)}$              | dBm/15kHz | -98 (N                              | lote 7)           | N/A                                | -98 (N                              | lote 7)           | N/A                                |
| $N_{oc}^{(j)}$ at antenna<br>port        | $N_{oc2}^{(j)}$              | dBm/15kHz | -98 (Note 8)                        |                   | N/A                                | -98 (Note 8)                        |                   | N/A                                |
|  | $N_{oc3}^{(j)}$              | dBm/15kHz | -93 (Note 9)                        |                   | N/A                                | -93 (Note 9)                        |                   | N/A                                |
| Subframe Configuration                   |                              |           | Non-M                               | IBSFN             | Non-MBSFN                          | Non-N                               | IBSFN             | Non-MBSFN                          |
| Cell Id                                  |                              |           | C                                   | )                 | Cell 2: 6<br>Cell 3: 1             | (                                   | )                 | Cell 2: 6<br>Cell 3: 1             |
| Time Offset between Cells                |                              | μs        | Cell 2: 3 usec<br>Cell 3: -1usec    |                   | Cell 2: 3 usec<br>Cell 3: -1usec   |                                     |                   |                                    |
| Frequency shift betw                     | een Cells                    | Hz        | Cell 2: 300Hz<br>Cell 3: -100Hz     |                   | Cell 2: 300Hz<br>Cell 3: -100Hz    |                                     |                   |                                    |
| ABS pattern (Note 2)                     | )                            |           | N/                                  | /A                | 0100010001<br>0100010001           | N                                   | /A                | 0100010001<br>0100010001           |
| RLM/RRM Measurer<br>Subframe Pattern (N  |                              |           | 00000                               |                   | N/A                                | 00000                               |                   | N/A                                |
| CSI Subframe Sets                        | C <sub>CSI,0</sub>           |           | 01000<br>01000                      |                   | N/A                                | 01000<br>01000                      |                   | N.A                                |
| (Note 3)                                 | C <sub>CSI,1</sub>           |           | 10001<br>10001                      | 01000             | N/A                                |                                     | 01000<br>01000    | N/A                                |
| Number of control OFDM symbols           |                              |           | 3                                   |                   | 3                                  |                                     |                   |                                    |
| Max number of HARQ<br>transmissions      |                              |           | 1 1                                 |                   | 1                                  |                                     |                   |                                    |
| CQI delay                                |                              | ms        |                                     |                   | 1                                  | 4                                   |                   |                                    |
| Reporting interval (Note 13)             |                              | ms        |                                     |                   |                                    | 0                                   |                   |                                    |
| Reporting mode                           |                              |           |                                     |                   | PUSC                               | CH 3-0                              |                   |                                    |
| Sub-band size                            |                              | RB        | 6 (full size)                       |                   |                                    |                                     |                   |                                    |
| ACK/NACK feedback                        | < mode                       |           | Multiplexing Multiplexing           |                   |                                    |                                     | lexing            |                                    |

Table 9.3.1.1.4-1 Sub-band test for single antenna transmission (TDD)

| Note 1:  | For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.                   |
|----------|---|
| Note 2:  | ABS pattern as defined in [9].  |
| Note 3:  | Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]   |
| Note 4:  | As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].                                      |
| Note 5:  | Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]   |
| Note 6:  | Cell 1 is the serving cell. Cell 2 and Cell 3 are the aggressor cells. The number of the CRS ports in Cell1, Cell2, and Cell3 is the same.                    |
| Note 7:  | This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.                              |
| Note 8:  | This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS  |
| Note 9:  | This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.   |
| Note 10: | Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.2.5                         |
| Note 11: | Reference measurement channel in Cell 1 RC.3 TDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2. |
| Note 12: | If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a   |
|          | downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4).                       |
| Note 13  | The CSI reporting is such that reference subframes belong to Casio  |

Note 13: The CSI reporting is such that reference subframes belong to C<sub>csi,0</sub>.

|             | Test 1 | Test 2 |
|-------------|--------|--------|
| α[%]        | 2      | 2      |
| β[%]        | 55     | 55     |
| γ           | 1.1    | 1.1    |
| 3           | 0.01   | 0.01   |
| UE Category | ≥1     | ≥1     |

Table 9.3.1.1.4-2 Minimum requirement (TDD)

## 9.3.1.2 Minimum requirement PUSCH 3-1 (CSI Reference Symbol)

#### 9.3.1.2.1 FDD

For the parameters specified in Table 9.3.1.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.2.1-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least  $\alpha$ % of the time but less than  $\beta$ % for each sub-band;
- b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set *S* shall be  $\geq \gamma$ ;
- c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.05.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD. Sub-bands of a size smaller than full size are excluded from the test.

| Parameter   |   | Unit         | Те                            | st 1                            | Te                   | Test 2           |  |
|---|---|--------------|-------------------------------|---------------------------------|----------------------|------------------|--|
| Bandwidth   |   | MHz          |                               | 10 MHz                          |                      |                  |  |
| Transmission mode   |   |              |                               |                                 | 9                    |                  |  |
| $\rho_{\scriptscriptstyle A}$   |   | dB           | 0                             |                                 |                      |                  |  |
| Downlink power  | $ ho_{\scriptscriptstyle B}$  | dB           | 0                             |                                 |                      |                  |  |
| allocation  | $P_c$   | dB           | 0                             |                                 | 0                    |                  |  |
|   | σ   | dB           | 0                             |                                 |                      |                  |  |
| SNR (   | Note 3)   | dB           | 4                             | 5                               | 11                   | 12               |  |
| Î   | (j)<br>or   | dB[mW/15kHz] | -94                           | -93                             | -87                  | 86               |  |
| N   | (j)<br>oc   | dB[mW/15kHz] | -(                            | 98                              | -9                   | 98               |  |
|   |   |              | Clause                        | e B.2.4 wi                      | th $	au_d = 0$       | ).45 <i>μ</i> s, |  |
| Propagatio  | on channel  |              |                               | a = 1, <i>f</i>                 | $f_D = 5  \text{Hz}$ |                  |  |
| Antenna co  | onfiguration  |              |                               | $a = 1, f_D = 5 \text{ Hz}$ 2x2 |                      |                  |  |
|   | ning Model  |              | As specified in Section B.4.3 |                                 |                      | B.4.3            |  |
|   | nce signals   |              | '<br>                         | Antenna ports 0                 |                      |                  |  |
| CSI refere  | nce signals   |              | A                             | ntenna p                        | orts 15,             | 16               |  |
|   | and subframe offset   |              |                               | 5                               | / 1                  |                  |  |
|   | $/\Delta_{CSI-RS}$  |              |                               | 5                               | / 1                  |                  |  |
|   | signal configuration  |              |                               |                                 | 4                    |                  |  |
| CodeBookSubset  | Restriction bitmap  |              | 000001                        |                                 |                      |                  |  |
| Reporting int   | erval (Note 4)  | ms           | 5                             |                                 |                      |                  |  |
|   | delay   | ms           |                               |                                 | 8                    |                  |  |
|   | ng mode   |              |                               |                                 | CH 3-1               |                  |  |
|   | ind size  | RB           | 6 (full size)                 |                                 |                      |                  |  |
|   | RQ transmissions  |              |                               |                                 | 1                    |                  |  |
| Note 1:       If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)         Note 2:       Reference measurement channel RC.8 FDD according to Table A.4-1 with one/two |   |              |                               |                                 |                      |                  |  |
| sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.  |   |              |                               |                                 |                      |                  |  |
|   | lote 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level. |              |                               |                                 |                      | two              |  |
| Note 4: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#1 and #6 to allow aperiodic CQI/PMI/RI to be transmitted in uplink SF#0 and #5.   |   |              |                               |                                 |                      |                  |  |

|      | Test 1 | Test 2 |
|------|--------|--------|
| α[%] | 2      | 2      |
| β[%] | 40     | 40     |
| γ    | 1.1    | 1.1    |

≥1

≥1

Table 9.3.1.2.1-2 Minimum requirement (FDD)

# 9.3.1.2.2 TDD

For the parameters specified in Table 9.3.1.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.2.2-2 and by the following

**UE** Category

- a) a sub-band differential CQI offset level of 0 shall be reported at least  $\alpha$ % of the time but less than  $\beta$ % for each sub-band;
- b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set *S* shall be  $\geq \gamma$ ;

c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.05.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD. Sub-bands of a size smaller than full size are excluded from the test.

| Parameter  |  | Unit         | Te                                 | st 1  | Te                | st 2     |  |
|--|--|--------------|------------------------------------|---|-------------------|----------|--|
| Bandwidth  |  | MHz          | 10 MHz                             |   |                   |          |  |
| Transmission mode  |  |              |                                    |   | 9                 |          |  |
| Uplink downlink configuration  |  |              |                                    |   | 2                 |          |  |
| Special subfrar  | ne configuration   |              |                                    |   | 4                 |          |  |
|  | $ ho_{\scriptscriptstyle A}$   | dB           | 0                                  |   |                   |          |  |
| Downlink power   | $ ho_{\scriptscriptstyle B}$   | dB           |                                    | 0   |                   |          |  |
| allocation   | $P_c$  | dB           |                                    |   | 0                 |          |  |
|  | σ  | dB           | 0                                  |   |                   |          |  |
| SNR (  | Note 3)  | dB           | 4                                  | 5   | 11                | 12       |  |
| Î  | (j)<br>pr  | dB[mW/15kHz] | -94                                | -93   | -87               | -86      |  |
| N  | r(j)   | dB[mW/15kHz] | -9                                 | 98  | -6                | 98       |  |
|  |  |              | Clause                             | B.2.4 wi  | th $\tau_{d} = 0$ | ).45 μs, |  |
| Propagati  | on channel   |              |                                    | Clause B.2.4 with $\tau_d = 0.45 \mu \text{s}$<br>$a = 1$ , $f_p = 5 \text{Hz}$ |                   |          |  |
| Antenna c  | onfiguration   |              | $a = 1, f_D = 5 \text{ Hz}$<br>2x2 |   |                   |          |  |
|  | ning Model   |              | As sr                              | As specified in Section B.4.3   |                   |          |  |
| CRS reference signals  |  |              |                                    |   | a port 0          |          |  |
|  | nce signals  |              |                                    | Antenna port 15,16  |                   |          |  |
| CSI-RS periodicity and subframe offset   |  |              |                                    |   | / 3               |          |  |
|  | $/\Delta_{CSI-RS}$   |              |                                    | C   | / 3               |          |  |
| CSI-RS reference   | signal configuration   |              |                                    |   | 4                 |          |  |
|  | Restriction bitmap   |              | 000001                             |   |                   |          |  |
|  | erval (Note 4)   | ms           | 5                                  |   |                   |          |  |
|  | delay  | ms           |                                    |   | 10                |          |  |
|  | ng mode  |              |                                    |   | CH 3-1            |          |  |
|  | and size   | RB           | 6 (full size)                      |   |                   |          |  |
|  | ARQ transmissions  |              |                                    | NA 141  | 1                 |          |  |
|  | edback mode  |              |                                    |   | blexing           |          |  |
| Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)                   |  |              |                                    |   |                   |          |  |
| Note 2: Reference  |  |              |                                    |   |                   | ′two     |  |
| Note 3: For each   | For each test, the minimum requirements shall be fulfilled for at least one of the two |              |                                    |   | two               |          |  |
| <ul> <li>SNR(s) and the respective wanted signal input level.</li> <li>Note 4: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink</li> <li>SF#3 and #8 to allow aperiodic CQI/PMI/RI to be transmitted on uplink SF#2 and #7.</li> </ul> |  |              |                                    |   |                   |          |  |

| Table 0.24.2.24   | Cub hand toot far TDD |
|-------------------|-----------------------|
| Table 9.3.1.2.2-1 | Sub-band test for TDD |

| Table 9.3.1.2.2-2 Minimum | requirement (TDD) |
|---------------------------|-------------------|
|---------------------------|-------------------|

|             | Test 1 | Test 2 |
|-------------|--------|--------|
| α[%]        | 2      | 2      |
| β[%]        | 40     | 40     |
| γ           | 1.1    | 1.1    |
| UE Category | ≥1     | ≥1     |

# 9.3.2 Frequency non-selective scheduling mode

The reporting accuracy of the channel quality indicator (CQI) under frequency non-selective fading conditions is determined by the reporting variance, and the relative increase of the throughput obtained when the transport format transmitted is that indicated by the reported CQI compared to the case for which a fixed transport format configured according to the reported median CQI is transmitted. In addition, the reporting accuracy is determined by a minimum BLER using the transport formats indicated by the reported CQI. The purpose is to verify that the UE is tracking the channel variations and selecting the largest transport format possible according to the prevailing channel state for frequently non-selective scheduling. To account for sensitivity of the input SNR the CQI reporting under frequency non-selective fading conditions is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

# 9.3.2.1 Minimum requirement PUCCH 1-0 (Cell-Specific Reference Symbol)

#### 9.3.2.1.1 FDD

For the parameters specified in Table 9.3.2.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.2.1.1-2 and by the following

a) a CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least  $\alpha$ % of the time;

b) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be  $\geq \gamma$ ;

c) when transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater or equal to 0.02

| Parameter   |                              | Unit         | Test 1 Test    |        |        | st 2 |
|---|------------------------------|--------------|----------------|--------|--------|------|
| Bandwidth   |                              | MHz          |                | 10 N   | MHz    |      |
| Transmission mode   |                              |              |                | 1 (po  | ort 0) |      |
| Downlink  | $ ho_{\scriptscriptstyle A}$ | dB           | 0              |        |        |      |
| power   | $ ho_{\scriptscriptstyle B}$ | dB           |                | 0      |        |      |
| allocation  | σ                            | dB           |                | (      | )      |      |
| SNR (   | Note 3)                      | dB           | 6              | 7      | 12     | 13   |
| Î   | (j)<br>pr                    | dB[mW/15kHz] | -92            | -91    | -86    | -85  |
| N   | oc (j)                       | dB[mW/15kHz] | -9             | 98     | -9     | 98   |
|   | on channel                   |              |                | EP     | A5     |      |
|   | tion and                     |              |                | High ( | 1 x 2) |      |
|   | onfiguration                 |              |                |        | H 1-0  |      |
|   | ng mode<br>periodicity       | ms           |                | Npd    |        |      |
| COL   | delay                        | ms           |                |        |        |      |
| Physical  | channel for                  | 115          |                | 8      |        |      |
|   | porting                      |              | PUSCH (Note 4) |        |        |      |
|   | eport Type                   |              |                | 4      | 1      |      |
|   | pmi-                         |              |                |        | 1      |      |
|   | ationIndex                   |              |                |        |        |      |
|   | er of HARQ                   |              |                | -      | 1      |      |
|   | issions                      |              |                |        |        |      |
| <ul> <li>Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)</li> <li>Note 2: Reference measurement channel RC.1 FDD according to Table A.4-1 for Category 2-8 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1 and RC.4 FDD according to Table A.4-1 for Category 1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.</li> </ul> |                              |              |                |        |        |      |
| Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.   |                              |              |                |        |        |      |
| Note 4: To avoid collisions between CQI reports and HARQ-ACK it is<br>necessary to report both on PUSCH instead of PUCCH. PDCCH<br>DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9<br>to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH<br>in uplink subframe SF#5, #7, #1 and #3.  |                              |              |                |        |        |      |

|             | Test 1 | Test 2 |
|-------------|--------|--------|
| α[%]        | 20     | 20     |
| γ           | 1.05   | 1.05   |
| UE Category | ≥1     | ≥1     |

#### 9.3.2.1.2 TDD

For the parameters specified in Table 9.3.2.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.2.1.2-2 and by the following

a) a CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least  $\alpha$ % of the time;

b) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be  $\geq \gamma$ ;

c) when transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater or equal to 0.02.

|   |   | 1                      | 1                               |            | 1            |          |
|---|---|------------------------|---------------------------------|------------|--------------|----------|
| Parameter   |   | Unit                   | Test 1 Test                     |            | st 2         |          |
| Bandwidth   |   | MHz                    |                                 |            | MHz          |          |
| Transmission mode   |   |                        |                                 | 1 (po      | ort 0)       |          |
| Downlink  | $ ho_{\scriptscriptstyle A}$  | dB                     |                                 |            | )            |          |
| power   | $ ho_{\scriptscriptstyle B}$  | dB                     |                                 | (          | )            |          |
| allocation  | σ   | dB                     |                                 | (          | )            |          |
| confi   | downlink<br>guration  |                        |                                 | 2          | 2            |          |
| confi   | subframe<br>guration  |                        |                                 | 2          | 1            |          |
|   | (Note 3)  | dB                     | 6                               | 7          | 12           | 13       |
|   | $\hat{I}_{or}^{(j)}$  | dB[mW/15kHz]           | -92                             | -91        | -86          | -85      |
| 1   | $V_{oc}^{(j)}$  | dB[mW/15kHz]           | -9                              | 98         | -9           | 98       |
|   | ion channel   |                        |                                 | EP         | A5           |          |
|   | ation and   |                        |                                 | High (     | (1 x 2)      |          |
|   | configuration   |                        |                                 |            | · · ·        |          |
|   | ing mode  | ms                     |                                 |            | <u>H 1-0</u> |          |
| Reporting periodicity<br>CQI delay  |   | ms<br>ms               | N <sub>pd</sub> = 5<br>10 or 11 |            |              |          |
|   | channel for   | 113                    |                                 |            |              |          |
| CQI r   | eporting  |                        | PUSCH (Note 4)                  |            |              |          |
|   | Report Type   |                        |                                 | 4          | 1            |          |
|   | i-pmi-<br>rationIndex   |                        |                                 | 3          | 3            |          |
|   | per of HARQ   |                        |                                 |            |              |          |
|   | missions  |                        |                                 | 1          | 1            |          |
|   | CK feedback   |                        |                                 | Madela     | 1            |          |
|   | node  |                        |                                 | Multip     | lexing       |          |
| Note 1:   | If the UE repo  | orts in an available u | plink rep                       | orting ins | tance at     |          |
|   |   | In based on CQI es     |                                 |            |              |          |
|   |   | , this reported wide   | band CQ                         | l cannot l | be applie    | d at the |
|   |   | before SF#(n+4).       |                                 |            |              |          |
| Note 2:   |   | easurement channel     |                                 |            |              |          |
| A.4-1 for Category 2-8 with one sided dynamic OCNG Pattern OP.1   |   |                        |                                 |            |              |          |
| TDD as described in Annex A.5.2.1 and RC.4 TDD according to   |   |                        |                                 |            |              |          |
| Table A.4-1 for Category 1 with one/two sided dynamic OCNG<br>Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.               |   |                        |                                 |            |              |          |
| Note 3:   | Note 3: For each test, the minimum requirements shall be fulfilled for at |                        |                                 |            |              |          |
| least one of the two SNR(s) and the respective wanted signal input  |   |                        |                                 |            |              |          |
| Note 4:   | level.<br>To avoid collis   | sions between COL      | renorts a                       |            |              | c        |
| Note 4: To avoid collisions between CQI reports and HARQ-ACK it is<br>necessary to report both on PUSCH instead of PUCCH. PDCCH |   |                        |                                 |            |              |          |
| DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow  |   |                        |                                 |            |              |          |
| periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink  |   |                        |                                 |            |              |          |
|   | subframe SF#  |                        |                                 |            |              | ·        |

Table 9.3.2.1.2-1 Fading test for single antenna (TDD)

Table 9.3.2.1.2-2 Minimum requirement (TDD)

|             | Test 1 | Test 2 |
|-------------|--------|--------|
| α[%]        | 20     | 20     |
| γ           | 1.05   | 1.05   |
| UE Category | ≥1     | ≥1     |

# 9.3.2.2 Minimum requirement PUCCH 1-1 (CSI Reference Symbol)

## 9.3.2.2.1 FDD

For the parameters specified in Table 9.3.2.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.2.2.1-2 and by the following

a) a CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least  $\alpha$ % of the time;

b) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be  $\geq \gamma$ ;

c) when transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater or equal to 0.02.

| Parameter   |                              | Unit         | Tes             | st 1     | Tes       | st 2  |
|---|------------------------------|--------------|-----------------|----------|-----------|-------|
| Bandwidth   |                              | MHz          |                 | 10       | MHz       |       |
| Transmission mode   |                              |              |                 | ć        | 9         |       |
|   | $ ho_{\scriptscriptstyle A}$ | dB           |                 | (        | C         |       |
| Downlink power  | $ ho_{\scriptscriptstyle B}$ | dB           |                 | (        | C         |       |
| allocation  | $P_c$                        | dB           |                 | -1       | 3         |       |
|   | σ                            | dB           |                 | -3       |           |       |
| SNR (1  | Note 3)                      | dB           | 2               | 3        | 7         | 8     |
| $\hat{I}_{a}^{0}$   | (j)<br>m                     | dB[mW/15kHz] | -96             | -95      | -91       | -90   |
| N   | (j)<br>oc                    | dB[mW/15kHz] | -9              | 8        | -9        | 98    |
| Propagatio  | on channel                   |              |                 | EP       | A5        |       |
| Correlation and an  |                              |              |                 | ULA Hig  | h (4 x 2) |       |
| Beamform  | ning Model                   |              | As sp           |          | Section   | B.4.3 |
| Cell-specific re  |                              |              |                 | Antenna  | ports 0,1 |       |
| CSI referen   | nce signals                  |              | An              | tenna po | rts 15,   | ,18   |
|   | and subframe offset          |              |                 |          | /1        |       |
|   | $\Delta_{CSI-RS}$            |              |                 | 5,       | /1        |       |
| CSI-RS reference s  | signal configuration         |              |                 |          | 2         |       |
| CodeBookSubset  | Restriction bitmap           |              | 0x0             | 000 000  | 0 0000 0  | 001   |
| Reportir  | ng mode                      |              |                 | PUCC     | CH 1-1    |       |
| Reporting   | ms                           |              | N <sub>pd</sub> | = 5      |           |       |
| CQI delay   |                              | ms           |                 | 8        | 3         |       |
| Physical chann  | nel for CQI/ PMI             |              |                 |          | (Note 4)  |       |
| repo  |                              |              |                 | FUSCH    | (11018 4) |       |
|   | Type for CQI/PMI             |              |                 |          | 2         |       |
|   | I for RI reporting           |              |                 |          | Format 2  |       |
| PUCCH repo  |                              |              |                 |          | 3         |       |
|   | gurationIndex                |              |                 |          | 2         |       |
|   | ïgIndex                      |              |                 |          | 1         |       |
|   | RQ transmissions             |              |                 |          | 1         |       |
| Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based<br>on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband<br>CQI cannot be applied at the eNB downlink before SF#(n+4)   |                              |              |                 |          |           |       |
| Note 2: Reference measurement channel RC.7 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.   |                              |              |                 | ne       |           |       |
| Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.   |                              |              |                 | the two  |           |       |
| Note 4: To avoid collisions between CQI/ PMI reports and HARQ-ACK it is necessary to<br>report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be<br>transmitted in downlink SF#1 and #6 to allow periodic CQI/ PMI to multiplex with the<br>HARQ-ACK on PUSCH in uplink subframe SF#0 and #5. |                              |              |                 |          |           |       |

Table 9.3.2.2.1-1 Fading test for FDD

|             | Test 1 | Test 2 |
|-------------|--------|--------|
| α[%]        | 20     | 20     |
| γ           | 1.05   | 1.05   |
| UE Category | ≥1     | ≥1     |

Table 9.3.2.2.1-2 Minimum requirement (FDD)

#### 9.3.2.2.2 TDD

For the parameters specified in Table 9.3.2.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.2.2.2-2 and by the following

a) a CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least  $\alpha$ % of the time;

b) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be  $\geq \gamma$ ;

c) when transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater or equal to 0.02.

|  | Parar  | neter  | Unit                | Tes          | st 1                                 | Те                   | st 2     |
|--|--|--|---------------------|--------------|--------------------------------------|----------------------|----------|
| Parameter<br>Bandwidth   |  |  | MHz                 | 100          |                                      | MHz                  | 51 2     |
| Transmission mode  |  |  |                     |              | 9                                    |                      |          |
| Uplink downlink configuration  |  |  |                     |              | 2                                    |                      |          |
|  |  | ne configuration                             |                     |              |                                      | 4                    |          |
|  |  | $\rho_A$                                     | dB                  | 0            |                                      |                      |          |
| Downlink p   | oower  | $ ho_{\scriptscriptstyle B}$                 | dB                  |              | (                                    | C                    |          |
| allocati   |  | $P_c$  | dB                  |              | -                                    | 6                    |          |
|  |  | σ  | dB                  | -3           |                                      |                      |          |
|  | SNR (I   |  | dB                  | 1            |                                      |                      |          |
|  | $\hat{I}_{o}^{(}$  | j)<br>r                                      | dB[mW/15kHz]        | -97          | -96                                  | -91                  | -90      |
|  | N  | ( <i>j</i> )<br>20                           | dB[mW/15kHz]        | -9           | 8                                    | -6                   | 98       |
|  |  | on channel                                   |                     |              |                                      | A5                   |          |
| Correlation  | and ant  | enna configuration                           |                     |              |                                      | n (8 x 2)            |          |
|  |  | ing Model                                    |                     |              |                                      | Section              |          |
|  |  | nce signals                                  |                     |              |                                      | ports 0, 1           |          |
|  |  | nce signals                                  |                     | An           | tenna po                             | rts 15,              | ,22      |
| CSI-RS per   |  | and subframe offset $\Delta_{\text{CSI-RS}}$ |                     |              | 5/                                   | 3                    |          |
| CSI-RS ref   |  | signal configuration                         |                     |              |                                      | 2                    |          |
|  |  | Restriction bitmap                           |                     | 0x000        | 0 0000 0                             | 000 0020             | 0000     |
|  | Reportir   | na mode                                      |                     | PLIC         | 0000 0001<br>PUCCH 1-1 (Sub-mode: 2) |                      |          |
|  |  | periodicity                                  | ms                  | 100          |                                      | = 5                  | 10. 2)   |
|  | CQI  |  | ms                  |              |                                      | 0                    |          |
| Physical channel for CQI/ PMI  |  |  |                     |              | PUSCH                                | (Note 4)             |          |
| reporting PUCCH Report Type for CQI/ PMI   |  |  |                     |              |                                      | . ,                  |          |
|  |  | I for RI reporting                           |                     |              |                                      | <u>c</u><br>Format 2 | ,        |
|  |  | ort type for RI                              |                     |              |                                      | 3                    |          |
|  |  | gurationIndex                                |                     |              |                                      | 3                    |          |
|  | ri-Conf  |  |                     |              | 805 (N                               | -                    |          |
| Max numb   |  | RQ transmissions                             |                     |              |                                      | 1                    |          |
| ACK/   | NACK fe  | edback mode                                  |                     |              | Multip                               | lexing               |          |
|  |  | reports in an availabl                       |                     |              |                                      |                      |          |
|  |  | stimation at a downlin                       |                     |              |                                      | orted wic            | leband   |
|  |  | ot be applied at the e                       |                     |              |                                      |                      |          |
|  |  | e measurement char                           |                     |              |                                      |                      | ne       |
|  |  | namic OCNG Pattern                           |                     |              |                                      |                      | the two  |
| Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two<br>SNR(s) and the respective wanted signal input level. |  |  |                     |              |                                      |                      |          |
| Note 4: To avoid collisions between C  |  |  |                     |              | CK it is r                           | necessar             | y to     |
| report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be   |  |  |                     | -            |                                      |                      |          |
|  | transmitted in downlink SF#3 and #8 to allow periodic CQI/ PMI to multiplex with th<br>HARQ-ACK on PUSCH in uplink subframe SF#2 and #7. |  |                     |              |                                      | with the             |          |
|  |  |  |                     |              |                                      |                      |          |
|  | collisions between RI, CQI/PMI and HARQ-ACK reports. In the case when all three  |  |                     |              |                                      |                      |          |
| r  | eports co  | ollide, it is expected the                   | hat CQI/PMI reports | s will be d  | ropped, v                            | while RI a           | and      |
| F  | IARQ-A   | CK will be multiplexed                       | d. At eNB, CQI repo | ort collecti | on shall                             | be skippe            | ed       |
| every 160ms during performance verification and the reported CQI in subframe   |  |  |                     |              |                                      |                      |          |
|  |  | he previous frame is                         |                     | subframe     | es until a                           | new CQ               | l (after |
| (  | JQI/PMI  | dropping) is available                       | 2.                  |              |                                      |                      |          |

| Table 0 2 2 2 2 4 | Eading toot for TDD |
|-------------------|---------------------|
| Table 9.3.2.2.2-1 | Fading test for TDD |

| Table 9.3.2.2.2-2 | Minimum | requirement | (TDD) |
|-------------------|---------|-------------|-------|
|-------------------|---------|-------------|-------|

|             | Test 1 | Test 2 |
|-------------|--------|--------|
| α[%]        | 20     | 20     |
| γ           | 1.05   | 1.05   |
| UE Category | ≥1     | ≥1     |

# 9.3.3 Frequency-selective interference

The accuracy of sub-band channel quality indicator (CQI) reporting under frequency selective interference conditions is determined by a percentile of the reported differential CQI offset level +2 for a preferred sub-band, and the relative increase of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest reported differential CQI offset level the corresponding transport format compared to the case for which a fixed format is transmitted on any sub-band in set *S* of TS 36.213 [6]. The purpose is to verify that preferred sub-bands are used for frequently-selective scheduling under frequency-selective interference conditions.

# 9.3.3.1 Minimum requirement PUSCH 3-0 (Cell-Specific Reference Symbol)

# 9.3.3.1.1 FDD

For the parameters specified in Table 9.3.3.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.3.1.1-2 and by the following

a) a sub-band differential CQI offset level of +2 shall be reported at least  $\alpha$ % for at least one of the sub-bands of full size at the channel edges;

b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set *S* shall be  $\geq \gamma$ ;

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD. Sub-bands of a size smaller than full size are excluded from the test.

| Para                                  | meter   | Unit            | Test 1                            | Test 2        |  |
|---------------------------------------|---|-----------------|-----------------------------------|---------------|--|
| Band                                  | dwidth  | MHz             | 10 MHz 10 MHz                     |               |  |
| Transmis                              | sion mode   |                 | 1 (port 0)                        | 1 (port 0)    |  |
| Downlink                              | $ ho_{\scriptscriptstyle A}$  | dB              | 0                                 | 0             |  |
| power                                 | $ ho_{\scriptscriptstyle B}$  | dB              | 0                                 | 0             |  |
| allocation                            | σ   | dB              | 0                                 | 0             |  |
| $I_{\scriptscriptstyle ot}^{(j)}$ for | RB 05   | dB[mW/15kHz]    | -102                              | -93           |  |
| $I_{\scriptscriptstyle ot}^{(j)}$ for | RB 641  | dB[mW/15kHz]    | -93                               | -93           |  |
| $I_{\mathit{ot}}^{(j)}$ for F         | RB 4249   | dB[mW/15kHz]    | -93                               | -102          |  |
| Î                                     | (j)<br>or   | dB[mW/15kHz]    | -94 -94                           |               |  |
|                                       | er of HARQ<br>hissions  |                 | 1                                 |               |  |
|                                       |   |                 | Clause B.2.4 with $	au_d=0.45\mu$ |               |  |
| Propagati                             | on channel  |                 | $a = 1, f_D = 5 \text{ Hz}$       |               |  |
| Reportin                              | ig interval   | ms              |                                   | -             |  |
|                                       | onfiguration  |                 | 1:                                | x 2           |  |
|                                       | delay   | ms              |                                   | 8             |  |
|                                       | ng mode   |                 |                                   | CH 3-0        |  |
|                                       | and size  | RB              | · · · · ·                         | l size)       |  |
| Note 2:                               | subframe SF#n based on CQI estimation at a downlink subframe<br>not later than SF#(n-4), this reported subband or wideband CQI<br>cannot be applied at the eNB downlink before SF#(n+4) |                 |                                   |               |  |
|                                       |   | nnex A.5.1.1/2. |                                   | 1.1/2 1 DD as |  |

Table 9.3.3.1.1-1 Sub-band test for single antenna transmission (FDD)

|             | Test 1 | Test 2 |
|-------------|--------|--------|
| α[%]        | 60     | 60     |
| γ           | 1.6    | 1.6    |
| UE Category | ≥1     | ≥1     |

Table 9.3.3.1.1-2 Minimum requirement (FDD)

# 9.3.3.1.2 TDD

For the parameters specified in Table 9.3.3.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.3.1.2-2 and by the following

a) a sub-band differential CQI offset level of +2 shall be reported at least  $\alpha$ % for at least one of the sub-bands of full size at the channel edges;

b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set *S* shall be  $\geq \gamma$ ;

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD. Sub-bands of a size smaller than full size are excluded from the test.

| Para   | ameter                       | Unit         | Test 1                         | Test 2     |
|--|------------------------------|--------------|--------------------------------|------------|
| Ban  | dwidth                       | MHz          | 10 MHz 10 MHz                  |            |
| Transmis   | ssion mode                   |              | 1 (port 0)                     | 1 (port 0) |
| Downlink   | $ ho_{\scriptscriptstyle A}$ | dB           | 0                              | 0          |
| power  | $ ho_{\scriptscriptstyle B}$ | dB           | 0                              | 0          |
| allocation   | σ                            | dB           | 0                              | 0          |
|  | downlink<br>guration         |              | 2                              |            |
|  | subframe<br>guration         |              | 4                              |            |
| $I_{\scriptscriptstyle ot}^{(j)}$ for  | r RB 05                      | dB[mW/15kHz] | -102                           | -93        |
| $I_{\scriptscriptstyle ot}^{(j)}$ for  | RB 641                       | dB[mW/15kHz] | -93                            | -93        |
| $I_{\scriptscriptstyle ot}^{(j)}$ for  | RB 4249                      | dB[mW/15kHz] | -93 -102                       |            |
| j  | $\hat{f}^{(j)}_{or}$         | dB[mW/15kHz] | -94 -94                        |            |
|  | per of HARQ                  |              | 1                              |            |
| Propagat   | ion channel                  |              | Clause B.2.4 with $a = 1, f_I$ | u          |
| Antenna o  | configuration                |              | 1 x<br>5                       | 2          |
| Reporti  | ng interval                  | ms           | 5                              |            |
|  | delay                        | ms           | 10 o                           |            |
| · · · ·  | ing mode                     |              | PUSC                           |            |
|  | and size                     | RB           | 6 (full                        | size)      |
|  | CK feedback<br>lode          |              | Multipl                        | exing      |
| <ul> <li>Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4).</li> <li>Note 2: Reference measurement channel RC.3 TDD according to table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.</li> </ul> |                              |              |                                |            |

Table 9.3.3.1.2-1 Sub-band test for single antenna transmission (TDD)

|             | Test 1 | Test 2 |
|-------------|--------|--------|
| α[%]        | 60     | 60     |
| γ           | 1.6    | 1.6    |
| UE Category | ≥1     | ≥1     |

9.3.3.2 Void

9.3.3.2.1 Void

9.3.3.2.2 Void

# 9.3.4 UE-selected subband CQI

The accuracy of UE-selected subband channel quality indicator (CQI) reporting under frequency-selective fading conditions is determined by the relative increase of the throughput obtained when transmitting on the UE-selected subbands with the corresponding transport format compared to the case for which a fixed format is transmitted on any subband in set *S* of TS 36.213 [6]. The purpose is to verify that correct subbands are accurately reported for frequency-selective scheduling. To account for sensitivity of the input SNR the subband CQI reporting under frequency-selective fading conditions is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

#### 9.3.4.1 Minimum requirement PUSCH 2-0 (Cell-Specific Reference Symbols)

#### 9.3.4.1.1 FDD

For the parameters specified in Table 9.3.4.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.4.1.1-2 and by the following

a) the ratio of the throughput obtained when transmitting on a randomly selected subband among the best M subbands reported by the UE the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected subband in set *S* shall be  $\geq \gamma$ ;

The requirements only apply for subbands of full size and the random scheduling across the subbands is done by selecting a new subband in each TTI for FDD. The transport block size TBS (wideband CQI median) is that resulting from the code rate which is closest to that indicated by the wideband CQI median and the  $N_{\text{PRB}}$  entry in Table 7.1.7.2.1-1 of TS 36.213 [6] that corresponds to the subband size.

| Par  | ameter                            | Unit         | Tes                         | Test 1 Test 2 |                |                 |
|--|-----------------------------------|--------------|-----------------------------|---------------|----------------|-----------------|
| Bar  | dwidth                            | MHz          | 10 MHz                      |               |                |                 |
| Transmi  | ssion mode                        |              | 1 (port 0)                  |               |                |                 |
| Downlink   | $ ho_{\scriptscriptstyle A}$      | dB           |                             | (             | )              |                 |
| power  | $ ho_{\scriptscriptstyle B}$      | dB           |                             | (             | )              |                 |
| allocation   | σ                                 | dB           |                             | (             | )              | -               |
| SNR  | (Note 3)                          | dB           | 9                           | 10            | 14             | 15              |
|  | $\hat{I}_{or}^{(j)}$              | dB[mW/15kHz] | -89                         | -88           | -84            | -83             |
| 1  | $V_{oc}^{(j)}$                    | dB[mW/15kHz] | -9                          | 98            | -9             | 98              |
|  |                                   |              | Clause                      | B.2.4 wit     | h $\tau_d = 0$ | .45 <i>μ</i> s, |
| Propaga  | tion channel                      |              | $a = 1, f_D = 5 \text{ Hz}$ |               |                |                 |
| Reporting interval   |                                   | ms           |                             | 5             |                |                 |
|  | l delay                           | ms           |                             | 8             | -              |                 |
|  | ing mode                          |              |                             | PUSC          | H 2-0          |                 |
|  | per of HARQ                       |              |                             |               | 1              |                 |
|  | missions                          |              | 0 (( ))                     |               |                |                 |
|  | nd size ( <i>k</i> )              | RBs          |                             | 3 (full       | size)          |                 |
|  | of preferred<br>ands ( <i>M</i> ) |              |                             | Ę             | 5              |                 |
| <ul> <li>Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)</li> <li>Note 2: Reference measurement channel RC.5 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.</li> <li>Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.</li> </ul> |                                   |              |                             |               |                |                 |

 Table 9.3.4.1.1-1 Subband test for single antenna transmission (FDD)

Table 9.3.4.1.1-2 Minimum requirement (FDD)

|             | Test 1 | Test 2 |
|-------------|--------|--------|
| γ           | 1.2    | 1.2    |
| UE Category | ≥1     | ≥1     |

#### 9.3.4.1.2 TDD

For the parameters specified in Table 9.3.4.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.4.1.2-2 and by the following

a) the ratio of the throughput obtained when transmitting on a randomly selected subband among the best M subbands reported by the UE the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected subband in set *S* shall be  $\geq \gamma$ ;

The requirements only apply for subbands of full size and the random scheduling across the subbands is done by selecting a new subband in each available downlink transmission instance for TDD. The transport block size TBS (wideband CQI median) is that resulting from the code rate which is closest to that indicated by the wideband CQI median and the  $N_{PRB}$  entry in Table 7.1.7.2.1-1 of TS 36.213 [6] that corresponds to the subband size.

| Para   | ameter                            | Unit         | Test 1 Test 2                     |         |                  | st 2 |
|--|-----------------------------------|--------------|-----------------------------------|---------|------------------|------|
| Ban  | dwidth                            | MHz          | 10 MHz                            |         |                  |      |
| Transmi  | ssion mode                        |              | 1 (port 0)                        |         |                  |      |
| Downlink   | $ ho_{\scriptscriptstyle A}$      | dB           | 0                                 |         |                  |      |
| power  | $ ho_{\scriptscriptstyle B}$      | dB           |                                   | (       | )                |      |
| allocation   | σ                                 | dB           |                                   | (       | )                |      |
| config   | downlink<br>guration              |              |                                   | 2       | 2                |      |
|  | subframe<br>guration              |              |                                   | 4       | 4                |      |
| SNR  | (Note 3)                          | dB           | 9                                 | 10      | 14               | 15   |
|  | $\hat{f}^{(j)}_{or}$              | dB[mW/15kHz] | -89                               | -88     | -84              | -83  |
| Ι  | $V_{oc}^{(j)}$                    | dB[mW/15kHz] | -9                                | 8       | -6               | 98   |
| _  |                                   |              | Clause B.2.4 with $\tau_d = 0.45$ |         | ).45 <i>μ</i> s, |      |
| Propagat   | ion channel                       |              | $a = 1, f_D = 5$ Hz               |         |                  |      |
| Reporti  | ng interval                       | ms           |                                   | 5       | 5                |      |
|  | delay                             | ms           |                                   | 10 c    |                  |      |
| Report   | ing mode                          |              |                                   | PUSC    | CH 2-0           |      |
| Max num  | per of HARQ                       |              |                                   |         | 1                |      |
| transr   | nissions                          |              |                                   |         | -                |      |
|  | nd size ( <i>k</i> )              | RBs          |                                   | 3 (full | size)            |      |
|  | of preferred<br>ands ( <i>M</i> ) |              |                                   | Ę       | 5                |      |
| ACK/NAC  | CK feedback                       |              |                                   | Multin  | lexing           |      |
|  | ode                               |              |                                   | •       | 0                |      |
| Note 1:       If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)         Note 2:       Reference measurement channel RC.5 TDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.         Note 3:       For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level. |                                   |              |                                   |         |                  |      |

#### Table 9.3.4.1.2-1 Sub-band test for single antenna transmission (TDD)

Table 9.3.4.1.2-2 Minimum requirement (TDD)

|             | Test 1 | Test 2 |
|-------------|--------|--------|
| γ           | 1.2    | 1.2    |
| UE Category | ≥1     | ≥1     |

## 9.3.4.2 Minimum requirement PUCCH 2-0 (Cell-Specific Reference Symbols)

### 9.3.4.2.1 FDD

For the parameters specified in Table 9.3.4.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.4.2.1-2 and by the following

a) the ratio of the throughput obtained when transmitting on subbands reported by the UE the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected subband in set *S* shall be  $\geq \gamma$ ;

The requirements only apply for subbands of full size and the random scheduling across the subbands is done by selecting a new subband in each TTI for FDD. The transport block size TBS (wideband CQI median) is that resulting

from the code rate which is closest to that indicated by the wideband CQI median and the  $N_{\text{PRB}}$  entry in Table 7.1.7.2.1-1 of TS 36.213 [6] that corresponds to the subband size.

| Para                                  | meter  | Unit   | Tes                                  | st 1                               | Tes                                      | st 2     |
|---------------------------------------|--|--|--------------------------------------|------------------------------------|--|----------|
|                                       | dwidth   | MHz  | 10 MHz                               |                                    | 10 MHz                                   |          |
| Transmis                              | sion mode  |  | 1 (port 0)                           |                                    |  |          |
| Downlink                              | $ ho_{\scriptscriptstyle A}$   | dB   | 0                                    |                                    |  |          |
| power                                 | $\rho_{\scriptscriptstyle B}$  | dB   | 0                                    |                                    |  |          |
| allocation                            | σ  | dB   |                                      | (                                  | )  |          |
| SNR                                   | (Note 3)   | dB   | 8                                    | 9                                  | 13                                       | 14       |
|                                       | (j)<br>or  | dB[mW/15kHz]   | -90                                  | -89                                | -85                                      | -84      |
|                                       | $I_{oc}^{(j)}$   | dB[mW/15kHz]   | -g                                   | 8                                  | -9                                       | 8        |
| Propagati                             | on channel   |  |                                      | B.2.4 wit<br>a = 1, f<br>$N_P$     | h $\tau_d = 0$<br>$\tau_D = 5 \text{Hz}$ | .45 μs,  |
| Reporting                             | periodicity  | ms   |                                      | N <sub>P</sub>                     | = 2                                      |          |
|                                       | delay  | ms   |                                      | 8                                  | 3  |          |
|                                       | channel for  |  |                                      | PUSCH                              | (Note 4)                                 |          |
| PUCCH F                               | Report Type  |  |                                      | 4                                  | 1  |          |
|                                       | band CQI   |  |                                      |                                    | •  |          |
|                                       | Report Type  |  |                                      | 1                                  | I  |          |
| for subband CQI<br>Max number of HARQ |  |  |                                      |                                    |  |          |
|                                       | nissions   |  | 1                                    |                                    |  |          |
|                                       | d size (k)   | RBs  | 6 (full size)                        |                                    |  |          |
|                                       | f bandwidth<br>ts ( <i>J</i> )   |  |                                      | 3                                  | 3  |          |
|                                       | K  |  |                                      | 1                                  |  |          |
| cqi-pmi-C                             | ConfigIndex  |  | 1                                    |                                    |  |          |
|                                       | subframe SF#<br>not later than<br>cannot be app  | orts in an available u<br>th based on CQI es<br>SF#(n-4), this repor<br>blied at the eNB dow   | timation a<br>ted subb<br>vnlink bef | at a down<br>and or wi<br>ore SF#( | llink subfr<br>deband (<br>n+4)          | CQI      |
|                                       | A.4-1 with one   | easurement channel   |                                      |                                    |  |          |
| Note 3:                               | For each test,   | Annex A.5.1.1/2.<br>the minimum requi<br>ne two SNR(s) and t   |                                      |                                    |  |          |
|                                       | To avoid collisions between CQI reports and HARQ-ACK it is<br>necessary to report both on PUSCH instead of PUCCH. PDCCH<br>DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9<br>to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH<br>in uplink subframe SF#5, #7, #1 and #3. |  |                                      |                                    |  |          |
| Note 5:                               | CQI reports for<br>bandwidth paraccording to t<br>with j=1.  | or the short subband (having 2RBs in the last<br>art) are to be disregarded and data scheduling<br>the most recent subband CQI report for bandwidth part |                                      |                                    |  | dth part |
|                                       |  | nere wideband CQI cording to the most  |                                      |                                    |  | I        |

Table 9.3.4.2.1-1 Subband test for single antenna transmission (FDD)

|             | Test 1 | Test 2 |
|-------------|--------|--------|
| γ           | 1.15   | 1.15   |
| UE Category | ≥1     | ≥1     |

#### 9.3.4.2.2 TDD

For the parameters specified in Table 9.3.4.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.4.2.2-2 and by the following

a) the ratio of the throughput obtained when transmitting on subbands reported by the UE the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected subband in set *S* shall be  $\geq \gamma$ ;

The requirements only apply for subbands of full size and the random scheduling across the subbands is done by selecting a new subband in each available downlink transmission instance for TDD. The transport block size TBS (wideband CQI median) is that resulting from the code rate which is closest to that indicated by the wideband CQI median and the  $N_{PRB}$  entry in Table 7.1.7.2.1-1 of TS 36.213 [6] that corresponds to the subband size.

| Para                                 | ameter  | Unit  | Tes                                  | st 1                                | Tes                               | st 2         |
|--------------------------------------|---|---|--------------------------------------|-------------------------------------|-----------------------------------|--------------|
|                                      | dwidth  | MHz   |                                      | 10                                  | MHz                               |              |
| Transmis                             | ssion mode  |   |                                      | 1 (po                               | ort 0)                            |              |
| Downlink                             | $ ho_{\scriptscriptstyle A}$  | dB  |                                      | (                                   | )                                 |              |
| power $\rho_{\scriptscriptstyle B}$  |   | dB  |                                      | (                                   | )                                 |              |
| allocation                           | σ   | dB  |                                      | (                                   | )                                 |              |
| Uplink                               | downlink  |   |                                      | ,                                   | 2                                 |              |
|                                      | guration  |   |                                      | 4                                   | <u>_</u>                          |              |
|                                      | subframe  |   |                                      | 4                                   | 1                                 |              |
|                                      | guration<br>(Note 3)  | dB  | 8                                    | 9                                   | 13                                | 14           |
|                                      |   |   |                                      |                                     |                                   |              |
| 1                                    | (j)<br>or   | dB[mW/15kHz]  | -90                                  | -89                                 | -85                               | -84          |
| Ν                                    | $V_{oc}^{(j)}$  | dB[mW/15kHz]  | -6                                   | 98                                  | -9                                | 8            |
| Propagat                             | ion channel   |   | Clause                               | B.2.4 wit                           | th $	au_d=0$                      | .45 μs,      |
|                                      |   |   |                                      | a=1, f                              | $_{D} = 5  \text{Hz}$             |              |
|                                      | periodicity   | ms  |                                      | <u>N<sub>P</sub></u>                | = 5                               |              |
|                                      | delay<br>channel for  | ms  |                                      | 10 c                                | or 11                             |              |
|                                      | eporting  |   |                                      | PUSCH                               | (Note 4)                          |              |
| PUCCH Report Type                    |   |   | 4                                    |                                     |                                   |              |
| for wideband CQI                     |   |   | •                                    |                                     |                                   |              |
| PUCCH Report Type<br>for subband CQI |   |   | 1                                    |                                     |                                   |              |
|                                      | per of HARQ   |   | 1                                    |                                     |                                   |              |
|                                      | nissions  |   |                                      |                                     |                                   |              |
|                                      | nd size ( <i>k</i> )  | RBs   |                                      | 6 (full                             | size)                             |              |
|                                      | of bandwidth<br>rts ( <i>J</i> )  |   | 3                                    |                                     |                                   |              |
| pu                                   | K   |   | 1                                    |                                     |                                   |              |
| cqi-pmi-(                            | ConfigIndex   |   |                                      | 3                                   | 3                                 |              |
| ACK/NAC                              | K feedback  |   | Multiplexing                         |                                     |                                   |              |
|                                      | ode   |   |                                      | -                                   | -                                 |              |
|                                      | subframe SF#<br>not later than<br>cannot be app   | nts in an available u<br>th based on CQI es<br>SF#(n-4), this repor<br>blied at the eNB dow | timation a<br>ted subb<br>vnlink bei | at a down<br>and or wi<br>fore SF#( | ilink subfr<br>ideband (<br>n+4). | CQI          |
| Note 2:                              |   | easurement channel<br>e/two sided dynamic   |                                      |                                     |                                   | -            |
|                                      |   | Annex A.5.2.1/2.  |                                      |                                     |                                   |              |
| Note 3:                              | least one of th   | the minimum requi<br>ne two SNR(s) and t  |                                      |                                     |                                   |              |
| Note 4:                              | level.<br>To avoid collisions between CQI reports and HARQ-ACK it is<br>necessary to report both on PUSCH instead of PUCCH. PDCCH<br>DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow<br>periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink |   |                                      |                                     |                                   | CCH<br>allow |
|                                      | subframe SF#7 and #2.<br>CQI reports for the short subband (having 2RBs in the last<br>bandwidth part) are to be disregarded and data scheduling<br>according to the most recent subband CQI report for bandwidth par<br>with j=1.  |   |                                      |                                     |                                   | dth part     |
| Note 6:                              |   | nere wideband CQI cording to the most   |                                      |                                     |                                   | l            |

# Table 9.3.4.2.2-1 Sub-band test for single antenna transmission (TDD)

|             | Test 1 | Test 2 |
|-------------|--------|--------|
| γ           | 1.15   | 1.15   |
| UE Category | ≥1     | ≥1     |

#### Table 9.3.4.2.2-2 Minimum requirement (TDD)

# 9.3.5 Additional requirements for enhanced receiver Type A

The purpose of the test is to verify that the reporting of the channel quality is based on the receiver of the enhanced Type A. Performance requirements are specified in terms of the relative increase of the throughput obtained when the transport format is that indicated by the reported CQI subject to an interference model compared to the case with a white Gaussian noise model, and a requirement on the minimum BLER of the transmitted transport formats indicated by the reported CQI subject to an interference model.

# 9.3.5.1 Minimum requirement PUCCH 1-0 (Cell-Specific Reference Symbol)

#### 9.3.5.1.1 FDD

For the parameters specified in Table 9.3.5.1.1-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in Table 9.3.5.1.1-2 and by the following

- a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to a white Gaussian noise source shall be  $\geq \gamma$ ;
- b) when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP, the average BLER for the indicated transport formats shall be greater than or equal to 2%.

|   | ameter  | Unit                | Cell 1              | Cell 2          |  |
|---|---|---------------------|---------------------|-----------------|--|
| Bandwidth   |   | MHz                 |                     | MHz             |  |
| Transmission mode   |   |                     | ů                   | ort 0)          |  |
|   | lic Prefix  |                     | Normal              | Normal          |  |
|   | ell ID  |                     | 0                   | 1               |  |
| SINF  | R (Note 8)  | dB                  | -2                  | N/A             |  |
|   | $N_{oc}^{(j)}$  | dB[mW/15kHz]        | -98                 | N/A             |  |
| Propaga   | tion channel  |                     | EPA5                | Static (Note 7) |  |
| Corre   | lation and  |                     | Low (1 x 2)         | (1 x 2)         |  |
| antenna   | configuration   |                     | LOW (1 X Z)         | (1 X Z)         |  |
|   | (Note 4)  | dB                  | N/A                 | -0.41           |  |
| Re  | ference   |                     | Note 2              | N/A             |  |
| measure   | ment channel  |                     |                     | -               |  |
| Repor   | ting mode   |                     | PUCCH 1-0           | N/A             |  |
| Reportin  | ng periodicity  | ms                  | $N_{\rm pd} = 2$    | N/A             |  |
|   | l delay   | ms                  | 8                   | N/A             |  |
|   | I channel for<br>reporting  |                     | PUSCH (Note<br>3)   | N/A             |  |
| PUCCH   | Report Type   |                     | 4                   | N/A             |  |
|   | qi-pmi-   |                     |                     |                 |  |
| Configu   | irationIndex  |                     | 1                   | N/A             |  |
|   | ber of HARQ   |                     | 1                   | N/A             |  |
| Note 1:   |   | rts in an available | unlink reporting in | stance at       |  |
| <ul> <li>than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)</li> <li>Note 2: Reference measurement channel RC.1 FDD according to Table A.4-1 for Category 2-8 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1 and RC.4 FDD according to Table A.4-1 for Category 1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.</li> <li>Note 3: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.</li> <li>Note 4: The respective received power spectral density of each interfering</li> </ul> |   |                     |                     |                 |  |
| $\begin{array}{llllllllllllllllllllllllllllllllllll$  |   |                     |                     |                 |  |
| Note 8:<br>Note 9:  | 8: SINR corresponds to $\hat{E}_s / N_{oc}$ of Cell 1 as defined in clause 8.1.1. |                     |                     |                 |  |

 Table 9.3.5.1.1-1 Fading test for single antenna (FDD)

Table 9.3.5.1.1-2 Minimum requirement (FDD)

| γ           | 1.8 |
|-------------|-----|
| UE Category | ≥1  |

#### 9.3.5.1.2 TDD

For the parameters specified in Table 9.3.5.1.2-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in 9.3.5.1.2-2 and by the following

- a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to a white Gaussian noise source shall be  $\geq \gamma$ ;
- b) when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP, the average BLER for the indicated transport formats shall be greater than or equal to 2%.

|  |  |   | <b>•</b> " <i>i</i>                 | 0.110                        |  |
|--|--|---|-------------------------------------|------------------------------|--|
|  | ameter   | Unit  | Cell 1                              | Cell 2                       |  |
| Bandwidth<br>Transmission mode         |  | MHz   |                                     | MHz                          |  |
|  |  |   | 1 (po                               | ort 0)                       |  |
| Uplink downlink<br>configuration       |  |   |                                     | 2                            |  |
|  | ll subframe  |   |                                     |                              |  |
|  | iguration  |   | 4                                   | 4                            |  |
|  | lic Prefix   |   | Normal                              | Normal                       |  |
|  |  |   | 0                                   | 1                            |  |
| -                                      | R (Note 8)   | dB  | -2                                  | N/A                          |  |
|  | · · · · ·  |   |                                     |                              |  |
|  | $N_{oc}^{(j)}$   | dB[mW/15kHz]  | -98                                 | -98                          |  |
|  | tion channel   |   | EPA5                                | Static (Note 7)              |  |
|  | configuration  |   | Low (1 x 2)                         | (1 x 2)                      |  |
|  | (Note 4)   | dB  | N/A                                 | -0.41                        |  |
|  | ference  |   | Note 2                              | N1/A                         |  |
| measure                                | ment channel   |   | Note 2                              | N/A                          |  |
|  | ting mode  |   | PUCCH 1-0                           | N/A                          |  |
| Reportin                               | ng periodicity   | ms  | $N_{\rm pd} = 5$                    | N/A                          |  |
| CC                                     | l delay  | ms  | 10 or 11                            | N/A                          |  |
|  | l channel for  |   | PUSCH (Note                         | N/A                          |  |
|  | reporting  |   | 3)                                  |                              |  |
|  | Report Type  |   | 4                                   | N/A                          |  |
|  | qi-pmi-<br>ırationIndex  |   | 3                                   | N/A                          |  |
| Max number of HARQ                     |  |   | 1                                   | N/A                          |  |
|  | missions<br>CK feedback  |   |                                     |                              |  |
|  | node   |   | Multiplexing                        | N/A                          |  |
| Note 1: If the UE repo<br>subframe SF# |  | rts in an available u<br>n based on CQI es<br>n, this reported wide   | timation at a down                  | link SF not later            |  |
| Note 2:                                | Reference me<br>A.4-1 for Cate<br>TDD as descr   | before SF#(n+4)<br>easurement channe<br>egory 2-8 with one s<br>ibed in Annex A.5.2<br>or Category 1 with o | ided dynamic OCI<br>.1 and RC.4 TDD | NG Pattern OP.1 according to |  |
| Note 3:                                | <ul> <li>Table A.4-1 for Category 1 with one/two sided dynamic OCNG<br/>Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.</li> <li>Note 3: To avoid collisions between CQI reports and HARQ-ACK it is<br/>necessary to report both on PUSCH instead of PUCCH. PDCCH<br/>DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow<br/>periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink<br/>subframe SF#7 and #2.</li> </ul> |   |                                     |                              |  |
| Note 4:                                | The respective   | e received power spin $N_{oc}$ is defined by  |                                     |                              |  |
| Note 5:<br>Note 6:<br>Note 7:          | specified in clause B.5.1.<br>Two cells are considered in which Cell 1 is the serving cell and Cell<br>2 is the interfering cell. The number of the CRS ports in both cells is<br>the same. Intefering cell is fully loaded.<br>Both cells are time-synchronous.<br>Static channel is used for the interference model. In case for white<br>Gaussian noise model Cell 2 is not present.  |   |                                     |                              |  |
| Note 8:                                | SINR corresp   | onds to $ \widehat{E}_{s} / N_{oc}    e$  | of Cell 1 as define                 | d in clause                  |  |
| Note 9:                                |  | sical channel setup<br>defined in Annex A   |                                     | OCNG pattern                 |  |

| Table 9.3.5.1.2-1 | Fading test for | single antenna (TE | )D) |
|-------------------|-----------------|--------------------|-----|
|-------------------|-----------------|--------------------|-----|

| Tab | le 9 | .3.5. | 1.2-2 | Minimum | requiremen | t (TDD) | ) |
|-----|------|-------|-------|---------|------------|---------|---|
|-----|------|-------|-------|---------|------------|---------|---|

| γ           | 1.8 |
|-------------|-----|
| UE Category | ≥1  |

## 9.3.5.2 Minimum requirement PUCCH 1-1 (CSI Reference Symbol)

## 9.3.5.2.1 FDD

For the parameters specified in Table 9.3.5.2.1-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in Table 9.3.5.2.1-2 and by the following

- a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to a white Gaussian noise source shall be  $\geq \gamma$ ;
- b) when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP, the average BLER for the indicated transport formats shall be greater than or equal to 2%.

| <b></b>  |   | 0.114                  | 0.110                      |  |  |  |  |
|--|---|------------------------|----------------------------|--|--|--|--|
| Parameter<br>Bandwidth   | Unit<br>MHz   | Cell 1                 | Cell 2<br>MHz              |  |  |  |  |
| Transmission mode  | IVINZ   |                        | 9                          |  |  |  |  |
| Cyclic Prefix  |   | Normal                 | Normal                     |  |  |  |  |
| Cell ID  |   | 0                      | 1                          |  |  |  |  |
| SINR (Note 8)  | dB  | -2                     | N/A                        |  |  |  |  |
| $N_{oc}^{(j)}$   | dB[mW/15kHz]  | -98                    | N/A                        |  |  |  |  |
| Propagation channel  |   | EPA5                   | Static (Note 7)            |  |  |  |  |
| Correlation and antenna configuration  |   | Low (2 x 2)            | (1 x 2)                    |  |  |  |  |
| DIP (Note 4)   | dB  | N/A                    | -0.41                      |  |  |  |  |
| Cell-specific reference  | uD  | Antenna ports          | Antenna port 0             |  |  |  |  |
| signals  |   | 0,1                    |                            |  |  |  |  |
| CSI reference signals  |   | Antenna ports<br>15,16 | N/A                        |  |  |  |  |
| CSI-RS periodicity and<br>subframe offset  |   | 5/1                    | N/A                        |  |  |  |  |
| CSI-RS reference<br>signal configuration   |   | 2                      | N/A                        |  |  |  |  |
| Zero-power CSI-RS  |   |                        |                            |  |  |  |  |
| configuration<br>I <sub>CSI-RS</sub> /<br>ZeroPowerCSI-RS<br>bitmap                        | Subframes /<br>bitmap   | N/A                    | 1 /<br>001000000000<br>000 |  |  |  |  |
| CodeBookSubsetRestr<br>iction bitmap   |   | 001111                 | N/A                        |  |  |  |  |
| Reference<br>measurement channel   |   | Note 2                 | N/A                        |  |  |  |  |
| Reporting mode   |   | PUCCH 1-1              | N/A                        |  |  |  |  |
| Reporting periodicity  | ms  | $N_{\rm pd} = 5$       | N/A                        |  |  |  |  |
| CQI delay  | ms  | 8                      | N/A                        |  |  |  |  |
| Physical channel for<br>CQI/PMI reporting  |   | PUSCH (Note 3)         | N/A                        |  |  |  |  |
| PUCCH Report Type<br>for CQI/PMI   |   | 2                      | N/A                        |  |  |  |  |
| PUCCH channel for RI<br>reporting  |   | PUCCH<br>Format 2      | N/A                        |  |  |  |  |
| PUCCH Report Type<br>for RI  |   | 3                      | N/A                        |  |  |  |  |
| cqi-pmi-   |   |                        | N. / A                     |  |  |  |  |
| ConfigurationIndex   |   | 2                      | N/A                        |  |  |  |  |
| ri-ConfigIndex   |   | 1                      | N/A                        |  |  |  |  |
| Max number of HARQ   |   | 1                      | N/A                        |  |  |  |  |
| transmissions  |   | -                      | -                          |  |  |  |  |
| subframe SF#<br>than SF#(n-4<br>eNB downlink<br>Note 2: Reference me<br>A.4-1 with on      | <ul> <li>Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)</li> <li>Note 2: Reference measurement channel RC.11 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as</li> </ul> |                        |                            |  |  |  |  |
| Note 3: To avoid collis<br>necessary to<br>DCI format 0<br>periodic CQI/<br>uplink subfrar | necessary to report both on PUSCH instead of PUCCH. PDCCH<br>DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow<br>periodic CQI/ PMI to multiplex with the HARQ-ACK on PUSCH in<br>uplink subframe SF#0 and #5.   |                        |                            |  |  |  |  |
|  | : The respective received power spectral density of each interfering cell relative to $N_{ac}$ is defined by its associated DIP value as  |                        |                            |  |  |  |  |
| specified in cl<br>Note 5: Two cells are   | specified in clause B.5.1.<br>Two cells are considered in which Cell 1 is the serving cell and Cell   |                        |                            |  |  |  |  |
| Note 6: Both cells are<br>Note 7: Static channe  | time-synchronous  | erference model.       | 5                          |  |  |  |  |

| Table 9.3.5.2.1-1 | Fading | test for | single | antenna | (FDD) |
|-------------------|--------|----------|--------|---------|-------|
|-------------------|--------|----------|--------|---------|-------|

| Note 8: | SINR corresponds to ${ar E}_s/N_{oc}$ ´ of Cell 1 as defined in clause  |
|---------|---|
| Note 9: | 8.1.1.<br>Downlink physical channel setup in Cell 2 applies OCNG pattern<br>OP.1 FDD as defined in Annex A.5.1.1. |

Table 9.3.5.2.1-2 Minimum requirement (FDD)

| γ           | 1.8 |
|-------------|-----|
| UE Category | ≥1  |

#### 9.3.5.2.2 TDD

For the parameters specified in Table 9.3.5.2.2-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in 9.3.5.2.2-2 and by the following

- a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to a white Gaussian noise source shall be  $\geq \gamma$ ;
- b) when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP, the average BLER for the indicated transport formats shall be greater than or equal to 2%.

| Parameter   | Unit                  | Cell 1                     | Cell 2                     |  |  |  |  |
|---|-----------------------|----------------------------|----------------------------|--|--|--|--|
| Bandwidth   | MHz                   |                            | MHz                        |  |  |  |  |
| Transmission mode   |                       | ,                          | 9                          |  |  |  |  |
| Uplink downlink   |                       |                            | 2                          |  |  |  |  |
| configuration<br>Special subframe   |                       |                            |                            |  |  |  |  |
| configuration   |                       | 4                          | 1                          |  |  |  |  |
| Cyclic Prefix   |                       | Normal                     | Normal                     |  |  |  |  |
| Cell ID   |                       | 0                          | 1                          |  |  |  |  |
| SINR (Note 8)   | dB                    | -2                         | N/A                        |  |  |  |  |
|   | -                     |                            |                            |  |  |  |  |
|   | dB[mW/15kHz]          | -98                        | -98                        |  |  |  |  |
| Propagation channel<br>Correlation and  |                       | EPA5                       | Static (Note 7)            |  |  |  |  |
| antenna configuration   |                       | Low (2 x 2)                | (1 x 2)                    |  |  |  |  |
| DIP (Note 4)  | dB                    | N/A                        | -0.41                      |  |  |  |  |
| Cell-specific reference   | uВ                    | Antenna ports              | Antenna port 0             |  |  |  |  |
| signals   |                       | 0,1                        | Antenna port o             |  |  |  |  |
| CSI reference signals   |                       | Antenna ports<br>15,16     | N/A                        |  |  |  |  |
| CSI-RS periodicity and<br>subframe offset   |                       | 5/3                        | N/A                        |  |  |  |  |
| CSI-RS reference  |                       | 0                          | N1/A                       |  |  |  |  |
| signal configuration  |                       | 2                          | N/A                        |  |  |  |  |
| Zero-power CSI-RS<br>configuration<br>I <sub>CSI-RS</sub> /<br>ZeroPowerCSI-RS<br>bitmap  | Subframes /<br>bitmap | N/A                        | 3 /<br>00100000000<br>0000 |  |  |  |  |
| CodeBookSubsetRestr<br>iction bitmap  |                       | 001111                     | N/A                        |  |  |  |  |
| Reference<br>measurement channel  |                       | Note 2                     | N/A                        |  |  |  |  |
| Reporting mode  |                       | PUCCH 1-1<br>(Sub-mode: 2) | N/A                        |  |  |  |  |
| Reporting periodicity   | ms                    | $N_{\rm pd} = 5$           | N/A                        |  |  |  |  |
| CQI delay   | ms                    | 10                         | N/A                        |  |  |  |  |
| Physical channel for  |                       | PUSCH (Note                | N1/A                       |  |  |  |  |
| CQI/PMI reporting   |                       | 3)                         | N/A                        |  |  |  |  |
| PUCCH Report Type   |                       | 2c                         | N/A                        |  |  |  |  |
| for CQI/PMI   |                       |                            | IN/A                       |  |  |  |  |
| Physical channel for RI reporting   |                       | PUCCH<br>Format 2          | N/A                        |  |  |  |  |
| PUCCH Report Type   |                       |                            |                            |  |  |  |  |
| for RI  |                       | 3                          | N/A                        |  |  |  |  |
| cqi-pmi-<br>ConfigurationIndex  |                       | 3                          | N/A                        |  |  |  |  |
| ri-ConfigIndex  |                       | 805 (Note 9)               | N/A                        |  |  |  |  |
| Max number of HARQ  |                       | 1                          | N/A                        |  |  |  |  |
| transmissions<br>ACK/NACK feedback  |                       |                            |                            |  |  |  |  |
| mode  |                       | Multiplexing               | N/A                        |  |  |  |  |
| <ul> <li>Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)</li> <li>Note 2: Reference measurement channel RC.11 TDD according to Table</li> </ul>   |                       |                            |                            |  |  |  |  |
| <ul> <li>A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.</li> <li>Note 3: To avoid collisions between CQI/ PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI/ PMI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#2 and #7.</li> <li>Note 4: The respective received power spectral density of each interfering</li> </ul> |                       |                            |                            |  |  |  |  |

|          | cell relative to $N_{_{oc}}$ ´ is defined by its associated DIP value as   |
|----------|--|
|          | specified in clause B.5.1.   |
| Note 5:  | Two cells are considered in which Cell 1 is the serving cell and Cell 2 is the interfering cell. Intefering cell is fully loaded.  |
| Note 6:  | Both cells are time-synchronous.   |
| Note 7:  | Static channel is used for the interference model. In case for white Gaussian noise model Cell 2 is not present.   |
| Note 8:  | SINR corresponds to $ \widehat{E}_{s} ig / N_{oc}   $ of Cell 1 as defined in clause   |
|          | 8.1.1.   |
| Note 9:  | RI reporting interval is set to the maximum allowable length of<br>160ms to minimise collisions between RI, CQI/PMI and HARQ-ACK<br>reports. In the case when all three reports collide, it is expected that<br>CQI/PMI reports will be dropped, while RI and HARQ-ACK will be<br>multiplexed. At eNB, CQI report collection shall be skipped every<br>160ms during performance verification and the reported CQI in<br>subframe SF#7 of the previous frame is applied in downlink<br>subframes until a new CQI (after CQI/PMI dropping) is available. |
| Note 10: |  |
|          | OP.1 TDD as defined in Annex A.5.2.1.  |

Table 9.3.5.2.2-2 Minimum requirement (TDD)

| γ           | 1.8 |
|-------------|-----|
| UE Category | ≥1  |

# 9.3.6 Minimum requirement (With multiple CSI processes)

The purpose of the test is to verify the reporting accuracy of the CQI and the UE processing capability for multiple CSI processes. Each CSI process is associated with a CSI-RS resource and a CSI-IM resource as shown in Table 9.3.6-1. For UE supports one CSI process, CSI process 2 is configured and the corresponding requirements shall be fulfilled. For UE supports three CSI processes, CSI processes 0, 1 and 2 are configured and the corresponding requirements shall be fulfilled. For UE supports four CSI processes, CSI processes 0, 1, 2 and 3 are configured and the corresponding requirements shall be fulfilled.

| Table 9.3.6-1 | Configuration of | CSI processes |
|---------------|------------------|---------------|
|---------------|------------------|---------------|

|                 | CSI process 0     | CSI process 1     | CSI process 2     | CSI process 3     |
|-----------------|-------------------|-------------------|-------------------|-------------------|
| CSI-RS resource | CSI-RS signal 0   | CSI-RS signal 1   | CSI-RS signal 0   | CSI-RS signal 1   |
| CSI-IM resource | CSI-IM resource 0 | CSI-IM resource 0 | CSI-IM resource 1 | CSI-IM resource 2 |

# 9.3.6.1 FDD

For the parameters specified in Table 9.3.6.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.6.1-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least  $\alpha$ % of the time but less than  $\beta$ % for each sub-band for CSI process 1, 2, or 3;
- b) a CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least  $\delta$ % of the time for CSI process 0;
- c) the difference of the median CQIs of the reported wideband CQI for configurated CSI processes shall be greater or equal to the values as in Table 9.3.6.1-3;
- d) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set *S* shall be  $\geq \gamma$ ;

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e) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.02.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD. Sub-bands of a size smaller than full size are excluded from the test.

| Table 9.3.6.1-1 | Fading test for FDD |
|-----------------|---------------------|
|-----------------|---------------------|

|                     |  | Unit         |                       | Tes   | st 1  |                   |                   | Te                 | st 2  |                     |
|---------------------|--|--------------|-----------------------|-------|---|-------------------|-------------------|--------------------|---|---------------------|
| Para                | Parameter  |              | TF                    |       |   | 22                | TP1 TP2           |                    |   | P2                  |
|                     | Bandwidth  |              | 10 MHz                |       | 10 MHz  |                   |                   |                    |   |                     |
| Transmis            | sion mode  |              | 1                     | 0     | 1   | 0                 | 10 10             |                    | 0   |                     |
|                     | $ ho_{\scriptscriptstyle A}$                               | dB           |                       | (     | 0   |                   | 0                 |                    |   |                     |
| Downlink power      | $ ho_{\scriptscriptstyle B}$                               | dB           | 0                     |       | 0   |                   |                   |                    |   |                     |
| allocation          | $P_c$  | dB           | -3                    |       | (   | )                 | -                 | 3                  | (   | 0                   |
|                     | σ  | dB           |                       | -     | 3   |                   |                   | -                  | 3   |                     |
| SNR (               | Note 7)  | dB           | 10                    | 11    | 7   | 8                 | 14                | 15                 | 9   | 10                  |
| $\hat{I}_{a}$       | (j)<br>or  | dB[mW/15kHz] | -88                   | -87   | -91   | -90               | -84               | -85                | -89   | -88                 |
| N                   | (j)<br>oc  | dB[mW/15kHz] |                       | -6    | 98  |                   |                   | -(                 | 98  |                     |
| Propagatio          | on channel   |              |                       |       | Clause B.2.4.1<br>with<br>$\tau_d = 0.45 \mu s$ ,<br>a = 1,<br>$f_D = 5 Hz$ |                   | EPA 5 Low         |                    | Clause B.2.4.1<br>with<br>$\tau_d = 0.45 \mu$ s,<br>a = 1,<br>$f_D = 5 \text{Hz}$ |                     |
| Antenna co          | onfiguration   |              | 4x                    | 2     | 2   | k2                | 4                 | x2                 | 2   | x2                  |
|                     | ning Model   |              |                       |       | Section   |                   |                   |                    | n Section   |                     |
|                     | between TPs  | US           |                       |       | 0   |                   |                   |                    | 0   |                     |
|                     | et between TPs   | Hz           |                       |       | 0   |                   |                   |                    | 0   |                     |
| Cell-specific re    | ference signals  |              |                       |       | ports 0,1   |                   |                   |                    | ports 0,1   |                     |
|                     | signal 0   |              | Antenn<br>15,         |       | N   | /A                |                   | na ports<br>,18    | N   | /A                  |
|                     | and subframe offset / $\Delta_{\rm CSI-RS}$                |              | 5/1                   |       | N/A   |                   | 5                 | /1                 | N/A   |                     |
| CSI-RS 0 c          | onfiguration   |              | 0                     |       | N/A   |                   | 0                 |                    | N/A   |                     |
| CSI-RS              | signal 1   |              | N/A                   |       | Antenna ports<br>15,16  |                   | N/A               |                    |   | na ports<br>,16     |
|                     | and subframe offset / $\Delta_{\rm CSI-RS}$                |              | N/                    | 'A    | 5/1   |                   | N/A               |                    |   | /1                  |
| CSI-RS 1 c          | onfiguration   |              | N/                    | Ά     | 5   |                   | N                 | /A                 | į   | 5                   |
| Zero-power CSI-F    | RS 0 configuration<br>erCSI-RS bitmap                      |              | N/                    |       |   | /<br>000000<br>00 |                   | /A                 | 111000  | /<br>0000000<br>000 |
|                     | RS 1 configuration<br>rerCSI-RS bitmap                     |              | 1<br>001001<br>000    | 10000 | N   | /A                | 00100             | /<br>110000<br>000 | N   | /A                  |
| T <sub>CSI-RS</sub> | and subframe offset $/ \Delta_{CSI-RS}$                    |              | 5/                    | 1     | 5/1   |                   | 5                 | 5/1 5/1            |   | /1                  |
|                     | onfiguration   |              | 2                     | 2     | 2   | 2                 |                   | 2                  | 2   | 2                   |
|                     | and subframe offset / $\Delta_{\rm CSI-RS}$                |              | 5/                    | '1    | N   | /A                | 5                 | /1                 | N   | /A                  |
| CSI-IM 1 c          | onfiguration   |              | 6                     | 6     | N   | /A                | (                 | 6                  | N   | /A                  |
|                     | and subframe offset / $\Delta_{CSI-RS}$                    |              | N/                    | A     | 5   | /1                | N                 | /A                 | 5   | /1                  |
|                     | onfiguration   |              | N/A                   |       | 1   |                   | N/A               |                    |   | 1                   |
|                     | CSI-RS   |              |                       |       | RS 0  |                   |                   |                    | RS 0  |                     |
|                     | CSI-IM   |              |                       |       | SI-IM 0 CSI-IM 0  |                   |                   |                    |   |                     |
|                     | Reporting mode<br>CodeBookSubsetR                          |              | 0.40                  |       |   | 001               | 0.4               |                    | CH 1-1  | 001                 |
|                     | estriction bitmap<br>Reporting                             |              | 0x0000 0000 0000 0001 |       | 0x0000 0000 0000 00   |                   | 001               |                    |   |                     |
| CSI process 0       | periodicity  | ms           | $N_{\rm pd}=5$        |       |   | $N_{\rm pd}=5$    |                   |                    |   |                     |
|                     | CQI delay<br>Physical channel<br>for CQI/ PMI<br>reporting | ms           |                       |       | 0<br>(Note 6)   |                   | 10<br>PUSCH (Note |                    |   |                     |
|                     | PUCCH Report<br>Type for CQI/PMI                           |              |                       |       | 2   |                   | 2                 |                    |   |                     |
|                     | PUCCH channel  |              |                       | PUCCH | Format 2  |                   | PUCCH Format 2    |                    |   |                     |

|                   | for RI reporting                     |    |                           |                           |   |                           |
|-------------------|--------------------------------------|----|---------------------------|---------------------------|---|---------------------------|
|                   | PUCCH report<br>type for RI          |    | ;                         | 3                         | 3   | 3                         |
|                   | cqi-pmi-<br>ConfigurationIndex       |    | 2                         | 2                         | 2   | 2                         |
|                   | ri-ConfigIndex                       |    |                           | 1                         |   |                           |
|                   | CSI-RS                               |    | CSI-                      | RS 1                      | CSI-  | RS 1                      |
|                   | CSI-IM                               |    | CSI-                      | -IM 0                     | CSI-  | IM 0                      |
|                   | Reporting mode                       |    | PUSC                      | CH 3-1                    | PUSCH 3-1   |                           |
| CSI process 1     | CodeBookSubsetR<br>estriction bitmap |    | 000001                    |                           | 000   | 001                       |
|                   | Reporting interval<br>(Note 9)       | ms |                           | 5                         |   |                           |
|                   | CQI delay                            | ms |                           | 0                         |   |                           |
|                   | Sub-band size                        | RB |                           | l size)                   | $ \begin{array}{c c c c c c c c c c c c c c c c c c c $ |                           |
|                   | CSI-RS                               |    |                           | RS 0                      |   |                           |
|                   | CSI-IM                               |    |                           | -IM 1                     |   |                           |
| CSI process 2     | Reporting mode                       |    | PUSC                      | CH 3-1                    | PUSC  | H 3-1                     |
|                   | CodeBookSubsetR<br>estriction bitmap |    | 0x0000 0000 0000 0001     |                           | 0x0000 0000 0000 0001                                   |                           |
| · F · · · · · -   | Reporting interval<br>(Note 9)       | ms | 5                         |                           | 5   |                           |
|                   | CQI delay                            | ms | 10                        |                           | 10  |                           |
|                   | Sub-band size                        | RB | 6 (full size              |                           |   |                           |
|                   | CSI-RS                               |    | CSI-ŔŠ 1                  |                           |   |                           |
|                   | CSI-IM                               |    | CSI-IM 2                  |                           |   |                           |
|                   | Reporting mode                       |    | PUSCH 3-1                 |                           |   |                           |
| CSI process 3     | CodeBookSubsetR<br>estriction bitmap |    | 000001                    |                           |   |                           |
|                   | Reporting interval<br>(Note 9)       | ms | ť                         | 5                         | 5   |                           |
|                   | CQI delay                            | ms | 1                         | 0                         | 1   | 0                         |
|                   | Sub-band size                        | RB | 6 (ful                    | l size)                   | 6 (full   | size)                     |
| CSI process for F | DSCH scheduling                      |    | CSI pro                   | ocess 2                   | CSI pro   | cess 2                    |
|                   | ll ID                                |    | 0                         | 6                         |   |                           |
| Quasi-co-loc      | cated CSI-RS                         |    | CSI-RS 0                  | CSI-RS 1                  | CSI-RS 0  | CSI-RS 1                  |
| Quasi-co-lo       | ocated CRS                           |    | Same Cell ID<br>as Cell 1 | Same Cell ID<br>as Cell 2 |   | Same Cell ID<br>as Cell 2 |
| PMI for subframe  | 2, 3, 4, 7, 8 and 9                  |    | 0x0000 0000<br>0000 0001  | 100000                    | 0x0000 0000<br>0000 0001                                | 100000                    |
| PMI for subf      | rame 1 and 6                         |    | 0x0000 0000<br>0001 0000  | 100000                    | 0x0000 0000<br>0001 0000                                | 100000                    |
| Mox number of H   | ARQ transmissions                    |    | 1                         | N/A                       | 1   | N/A                       |

Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4).

Note 2: 3 symbols allocated to PDCCH.

Note 3: Reference measurement channel RC.12 FDD according to Table A.4-1. PDSCH transmission is scheduled on subframe 2, 3, 4, 7, 8 and 9 from TP1.

Note 4: TM10 OCNG as specified in A.5.1.8 is transmitted on subframe 1 and 6 from TP1.

Note 5: TM10 OCNG as specified in A.5.1.8 is transmitted on subframe 1, 2, 3, 4, 6, 7, 8 and 9 from TP2

Note 6: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#0 and #5.

Note 7: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.

Note 8: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#1 and #6 to allow aperiodic CQI/PMI/RI to be transmitted in uplink SF#0 and #5.

Note 9: For these sub-bands which are not selected for PDSCH transmission, TM10 OCNG should be transmitted.

|              | CSI process 0 | CSI process 1 | CSI process 2 | CSI process 3 |
|--------------|---------------|---------------|---------------|---------------|
| α[%]         | N/A           | 2             | 2             | 2             |
| $\beta$ [%]  | N/A           | 40            | 40            | 40            |
| $\delta$ [%] | 10            | N/A           | N/A           | N/A           |
| γ            | N/A           | N/A           | 1.02          | N/A           |
| UE Category  |               |               | ≥1            |               |

Table 9.3.6.1-2 Minimum requirement (FDD)

#### Table 9.3.6.1-3 Minimum median CQI difference between configured CSI processes (FDD)

|               | CSI process 1 | CSI process 2 | CSI process 3 |
|---------------|---------------|---------------|---------------|
| CSI process 0 | N/A           | 1             | 3             |
| UE Category   |               | ≥1            |               |

# 9.3.6.2 TDD

For the parameters specified in Table 9.3.6.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.6.2-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least  $\alpha$ % of the time but less than  $\beta$ % for each sub-band for CSI process 1, 2, or 3;
- b) a CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least  $\delta$ % of the time for CSI process 0;
- c) the difference of the median CQIs of the reported wideband CQI for configurated CSI processes shall be greater or equal to the values as in Table 9.3.6.2-3;
- d) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set *S* shall be  $\geq \gamma$ ;
- e) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.02.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD. Sub-bands of a size smaller than full size are excluded from the test.

| Parameter   |   | 11:4         | Test 1                     |                |  | Test 2                 |                             |       |                         |                      |  |
|---|---|--------------|----------------------------|----------------|--|------------------------|-----------------------------|-------|-------------------------|----------------------|--|
| Parameter   |   | Unit         | TP1 TP2                    |                | 22                                       | TP1 TP2                |                             |       |                         |                      |  |
| Bandwidth   |   | MHz          | 10 MH                      |                |  |                        | 10 MI                       |       |                         |                      |  |
| Transmission mode   |   |              | 10                         |                |  | 0                      | 10                          |       | 10                      |                      |  |
|   | Uplink downlink configuration<br>Special subframe configuration                   |              | 2 4                        |                | 2 4                                      |                        |                             | 2     | 2 4                     |                      |  |
|   |   | dB           | 0                          |                |  | <u>4</u> <u>4</u><br>0 |                             | +     |                         |                      |  |
|   | $\rho_A$  |              |                            |                |  | 0                      |                             |       |                         |                      |  |
| Downlink power<br>allocation  | $ ho_{\scriptscriptstyle B}$  | dB           |                            | (              |  |                        |                             |       | -                       |                      |  |
| anocation   | P <sub>c</sub>  | dB           | -3                         |                | 0  |                        | -3                          |       |                         | C                    |  |
|   | σ   | dB           |                            |                | 3  |                        |                             |       | 3                       |                      |  |
|   | Note 7)   | dB           | 10                         | 11             | 7  | 8                      | 14                          | 15    | 9                       | 10                   |  |
| I   | (j)<br>pr   | dB[mW/15kHz] | -88                        | -87            | -91                                      | -90                    | -84                         | -85   | -89                     | -88                  |  |
| N   | (j)<br>oc   | dB[mW/15kHz] | -98                        |                |  | -98                    |                             |       |                         |                      |  |
|   |   |              | 1                          |                | Clause                                   | B.2.4.1                |                             |       | Clause                  | B.2.4.1              |  |
|   |   |              |                            |                | with                                     |                        |                             |       |                         | ith                  |  |
| Propagati   | on channel  |              | EPA 5                      | 5 Low          | $\tau_d = 0.45 \mu \mathrm{s},$ $a = 1,$ |                        | EPA                         | 5 Low | $\tau_d = 0$            | ).45 <i>μ</i> s,     |  |
| -   |   |              |                            |                |  |                        |                             |       |                         | = 1,                 |  |
|   |   |              |                            |                | $f_D = 5 \mathrm{Hz}$                    |                        |                             |       | $f_D =$                 | = 5 Hz               |  |
|   | onfiguration  |              | 4>                         |                | 22                                       |                        | 4)                          |       |                         | x2                   |  |
|   | ning Model  |              | As sp                      |                | Section                                  | B.4.3                  | As sp                       |       | n Section B.4.3         |                      |  |
|   | between TPs<br>et between TPs   | us<br>Hz     |                            |                | 0<br>0                                   |                        | -                           |       | 0                       |                      |  |
|   | ference signals   | ΠΖ           | Antenna ports 0,1          |                |  | 0<br>Antenna ports 0,1 |                             |       |                         |                      |  |
|   | signal 0  |              | Antenna ports              |                | N/A                                      |                        | Antenna ports               |       | 1                       | /A                   |  |
|   | and subframe offset   |              | 15,, 18                    |                |  |                        | 15,, 18                     |       |                         | -                    |  |
| $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$                                    |   |              | 5/3                        |                | N/A                                      |                        | 5/3                         |       |                         | /A                   |  |
| CSI-RS 0 configuration  |   |              | 0                          |                | N,                                       |                        | 0                           |       | N/A                     |                      |  |
| CSI-RS  | signal 1  |              | N/A                        |                |  | a ports<br>16          | N/A                         |       | Antenna ports<br>15, 16 |                      |  |
|   | CSI-RS 1 periodicity and subframe offset<br>$T_{CSI-RS} / \Delta_{CSI-RS}$        |              | N/A                        |                | 5  | /3                     | N/A                         |       | 5                       | /3                   |  |
|   | onfiguration  |              | N/A                        |                |  | 5 N/A                  |                             | /A    | 5                       |                      |  |
|   | Zero-power CSI-RS 0 configuration<br>I <sub>CSI-RS</sub> / ZeroPowerCSI-RS bitmap |              | N/A                        |                | 3<br>111000<br>000                       | 000000                 | N/A                         |       | 11100                   | ; /<br>000000<br>000 |  |
| Zero-power CSI-RS 1 configuration<br>I <sub>CSI-RS</sub> / ZeroPowerCSI-RS bitmap |   |              | 3/<br>00100110000<br>00000 |                | N  | /A                     | 3 /<br>00100110000<br>00000 |       | N                       | /A                   |  |
|   | and subframe offset   |              | 5/                         | 3              | 5,                                       | /3                     | 5,                          | /3    | 5                       | /3                   |  |
|   | $T_{\text{CSI-RS}} / \Delta_{\text{CSI-RS}}$<br>CSI-IM 0 configuration            |              | 2                          | 2              | 2  | 2                      |                             | 2     |                         | 2                    |  |
|   | and subframe offset / $\Delta_{CSI-RS}$   |              | 5/                         | '3             | N  | /A                     | 5,                          | /3    | N                       | /A                   |  |
| CSI-IM 1 configuration  |   |              | 6                          | S              | N  | /A                     | 6                           | 6     | N                       | /A                   |  |
|   | and subframe offset   |              | N/                         | Ά              | 5,                                       | /3                     | N                           | /A    | 5                       | /3                   |  |
|   | $/\Delta_{CSI-RS}$  |              | N/                         |                |  | 1                      | N                           |       |                         | 1                    |  |
| 001-111/2 0   | CSI-RS  |              | 11/                        |                | RS 0                                     | •                      | 110                         |       | RS 0                    | •                    |  |
|   | CSI-IM  |              | CSI-IM                     |                | IM 0                                     |                        | CSI-IM 0                    |       |                         |                      |  |
|   | Reporting mode  |              | PUCC                       |                |  |                        | PUCCH 1-1                   |       |                         |                      |  |
|   | CodeBookSubsetR<br>estriction bitmap  |              | 0x0000 0000                |                | 0000 0000 0001                           |                        | 0x0000 0000 0000 000        |       | 001                     |                      |  |
| CSI process 0   | Reporting periodicity   | ms           | $N_{\rm pd} = 5$           |                |  | N <sub>pd</sub> = 5    |                             |       |                         |                      |  |
|   | CQI delay   | ms           |                            | 12             |  |                        | 12                          |       |                         |                      |  |
|   | Physical channel<br>for CQI/ PMI  |              |                            | PUSCH (Note 6) |  |                        | PUSCH (Note 6)              |       |                         |                      |  |
| reporting<br>PUCCH Report   |   |              | 2                          |                |  | 2                      |                             |       |                         |                      |  |

# Table 9.3.6.2-1 Fading test for TDD

|   | Turne for COL/DML  |                       |   |                                       |  |                 |  |
|---|--|-----------------------|---|---------------------------------------|--|-----------------|--|
|   | Type for CQI/PMI<br>PUCCH channel  |                       |   |                                       |  |                 |  |
|   | for RI reporting   |                       | PUCCH                                     | Format 2                              | PUCCH                                  | Format 2        |  |
|   | PUCCH report   |                       |   | 3 3                                   |  |                 |  |
|   | type for RI  |                       |   | 3                                     |  | 3               |  |
|   | cqi-pmi-<br>ConfigurationIndex   |                       | :   | 3                                     |  | 3               |  |
|   | ri-ConfigIndex   |                       | 805 (N                                    | ote 10)                               | 805 (Note 10)                          |                 |  |
|   | CSI-RS   |                       |   | RS 1                                  |  | RS 1            |  |
|   | CSI-IM   |                       |   | -IM 0                                 |  | ·IM 0           |  |
|   | Reporting mode   |                       | PUSCH 3-1                                 |                                       | PUSCH 3-1                              |                 |  |
|   | CodeBookSubsetR  |                       |   |                                       | 000001                                 |                 |  |
| CSI process 1                                       | estriction bitmap  |                       | 000                                       | 000001                                |  | 001             |  |
|   | Reporting interval<br>(Note 9)   | ms                    | Į   | 5                                     | 5                                      |                 |  |
|   | CQI delay  | ms                    | 12  |                                       | 12                                     |                 |  |
|   | Sub-band size  | RB                    | 6 (full size)                             |                                       | 6 (full size)                          |                 |  |
|   | CSI-RS   |                       |   | RS 0                                  |  | RS 0            |  |
|   | CSI-IM   |                       | CSI-                                      |                                       | CSI-                                   |                 |  |
|   | Reporting mode   |                       | PUSC                                      |                                       | PUSC                                   |                 |  |
|   | CodeBookSubsetR  |                       |   |                                       |  |                 |  |
| CSI process 2                                       | estriction bitmap  |                       | 0x0000 000                                | 0 0000 0001                           | 0x0000 000                             | 0 0000 0001     |  |
|   | Reporting interval   |                       |   | -                                     |  | _               |  |
|   | (Note 9)   | ms                    | Ę   | 5                                     | Ę                                      | 5               |  |
|   | CQI delay  | ms                    | 1   | 2                                     | 1                                      | 12              |  |
|   | Sub-band size  | RB                    | 6 (full size                              | e) (Note 8)                           | 6 (full size) (Note 8)                 |                 |  |
|   | CSI-RS   |                       | CSI-                                      | ŔŜ 1                                  | CSI-                                   |                 |  |
|   | CSI-IM   |                       | CSI-IM 2                                  |                                       | CSI-IM 2                               |                 |  |
|   | Reporting mode   |                       | PUSCH 3-1                                 |                                       | PUSCH 3-1                              |                 |  |
|   | CodeBookSubsetR  |                       | 000001                                    |                                       | 000001                                 |                 |  |
| CSI process 3                                       | estriction bitmap  |                       | 000                                       | 1001                                  | 000001                                 |                 |  |
|   | Reporting interval<br>(Note 9)   | ms                    | 5   |                                       | 5                                      |                 |  |
|   | CQI delay  | ms                    | 1   | 2                                     | 12                                     |                 |  |
|   | Sub-band size  | RB                    | 6 (full size)                             |                                       | 6 (full size)                          |                 |  |
| CSI process for I                                   | DSCH scheduling  |                       | CSI pro                                   | ocess 2                               | CSI process 2                          |                 |  |
|   | ell ID   |                       | 0   | 6                                     | 0                                      | 6               |  |
| Quasi-co-lo   | cated CSI-RS   |                       | CSI-RS 0                                  | CSI-RS 1                              | CSI-RS 0                               | CSI-RS 1        |  |
| Quasi-co-l  | ocated CRS   |                       | Same Cell ID                              | Same Cell ID                          | Same Cell ID                           | Same Cell ID    |  |
|   |  |                       | as Cell 1                                 | as Cell 2                             | as Cell 1                              | as Cell 2       |  |
| PMI for sub   | frame 4and 9   |                       | 0x0000 0000<br>0000 0001                  | 100000                                | 0x0000 0000<br>0000 0001               | 100000          |  |
| PMI for sub   | frame 3 and 8  |                       | 0x0000 0000<br>0001 0000                  | 100000                                | 0x0000 0000<br>0001 0000               | 100000          |  |
| Max number of HARQ transmissions                    |  |                       | 1   | N/A                                   | 1                                      | N/A             |  |
|   | eedback mode   |                       | Multiplexing                              | N/A                                   | Multiplexing                           | N/A             |  |
| Note 1: If the UE<br>later than<br>Note 2: 3 symbol | reports in an available<br>SF#(n-4), this reported<br>s allocated to PDCCH.        | d wideband CQI canr   | nce at subframe S<br>not be applied at th | SF#n based on CO<br>ne eNB downlink b | QI estimation at a<br>before SF#(n+4). | downlink SF no  |  |
| and 9 fro   |  |                       | -   |                                       | ssion is schedule                      | d on subframe 4 |  |
|   | CNG is transmitted as s  |                       |   |                                       |  |                 |  |
|   | CNG is transmitted as s  |                       |   |                                       |  |                 |  |
| PDCCH   | collisions between CQI<br>DCI format 0 shall be tr                                 | ansmitted in downlinl |   |                                       |  |                 |  |
| Note 7: For each                                    | PUSCH in uplink SF#7<br>test, the minimum requ                                     |                       | filled for at least of                    | ne of the two SNF                     | R(s) and the respe                     | ctive wanted    |  |
|   | out level.<br>DCI format 0 with a trig   |                       | shall be transmitt                        | ed in downlink SF                     | #3 and #8 to allow                     | v aperiodic     |  |
| 1 .1 .1.1.1.1.                                      | /Pl to be transmitted in   | unlink SE#7 and #0    |   |                                       |  |                 |  |
|   | RI to be transmitted in  |                       | CH transmission                           | TM10 OCNG show                        | Ild he transmitted                     |                 |  |
| Note 9: For these                                   | /RI to be transmitted in<br>e sub-bands which are in<br>ing interval is set to the | not selected for PDS  |   |                                       |  |                 |  |

and HARQ-ACK will be multiplexed. At eNB, CQI report collection shall be skipped every 160ms during performance verification and the reported CQI in subframe SF#7 of the previous frame is applied in downlink subframes until a new CQI (after CQI/PMI dropping) is available.

|              | CSI process 0 | CSI process 1 | CSI process 2 | CSI process 3 |  |  |
|--------------|---------------|---------------|---------------|---------------|--|--|
| α[%]         | N/A           | 2             | 2             | 2             |  |  |
| β[%]         | N/A           | 40            | 40            | 40            |  |  |
| $\delta$ [%] | 10            | N/A           | N/A           | N/A           |  |  |
| γ            | N/A           | N/A           | 1.02          | N/A           |  |  |
| UE Category  | ≥1            |               |               |               |  |  |

Table 9.3.6.2-2 Minimum requirement (TDD)

Table 9.3.6.2-3 Minimum median CQI difference between configured CSI processes (TDD)

|               | CSI process 1 | CSI process 2 | CSI process 3 |
|---------------|---------------|---------------|---------------|
| CSI process 0 | N/A           | 1             | 3             |
| UE Category   |               | ≥1            |               |

# 9.4 Reporting of Precoding Matrix Indicator (PMI)

The minimum performance requirements of PMI reporting are defined based on the precoding gain, expressed as the relative increase in throughput when the transmitter is configured according to the UE reports compared to the case when the transmitter is using random precoding, respectively. When the transmitter uses random precoding, for each PDSCH allocation a precoder is randomly generated and applied to the PDSCH. A fixed transport format (FRC) is configured for all requirements.

The requirements for transmission mode 6 with 1 TX and transmission mode 9 with 4 TX are specified in terms of the ratio

$$\gamma = \frac{t_{ue}}{t_{rnd}} \, .$$

In the definition of  $\gamma$ , for PUSCH 3-1 single PMI and PUSCH 1-2 multiple PMI requirements,  $t_{rnd}$  is 60% of the maximum throughput obtained at  $SNR_{rnd}$  using random precoding, and  $t_{ue}$  the throughput measured at  $SNR_{rnd}$  with precoders configured according to the UE reports;

For the PUCCH 2-1 single PMI requirement,  $t_{rnd}$  is 60% of the maximum throughput obtained at  $SNR_{rnd}$  using random precoding on a randomly selected full-size subband in set S subbands, and  $t_{ue}$  the throughput measured at  $SNR_{rnd}$  with both the precoder and the preferred full-size subband applied according to the UE reports;

For PUSCH 2-2 multiple PMI requirements,  $t_{rnd}$  is 60% of the maximum throughput obtained at  $SNR_{rnd}$  using random precoding on a randomly selected full-size subband in set S subbands, and  $t_{ue}$  the throughput measured at  $SNR_{rnd}$  with both the subband precoder and a randomly selected full-size subband (within the preferred subbands) applied according to the UE reports.

The requirements for transmission mode 9 with 8 TX are specified in terms of the ratio

$$\gamma = \frac{t_{ue, follow1, follow2}}{t_{rnd1, rnd2}}$$

In the definition of  $\gamma$ , for PUSCH 3-1 single PMI and PUSCH 1-2 multiple PMI requirements,  $t_{follow1,follow2}$  is 70% of the maximum throughput obtained at  $SNR_{follow1,follow2}$  using the precoders configured according to the UE reports, and  $t_{rnd1, rnd2}$  is the throughput measured at  $SNR_{follow1, follow2}$  with random precoding.

# 9.4.1 Single PMI

# 9.4.1.1 Minimum requirement PUSCH 3-1 (Cell-Specific Reference Symbols)

#### 9.4.1.1.1 FDD

For the parameters specified in Table 9.4.1.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.1.1-2.

| Parameter   |                              | Unit         | Test 1    |
|---|------------------------------|--------------|-----------|
| Bandwidth   |                              | MHz          | 10        |
| Transmis  | sion mode                    |              | 6         |
| Propagat  | ion channel                  |              | EVA5      |
| Precoding   | g granularity                | PRB          | 50        |
|   | ation and onfiguration       |              | Low 2 x 2 |
| Downlink  | $ ho_{\scriptscriptstyle A}$ | dB           | -3        |
| power   | $ ho_{\scriptscriptstyle B}$ | dB           | -3        |
| allocation  | σ                            | dB           | 0         |
| $N_{oc}^{(j)}$  |                              | dB[mW/15kHz] | -98       |
| Report  | ing mode                     |              | PUSCH 3-1 |
| Reporti   | ng interval                  | ms           | 1         |
| PMI delay (Note 2)  |                              | ms           | 8         |
| Measurement channel   |                              |              | R. 10 FDD |
| OCNG Pattern  |                              |              | OP.1 FDD  |
| Max number of HARQ<br>transmissions   |                              |              | 4         |
| Redundancy version<br>coding sequence   |                              |              | {0,1,2,3} |
| Note 1: For random precoder selection, the pre<br>shall be updated in each TTI (1 ms gra  |                              |              |           |
| Note 2: If the UE reports in an available uplink reporting<br>instance at subrame SF#n based on PMI<br>estimation at a downlink SF not later than SF#(n-<br>4), this reported PMI cannot be applied at the<br>eNB downlink before SF#(n+4). |                              |              |           |

Table 9.4.1.1.1-1 PMI test for single-layer (FDD)

| Table 9.4.1.1.1-2 Minimum | requirement (FDD) |
|---------------------------|-------------------|
|---------------------------|-------------------|

| Parameter   | Test 1 |  |
|-------------|--------|--|
| γ           | 1.1    |  |
| UE Category | ≥1     |  |

## 9.4.1.1.2 TDD

For the parameters specified in Table 9.4.1.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in 9.4.1.1.2-2.

| Parameter   |                              | Unit                                | Test 1          |
|---|------------------------------|-------------------------------------|-----------------|
| Bandwidth   |                              | MHz                                 | 10              |
| Transmission mode   |                              |                                     | 6               |
|   | downlink                     |                                     | 4               |
|   | uration                      |                                     | 1               |
| Special   | subframe                     |                                     | 4               |
|   | uration                      |                                     | •               |
| Propagatio  | on channel                   |                                     | EVA5            |
|   | granularity                  | PRB                                 | 50              |
|   | tion and                     |                                     | Low 2 x 2       |
| antenna co  | onfiguration                 |                                     |                 |
| Downlink  | $ ho_{\scriptscriptstyle A}$ | dB                                  | -3              |
| power   | $ ho_{\scriptscriptstyle B}$ | dB                                  | -3              |
| allocation  | σ                            | dB                                  | 0               |
| N   | oc                           | dB[mW/15kHz]                        | -98             |
| Reporti   | ng mode                      |                                     | PUSCH 3-1       |
| Reportin  | g interval                   | ms                                  | 1               |
| PMI dela  | y (Note 2)                   | ms                                  | 10 or 11        |
| Measurem  | ent channel                  |                                     | R.10 TDD        |
|   | Pattern                      |                                     | OP.1 TDD        |
| Max numb  | er of HARQ                   |                                     | 4               |
|   | issions                      |                                     | 7               |
|   | ncy version                  |                                     | {0,1,2,3}       |
| coding sequence   |                              |                                     | [0,1,2,0]       |
| ACK/NACK feedback   |                              |                                     | Multiplexing    |
| mode  |                              |                                     |                 |
| Note 1: For random precoder selection, the precoder shall be updated in each available downlink |                              |                                     |                 |
| transmission instance.  |                              |                                     |                 |
| Note 2: If the UE reports in an available uplink reporting                                      |                              |                                     | plink reporting |
| instance at su  |                              | brame SF#n based on PMI             |                 |
|   |                              | a downlink SF not later than SF#(n- |                 |
| 4), this reported PMI cannot be applied a   |                              |                                     | oplied at the   |
| eNB downlink before SF#(n+4).   |                              |                                     |                 |

Table 9.4.1.1.2-1 PMI test for single-layer (TDD)

| Parameter   | Test 1 |  |
|-------------|--------|--|
| γ           | 1.1    |  |
| UE Category | ≥1     |  |

# 9.4.1.2 Minimum requirement PUCCH 2-1 (Cell-Specific Reference Symbols)

## 9.4.1.2.1 FDD

For the parameters specified in Table 9.4.1.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.2.1-2.

| Parameter   |   | Unit                  | Test 1                                |
|---|---|-----------------------|---------------------------------------|
| Bandwidth   |   | MHz                   | 10                                    |
| Transmission mode   |   |                       | 6                                     |
| Propagation channel   |   |                       | EVA5                                  |
|   | tion and onfiguration   |                       | Low 4 x 2                             |
| Downlink  | $ ho_{\scriptscriptstyle A}$  | dB                    | -6                                    |
| power   | $ ho_{\scriptscriptstyle B}$  | dB                    | -6                                    |
| allocation  | σ   | dB                    | 3                                     |
| N   | o(j)  | dB[mW/15kHz]          | -98                                   |
| PMI   | delay   | ms                    | 8 or 9                                |
|   | ng mode   |                       | PUCCH 2-1 (Note 6)                    |
|   | periodicity   | ms                    | $N_{\rm pd} = 2$                      |
|   | hannel for porting  |                       | PUSCH (Note 3)                        |
| PUCCH R   | eport Type<br>nd CQI/PMI  |                       | 2                                     |
|   | eport Type<br>and CQI   |                       | 1                                     |
|   | ent channel   |                       | R.14-1 FDD                            |
|   | Pattern   |                       | OP.1/2 FDD                            |
|   | granularity   | PRB                   | 6 (full size)                         |
| Number of bandwidth<br>parts (J)  |   |                       | 3                                     |
| ł   | <   |                       | 1                                     |
|   | onfigIndex  |                       | 1                                     |
|   | er of HARQ  |                       | 4                                     |
|   | issions   |                       | · · · · · · · · · · · · · · · · · · · |
|   | icy version<br>equence  |                       | {0,1,2,3}                             |
|   |   | recoder selection, th | ne precoder shall be updated          |
| Note 2: I   | every two TTI (2 ms granularity).   |                       |                                       |
| <ul> <li>Note 3: To avoid collisions between HARQ-ACK and wideband CQI/PMI or subband CQI, it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.</li> </ul> |   |                       |                                       |
| Note 4: F<br>F<br>t   | Reports for the short subband (having 2RBs in the last bandwidth part) are to be disregarded and instead data is to be transmitted on the most recently used subband for bandwidth part with j=1.   |                       |                                       |
| Note 5: In the case where wideband PMI is reported, data transmitted on the most recently used subband  |   |                       |                                       |
| Note 6: T<br>t<br>i   | transmitted on the most recently used subband.<br>The bit field for PMI confirmation in DCI format 1B shall be mapped<br>to "0" and TPMI information shall indicate the codebook index used<br>in Table 6.3.4.2.3-2 of TS36.211 [4] according to the latest PMI<br>report on PUCCH. |                       |                                       |

Table 9.4.1.2.1-1 PMI test for single-layer (FDD)

Table 9.4.1.2.1-2 Minimum requirement (FDD)

|             | Test 1 |
|-------------|--------|
| γ           | 1.2    |
| UE Category | ≥1     |

## 9.4.1.2.2 TDD

For the parameters specified in Table 9.4.1.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.2.2-2.

| Parameter  |  | Unit   | Test 1                             |  |
|--|--|--|------------------------------------|--|
| Bandwidth  |  | MHz  | 10                                 |  |
|  | sion mode  |  | 6                                  |  |
| Uplink downlink<br>configuration   |  |  | 1                                  |  |
|  | subframe<br>guration   |  | 4                                  |  |
|  | ion channel  |  | EVA5                               |  |
|  | ation and  |  |                                    |  |
|  | onfiguration   |  | Low 4 x 2                          |  |
| Downlink   | $ ho_{\scriptscriptstyle A}$   | dB   | -6                                 |  |
| power  | $ ho_{\scriptscriptstyle B}$   | dB   | -6                                 |  |
| allocation   | σ  | dB   | 3                                  |  |
| Ν  | $V_{oc}^{(j)}$   | dB[mW/15kHz]                                       | -98                                |  |
| PMI  | delay  | ms   | 10                                 |  |
|  | ing mode   |  | PUCCH 2-1 (Note 6)                 |  |
|  | periodicity  | ms   | $N_{\rm P}=5$                      |  |
| Physical   | channel for<br>eporting  |  | PUSCH (Note 3)                     |  |
|  | Report Type  |  |                                    |  |
| for wideba   | and CQI/PMI  |  | 2                                  |  |
|  | Report Type<br>band CQI  |  | 1                                  |  |
|  | nent channel   |  | R.14-1 TDD                         |  |
|  | Pattern  |  | OP.1/2 TDD                         |  |
|  | g granularity  | PRB  | 6 (full size)                      |  |
|  | f bandwidth  | TRD  | , <i>,</i>                         |  |
|  | ts (J)   |  | 3                                  |  |
| pu   | <u>K</u>   |  | 1                                  |  |
| cqi-pmi-0  | ConfigIndex  |  | 4                                  |  |
|  | per of HARQ  |  |                                    |  |
| transr   | nissions   |  | 4                                  |  |
| Redunda  | ncy version  |  | {0,1,2,3}                          |  |
|  | sequence   |  | {0,1,2,0}                          |  |
|  | CK fedback<br>ode  |  | Multiplexing                       |  |
|  |  | recoder selection, th                              | ne precoder shall be updated in    |  |
|  |  | e downlink transmis                                |                                    |  |
|  |  |  | plink reporting instance at        |  |
|  |  |  | imation at a downlink SF not later |  |
|  | than SF#(n-4)  | , this reported PMI                                | cannot be applied at the eNB       |  |
|  | downlink befo  |  |                                    |  |
| Note 3:  |  | sions between HARQ-ACK and wideband CQI/PMI or     |                                    |  |
|  |  | it is necessary to report both on PUSCH instead of |                                    |  |
| PUCCH. PDCCH DCI format 0 shall be transmitted in downlink   |  |  |                                    |  |
| SF#4 and #9 to allow periodic CQI to multiplex with the HARQ-ACH   |  |  |                                    |  |
| on PUSCH in uplink subframe SF#8 and #3.<br>Note 4: Reports for the short subband (having 2RBs in the last bandwidth |  |  |                                    |  |
| 1010 4.  | part) are to be disregarded and instead data is to be transmitted on |  |                                    |  |
|  | the most recently used subband for bandwidth part with j=1.          |  |                                    |  |
| Note 5:  |  |  |                                    |  |
|  |  | the most recently u                                |                                    |  |
|  |  |  | in DCI format 1B shall be mapped   |  |
|  |  |  | indicate the codebook index used   |  |
|  |  |  | [4] according to the latest PMI    |  |
| report on PUCCH.   |  |  |                                    |  |

Table 9.4.1.2.2-1 PMI test for single-layer (TDD)

| Table 9.4.1.2.2-2 Minimum | requirement | (TDD) |
|---------------------------|-------------|-------|
|---------------------------|-------------|-------|

|             | Test 1 |
|-------------|--------|
| γ           | 1.2    |
| UE Category | ≥1     |

# 9.4.1.3 Minimum requirement PUSCH 3-1 (CSI Reference Symbol)

#### 9.4.1.3.1 FDD

For the parameters specified in Table 9.4.1.3.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.3.1-2.

|  |  | -                     |                  |  |
|--|--|-----------------------|------------------|--|
| Parameter                                      |  | Unit                  | Test 1           |  |
| Bandwidth                                      |  | MHz                   | 10               |  |
| Transmission mode<br>Propagation channel       |  |                       | 9                |  |
|  |  | PRB                   | EPA5             |  |
| Corrolo  | granularity<br>tion and  | PKD                   | 50<br>Low        |  |
|  | onfiguration   |                       | ULA 4 x 2        |  |
|  | c reference  |                       | Antenna ports    |  |
| sigr   |  |                       | 0,1              |  |
|  |  |                       | Antenna ports    |  |
|  | nce signals  |                       | 15,,18           |  |
|  | ning model   |                       | Annex B.4.3      |  |
| CSI-RS per                                     | iodicity and   |                       | - / /            |  |
|  | ne offset  |                       | 5/ 1             |  |
|  | / <sub>Acsi-Rs</sub>   |                       |                  |  |
|  | figuration   |                       | 6                |  |
| CodeBook                                       | SubsetRestr  |                       | 0x0000 0000      |  |
| iction   |  |                       | 0000 FFFF        |  |
|  | $ ho_{\scriptscriptstyle A}$   | dB                    | 0                |  |
| Downlink                                       | $ ho_{\scriptscriptstyle B}$   | dB                    | 0                |  |
| power<br>allocation                            | Pc   | dB                    | -3               |  |
|  | σ  | dB                    | -3               |  |
| N  | (j)<br>oc  | dB[mW/15kHz]          | -98              |  |
|  | ng mode  |                       | PUSCH 3-1        |  |
|  | g interval   | ms                    | 5                |  |
|  | y (Note 2)   | ms                    | 8                |  |
| Measurement channel                            |  |                       | R.44 FDD         |  |
| OCNG   | Pattern  |                       | OP.1 FDD         |  |
|  | er of HARQ   |                       | 4                |  |
| transm   |  |                       |                  |  |
| Redundancy version<br>coding sequence          |  |                       | {0,1,2,3}        |  |
| Note 1: F                                      | equence  | recoder selection, th | • • • •          |  |
|  |  |                       |                  |  |
| Note 2:  | shall be updated in each TTI (1 ms granularity).<br>If the UE reports in an available uplink reporting |                       |                  |  |
|  | instance at subrame SF#n based on PMI  |                       |                  |  |
| estimation at a downlink SF not later than SF# |  |                       | ater than SF#(n- |  |
| 4  | ), this reported   | ed PMI cannot be a    |                  |  |
| e  | eNB downlink before SF#(n+4).  |                       |                  |  |
|  | PDSCH_RA= 0 dB, PDSCH_RB= 0 dB in order  |                       |                  |  |
|  | to have the same PDSCH and OCNG power per  |                       |                  |  |
| subcarrier at the receiver.                    |  |                       |                  |  |

#### Table 9.4.1.3.1-1 PMI test for single-layer (FDD)

| Parameter   | Test 1 |
|-------------|--------|
| γ           | 1.2    |
| UE Category | ≥1     |

#### Table 9.4.1.3.1-2 Minimum requirement (FDD)

#### 9.4.1.3.2 TDD

For the parameters specified in Table 9.4.1.3.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.3.2-2.

|  |  | -                    |                         |
|--|--|----------------------|-------------------------|
|  | neter  | Unit                 | Test 1                  |
| Band   |  | MHz                  | <u>10</u><br>9          |
|  | sion mode<br>Iownlink  |                      | 9                       |
|  | uration  |                      | 1                       |
|  | subframe   |                      |                         |
|  | uration  |                      | 4                       |
|  | on channel   |                      | EVA5                    |
|  | granularity  | PRB                  | 50                      |
| Antenna co   | onfiguration   |                      | 8 x 2                   |
| Correlation  | n modeling   |                      | High, Cross             |
|  |  |                      | polarized               |
|  | c reference  |                      | Antenna ports           |
| sigr   | nais   |                      | 0,1                     |
| CSI referen  | nce signals  |                      | Antenna ports<br>15,,22 |
| Beamform   | ning model   |                      | Annex B.4.3             |
|  | iodicity and   |                      | 7(IIIIOX D.4.0          |
|  | ne offset  |                      | 5/4                     |
| T <sub>CSI-RS</sub>  | / $\Delta_{CSI-RS}$  |                      |                         |
| CSI-RS r   | eference   |                      | 0                       |
| signal cor   | nfiguration  |                      |                         |
|  |  |                      | 0x0000 0000             |
|  | SubsetRestr  |                      | 001F FFE0               |
| iction   | bitmap   |                      | 0000 0000               |
|  |  |                      | FFFF                    |
|  | $ ho_{\scriptscriptstyle A}$   | dB                   | 0                       |
| Downlink   | $ ho_{\scriptscriptstyle B}$   | dB                   | 0                       |
| power  | Pc   | dB                   | -6                      |
| allocation   | FC   |                      | -                       |
|  | σ  | dB                   | -3                      |
| N  | (j)<br>oc  | dB[mW/15kHz]         | -98                     |
|  | ng mode  |                      | PUSCH 3-1               |
|  | g interval   | ms                   | 5                       |
|  | y (Note 2)   | ms                   | 10                      |
|  | , ,  |                      | R.45-1 TDD              |
|  |  |                      | for UE                  |
| Measurem   | ent channel  |                      | Category 1,             |
| Measurenn  |  |                      | R.45 TDD for            |
|  |  |                      | UE Category             |
|  | _  |                      | ≥2                      |
|  | Pattern  |                      | OP.1 TDD                |
|  | er of HARQ   |                      | 4                       |
| transm   |  |                      |                         |
|  | cy version<br>equence  |                      | {0,1,2,3}               |
|  | K feedback   |                      |                         |
|  | de   |                      | Multiplexing            |
| Note 1: For random precoder selection, the precoder  |  |                      | ne precoder             |
| shall be updated in each TTI (1 ms granularity).   |  |                      |                         |
| Note 2: If the UE reports in an available uplink reporting   |  |                      |                         |
| i  | nstance at su  | brame SF#n based     | on PMI                  |
|  |  | a downlink SF not la |                         |
| 4), this reported PMI cannot be applied at the   |  |                      |                         |
| eNB downlink before SF#(n+4).  |  |                      |                         |
| Note 3: PDCCH DCI format 0 with a trigger for aperiodic<br>CQI shall be transmitted in downlink SF#4 and # |  |                      |                         |
|  |  |                      |                         |
|  |  | odic CQI/PMI/RI to b | be transmitted          |
|  | on uplink SF#<br>Pandomizatio  |                      | am direction            |
|  | Note 4: Randomization of the principle beam direction shall be used as specified in B.2.3A.4 |                      |                         |
| 1 3  |  | as specified in D.Z. | л. <del>т</del>         |

Table 9.4.1.3.2-1 PMI test for single-layer (TDD)

| Table 9.4.1.3.2-2 Minimum | requirement | (TDD) |
|---------------------------|-------------|-------|
|---------------------------|-------------|-------|

| Parameter   | Test 1 |
|-------------|--------|
| γ           | 3      |
| UE Category | ≥1     |

# 9.4.1a Void

- 9.4.1a.1 Void
- 9.4.1a.1.1 Void
- 9.4.1a.1.2 Void
- 9.4.2 Multiple PMI

# 9.4.2.1 Minimum requirement PUSCH 1-2 (Cell-Specific Reference Symbols)

9.4.2.1.1 FDD

For the parameters specified in Table 9.4.2.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in 9.4.2.1.1-2.

|  | meter   | Unit         | Test 1   |
|--|---|--------------|--|
| Band   | lwidth  | MHz          | 10   |
| Transmis   | sion mode   |              | 6  |
|  | on channel  |              | EPA5   |
| Precoding granularity<br>(only for reporting and<br>following PMI)   |   | PRB          | 6  |
|  | tion and  |              | Low 2 x 2  |
| Downlink   | $ ho_{\scriptscriptstyle A}$  | dB           | -3   |
| power  | $ ho_{\scriptscriptstyle B}$  | dB           | -3   |
| allocation   | σ   | dB           | 0  |
|  | oc  | dB[mW/15kHz] | -98  |
|  | ng mode   |              | PUSCH 1-2  |
|  | g interval  | ms           | 1  |
| PMI  | delay   | ms           | 8  |
| Measurement channel  |   |              | R.11-3 FDD<br>for UE<br>Category 1,<br>R.11 FDD for<br>UE Category<br>≥2 |
| OCNG Pattern   |   |              | OP.1/2 FDD   |
| Max numb   | er of HARQ<br>iissions  |              | 4  |
| Redundancy version   |   | {0,1,2,3}    |  |
| Note 1:For random precoder selection, the precoders<br>shall be updated in each TTI (1 ms granularity).Note 2:If the UE reports in an available uplink reporting<br>instance at subrame SF#n based on PMI<br>estimation at a downlink SF not later than SF#(n- |   |              |  |
| Note 3: 0  | 4), this reported PMI cannot be applied at the<br>eNB downlink before SF#(n+4).<br>One/two sided dynamic OCNG Pattern OP.1/2<br>FDD as described in Annex A.5.1.1/2 shall be<br>used. |              |  |

Table 9.4.2.1.1-1 PMI test for single-layer (FDD)

 Table 9.4.2.1.1-2 Minimum requirement (FDD)

| Parameter   | Test 1 |
|-------------|--------|
| γ           | 1.2    |
| UE Category | ≥1     |

## 9.4.2.1.2 TDD

For the parameters specified in Table 9.4.2.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in 9.4.2.1.2-2.

| r  |   | 1             |                 |
|--|---|---------------|-----------------|
|  | meter   | Unit          | Test 1          |
|  | lwidth  | MHz           | 10              |
|  | sion mode   |               | 6               |
|  | downlink  |               | 1               |
|  | uration   |               |                 |
|  | subframe  |               | 4               |
|  | uration   |               | EPA5            |
|  | on channel  |               | EPAS            |
|  | granularity                                       | ססס           | C               |
| (only for re   | porting and ng PMI)                               | PRB           | 6               |
|  | tion and  |               |                 |
|  | onfiguration                                      |               | Low 2 x 2       |
|  |   | ٩D            | 2               |
| Downlink   | $\rho_{A}$  | dB            | -3              |
| power<br>allocation  | $ ho_{\scriptscriptstyle B}$                      | dB            | -3              |
| anocation  | σ   | dB            | 0               |
| N  | •(j)<br>oc  | dB[mW/15kHz]  | -98             |
| Reporti  | ng mode   |               | PUSCH 1-2       |
| Reportin   | g interval  | ms            | 1               |
| PMI  | delay   | ms            | 10 or 11        |
|  |   |               | R.11-3 TDD      |
|  |   |               | for UE          |
| Measurem   | ent channel                                       |               | Category 1      |
| modourom   |   |               | R.11 TDD for    |
|  |   |               | UE Category     |
|  |   |               | ≥2              |
|  | Pattern   |               | OP.1/2 TDD      |
|  | er of HARQ<br>iissions                            |               | 4               |
|  | icy version                                       |               |                 |
|  | equence   |               | {0,1,2,3}       |
|  | K feedback  |               |                 |
| ma   | ode   |               | Multiplexing    |
| Note 1: For random precoder selection, the precoders   |   |               |                 |
|  | shall be updated in each available downlink       |               |                 |
|  | transmission instance.                            |               |                 |
|  | · · · · · · · · · · · · · · · · · · ·             |               |                 |
| instance at subrame SF#n based on PMI  |   |               |                 |
|  | estimation at a downlink SF not later than SF#(n- |               |                 |
| <ul> <li>4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).</li> <li>Note 3: One/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2 shall be</li> </ul> |   | pplied at the |                 |
|  |   | ottorn OP 1/2 |                 |
|  |   |               |                 |
| used.  |   |               | . 1/2 311ali De |
|  |   |               |                 |

Table 9.4.2.1.2-1 PMI test for single-layer (TDD)

#### Table 9.4.2.1.2-2 Minimum requirement (TDD)

| Parameter   | Test 1 |
|-------------|--------|
| γ           | 1.2    |
| UE Category | ≥1     |

# 9.4.2.2 Minimum requirement PUSCH 2-2 (Cell-Specific Reference Symbols)

#### 9.4.2.2.1 FDD

For the parameters specified in Table 9.4.2.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.2.2.1-2.

| Para   | meter   | Unit   | Test 1        |  |
|--|---|--|---------------|--|
| Band   | width   | MHz  | 10            |  |
| Transmiss  | sion mode                                       |  | 6             |  |
| Propagatio   | on channel                                      |  | EVA5          |  |
| Correlat<br>antenna co   | tion and onfiguration                           |  | Low 4 x 2     |  |
| Downlink   | $ ho_{\scriptscriptstyle A}$                    | dB   | -6            |  |
| power  | $ ho_{\scriptscriptstyle B}$                    | dB   | -6            |  |
| allocation   | σ   | dB   | 3             |  |
| N  | (j)<br>oc                                       | dB[mW/15kHz]   | -98           |  |
| PMI  | delay   | ms   | 8             |  |
| Reportir   | ng mode   |  | PUSCH 2-2     |  |
| Reporting  | g interval                                      | ms   | 1             |  |
| Measureme  | ent channel                                     |  | R.14-2 FDD    |  |
| OCNG   | Pattern   |  | OP.1/2 FDD    |  |
| Subband  | d size ( <i>k</i> )                             | RBs  | 3 (full size) |  |
| Number of preferred 5<br>subbands ( <i>M</i> )   |   | 5  |               |  |
| Max number of HARQ<br>transmissions 4  |   | 4  |               |  |
|  | Redundancy version<br>coding sequence {0,1,2,3} |  | {0,1,2,3}     |  |
| Note 1:         For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity)           Note 2:         If the UE reports in an available uplink reporting instance at |   |  |               |  |
| ť  | han SF#(n-4)                                    | #n based on PMI estimation at a downlink SF not later<br>4), this reported PMI cannot be applied at the eNB<br>fore SF#(n+4) |               |  |

| Table 9.4.2.2.1-1 | PMI test for single | e-layer (FDD) |
|-------------------|---------------------|---------------|
|-------------------|---------------------|---------------|

| Table 9.4.2.2.1-2 | Minimum | requirement | (FDD) |
|-------------------|---------|-------------|-------|
|-------------------|---------|-------------|-------|

|             | Test 1 |
|-------------|--------|
| γ           | 1.2    |
| UE Category | ≥1     |

#### 9.4.2.2.2 TDD

For the parameters specified in Table 9.4.2.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.2.2.2-2.

| Parameter  |                               | Unit         | Test 1                       |
|--|-------------------------------|--------------|------------------------------|
| Bandwidth  |                               | MHz          | 10                           |
| Transmission mode  |                               |              | 6                            |
|  | lownlink                      |              | 1                            |
| config   |                               |              |                              |
| Special s<br>configi   | subframe<br>uration           |              | 4                            |
|  | on channel                    |              | EVA5                         |
| Correlat   | tion and<br>onfiguration      |              | Low 4 x 2                    |
|  |                               | dB           | -6                           |
| Downlink   | $ ho_{\scriptscriptstyle A}$  |              | -                            |
| power<br>allocation  | $ ho_{\scriptscriptstyle B}$  | dB           | -6                           |
| allocation   | σ                             | dB           | 3                            |
| N  | (j)<br>oc                     | dB[mW/15kHz] | -98                          |
| PMI  | delay                         | ms           | 10                           |
| Reportir   | ng mode                       |              | PUSCH 2-2                    |
| Reportin   |                               | ms           | 1                            |
| Measurement channel  |                               |              | R.14-2 TDD                   |
|  | Pattern                       |              | OP.1/2 TDD                   |
| Subband size (k)   |                               | RBs          | 3 (full size)                |
| Number of preferred subbands ( <i>M</i> )  |                               |              | 5                            |
| Max number of HARQ<br>transmissions  |                               |              | 4                            |
| Redundancy version   |                               |              | {0,1,2,3}                    |
| coding sequence  |                               |              |                              |
| mode   |                               |              | Multiplexing                 |
| Note 1: For random precoder selection, the precoders shall be updated in each available downlink transmission instance.                |                               |              |                              |
| Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later |                               |              |                              |
|  | han SF#(n-4)<br>Iownlink befo |              | cannot be applied at the eNB |

| Table 9.4.2.2.2-2 | Minimum | requirement | (TDD) |
|-------------------|---------|-------------|-------|
|-------------------|---------|-------------|-------|

|             | Test 1 |
|-------------|--------|
| γ           | 1.15   |
| UE Category | ≥1     |

# 9.4.2.3 Minimum requirement PUSCH 1-2 (CSI Reference Symbol)

#### 9.4.2.3.1 FDD

For the parameters specified in Table 9.4.2.3.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in 9.4.2.3.1-2.

|  | neter   | Unit                  | Test 1  |  |  |
|--|---|-----------------------|---|--|--|
|  | width   | MHz                   | 10  |  |  |
|  | sion mode   |                       | 9   |  |  |
|  | on channel  |                       | EVA5  |  |  |
|  | granularity   |                       | -   |  |  |
| only for re (only for re   | porting and ng PMI)   | PRB                   | 6   |  |  |
| Correla  | tion and  |                       | Low   |  |  |
|  | onfiguration  |                       | ULA 4 x 2   |  |  |
| Cell-specifi   | c reference   |                       | Antenna ports   |  |  |
| sigr   | nals  |                       | 0,1   |  |  |
| CSI refere   | nce signals   |                       | Antenna ports<br>15,,18   |  |  |
| Beamform   | ning model  |                       | Annex B.4.3   |  |  |
|  | iodicity and  |                       |   |  |  |
|  | ne offset   |                       | 5/ 1  |  |  |
| T <sub>CSI-RS</sub>  | / $\Delta_{csi-rs}$   |                       |   |  |  |
| CSI-RS r   | eference  |                       | 0   |  |  |
|  | nfiguration   |                       | 8   |  |  |
| CodeBookS  | SubsetRestr   |                       | 0x0000 0000   |  |  |
| iction   | bitmap  |                       | 0000 FFFF   |  |  |
|  | $\rho_{\scriptscriptstyle A}$   | dB                    | 0   |  |  |
| Downlink   | $ ho_{\scriptscriptstyle B}$  | dB                    | 0   |  |  |
| power<br>allocation  | Pc  | dB                    | -3  |  |  |
|  | σ   | dB                    | -3  |  |  |
| N  | (j)<br>oc   | dB[mW/15kHz]          | -98   |  |  |
| Reportir   | ng mode   |                       | PUSCH 1-2   |  |  |
| Reportin   | g interval  | ms                    | 5   |  |  |
| PMI  | delay   | ms                    | 8   |  |  |
| Measurement channel  |   |                       | R.45-1 FDD<br>for UE<br>Category 1,<br>R.45 FDD for<br>UE Category<br>≥2  |  |  |
| OCNG   | Pattern   |                       | OP.1 FDD  |  |  |
| Max numbe  | er of HARQ  |                       |   |  |  |
| transm   |   |                       | 4   |  |  |
|  | cy version  |                       | <i>(</i> <b>)</b> <i>( ) <i>( ) <i>( ) <i>( ) ( ) <i>( ) <i>( ) ( ) <i>( ) <i>( ) ( ) <i>( ) ( ) <i>( ) <i>( ) <i>( ) ( ) ( ) <i>( ) ( ) () ( ) <i>( ) () ( ) () () () ()</i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i></i> |  |  |
|  | equence   |                       | {0,1,2,3}   |  |  |
|  |   | recoder selection, th | e precoders   |  |  |
| shall be updated in each TTI (1 ms granularity).<br>Note 2: If the UE reports in an available uplink reporting<br>instance at subrame SF#n based on PMI<br>estimation at a downlink SF not later than SF#(n-<br>4), this reported PMI cannot be applied at the |   |                       |   |  |  |
| Note 3: C  | eNB downlink before SF#(n+4).<br>One/two sided dynamic OCNG Pattern OP.1/2<br>FDD as described in Annex A.5.1.1/2 shall be<br>used. |                       |   |  |  |
| Note 4: PDSCH _RA= 0 dB, PDSCH_RB= 0 dB in order<br>to have the same PDSCH and OCNG power per<br>subcarrier at the receiver.   |   |                       |   |  |  |

Table 9.4.2.3.1-1 PMI test for single-layer (FDD)

| Table 9.4.2.3.1-2 Minimum requirement | (FDD) |  |
|---------------------------------------|-------|--|
|                                       |       |  |

| Parameter   | Test 1 |
|-------------|--------|
| γ           | 1.3    |
| UE Category | ≥1     |

## 9.4.2.3.2 TDD

For the parameters specified in Table 9.4.2.3.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in 9.4.2.3.2-2.

| Parar   |  | Unit                          | Test 1  |  |
|---|--|-------------------------------|---|--|
| Band  |  | MHz                           | 10  |  |
| Transmiss   |  |                               | 9   |  |
| Uplink d<br>configu   |  |                               | 1   |  |
| Special s   |  |                               | 4   |  |
| configu   |  |                               | EVA5  |  |
| Propagatic<br>Precoding   |  |                               | EVAS  |  |
| (only for rep   |  | PRB                           | 6   |  |
| followin  |  | FILD                          | 0   |  |
| Antenna co  |  |                               | 8 x 2   |  |
| Correlation   |  |                               | High, Cross   |  |
| Cell-specifi  | -  |                               | polarized   |  |
| sigr  |  |                               | Antenna ports<br>0,1                                |  |
| CSI referer   | nce signals  |                               | Antenna ports<br>15,,22                             |  |
| Beamform  | ing model  |                               | Annex B.4.3   |  |
| CSI-RS per  |  |                               |   |  |
| subfram   |  |                               | 5/4   |  |
|   | $\Delta$ CSI-RS  |                               |   |  |
| CSI-RS r  |  |                               | 4   |  |
| signal con  | figuration   |                               | _   |  |
|   |  |                               | 0x0000 0000   |  |
| CodeBookS   |  |                               | 001F FFE0   |  |
| iction b  | bitmap   |                               | 0000 0000   |  |
|   |  |                               | FFFF  |  |
|   | $ ho_{\scriptscriptstyle A}$   | dB                            | 0   |  |
| Downlink<br>power   | $ ho_{\scriptscriptstyle B}$   | dB                            | 0   |  |
| allocation  | Pc   | db                            | -6  |  |
|   | σ  | dB                            | -3  |  |
| N   | (j)<br>90  | dB[mW/15kHz]                  | -98   |  |
| Reportin  | ig mode  |                               | PUSCH 1-2   |  |
| Reporting   | g interval   | ms                            | 5 (Note 4)  |  |
| PMI   | delay  | ms                            | 8   |  |
| Measureme   | ent channel  |                               | R.45-1 TDD<br>for UE<br>Category 1,<br>R.45 TDD for |  |
|   |  |                               | UE Category   |  |
|   | Dattern  |                               | ≥2<br>OP.1 TDD                                      |  |
| OCNG<br>Max numbe   |  |                               |   |  |
| transm  |  |                               | 4   |  |
| Redundan  | cy version   |                               | {0,1,2,3}   |  |
| coding se<br>ACK/NACK   |  |                               |   |  |
| mo  | de   | and an and a star of the star | Multiplexing  |  |
| Note 1:For random precoder selection, the precoders<br>shall be updated in each TTI (1 ms granularity).Note 2:If the UE reports in an available uplink reporting<br>instance at subrame SF#n based on PMI |  |                               |   |  |
| 4<br>e  | estimation at a downlink SF not later than SF#(n-<br>4), this reported PMI cannot be applied at the<br>eNB downlink before SF#(n+4).<br>ote 3: One/two sided dynamic OCNG Pattern OP.1/2 |                               |   |  |
| T<br>u  | TDD as described in Annex A.5.2.1/2 shall be used.   |                               |   |  |
| Note 4: PDCCH DCI format 0 with a trigger for aperio<br>CQI shall be transmitted in downlink SF#4 and<br>to allow aperiodic CQI/PMI/RI to be transmitted  |  |                               | ink SF#4 and #9                                     |  |

Table 9.4.2.3.2-1 PMI test for single-layer (TDD)

|         | on uplink SF#3 and #8.                        |
|---------|---|
| Note 5: | Randomization of the principle beam direction |
|         | shall be used as specified in B.2.3A.4.       |

#### Table 9.4.2.3.2-2 Minimum requirement (TDD)

| Parameter   | Test 1 |
|-------------|--------|
| γ           | 3.5    |
| UE Category | ≥1     |

- 9.4.3 Void
- 9.4.3.1 Void
- 9.4.3.1.1 Void
- 9.4.3.1.2 Void

# 9.5 Reporting of Rank Indicator (RI)

The purpose of this test is to verify that the reported rank indicator accurately represents the channel rank. The accuracy of RI (CQI) reporting is determined by the relative increase of the throughput obtained when transmitting based on the reported rank compared to the case for which a fixed rank is used for transmission. Transmission mode 4 is used with the specified CodebookSubSetRestriction in section 9.5.1, transmission mode 9 is used with the specified CodebookSubSetRestriction in section 9.5.2 and transmission mode 3 is used with the specified CodebookSubSetRestriction in section 9.5.3, and transmission mode 10 is used with the specified CodebookSubSetRestriction in section 9.5.5.

For fixed rank 1 transmission in sections 9.5.1, 9.5.2 and 9.5.5, the RI and PMI reporting is restricted to two singlelayer precoders, For fixed rank 2 transmission in sections 9.5.1, 9.5.2 and 9.5.5, the RI and PMI reporting is restricted to one two-layer precoder, For follow RI transmission in sections 9.5.1, 9.5.2, the RI and PMI reporting is restricted to select the union of these precoders. Channels with low and high correlation are used to ensure that RI reporting reflects the channel condition.

For fixed rank 1 transmission in section 9.5.3, the RI reporting is restricted to single-layer, for fixed rank 2 transmission in section 9.5.3, the RI reporting is restricted to two-layers. For follow RI transmission in section 9.5.3, the RI reporting is either one or two layers.

# 9.5.1 Minimum requirement (Cell-Specific Reference Symbols)

#### 9.5.1.1 FDD

The minimum performance requirement in Table 9.5.1.1-2 is defined as

a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be  $\geq \gamma_1$ ;

b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be  $\geq \gamma_2$ ;

For the parameters specified in Table 9.5.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.1.1-2.

| Parameter  |                              | Unit   | Test 1                  | Test 2              | Test 3        |
|--|------------------------------|--|-------------------------|---------------------|---------------|
| Bandwidth  |                              | MHz  |                         | 10                  |               |
| PDSCH transmission mode  |                              |  |                         | 4                   |               |
| $\rho_{\Lambda}$   |                              | dB   |                         | -3                  |               |
| Downlink power<br>allocation   | $ ho_{\scriptscriptstyle B}$ | dB   |                         | -3                  |               |
| allocation   | σ                            | dB   |                         | 0                   |               |
| Propagation condit<br>antenna configu  |                              |  |                         | 2 x 2 EPA5          |               |
| CodeBookSubsetRe   |                              |  |                         | 11 for fixed RI = 1 |               |
| bitmap   | 5511011011                   |  | 010000 for fixed RI = 2 |                     |               |
|  |                              |  | 010011                  | for UE reported     |               |
| Antenna correla  | ation                        |  | Low                     | Low                 | High          |
| RI configuration   | on                           |  | Fixed RI=2 and          | Fixed RI=1          | Fixed RI=1    |
|  |                              | 15   | follow RI               | and follow RI       | and follow RI |
| SNR  |                              | dB   | 0                       | 20                  | 20            |
| $N_{oc}^{(j)}$   |                              | dB[mW/15kHz]   | -98                     | -98                 | -98           |
| $\hat{I}^{(j)}_{or}$   |                              | dB[mW/15kHz]   | -98                     | -78                 | -78           |
| Maximum number o<br>transmission   |                              |  | 1                       |                     |               |
| Reporting mo   |                              |  | PUCCH 1-1 (Note 4)      |                     |               |
| Physical channel for   | CQI/PMI                      |  | PUCCH Format 2          |                     |               |
| reporting  |                              |  |                         |                     |               |
| PUCCH Report Type for<br>CQI/PMI   |                              |  | 2                       |                     |               |
| Physical channel for RI<br>reporting   |                              |  | PUSCH (Note 3)          |                     |               |
| PUCCH Report Typ   | e for RI                     |  |                         | 3                   |               |
| Reporting period   |                              | ms   | N_{pd}= 5               |                     |               |
| PMI and CQI d  |                              | ms   | 8                       |                     |               |
| cqi-pmi-Configurati  |                              | 1110   | 6                       |                     |               |
| ri-Configuration   |                              |  | 1 (Note 5)              |                     |               |
|  |                              | ailable uplink repor                                 | ting instance at subfra |                     | on PMI and    |
|  |                              |  | ot later than SF#(n-4), |                     |               |
|  |                              |  | NB downlink before S    |                     |               |
|  |                              |  | according to Table A    |                     | ed dynamic    |
| OCNG Pat   | ttern OP.1 I                 | FDD as described ir                                  | n Annex A.5.1.1.        |                     |               |
|  |                              |  | d HARQ-ACK it is neo    |                     |               |
| PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 ar  |                              |  |                         |                     |               |
| #9 to allow periodic RI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8  |                              |  |                         | oframe SF#8         |               |
| and #3.  |                              |  |                         |                     |               |
|  |                              | ding information in DCI format 2 shall be mapped as: |                         |                     |               |
| <ul> <li>For reported RI = 1 and PMI = 0 &gt;&gt; precoding information bit field index = 1</li> <li>For reported RI = 1 and PMI = 1 &gt;&gt; precoding information bit field index = 2</li> </ul> |                              |  |                         |                     |               |
| <ul> <li>For reported RI = 1 and PMI = 1 &gt;&gt; precoding information bit field index = 2</li> <li>For reported RI = 2 and PMI = 0 &gt;&gt; precoding information bit field index = 0</li> </ul> |                              |  |                         |                     |               |
| • For reported RI = 2 and PMI = 0 >> precoding information bit field index = 0   |                              | owitabies DI   |                         |                     |               |
| Note 5: To avoid the ambiguity of TE behaviour when<br>reports are to be applied at the TE with one su   |                              |  |                         |                     |               |
|  |                              |  | ne subtrame delay in a  | addition to inote 1 | to align with |
| CQI and PMI reports.   |                              |  |                         |                     |               |

| Table 9.5.1.1-1 | RI Test (FDD) |
|-----------------|---------------|
|-----------------|---------------|

| Table 9.5.1.1-2 | Minimum | requirement | (FDD) |
|-----------------|---------|-------------|-------|
|-----------------|---------|-------------|-------|

|             | Test 1 | Test 2 | Test 3 |
|-------------|--------|--------|--------|
| <i>)</i> 1  | N/A    | 1.05   | 0.9    |
| Ýź          | 1      | N/A    | N/A    |
| UE Category | ≥2     | ≥2     | ≥2     |

# 9.5.1.2 TDD

The minimum performance requirement in Table 9.5.1.2-2 is defined as

- The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when a) transmitting with fixed rank 1 shall be  $\geq \gamma_1$ ;
- The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when b) transmitting with fixed rank 2 shall be  $\geq \gamma_2$ ;

For the parameters specified in Table 9.5.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.1.2-2.

| Paramete                            | r                            | Unit  | Test 1  | Test 2           | Test 3        |  |  |
|-------------------------------------|------------------------------|---|---|------------------|---------------|--|--|
| Bandwidth                           | ו                            | MHz   |   | 10               |               |  |  |
| PDSCH transmiss                     | ion mode                     |   | 4   |                  |               |  |  |
|                                     | $ ho_{\scriptscriptstyle A}$ | dB  |   | -3               |               |  |  |
| Downlink power<br>allocation        | $ ho_{\scriptscriptstyle B}$ | dB  |   | -3               |               |  |  |
|                                     | σ                            | dB  | 0   |                  |               |  |  |
| Uplink downlink cor                 | figuration                   |   |   | 2                |               |  |  |
| Special subfra<br>configuratio      |                              |   |   | 4                |               |  |  |
| Propagation cond<br>antenna configu |                              |   |   | 2 x 2 EPA5       |               |  |  |
| CodeBookSubsetRestriction<br>bitmap |                              |   | 000011 for fixed RI = 1<br>010000 for fixed RI = 2<br>010011 for UE reported RI |                  |               |  |  |
| Antenna correlation                 |                              |   | Low Low High  |                  |               |  |  |
| RI configuration                    |                              |   | Fixed RI=2 and Fixed RI=1 Fixed RI<br>follow RI and follow RI and follow        |                  |               |  |  |
| SNR                                 |                              | dB  | 0   | 20               | 20            |  |  |
| $N_{oc}^{(j)}$                      |                              | dB[mW/15kHz]  | -98   | -98              | -98           |  |  |
| $\hat{I}_{or}^{(j)}$                |                              | dB[mW/15kHz]  | -98   | -78              | -78           |  |  |
| Maximum number<br>transmissio       |                              |   |   | 1                |               |  |  |
| Reporting mode                      |                              |   | PUS   | SCH 3-1 (Note 3) |               |  |  |
| Reporting inte                      | erval                        | ms  |   | 5                |               |  |  |
| PMI and CQI                         | delay                        | ms  |   | 10 or 11         |               |  |  |
| ACK/NACK feedba                     |                              |   |   | Bundling         |               |  |  |
| CQI estim                           | nation at a d                | n available uplink reporting instance at subframe SF#n based on PMI and<br>downlink subframe not later than SF#(n-4), this reported PMI and<br>ot be applied at the eNB downlink before SF#(n+4). |   |                  |               |  |  |
| Note 2: Reference<br>OCNG Pa        | e measurem<br>attern OP.1    | nent channel RC.2 T<br>TDD as described ir  | DD according to Table   | e A.4-1 with one | sided dynamic |  |  |

#### Table 9.5.1.2-1 RI Test (TDD)

Note 3: Reported wideband CQI and PMI are used and sub-band CQI is discarded.

|             | Test 1 | Test 2 | Test 3 |
|-------------|--------|--------|--------|
| 'n          | N/A    | 1.05   | 0.9    |
| <i>Y</i> 2  | 1      | N/A    | N/A    |
| UE Category | ≥2     | ≥2     | ≥2     |

#### Minimum requirement (CSI Reference Symbols) 9.5.2

#### 9.5.2.1 FDD

The minimum performance requirement in Table 9.5.2.1-2 is defined as

a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be  $\geq \gamma_1$ ;

b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be  $\geq \gamma_2$ ;

For the parameters specified in Table 9.5.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.2.1-2.

| Paramete                                   | r   | Unit                 | Test 1   | Test 2                | Test 3              |  |  |
|--|---|----------------------|--|-----------------------|---------------------|--|--|
| Bandwidt                                   |   | MHz                  |  | 10                    |                     |  |  |
| PDSCH transmiss                            |   |                      |  | 9                     |                     |  |  |
|  | $\rho_A$  | dB                   |  | 0                     |                     |  |  |
| Downlink power                             |   | dB                   |  | 0                     |                     |  |  |
| allocation                                 | $\rho_{\scriptscriptstyle B}$   | -                    |  | -                     |                     |  |  |
|  | Pc  | dB<br>dB             |  | 0                     |                     |  |  |
| σ<br>Propagation condition and             |   | uБ                   |  |                       |                     |  |  |
| antenna configu                            |   |                      |  | 2 x 2 EPA5            |                     |  |  |
| Cell-specific referen                      |   |                      | Ar   | ntenna ports 0        |                     |  |  |
| Beamforming I                              |   |                      |  | ified in Section B    | .4.3                |  |  |
| CSI reference s                            |   |                      |  | enna ports 15, 16     | -                   |  |  |
| CSI-RS periodic                            |   |                      |  |                       |                     |  |  |
| subframe of                                |   |                      |  | 5/1                   |                     |  |  |
| $T_{\text{CSI-RS}}$ / $\Delta_{\text{CS}}$ | I-RS  |                      |  |                       |                     |  |  |
| CSI reference                              | signal  |                      |  | 6                     |                     |  |  |
| configuration                              | on  |                      |  |                       |                     |  |  |
| CodeBookSubsetF                            | estriction  |                      |  | 11 for fixed $RI = 2$ |                     |  |  |
| bitmap                                     | Councilon   |                      |  | 00 for fixed $RI = 2$ |                     |  |  |
| ·  |   |                      |  | for UE reported       |                     |  |  |
| Antenna corre                              | lation  |                      | Low  | Low                   | High                |  |  |
| RI configurat                              | tion  |                      | Fixed RI=2 and   | Fixed RI=1            | Fixed RI=1          |  |  |
| SNR  | -   |                      | follow RI<br>0   | and follow RI<br>20   | and follow RI<br>20 |  |  |
| $N_{oc}^{(j)}$                             |   |                      | -98  | -98                   | -98                 |  |  |
|  |   |                      |  |                       |                     |  |  |
| $\hat{I}^{(j)}_{or}$                       |   | dB[mW/15kHz]         | -98  | -78                   | -78                 |  |  |
| Maximum number of HARQ                     |   |                      |  | 1                     |                     |  |  |
| transmissio                                |   |                      |  |                       |                     |  |  |
| Reporting me<br>Physical channel for       |   |                      |  | PUCCH 1-1             |                     |  |  |
| reporting                                  |   |                      | PL   | JSCH (Note 3)         |                     |  |  |
| PUCCH Report                               |   |                      |  |                       |                     |  |  |
| CQI/PMI                                    | i ypo ioi   |                      |  | 2                     |                     |  |  |
| Physical channe                            | l for RI  |                      | PU   | ICCH Format 2         |                     |  |  |
| reporting                                  |   |                      |  |                       |                     |  |  |
| PUCCH Report Ty                            |   |                      |  | 3                     |                     |  |  |
| Reporting perio                            |   | ms                   |  | $N_{\rm pd} = 5$      |                     |  |  |
| PMI and CQI                                |   | ms                   |  | 8                     |                     |  |  |
| cqi-pmi-Configura                          |   |                      |  | 6<br>1 (Noto 4)       |                     |  |  |
| ri-Configuratio                            |   | ovoiloble unlink re  | l<br>porting instance at sub                           | 1 (Note 4)            | ad an DMI and       |  |  |
|  |   |                      | ot later than SF#(n-4),                                |                       |                     |  |  |
|  |   |                      |  |                       |                     |  |  |
|  | wideband CQI cannot be applied at the eNB downlink before SF#(n+4).<br>Reference measurement channel RC.9 FDD according to Table A.4-1 with one sided dynamic |                      |  |                       |                     |  |  |
|  |   | FDD as described in  |  |                       |                     |  |  |
| Note 3: To avoid                           | collisions be   | tween CQI/ PMI rep   | reports and HARQ-ACK it is necessary to report both on |                       |                     |  |  |
|  |   |                      | CI format 0 shall be transmitted in downlink SF#1 and  |                       |                     |  |  |
|  | w periodic C  | QI/ PMI to multiple> | with the HARQ-ACK                                      | on PUSCH in up        | link SF#0 and       |  |  |
| #5.  |   |                      |  |                       |                     |  |  |
|  |   |                      | when applying CQI and                                  |                       |                     |  |  |
|  | re to be appl<br>PMI reports.   |                      | ne subframe delay in a                                 | addition to Note      | I to align with     |  |  |

#### Table 9.5.2.1-1 RI Test (FDD)

|             | Test 1 | Test 2 | Test 3 |
|-------------|--------|--------|--------|
| <i>γ</i> 1  | N/A    | 1.05   | 0.9    |
| <i>γ</i> 2  | 1      | N/A    | N/A    |
| UE Category | ≥2     | ≥2     | ≥2     |

 Table 9.5.2.1-2 Minimum requirement (FDD)

# 9.5.2.2 TDD

The minimum performance requirement in Table 9.5.2.2-2 is defined as

a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be  $\geq \gamma_1$ ;

b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be  $\geq \gamma_2$ ;

For the parameters specified in Table 9.5.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.2.2-2.

| Para                   | neter            |                               | Unit  | Test 1 Test 2 Test 3      |  |               |  |  |
|------------------------|------------------|-------------------------------|---|---------------------------|--|---------------|--|--|
| Band                   | width            |                               | MHz   |                           | 10   |               |  |  |
| PDSCH trans            |                  | n mode                        |   |                           | 9  |               |  |  |
|                        |                  | $ ho_{\scriptscriptstyle A}$  | dB  |                           | 0  |               |  |  |
| Downlink pov           | ver              |                               | dB  |                           | 0  |               |  |  |
| allocation             | VCI              | $\rho_{\scriptscriptstyle B}$ | -   |                           | -  |               |  |  |
|                        |                  | Pc                            | dB  |                           | 0  |               |  |  |
| Uplink downlin         | k oonf           | σ                             | dB  | 0                         |  |               |  |  |
| Special s              |                  |                               |   |                           |  |               |  |  |
| config                 |                  |                               |   |                           | 4  |               |  |  |
| Propagation            |                  |                               |   |                           |  |               |  |  |
| antenna co             |                  |                               |   |                           | 2 x 2 EPA5                                     |               |  |  |
| Cell-specific re       |                  |                               |   | Ar                        | ntenna ports 0                                 |               |  |  |
| CSI refere             |                  |                               |   |                           | nna ports 15, 16                               |               |  |  |
| Beamform               | ning M           | odel                          |   |                           | fied in Section B                              | .4.3          |  |  |
| CSI refere             |                  |                               |   |                           | 4  |               |  |  |
| config                 |                  |                               |   |                           | 4  |               |  |  |
| CSI-RS per             |                  |                               |   |                           |  |               |  |  |
| subfram                |                  |                               |   |                           | 5/4  |               |  |  |
| T <sub>CSI-RS</sub>    | $\Delta_{CSI-F}$ | RS                            |   | 0000                      |  |               |  |  |
| CodeBookSub            | setRe            | estriction                    |   |                           | 11 for fixed $RI = 2$<br>00 for fixed $RI = 2$ |               |  |  |
| bitr                   | nap              |                               |   |                           |  |               |  |  |
| Antenna                | orrela           | ition                         |   | 010011 for UE reported RI |  |               |  |  |
|                        |                  |                               |   |                           |  | Fixed RI=1    |  |  |
| RI confi               | RI configuration |                               |   |                           |  | and follow RI |  |  |
| SI                     | ١R               |                               | dB  | 0                         | 20   | 20            |  |  |
| N                      | $N_{oc}^{(j)}$   |                               | dB[mW/15kHz]  | -98                       | -98  | -98           |  |  |
| $\hat{I}_{or}^{(j)}$   |                  | dB[mW/15kHz]                  | -98   | -78                       | -78  |               |  |  |
| Maximum nur            |                  | f HARQ                        |   |                           |  |               |  |  |
| transm                 |                  |                               |   |                           | 1  |               |  |  |
| Reportir               | ng mo            | de                            |   |                           | PUCCH 1-1                                      |               |  |  |
| Physical chann         |                  |                               |   | וס                        | ISCH (Noto 2)                                  |               |  |  |
|                        | rting            |                               |   | FU                        | JSCH (Note 3)                                  |               |  |  |
| PUCCH repor            | t type<br>MI     | for CQI/                      |   |                           | 2  |               |  |  |
| Physical ch            |                  | for RI                        |   | PU                        | CCH Format 2                                   |               |  |  |
|                        | rting            |                               |   |                           |  |               |  |  |
| Reporting              |                  |                               | ms  |                           | $N_{\rm pd} = 5$                               |               |  |  |
| PMI and<br>ACK/NACK fe |                  |                               | ms  |                           | <u>10</u>                                      |               |  |  |
| cqi-pmi-Confi          |                  |                               |   |                           | Bundling<br>4                                  |               |  |  |
|                        |                  |                               |   |                           | <u>4</u><br>1                                  |               |  |  |
| Note 1: If the CQI     |                  |                               |   |                           |  |               |  |  |
| Note 2: Refe           | rence            | measurem                      | ent channel RC.9 T  | DD according to Table     |  | sided dynamic |  |  |
|                        |                  |                               | TDD as described ir   |                           |  |               |  |  |
| PUS                    | CH in:           | stead of PL                   | isions between CQI/PMI reports and HARQ-ACK it is necessary to report both on<br>ead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and<br>eriodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#3 and |                           |  |               |  |  |

# Table 9.5.2.2-1 RI Test (TDD)

| Table 9.5.2.2-2 | Minimum rec | uirement ( | (TDD) |
|-----------------|-------------|------------|-------|

|             | Test 1 | Test 2 | Test 3 |
|-------------|--------|--------|--------|
| <i>)</i> /1 | N/A    | 1.05   | 0.9    |
| 1/2         | 1      | N/A    | N/A    |
| UE Category | ≥2     | ≥2     | ≥2     |

# 9.5.3 Minimum requirement (CSI measurements in case two CSI subframe sets are configured)

#### 9.5.3.1 FDD

The minimum performance requirement in Table 9.5.3.1-2 is defined as

a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be  $\geq \gamma_1$ 

For the parameters specified in Table 9.5.3.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.3.1-2.

| Devementer                           |  | l lmit         | Т  | est 1  | Tes  | st 2  |
|--------------------------------------|--|----------------|--|--|--|---|
| Parameter                            |  | Unit           | Cell 1   | Cell 2   | Cell 1   | Cell 2  |
| Bandwidth                            |  | MHz            | 3  | 10<br>Note 10  | 1  |   |
| PDSCH transmissio                    |  | dB             | 3  | -3   |  | Note 10   |
| Downlink power                       | $\rho_{A}$                               | -              |  |  |  | -   |
| allocation                           | $ ho_{\scriptscriptstyle B}$             | dB<br>dB       |  | -3<br>0  |  | 3   |
| Propagation condition                | σ<br>on and                              | uв             |  |  |  |   |
| antenna configur                     |  |                |  | 2 EPA5   | 2 x 2  | EPA5  |
| bitmap                               | CodeBookSubsetRestriction                |                | 01 for<br>fixed RI =<br>10 for<br>fixed RI =<br>2<br>11 for UE<br>reported<br>RI | N/A  | 01 for fixed RI<br>= 1<br>10 for fixed RI<br>= 2<br>11 for UE<br>reported RI | N/A   |
| Antenna correla                      | tion                                     |                | Fixed  | _ow  | Lc   | W   |
| RI configuratio                      | n  |                | RI=1 and<br>follow RI  | N/A  | Fixed RI=1<br>and follow RI  | N/A   |
| $\widehat{E}_{s}/N_{oc2}$            |  | dB             | 0  | -12  | 20   | 6   |
|                                      | $N_{oc1}^{(j)}$                          | _              | -98 (Note<br>3)  | N/A  | -102 (Note 3)  | N/A   |
| $N_{oc}^{(j)}$                       | $N_{oc2}^{(j)}$                          | dBmW/15kH<br>z | -98 (Note<br>4)  | N/A  | -98 (Note 4)   | N/A   |
|                                      | $N_{oc3}^{(j)}$                          | dB[mW/15k      | -98 (Note<br>5)  | N/A  | -94.8 (Note 5)   | N/A   |
| $\hat{I}^{(j)}_{or}$                 | $\hat{I}_{or}^{(j)}$                     |                | -98  | -110   | -78  | -92   |
| Subframe Configu                     | ration                                   |                | Non-<br>MBSFN  | Non-MBSFN  | Non-MBSFN  | Non-MBSFN   |
| Cell Id                              |  |                | 0  | 1  | 0  | 1   |
| Time Offset betwee                   |  | μs             | 2.5 (syncr<br>N/A  | ronous cells)<br>10000000<br>10000000<br>10000000<br>10000000<br>1000000 | 2.5 (synchro<br>N/A  | 10000000<br>10000000<br>10000000<br>10000000<br>1000000 |
| RLM/RRM Measur<br>Subframe Pattern ( |  |                | 1000000<br>1000000<br>1000000<br>1000000<br>1000000                              | N/A  | 1000000<br>1000000<br>1000000<br>1000000<br>1000000                          | N/A   |
| CSI Subframe Sets<br>(Note 8)        | C <sub>CSI,0</sub><br>C <sub>CSI,1</sub> | -              | 10000000<br>10000000<br>10000000<br>10000000<br>0111111                          | N/A  | 10000000<br>10000000<br>10000000<br>10000000<br>0111111                      | N/A   |
| Number of control<br>Symbols         | OFDM                                     |                | 3  | 3  | 3  | 3   |
|                                      | Maximum number of HARQ                   |                |  | 1  | 1  |   |
| transmission<br>Reporting mod        |  |                | PLIC   | CH 1-0   | PUCC   | H 1-0   |
| Physical channel f                   |  |                |  |  |  |   |
| reporting                            |  |                | PUCCF  | I Format 2   |  | Format 2  |
| PUCCH Report Type                    | e tor CQI                                | <u> </u>       |  | 4  | 2  | ł   |

# Table 9.5.3.1-1 RI Test (FDD)

| Physical | channel for RI reporting   |                | PUCCH Format 2  |                 | PUCCH              | Format 2         |
|----------|--|----------------|-----------------|-----------------|--------------------|------------------|
| PUCC     | PUCCH Report Type for RI   |                | 3               |                 |                    | 3                |
| Re       | Reporting periodicity ms   |                | Npd             | = 10            | N <sub>pd</sub> :  | = 10             |
| cqi-pn   | ni-ConfigurationIndex  |                | 1               | 1               | 1                  | 1                |
| ri-      | ConfigurationInd   |                |                 | 5               |                    | 5                |
| cqi-pm   | i-ConfigurationIndex2  |                | 1               | 0               | 1                  | 0                |
| ri-(     | ConfigurationInd2  |                |                 | 2               |                    | 2                |
|          | Cyclic prefix  |                | Normal          | Normal          | Normal             | Normal           |
| Note 1:  | If the UE reports in an av<br>a downlink subframe not  |                |                 |                 |                    |                  |
|          | downlink before SF#(n+4  |                |                 |                 |                    |                  |
| Note 2:  | Reference measuremen   |                |                 |                 | ble A.4-1 with one | e sided dynamic  |
|          | OCNG Pattern OP.1 FD   |                |                 |                 |                    |                  |
| Note 3:  | This noise is applied in C   | •              | #1, #2, #3, #5, | #6, #8, #9, #10 | ,#12, #13 of a sub | oframe           |
|          | overlapping with the agg   |                |                 |                 |                    |                  |
| Note 4:  | This noise is applied in C ABS.  | )FDM symbols a | #0, #4, #7, #11 | of a subframe   | overlapping with t | he aggressor     |
| Note 5:  | This noise is applied in a   | II OFDM symbo  | ls of a subfram | e overlapping   | with aggressor no  | n-ABS            |
| Note 6:  | ABS pattern as defined i   |                |                 |                 |                    |                  |
|          | transmitted in the serving   |                |                 |                 |                    | subframe of      |
|          | aggressor cell and the su  |                |                 |                 |                    |                  |
| Note 7:  | Time-domain measurem   |                |                 |                 |                    |                  |
| Note 8:  | As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]. |                |                 |                 |                    |                  |
| Note 9:  |  |                |                 |                 |                    | ell 1 and Cell 2 |
| Note 10: | Downlink physical chann<br>defined in Annex A.5.1.5  |                | 2 in accordanc  | e with Annex C  | 3.3.3 applying OCI | NG pattern as    |

#### Table 9.5.3.1-2 Minimum requirement (FDD)

|             | Test 1 | Test 2 |
|-------------|--------|--------|
| <i>γ</i> 1  | 0.9    | 1.05   |
| UE Category | ≥2     | ≥2     |

# 9.5.3.2 TDD

The minimum performance requirement in Table 9.5.3.2-2 is defined as

a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be  $\geq \gamma_1$ .

For the parameters specified in Table 9.5.3.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.3.2-2.

| Parameter                              |                              | Unit             | Tes   |                                  | Tes  |                          |
|--|------------------------------|------------------|---|----------------------------------|--|--------------------------|
|  |                              |                  | Cell 1  | Cell 2                           | Cell 1   | Cell 2                   |
| Bandwidth<br>PDSCH transmissio         | n mode                       | MHz              | 3   | Note 11                          | 10<br>3  | Note 11                  |
| Uplink downlink conf                   |                              |                  |   |                                  | 1  |                          |
| Special subfra                         |                              |                  |   |                                  | -  |                          |
| configuration                          | ו                            |                  | 4   |                                  | 4  |                          |
| Downlink nower                         | $ ho_{\scriptscriptstyle A}$ | dB               | -3  | 3                                | -1   | 8                        |
| Downlink power<br>allocation           | $ ho_{\scriptscriptstyle B}$ | dB               | -3  | 3                                | -3   | 3                        |
| anoodion                               | σ                            | dB               | C   |                                  | 0  |                          |
| Propagation condit<br>antenna configur |                              |                  | 2 x 2 l   | EPA5                             | 2 x 2 E  | EPA5                     |
| CodeBookSubsetRe<br>bitmap             |                              |                  | 01 for<br>fixed RI =<br>1<br>10 for<br>fixed RI =<br>2<br>11 for UE<br>reported<br>RI | N/A                              | 01 for fixed RI<br>= 1<br>10 for fixed RI<br>= 2<br>11 for UE<br>reported RI | N/A                      |
| Antenna correla                        | ition                        |                  | Lo  | W/                               | Lo   | M/                       |
| RI configuratio                        |                              |                  | Fixed<br>RI=1 and<br>follow RI  | N/A                              | Fixed RI=1<br>and follow RI  | N/A                      |
| $\widehat{E}_{s}/N_{oc2}$              |                              | dB               | 0   | -12                              | 20   | 6                        |
|  | $N_{ocl}^{(j)}$              |                  | -98 (Note<br>4)   | N/A                              | -102 (Note 4)  | N/A                      |
| $N_{\scriptscriptstyle oc}^{(j)}$      | $N_{oc2}^{(j)}$              | dB[mW/15k<br>Hz] | -98 (Note<br>5)   | N/A                              | -98 (Note 5)   | N/A                      |
|  | $N_{oc3}^{(j)}$              |                  | -98 (Note<br>6)   | N/A                              | -94.8 (Note 6)   | N/A                      |
| $\hat{I}_{or}^{(j)}$                   |                              | dB[mW/15k<br>Hz] | -98   | -110                             | -78  | -92                      |
| Subframe Configu                       | iration                      |                  | Non-<br>MBSFN   | Non-<br>MBSFN                    | Non-MBSFN  | Non-MBSFN                |
| Cell Id                                |                              |                  | 0   | 1                                | 0  | 1                        |
| Time Offset betwee                     | en Cells                     | μs               | 2.5 (sync<br>cel  |                                  | 2.5 (synchro   | nous cells)              |
| ABS Pattern (No                        | ite 7)                       |                  | N/A   | 0000000<br>001<br>0000000<br>001 | N/A  | 0000000001<br>0000000001 |
| RLM/RRM Measu<br>Subframe Pattern (    |                              |                  | 00000000<br>01<br>00000000<br>01  | N/A                              | 0000000001<br>0000000001   | N/A                      |
| CSI Subframe Sets                      | C <sub>CSI,0</sub>           |                  | 00000000<br>01<br>00000000<br>01  | N/A                              | 0000000001<br>0000000001   | N/A                      |
| (Note 9)                               | C <sub>CSI,1</sub>           |                  | 11001110<br>00<br>11001110<br>00  |                                  | 1100111000<br>1100111000   |                          |
| Number of control<br>Symbols           | OFDM                         |                  | 3   | 3                                | 3  | 3                        |
| Maximum number o                       |                              |                  | 1   |                                  | 1  |                          |
| transmission                           |                              |                  |   |                                  | -  |                          |
| Reporting mo                           |                              |                  | PUCC  | H 1-0                            | PUCCH 1-0  |                          |
| Physical channel for<br>and RI reporti | ng                           |                  | PUCCH I   | Format 2                         | PUCCHI   | Format 2                 |
| PUCCH Report Type                      | e for CQI                    |                  | 4   |                                  | 4  |                          |

# Table 9.5.3.2-1 RI Test (TDD)

|          | channel for C <sub>CSI,1</sub> CQI<br>nd RI reporting  |  | PUSCH                           | (Note 3)       | PUSCH                       | (Note 3)       |  |
|----------|--|--|---------------------------------|----------------|-----------------------------|----------------|--|
|          | Report Type for RI   |  | 3                               | 3              |                             | 3              |  |
| Rep      | orting periodicity   | ms   | N <sub>pd</sub> =               | = 10           | <i>N</i> <sub>pd</sub> = 10 |                |  |
| ACK/NA   | ACK feedback mode  |  | Multip                          | lexing         | Multip                      | lexing         |  |
|          | -ConfigurationIndex  |  | 8                               |                |                             | 3              |  |
|          | ConfigurationInd   |  | 5                               |                |                             | 5              |  |
|          | ConfigurationIndex2  |  | g                               |                |                             | 9              |  |
|          | onfigurationInd2   |  | C                               |                |                             | )              |  |
|          | Cyclic prefix  |  | Normal                          | Normal         | Normal                      | Normal         |  |
| Note 1:  | If the UE reports in an estimation at a downli be applied at the eNB   | nk subframe n<br>downlink befo   | ot later than S<br>re SF#(n+4). | SF#(n-4), this | s reported wideba           | nd CQI cannot  |  |
| Note 2:  | Reference measurem<br>dynamic OCNG Patte   |  |                                 |                |                             | with one sided |  |
| Note 3:  | To avoid collisions between RI/CQI reports and HARQ-ACK it is necessary to report them on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#9 to allow periodic RI/CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#3. |  |                                 |                |                             |                |  |
| Note 4:  | This noise is applied i overlapping with the a   | n OFDM symb  | ols #1, #2, #3                  |                |                             |                |  |
| Note 5:  | This noise is applied i aggressor ABS.   |  |                                 | 7, #11 of a sι | ıbframe overlappi           | ng with the    |  |
| Note 6:  |  | This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS |                                 |                |                             |                |  |
| Note 7:  | ABS pattern as define  | d in [9]. PDSC   | H other than                    | SIB1/paging    | and its associate           | d              |  |
|          | PDCCH/PCFICH are<br>with the ABS subfram   |  |                                 |                |                             |                |  |
| Note 8:  | reference channel.<br>Time-domain measurement resource restriction pattern for PCell measurements as defined in<br>[7].  |  |                                 |                |                             |                |  |
| Note 9:  | As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].   |  |                                 |                |                             |                |  |
| Note 10: | Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell 1 and Cell 2 is the same.  |  |                                 |                |                             |                |  |
| Note 11: | Downlink physical cha<br>pattern as defined in A   |  | Cell 2 in acco                  | rdance with    | Annex C.3.3 apply           | ying OCNG      |  |

Table 9.5.3.2-2 Minimum requirement (TDD)

|             | Test 1 | Test 2 |
|-------------|--------|--------|
| <i>)</i> /1 | 0.9    | 1.05   |
| UE Category | ≥2     | ≥2     |

9.5.4 Minimum requirement (CSI measurements in case two CSI subframe sets are configured and CRS assistance information are configured)

#### 9.5.4.1 FDD

For the parameters specified in Table 9.5.4.1-1, the minimum performance requirement in Table 9.5.4.1-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be  $\geq \gamma_{1;}$
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be  $\geq \gamma_2$ ;

In Table 9.5.4.1-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggresso cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

| Parameter                               |                              | Unit             | Cell 1   | Cell 2  | Cell 3  |
|---|------------------------------|------------------|--|---|---|
| Bandwidth                               |                              |                  | 10   | 10  | 10  |
| PDSCH transmissio                       | n mode                       |                  | 3  | As defined in<br>Note 1                                 | As defined in<br>Note 1                                 |
|   | $ ho_{\scriptscriptstyle A}$ | dB               | -3   | -3  | -3  |
| Downlink power<br>allocation            | $ ho_{\scriptscriptstyle B}$ | dB               | -3   | -3  | -3  |
|   | σ                            | dB               | 0  | N/A   | N/A   |
| Propagation conditi<br>antenna configur |                              |                  | 2×2 EPA5 (Note 2)  | 2×2 EPA5<br>(Note 2)                                    | 2×2 EPA5<br>(Note 2)                                    |
| CodeBookSubsetRe<br>bitmap              |                              |                  | 01 for fixed RI = 1<br>10 for fixed RI = 2<br>11 for UE<br>reported RI | As defined in<br>Note 1                                 | As defined in<br>Note 1                                 |
|   | $N_{oc1}$                    | dB[mW/15k<br>Hz] | -98 (Note 3)   | N/A   | N/A   |
| $N_{oc}$ at antenna port                | $N_{oc2}$                    | dB[mW/15k<br>Hz] | -98 (Note 4)   | N/A   | N/A   |
|   | N <sub>oc3</sub>             | dB[mW/15k<br>Hz] | -93 (Note 5)   | N/A   | N/A   |
| $\hat{E}_s/N_{oc2}$                     |                              | dB               | Reference Value<br>in Table 9.5.4.1-2<br>for each test                 | 12  | 10  |
| $\hat{I}_{or}^{(j)}$                    |                              | dB[mW/15k<br>Hz] | Reference Value<br>in Table 9.5.4.1-2<br>for each test                 | -86   | -88   |
| Subframe Configu                        | ration                       |                  | Non-MBSFN  | Non-MBSFN   | Non-MBSFN   |
| Time Offset betwee                      | n Cells                      | μs               | N/A  | 3   | -1  |
| Frequency shift betwe                   | en Cells                     | Hz               | N/A  | 300   | -100  |
| Cell Id                                 |                              |                  | 0  | 126   | 1   |
| ABS pattern (No                         | te 6)                        |                  | N/A  | 10000000<br>10000000<br>10000000<br>10000000<br>1000000 | 10000000<br>10000000<br>10000000<br>10000000<br>1000000 |
| RLM/RRM Measur<br>Subframe Pattern (    |                              |                  | 10000000<br>10000000<br>10000000<br>10000000<br>1000000                | N/A   | N/A   |
| CSI Subframe Sets                       | C <sub>CSI,0</sub>           |                  | 10000000<br>10000000<br>10000000<br>10000000<br>1000000                | N/A   | N/A   |
| (Note 8)                                | C <sub>CSI,1</sub>           |                  | 01111111<br>01111111<br>01111111<br>01111111<br>0111111                | N/A   | N/A   |
| Number of control<br>symbols            | OFDM                         |                  | 3  | Note 9  | Note 9  |
| Maximum number o<br>transmission        |                              |                  | 1  | N/A   | N/A   |
| Reporting mod                           |                              |                  | PUCCH 1-0  | N/A   | N/A   |
| Physical channel for reporting          |                              |                  | PUCCH format 2   | N/A   | N/A   |
| PUCCH Report Type                       | for COI                      |                  | 4  | N/A   | N/A   |
| Physical channel for R                  |                              |                  | PUCCH Format 2   | N/A   | N/A   |
| PUCCH Report Typ                        |                              |                  | 3  | N/A   | N/A   |
| Reporting period                        |                              | ms               | $N_{pd}=10$  | N/A   | N/A   |

# Table 9.5.4.1-1: RI Test (FDD)

| cqi-pm   | ni-ConfigurationIndex  |                   | 11                      | N/A                   | N/A               |
|----------|--|-------------------|-------------------------|-----------------------|-------------------|
| ri-      | ConfigurationInd   |                   | 5                       | N/A                   | N/A               |
| cqi-pm   | i-ConfigurationIndex2  |                   | 10                      | N/A                   | N/A               |
| ri-C     | ConfigurationInd2  |                   | 2                       | N/A                   | N/A               |
|          | Cyclic prefix  |                   | Normal                  | Normal                | Normal            |
| Note 1:  | Downlink physical chann  |                   |                         | Annex C.3.3 app       | lying OCNG        |
|          | pattern OP.5 FDD as de   |                   |                         |                       |                   |
| Note 2:  | The propagation condition  |                   |                         |                       |                   |
| Note 3:  | This noise is applied in (   |                   | #1, #2, #3, #5, #6, #8  | 3, #9, #10,#12, #1    | 3 of a subframe   |
|          | overlapping with the age   |                   |                         |                       |                   |
| Note 4:  | This noise is applied in aggressor ABS.  | OFDM symbols      | #0, #4, #7, #11 of a s  | subframe overlapp     | oing with the     |
| Note 5:  | This noise is applied in a   |                   |                         |                       |                   |
| Note 6:  | ABS pattern as defined   | in [9]. PDSCH c   | ther than SIB1/pagin    | g and its associat    | ed                |
|          | PDCCH/PCFICH are tra   |                   |                         |                       |                   |
|          | overlapped with the ABS  |                   | ggressor cell and the   | subframe is available | able in the       |
|          | definition of the reference  |                   |                         |                       |                   |
| Note 7:  | Time-domain measurem [7]   | ent resource re   | striction pattern for P | Cell measuremen       | its as defined in |
| Note 8:  | As configured according<br>measurements defined i  |                   | nain measurement re     | source restriction    | pattern for CSI   |
| Note 9:  | The number of control C  |                   | s not available for AB  | S and is 3 for the    | subframe          |
|          | indicated by "0" of ABS  | pattern.          |                         |                       |                   |
| Note 10: | If the UE reports in an a  | vailable uplink r | eporting instance at s  | subframe SF#n ba      | ased on CQI       |
|          | estimation at a downlink subframe not later than SF#(n-4), this reported wideband CQI cannot |                   |                         |                       |                   |
|          | be applied at the eNB downlink before SF#(n+4).  |                   |                         |                       |                   |
| Note 11: | Reference measuremen   |                   |                         |                       | with one sided    |
|          | dynamic OCNG Pattern   |                   |                         |                       |                   |
| Note 12: | The number of the CRS  |                   |                         | e same.               |                   |
| Note 13: | SIB-1 will not be transm   | itted in Cell2 an | d Cell 3 in this test.  |                       |                   |

#### Table 9.5.4.1-2 Minimum requirement (FDD)

|   | Test 1  | Test 2                               | Test 3  |
|---|---|--------------------------------------|---|
| $\widehat{E}_{_{s}}/N_{_{oc2}}$ for Cell 1 (dB) | 4   | 20                                   | 20  |
| $\hat{I}_{or}^{(j)}$ for Cell 1 (dB[mW/15kHz])  | -94   | -78                                  | -78   |
| Antenna correlation                             | High for Cell 1, low for<br>Cell 2 and Cell 3 | Low for Cell 1, Cell 2<br>and Cell 3 | High for Cell 1, low for<br>Cell 2 and Cell 3 |
| <i>γ</i> 1                                      | N/A   | 1.05                                 | 0.9   |
| 1/2   | 1.05  | N/A                                  | N/A   |
| UE Category                                     | ≥2  | ≥2                                   | ≥2  |

#### 9.5.4.2 TDD

For the parameters specified in Table 9.5.4.2-1, the minimum performance requirement in Table 9.5.4.2-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be  $\geq \gamma_{1;}$
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be  $\geq \gamma_2$ ;

In Table 9.5.4.2-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggresso cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

| Parameter                                 |                              | Unit             | Cell 1   | Cell 2                   | Cell 3                   |
|---|------------------------------|------------------|--|--------------------------|--------------------------|
| Bandwidth                                 |                              | MHz              | 10   | 10                       | 10                       |
| PDSCH transmissio                         | n mode                       |                  | 3  | As defined in<br>Note 1  | As defined in<br>Note 1  |
| Uplink downlink conf                      |                              |                  | 1  | 1                        | 1                        |
| Special subframe con                      | figuration                   |                  | 4  | 4                        | 4                        |
| Develiek zewez                            | $ ho_{\scriptscriptstyle A}$ | dB               | -3   | -3                       | -3                       |
| Downlink power<br>allocation              | $ ho_{\scriptscriptstyle B}$ | dB               | -3   | -3                       | -3                       |
|   | σ                            | dB               | 0  | N/A                      | N/A                      |
| Propagation conditi<br>antenna configura  |                              |                  | 2x2 EPA5 (Note 2)  | 2×2 EPA5<br>(Note 2)     | 2x2 EPA5<br>(Note 2)     |
| CodeBookSubsetRe<br>bitmap                | striction                    |                  | 01 for fixed RI = 1<br>10 for fixed RI = 2<br>11 for UE<br>reported RI | As defined in<br>Note 1  | As defined in<br>Note 1  |
|   | $N_{oc1}$                    | dB[mW/15k<br>Hz] | -98 (Note 3)   | N/A                      | N/A                      |
| $N_{oc}$ at antenna port                  | $N_{oc2}$                    | dB[mW/15k<br>Hz] | -98 (Note 4)   | N/A                      | N/A                      |
|   | $N_{oc3}$                    | dB[mW/15k<br>Hz] | -93 (Note 5)   | N/A                      | N/A                      |
| $\hat{E}_s/N_{oc2}$                       |                              | dB               | Reference Value<br>in Table 9.5.4.2-2<br>for each test                 | 12                       | 10                       |
| $\hat{I}_{or}^{(j)}$                      |                              | dB[mW/15k<br>Hz] | Reference Value<br>in Table 9.5.4.2-2<br>for each test                 | -86                      | -88                      |
| Subframe Configu                          | ration                       |                  | Non-MBSFN  | Non-MBSFN                | Non-MBSFN                |
| Time Offset betwee                        | n Cells                      | μs               | N/A  | 3                        | -1                       |
| Frequency shift betwe                     | een Cells                    | Hz               | N/A  | 300                      | -100                     |
| Cell Id                                   |                              |                  | 0  | 126                      | 1                        |
| ABS pattern (No                           |                              |                  | N/A  | 0000000001<br>0000000001 | 0000000001<br>0000000001 |
| RLM/RRM Measur<br>Subframe Pattern (I     |                              |                  | 0000000001<br>0000000001   | N/A                      | N/A                      |
| CSI Subframe Sets                         | C <sub>CSI,0</sub>           |                  | 0000000001<br>0000000001   | N/A                      | N/A                      |
| (Note 8)                                  | C <sub>CSI,1</sub>           |                  | 1100111000<br>1100111000   | N/A                      | N/A                      |
| Number of control<br>symbols              | OFDM                         |                  | 3  | Note 9                   | Note 9                   |
| Maximum number o<br>transmissions         |                              |                  | 1  | N/A                      | N/A                      |
| Reporting mod                             |                              |                  | PUCCH 1-0  | N/A                      | N/A                      |
| Physical channel for 0<br>and RI reportir |                              |                  | PUCCH format 2   | N/A                      | N/A                      |
| Physical channel for (<br>and RI reportir | C <sub>CSI,1</sub> CQI       |                  | PUSCH (Note<br>14)   | N/A                      | N/A                      |
| PUCCH Report Type                         |                              |                  | 4  | N/A                      | N/A                      |
| PUCCH Report Typ                          |                              |                  | 3  | N/A                      | N/A                      |
| Reporting period                          | icity                        | ms               | <i>N<sub>pd</sub></i> = 10   | N/A                      | N/A                      |
| ACK/NACK feedbac                          |                              |                  | Multiplexing   | N/A                      | N/A                      |
| cqi-pmi-Configuratio                      | onIndex                      |                  | 8  | N/A                      | N/A                      |
| ri-Configuration                          |                              |                  | 5  | N/A                      | N/A                      |
| cqi-pmi-Configuratio                      |                              |                  | 9  | N/A                      | N/A                      |
| ri-Configuration                          | nd2                          |                  | 0  | N/A                      | N/A                      |
| Cyclic prefix                             |                              |                  | Normal   | Normal                   | Normal                   |

# Table 9.5.4.2-1: RI Test (TDD)

| Note 1:  | Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG pattern OP.5 TDD as defined in Annex A.5.2.5.   |
|----------|--|
| Note 2:  | The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  |
| Note 3:  | This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.   |
| Note 4:  | This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.  |
| Note 5:  | This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS   |
| Note 6:  | ABS pattern as defined in [9]. PDSCH other than SIB1/paging and its associated   |
|          | PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is   |
|          | overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.   |
| Note 7:  | Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]  |
| Note 8:  | As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].   |
| Note 9:  | The number of control OFDM symbols is not available for ABS and is 3 for the subframe indicated by "0" of ABS pattern.   |
| Note 10: | If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4). |
| Note 11: |  |
| Note 12: | The number of the CRS ports in Cell1, Cell2 and Cell 3 is the same.  |
| Note 13: | SIB-1 will not be transmitted in Cell2 and Cell 3 in this test.  |
| Note 14: | To avoid collisions between RI/CQI reports and HARQ-ACK it is necessary to report them on  |
|          | PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and   |
|          | #9 to allow periodic RI/CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe   |
|          | SF#8 and #3.   |

#### Table 9.5.4.2-2 Minimum requirement (TDD)

|  | Test 1  | Test 2                               | Test 3  |
|--|---|--------------------------------------|---|
| $\widehat{E}_{s}/N_{oc2}$ for Cell 1 (dB)      | 4   | 20                                   | 20  |
| $\hat{I}_{or}^{(j)}$ for Cell 1 (dB[mW/15kHz]) | -94   | -78                                  | -78   |
| Antenna correlation                            | High for Cell 1, low for<br>Cell 2 and Cell 3 | Low for Cell 1, Cell 2<br>and Cell 3 | High for Cell 1, low for<br>Cell 2 and Cell 3 |
| 'n   | N/A   | 1.05                                 | 0.9   |
| 1/2  | 1.05  | N/A                                  | N/A   |
| UE Category                                    | ≥2  | ≥2                                   | ≥2  |

# 9.5.5 Minimum requirement (with CSI process)

Each CSI process is associated with a CSI-RS resource and a CSI-IM resource as shown in Table 9.5.5-1.

For UE supports one CSI process, CSI process 0 is configured for Test 1 and Test 2, but CSI process 1 is not configured for Test 2. The corresponding  $\gamma$  requirements for Test 1 and Test 2 shall be fulfilled. The requirement on reported RI for CSI process 1 in Test 2 is not applicable.

For UE supports multiple CSI processes, CSI process 0 is configured for Test 1 and CSI processes 0 and 1 are configured for Test 2. The corresponding  $\gamma$  requirements for Test 1 and Test 2 shall be fulfilled, and also the requirement on reported RI for CSI process 1 in Test 2.

| Table 9.5.5-1 | Configuration | of CSI processes |
|---------------|---------------|------------------|
|---------------|---------------|------------------|

|                 | CSI process 0     | CSI process 1     |
|-----------------|-------------------|-------------------|
| CSI-RS resource | CSI-RS signal 0   | CSI-RS signal 1   |
| CSI-IM resource | CSI-IM resource 0 | CSI-IM resource 1 |

#### 9.5.5.1 FDD

The minimum performance requirement in Table 9.5.5.1-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be  $\geq \gamma_1$ ;
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be  $\geq \gamma_2$ ;
- c) For Test 2, the RI reported for CSI process 1 shall be the same as the most recent RI reported for CSI process 0 if UE is configured with multiple CSI processes.

For the parameters specified in Table 9.5.5.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.5.1-2.

# Table 9.5.5.1-1 RI Test (FDD)

|   |                                |              | Tes                         | st 1                        | Te                          | st 2                        |
|---|--------------------------------|--------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| Parameter<br>Bandwidth  |                                | Unit         | TP1                         | TP2                         | TP1                         | TP2                         |
|   |                                | MHz          | 10 MHz                      |                             |                             | MHz                         |
| Transmission mode   |                                |              | 10                          | 10                          | 10                          | 10                          |
|   | $ ho_{\scriptscriptstyle A}$   | dB           | (                           | 0                           |                             | 0                           |
| Downlink power  | $ ho_{\scriptscriptstyle B}$   | dB           | (                           | D                           |                             | C                           |
| allocation  | P <sub>c</sub>                 | dB           | 0                           | 0                           | 0                           | 0                           |
|   | σ                              | dB           | - (                         | 0                           |                             | <u> </u>                    |
| SNR   | Ŭ                              | dB           | 0                           | 0                           | 20                          | 20                          |
| $\hat{I}^{(j)}_{or}$  |                                | dB[mW/15kHz] | -98                         | -98                         | -78                         | -78                         |
| $\overline{N_{oc}^{(j)}}$   |                                | dB[mW/15kHz] |                             | 98                          | {                           | 98                          |
| Propagation channe  | <u>ə</u> l                     |              | EPA 5 Low                   | EPA 5 Low                   | EPA 5 Low                   | EPA 5 High                  |
| Antenna configurati   |                                |              | 2x2                         | 2x2                         | 2x2                         | 2x2                         |
| Beamforming Mode  |                                |              |                             | Section B.4.3               |                             | Section B.4.3               |
| Timing offset betwe   |                                | us           | 1                           | C                           | 1                           | C                           |
| Frequency offset be   |                                | Hz           |                             | 0                           |                             | 0                           |
| Cell-specific referen   | nce signals                    |              |                             | a ports 0                   |                             | a ports 0                   |
| CSI-RS signal 0   |                                |              | Antenna ports<br>15,16      | N/A                         | Antenna ports<br>15,16      | N/A                         |
| CSI-RS 0 periodicity<br>$T_{CSI-RS} / \Delta_{CSI-RS}$                            | y and subframe offset          |              | 5/1                         | N/A                         | 5/1                         | N/A                         |
| CSI-RS 0 configura  | tion                           |              | 0                           | N/A                         | 0                           | N/A                         |
| CSI-RS signal 1   |                                |              | N/A                         | Antenna ports<br>15,16      | N/A                         | Antenna ports<br>15,16      |
| CSI-RS 1 periodicity and subframe offset $T_{CSI-RS} / \Delta_{CSI-RS}$           |                                |              | N/A                         | 5/1                         | N/A                         | 5/1                         |
| CSI-RS 1 configuration  |                                |              | N/A                         | 3                           | N/A                         | 3                           |
| Zero-power CSI-RS 0 configuration<br>I <sub>CSI-RS</sub> / ZeroPowerCSI-RS bitmap |                                |              | N/A                         | 1 /<br>10000010000<br>00000 | N/A                         | 1 /<br>10000010000<br>00000 |
| Zero-power CSI-RS 1 configuration<br>I <sub>CSI-RS</sub> / ZeroPowerCSI-RS bitmap |                                |              | 1 /<br>00110000000<br>00000 | N/A                         | 1 /<br>00110000000<br>00000 | N/A                         |
| CSI-IM 0 periodicity<br>$T_{CSI-RS} / \Delta_{CSI-RS}$                            | and subframe offset            |              | 5/1                         | N/A                         | 5/1                         | N/A                         |
| CSI-IM 0 configurat   | ion                            |              | 2                           | N/A                         | 2                           | N/A                         |
| CSI-IM 1 periodicity<br>$T_{CSI-RS} / \Delta_{CSI-RS}$                            | and subframe offset            |              | N/A                         | 5/1                         | N/A                         | 5/1                         |
| CSI-IM 1 configurat   | ion                            |              | N/A                         | 6                           | N/A                         | 6                           |
| RI configuration  |                                |              | Fixed RI=2<br>and follow RI | N/A                         | Fixed RI=1<br>and follow RI | N/A                         |
| Physical channel fo   | r CQI/PMI reporting            |              | PUSCH (Note<br>6)           | N/A                         | PUSCH (Note<br>6)           | PUSCH (Note<br>6)           |
| PUCCH Report Typ  | e for CQI/PMI                  |              | 2                           | N/A                         | 2                           | 2                           |
| Physical channel fo   | r RI reporting                 |              | PUCCH<br>Format 2           | N/A                         | PUCCH<br>Format 2           | PUCCH<br>Format 2           |
| PUCCH Report Typ  | e for RI                       |              | 3                           | N/A                         | 3                           | 3                           |
|   | CSI-RS                         |              | CSI-RS 0                    | N/A                         | CSI-RS 0                    | N/A                         |
|   | CSI-IM                         |              | CSI-IM 0                    | N/A                         | CSI-IM 0                    | N/A                         |
|   | Reporting mode                 |              | PUCCH 1-1                   | N/A                         | PUCCH 1-1                   | N/A                         |
| CSI process 0<br>(Note 7)   | Reporting<br>periodicity       | ms           | $N_{\rm pd} = 5$            | N/A                         | $N_{\rm pd}=5$              | N/A                         |
|   | CQI delay                      | ms           | 8                           | N/A                         | 10                          | N/A                         |
|   | cqi-pmi-<br>ConfigurationIndex |              | 6                           | N/A                         | 6                           | N/A                         |
|   | ri-ConfigIndex                 |              | 1                           | N/A                         | 1                           | N/A                         |
|   | CSI-RS                         |              | N/A                         | N/A                         | N/A                         | CSI-RS 1                    |
| CSI process 1   | CSI-IM                         |              | N/A                         | N/A                         | N/A                         | CSI-IM 1                    |
| (Note 7, Note 9)  | Reporting mode                 |              | N/A                         | N/A                         | N/A                         | PUCCH 1-1                   |
|   | Reporting<br>periodicity       | ms           | N/A                         | N/A                         | N/A                         | $N_{\rm pd}=5$              |

|   | CQI delay   | ms                      | N/A  | N/A                       | N/A  | 10                        |
|---|---|-------------------------|--|---------------------------|--|---------------------------|
|   | cqi-pmi-<br>ConfigurationIndex  |                         | N/A  | N/A                       | N/A  | 4                         |
|   | ri-ConfigIndex  |                         | N/A  | N/A                       | N/A  | 1                         |
| CSI proce   | ess for PDSCH scheduling  |                         | CSI pro  | ocess 0                   | CSI pro  | ocess 0                   |
| Cell ID   |   |                         | 0  | 6                         | 0  | 6                         |
| Quasi-co  | -located CSI-RS   |                         | CSI-RS 0   | CSI-RS 1                  | CSI-RS 0   | CSI-RS 1                  |
| Quasi-co  | -located CRS  |                         | Same Cell ID<br>as Cell 1                                  | Same Cell ID<br>as Cell 2 | Same Cell ID<br>as Cell 1                                  | Same Cell ID<br>as Cell 2 |
| PMI for s   | ubframe 2, 3, 4, 7, 8 and 9   |                         | 010000 for<br>fixed RI = 2<br>010011 for UE<br>reported RI | 100000                    | 000011 for<br>fixed RI = 1<br>010011 for UE<br>reported RI | N/A                       |
| PMI for subframe 1 and 6  |   |                         | 100000   | 100000                    | 100000   | N/A                       |
| Max number of HARQ transmissions  |   |                         | 1  | N/A                       | 1  | N/A                       |
| Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4) |   |                         |  |                           |  |                           |
| Note 2:   | 3 symbols allocated to PDCCH  |                         |  |                           |  |                           |
| Note 3:   | Reference measurement channel RC.13 FDD according to Table A.4-1. PDSCH transmission is scheduled on subframe 2, 3, 4, 7, 8 and 9 from TP1. |                         |  |                           |  |                           |
| Note 4:   | TM10 OCNG as specified in A.5   | 5.1.8 is transmitted or | subframe 1 and 6   | 6 from TP1.               |  |                           |
| Note 5:   | TM10 OCNG as specified in A.5.1.8 is transmitted on subframe 1, 2, 3, 4, 6, 7, 8 and 9 from TP2 for Test 1; TP2 is                          |                         |  |                           |  |                           |

Note 5: TM10 OCNG as specified in A.5.1.8 is transmitted on subframe 1, 2, 3, 4, 6, 7, 8 and 9 from TP2 for Test 1; TP2 is blanked for Test 2.

Note 6: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#0 and #5.

Note 7: If UE supports multiple CSI processes, CSI process 0 is configured as 'RI-reference CSI process' for CSI process 1.

Note 8: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#1 and #6 to allow aperiodic CQI/PMI/RI to be transmitted in uplink SF#0 and #5.

Note 9: If UE supports one CSI process, CSI process 1 is not configured in Test 2.

#### Table 9.5.5.1-2 Minimum requirement (FDD)

|             | Test 1 | Test 2 |
|-------------|--------|--------|
| <i>γ</i> 1  | N/A    | 1.0    |
| <i>Y</i> 2  | 1.0    | N/A    |
| UE Category | ≥2     | ≥2     |

#### 9.5.5.2 TDD

The minimum performance requirement in Table 9.5.5.2-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be  $\geq \gamma_1$ ;
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be  $\geq \gamma_2$ ;
- c) For Test 2, the RI reported for CSI process 1 shall be the same as the most recent RI reported for CSI process 0 if UE is configured with multiple CSI processes.

For the parameters specified in Table 9.5.5.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.5.2-2.

# Table 9.5.5.2-1 RI Test (TDD)

| Parameter   |                              |              | Test 1                                      |                             | Test 2                                      |                             |
|---|------------------------------|--------------|---|-----------------------------|---|-----------------------------|
| Parameter<br>Bandwidth  |                              | Unit         | TP1   | TP2                         | TP1   | TP2                         |
|   |                              | MHz          | 10 MHz                                      |                             |   | MHz                         |
| Transmission mode   |                              |              | 10  | 10                          | 10  | 10                          |
| $ ho_{\scriptscriptstyle A}$  |                              | dB           | (   | D                           | (   | 0                           |
| Downlink power  | $ ho_{\scriptscriptstyle B}$ | dB           |   | 0                           | (   | 0                           |
| allocation  | $P_c$                        | dB           | 0   | 0                           | 0   | 0                           |
|   | σ                            | dB           | _   | 0                           | -   | 0                           |
| Uplink downlink co  | -                            | üB           | 2   | 2                           | 2   | 2                           |
| Special subframe c  | 0                            |              | 4   | 4                           | 4   | 4                           |
| SNR   | John gui da on               | dB           | 0   | 0                           | 20  | 20                          |
| $\hat{I}_{or}^{(j)}$  |                              | dB[mW/15kHz] | -98   | -98                         | -78   | -78                         |
| $N_{oc}^{(j)}$  |                              | dB[mW/15kHz] | -9  | 98                          | -2  | 98                          |
| Propagation chann   | el                           |              | EPA 5 Low                                   | EPA 5 Low                   | EPA 5 Low                                   | EPA 5 High                  |
| Antenna configurat  | tion                         |              | 2x2   | 2x2                         | 2x2   | 2x2                         |
| Beamforming Mode  |                              |              | As specified in                             | Section B.4.3               | As specified in                             | Section B.4.3               |
| Timing offset betwe   |                              | US           |   | 0                           |   | 0                           |
| Frequency offset b  |                              | Hz           |   | 0                           |   | 0                           |
| Cell-specific refere  | nce signals                  |              |   | a ports 0                   |   | a ports 0                   |
| CSI-RS signal 0   |                              |              | Antenna ports<br>15,16                      | N/A                         | Antenna ports<br>15,16                      | N/A                         |
| CSI-RS 0 periodicit<br>T <sub>CSI-RS</sub> / $\Delta$ <sub>CSI-RS</sub>           | ty and subframe offset       |              | 5/3   | N/A                         | 5/3   | N/A                         |
| CSI-RS 0 configura  | ation                        |              | 0   | N/A                         | 0   | N/A                         |
| CSI-RS signal 1   |                              |              | N/A   | Antenna ports<br>15,16      | N/A   | Antenna port<br>15,16       |
| CSI-RS 1 periodicity and subframe offset $T_{CSI-RS} / \Delta_{CSI-RS}$           |                              |              | N/A   | 5/3                         | N/A   | 5/3                         |
| CSI-RS 1 configura  | ation                        |              | N/A   | 3                           | N/A   | 3                           |
| Zero-power CSI-RS 0 configuration<br>I <sub>CSI-RS</sub> / ZeroPowerCSI-RS bitmap |                              |              | N/A   | 3 /<br>10000010000<br>00000 | N/A   | 3 /<br>10000010000<br>00000 |
| Zero-power CSI-RS 1 configuration<br>I <sub>CSI-RS</sub> / ZeroPowerCSI-RS bitmap |                              |              | 3 /<br>00110000000<br>00000                 | N/A                         | 3 /<br>00110000000<br>00000                 | N/A                         |
| CSI-IM 0 periodicity<br>T <sub>CSI-RS</sub> / $\Delta$ <sub>CSI-RS</sub>          | y and subframe offset        |              | 5/3   | N/A                         | 5/3   | N/A                         |
| CSI-IM 0 configura  | tion                         |              | 2   | N/A                         | 2   | N/A                         |
| CSI-IM 1 periodicity<br>T <sub>CSI-RS</sub> / $\Delta$ <sub>CSI-RS</sub>          | y and subframe offset        |              | N/A   | 5/3                         | N/A   | 5/3                         |
| CSI-IM 1 configura  | tion                         |              | N/A   | 6                           | N/A   | 6                           |
| RI configuration  |                              |              | Fixed RI=2<br>and follow RI                 | N/A                         | Fixed RI=1<br>and follow RI                 | N/A                         |
|   | CSI-RS                       |              | CSI-RS 0                                    | N/A                         | CSI-RS 0                                    | N/A                         |
|   | CSI-IM                       |              | CSI-IM 0                                    | N/A                         | CSI-IM 0                                    | N/A                         |
| CSI process 0<br>(Note 6, 7)  | Reporting mode               |              | PUSCH 3-1                                   | N/A                         | PUSCH 3-1                                   | N/A                         |
|   | Reporting Interval           | ms           | 5   | N/A                         | 5   | N/A                         |
|   | CQI delay                    | ms           | 11  | N/A                         | 11  | N/A                         |
|   | CSI-RS                       |              | N/A   | N/A                         | N/A   | CSI-RS 1                    |
| CSI process 1   | CSI-IM                       |              | N/A   | N/A                         | N/A   | CSI-IM 1                    |
| (Note 6, 7, 8)  | Reporting mode               |              | N/A   | N/A                         | N/A   | PUSCH 3-1                   |
| · · · · · · · · · · · · · · · · · · ·   | Reporting Interval           | ms           | N/A   | N/A                         | N/A   | 5                           |
| CQI delay<br>CSI process for PDSCH scheduling                                     |                              | ms           | N/A   | N/A                         | N/A   | 11                          |
| CSI process for PL<br>Cell ID   | SCH scheduling               |              |   | ocess 0                     |   | ocess 0                     |
| Quasi-co-located C  |                              |              | CSI-RS 0                                    | 6<br>CSI-RS 1               | CSI-RS 0                                    | 6<br>CSI-RS 1               |
|   |                              |              | Same Cell ID                                | Same Cell ID                | Same Cell ID                                | Same Cell IE                |
| Quasi-co-located C  | CRS                          |              | as Cell 1                                   | as Cell 2                   | as Cell 1                                   | as Cell 2                   |
| PMI for subframe 4  | and 9                        |              | 010000 for<br>fixed RI = 2<br>010011 for UE | 100000                      | 000011 for<br>fixed RI = 1<br>010011 for UE | N/A                         |

|                          |  |                       | reported RI       |        | reported RI  |                 |
|--------------------------|--|-----------------------|-------------------|--------|--------------|-----------------|
| PMI for subframe 3 and 8 |  |                       | 100000            | 100000 | 100000       | N/A             |
| Max num                  | ber of HARQ transmissions  |                       | 1                 | N/A    | 1            | N/A             |
| ACK/NAC                  | CK feedback mode   |                       | Multiplexing      | N/A    | Multiplexing | N/A             |
| Note 1:                  | Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF no later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4) |                       |                   |        |              | downlink SF not |
| Note 2:                  | 3 symbols allocated to PDCCH   |                       |                   |        |              |                 |
| Note 3:                  | 93: Reference measurement channel RC.13 TDD according to Table A.4-1. PDSCH transmission is scheduled on subframe 4 and 9 from TP1.  |                       |                   |        |              |                 |
| Note 4:                  | TM10 OCNG as specified in A.5.2.8 is transmitted on subframe 3 and 8 from TP1.   |                       |                   |        |              |                 |
| Note 5:                  |  |                       |                   |        |              |                 |
| Note 6:                  | Reported wideband CQI and PM   | II are used and sub-b | and CQI is discar | ded.   |              |                 |
| Note 7:                  | If UE supports multiple CSI processes, CSI process 0 is configured as 'RI-reference CSI process' for CSI process 1.  |                       |                   |        |              |                 |
| Note 8:                  | If UE supports one CSI process, CSI process 1 is not configured in Test 2.   |                       |                   |        |              |                 |
| Note 9:                  | PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#3and #8 to allow aperiodic CQI/PMI/RI to be transmitted in uplink SF#7 and #2.   |                       |                   |        |              |                 |

| Table 9.5.5.2-2 Minimum r | requirement ( | (TDD) |
|---------------------------|---------------|-------|
|---------------------------|---------------|-------|

|             | Test 1 | Test 2 |
|-------------|--------|--------|
| <i>)</i> 1  | N/A    | 1.0    |
| <i>j</i> 2  | 1.0    | N/A    |
| UE Category | ≥2     | ≥2     |

# 9.6 Additional requirements for carrier aggregation

This clause includes requirements for the reporting of channel state information (CSI) with the UE configured for carrier aggregation. The purpose is to verify that the channel state for each cell is correctly reported with multiple cells configured for periodic reporting.

# 9.6.1 Periodic reporting on multiple cells (Cell-Specific Reference Symbols)

#### 9.6.1.1 FDD

The following requirements apply to UE Category  $\geq 3$ . For the parameters specified in Table 9.6.1.1-1 and Table 9.6.1.1-2, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2 on each cell, the difference between the wideband CQI indices of Pcell and Scell reported shall be such that

wideband  $CQI_{Pcell}-wideband\ CQI_{Scell} \geq 2$ 

for more than 90% of the time.

| Parameter                              |                              | Unit         | Pcell   | Scell                                |
|--|------------------------------|--------------|---|--------------------------------------|
| PDSCH transmission mode                |                              |              |   | 1                                    |
| Downlink power $\rho_A$                |                              | dB           | 0   |                                      |
| allocation                             | $ ho_{\scriptscriptstyle B}$ | dB           |   | 0                                    |
| Propagation condit<br>antenna configur |                              |              | AWG   | N (1 x 2)                            |
| SNR                                    |                              | dB           | 10  | 4                                    |
| $\hat{I}_{or}^{(j)}$                   |                              | dB[mW/15kHz] | -88   | -94                                  |
| $N_{oc}^{(j)}$                         |                              | dB[mW/15kHz] | -98   | -98                                  |
| Physical channel for CQI<br>reporting  |                              |              | PUCCH   | Format 2                             |
| PUCCH Report                           | Туре                         |              |   | 4                                    |
| Reporting period                       | dicity                       | ms           | $N_{\rm pd} = 10$                                       |                                      |
| cqi-pmi-ConfigurationIndex             |                              |              | 11  | 16 [shift of 5 ms relative to Pcell] |
|  |                              |              | DSCH for user data is sche<br>as described in Annex A.5 |                                      |

# Table 9.6.1.1-1: Parameters for PUCCH 1-0 static test on multiple cells (FDD)

#### Table 9.6.1.1-2: PUCCH 1-0 static test (FDD)

| Test number |   | Bandwidth combination                       |
|-------------|---|---|
| 1           |   | 10MHz for both cells                        |
| 2           |   | 20MHz for both cells                        |
| Note 1:     | lote 1: The applicability of requirements for different CA configurations and |   |
|             | bandwid   | dth combination sets is defined in 9.1.1.2. |

## 9.6.1.2 TDD

The following requirements apply to UE Category  $\geq 3$ . For the parameters specified in Table 9.6.1.2-1 and Table 9.6.1.2-2, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2 on each cell, the difference between the wideband CQI indices of Pcell and Scell reported shall be such that

wideband  $CQI_{Pcell}-wideband\ CQI_{Scell} \geq 2$ 

for more than 90% of the time.

| Parameter  |                              | Unit         | Pcell          | Scell                                |  |  |  |
|--|------------------------------|--------------|----------------|--------------------------------------|--|--|--|
| PDSCH transmissio  | on mode                      |              |                | 1                                    |  |  |  |
| Uplink downlink cont   | figuration                   |              |                | 2                                    |  |  |  |
| Special subfra<br>configuration  |                              |              |                | 4                                    |  |  |  |
| Downlink power   | $ ho_{\scriptscriptstyle A}$ | dB           |                | 0                                    |  |  |  |
| allocation   | $ ho_{\scriptscriptstyle B}$ | dB           |                | 0                                    |  |  |  |
| Propagation condit<br>antenna configu  |                              |              | AWGN (1 x 2)   |                                      |  |  |  |
| SNR  |                              | dB           | 10             | 4                                    |  |  |  |
| $\hat{I}^{(j)}_{or}$   |                              | dB[mW/15kHz] | -88            | -94                                  |  |  |  |
| $N_{oc}^{(j)}$   |                              | dB[mW/15kHz] | -98            | -98                                  |  |  |  |
| Physical channel f<br>reporting  | or CQI                       |              | PUCCH Format 2 |                                      |  |  |  |
| PUCCH Report   | Туре                         |              |                | 4                                    |  |  |  |
| Reporting period   | dicity                       | ms           | Λ              | / <sub>pd</sub> = 10                 |  |  |  |
| cqi-pmi-Configurati  | onIndex                      |              | 8              | 13 [shift of 5 ms relative to Pcell] |  |  |  |
| Note 1: 3 symbols are allocated to PDCCH. No PDSCH for user data is scheduled for the UE with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1. |                              |              |                |                                      |  |  |  |

Table 9.6.1.2-1: PUCCH 1-0 static test on multiple cells (TDD)

#### Table 9.6.1.2-2: PUCCH 1-0 static test (TDD)

| Test number |  | Bandwidth combination |  |  |  |  |  |
|-------------|--|-----------------------|--|--|--|--|--|
| 1           |  | 20MHz for both cells  |  |  |  |  |  |
| Note 1:     | The applicability of requirements for different CA configurations<br>and bandwidth combination sets is defined in 9.1.1.2. |                       |  |  |  |  |  |

## 10 Performance requirement (MBMS)

## 10.1 FDD (Fixed Reference Channel)

The parameters specified in Table 10.1-1 are valid for all FDD tests unless otherwise stated. For the requirements defined in this section, the difference between CRS EPRE and the MBSFN RS EPRE should be set to 0 dB as the UE demodulation performance might be different when this condition is not met (e.g. in scenarios where power offsets are present, such as scenarios when reserved cells are present).

| Parameter   | Unit      | Value       |  |  |  |  |  |
|---|-----------|-------------|--|--|--|--|--|
| Number of HARQ<br>processes   | Processes | None        |  |  |  |  |  |
| Subcarrier spacing  | kHz       | 15 kHz      |  |  |  |  |  |
| Allocated subframes per<br>Radio Frame (Note 1)   |           | 6 subframes |  |  |  |  |  |
| Number of OFDM<br>symbols for PDCCH   |           | 2           |  |  |  |  |  |
| Cyclic Prefix   |           | Extended    |  |  |  |  |  |
| Note1: For FDD mode, up to 6 subframes (#1/2/3/6/7/8) are available for MBMS, in line with TS 36.331. |           |             |  |  |  |  |  |

#### 10.1.1 Minimum requirement

The receive characteristic of MBMS is determined by the BLER. The requirement is valid for all RRC states for which the UE has capabilities for MBMS.

For the parameters specified in Table 10.1-1 and Table 10.1.1-1 and Annex A.3.8.1, the average downlink SNR shall be below the specified value for the BLER shown in Table 10.1.1-2.

| Parameter                    |                              | Unit      | Test 1-4   |  |  |  |
|------------------------------|------------------------------|-----------|------------|--|--|--|
| Downlink power<br>allocation | $ ho_{\scriptscriptstyle A}$ | dB        | 0          |  |  |  |
|                              | $ ho_{\scriptscriptstyle B}$ | dB        | 0 (Note 1) |  |  |  |
|                              | σ                            | dB        | 0          |  |  |  |
| $N_{\it oc}$ at antenna      | port                         | dBm/15kHz | -98        |  |  |  |
| Note 1: $P_B = 0$ .          |                              |           |            |  |  |  |

Table 10.1.1-1: Test Parameters for Testing

 Table 10.1.1-2: Minimum performance

| Test   | Bandwidth | Reference  | OCNG        | Propagation             | Correlation           | Referen     | ce value | MBMS           |
|--------|-----------|------------|-------------|-------------------------|-----------------------|-------------|----------|----------------|
| number |           | Channel    | Pattern     | condition               | Matrix and<br>antenna | BLER<br>(%) | SNR(dB)  | UE<br>Category |
| 1      | 10 MHz    | R.37 FDD   | OP.4<br>FDD |                         |                       |             | 4.1      | ≥1             |
| 2      | 10 MHz    | R.38 FDD   | OP.4<br>FDD | MBSFN                   |                       |             | 11.0     | ≥1             |
| 3      | 10 MHz    | R.39 FDD   | OP.4<br>FDD | channel<br>model (Table | 1x2 low               | 1           | 20.1     | ≥2             |
|        | 5.0MHz    | R.39-1 FDD | OP.4<br>FDD | B.2.6-1)                |                       |             | 20.5     | 1              |
| 4      | 1.4 MHz   | R.40 FDD   | OP.4<br>FDD | ]                       |                       |             | 6.6      | ≥1             |

## 10.2 TDD (Fixed Reference Channel)

The parameters specified in Table 10.2-1 are valid for all TDD tests unless otherwise stated. For the requirements defined in this section, the difference between CRS EPRE and the MBSFN RS EPRE should be set to 0 dB as the UE demodulation performance might be different when this condition is not met (e.g. in scenarios where power offsets are present, such as scenarios when reserved cells are present).

| Par  | rameter   | Unit      | Value       |  |  |  |
|--|---|-----------|-------------|--|--|--|
|  | er of HARQ<br>ocesses                           | Processes | None        |  |  |  |
| Subcar   | rier spacing                                    | kHz       | 15 kHz      |  |  |  |
|  | Allocated subframes per<br>Radio Frame (Note 1) |           | 5 subframes |  |  |  |
|  | Number of OFDM<br>symbols for PDCCH             |           | 2           |  |  |  |
| Сус  | lic Prefix                                      |           | Extended    |  |  |  |
| Note1: For TDD mode, in line with TS 36.331, Uplink-Downlink Configuration 5 is proposed, up to 5 subframes (#3/4/7/8/9) are available for MBMS. |   |           |             |  |  |  |

Table 10.2-1: Common Test Parameters (TDD)

### 10.2.1 Minimum requirement

The receive characteristic of MBMS is determined by the BLER. The requirement is valid for all RRC states for which the UE has capabilities for MBMS.

For the parameters specified in Table 10.2-1 and Table 10.2.1-1 and Annex A.3.8.2, the average downlink SNR shall be below the specified value for the BLER shown in Table 10.2.1-2.

| Parameter                    | ,                            | Unit      | Test 1-4   |  |  |
|------------------------------|------------------------------|-----------|------------|--|--|
| Downlink power<br>allocation | $ ho_{\scriptscriptstyle A}$ | dB        | 0          |  |  |
|                              | $ ho_{\scriptscriptstyle B}$ | dB        | 0 (Note 1) |  |  |
|                              | σ                            | dB        | 0          |  |  |
| $N_{\it oc}$ at antenna      | port                         | dBm/15kHz | -98        |  |  |
| Note 1: $P_B = 0$ .          |                              |           |            |  |  |

Table 10.2.1-1: Test Parameters for Testing

| Table 10.2.1-2: Minimum pe | erformance |
|----------------------------|------------|
|----------------------------|------------|

| Test   | Bandwidth | Reference  | OCNG        | Propagation             | Correlation        | Referen     | ce value | MBMS           |
|--------|-----------|------------|-------------|-------------------------|--------------------|-------------|----------|----------------|
| number |           | Channel    | Pattern     | condition               | Matrix and antenna | BLER<br>(%) | SNR(dB)  | UE<br>Category |
| 1      | 10 MHz    | R.37 TDD   | OP.4<br>TDD |                         |                    |             | 3.4      | ≥1             |
| 2      | 10 MHz    | R.38 TDD   | OP.4<br>TDD | MBSFN                   |                    |             | 11.1     | ≥1             |
| 3a     | 10 MHz    | R.39 TDD   | OP.4<br>TDD | channel<br>model (Table | 1x2 low            | 1           | 20.1     | ≥2             |
| 3b     | 5MHz      | R.39-1 TDD | OP.4<br>TDD | B.2.6-1)                |                    |             | 20.5     | 1              |
| 4      | 1.4 MHz   | R.40 TDD   | OP.4<br>TDD |                         |                    |             | 5.8      | ≥1             |

## Annex A (normative): Measurement channels

## A.1 General

The throughput values defined in the measurement channels specified in Annex A, are calculated and are valid per datastream (codeword). For multi-stream (more than one codeword) transmissions, the throughput referenced in the minimum requirements is the sum of throughputs of all datastreams (codewords).

The UE category entry in the definition of the reference measurement channel in Annex A is only informative and reveals the UE categories, which can support the corresponding measurement channel. Whether the measurement channel is used for testing a certain UE category or not is specified in the individual minimum requirements.

## A.2 UL reference measurement channels

## A.2.1 General

#### A.2.1.1 Applicability and common parameters

The following sections define the UL signal applicable to the Transmitter Characteristics (clause 6) and for the Receiver Characteristics (clause 7) where the UL signal is relevant.

The Reference channels in this section assume transmission of PUSCH and Demodulation Reference signal only. The following conditions apply:

- 1 HARQ transmission
- Cyclic Prefix normal
- PUSCH hopping off
- Link adaptation off
- Demodulation Reference signal as per TS 36.211 [4] subclause 5.5.2.1.2.

Where ACK/NACK is transmitted, it is assumed to be multiplexed on PUSCH as per TS 36.212 [5] subclause 5.2.2.6.

- ACK/NACK 1 bit
- ACK/NACK mapping adjacent to Demodulation Reference symbol
- ACK/NACK resources punctured into data
- Max number of resources for ACK/NACK: 4 SC-FDMA symbols per subframe
- No CQI transmitted, no RI transmitted

#### A.2.1.2 Determination of payload size

The algorithm for determining the payload size A is as follows; given a desired coding rate R and radio block allocation  $N_{\text{RB}}$ 

- 1. Calculate the number of channel bits  $N_{ch}$  that can be transmitted during the first transmission of a given sub-frame.
- 2. Find A such that the resulting coding rate is as close to R as possible, that is,

 $\min |R - (A + 24*(N_{CB} + 1)) / N_{ch}|, where N_{CB} = \begin{cases} 0, if C = 1\\ C, if C > 1 \end{cases}$  subject to

- a) A is a valid TB size according to section 7.1.7 of TS 36.213 [6] assuming an allocation of  $N_{\text{RB}}$  resource blocks.
- b) C is the number of Code Blocks calculated according to section 5.1.2 of TS 36.212 [5].
- c) For RMC-s, which at the nominal target coding rate do not cover all the possible UE categories for the given modulation, reduce the target coding rate gradually (within the same modulation), until the maximal possible number of UE categories is covered.

3. If there is more than one *A* that minimises the equation above, then the larger value is chosen per default and the chosen code rate should not exceed 0.93.

#### A.2.1.3 Overview of UL reference measurement channels

In Table A.2.1.3-1 are listed the UL reference measurement channels specified in annexes A.2.2 and A.2.3 of this release of TS 36.101. This table is informative and serves only to a better overview. The reference for the concrete reference measurement channels and corresponding implementation's parameters as to be used for requirements are annexes A.2.2 and A.2.3 as appropriate.

| Duplex   | Table                | Name | BW       | Mod   | TCR | RB  | RB<br>Off<br>set | UE<br>Cat<br>eg | Notes |
|----------|----------------------|------|----------|-------|-----|-----|------------------|-----------------|-------|
| FDD, Ful | I RB allocation, QP  | SK   |          |       |     |     |                  |                 |       |
| FDD      | Table A.2.2.1.1-1    |      | 1.4      | QPSK  | 1/3 | 6   |                  | ≥ 1             |       |
| FDD      | Table A.2.2.1.1-1    |      | 3        | QPSK  | 1/3 | 15  |                  | ≥ 1             |       |
| FDD      | Table A.2.2.1.1-1    |      | 5        | QPSK  | 1/3 | 25  |                  | ≥ 1             |       |
| FDD      | Table A.2.2.1.1-1    |      | 10       | QPSK  | 1/3 | 50  |                  | ≥ 1             |       |
| FDD      | Table A.2.2.1.1-1    |      | 15       | QPSK  | 1/5 | 75  |                  | ≥ 1             |       |
| FDD      | Table A.2.2.1.1-1    |      | 20       | QPSK  | 1/6 | 100 |                  | ≥ 1             |       |
| FDD, Ful | I RB allocation, 16- | QAM  |          |       |     |     |                  |                 |       |
| FDD      | Table A.2.2.1.2-1    |      | 1.4      | 16QAM | 3/4 | 6   |                  | ≥ 1             |       |
| FDD      | Table A.2.2.1.2-1    |      | 3        | 16QAM | 1/2 | 15  |                  | ≥ 1             |       |
| FDD      | Table A.2.2.1.2-1    |      | 5        | 16QAM | 1/3 | 25  |                  | ≥ 1             |       |
| FDD      | Table A.2.2.1.2-1    |      | 10       | 16QAM | 3/4 | 50  |                  | ≥ 2             |       |
| FDD      | Table A.2.2.1.2-1    |      | 15       | 16QAM | 1/2 | 75  |                  | ≥ 2             |       |
| FDD      | Table A.2.2.1.2-1    |      | 20       | 16QAM | 1/3 | 100 |                  | ≥ 2             |       |
| FDD, Par | rtial RB allocation, | QPSK |          |       |     |     |                  |                 |       |
| FDD      | Table A.2.2.2.1-1    |      | 1.4 - 20 | QPSK  | 1/3 | 1   |                  | ≥ 1             |       |
| FDD      | Table A.2.2.2.1-1    |      | 1.4 - 20 | QPSK  | 1/3 | 2   |                  | ≥ 1             |       |
| FDD      | Table A.2.2.2.1-1    |      | 1.4 - 20 | QPSK  | 1/3 | 3   |                  | ≥ 1             |       |
| FDD      | Table A.2.2.2.1-1    |      | 1.4 - 20 | QPSK  | 1/3 | 4   |                  | ≥ 1             |       |
| FDD      | Table A.2.2.2.1-1    |      | 1.4 - 20 | QPSK  | 1/3 | 5   |                  | ≥ 1             |       |
| FDD      | Table A.2.2.2.1-1    |      | 3 - 20   | QPSK  | 1/3 | 6   |                  | ≥ 1             |       |
| FDD      | Table A.2.2.2.1-1    |      | 3 - 20   | QPSK  | 1/3 | 8   |                  | ≥ 1             |       |
| FDD      | Table A.2.2.2.1-1    |      | 3 - 20   | QPSK  | 1/3 | 9   |                  | ≥ 1             |       |
| FDD      | Table A.2.2.2.1-1    |      | 3 - 20   | QPSK  | 1/3 | 10  |                  | ≥ 1             |       |
| FDD      | Table A.2.2.2.1-1    |      | 3 - 20   | QPSK  | 1/3 | 12  |                  | ≥ 1             |       |
| FDD      | Table A.2.2.2.1-1    |      | 5 - 20   | QPSK  | 1/3 | 15  |                  | ≥ 1             |       |
| FDD      | Table A.2.2.2.1-1    |      | 5 - 20   | QPSK  | 1/3 | 16  |                  | ≥ 1             |       |
| FDD      | Table A.2.2.2.1-1    |      | 5 - 20   | QPSK  | 1/3 | 18  |                  | ≥ 1             |       |
| FDD      | Table A.2.2.2.1-1    |      | 5 - 20   | QPSK  | 1/3 | 20  |                  | ≥ 1             |       |
| FDD      | Table A.2.2.2.1-1    |      | 5 - 20   | QPSK  | 1/3 | 24  |                  | ≥ 1             |       |
| FDD      | Table A.2.2.2.1-1    |      | 10 - 20  | QPSK  | 1/3 | 25  |                  | ≥ 1             |       |
| FDD      | Table A.2.2.2.1-1    |      | 10 - 20  | QPSK  | 1/3 | 27  |                  | ≥ 1             |       |
| FDD      | Table A.2.2.2.1-1    |      | 10 - 20  | QPSK  | 1/3 | 30  |                  | ≥ 1             |       |
| FDD      | Table A.2.2.2.1-1    |      | 10 - 20  | QPSK  | 1/3 | 32  |                  | ≥ 1             |       |
| FDD      | Table A.2.2.2.1-1    |      | 10 - 20  | QPSK  | 1/3 | 36  |                  | ≥ 1             |       |
| FDD      | Table A.2.2.2.1-1    |      | 10 - 20  | QPSK  | 1/3 | 40  |                  | ≥ 1             |       |
| FDD      | Table A.2.2.2.1-1    |      | 10 - 20  | QPSK  | 1/3 | 45  |                  | ≥ 1             |       |
| FDD      | Table A.2.2.2.1-1    |      | 10 - 20  | QPSK  | 1/3 | 48  |                  | ≥ 1             |       |
| FDD      | Table A.2.2.2.1-1    |      | 15 - 20  | QPSK  | 1/3 | 50  |                  | ≥ 1             |       |
| FDD      | Table A.2.2.2.1-1    |      | 15 - 20  | QPSK  | 1/3 | 54  |                  | ≥ 1             |       |
| FDD      | Table A.2.2.2.1-1    |      | 15 - 20  | QPSK  | 1/4 | 60  |                  | ≥ 1             |       |
| FDD      | Table A.2.2.2.1-1    |      | 15 - 20  | QPSK  | 1/4 | 64  |                  | ≥ 1             |       |
| FDD      | Table A.2.2.2.1-1    |      | 15 - 20  | QPSK  | 1/4 | 72  |                  | ≥ 1             |       |
| FDD      | Table A.2.2.2.1-1    |      | 20       | QPSK  | 1/5 | 75  |                  | ≥ 1             |       |
| FDD      | Table A.2.2.2.1-1    |      | 20       | QPSK  | 1/5 | 80  |                  | ≥ 1             |       |

Table A.2.1.3-1: Overview of UL reference measurement channels

| TOD       Table A.22.1:1       Zu       OPS       No       No       A       A       A       A       A       A       A       A       A       A       A       A       A       No       B       A       A       A       A       B       B       A       A       A       B       B       A       A       B       B       A       A       B       B       A       A       B       B       A       A       B       B       A       A       B       B       A <th>FDD</th> <th></th> <th></th> <th>20</th> <th>QPSK</th> <th>1/5</th> <th>01</th> <th></th> <th><b>N</b>1</th> <th></th>   | FDD                           |                   |            | 20      | QPSK    | 1/5  | 01 |  | <b>N</b> 1 |  |
|---|-------------------------------|-------------------|------------|---------|---------|------|----|--|------------|--|
| FDD       Table A.2.2.2.1.1       V       Q0       QPSK       1.6       96       2.1         FDD       Table A.2.2.2.2.1       1.4.20       160AM       3/4       1       2       2.1         FDD       Table A.2.2.2.2.1       1.4.20       160AM       3/4       3       2.1         FDD       Table A.2.2.2.2.1       1.4.20       160AM       3/4       4       2.1         FDD       Table A.2.2.2.2.1       1.4.20       160AM       3/4       4       2.1         FDD       Table A.2.2.2.2.1       3.20       160AM       3/4       6       2.1         FDD       Table A.2.2.2.2.1       3.20       160AM       3/4       8       2.1         FDD       Table A.2.2.2.2.1       3.20       160AM       3/4       10       2.1         FDD       Table A.2.2.2.2.1       3.20       160AM       1/2       2.1       2.1         FDD       Table A.2.2.2.2.1       5.20       160AM       1/2       2.1       2.1         FDD       Table A.2.2.2.2.1       5.20       160AM       1/3       2.0       2.1         FDD       Table A.2.2.2.1       5.20       160AM       1/3       2.1       2.   |                               | Table A.2.2.2.1-1 |            | 20      |         | 1/5  | 81 |  | ≥ 1        |  |
| FDD.         Partial RB allocation, 16-QAM         3/4         1         2         1           FDD         Table A.22.2.2.1         1.4 - 20         160AM         3/4         2         2         2           FDD         Table A.22.2.2.1         1.4 - 20         160AM         3/4         2         2         2           FDD         Table A.22.2.2.1         1.4 - 20         160AM         3/4         4         2         1           FDD         Table A.22.2.2.1         1.4 - 20         160AM         3/4         6         2.1           FDD         Table A.22.2.2.1         3 - 20         160AM         3/4         9         2.1           FDD         Table A.22.2.2.1         3 - 20         160AM         3/4         9         2.1           FDD         Table A.22.2.2.1         5 - 20         160AM         3/4         12         2.1           FDD         Table A.22.2.2.1         5 - 20         160AM         1/2         2.1         1           FDD         Table A.22.2.2.1         5 - 20         160AM         1/3         2.6         2.1           FDD         Table A.22.2.2.1         10 - 20         160AM         1/3         2.6         2.1  |                               |                   |            |         |         |      |    |  |            |  |
| FDD       Table A.2.2.2.2.1       1.4.20       160AM       3/4       1       2.1         FDD       Table A.2.2.2.2.1       1.4.20       160AM       3/4       2       2.1         FDD       Table A.2.2.2.2.1       1.4.20       160AM       3/4       3       2.1         FDD       Table A.2.2.2.2.1       1.4.20       160AM       3/4       6       2.1         FDD       Table A.2.2.2.2.1       3.20       160AM       3/4       6       2.1         FDD       Table A.2.2.2.2.1       3.20       160AM       3/4       9       2.1         FDD       Table A.2.2.2.2.1       3.20       160AM       3/4       10       2.1         FDD       Table A.2.2.2.2.1       3.20       160AM       3/4       10       2.1         FDD       Table A.2.2.2.2.1       5.20       160AM       1/2       16       2.1         FDD       Table A.2.2.2.2.1       5.20       160AM       1/3       2.0       2.1         FDD       Table A.2.2.2.2.1       5.20       160AM       1/3       2.6       1         FDD       Table A.2.2.2.1       10.20       160AM       3/4       30       2.2 <t< td=""><td></td><td></td><td></td><td>20</td><td>QPSK</td><td>1/6</td><td>96</td><td></td><td>21</td><td></td></t<>   |                               |                   |            | 20      | QPSK    | 1/6  | 96 |  | 21         |  |
| FDD       Table A.2.2.2.1       1.4.20       160AM       3/4       2       2       2.1         FDD       Table A.2.2.2.1       1.4.20       160AM       3/4       3       2.1         FDD       Table A.2.2.2.1       1.4.20       160AM       3/4       4       2.1         FDD       Table A.2.2.2.1       3.20       160AM       3/4       6       2.1         FDD       Table A.2.2.2.1       3.20       160AM       3/4       8       2.1         FDD       Table A.2.2.2.1       3.20       160AM       3/4       9       2.1         FDD       Table A.2.2.2.1       3.20       160AM       3/4       10       2.1         FDD       Table A.2.2.2.1       5.20       160AM       1/2       16       2.1         FDD       Table A.2.2.2.1       5.20       160AM       1/3       20       2.1         FDD       Table A.2.2.2.1       5.20       160AM       1/3       2.5       2.1         FDD       Table A.2.2.2.1       10.20       160AM       1/3       2.5       2.1         FDD       Table A.2.2.2.1       10.20       160AM       3/4       30       2.2         FD  |                               |                   | 16-QAW     | 4.4.00  | 400.004 | 0/4  |    |  |            |  |
| FDD       Table A.22.2.21       1.4 - 20       160AM       3.4       3       2.1         FDD       Table A.22.2.21       1.4 - 20       160AM       3.4       4       2.1         FDD       Table A.22.2.21       1.4 - 20       160AM       3.4       6       2.1         FDD       Table A.22.2.21       3 - 20       160AM       3.4       8       2.1         FDD       Table A.22.2.21       3 - 20       160AM       3.4       8       2.1         FDD       Table A.22.2.21       3 - 20       160AM       3.4       10       2.1         FDD       Table A.22.2.21       3 - 20       160AM       3.4       12       2.1         FDD       Table A.22.2.21       5 - 20       160AM       1/2       16       2.1         FDD       Table A.22.2.21       5 - 20       160AM       1/3       20       2.1         FDD       Table A.22.2.21       5 - 20       160AM       1/3       20       2.1         FDD       Table A.22.2.21       10 - 20       160AM       3/4       30       2.2         FDD       Table A.22.2.21       10 - 20       160AM       3/4       36       2.2  |                               |                   |            |         |         |      |    |  |            |  |
| FDD       Table A.2.2.2.1       1.4 · 20       160AM       3/4       4       ≥ 1         FDD       Table A.2.2.2.1       3 · 20       160AM       3/4       6       ≥ 1         FDD       Table A.2.2.2.1       3 · 20       160AM       3/4       6       ≥ 1         FDD       Table A.2.2.2.1       3 · 20       160AM       3/4       9       ≥ 1         FDD       Table A.2.2.2.1       3 · 20       160AM       3/4       10       ≥ 1         FDD       Table A.2.2.2.1       3 · 20       160AM       3/4       10       ≥ 1         FDD       Table A.2.2.2.1       5 · 20       160AM       1/2       16       ≥ 1         FDD       Table A.2.2.2.1       5 · 20       160AM       1/3       20       ≥ 1         FDD       Table A.2.2.2.1       5 · 20       160AM       1/3       24       ≥ 1         FDD       Table A.2.2.2.1       10 · 20       160AM       1/3       27       ≥ 1         FDD       Table A.2.2.2.1       10 · 20       160AM       3/4       36       ≥ 2         FDD       Table A.2.2.2.1       10 · 20       160AM       3/4       46       ≥ 2 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>  |                               |                   |            |         |         |      |    |  |            |  |
| FDD       Table A.2.2.2.1       1.4 - 20       160AM       3/4       5       ≥ 1         FDD       Table A.2.2.2.1       3 - 20       160AM       3/4       8       ≥ 1         FDD       Table A.2.2.2.1       3 - 20       160AM       3/4       9       ≥ 1         FDD       Table A.2.2.2.1       3 - 20       160AM       3/4       10       ≥ 1         FDD       Table A.2.2.2.1       3 - 20       160AM       3/4       12       ≥ 1         FDD       Table A.2.2.2.2.1       5 - 20       160AM       1/2       18       ≥ 1         FDD       Table A.2.2.2.1       5 - 20       160AM       1/2       18       ≥ 1         FDD       Table A.2.2.2.1       5 - 20       160AM       1/3       20       ≥ 1         FDD       Table A.2.2.2.1       10 - 20       160AM       1/3       27       ≥ 1         FDD       Table A.2.2.2.1       10 - 20       160AM       3/4       30       ≥ 2         FDD       Table A.2.2.2.1       10 - 20       160AM       3/4       40       ≥ 2         FDD       Table A.2.2.2.1       10 - 20       160AM       3/4       48       ≥ 2  |                               |                   |            |         |         |      |    |  |            |  |
| FDD       Table A.2.2.2.1       3 - 20       160AM       3/4       6       2 1         FDD       Table A.2.2.2.1       3 - 20       160AM       3/4       9       21         FDD       Table A.2.2.2.1       3 - 20       160AM       3/4       9       21         FDD       Table A.2.2.2.1       3 - 20       160AM       3/4       10       21         FDD       Table A.2.2.2.1       5 - 20       160AM       1/2       15       21         FDD       Table A.2.2.2.1       5 - 20       160AM       1/2       18       21         FDD       Table A.2.2.2.1       5 - 20       160AM       1/3       20       21         FDD       Table A.2.2.2.1       10 - 20       160AM       1/3       20       21         FDD       Table A.2.2.2.1       10 - 20       160AM       3/4       30       22         FDD       Table A.2.2.2.1       10 - 20       160AM       3/4       30       22         FDD       Table A.2.2.2.1       10 - 20       160AM       3/4       36       22         FDD       Table A.2.2.2.1       10 - 20       160AM       3/4       48       22         FDD  |                               |                   |            |         |         |      |    |  |            |  |
| FDD       Table A.2.2.2.1       3 - 20       16QAM       3/4       8       2 1         FDD       Table A.2.2.2.1       3 - 20       16QAM       3/4       9       21         FDD       Table A.2.2.2.1       3 - 20       16QAM       3/4       10       21         FDD       Table A.2.2.2.1       5 - 20       16QAM       1/2       16       21         FDD       Table A.2.2.2.1       5 - 20       16QAM       1/2       16       21         FDD       Table A.2.2.2.1       5 - 20       16QAM       1/2       16       21         FDD       Table A.2.2.2.1       5 - 20       16QAM       1/3       20       21         FDD       Table A.2.2.2.1       10 - 20       16QAM       1/3       25       21         FDD       Table A.2.2.2.1       10 - 20       16QAM       3/4       30       22         FDD       Table A.2.2.2.1       10 - 20       16QAM       3/4       40       22         FDD       Table A.2.2.2.1       10 - 20       16QAM       3/4       40       22         FDD       Table A.2.2.2.1       10 - 20       16QAM       3/4       48       22         FDD <td></td>   |                               |                   |            |         |         |      |    |  |            |  |
| FDD       Table A.2.2.2.1       3 - 20       160AM       3/4       9       2 1         FDD       Table A.2.2.2.1       3 - 20       160AM       3/4       10       2 1         FDD       Table A.2.2.2.2.1       5 - 20       160AM       1/2       15       2 1         FDD       Table A.2.2.2.1       5 - 20       160AM       1/2       16       2 1         FDD       Table A.2.2.2.1       5 - 20       160AM       1/2       18       2 1         FDD       Table A.2.2.2.1       5 - 20       160AM       1/3       20       2 1         FDD       Table A.2.2.2.1       10 - 20       160AM       1/3       27       2 1         FDD       Table A.2.2.2.1       10 - 20       160AM       3/4       30       2 2         FDD       Table A.2.2.2.1       10 - 20       160AM       3/4       30       2 2         FDD       Table A.2.2.2.1       10 - 20       160AM       3/4       48       2 2         FDD       Table A.2.2.2.1       10 - 20       160AM       3/4       48       2 2         FDD       Table A.2.2.2.1       10 - 20       160AM       3/4       48       2 2  |                               |                   |            |         |         |      |    |  |            |  |
| FDD       Table A.2.2.2-1       3 - 20       160AM       3/4       10       ≥ 1         FDD       Table A.2.2.2-1       5 - 20       160AM       1/2       15       ≥ 1         FDD       Table A.2.2.2-1       5 - 20       160AM       1/2       15       ≥ 1         FDD       Table A.2.2.2-1       5 - 20       160AM       1/2       18       ≥ 1         FDD       Table A.2.2.2-1       5 - 20       160AM       1/3       20       ≥ 1         FDD       Table A.2.2.2-1       5 - 20       160AM       1/3       24       ≥ 1         FDD       Table A.2.2.2-1       10 - 20       160AM       1/3       25       ≥ 1         FDD       Table A.2.2.2-1       10 - 20       160AM       3/4       30       ≥ 2         FDD       Table A.2.2.2-1       10 - 20       160AM       3/4       36       ≥ 2         FDD       Table A.2.2.2-1       10 - 20       160AM       3/4       40       ≥ 2         FDD       Table A.2.2.2-1       10 - 20       160AM       3/4       48       ≥ 2         FDD       Table A.2.2.2-1       10 - 20       160AM       3/4       48       ≥ 2   |                               |                   |            |         |         |      |    |  |            |  |
| FDD       Table A.2.2.2-1       3 - 20       160AM       3/4       12       2 1         FDD       Table A.2.2.2-1       5 - 20       160AM       1/2       15       2 1         FDD       Table A.2.2.2-1       5 - 20       160AM       1/2       16       2 1         FDD       Table A.2.2.2-1       5 - 20       160AM       1/3       20       2 1         FDD       Table A.2.2.2-1       5 - 20       160AM       1/3       24       2 1         FDD       Table A.2.2.2-1       5 - 20       160AM       1/3       25       2 1         FDD       Table A.2.2.2-1       10 - 20       160AM       1/3       27       2 1         FDD       Table A.2.2.2-1       10 - 20       160AM       3/4       30       2 2         FDD       Table A.2.2.2-1       10 - 20       160AM       3/4       40       2 2         FDD       Table A.2.2.2-1       10 - 20       160AM       3/4       48       2 2         FDD       Table A.2.2.2-1       10 - 20       160AM       3/4       48       2 2         FDD       Table A.2.2.2-1       10 - 20       160AM       3/4       44       2 2   |                               |                   |            | 3 - 20  |         | 3/4  | 9  |  |            |  |
| FDD       Table A.2.2.2-1       5 - 20       160AM       1/2       15       21         FDD       Table A.2.2.2-1       5 - 20       160AM       1/2       16       21         FDD       Table A.2.2.2-1       5 - 20       160AM       1/2       18       21         FDD       Table A.2.2.2-1       5 - 20       160AM       1/3       20       21         FDD       Table A.2.2.2-1       10 - 20       160AM       1/3       25       21         FDD       Table A.2.2.2-1       10 - 20       160AM       3/4       30       22         FDD       Table A.2.2.2-1       10 - 20       160AM       3/4       32       22         FDD       Table A.2.2.2-1       10 - 20       160AM       3/4       30       22         FDD       Table A.2.2.2-1       10 - 20       160AM       3/4       40       22         FDD       Table A.2.2.2-1       10 - 20       160AM       3/4       45       22         FDD       Table A.2.2.2-1       10 - 20       160AM       3/4       45       22         FDD       Table A.2.2.2-1       10 - 20       160AM       3/4       45       22         FDD   | FDD                           | Table A.2.2.2.2-1 |            | 3 - 20  | 16QAM   | 3/4  | 10 |  | ≥ 1        |  |
| FDD       Table A.2.2.2.1       5 - 20       160AM       1/2       16       2 1         FDD       Table A.2.2.2.1       5 - 20       16QAM       1/3       20       2 1         FDD       Table A.2.2.2.1       5 - 20       16QAM       1/3       24       2 1         FDD       Table A.2.2.2.1       10 - 20       16QAM       1/3       24       2 1         FDD       Table A.2.2.2.1       10 - 20       16QAM       1/3       27       2 1         FDD       Table A.2.2.2.1       10 - 20       16QAM       3/4       30       2 2         FDD       Table A.2.2.2.1       10 - 20       16QAM       3/4       36       2 2         FDD       Table A.2.2.2.1       10 - 20       16QAM       3/4       40       2 2         FDD       Table A.2.2.2.1       10 - 20       16QAM       3/4       48       2 2         FDD       Table A.2.2.2.1       10 - 20       16QAM       3/4       48       2 2         FDD       Table A.2.2.2.1       10 - 20       16QAM       3/4       48       2 2         FDD       Table A.2.2.2.1       15 - 20       16QAM       3/4       50       2 2  | FDD                           |                   |            | 3 - 20  |         | 3/4  | 12 |  | ≥ 1        |  |
| FDD       Table A.2.2.2.1       5 -20       160AM       1/2       18       21         FDD       Table A.2.2.2.1       5 -20       16QAM       1/3       20       21         FDD       Table A.2.2.2.1       5 -20       16QAM       1/3       24       21         FDD       Table A.2.2.2.1       10 -20       16QAM       1/3       25       21         FDD       Table A.2.2.2.1       10 -20       16QAM       3/4       30       22         FDD       Table A.2.2.2.1       10 -20       16QAM       3/4       30       22         FDD       Table A.2.2.2.1       10 -20       16QAM       3/4       30       22         FDD       Table A.2.2.2.1       10 -20       16QAM       3/4       40       22         FDD       Table A.2.2.2.1       10 -20       16QAM       3/4       48       22         FDD       Table A.2.2.2.1       10 -20       16QAM       3/4       48       22         FDD       Table A.2.2.2.1       10 -20       16QAM       3/4       48       22         FDD       Table A.2.2.2.1       15 -20       16QAM       3/4       50       22         FDD  | FDD                           | Table A.2.2.2.2-1 |            | 5 - 20  | 16QAM   | 1/2  | 15 |  | ≥ 1        |  |
| FDD       Table A.2.2.2.1       5 - 20       160AM       1/3       20       21         FDD       Table A.2.2.2.1       5 - 20       16QAM       1/3       24       21         FDD       Table A.2.2.2.1       10 - 20       16QAM       1/3       25       21         FDD       Table A.2.2.2.1       10 - 20       16QAM       1/3       27       21         FDD       Table A.2.2.2.1       10 - 20       16QAM       3/4       30       22         FDD       Table A.2.2.2.1       10 - 20       16QAM       3/4       30       22         FDD       Table A.2.2.2.1       10 - 20       16QAM       3/4       40       22         FDD       Table A.2.2.2.1       10 - 20       16QAM       3/4       48       22         FDD       Table A.2.2.2.1       10 - 20       16QAM       3/4       48       22         FDD       Table A.2.2.2.1       10 - 20       16QAM       3/4       48       22         FDD       Table A.2.2.2.1       15 - 20       16QAM       3/4       54       22         FDD       Table A.2.2.2.1       15 - 20       16QAM       1/2       75       22         F   | FDD                           | Table A.2.2.2.2-1 |            | 5 - 20  | 16QAM   | 1/2  | 16 |  | ≥ 1        |  |
| FDD         Table A.2.2.2-1         5 - 20         16QAM         1/3         24         ≥ 1           FDD         Table A.2.2.2-1         10 - 20         16QAM         1/3         25         ≥ 1           FDD         Table A.2.2.2-1         10 - 20         16QAM         3/4         30         ≥ 2           FDD         Table A.2.2.2-1         10 - 20         16QAM         3/4         30         ≥ 2           FDD         Table A.2.2.2-1         10 - 20         16QAM         3/4         36         ≥ 2           FDD         Table A.2.2.2-1         10 - 20         16QAM         3/4         40         ≥ 2           FDD         Table A.2.2.2-1         10 - 20         16QAM         3/4         48         ≥ 2           FDD         Table A.2.2.2-1         10 - 20         16QAM         3/4         48         ≥ 2           FDD         Table A.2.2.2-1         10 - 20         16QAM         3/4         50         ≥ 2           FDD         Table A.2.2.2-1         15 - 20         16QAM         3/4         54         ≥ 2           FDD         Table A.2.2.2-1         15 - 20         16QAM         1/2         75         ≥ 2           FDD   | FDD                           | Table A.2.2.2.2-1 |            | 5 - 20  | 16QAM   | 1/2  | 18 |  | ≥ 1        |  |
| FDD         Table A.2.2.2.1         10 - 20         16QAM         1/3         25         ≥ 1           FDD         Table A.2.2.2.1         10 - 20         16QAM         3/4         30         ≥ 2           FDD         Table A.2.2.2.2.1         10 - 20         16QAM         3/4         32         ≥ 2           FDD         Table A.2.2.2.2.1         10 - 20         16QAM         3/4         36         ≥ 2           FDD         Table A.2.2.2.2.1         10 - 20         16QAM         3/4         40         ≥ 2           FDD         Table A.2.2.2.2.1         10 - 20         16QAM         3/4         40         ≥ 2           FDD         Table A.2.2.2.2.1         10 - 20         16QAM         3/4         48         ≥ 2           FDD         Table A.2.2.2.2.1         10 - 20         16QAM         3/4         48         ≥ 2           FDD         Table A.2.2.2.2.1         15 - 20         16QAM         3/4         50         ≥ 2           FDD         Table A.2.2.2.2.1         15 - 20         16QAM         1/2         50         ≥ 2           FDD         Table A.2.2.2.1         15 - 20         16QAM         1/2         52         2  | FDD                           | Table A.2.2.2.2-1 |            | 5 - 20  | 16QAM   | 1/3  | 20 |  | ≥ 1        |  |
| FDD         Table A.2.2.2.1         IO - 20         16QAM         1/3         27         ≥ 1           FDD         Table A.2.2.2.1         IO - 20         16QAM         3/4         30         ≥ 2           FDD         Table A.2.2.2.1         IO - 20         16QAM         3/4         32         ≥ 2           FDD         Table A.2.2.2.1         IO - 20         16QAM         3/4         40         ≥ 2           FDD         Table A.2.2.2.1         IO - 20         16QAM         3/4         46         ≥ 2           FDD         Table A.2.2.2.1         IO - 20         16QAM         3/4         48         ≥ 2           FDD         Table A.2.2.2.1         IO - 20         16QAM         3/4         48         ≥ 2           FDD         Table A.2.2.2.1         IO - 20         16QAM         3/4         50         ≥ 2           FDD         Table A.2.2.2.1         IS - 20         16QAM         3/4         54         ≥ 2           FDD         Table A.2.2.2.1         IS - 20         16QAM         1/2         60         ≥ 2           FDD         Table A.2.2.2.1         IS - 20         16QAM         1/2         75         ≥ 2           FDD  | FDD                           | Table A.2.2.2.2-1 |            | 5 - 20  | 16QAM   | 1/3  | 24 |  | ≥ 1        |  |
| FDD         Table A.2.2.2.1         IO - 20         16QAM         3/4         30         ≥ 2           FDD         Table A.2.2.2.1         IO - 20         16QAM         3/4         32         ≥ 2           FDD         Table A.2.2.2.1         IO - 20         16QAM         3/4         36         ≥ 2           FDD         Table A.2.2.2.1         IO - 20         16QAM         3/4         40         ≥ 2           FDD         Table A.2.2.2.1         IO - 20         16QAM         3/4         46         ≥ 2           FDD         Table A.2.2.2.1         IO - 20         16QAM         3/4         48         ≥ 2           FDD         Table A.2.2.2.1         IO - 20         16QAM         3/4         48         ≥ 2           FDD         Table A.2.2.2.1         IO - 20         16QAM         3/4         54         ≥ 2           FDD         Table A.2.2.2.1         IS - 20         16QAM         3/4         54         ≥ 2           FDD         Table A.2.2.2.1         IS - 20         16QAM         1/2         72         ≥ 2           FDD         Table A.2.2.2.1         IS - 20         16QAM         1/2         75         ≥ 2           FDD  | FDD                           | Table A.2.2.2.2-1 |            | 10 - 20 | 16QAM   | 1/3  | 25 |  | ≥ 1        |  |
| FDD         Table A.2.2.2.2.1         10 - 20         16QAM         3/4         32         ≥ 2           FDD         Table A.2.2.2.2.1         10 - 20         16QAM         3/4         36         ≥ 2           FDD         Table A.2.2.2.2.1         10 - 20         16QAM         3/4         40         ≥ 2           FDD         Table A.2.2.2.2.1         10 - 20         16QAM         3/4         48         ≥ 2           FDD         Table A.2.2.2.2.1         10 - 20         16QAM         3/4         48         ≥ 2           FDD         Table A.2.2.2.2.1         10 - 20         16QAM         3/4         48         ≥ 2           FDD         Table A.2.2.2.2.1         15 - 20         16QAM         3/4         50         ≥ 2           FDD         Table A.2.2.2.2.1         15 - 20         16QAM         1/2         5         ≥ 2           FDD         Table A.2.2.2.2.1         15 - 20         16QAM         1/2         72         ≥ 2           FDD         Table A.2.2.2.2.1         20         16QAM         1/2         75         ≥ 2           FDD         Table A.2.2.2.2.1         20         16QAM         1/2         80         ≥ 2 <t< td=""><td>FDD</td><td>Table A.2.2.2.2-1</td><td></td><td>10 - 20</td><td>16QAM</td><td>1/3</td><td>27</td><td></td><td>≥ 1</td><td></td></t<>   | FDD                           | Table A.2.2.2.2-1 |            | 10 - 20 | 16QAM   | 1/3  | 27 |  | ≥ 1        |  |
| FDDTable A.2.2.2.110 $\cdot$ 2016QAM3/436 $\geq$ 2FDDTable A.2.2.2.110 $\cdot$ 2016QAM3/440 $\geq$ 2FDDTable A.2.2.2.110 $\cdot$ 2016QAM3/448 $\geq$ 2FDDTable A.2.2.2.110 $\cdot$ 2016QAM3/448 $\geq$ 2FDDTable A.2.2.2.115 $\cdot$ 2016QAM3/450 $\geq$ 2FDDTable A.2.2.2.115 $\cdot$ 2016QAM3/454 $\geq$ 2FDDTable A.2.2.2.115 $\cdot$ 2016QAM3/454 $\geq$ 2FDDTable A.2.2.2.115 $\cdot$ 2016QAM2/360 $\geq$ 2FDDTable A.2.2.2.115 $\cdot$ 2016QAM1/272 $\geq$ 2FDDTable A.2.2.2.115 $\cdot$ 2016QAM1/272 $\geq$ 2FDDTable A.2.2.2.115 $\cdot$ 2016QAM1/275 $\geq$ 2FDDTable A.2.2.2.12016QAM1/280 $\geq$ 2FDDTable A.2.2.2.12016QAM1/280 $\geq$ 2FDDTable A.2.2.2.12016QAM1/280 $\geq$ 2FDDTable A.2.2.2.12016QAM1/281 $\geq$ 2FDDTable A.2.2.2.12016QAM1/280 $\geq$ 2FDDTable A.2.2.3.1R.1.1 FDD10QPSK0.3140 $\geq$ 1FDDTable A.2.2.3.1R.1.3 FDD20QPSK0.3140 $\geq$ 1 <td>FDD</td> <td>Table A.2.2.2.2-1</td> <td></td> <td>10 - 20</td> <td>16QAM</td> <td>3/4</td> <td>30</td> <td></td> <td>≥ 2</td> <td></td>   | FDD                           | Table A.2.2.2.2-1 |            | 10 - 20 | 16QAM   | 3/4  | 30 |  | ≥ 2        |  |
| FDD         Table A.2.2.2.1         10 · 20         16QAM         3/4         40         ≥ 2           FDD         Table A.2.2.2.1         10 · 20         16QAM         3/4         45         ≥ 2           FDD         Table A.2.2.2.1         10 · 20         16QAM         3/4         48         ≥ 2           FDD         Table A.2.2.2.1         15 · 20         16QAM         3/4         50         ≥ 2           FDD         Table A.2.2.2.2.1         15 · 20         16QAM         3/4         54         ≥ 2           FDD         Table A.2.2.2.2.1         15 · 20         16QAM         3/4         54         ≥ 2           FDD         Table A.2.2.2.2.1         15 · 20         16QAM         2/3         60         ≥ 2           FDD         Table A.2.2.2.2.1         15 · 20         16QAM         1/2         72         ≥ 2           FDD         Table A.2.2.2.2.1         15 · 20         16QAM         1/2         72         ≥ 2           FDD         Table A.2.2.2.2.1         2.0         16QAM         1/2         80         ≥ 2           FDD         Table A.2.2.2.2.1         2.0         16QAM         1/2         81         ≥ 2           FDD<   | FDD                           | Table A.2.2.2.2-1 |            | 10 - 20 | 16QAM   | 3/4  | 32 |  | ≥ 2        |  |
| FDD       Table A.2.2.2.2-1       10 - 20       16QAM       3/4       45       ≥ 2         FDD       Table A.2.2.2.2-1       10 - 20       16QAM       3/4       48       ≥ 2         FDD       Table A.2.2.2.2-1       15 - 20       16QAM       3/4       54       ≥ 2         FDD       Table A.2.2.2.2-1       15 - 20       16QAM       2/3       60       ≥ 2         FDD       Table A.2.2.2.2-1       15 - 20       16QAM       2/3       64       ≥ 2         FDD       Table A.2.2.2.2-1       15 - 20       16QAM       1/2       72       ≥ 2         FDD       Table A.2.2.2.2-1       15 - 20       16QAM       1/2       72       ≥ 2         FDD       Table A.2.2.2.2-1       15 - 20       16QAM       1/2       72       ≥ 2         FDD       Table A.2.2.2.2-1       20       16QAM       1/2       75       ≥ 2         FDD       Table A.2.2.2.2-1       20       16QAM       1/2       80       ≥ 2         FDD       Table A.2.2.2.2-1       20       16QAM       1/2       80       ≥ 2         FDD       Table A.2.2.2.1       20       16QAM       2/5       90       ≥ 2   | FDD                           | Table A.2.2.2.2-1 |            | 10 - 20 | 16QAM   | 3/4  | 36 |  | ≥ 2        |  |
| FDDTable A.2.2.2.2.110 - 2016QAM3/448≥ 2FDDTable A.2.2.2.2.115 - 2016QAM3/450≥ 2FDDTable A.2.2.2.2.115 - 2016QAM2/360≥ 2FDDTable A.2.2.2.2.115 - 2016QAM2/364≥ 2FDDTable A.2.2.2.2.115 - 2016QAM1/272≥ 2FDDTable A.2.2.2.2.115 - 2016QAM1/272≥ 2FDDTable A.2.2.2.2.115 - 2016QAM1/275≥ 2FDDTable A.2.2.2.2.12016QAM1/275≥ 2FDDTable A.2.2.2.2.12016QAM1/280≥ 2FDDTable A.2.2.2.2.12016QAM1/280≥ 2FDDTable A.2.2.2.2.12016QAM1/280≥ 2FDDTable A.2.2.2.2.12016QAM1/280≥ 2FDDTable A.2.2.2.2.12016QAM1/280≥ 2FDDTable A.2.2.2.12016QAM1/280≥ 2FDDTable A.2.2.2.12016QAM1/280≥ 2FDDTable A.2.2.2.12016QAM2/590≥ 2FDDTable A.2.2.3.1R.1.1 FDD10QPSK0.3140≥ 1FDDTable A.2.3.1R.1.3 FDD20QPSK0.3190≥ 2FDDTable A.2.3.1R.1.4 FDD </td <td>FDD</td> <td>Table A.2.2.2.2-1</td> <td></td> <td>10 - 20</td> <td>16QAM</td> <td>3/4</td> <td>40</td> <td></td> <td>≥ 2</td> <td></td>   | FDD                           | Table A.2.2.2.2-1 |            | 10 - 20 | 16QAM   | 3/4  | 40 |  | ≥ 2        |  |
| FDD       Table A.2.2.2.2·1       15 - 20       16QAM       3/4       50       ≥ 2         FDD       Table A.2.2.2.2·1       15 - 20       16QAM       3/4       54       ≥ 2         FDD       Table A.2.2.2.2·1       15 - 20       16QAM       2/3       60       ≥ 2         FDD       Table A.2.2.2·1       15 - 20       16QAM       2/3       64       ≥ 2         FDD       Table A.2.2.2·1       15 - 20       16QAM       1/2       72       ≥ 2         FDD       Table A.2.2.2·1       15 - 20       16QAM       1/2       75       ≥ 2         FDD       Table A.2.2.2·1       20       16QAM       1/2       75       ≥ 2         FDD       Table A.2.2.2·1       20       16QAM       1/2       80       ≥ 2         FDD       Table A.2.2.2·1       20       16QAM       1/2       80       ≥ 2         FDD       Table A.2.2.2·1       20       16QAM       1/2       80       ≥ 2         FDD       Table A.2.2.2·1       20       16QAM       2/5       90       ≥ 2         FDD       Table A.2.2.2·1       20       16QAM       2/5       90       ≥ 2         FDD   | FDD                           | Table A.2.2.2.2-1 |            | 10 - 20 | 16QAM   | 3/4  | 45 |  | ≥ 2        |  |
| FDD         Table A.2.2.2.2.1         15 - 20         16QAM         3/4         54         ≥ 2           FDD         Table A.2.2.2.2.1         15 - 20         16QAM         2/3         60         ≥ 2           FDD         Table A.2.2.2.2.1         15 - 20         16QAM         2/3         64         ≥ 2           FDD         Table A.2.2.2.2.1         15 - 20         16QAM         1/2         72         ≥ 2           FDD         Table A.2.2.2.2.1         15 - 20         16QAM         1/2         72         ≥ 2           FDD         Table A.2.2.2.2.1         20         16QAM         1/2         80         ≥ 2           FDD         Table A.2.2.2.2.1         20         16QAM         1/2         80         ≥ 2           FDD         Table A.2.2.2.1         20         16QAM         1/2         81         ≥ 2           FDD         Table A.2.2.2.1         20         16QAM         2/5         90         ≥ 2           FDD         Table A.2.2.2.1         20         16QAM         2/5         90         ≥ 2           FDD         Table A.2.2.3.1         R.1-1 FDD         10         QPSK         0.31         40         ≥ 1 <t< td=""><td>FDD</td><td>Table A.2.2.2.2-1</td><td></td><td>10 - 20</td><td>16QAM</td><td>3/4</td><td>48</td><td></td><td>≥ 2</td><td></td></t<>  | FDD                           | Table A.2.2.2.2-1 |            | 10 - 20 | 16QAM   | 3/4  | 48 |  | ≥ 2        |  |
| FDD       Table A.2.2.2.2-1       15 - 20       16QAM       2/3       60       ≥ 2         FDD       Table A.2.2.2.2-1       15 - 20       16QAM       1/2       72       ≥ 2         FDD       Table A.2.2.2.2-1       15 - 20       16QAM       1/2       72       ≥ 2         FDD       Table A.2.2.2.2-1       20       16QAM       1/2       75       ≥ 2         FDD       Table A.2.2.2.2-1       20       16QAM       1/2       80       ≥ 2         FDD       Table A.2.2.2.2-1       20       16QAM       1/2       80       ≥ 2         FDD       Table A.2.2.2.2-1       20       16QAM       1/2       81       ≥ 2         FDD       Table A.2.2.2.2-1       20       16QAM       1/2       81       ≥ 2         FDD       Table A.2.2.2.2-1       20       16QAM       2/5       90       ≥ 2         FDD       Table A.2.2.2.2-1       20       16QAM       2/5       90       ≥ 2         FDD       Table A.2.2.2.1       R.1-1 FDD       10       QPSK       0.31       40       ≥ 1         FDD       Table A.2.2.3.1       R.1-2 FDD       10       QPSK       0.31       40  | FDD                           | Table A.2.2.2.2-1 |            | 15 - 20 | 16QAM   | 3/4  | 50 |  | ≥ 2        |  |
| FDD       Table A.2.2.2.2.1       15 · 20       16QAM       2/3       64       ≥ 2         FDD       Table A.2.2.2.2.1       15 · 20       16QAM       1/2       72       ≥ 2         FDD       Table A.2.2.2.2.1       20       16QAM       1/2       75       ≥ 2         FDD       Table A.2.2.2.2.1       20       16QAM       1/2       80       ≥ 2         FDD       Table A.2.2.2.2.1       20       16QAM       1/2       80       ≥ 2         FDD       Table A.2.2.2.2.1       20       16QAM       1/2       81       ≥ 2         FDD       Table A.2.2.2.2.1       20       16QAM       1/2       81       ≥ 2         FDD       Table A.2.2.2.2.1       20       16QAM       2/5       90       ≥ 2         FDD       Table A.2.2.2.2.1       20       16QAM       2/5       90       ≥ 2         FDD       Table A.2.2.2.2.1       20       16QAM       2/5       96       ≥ 2         FDD       Table A.2.2.2.1       R.1-1 FDD       10       QPSK       0.31       40       ≥ 1         FDD       Table A.2.2.3.1       R.1-3 FDD       10       QPSK       0.31       40       ≥ 1<  | FDD                           | Table A.2.2.2.2-1 |            | 15 - 20 | 16QAM   | 3/4  | 54 |  | ≥ 2        |  |
| FDD       Table A.2.2.2.2·1       15 · 20       16QAM       1/2       72       ≥ 2         FDD       Table A.2.2.2·1       20       16QAM       1/2       75       ≥ 2         FDD       Table A.2.2.2·1       20       16QAM       1/2       80       ≥ 2         FDD       Table A.2.2.2·1       20       16QAM       1/2       80       ≥ 2         FDD       Table A.2.2.2·1       20       16QAM       1/2       81       ≥ 2         FDD       Table A.2.2.2·1       20       16QAM       2/5       90       ≥ 2         FDD       Table A.2.2.2·1       20       16QAM       2/5       90       ≥ 2         FDD       Table A.2.2.2·1       20       16QAM       2/5       96       ≥ 2         FDD       Table A.2.2.2·1       10       20       16QAM       2/5       96       ≥ 2         FDD       Table A.2.2.3·1       R.1·1 FDD       10       QPSK       0.31       40       ≥ 1         FDD       Table A.2.2.3·1       R.1·3 FDD       20       QPSK       0.31       40       ≥ 1         FDD       Table A.2.3·1       R.1·4 FDD       20       QPSK       0.31       40 </td <td>FDD</td> <td>Table A.2.2.2.2-1</td> <td></td> <td>15 - 20</td> <td>16QAM</td> <td>2/3</td> <td>60</td> <td></td> <td>≥ 2</td> <td></td>  | FDD                           | Table A.2.2.2.2-1 |            | 15 - 20 | 16QAM   | 2/3  | 60 |  | ≥ 2        |  |
| FDDTable A.2.2.2.1Image: A product of the analysis of the a | FDD                           | Table A.2.2.2.2-1 |            | 15 - 20 | 16QAM   | 2/3  | 64 |  | ≥ 2        |  |
| FDD       Table A.2.2.2.2-1       Image: Constraint of the constraint                 | FDD                           | Table A.2.2.2.2-1 |            | 15 - 20 | 16QAM   | 1/2  | 72 |  | ≥ 2        |  |
| FDDTable A.2.2.2.2-1 $1/2$ 81 $\geq 2$ FDDTable A.2.2.2.2-1 $2/5$ 90 $\geq 2$ FDDTable A.2.2.2.2-1 $2/5$ 96 $\geq 2$ FDDTable A.2.2.2.2-1 $2/5$ 96 $\geq 2$ FDDTable A.2.2.2-1 $2/5$ 96 $\geq 2$ FDDTable A.2.2.3-1R.1-1 FDD10QPSK0.3140 $\geq 1$ FDDTable A.2.2.3-1R.1-1 FDD10QPSK0.3140 $\geq 1$ FDDTable A.2.2.3-1R.1-2 FDD10QPSK0.3140 $\geq 1$ FDDTable A.2.2.3-1R.1-3 FDD20QPSK0.3190 $\geq 2$ FDDTable A.2.2.3-1R.1-3 FDD10QPSK0.3140 $\geq 1$ FDDTable A.2.3.1R.1-4 FDD20QPSK0.3190 $\geq 2$ TDDTable A.2.3.1.1-1I.4QPSK1/36 $\geq 1$ TDDTable A.2.3.1.1-1I.4QPSK1/315 $\geq 1$ TDDTable A.2.3.1.1-1I.4QPSK1/325 $\geq 1$ TDDTable A.2.3.1.1-1I.4S <th< td=""><td>FDD</td><td>Table A.2.2.2.2-1</td><td></td><td>20</td><td>16QAM</td><td>1/2</td><td>75</td><td></td><td>≥ 2</td><td></td></th<>   | FDD                           | Table A.2.2.2.2-1 |            | 20      | 16QAM   | 1/2  | 75 |  | ≥ 2        |  |
| FDDTable A.2.2.2.116QAM2/590 $\geq 2$ FDDTable A.2.2.2.1 $\geq 2$ FDD, Sustained data rateFDDTable A.2.2.3.1R.1.1 FDD10QPSK0.3140 $\geq 1$ FDDTable A.2.2.3.1R.1.2 FDD10QPSK0.3140 $\geq 1$ FDDTable A.2.2.3.1R.1.3 FDD10QPSK0.3140 $\geq 1$ FDDTable A.2.2.3.1R.1.3 FDD20QPSK0.3190 $\geq 2$ FDDTable A.2.2.3.1R.1.3A FDD10QPSK0.3140 $\geq 1$ FDDTable A.2.2.3.1R.1.4 FDD20QPSK0.3190 $\geq 2$ FDDTable A.2.3.1.11.4QPSK1.36 $\geq 1$ TDDTable A.2.3.1.1.13QPSK1/315 $\geq 1$ TDDTable A.2.3.1.1.15QPSK1/325 $\geq 1$   | FDD                           | Table A.2.2.2.2-1 |            | 20      | 16QAM   | 1/2  | 80 |  | ≥ 2        |  |
| FDDTable A.2.2.2.21 $20$ 16QAM $2/5$ 96 $\geq 2$ FDD, Sustained data rateFDDTable A.2.2.3-1R.1-1 FDD10QPSK0.3140 $\geq 1$ FDDTable A.2.2.3-1R.1-2 FDD10QPSK0.3140 $\geq 1$ FDDTable A.2.2.3-1R.1-3 FDD20QPSK0.3190 $\geq 2$ FDDTable A.2.2.3-1R.1-3 FDD20QPSK0.3190 $\geq 2$ FDDTable A.2.2.3-1R.1-3 FDD20QPSK0.3190 $\geq 2$ FDDTable A.2.3.1R.1-4 FDD20QPSK0.3190 $\geq 2$ TDDTable A.2.3.1.1-11.4QPSK1/36 $\geq 1$ TDDTable A.2.3.1.1-15QPSK1/325 $\geq 1$   | FDD                           | Table A.2.2.2.2-1 |            | 20      | 16QAM   | 1/2  | 81 |  | ≥ 2        |  |
| FDD, Sustained data rate         FDD       Table A.2.2.3-1       R.1-1 FDD       10       QPSK       0.31       40       ≥ 1         FDD       Table A.2.2.3-1       R.1-2 FDD       10       QPSK       0.31       40       ≥ 1         FDD       Table A.2.2.3-1       R.1-2 FDD       10       QPSK       0.31       40       ≥ 1         FDD       Table A.2.2.3-1       R.1-3 FDD       20       QPSK       0.31       90       ≥ 2         FDD       Table A.2.2.3-1       R.1-3 FDD       20       QPSK       0.31       40       ≥ 1         FDD       Table A.2.2.3-1       R.1-3 FDD       20       QPSK       0.31       40       ≥ 1         FDD       Table A.2.2.3-1       R.1-3 FDD       20       QPSK       0.31       40       ≥ 1         FDD       Table A.2.3.1       R.1-4 FDD       20       QPSK       0.31       90       ≥ 2         TDD       Table A.2.3.1.1-1       1.4       QPSK       1/3       6       ≥ 1         TDD       Table A.2.3.1.1-1       3       QPSK       1/3       15       ≥ 1         TDD       Table A.2.3.1.1-1       5       QPSK       1/3  | FDD                           | Table A.2.2.2.2-1 |            | 20      | 16QAM   | 2/5  | 90 |  | ≥ 2        |  |
| FDDTable A.2.2.3-1R.1-1 FDD10QPSK0.3140 $\geq 1$ FDDTable A.2.2.3-1R.1-2 FDD10QPSK0.3140 $\geq 1$ FDDTable A.2.2.3-1R.1-3 FDD20QPSK0.3190 $\geq 2$ FDDTable A.2.2.3-1R.1-3 FDD10QPSK0.3140 $\geq 1$ FDDTable A.2.2.3-1R.1-3 FDD10QPSK0.3140 $\geq 1$ FDDTable A.2.2.3-1R.1-4 FDD20QPSK0.3190 $\geq 2$ <b>TDD, Full RB allocation, QPSK</b> 20QPSK1/390 $\geq 2$ TDDTable A.2.3.1.1-11.4QPSK1/36 $\geq 1$ TDDTable A.2.3.1.1-13QPSK1/315 $\geq 1$ TDDTable A.2.3.1.1-15QPSK1/325 $\geq 1$  | FDD                           | Table A.2.2.2.2-1 |            | 20      | 16QAM   | 2/5  | 96 |  | ≥ 2        |  |
| FDDTable A.2.2.3-1R.1-2 FDD10QPSK0.3140 $\geq 1$ FDDTable A.2.2.3-1R.1-3 FDD20QPSK0.3190 $\geq 2$ FDDTable A.2.2.3-1R.1-3A FDD10QPSK0.3140 $\geq 1$ FDDTable A.2.2.3-1R.1-3A FDD10QPSK0.3190 $\geq 2$ FDDTable A.2.3.1R.1-4 FDD20QPSK0.3190 $\geq 2$ TDDTable A.2.3.1.1-11.4QPSK1/36 $\geq 1$ TDDTable A.2.3.1.1-15QPSK1/315 $\geq 1$ TDDTable A.2.3.1.1-15QPSK1/325 $\geq 1$   | FDD, Su                       | stained data rate |            |         |         |      |    |  |            |  |
| FDDTable A.2.2.3-1R.1-3 FDD20QPSK0.3190 $\geq 2$ FDDTable A.2.2.3-1R.1-3A FDD10QPSK0.3140 $\geq 1$ FDDTable A.2.2.3-1R.1-4 FDD20QPSK0.3190 $\geq 2$ <b>TDD, Full RB allocation, QPSK</b> TDDTable A.2.3.1.1-11.4QPSK1/36 $\geq 1$ TDDTable A.2.3.1.1-133QPSK1/315 $\geq 1$ TDDTable A.2.3.1.1-15QPSK1/325 $\geq 1$  | FDD                           | Table A.2.2.3-1   | R.1-1 FDD  | 10      | QPSK    | 0.31 | 40 |  | ≥ 1        |  |
| FDDTable A.2.2.3-1R.1-3A FDD10QPSK0.3140 $\geq 1$ FDDTable A.2.2.3-1R.1-4 FDD20QPSK0.3190 $\geq 2$ TDD, Full RB allocation, QPSKTDD, Table A.2.3.1.1-11.4QPSK1/36 $\geq 1$ TDDTable A.2.3.1.1-13.3QPSK1/35 $\geq 1$ TDDTable A.2.3.1.1-15QPSK1/325 $\geq 1$   | FDD                           | Table A.2.2.3-1   | R.1-2 FDD  | 10      | QPSK    | 0.31 | 40 |  | ≥ 1        |  |
| FDD       Table A.2.2.3-1       R.1-4 FDD       20       QPSK       0.31       90       ≥ 2 <b>TDD, Full RB allocation, QPSK</b> 1/4       QPSK       1/3       6       ≥ 1         TDD       Table A.2.3.1.1-1       1.4       QPSK       1/3       15       ≥ 1         TDD       Table A.2.3.1.1-1       3       QPSK       1/3       25       ≥ 1         TDD       Table A.2.3.1.1-1       5       QPSK       1/3       25       ≥ 1   | FDD                           | Table A.2.2.3-1   | R.1-3 FDD  | 20      | QPSK    | 0.31 | 90 |  | ≥ 2        |  |
| TDD, Full RB allocation, QPSK         TDD       Table A.2.3.1.1-1       1.4       QPSK       1/3       6       ≥ 1         TDD       Table A.2.3.1.1-1       3       QPSK       1/3       15       ≥ 1         TDD       Table A.2.3.1.1-1       5       QPSK       1/3       25       ≥ 1  | FDD                           | Table A.2.2.3-1   | R.1-3A FDI | D 10    | QPSK    | 0.31 | 40 |  | ≥ 1        |  |
| TDD       Table A.2.3.1.1-1       1.4       QPSK       1/3       6       ≥ 1         TDD       Table A.2.3.1.1-1       3       QPSK       1/3       15       ≥ 1         TDD       Table A.2.3.1.1-1       5       QPSK       1/3       25       ≥ 1  | FDD                           | Table A.2.2.3-1   | R.1-4 FDD  | 20      | QPSK    | 0.31 | 90 |  | ≥ 2        |  |
| TDD     Table A.2.3.1.1-1     3     QPSK     1/3     15     ≥ 1       TDD     Table A.2.3.1.1-1     5     QPSK     1/3     25     ≥ 1   | TDD, Full RB allocation, QPSK |                   |            |         |         |      |    |  |            |  |
| TDD         Table A.2.3.1.1-1         5         QPSK         1/3         25         ≥ 1   | TDD                           | Table A.2.3.1.1-1 |            | 1.4     | QPSK    | 1/3  | 6  |  | ≥ 1        |  |
|   | TDD                           | Table A.2.3.1.1-1 |            | 3       | QPSK    | 1/3  | 15 |  | ≥ 1        |  |
| TDD Table A.2.3.1.1-1 10 QPSK 1/3 50 ≥ 1  | TDD                           | Table A.2.3.1.1-1 |            | 5       | QPSK    | 1/3  | 25 |  | ≥ 1        |  |
|   | TDD                           | Table A.2.3.1.1-1 |            | 10      | QPSK    | 1/3  | 50 |  | ≥ 1        |  |

| TDD     | Table A.2.3.1.1-1     |   | 15       | QPSK  | 1/5 | 75  |   | <b>N</b> 1 | 1 |
|---------|-----------------------|---|----------|-------|-----|-----|---|------------|---|
|         |                       |   |          |       |     |     |   | ≥ 1        |   |
| TDD     | Table A.2.3.1.1-1     | ~ | 20       | QPSK  | 1/6 | 100 |   | ≥ 1        |   |
|         | II RB allocation, 16- | QAM                                     | T        |       |     |     |   |            |   |
| TDD     | Table A.2.3.1.2-1     |   | 1.4      | 16QAM | 3/4 | 6   |   | ≥ 1        |   |
| TDD     | Table A.2.3.1.2-1     |   | 3        | 16QAM | 1/2 | 15  |   | ≥ 1        |   |
| TDD     | Table A.2.3.1.2-1     |   | 5        | 16QAM | 1/3 | 25  |   | ≥ 1        |   |
| TDD     | Table A.2.3.1.2-1     |   | 10       | 16QAM | 3/4 | 50  |   | ≥ 2        |   |
| TDD     | Table A.2.3.1.2-1     |   | 15       | 16QAM | 1/2 | 75  |   | ≥ 2        |   |
| TDD     | Table A.2.3.1.2-1     |   | 20       | 16QAM | 1/3 | 100 |   | ≥ 2        |   |
|         | rtial RB allocation,  | QPSK                                    |          |       |     |     |   |            |   |
| TDD     | Table A.2.3.2.1-1     |   | 1.4 - 20 | QPSK  | 1/3 | 1   |   | ≥ 1        |   |
| TDD     | Table A.2.3.2.1-1     |   | 1.4 - 20 | QPSK  | 1/3 | 2   |   | ≥ 1        |   |
| TDD     | Table A.2.3.2.1-1     |   | 1.4 - 20 | QPSK  | 1/3 | 3   |   | ≥ 1        |   |
| TDD     | Table A.2.3.2.1-1     |   | 1.4 - 20 | QPSK  | 1/3 | 4   |   | ≥ 1        |   |
| TDD     | Table A.2.3.2.1-1     |   | 1.4 - 20 | QPSK  | 1/3 | 5   |   | ≥ 1        |   |
| TDD     | Table A.2.3.2.1-1     |   | 3 - 20   | QPSK  | 1/3 | 6   |   | ≥ 1        |   |
| TDD     | Table A.2.3.2.1-1     |   | 3 - 20   | QPSK  | 1/3 | 8   |   | ≥ 1        |   |
| TDD     | Table A.2.3.2.1-1     |   | 3 - 20   | QPSK  | 1/3 | 9   |   | ≥ 1        |   |
| TDD     | Table A.2.3.2.1-1     |   | 3 - 20   | QPSK  | 1/3 | 10  |   | ≥ 1        |   |
| TDD     | Table A.2.3.2.1-1     |   | 3 - 20   | QPSK  | 1/3 | 12  |   | ≥ 1        |   |
| TDD     | Table A.2.3.2.1-1     |   | 5 - 20   | QPSK  | 1/3 | 15  |   | ≥ 1        |   |
| TDD     | Table A.2.3.2.1-1     |   | 5 - 20   | QPSK  | 1/3 | 16  |   | ≥ 1        |   |
| TDD     | Table A.2.3.2.1-1     |   | 5 - 20   | QPSK  | 1/3 | 18  |   | ≥ 1        |   |
| TDD     | Table A.2.3.2.1-1     |   | 5 - 20   | QPSK  | 1/3 | 20  |   | ≥ 1        |   |
| TDD     | Table A.2.3.2.1-1     |   | 5 - 20   | QPSK  | 1/3 | 24  |   | ≥ 1        |   |
| TDD     | Table A.2.3.2.1-1     |   | 10 - 20  | QPSK  | 1/3 | 25  |   | ≥ 1        |   |
| TDD     | Table A.2.3.2.1-1     |   | 10 - 20  | QPSK  | 1/3 | 27  |   | ≥ 1        |   |
| TDD     | Table A.2.3.2.1-1     |   | 10 - 20  | QPSK  | 1/3 | 30  |   | ≥ 1        |   |
| TDD     | Table A.2.3.2.1-1     |   | 10 - 20  | QPSK  | 1/3 | 32  |   | ≥ 1        |   |
| TDD     | Table A.2.3.2.1-1     |   | 10 - 20  | QPSK  | 1/3 | 36  |   | ≥ 1        |   |
| TDD     | Table A.2.3.2.1-1     |   | 10 - 20  | QPSK  | 1/3 | 40  |   | ≥ 1        |   |
| TDD     | Table A.2.3.2.1-1     |   | 10 - 20  | QPSK  | 1/3 | 45  |   | ≥ 1        |   |
| TDD     | Table A.2.3.2.1-1     |   | 10 - 20  | QPSK  | 1/3 | 48  |   | ≥ 1        |   |
| TDD     | Table A.2.3.2.1-1     |   | 15 - 20  | QPSK  | 1/3 | 50  |   | ≥ 1        |   |
| TDD     | Table A.2.3.2.1-1     |   | 15 - 20  | QPSK  | 1/3 | 54  |   | ≥ 1        |   |
| TDD     | Table A.2.3.2.1-1     |   | 15 - 20  | QPSK  | 1/4 | 60  |   | ≥ 1        |   |
| TDD     | Table A.2.3.2.1-1     |   | 15 - 20  | QPSK  | 1/4 | 64  |   | ≥ 1        |   |
| TDD     | Table A.2.3.2.1-1     |   | 15 - 20  | QPSK  | 1/4 | 72  |   | ≥ 1        |   |
| TDD     | Table A.2.3.2.1-1     |   | 20       | QPSK  | 1/5 | 75  |   | ≥ 1        |   |
| TDD     | Table A.2.3.2.1-1     |   | 20       | QPSK  | 1/5 | 80  |   | ≥ 1        |   |
| TDD     | Table A.2.3.2.1-1     |   | 20       | QPSK  | 1/5 | 81  |   | ≥ 1        |   |
| TDD     | Table A.2.3.2.1-1     |   | 20       | QPSK  | 1/6 | 90  |   | ≥ 1        |   |
| TDD     | Table A.2.3.2.1-1     |   | 20       | QPSK  | 1/6 | 96  |   | ≥ 1        |   |
| TDD, Pa | rtial RB allocation,  | 16-QAM                                  |          |       |     |     |   |            |   |
| TDD     | Table A.2.3.2.2-1     |   | 1.4 - 20 | 16QAM | 3/4 | 1   |   | ≥ 1        |   |
| TDD     | Table A.2.3.2.2-1     |   | 1.4 - 20 | 16QAM | 3/4 | 2   |   | ≥ 1        |   |
| TDD     | Table A.2.3.2.2-1     |   | 1.4 - 20 | 16QAM | 3/4 | 3   |   | ≥ 1        |   |
| TDD     | Table A.2.3.2.2-1     |   | 1.4 - 20 | 16QAM | 3/4 | 4   |   | ≥ 1        |   |
|         | 1                     |   |          | 1     |     | 1   | 1 |            | 1 |

| TDD     | Table A.2.3.2.2-1 |            | 1.4 - 20 | 16QAM | 3/4  | 5  | ≥ 1 |  |
|---------|-------------------|------------|----------|-------|------|----|-----|--|
| TDD     | Table A.2.3.2.2-1 |            | 3 - 20   | 16QAM | 3/4  | 6  | ≥ 1 |  |
| TDD     | Table A.2.3.2.2-1 |            | 3 - 20   | 16QAM | 3/4  | 8  | ≥ 1 |  |
| TDD     | Table A.2.3.2.2-1 |            | 3 - 20   | 16QAM | 3/4  | 9  | ≥ 1 |  |
| TDD     | Table A.2.3.2.2-1 |            | 3 - 20   | 16QAM | 3/4  | 10 | ≥ 1 |  |
| TDD     | Table A.2.3.2.2-1 |            | 3 - 20   | 16QAM | 3/4  | 12 | ≥ 1 |  |
| TDD     | Table A.2.3.2.2-1 |            | 5 - 20   | 16QAM | 1/2  | 15 | ≥ 1 |  |
| TDD     | Table A.2.3.2.2-1 |            | 5 - 20   | 16QAM | 1/2  | 16 | ≥ 1 |  |
| TDD     | Table A.2.3.2.2-1 |            | 5 - 20   | 16QAM | 1/2  | 18 | ≥ 1 |  |
| TDD     | Table A.2.3.2.2-1 |            | 5 - 20   | 16QAM | 1/3  | 20 | ≥ 1 |  |
| TDD     | Table A.2.3.2.2-1 |            | 5 - 20   | 16QAM | 1/3  | 24 | ≥ 1 |  |
| TDD     | Table A.2.3.2.2-1 |            | 10 - 20  | 16QAM | 1/3  | 25 | ≥ 1 |  |
| TDD     | Table A.2.3.2.2-1 |            | 10 - 20  | 16QAM | 1/3  | 27 | ≥ 1 |  |
| TDD     | Table A.2.3.2.2-1 |            | 10 - 20  | 16QAM | 3/4  | 30 | ≥ 2 |  |
| TDD     | Table A.2.3.2.2-1 |            | 10 - 20  | 16QAM | 3/4  | 32 | ≥ 2 |  |
| TDD     | Table A.2.3.2.2-1 |            | 10 - 20  | 16QAM | 3/4  | 36 | ≥ 2 |  |
| TDD     | Table A.2.3.2.2-1 |            | 10 - 20  | 16QAM | 3/4  | 40 | ≥ 2 |  |
| TDD     | Table A.2.3.2.2-1 |            | 10 - 20  | 16QAM | 3/4  | 45 | ≥ 2 |  |
| TDD     | Table A.2.3.2.2-1 |            | 10 - 20  | 16QAM | 3/4  | 48 | ≥ 2 |  |
| TDD     | Table A.2.3.2.2-1 |            | 15 - 20  | 16QAM | 3/4  | 50 | ≥ 2 |  |
| TDD     | Table A.2.3.2.2-1 |            | 15 - 20  | 16QAM | 3/4  | 54 | ≥ 2 |  |
| TDD     | Table A.2.3.2.2-1 |            | 15 - 20  | 16QAM | 2/3  | 60 | ≥ 2 |  |
| TDD     | Table A.2.3.2.2-1 |            | 15 - 20  | 16QAM | 2/3  | 64 | ≥ 2 |  |
| TDD     | Table A.2.3.2.2-1 |            | 15 - 20  | 16QAM | 1/2  | 72 | ≥ 2 |  |
| TDD     | Table A.2.3.2.2-1 |            | 20       | 16QAM | 1/2  | 75 | ≥ 2 |  |
| TDD     | Table A.2.3.2.2-1 |            | 20       | 16QAM | 1/2  | 80 | ≥ 2 |  |
| TDD     | Table A.2.3.2.2-1 |            | 20       | 16QAM | 1/2  | 81 | ≥ 2 |  |
| TDD     | Table A.2.3.2.2-1 |            | 20       | 16QAM | 2/5  | 90 | ≥ 2 |  |
| TDD     | Table A.2.3.2.2-1 |            | 20       | 16QAM | 2/5  | 96 | ≥ 2 |  |
| TDD, Su | stained data rate |            |          | -     |      |    |     |  |
| TDD     | Table A.2.3.3-1   | R.1-1 TDD  | 10       | QPSK  | 0.43 | 40 | ≥ 1 |  |
| TDD     | Table A.2.3.3-1   | R.1-2 TDD  | 10       | QPSK  | 0.61 | 40 | ≥ 2 |  |
| TDD     | Table A.2.3.3-1   | R.1-3 TDD  | 20       | QPSK  | 0.49 | 90 | ≥ 2 |  |
| TDD     | Table A.2.3.3-1   | R.1-3B TDI | D 15     | QPSK  | 0.42 | 60 | ≥ 2 |  |
| TDD     | Table A.2.3.3-1   | R.1-4 TDD  | 20       | QPSK  | 0.49 | 90 | ≥ 2 |  |

## A.2.2 Reference measurement channels for FDD

#### A.2.2.1 Full RB allocation

#### A.2.2.1.1 QPSK

#### Table A.2.2.1.1-1 Reference Channels for QPSK with full RB allocation

| Parameter                                | Unit         |            |          | Va       | lue       |           |         |  |
|--|--------------|------------|----------|----------|-----------|-----------|---------|--|
| Channel bandwidth                        | MHz          | 1.4        | 3        | 5        | 10        | 15        | 20      |  |
| Allocated resource blocks                |              | 6          | 15       | 25       | 50        | 75        | 100     |  |
| DFT-OFDM Symbols per Sub-Frame           |              | 12         | 12       | 12       | 12        | 12        | 12      |  |
| Modulation                               |              | QPSK       | QPSK     | QPSK     | QPSK      | QPSK      | QPSK    |  |
| Target Coding rate                       |              | 1/3        | 1/3      | 1/3      | 1/3       | 1/5       | 1/6     |  |
| Payload size                             | Bits         | 600        | 1544     | 2216     | 5160      | 4392      | 4584    |  |
| Transport block CRC                      | Bits         | 24         | 24       | 24       | 24        | 24        | 24      |  |
| Number of code blocks per Sub-Frame      |              | 1          | 1        | 1        | 1         | 1         | 1       |  |
| (Note 1)                                 |              |            |          |          |           |           |         |  |
| Total number of bits per Sub-Frame       | Bits         | 1728       | 4320     | 7200     | 14400     | 21600     | 28800   |  |
| Total symbols per Sub-Frame              |              | 864        | 2160     | 3600     | 7200      | 10800     | 14400   |  |
| UE Category                              |              | ≥ 1        | ≥ 1      | ≥ 1      | ≥ 1       | ≥1        | ≥ 1     |  |
| Note 1: If more than one Code Block is   | s present, a | n addition | al CRC s | sequence | of L = 24 | Bits is a | ttached |  |
| to each Code Block (otherwise L = 0 Bit) |              |            |          |          |           |           |         |  |

#### A.2.2.1.2 16-QAM

#### Table A.2.2.1.2-1 Reference Channels for 16-QAM with full RB allocation

| Parameter  | Unit |       |       | Va    | lue   |       |       |  |  |
|--|------|-------|-------|-------|-------|-------|-------|--|--|
| Channel bandwidth  | MHz  | 1.4   | 3     | 5     | 10    | 15    | 20    |  |  |
| Allocated resource blocks  |      | 6     | 15    | 25    | 50    | 75    | 100   |  |  |
| DFT-OFDM Symbols per Sub-Frame   |      | 12    | 12    | 12    | 12    | 12    | 12    |  |  |
| Modulation   |      | 16QAM | 16QAM | 16QAM | 16QAM | 16QAM | 16QAM |  |  |
| Target Coding rate   |      | 3/4   | 1/2   | 1/3   | 3/4   | 1/2   | 1/3   |  |  |
| Payload size   | Bits | 2600  | 4264  | 4968  | 21384 | 21384 | 19848 |  |  |
| Transport block CRC  | Bits | 24    | 24    | 24    | 24    | 24    | 24    |  |  |
| Number of code blocks per Sub-Frame (Note 1)   |      | 1     | 1     | 1     | 4     | 4     | 4     |  |  |
| Total number of bits per Sub-Frame   | Bits | 3456  | 8640  | 14400 | 28800 | 43200 | 57600 |  |  |
| Total symbols per Sub-Frame  |      | 864   | 2160  | 3600  | 7200  | 10800 | 14400 |  |  |
| UE Category  |      | ≥1    | ≥ 1   | ≥1    | ≥ 2   | ≥2    | ≥2    |  |  |
| Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit) |      |       |       |       |       |       |       |  |  |

#### A.2.2.1.3 64-QAM

[FFS]

#### A.2.2.2 Partial RB allocation

For each channel bandwidth, various partial RB allocations are specified. The number of allocated RBs is chosen according to values specified in the Tx and Rx requirements. The single allocated RB case is included.

The allocated RBs are contiguous and start from one end of the channel bandwidth. A single allocated RB is at one end of the channel bandwidth.

### A.2.2.2.1 QPSK

| Paramet<br>er | Ch BW    | Allocate<br>d RBs | DFT-<br>OFDM<br>Symbols<br>per Sub-<br>Frame | Mod'n | Target<br>Coding<br>rate | Payload<br>size | Transpo<br>rt block<br>CRC | Number<br>of code<br>blocks<br>per Sub-<br>Frame<br>(Note 1) | Total<br>number<br>of bits<br>per Sub-<br>Frame | Total<br>symbols<br>per Sub-<br>Frame | UE<br>Categor<br>y |
|---------------|----------|-------------------|--|-------|--------------------------|-----------------|----------------------------|--|---|---------------------------------------|--------------------|
| Unit          | MHz      |                   |  |       |                          | Bits            | Bits                       |  | Bits  |                                       |                    |
|               | 1.4 - 20 | 1                 | 12   | QPSK  | 1/3                      | 72              | 24                         | 1  | 288   | 144                                   | ≥1                 |
|               | 1.4 - 20 | 2                 | 12   | QPSK  | 1/3                      | 176             | 24                         | 1  | 576   | 288                                   | ≥1                 |
|               | 1.4 - 20 | 3                 | 12   | QPSK  | 1/3                      | 256             | 24                         | 1  | 864   | 432                                   | ≥1                 |
|               | 1.4 - 20 | 4                 | 12   | QPSK  | 1/3                      | 392             | 24                         | 1  | 1152  | 576                                   | ≥1                 |
|               | 1.4 - 20 | 5                 | 12   | QPSK  | 1/3                      | 424             | 24                         | 1  | 1440  | 720                                   | ≥1                 |
|               | 3-20     | 6                 | 12   | QPSK  | 1/3                      | 600             | 24                         | 1  | 1728  | 864                                   | ≥1                 |
|               | 3-20     | 8                 | 12   | QPSK  | 1/3                      | 808             | 24                         | 1  | 2304  | 1152                                  | ≥1                 |
|               | 3-20     | 9                 | 12   | QPSK  | 1/3                      | 776             | 24                         | 1  | 2592  | 1296                                  | ≥1                 |
|               | 3-20     | 10                | 12   | QPSK  | 1/3                      | 872             | 24                         | 1  | 2880  | 1440                                  | ≥1                 |
|               | 3-20     | 12                | 12   | QPSK  | 1/3                      | 1224            | 24                         | 1  | 3456  | 1728                                  | ≥1                 |
|               | 5-20     | 15                | 12   | QPSK  | 1/3                      | 1320            | 24                         | 1  | 4320  | 2160                                  | ≥1                 |
|               | 5-20     | 16                | 12   | QPSK  | 1/3                      | 1384            | 24                         | 1  | 4608  | 2304                                  | ≥1                 |
|               | 5-20     | 18                | 12   | QPSK  | 1/3                      | 1864            | 24                         | 1  | 5184  | 2592                                  | ≥1                 |
|               | 5-20     | 20                | 12   | QPSK  | 1/3                      | 1736            | 24                         | 1  | 5760  | 2880                                  | ≥1                 |
|               | 5-20     | 24                | 12   | QPSK  | 1/3                      | 2472            | 24                         | 1  | 6912  | 3456                                  | ≥1                 |
|               | 10-20    | 25                | 12   | QPSK  | 1/3                      | 2216            | 24                         | 1  | 7200  | 3600                                  | ≥1                 |
|               | 10-20    | 27                | 12   | QPSK  | 1/3                      | 2792            | 24                         | 1  | 7776  | 3888                                  | ≥ 1                |
|               | 10-20    | 30                | 12   | QPSK  | 1/3                      | 2664            | 24                         | 1  | 8640  | 4320                                  | ≥ 1                |
|               | 10-20    | 32                | 12   | QPSK  | 1/3                      | 2792            | 24                         | 1  | 9216  | 4608                                  | ≥1                 |
|               | 10-20    | 36                | 12   | QPSK  | 1/3                      | 3752            | 24                         | 1  | 10368   | 5184                                  | ≥ 1                |
|               | 10-20    | 40                | 12   | QPSK  | 1/3                      | 4136            | 24                         | 1  | 11520   | 5760                                  | ≥ 1                |
|               | 10-20    | 45                | 12   | QPSK  | 1/3                      | 4008            | 24                         | 1  | 12960   | 6480                                  | ≥1                 |
|               | 10-20    | 48                | 12   | QPSK  | 1/3                      | 4264            | 24                         | 1  | 13824   | 6912                                  | ≥1                 |
|               | 15 - 20  | 50                | 12   | QPSK  | 1/3                      | 5160            | 24                         | 1  | 14400   | 7200                                  | ≥ 1                |
|               | 15 - 20  | 54                | 12   | QPSK  | 1/3                      | 4776            | 24                         | 1  | 15552   | 7776                                  | ≥1                 |
|               | 15 - 20  | 60                | 12   | QPSK  | 1/4                      | 4264            | 24                         | 1  | 17280   | 8640                                  | ≥ 1                |
|               | 15 - 20  | 64                | 12   | QPSK  | 1/4                      | 4584            | 24                         | 1  | 18432   | 9216                                  | ≥ 1                |
|               | 15 - 20  | 72                | 12   | QPSK  | 1/4                      | 5160            | 24                         | 1  | 20736   | 10368                                 | ≥1                 |
|               | 20       | 75                | 12   | QPSK  | 1/5                      | 4392            | 24                         | 1  | 21600   | 10800                                 | ≥1                 |
|               | 20       | 80                | 12   | QPSK  | 1/5                      | 4776            | 24                         | 1  | 23040   | 11520                                 | ≥1                 |
|               | 20       | 81                | 12   | QPSK  | 1/5                      | 4776            | 24                         | 1  | 23328   | 11664                                 | ≥1                 |
|               | 20       | 90                | 12   | QPSK  | 1/6                      | 4008            | 24                         | 1  | 25920   | 12960                                 | ≥ 1                |
|               | 20       | 96                | 12   | QPSK  | 1/6                      | 4264            | 24                         | 1  | 27648   | 13824                                 | ≥1                 |

#### Table A.2.2.2.1-1 Reference Channels for QPSK with partial RB allocation

#### A.2.2.2.2 16-QAM

| Paramet<br>er | Ch BW    | Allocate<br>d RBs | DFT-<br>OFDM<br>Symbols<br>per Sub-<br>Frame | Mod'n | Target<br>Coding<br>rate | Payload<br>size | Transpo<br>rt block<br>CRC | Number<br>of code<br>blocks<br>per Sub-<br>Frame<br>(Note 1) | Total<br>number<br>of bits<br>per Sub-<br>Frame | Total<br>symbols<br>per Sub-<br>Frame | UE<br>Categor<br>y |
|---------------|----------|-------------------|--|-------|--------------------------|-----------------|----------------------------|--|---|---------------------------------------|--------------------|
| Unit          | MHz      |                   |  |       |                          | Bits            | Bits                       |  | Bits  |                                       |                    |
|               | 1.4 - 20 | 1                 | 12   | 16QAM | 3/4                      | 408             | 24                         | 1  | 576   | 144                                   | ≥1                 |
|               | 1.4 - 20 | 2                 | 12   | 16QAM | 3/4                      | 840             | 24                         | 1  | 1152  | 288                                   | ≥1                 |
|               | 1.4 - 20 | 3                 | 12   | 16QAM | 3/4                      | 1288            | 24                         | 1  | 1728  | 432                                   | ≥1                 |
|               | 1.4 - 20 | 4                 | 12   | 16QAM | 3/4                      | 1736            | 24                         | 1  | 2304  | 576                                   | ≥1                 |
|               | 1.4 - 20 | 5                 | 12   | 16QAM | 3/4                      | 2152            | 24                         | 1  | 2880  | 720                                   | ≥1                 |
|               | 3-20     | 6                 | 12   | 16QAM | 3/4                      | 2600            | 24                         | 1  | 3456  | 864                                   | ≥1                 |
|               | 3-20     | 8                 | 12   | 16QAM | 3/4                      | 3496            | 24                         | 1  | 4608  | 1152                                  | ≥1                 |
|               | 3-20     | 9                 | 12   | 16QAM | 3/4                      | 3880            | 24                         | 1  | 5184  | 1296                                  | ≥1                 |
|               | 3-20     | 10                | 12   | 16QAM | 3/4                      | 4264            | 24                         | 1  | 5760  | 1440                                  | ≥1                 |
|               | 3-20     | 12                | 12   | 16QAM | 3/4                      | 5160            | 24                         | 1  | 6912  | 1728                                  | ≥1                 |
|               | 5-20     | 15                | 12   | 16QAM | 1/2                      | 4264            | 24                         | 1  | 8640  | 2160                                  | ≥1                 |
|               | 5-20     | 16                | 12   | 16QAM | 1/2                      | 4584            | 24                         | 1  | 9216  | 2304                                  | ≥1                 |
|               | 5-20     | 18                | 12   | 16QAM | 1/2                      | 5160            | 24                         | 1  | 10368   | 2592                                  | ≥1                 |
|               | 5-20     | 20                | 12   | 16QAM | 1/3                      | 4008            | 24                         | 1  | 11520   | 2880                                  | ≥1                 |
|               | 5-20     | 24                | 12   | 16QAM | 1/3                      | 4776            | 24                         | 1  | 13824   | 3456                                  | ≥1                 |
|               | 10-20    | 25                | 12   | 16QAM | 1/3                      | 4968            | 24                         | 1  | 14400   | 3600                                  | ≥1                 |
|               | 10-20    | 27                | 12   | 16QAM | 1/3                      | 4776            | 24                         | 1  | 15552   | 3888                                  | ≥1                 |
|               | 10-20    | 30                | 12   | 16QAM | 3/4                      | 12960           | 24                         | 3  | 17280   | 4320                                  | ≥2                 |
|               | 10-20    | 32                | 12   | 16QAM | 3/4                      | 13536           | 24                         | 3  | 18432   | 4608                                  | ≥ 2                |
|               | 10-20    | 36                | 12   | 16QAM | 3/4                      | 15264           | 24                         | 3  | 20736   | 5184                                  | ≥2                 |
|               | 10-20    | 40                | 12   | 16QAM | 3/4                      | 16992           | 24                         | 3  | 23040   | 5760                                  | ≥2                 |
|               | 10-20    | 45                | 12   | 16QAM | 3/4                      | 19080           | 24                         | 4  | 25920   | 6480                                  | ≥2                 |
|               | 10-20    | 48                | 12   | 16QAM | 3/4                      | 20616           | 24                         | 4  | 27648   | 6912                                  | ≥2                 |
|               | 15 - 20  | 50                | 12   | 16QAM | 3/4                      | 21384           | 24                         | 4  | 28800   | 7200                                  | ≥2                 |
|               | 15 - 20  | 54                | 12   | 16QAM | 3/4                      | 22920           | 24                         | 4  | 31104   | 7776                                  | ≥2                 |
|               | 15 - 20  | 60                | 12   | 16QAM | 2/3                      | 23688           | 24                         | 4  | 34560   | 8640                                  | ≥2                 |
|               | 15 - 20  | 64                | 12   | 16QAM | 2/3                      | 25456           | 24                         | 4  | 36864   | 9216                                  | ≥2                 |
|               | 15 - 20  | 72                | 12   | 16QAM | 1/2                      | 20616           | 24                         | 4  | 41472   | 10368                                 | ≥2                 |
|               | 20       | 75                | 12   | 16QAM | 1/2                      | 21384           | 24                         | 4  | 43200   | 10800                                 | ≥2                 |
|               | 20       | 80                | 12   | 16QAM | 1/2                      | 22920           | 24                         | 4  | 46080   | 11520                                 | ≥2                 |
|               | 20       | 81                | 12   | 16QAM | 1/2                      | 22920           | 24                         | 4  | 46656   | 11664                                 | ≥2                 |
|               | 20       | 90                | 12   | 16QAM | 2/5                      | 20616           | 24                         | 4  | 51840   | 12960                                 | ≥2                 |
|               | 20       | 96                | 12   | 16QAM | 2/5                      | 22152           | 24                         | 4  | 55296   | 13824                                 | ≥2                 |

#### Table A.2.2.2.2-1 Reference Channels for 16-QAM with partial RB allocation

#### A.2.2.2.3 64-QAM

[FFS]

## A.2.2.3 Reference measurement channels for sustained downlink data rate provided by lower layers

| Unit Value   |          |  |  |  |   |   |  |  |  |  |
|--|----------|--|--|--|---|---|--|--|--|--|
|  | R.1-1    | R.1-2  | R.1-3  | R.1-3A   | R.1-4   | FFS   |  |  |  |  |
|  | FDD      | FDD  | FDD  | FDD  | FDD   |   |  |  |  |  |
| MHz  | 10       | 10   | 20   | 10   | 20  |   |  |  |  |  |
|  | 40       | 40   | 90   | 40   | 90  |   |  |  |  |  |
|  | (Note 2) | (Note 2)   | (Note 3)   | (Note 2)   | (Note 3)  |   |  |  |  |  |
|  | 10       | 10   | 10   | 10   | 10  |   |  |  |  |  |
|  | 12       | 12   | 12   | 12   | 12  |   |  |  |  |  |
|  | QPSK     | QPSK   | QPSK   | QPSK   | QPSK  |   |  |  |  |  |
|  | 0.31     | 0.31   | 0.31   | 0.31   | 0.31  |   |  |  |  |  |
| Bits   | 3496     | 3496   | 7992   | 3496   | 7992  |   |  |  |  |  |
|  | 1        | 1  | 2  | 1  | 2   |   |  |  |  |  |
|  |          |  |  |  |   |   |  |  |  |  |
|  | 5760     | 5760   | 12960  | 5760   | 12960   |   |  |  |  |  |
|  | 11520    | 11520  | 25920  | 11520  | 25920   |   |  |  |  |  |
| Mbps   | 3.496    | 3.496  | 7.992  | 3.496  | 7.992   |   |  |  |  |  |
|  | ≥ 1      | ≥ 1  | ≥2   | ≥ 1  | ≥2  |   |  |  |  |  |
| Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code |          |  |  |  |   |   |  |  |  |  |
|  |          |  |  |  |   |   |  |  |  |  |
|  |          |  |  |  |   |   |  |  |  |  |
|  | Bits     | R.1-1       FDD         MHz       10         40       40         (Note 2)       10         12       QPSK         0.31       3496         1       5760         11520       Mbps         3.496       ≥ 1         resent, an additional ( | $\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$ | $\begin{array}{ c c c c c c c c c c c c c c c c c c c$ | R.1-1<br>FDDR.1-2<br>FDDR.1-3<br>FDDR.1-3A<br>FDDMHz1010201040409040(Note 2)(Note 2)(Note 3)(Note 2)101010101012121212QPSKQPSKQPSKQPSK0.310.310.310.31Bits3496349679923496111215760576012960576011520115202592011520Mbps3.4963.4967.9923.496 $\geq 1$ $\geq 1$ $\geq 2$ $\geq 1$ resent, an additional CRC sequence of L = 24 Bits is attract | $ \begin{array}{ c c c c c c c c c c c c c c c c c c c$ |  |  |  |  |

#### Table A.2.2.3-1: Uplink Reference Channels for sustained data-rate test (FDD)

Note 3: RB-s 5-94 allocated with PUSCH.

## A.2.3 Reference measurement channels for TDD

For TDD, the measurement channel is based on DL/UL configuration ratio of 2DL:2UL.

#### A.2.3.1 Full RB allocation

#### A.2.3.1.1 QPSK

#### Table A.2.3.1.1-1 Reference Channels for QPSK with full RB allocation

| Parameter  | Unit  |            |          | Va      | lue       |           |         |
|--|-------|------------|----------|---------|-----------|-----------|---------|
| Channel bandwidth  | MHz   | 1.4        | 3        | 5       | 10        | 15        | 20      |
| Allocated resource blocks  |       | 6          | 15       | 25      | 50        | 75        | 100     |
| Uplink-Downlink Configuration (Note 2)                               |       | 1          | 1        | 1       | 1         | 1         | 1       |
| DFT-OFDM Symbols per Sub-Frame                                       |       | 12         | 12       | 12      | 12        | 12        | 12      |
| Modulation   |       | QPSK       | QPSK     | QPSK    | QPSK      | QPSK      | QPSK    |
| Target Coding rate   |       | 1/3        | 1/3      | 1/3     | 1/3       | 1/5       | 1/6     |
| Payload size   |       |            |          |         |           |           |         |
| For Sub-Frame 2,3,7,8  | Bits  | 600        | 1544     | 2216    | 5160      | 4392      | 4584    |
| Transport block CRC  | Bits  | 24         | 24       | 24      | 24        | 24        | 24      |
| Number of code blocks per Sub-Frame                                  |       |            |          |         |           |           |         |
| (Note 1)   |       |            |          |         |           |           |         |
| For Sub-Frame 2,3,7,8  |       | 1          | 1        | 1       | 1         | 1         | 1       |
| Total number of bits per Sub-Frame                                   |       |            |          |         |           |           |         |
| For Sub-Frame 2,3,7,8  | Bits  | 1728       | 4320     | 7200    | 14400     | 21600     | 28800   |
| Total symbols per Sub-Frame  |       |            |          |         |           |           |         |
| For Sub-Frame 2,3,7,8  |       | 864        | 2160     | 3600    | 7200      | 10800     | 14400   |
| UE Category  |       | ≥ 1        | ≥ 1      | ≥1      | ≥ 1       | ≥1        | ≥1      |
| Note 1: If more than one Code Block is to each Code Block (otherwise |       | n addition | al CRC s | equence | of L = 24 | Bits is a | ttached |
| Note 2: As per Table 4.2-2 in TS 36.21                               | 1 [4] |            |          |         |           |           |         |

#### A.2.3.1.2 16-QAM

#### Table A.2.3.1.2-1 Reference Channels for 16-QAM with full RB allocation

| Parameter   | Unit |       |       | Va    | lue   |       |       |  |  |
|---|------|-------|-------|-------|-------|-------|-------|--|--|
| Channel bandwidth   | MHz  | 1.4   | 3     | 5     | 10    | 15    | 20    |  |  |
| Allocated resource blocks   |      | 6     | 15    | 25    | 50    | 75    | 100   |  |  |
| Uplink-Downlink Configuration (Note 2)  |      | 1     | 1     | 1     | 1     | 1     | 1     |  |  |
| DFT-OFDM Symbols per Sub-Frame  |      | 12    | 12    | 12    | 12    | 12    | 12    |  |  |
| Modulation  |      | 16QAM | 16QAM | 16QAM | 16QAM | 16QAM | 16QAM |  |  |
| Target Coding rate  |      | 3/4   | 1/2   | 1/3   | 3/4   | 1/2   | 1/3   |  |  |
| Payload size  |      |       |       |       |       |       |       |  |  |
| For Sub-Frame 2,3,7,8   | Bits | 2600  | 4264  | 4968  | 21384 | 21384 | 19848 |  |  |
| Transport block CRC   | Bits | 24    | 24    | 24    | 24    | 24    | 24    |  |  |
| Number of code blocks per Sub-Frame (Note 1)  |      |       |       |       |       |       |       |  |  |
| For Sub-Frame 2,3,7,8   |      | 1     | 1     | 1     | 4     | 4     | 4     |  |  |
| Total number of bits per Sub-Frame  |      |       |       |       |       |       |       |  |  |
| For Sub-Frame 2,3,7,8   | Bits | 3456  | 8640  | 14400 | 28800 | 43200 | 57600 |  |  |
| Total symbols per Sub-Frame   |      |       |       |       |       |       |       |  |  |
| For Sub-Frame 2,3,7,8   |      | 864   | 2160  | 3600  | 7200  | 10800 | 14400 |  |  |
| UE Category   |      | ≥ 1   | ≥ 1   | ≥1    | ≥ 2   | ≥2    | ≥2    |  |  |
| <ul> <li>Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)</li> <li>Note 2: As per Table 4.2-2 in TS 36.211 [4]</li> </ul> |      |       |       |       |       |       |       |  |  |

#### A.2.3.1.3 64-QAM

[FFS]

#### A.2.3.2 Partial RB allocation

For each channel bandwidth, various partial RB allocations are specified. The number of allocated RBs is chosen according to values specified in the Tx and Rx requirements. The single allocated RB case is included.

The allocated RBs are contiguous and start from one end of the channel bandwidth. A single allocated RB is at one end of the channel bandwidth.

#### A.2.3.2.1 QPSK

| Parame<br>ter | Ch BW              | Allocat<br>ed RBs | UDL<br>Configu<br>ration<br>(Note 2) | DFT-<br>OFDM<br>Symbol<br>s per<br>Sub-<br>Frame | Mod'n        | Target<br>Coding<br>rate | Payloa<br>d size<br>for<br>Sub-<br>Frame<br>2, 3, 7,<br>8 | Transp<br>ort<br>block<br>CRC | Number<br>of code<br>blocks<br>per<br>Sub-<br>Frame<br>(Note 1) | Total<br>number<br>of bits<br>per<br>Sub-<br>Frame<br>for<br>Sub-<br>Frame<br>2, 3, 7,<br>8 | Total<br>symbol<br>s per<br>Sub-<br>Frame<br>for<br>Sub-<br>Frame<br>2, 3, 7,<br>8 | UE<br>Categor<br>y |
|---------------|--------------------|-------------------|--------------------------------------|--|--------------|--------------------------|---|-------------------------------|---|---|--|--------------------|
| Unit          | MHz                |                   |                                      |  |              |                          | Bits  | Bits                          |   | Bits  |  |                    |
|               | 1.4 - 20           | 1                 | 1                                    | 12   | QPSK         | 1/3                      | 72  | 24                            | 1   | 288   | 144  | ≥1                 |
|               | 1.4 - 20           | 2                 | 1                                    | 12   | QPSK         | 1/3                      | 176   | 24                            | 1   | 576   | 288  | ≥ 1                |
|               | 1.4 - 20           | 3                 | 1                                    | 12   | QPSK         | 1/3                      | 256   | 24                            | 1   | 864   | 432  | ≥1                 |
|               | 1.4 - 20           | 4                 | 1                                    | 12   | QPSK         | 1/3                      | 392   | 24                            | 1   | 1152  | 576  | ≥ 1                |
|               | 1.4 - 20           | 5                 | 1                                    | 12   | QPSK<br>QPSK | 1/3                      | 424   | 24                            | 1   | 1440  | 720  | ≥1                 |
|               | 3-20<br>3-20       | 6<br>8            | 1                                    | 12<br>12   | QPSK         | 1/3<br>1/3               | 600<br>808  | 24<br>24                      | 1   | 1728<br>2304  | 864<br>1152  | ≥ 1<br>≥ 1         |
|               | 3-20               | 9                 | 1                                    | 12   | QPSK         | 1/3                      | 776   | 24                            | 1   | 2304  | 1296   | ≥1                 |
|               | 3-20               | 10                | 1                                    | 12   | QPSK         | 1/3                      | 872   | 24                            | 1   | 2392  | 1290   | ≥1                 |
|               | 3-20               | 10                | 1                                    | 12   | QPSK         | 1/3                      | 1224  | 24                            | 1   | 3456  | 1728   | ≥1                 |
|               | 5-20               | 15                | 1                                    | 12   | QPSK         | 1/3                      | 1320  | 24                            | 1   | 4320  | 2160   | ≥1                 |
|               | 5-20               | 16                | 1                                    | 12   | QPSK         | 1/3                      | 1384  | 24                            | 1   | 4608  | 2304   | ≥1                 |
|               | 5-20               | 18                | 1                                    | 12   | QPSK         | 1/3                      | 1864  | 24                            | 1   | 5184  | 2592   | ≥ 1                |
|               | 5-20               | 20                | 1                                    | 12   | QPSK         | 1/3                      | 1736  | 24                            | 1   | 5760  | 2880   | ≥ 1                |
|               | 5-20               | 24                | 1                                    | 12   | QPSK         | 1/3                      | 2472  | 24                            | 1   | 6912  | 3456   | ≥ 1                |
|               | 10-20              | 25                | 1                                    | 12   | QPSK         | 1/3                      | 2216  | 24                            | 1   | 7200  | 3600   | ≥ 1                |
|               | 10-20              | 27                | 1                                    | 12   | QPSK         | 1/3                      | 2792  | 24                            | 1   | 7776  | 3888   | ≥ 1                |
|               | 10-20              | 30                | 1                                    | 12   | QPSK         | 1/3                      | 2664  | 24                            | 1   | 8640  | 4320   | ≥ 1                |
|               | 10-20              | 32                | 1                                    | 12   | QPSK         | 1/3                      | 2792  | 24                            | 1   | 9216  | 4608   | ≥ 1                |
|               | 10-20              | 36                | 1                                    | 12   | QPSK         | 1/3                      | 3752  | 24                            | 1   | 10368   | 5184   | ≥ 1                |
|               | 10-20              | 40                | 1                                    | 12   | QPSK         | 1/3                      | 4136  | 24                            | 1   | 11520   | 5760   | ≥ 1                |
|               | 10-20              | 45                | 1                                    | 12   | QPSK         | 1/3                      | 4008  | 24                            | 1   | 12960   | 6480   | ≥ 1                |
|               | 10-20              | 48                | 1                                    | 12   | QPSK         | 1/3                      | 4264  | 24                            | 1   | 13824   | 6912   | ≥1                 |
|               | 15 - 20            | 50                | 1                                    | 12<br>12   | QPSK         | 1/3                      | 5160  | 24                            | 1   | 14400   | 7200   | ≥1                 |
|               | 15 - 20<br>15 - 20 | 54<br>60          | 1                                    | 12   | QPSK<br>QPSK | 1/3<br>1/4               | 4776<br>4264  | 24<br>24                      | 1   | 15552<br>17280  | 7776<br>8640   | ≥ 1<br>≥ 1         |
|               | 15 - 20            | 64                | 1                                    | 12   | QPSK         | 1/4                      | 4204  | 24                            | 1   | 18432   | 9216   | ≥1                 |
|               | 15 - 20            | 72                | 1                                    | 12   | QPSK         | 1/4                      | 5160  | 24                            | 1   | 20736   | 10368  | ≥1                 |
|               | 20                 | 75                | 1                                    | 12   | QPSK         | 1/4                      | 4392  | 24                            | 1   | 21600   | 10800  | ≥1                 |
|               | 20                 | 80                | 1                                    | 12   | QPSK         | 1/5                      | 4776  | 24                            | 1   | 23040   | 11520  | ≥1                 |
|               | 20                 | 81                | 1                                    | 12   | QPSK         | 1/5                      | 4776  | 24                            | 1   | 23328   | 11664  | ≥1                 |
|               | 20                 | 90                | 1                                    | 12   | QPSK         | 1/6                      | 4008  | 24                            | 1   | 25920   | 12960  | ≥ 1                |
|               | 20                 | 96                | 1                                    | 12   | QPSK         | 1/6                      | 4264  | 24                            | 1   | 27648   | 13824  | ≥1                 |

#### Table A.2.3.2.1-1 Reference Channels for QPSK with partial RB allocation

#### A.2.3.2.2 16-QAM

| Parame<br>ter      | Ch BW                     | Allocat<br>ed RBs | UDL<br>Configu<br>ration<br>(Note 2) | DFT-<br>OFDM<br>Symbol<br>s per<br>Sub-<br>Frame | Mod'n          | Target<br>Coding<br>rate | Payloa<br>d size<br>for<br>Sub-<br>Frame<br>2, 3, 7,<br>8 | Transp<br>ort<br>block<br>CRC | Number<br>of code<br>blocks<br>per<br>Sub-<br>Frame<br>(Note 1) | Total<br>number<br>of bits<br>per<br>Sub-<br>Frame<br>for<br>Sub-<br>Frame<br>2, 3, 7,<br>8 | Total<br>symbol<br>s per<br>Sub-<br>Frame<br>for<br>Sub-<br>Frame<br>2, 3, 7,<br>8 | UE<br>Categor<br>y |
|--------------------|---------------------------|-------------------|--------------------------------------|--|----------------|--------------------------|---|-------------------------------|---|---|--|--------------------|
| Unit               | MHz                       |                   |                                      |  |                |                          | Bits  | Bits                          |   | Bits  |  |                    |
|                    | 1.4 - 20                  | 1                 | 1                                    | 12   | 16QAM          | 3/4                      | 408   | 24                            | 1   | 576   | 144  | ≥ 1                |
|                    | 1.4 - 20                  | 2                 | 1                                    | 12   | 16QAM          | 3/4                      | 840   | 24                            | 1   | 1152  | 288  | ≥ 1                |
|                    | 1.4 - 20                  | 3                 | 1                                    | 12   | 16QAM          | 3/4                      | 1288  | 24                            | 1   | 1728  | 432  | ≥ 1                |
|                    | 1.4 - 20                  | 4                 | 1                                    | 12   | 16QAM          | 3/4                      | 1736  | 24                            | 1   | 2304  | 576  | ≥ 1                |
|                    | 1.4 - 20                  | 5                 | 1                                    | 12   | 16QAM          | 3/4                      | 2152  | 24                            | 1   | 2880  | 720  | ≥1                 |
|                    | 3-20                      | 6                 | 1                                    | 12   | 16QAM          | 3/4                      | 2600  | 24                            | 1   | 3456  | 864  | ≥ 1                |
|                    | 3-20                      | 8                 | 1                                    | 12   | 16QAM          | 3/4                      | 3496  | 24                            | 1   | 4608  | 1152   | ≥1                 |
|                    | 3-20                      | 9                 | 1                                    | 12   | 16QAM          | 3/4                      | 3880  | 24                            | 1   | 5184  | 1296   | ≥ 1                |
|                    | 3-20                      | 10                | 1                                    | 12   | 16QAM          | 3/4                      | 4264  | 24                            | 1   | 5760  | 1440   | ≥1                 |
|                    | 3-20                      | 12                | 1                                    | 12   | 16QAM          | 3/4                      | 5160  | 24                            | 1   | 6912  | 1728   | ≥ 1                |
|                    | 5-20                      | 15                | 1                                    | 12   | 16QAM          | 1/2                      | 4264  | 24                            | 1   | 8640  | 2160   | ≥ 1                |
|                    | 5-20                      | 16                | 1                                    | 12   | 16QAM          | 1/2                      | 4584  | 24                            | 1   | 9216  | 2304   | ≥1                 |
|                    | 5-20                      | 18                | 1                                    | 12   | 16QAM          | 1/2                      | 5160  | 24                            | 1   | 10368   | 2592   | ≥1                 |
|                    | 5-20                      | 20                | 1                                    | 12   | 16QAM          | 1/3                      | 4008  | 24                            | 1   | 11520   | 2880   | ≥ 1                |
|                    | 5-20                      | 24                | 1                                    | 12   | 16QAM          | 1/3                      | 4776  | 24                            | 1   | 13824   | 3456   | ≥ 1                |
|                    | 10-20                     | 25                | 1                                    | 12   | 16QAM          | 1/3                      | 4968  | 24                            | 1   | 14400   | 3600   | ≥1                 |
|                    | 10-20                     | 27                | 1                                    | 12   | 16QAM          | 1/3                      | 4776  | 24                            | 1   | 15552   | 3888   | ≥ 1                |
|                    | 10-20                     | 30                | 1                                    | 12   | 16QAM          | 3/4                      | 12960   | 24                            | 3   | 17280   | 4320   | ≥ 2                |
|                    | 10-20                     | 32                | 1                                    | 12   | 16QAM          | 3/4                      | 13536   | 24                            | 3   | 18432   | 4608   | ≥ 2                |
|                    | 10-20                     | 36                | 1                                    | 12   | 16QAM          | 3/4                      | 15264   | 24                            | 3   | 20736   | 5184   | ≥ 2                |
|                    | 10-20                     | 40                | 1                                    | 12   | 16QAM          | 3/4                      | 16992   | 24                            | 3   | 23040   | 5760   | ≥ 2                |
|                    | 10-20                     | 45                | 1                                    | 12   | 16QAM          | 3/4                      | 19080   | 24                            | 4   | 25920   | 6480   | ≥2                 |
|                    | 10-20                     | 48                | 1                                    | 12   | 16QAM          | 3/4                      | 20616   | 24                            | 4   | 27648   | 6912   | ≥2                 |
|                    | 15 - 20                   | 50<br>54          | 1                                    | 12<br>12   | 16QAM          | 3/4                      | 21384   | 24<br>24                      | 4   | 28800   | 7200   | ≥2                 |
|                    | 15 - 20                   | 54<br>60          | 1                                    | 12   | 16QAM          | 3/4                      | 22920<br>23688  | 24                            | 4 4   | 31104   | 7776<br>8640   | ≥2                 |
|                    | <u>15 - 20</u><br>15 - 20 | 60<br>64          | 1                                    | 12   | 16QAM<br>16QAM | 2/3<br>2/3               | 23688   | 24                            | 4   | 34560<br>36864  | 9216   | ≥ 2<br>≥ 2         |
|                    | 15 - 20                   | 64<br>72          | 1                                    | 12   | 16QAM<br>16QAM | 2/3                      | 25456   | 24                            | 4   | 36864<br>41472  | 10368  | ≥2<br>≥2           |
|                    | 20                        | 72                | 1                                    | 12   | 16QAM<br>16QAM | 1/2                      | 20616   | 24                            | 4   | 41472   | 10368  | ≥2<br>≥2           |
|                    | 20                        | 75<br>80          | 1                                    | 12   | 16QAM<br>16QAM | 1/2                      | 21384   | 24                            | 4   | 43200   | 11520  | ≥2                 |
|                    | 20                        | 80                | 1                                    | 12   | 16QAM          | 1/2                      | 22920   | 24                            | 4   | 46080   | 11664  | ≥2                 |
|                    | 20                        | 90                | 1                                    | 12   | 16QAM          | 2/5                      | 22920   | 24                            | 4   | 51840   | 12960  | ≥2                 |
|                    | 20                        | 90<br>96          | 1                                    | 12   | 16QAM          | 2/5                      | 20010   | 24                            | 4   | 55296   | 13824  | ≥2                 |
| Note 1:<br>Note 2: | If more t                 | han one Co        | de Block is p<br>n TS 36.211         | resent, an a                                     |                |                          |   |                               |   |   |  |                    |

#### Table A.2.3.2.2-1 Reference Channels for 16QAM with partial RB allocation

A.2.3.2.3 64-QAM

[FFS]

#### A.2.3.3 Reference measurement channels for sustained downlink data rate provided by lower layers

| Parameter                                | Unit        |              |            | Value          | •              |          |
|--|-------------|--------------|------------|----------------|----------------|----------|
| Reference Channel                        |             | R.1-1        | R.1-2      | R.1-3          | R.1-3B         | R.1-4    |
|  |             | TDD          | TDD        | TDD            | TDD            | TDD      |
| Channel Bandwidth                        | MHz         | 10           | 10         | 20             | 15             | 20       |
| Uplink-Downlink Configuration (Note 2)   |             | 5            | 5          | 5              | 1              | 1        |
| Allocated Resource Blocks                |             | 40           | 40         | 90             | 60             | 90       |
|  |             | (Note 3)     | (Note 3)   | (Note 5)       | (Note 4)       | (Note 5) |
| Allocated Sub-Frames per Radio-Frame     |             | 1            | 1          | 1              | 1              | 1        |
| DFT-OFDM Symbols per Sub-Frame           |             | 12           | 12         | 12             | 12             | 12       |
| Modulation                               |             | QPSK         | QPSK       | QPSK           | QPSK           | QPSK     |
| Coding Rate                              |             |              |            |                |                |          |
| For Sub-Frame 2                          |             | 0.43         | 0.61       | 0.49           | 0.42           | 0.49     |
| For Sub-Frame 3,7,8                      |             | n/a          | n/a        | n/a            | 0.42           | 0.49     |
| Information Bit Payload per Sub-Frame    | Bits        |              |            |                |                |          |
| For Sub-Frame 2                          |             | 4968         | 6968       | 12576          | 7224           | 12576    |
| For Sub-Frame 3,7,8                      |             | 0            | 0          | 0              | 7224           | 12576    |
| Number of Code Blocks per Sub-Frame      |             |              |            |                |                |          |
| (Note 1)                                 |             |              |            |                |                |          |
| For Sub-Frame 2                          |             | 1            | 2          | 3              | 2              | 3        |
| For Sub-Frame 3,7,8                      |             | 0            | 0          | 0              | 2              | 3        |
| Modulation Symbols per Sub-Frame         |             |              |            |                |                |          |
| For Sub-Frame 2                          |             | 5760         | 5760       | 12960          | 8640           | 10240    |
| For Sub-Frame 3,7,8                      |             | 0            | 0          | 0              | 8640           | 10240    |
| Binary Channel Bits per Sub-Frame        |             |              |            |                |                |          |
| For Sub-Frame 2                          |             | 11520        | 11520      | 25920          | 17280          | 25920    |
| For Sub-Frame 3,7,8                      |             | n/a          | n/a        | n/a            | 17280          | 25920    |
| Max Throughput over 1 Radio-Frame        | Mbps        | 0.4968       | 0.6968     | 1.2576         | 2.8896         | 5.0304   |
| UE Category                              |             | ≥ 1          | ≥ 2        | ≥2             | ≥ 2            | ≥ 2      |
| Note 1: If more than one Code Block is p | present, an | additional C | CRC sequer | nce of $L = 2$ | 4 Bits is atta | ached to |
| each Code Block (otherwise L =           |             |              |            |                |                |          |
| Note 2: As per Table 4.2-2 in TS 36.211  |             |              |            |                |                |          |
| Note 3: RB-s 5-44 allocated with PUSCH   |             |              |            |                |                |          |
| Note 4: RB-s 7-66 allocated with PUSCH   |             |              |            |                |                |          |
| Note 5: RB-s 5-94 allocated with PUSCH   | 1.          |              |            |                |                |          |

Table A.2.3.3-1: Uplink Reference Channels for sustained data-rate test (TDD)

## A.3 DL reference measurement channels

## A.3.1 General

The number of available channel bits varies across the sub-frames due to PBCH and PSS/SSS overhead. The payload size per sub-frame is varied in order to keep the code rate constant throughout a frame.

No user data is scheduled on subframes #5 in order to facilitate the transmission of system information blocks (SIB).

The algorithm for determining the payload size A is as follows; given a desired coding rate R and radio block allocation  $N_{\text{RB}}$ 

1. Calculate the number of channel bits  $N_{ch}$  that can be transmitted during the first transmission of a given sub-frame.

2. Find A such that the resulting coding rate is as close to R as possible, that is,

$$\min |R - (A + 24*(N_{CB} + 1))/N_{ch}|, where N_{CB} = \begin{cases} 0, if C = 1\\ C, if C > 1 \end{cases}$$
 subject to

a) A is a valid TB size according to section 7.1.7 of TS 36.213 [6] assuming an allocation of  $N_{\rm RB}$  resource blocks.

b) C is the number of Code Blocks calculated according to section 5.1.2 of TS 36.212 [5].

3. If there is more than one A that minimizes the equation above, then the larger value is chosen per default and the chosen code rate should not exceed 0.93.

4. For TDD, the measurement channel is based on DL/UL configuration ratio of 2DL+DwPTS (12 OFDM symbol): 2UL

#### A.3.1.1 Overview of DL reference measurement channels

In Table A.3.1.1-1 are listed the DL reference measurement channels specified in annexes A.3.2 to A.3.10 of this release of TS 36.101. This table is informative and serves only to a better overview. The reference for the concrete reference measurement channels and corresponding implementation's parameters as to be used for requirements are annexes A.3.2 to A.3.10 as appropriate.

| Duplex    | Table               | Name        | BW        | Mod       | TCR     | RB    | RB<br>Off<br>set | UE<br>Cat<br>eg | Notes |
|-----------|---------------------|-------------|-----------|-----------|---------|-------|------------------|-----------------|-------|
| FDD, Rece | eiver requirements  |             |           |           | •       |       |                  |                 |       |
| FDD       | Table A.3.2-1       |             | 1.4       | QPSK      | 1/3     | 6     |                  | ≥ 1             |       |
| FDD       | Table A.3.2-1       |             | 3         | QPSK      | 1/3     | 15    |                  | ≥ 1             |       |
| FDD       | Table A.3.2-1       |             | 5         | QPSK      | 1/3     | 25    |                  | ≥ 1             |       |
| FDD       | Table A.3.2-1       |             | 10        | QPSK      | 1/3     | 50    |                  | ≥ 1             |       |
| FDD       | Table A.3.2-1       |             | 15        | QPSK      | 1/3     | 75    |                  | ≥ 1             |       |
| FDD       | Table A.3.2-1       |             | 20        | QPSK      | 1/3     | 100   |                  | ≥ 1             |       |
| TDD, Rece | eiver requirements  |             |           |           | _       |       |                  | -               |       |
| TDD       | Table A.3.2-2       |             | 1.4       | QPSK      | 1/3     | 6     |                  | ≥ 1             |       |
| TDD       | Table A.3.2-2       |             | 3         | QPSK      | 1/3     | 15    |                  | ≥ 1             |       |
| TDD       | Table A.3.2-2       |             | 5         | QPSK      | 1/3     | 25    |                  | ≥ 1             |       |
| TDD       | Table A.3.2-2       |             | 10        | QPSK      | 1/3     | 50    |                  | ≥ 1             |       |
| TDD       | Table A.3.2-2       |             | 15        | QPSK      | 1/3     | 75    |                  | ≥ 1             |       |
| TDD       | Table A.3.2-2       |             | 20        | QPSK      | 1/3     | 100   |                  | ≥ 1             |       |
| FDD, Rece | eiver requirements, | Maximum inp | out level | for UE Ca | tegorie | s 3-5 |                  |                 |       |
| FDD       | Table A.3.2-3       |             | 1.4       | 64QAM     | 3/4     | 6     |                  | -               |       |
| FDD       | Table A.3.2-3       |             | 3         | 64QAM     | 3/4     | 15    |                  | -               |       |
| FDD       | Table A.3.2-3       |             | 5         | 64QAM     | 3/4     | 25    |                  | -               |       |
| FDD       | Table A.3.2-3       |             | 10        | 64QAM     | 3/4     | 50    |                  | -               |       |
| FDD       | Table A.3.2-3       |             | 15        | 64QAM     | 3/4     | 75    |                  | -               |       |
| FDD       | Table A.3.2-3       |             | 20        | 64QAM     | 3/4     | 100   |                  | -               |       |
| FDD, Rece | eiver requirements, | Maximum inp | out level | for UE Ca | tegorie | s 1   |                  |                 |       |
| FDD       | Table A.3.2-3a      |             | 1.4       | 64QAM     | 3/4     | 6     |                  | -               |       |
| FDD       | Table A.3.2-3a      |             | 3         | 64QAM     | 3/4     | 15    |                  | -               |       |
| FDD       | Table A.3.2-3a      |             | 5         | 64QAM     | 3/4     | 18    |                  | -               |       |
| FDD       | Table A.3.2-3a      |             | 10        | 64QAM     | 3/4     | 17    |                  | -               |       |
| FDD       | Table A.3.2-3a      |             | 15        | 64QAM     | 3/4     | 17    |                  | -               |       |
| FDD       | Table A.3.2-3a      |             | 20        | 64QAM     | 3/4     | 17    |                  | -               |       |
|           | eiver requirements, | Maximum inp | 1         | -         | tegorie | s 2   |                  | -               |       |
| FDD       | Table A.3.2-3b      |             | 1.4       | 64QAM     | 3/4     | 6     |                  | -               |       |
| FDD       | Table A.3.2-3b      |             | 3         | 64QAM     | 3/4     | 15    |                  | -               |       |
| FDD       | Table A.3.2-3b      |             | 5         | 64QAM     | 3/4     | 25    |                  | -               |       |
| FDD       | Table A.3.2-3b      |             | 10        | 64QAM     | 3/4     | 50    |                  | -               |       |
| FDD       | Table A.3.2-3b      |             | 15        | 64QAM     | 3/4     | 75    |                  | -               |       |
| FDD       | Table A.3.2-3b      |             | 20        | 64QAM     | 3/4     | 83    |                  | -               |       |
|           | eiver requirements, | Maximum inp | 1         | 1         |         | 1     | 1                | 1               |       |
| TDD       | Table A.3.2-4       |             | 1.4       | 64QAM     | 3/4     | 6     |                  | -               |       |
| TDD       | Table A.3.2-4       |             | 3         | 64QAM     | 3/4     | 15    |                  | -               |       |
| TDD       | Table A.3.2-4       |             | 5         | 64QAM     | 3/4     | 25    |                  | -               |       |
| TDD       | Table A.3.2-4       |             | 10        | 64QAM     | 3/4     | 50    |                  | -               |       |
| TDD       | Table A.3.2-4       |             | 15        | 64QAM     | 3/4     | 75    |                  | -               |       |
| TDD       | Table A.3.2-4       |             | 20        | 64QAM     | 3/4     | 100   |                  | -               |       |
|           | eiver requirements, | Maximum inp | 1         | r         | _       | 1     |                  |                 |       |
| TDD       | Table A.3.2-4a      |             | 1.4       | 64QAM     | 3/4     | 6     |                  | -               |       |
| TDD       | Table A.3.2-4a      |             | 3         | 64QAM     | 3/4     | 15    |                  | -               |       |

#### Table A.3.1.1-1: Overview of DL reference measurement channels

| TDD      |                     |               |            |            | 0/4        | 40      |       |        |               |
|----------|---------------------|---------------|------------|------------|------------|---------|-------|--------|---------------|
| TDD      | Table A.3.2-4a      |               | 5          | 64QAM      | 3/4        | 18      |       | -      |               |
| TDD      | Table A.3.2-4a      |               | 10         | 64QAM      | 3/4        | 17      |       | -      |               |
| TDD      | Table A.3.2-4a      |               | 15         | 64QAM      | 3/4        | 17      |       | -      |               |
| TDD      | Table A.3.2-4a      |               | 20         | 64QAM      | 3/4        | 17      |       | -      |               |
|          | eiver requirements, | Maximum inp   | 1          | 1          |            | I I     |       |        |               |
| TDD      | Table A.3.2-4b      |               | 1.4        | 64QAM      | 3/4        | 6       |       | -      |               |
| TDD      | Table A.3.2-4b      |               | 3          | 64QAM      | 3/4        | 15      |       | -      |               |
| TDD      | Table A.3.2-4b      |               | 5          | 64QAM      | 3/4        | 25      |       | -      |               |
| TDD      | Table A.3.2-4b      |               | 10         | 64QAM      | 3/4        | 50      |       | -      |               |
| TDD      | Table A.3.2-4b      |               | 15         | 64QAM      | 3/4        | 75      |       | -      |               |
| TDD      | Table A.3.2-4b      |               | 20         | 64QAM      | 3/4        | 83      |       | -      |               |
|          | CH Performance, S   | -             | transm     | 1          | :S)        |         |       |        |               |
| FDD      | Table A.3.3.1-1     | R.4 FDD       | 1.4        | QPSK       | 1/3        | 6       |       | ≥ 1    |               |
| FDD      | Table A.3.3.1-1     | R.42 FDD      | 20         | QPSK       | 1/3        | 100     |       | ≥ 1    |               |
| FDD      | Table A.3.3.1-1     | R.2 FDD       | 10         | QPSK       | 1/3        | 50      |       | ≥ 1    |               |
| FDD      | Table A.3.3.1-2     | R.3-1 FDD     | 5          | 16QAM      | 1/2        | 25      |       | ≥ 1    |               |
| FDD      | Table A.3.3.1-2     | R.3 FDD       | 10         | 16QAM      | 1/2        | 50      |       | ≥ 2    |               |
| FDD      | Table A.3.3.1-3     | R.5 FDD       | 3          | 64QAM      | 3/4        | 15      |       | ≥ 1    |               |
| FDD      | Table A.3.3.1-3     | R.6 FDD       | 5          | 64QAM      | 3/4        | 25      |       | ≥ 2    |               |
| FDD      | Table A.3.3.1-3     | R.7 FDD       | 10         | 64QAM      | 3/4        | 50      |       | ≥ 2    |               |
| FDD      | Table A.3.3.1-3     | R.8 FDD       | 15         | 64QAM      | 3/4        | 75      |       | ≥ 2    |               |
| FDD      | Table A.3.3.1-3     | R.9 FDD       | 20         | 64QAM      | 3/4        | 100     |       | ≥ 3    |               |
| FDD      | Table A.3.3.1-3a    | R.6-1 FDD     | 5          | 64QAM      | 3/4        | 18      |       | ≥ 1    |               |
| FDD      | Table A.3.3.1-3a    | R.7-1 FDD     | 10         | 64QAM      | 3/4        | 17      |       | ≥ 1    |               |
| FDD      | Table A.3.3.1-3a    | R.8-1 FDD     | 15         | 64QAM      | 3/4        | 17      |       | ≥ 1    |               |
| FDD      | Table A.3.3.1-3a    | R.9-1 FDD     | 20         | 64QAM      | 3/4        | 17      |       | ≥ 1    |               |
| FDD      | Table A.3.3.1-3a    | R.9-2 FDD     | 20         | 64QAM      | 3/4        | 83      |       | ≥ 2    |               |
| FDD      | Table A.3.3.1-6     | R.41 FDD      | 10         | QPSK       | 1/10       | 50      |       | ≥ 1    |               |
| FDD, PDS | CH Performance, S   | ingle-antenna | transm     | ission (CR | S), Sin    | gle PRB | (Cha  | nnel e | edge)         |
| FDD      | Table A.3.3.1-4     | R.0 FDD       | 3          | 16QAM      | 1/2        | 1       |       | ≥ 1    |               |
| FDD      | Table A.3.3.1-4     | R.1 FDD       | 10 /<br>20 | 16QAM      | 1/2        | 1       |       | ≥ 1    |               |
| FDD. PDS | CH Performance, S   | ingle-antenna |            | ission (CR | S). Sin    | ale PRB | (MBS  |        | onfiguration) |
| FDD      | Table A.3.3.1-5     | R.29 FDD      | 10         | 16QAM      | 1/2        | 1       |       | ≥ 1    |               |
|          | CH Performance: C   |               |            |            |            | · ·     |       |        |               |
| FDD      | Table A.3.3.1-7     | R.49 FDD      | 20         | 64QAM      | 0.84-      | 100     |       | ≥5     |               |
|          |                     |               |            |            | 0.87       |         |       | - 5    |               |
|          | CH Performance: C   |               | 1          | -          | nset       | 50      |       |        |               |
| FDD PDC  | Table A.3.4.2.1-3   | R.YY FDD      | 10         | 64QAM      | ) <b>T</b> | 50      |       | ≥ 3    |               |
|          | CH Performance, N   | [             |            |            | 1          | I I     | ports |        |               |
| FDD      | Table A.3.3.2.1-1   | R.10 FDD      | 10         | QPSK       | 1/3        | 50      |       | ≥ 1    |               |
| FDD      | Table A.3.3.2.1-1   | R.11 FDD      | 10         | 16QAM      | 1/2        | 50      |       | ≥ 2    |               |
| FDD      | Table A.3.3.2.1-1   | R.11-2 FDD    | 5          | 16QAM      | 1/2        | 25      |       | ≥ 1    |               |
| FDD      | Table A.3.3.2.1-1   | R.11-3 FDD    | 10         | 16QAM      | 1/2        | 40      |       | ≥ 1    |               |
| FDD      | Table A.3.3.2.1-1   | R.11-4 FDD    | 10         | QPSK       | 1/2        | 50      |       | ≥ 1    |               |
| FDD      | Table A.3.3.2.1-1   | R.30 FDD      | 20         | 16QAM      | 1/2        | 100     |       | ≥ 2    |               |
| FDD      | Table A.3.3.2.1-1   | R.30-1 FDD    | 15         | 16QAM      | 1/2        | 75      |       | ≥ 2    |               |
| FDD      | Table A.3.3.2.1-1   | R.35 FDD      | 10         | 64QAM      | 1/2        | 50      |       | ≥ 2    |               |
| FDD      | Table A.3.3.2.1-1   | R.35-1 FDD    | 20         | 64QAM      | 0.39       | 100     |       | 4      |               |
| FDD      | Table A.3.3.2.1-1   | R.35-2 FDD    | 15         | 64QAM      | 0.39       | 75      |       | ≥ 2    |               |

| FDD      | Table A.3.3.2.1-1 | R.35-3 FDD    | 10         | 64QAM         | 0.39    | 50         | ≥ 2            |               |
|----------|-------------------|---------------|------------|---------------|---------|------------|----------------|---------------|
| FDD      |                   |               | -          |               |         | 50         | ≥ 2            |               |
|          | Table A.3.3.2.1-2 | R.35-4 FDD    | 10         | 64QAM<br>QPSK | 0.47    | 50         |                |               |
| FDD      | Table A.3.3.2.1-2 | R.46 FDD      | 10         |               |         |            | ≥ 1            |               |
| FDD      | Table A.3.3.2.1-2 | R.47 FDD      | 10         | 16QAM         |         | 50         | ≥ 1            |               |
|          | CH Performance, N |               |            | -             | -       | -          |                |               |
| FDD      | Table A.3.3.2.2-1 | R.12 FDD      | 1.4        | QPSK          | 1/3     | 6          | ≥ 1            |               |
| FDD      | Table A.3.3.2.2-1 | R.13 FDD      | 10         | QPSK          | 1/3     | 50         | ≥ 1            |               |
| FDD      | Table A.3.3.2.2-1 | R.14 FDD      | 10         | 16QAM         | 1/2     | 50         | ≥ 2            |               |
| FDD      | Table A.3.3.2.2-1 | R.14-1 FDD    | 10         | 16QAM         | 1/2     | 6          | ≥ 1            |               |
| FDD      | Table A.3.3.2.2-1 | R.14-2 FDD    | 10         | 16QAM         | 1/2     | 3          | ≥ 1            |               |
| FDD      | Table A.3.3.2.2-1 | R.14-3 FDD    | 20         | 16QAM         | 1/2     | 100        | ≥ 2            |               |
| FDD      | Table A.3.3.2.2-1 | R.36 FDD      | 10         | 64QAM         | 1/2     | 50         | ≥ 2            |               |
|          | CH Performance (U |               |            | -             | -       |            | - <u>r</u> - r |               |
| FDD      | Table A.3.3.3.1-1 | R.51 FDD      | 10         | 16QAM         | 1/2     | 50         | ≥ 2            |               |
|          | CH Performance (U |               |            | -             |         | -RS, non ( | Quasi Co-I     | ocated)       |
| FDD      | Table A.3.3.3.1-2 | R.52 FDD      | 10         | 64QAM         | 1/2     | 50         | ≥ 2            |               |
| FDD      | Table A.3.3.3.1-2 | R.53 FDD      | 10         | 64QAM         | 1/2     | 50         | ≥ 2            |               |
| FDD      | Table A.3.3.3.1-2 | R.54 FDD      | 10         | 16QAM         | 1/2     | 50         | ≥ 2            |               |
|          | CH Performance (U | -             |            | -             |         | -          | - <u>r</u> - r |               |
| FDD      | Table A.3.3.3.2-1 | R.43 FDD      | 10         | QPSK          | 1/3     | 50         | ≥ 1            |               |
| FDD      | Table A.3.3.3.2-1 | R.50 FDD      | 10         | 64QAM         | 1/2     | 50         | ≥ 2            |               |
| FDD      | Table A.3.3.3.2-2 | R.44 FDD      | 10         | QPSK          | 1/3     | 50         | ≥ 1            |               |
| FDD      | Table A.3.3.3.2-2 | R.45 FDD      | 10         | 16QAM         | 1/2     | 50         | ≥ 2            |               |
| FDD      | Table A.3.3.3.2-2 | R.45-1 FDD    | 10         | 16QAM         | 1/2     | 39         | ≥ 1            |               |
| FDD      | Table A.3.3.3.2-1 | R.48 FDD      | 10         | QPSK          |         | 50         | ≥ 1            |               |
| TDD, PDS | CH Performance, S | ingle-antenna | transm     | ission (CR    | S)      | r          |                |               |
| TDD      | Table A.3.4.1-1   | R.4 TDD       | 1.4        | QPSK          | 1/3     | 6          | ≥ 1            |               |
| TDD      | Table A.3.4.1-1   | R.42 TDD      | 20         | QPSK          | 1/3     | 100        | ≥ 1            |               |
| TDD      | Table A.3.4.1-1   | R.2 TDD       | 10         | QPSK          | 1/3     | 50         | ≥ 1            |               |
| TDD      | Table A.3.4.1-2   | R.3-1 TDD     | 5          | 16QAM         | 1/2     | 25         | ≥ 1            |               |
| TDD      | Table A.3.4.1-2   | R.3 TDD       | 10         | 16QAM         | 1/2     | 50         | ≥ 2            |               |
| TDD      | Table A.3.4.1-3   | R.5 TDD       | 3          | 64QAM         | 3/4     | 15         | ≥ 1            |               |
| TDD      | Table A.3.4.1-3   | R.6 TDD       | 5          | 64QAM         | 3/4     | 25         | ≥ 2            |               |
| TDD      | Table A.3.4.1-3   | R.7 TDD       | 10         | 64QAM         | 3/4     | 50         | ≥ 2            |               |
| TDD      | Table A.3.4.1-3   | R.8 TDD       | 15         | 64QAM         | 3/4     | 75         | ≥ 2            |               |
| TDD      | Table A.3.4.1-3   | R.9 TDD       | 20         | 64QAM         | 3/4     | 100        | ≥ 3            |               |
| TDD      | Table A.3.4.1-3a  | R.6-1 TDD     | 5          | 64QAM         | 3/4     | 18         | ≥ 1            |               |
| TDD      | Table A.3.4.1-3a  | R.7-1 TDD     | 10         | 64QAM         | 3/4     | 17         | ≥ 1            |               |
| TDD      | Table A.3.4.1-3a  | R.8-1 TDD     | 15         | 64QAM         | 3/4     | 17         | ≥ 1            |               |
| TDD      | Table A.3.4.1-3a  | R.9-1 TDD     | 20         | 64QAM         | 3/4     | 17         | ≥ 1            |               |
| TDD      | Table A.3.4.1-3a  | R.9-2 TDD     | 20         | 64QAM         | 3/4     | 83         | ≥ 2            |               |
| TDD      | Table A.3.4.1-6   | R.41 TDD      | 10         | QPSK          | 1/10    | 50         | ≥ 1            |               |
| TDD, PDS | CH Performance, S | ingle-antenna | transm     | ission (CR    | S), Sin | gle PRB (  | Channel e      | dge)          |
| TDD      | Table A.3.4.1-4   | R.0 TDD       | 3          | 16QAM         | 1/2     | 1          | ≥ 1            |               |
| TDD      | Table A.3.4.1-4   | R.1 TDD       | 10 /<br>20 | 16QAM         | 1/2     | 1          | ≥ 1            |               |
| TDD. PDS | CH Performance, S | ingle-antenna |            | ission (CR    | S). Sin | gle PRB (I | MBSFN Co       | onfiguration) |
| TDD      | Table A.3.4.1-5   | R.29 TDD      | 10         | 16QAM         | 1/2     | 1          | ≥ 1            | <u> </u>      |
|          | CH Performance: C |               |            |               |         | ce         |                |               |
| ,        |                   |               |            |               |         |            |                |               |

| TDD      | Table A.3.4.1-7   | R.49 TDD        | 20        | 64QAM      | 0.81-    | 100    |         | ≥ 5     |          |
|----------|-------------------|-----------------|-----------|------------|----------|--------|---------|---------|----------|
|          |                   |                 |           |            | 087      |        |         |         |          |
|          | CH Performance, N | [               | <b></b>   |            | ř.       | 1      | ha port | [       |          |
| TDD      | Table A.3.4.2.1-1 | R.10 TDD        | 10        | QPSK       | 1/3      | 50     |         | ≥1      |          |
| TDD      | Table A.3.4.2.1-1 | R.11 TDD        | 10        | 16QAM      | 1/2      | 50     |         | ≥ 2     |          |
| TDD      | Table A.3.4.2.1-1 | R.11-1 TDD      | 10        | 16QAM      | 1/2      | 50     |         | ≥ 2     |          |
| TDD      | Table A.3.4.2.1-1 | R.11-2 TDD      | 5         | 16QAM      | 1/2      | 25     |         | ≥1      |          |
| TDD      | Table A.3.4.2.1-1 | R.11-3 TDD      | 10        | 16QAM      | 1/2      | 40     |         | ≥1      |          |
| TDD      | Table A.3.4.2.1-1 | R.11-4 TDD      | 10        | QPSK       | 1/2      | 50     |         | ≥ 1     |          |
| TDD      | Table A.3.4.2.1-1 | R.30 TDD        | 20        | 16QAM      | 1/2      | 100    |         | ≥ 2     |          |
| TDD      | Table A.3.4.2.1-1 | R.30-1 TDD      | 20        | 16QAM      | 1/2      | 100    |         | ≥ 2     |          |
| TDD      | Table A.3.4.2.1-1 | R.30-2 TDD      | 20        | 16QAM      | 1/2      | 100    |         | 3       |          |
| TDD      | Table A.3.4.2.1-1 | R.35 TDD        | 10        | 64QAM      | 1/2      | 50     |         | ≥ 2     |          |
| TDD      | Table A.3.4.2.1-1 | R.35-1 TDD      | 20        | 64QAM      | 0.39     | 100    |         | 4       |          |
| TDD      | Table A.3.4.2.1-2 | R.35-2 TDD      | 10        | 64QAM      | 0.47     | 50     |         | ≥ 2     |          |
| TDD      | Table A.3.4.2.1-2 | R.46 TDD        | 10        | QPSK       |          | 50     |         | ≥ 1     |          |
| TDD      | Table A.3.4.2.1-2 | R.47 TDD        | 10        | 16QAM      |          | 50     |         | ≥ 1     |          |
| TDD, PDS | CH Performance, N | lulti-antenna t | ransmis   | sion (CRS  | 5), Four | anten  | na por  | ts      | I        |
| TDD      | Table A.3.4.2.2-1 | R.12 TDD        | 1.4       | QPSK       | 1/3      | 6      |         | ≥ 1     |          |
| TDD      | Table A.3.4.2.2-1 | R.13 TDD        | 10        | QPSK       | 1/3      | 50     |         | ≥ 1     |          |
| TDD      | Table A.3.4.2.2-1 | R.14 TDD        | 10        | 16QAM      | 1/2      | 50     |         | ≥ 2     |          |
| TDD      | Table A.3.4.2.2-1 | R.14-1 TDD      | 10        | 16QAM      | 1/2      | 6      |         | ≥ 1     |          |
| TDD      | Table A.3.4.2.2-1 | R.14-2 TDD      | 10        | 16QAM      | 1/2      | 3      |         | ≥ 1     |          |
| TDD      | Table A.3.4.2.2-1 | R.43 TDD        | 20        | 16QAM      | 1/2      | 100    |         | ≥2      |          |
| TDD      | Table A.3.4.2.2-1 | R.36 TDD        | 10        | 64QAM      | 1/2      | 50     |         | ≥ 2     |          |
| TDD, PDS | CH Performance, S | ingle antenna   | port (D   | RS)        | _        | -      | -       |         |          |
| TDD      | Table A.3.4.3.1-1 | R.25 TDD        | 10        | QPSK       | 1/3      | 50     |         | ≥ 1     |          |
| TDD      | Table A.3.4.3.1-1 | R.26 TDD        | 10        | 16QAM      | 1/2      | 50     |         | ≥ 2     |          |
| TDD      | Table A.3.4.3.1-1 | R.26-1 TDD      | 5         | 16QAM      | 1/2      | 25     |         | ≥ 1     |          |
| TDD      | Table A.3.4.3.1-1 | R.27 TDD        | 10        | 64QAM      | 3/4      | 50     |         | ≥ 2     |          |
| TDD      | Table A.3.4.3.1-1 | R.27-1 TDD      | 10        | 64QAM      | 3/4      | 18     |         | ≥ 1     |          |
| TDD      | Table A.3.4.3.1-1 | R.28 TDD        | 10        | 16QAM      | 1/2      | 1      |         | ≥ 1     |          |
| TDD, PDS | CH Performance, T | wo antenna p    | orts (DR  | S)         |          |        |         |         |          |
| TDD      | Table A.3.4.3.2-1 | R.31 TDD        | 10        | QPSK       | 1/3      | 50     |         | ≥ 1     |          |
| TDD      | Table A.3.4.3.2-1 | R.32 TDD        | 10        | 16QAM      | 1/2      | 50     |         | ≥ 2     |          |
| TDD      | Table A.3.4.3.2-1 | R.32-1 TDD      | 5         | 16QAM      | 1/2      | [25]   |         | ≥ 1     |          |
| TDD      | Table A.3.4.3.2-1 | R.33 TDD        | 10        | 64QAM      | 3/4      | 50     |         | ≥ 2     |          |
| TDD      | Table A.3.4.3.2-1 | R.33-1 TDD      | 10        | 64QAM      | 3/4      | [18]   |         | ≥ 1     |          |
| TDD      | Table A.3.4.3.2-1 | R.34 TDD        | 10        | 64QAM      | 1/2      | 50     |         | ≥ 2     |          |
| TDD, PDS | CH Performance (U | E specific RS   | ) Two ar  | ntenna por | rts (CSI | -RS)   |         |         |          |
| TDD      | Table A.3.4.3.3-1 | R.51 TDD        | 10        | 16QAM      | 1/2      | 50     |         | ≥ 2     |          |
| TDD, PDS | CH Performance (U | E specific RS   | ) Two ar  | ntenna por | rts (CSI | -RS, n | on Qua  | asi Co- | located) |
| TDD      | Table A.3.4.3.3-2 | R.52 TDD        | 10        | 64QAM      | 1/2      | 50     |         | ≥ 2     |          |
| TDD      | Table A.3.4.3.3-2 | R.53 TDD        | 10        | 64QAM      | 1/2      | 50     |         | ≥ 2     |          |
| TDD      | Table A.3.4.3.3-2 | R.54 TDD        | 10        | 16QAM      | 1/2      | 50     |         | ≥ 2     |          |
| TDD, PDS | CH Performance (U | E specific RS   | ) Four a  | ntenna po  | rts (CS  | I-RS)  |         |         |          |
| TDD      | Table A.3.4.3.4-1 | R.44 TDD        | 10        | 64QAM      | 1/2      | 50     |         | ≥ 2     |          |
| TDD      | Table A.3.4.3.4-1 | R.48 TDD        | 10        | QPSK       |          | 50     |         | ≥ 1     |          |
| TDD, PDS | CH Performance (U | E specific RS   | ) Eight a | intenna po | orts (CS | SI-RS) |         |         |          |
|          |                   |                 |           |            |          |        |         |         |          |

| TDD                | Table A.3.4.3.5-1   | R.50 TDD       | 10  | QPSK  | 1/3           | 50 | ≥ 1     |  |
|--------------------|---------------------|----------------|-----|-------|---------------|----|---------|--|
| TDD                | Table A.3.4.3.5-1   | R.45 TDD       | 10  | 16QAM | 1/3           | 50 | <br>≥ 2 |  |
| TDD                | Table A.3.4.3.5-2   | R.45-1 TDD     | 10  | 16QAM | 1/2           | 39 | ≥ 1     |  |
|                    | CH / PCFICH Perfo   |                | 10  | TOQAM | 1/2           | 55 | - 1     |  |
| FDD                | Table A.3.5.1-1     | R.15 FDD       | 10  | PDCCH |               | -  | -       |  |
| FDD                | Table A.3.5.1-1     | R.15-1 FDD     | 10  | PDCCH |               |    |         |  |
| FDD                | Table A.3.5.1-1     | R.15-2 FDD     | 10  | PDCCH |               |    |         |  |
| FDD                | Table A.3.5.1-1     | R.16 FDD       | 10  | PDCCH |               |    |         |  |
| FDD                | Table A.3.5.1-1     | R.17 FDD       | 5   | PDCCH |               |    |         |  |
| TDD, PDC           | CH / PCFICH Perfo   | rmance         |     |       |               |    |         |  |
| TDD                | Table A.3.5.2-1     | R.15 TDD       | 10  | PDCCH |               |    |         |  |
| TDD                | Table A.3.5.2-1     | R.15-1 TDD     | 10  | PDCCH |               |    |         |  |
| TDD                | Table A.3.5.2-1     | R.15-2 TDD     | 10  | PDCCH |               |    |         |  |
| TDD                | Table A.3.5.2-1     | R.16 TDD       | 10  | PDCCH |               |    |         |  |
| TDD                | Table A.3.5.2-1     | R.17 TDD       | 5   | PDCCH |               |    |         |  |
| FDD / TDD          | , PHICH Performar   | nce            |     |       |               |    |         |  |
| FDD /<br>TDD       | Table A.3.6-1       | R.18           | 10  | PHICH |               |    |         |  |
| FDD /              | Table A.3.6-1       | R.19           | 10  | PHICH |               |    |         |  |
| TDD<br>FDD /       | Table A.3.6-1       | R.20           | 5   | PHICH |               |    |         |  |
| TDD<br>FDD /       |                     |                |     |       |               |    |         |  |
| TDD                | Table A.3.6-1       | R.24           | 10  | PHICH |               |    |         |  |
| FDD / TDD<br>FDD / | ), PBCH Performan   | ce             |     | 1     | 40/           |    |         |  |
| TDD                | Table A.3.7-1       | R.21           | 1.4 | QPSK  | 1920          |    |         |  |
| FDD /<br>TDD       | Table A.3.7-1       | R.22           | 1.4 | QPSK  | 40/<br>1920   |    |         |  |
| FDD /<br>TDD       | Table A.3.7-1       | R.23           | 1.4 | QPSK  | 40/<br>1920   |    |         |  |
|                    | H Performance       | I              |     |       | 1520          |    |         |  |
| FDD                | Table A.3.8.1-1     | R.40 FDD       | 1.4 | QPSK  | 1/3           | 6  | ≥ 1     |  |
| FDD                | Table A.3.8.1-1     | R.37 FDD       | 10  | QPSK  | 1/3           | 50 | ≥ 1     |  |
| FDD                | Table A.3.8.1-2     | R.38 FDD       | 10  | 16QAM | 1/2           | 50 | ≥ 1     |  |
| FDD                | Table A.3.8.1-3     | R.39-1 FDD     | 5   | 64QAM | 2/3           | 25 | ≥ 1     |  |
| FDD                | Table A.3.8.1-3     | R.39 FDD       | 10  | 64QAM | 2/3           | 50 | ≥ 2     |  |
| TDD, PMC           | H Performance       |                |     |       |               |    |         |  |
| TDD                | Table A.3.8.2-1     | R.40 TDD       | 1.4 | QPSK  | 1/3           | 6  | ≥ 1     |  |
| TDD                | Table A.3.8.2-1     | R.37 TDD       | 10  | QPSK  | 1/3           | 50 | ≥ 1     |  |
| TDD                | Table A.3.8.2-2     | R.38 TDD       | 10  | 16QAM | 1/2           | 50 | ≥ 1     |  |
| TDD                | Table A.3.8.2-3     | R.39-1 TDD     | 5   | 64QAM | 2/3           | 25 | <br>≥ 1 |  |
| TDD                | Table A.3.8.2-3     | R.39 TDD       | 10  | 64QAM | 2/3           | 50 | ≥ 2     |  |
|                    | ained data rate (CF | -              |     |       |               |    |         |  |
| FDD                | Table A.3.9.1-1     | R.31-1 FDD     | 10  | 64QAM | 0.40          |    | <br>≥ 1 |  |
| FDD                | Table A.3.9.1-1     | R.31-2 FDD     | 10  | 64QAM | 0.59-<br>0.64 |    | ≥ 2     |  |
| FDD                | Table A.3.9.1-1     | R.31-3 FDD     | 20  | 64QAM | 0.59-<br>0.62 |    | ≥ 2     |  |
| FDD                | Table A.3.9.1-1     | R.31-3A FDD    | 10  | 64QAM | 0.85-<br>0.90 |    | ≥ 2     |  |
| FDD                | Table A.3.9.1-1     | R.31-3C<br>FDD | 15  | 64QAM | 0.87-<br>0.91 |    | ≥ 3     |  |
| FDD                | Table A.3.9.1-1     | R.31-4 FDD     | 20  | 64QAM | 0.87-<br>0.90 |    | ≥ 3     |  |
| FDD                | Table A.3.9.1-1     | R.31-4B FDD    | 15  | 64QAM | 0.85-<br>0.88 |    | ≥ 4     |  |

| FDD       | Table A.3.9.1-1      | R.31-5 FDD      | 15      | 64QAM      | 0.85-         | ≥ 3     |  |
|-----------|----------------------|-----------------|---------|------------|---------------|---------|--|
| TDD. Sust | tained data rate (CR | (S)             |         |            | 0.91          |         |  |
| TDD       | Table A.3.9.2-1      | R.31-1 TDD      | 10      | 64QAM      | 0.40          | ≥ 1     |  |
| TDD       | Table A.3.9.2-1      | R.31-2 TDD      | 10      | 64QAM      | 0.59-<br>0.64 | ≥ 2     |  |
| TDD       | Table A.3.9.2-1      | R.31-3 TDD      | 20      | 64QAM      | 0.59-<br>0.62 | ≥ 2     |  |
| TDD       | Table A.3.9.2-1      | R.31-3A TDD     | 15      | 64QAM      | 0.87-<br>0.90 | ≥ 2     |  |
| TDD       | Table A.3.9.2-1      | R.31-4 TDD      | 20      | 64QAM      | 0.87-<br>0.90 | ≥ 3     |  |
| FDD, Sust | tained data rate tes | t with EPDCCI   | H sched | uling (CRS | -             |         |  |
| FDD       | Table A.3.9.3-1      | R.31E-1 FDD     | 10      | 64QAM      | 0.40-<br>0.41 | ≥ 1     |  |
| FDD       | Table A.3.9.3-1      | R.31E-2 FDD     | 10      | 64QAM      | 0.59-<br>0.66 | ≥ 2     |  |
| FDD       | Table A.3.9.3-1      | R.31E-3 FDD     | 20      | 64QAM      | 0.59-<br>0.63 | <br>≥ 2 |  |
| FDD       | Table A.3.9.1-1      | R.31E-3C<br>FDD | 15      | 64QAM      | 0.87-<br>0.92 | <br>≥ 3 |  |
| FDD       | Table A.3.9.3-1      | R.31E-3A<br>FDD | 10      | 64QAM      | 0.85-<br>0.92 | ≥ 2     |  |
| FDD       | Table A.3.9.3-1      | R.31E-4 FDD     | 20      | 64QAM      | 0.87-<br>0.91 | ≥ 3     |  |
| FDD       | Table A.3.9.1-1      | R.31E-4B<br>FDD | 15      | 64QAM      | 0.87-<br>0.90 | ≥ 4     |  |
| TDD, Sust | ained data rate tes  | t with EPDCCI   | H sched | uling (CRS | -             |         |  |
| TDD       | Table A.3.9.4-1      | R.31E-1 TDD     | 10      | 64QAM      | 0.40-<br>0.41 | <br>≥ 1 |  |
| TDD       | Table A.3.9.4-1      | R.31E-2 TDD     | 10      | 64QAM      | 0.59-<br>0.65 | ≥ 2     |  |
| TDD       | Table A.3.9.4-1      | R.31E-3 TDD     | 20      | 64QAM      | 0.59-<br>0.63 | <br>≥ 2 |  |
| TDD       | Table A.3.9.4-1      | R.31E-3A<br>TDD | 15      | 64QAM      | 0.87-0.92     | ≥ 2     |  |
| TDD       | Table A.3.9.4-1      | R.31E-4 TDD     | 20      | 64QAM      | 0.87-<br>0.90 | ≥ 3     |  |
| FDD, ePD  | CCH performance      |                 |         |            |               |         |  |
| FDD       | Table A.3.10.1-1     | R.55 FDD        | 10      | EPDCC<br>H |               |         |  |
| FDD       | Table A.3.10.1-1     | R.56 FDD        | 10      | EPDCC<br>H |               |         |  |
| FDD       | Table A.3.10.1-1     | R.57 FDD        | 10      | EPDCC<br>H |               |         |  |
| FDD       | Table A.3.10.1-1     | R.58 FDD        | 10      | EPDCC<br>H |               |         |  |
| FDD       | Table A.3.10.1-1     | R.59 FDD        | 10      | EPDCC<br>H |               |         |  |
| TDD, ePD  | CCH performance      |                 |         |            |               |         |  |
| TDD       | Table A.3.10.2-1     | R.55 TDD        | 10      | EPDCC<br>H |               |         |  |
| TDD       | Table A.3.10.2-1     | R.56 TDD        | 10      | EPDCC<br>H |               |         |  |
| TDD       | Table A.3.10.2-1     | R.57 TDD        | 10      | EPDCC<br>H |               |         |  |
| TDD       | Table A.3.10.2-1     | R.58 TDD        | 10      | EPDCC<br>H |               |         |  |
| TDD       | Table A.3.10.2-1     | R.59 TDD        | 10      | EPDCC<br>H |               |         |  |
| L         | l                    | 1               | 1       | 1 11       | 1             | 1       |  |

# A.3.2 Reference measurement channel for receiver characteristics

Tables A.3.2-1 and A.3.2-2 are applicable for measurements on the Receiver Characteristics (clause 7) with the exception of subclause 7.4 (Maximum input level).

Tables A.3.2-3, A.3.2-3a, A.3.2-3b, A.3.2-4, A.3.2-4a and A.3.2-4b are applicable for subclause 7.4 (Maximum input level).

Tables A.3.2-1 and A.3.2-2 also apply for the modulated interferer used in Clauses 7.5, 7.6 and 7.8 with test specific bandwidths.

| Parameter   | Unit      | Value     |                                       |            |           |            |       |  |  |  |  |  |
|---|-----------|-----------|---------------------------------------|------------|-----------|------------|-------|--|--|--|--|--|
| Channel bandwidth   | MHz       | 1.4       | 3                                     | 5          | 10        | 15         | 20    |  |  |  |  |  |
| Allocated resource blocks   |           | 6         | 15                                    | 25         | 50        | 75         | 100   |  |  |  |  |  |
| Subcarriers per resource block  |           | 12        | 12                                    | 12         | 12        | 12         | 12    |  |  |  |  |  |
| Allocated subframes per Radio Frame   |           | 9         | 9                                     | 9          | 9         | 9          | 9     |  |  |  |  |  |
| Modulation  |           | QPSK      | QPSK                                  | QPSK       | QPSK      | QPSK       | QPSK  |  |  |  |  |  |
| Target Coding Rate  |           | 1/3       | 1/3                                   | 1/3        | 1/3       | 1/3        | 1/3   |  |  |  |  |  |
| Number of HARQ Processes  | Processes | 8         | 8                                     | 8          | 8         | 8          | 8     |  |  |  |  |  |
| Maximum number of HARQ transmissions  |           | 1         | 1                                     | 1          | 1         | 1          | 1     |  |  |  |  |  |
| Information Bit Payload per Sub-Frame   |           |           |                                       |            |           |            |       |  |  |  |  |  |
| For Sub-Frames 1,2,3,4,6,7,8,9  | Bits      | 408       | 1320                                  | 2216       | 4392      | 6712       | 8760  |  |  |  |  |  |
| For Sub-Frame 5   | Bits      | N/A       | N/A                                   | N/A        | N/A       | N/A        | N/A   |  |  |  |  |  |
| For Sub-Frame 0   | Bits      | 152       | 872                                   | 1800       | 4392      | 6712       | 8760  |  |  |  |  |  |
| Transport block CRC   | Bits      | 24        | 24                                    | 24         | 24        | 24         | 24    |  |  |  |  |  |
| Number of Code Blocks per Sub-Frame   |           |           |                                       |            |           |            |       |  |  |  |  |  |
| (Note 3)  |           |           |                                       |            |           |            |       |  |  |  |  |  |
| For Sub-Frames 1,2,3,4,6,7,8,9  | Bits      | 1         | 1                                     | 1          | 1         | 2          | 2     |  |  |  |  |  |
| For Sub-Frame 5   | Bits      | N/A       | N/A                                   | N/A        | N/A       | N/A        | N/A   |  |  |  |  |  |
| For Sub-Frame 0   | Bits      | 1         | 1                                     | 1          | 1         | 2          | 2     |  |  |  |  |  |
| Binary Channel Bits Per Sub-Frame   |           |           |                                       |            |           |            |       |  |  |  |  |  |
| For Sub-Frames 1,2,3,4,6,7,8,9  | Bits      | 1368      | 3780                                  | 6300       | 13800     | 20700      | 27600 |  |  |  |  |  |
| For Sub-Frame 5   | Bits      | N/A       | N/A                                   | N/A        | N/A       | N/A        | N/A   |  |  |  |  |  |
| For Sub-Frame 0   | Bits      | 528       | 2940                                  | 5460       | 12960     | 19860      | 26760 |  |  |  |  |  |
| Max. Throughput averaged over 1 frame   | kbps      | 341.6     | 1143.                                 | 1952.      | 3952.     | 6040.      | 7884  |  |  |  |  |  |
|   |           |           | 2                                     | 8          | 8         | 8          |       |  |  |  |  |  |
| UE Category         ≥ 1 <t< td=""></t<> |           |           |                                       |            |           |            |       |  |  |  |  |  |
| Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10MHz channel BW. 3 symbols allocated to  |           |           |                                       |            |           |            |       |  |  |  |  |  |
| PDCCH for 5 MHz and 3 MHz. 4 s  |           |           |                                       |            |           |            |       |  |  |  |  |  |
| Note 2: Reference signal, Synchronization   |           |           |                                       |            |           |            |       |  |  |  |  |  |
| Note 3: If more than one Code Block is pro  |           | tional CR | C seque                               | nce of L = | = 24 Bits | is attache | ed to |  |  |  |  |  |
| each Code Block (otherwise L = 0  | Bit)      |           | each Code Block (otherwise L = 0 Bit) |            |           |            |       |  |  |  |  |  |

Table A.3.2-1 Fixed Reference Channel for Receiver Requirements (FDD)

| Parameter  | Unit      |       |      | Va   | lue   |       |       |  |  |
|--|-----------|-------|------|------|-------|-------|-------|--|--|
| Channel Bandwidth  | MHz       | 1.4   | 3    | 5    | 10    | 15    | 20    |  |  |
| Allocated resource blocks  |           | 6     | 15   | 25   | 50    | 75    | 100   |  |  |
| Uplink-Downlink Configuration (Note 5)   |           | 1     | 1    | 1    | 1     | 1     | 1     |  |  |
| Allocated subframes per Radio Frame (D+S)  |           | 3     | 3+2  | 3+2  | 3+2   | 3+2   | 3+2   |  |  |
| Number of HARQ Processes   | Processes | 7     | 7    | 7    | 7     | 7     | 7     |  |  |
| Maximum number of HARQ transmission  |           | 1     | 1    | 1    | 1     | 1     | 1     |  |  |
| Modulation   |           | QPSK  | QPSK | QPSK | QPSK  | QPSK  | QPSK  |  |  |
| Target coding rate   |           | 1/3   | 1/3  | 1/3  | 1/3   | 1/3   | 1/3   |  |  |
| Information Bit Payload per Sub-Frame  | Bits      |       |      |      |       |       |       |  |  |
| For Sub-Frame 4, 9   |           | 408   | 1320 | 2216 | 4392  | 6712  | 8760  |  |  |
| For Sub-Frame 1, 6   |           | N/A   | 968  | 1544 | 3240  | 4968  | 6712  |  |  |
| For Sub-Frame 5  |           | N/A   | N/A  | N/A  | N/A   | N/A   | N/A   |  |  |
| For Sub-Frame 0  |           | 208   | 1064 | 1800 | 4392  | 6712  | 8760  |  |  |
| Transport block CRC  | Bits      | 24    | 24   | 24   | 24    | 24    | 24    |  |  |
| Number of Code Blocks per Sub-Frame  |           |       |      |      |       |       |       |  |  |
| (Note 4)   |           |       |      |      |       |       |       |  |  |
| For Sub-Frame 4, 9   |           | 1     | 1    | 1    | 1     | 2     | 2     |  |  |
| For Sub-Frame 1, 6   |           | N/A   | 1    | 1    | 1     | 1     | 2     |  |  |
| For Sub-Frame 5  |           | N/A   | N/A  | N/A  | N/A   | N/A   | N/A   |  |  |
| For Sub-Frame 0  |           | 1     | 1    | 1    | 1     | 2     | 2     |  |  |
| Binary Channel Bits Per Sub-Frame  | Bits      |       |      |      |       |       |       |  |  |
| For Sub-Frame 4, 9   |           | 1368  | 3780 | 6300 | 13800 | 20700 | 27600 |  |  |
| For Sub-Frame 1, 6   |           | N/A   | 3276 | 5556 | 11256 | 16956 | 22656 |  |  |
| For Sub-Frame 5  |           | N/A   | N/A  | N/A  | N/A   | N/A   | N/A   |  |  |
| For Sub-Frame 0  |           | 672   | 3084 | 5604 | 13104 | 20004 | 26904 |  |  |
| Max. Throughput averaged over 1 frame  | kbps      | 102.4 | 564  | 932  | 1965. | 3007. | 3970. |  |  |
|  |           |       |      |      | 6     | 2     | 4     |  |  |
| UE Category  | L         | ≥1    | ≥1   | ≥1   | ≥1    | ≥1    | ≥1    |  |  |
| <ul> <li>Note 1: For normal subframes(0,4,5,9), 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special subframe (1&amp;6), only 2 OFDM symbols are allocated to PDCCH for all BWs.</li> <li>Note 2: For 1.4MHz, no data shall be scheduled on special subframes(1&amp;6) to avoid problems with insufficient PDCCH performance</li> <li>Note 3: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4]</li> <li>Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).</li> <li>Note 5: As per Table 4.2-2 in TS 36.211 [4]</li> </ul> |           |       |      |      |       |       |       |  |  |

#### Table A.3.2-2 Fixed Reference Channel for Receiver Requirements (TDD)

| Parameter  | Unit      |        |        | Va    | lue   |       |       |  |  |
|--|-----------|--------|--------|-------|-------|-------|-------|--|--|
| Channel bandwidth  | MHz       | 1.4    | 3      | 5     | 10    | 15    | 20    |  |  |
| Allocated resource blocks  |           | 6      | 15     | 25    | 50    | 75    | 100   |  |  |
| Subcarriers per resource block   |           | 12     | 12     | 12    | 12    | 12    | 12    |  |  |
| Allocated subframes per Radio Frame  |           | 8      | 9      | 9     | 9     | 9     | 9     |  |  |
| Modulation   |           | 64QAM  | 64QAM  | 64QAM | 64QAM | 64QAM | 64QAM |  |  |
| Target Coding Rate   |           | 3/4    | 3/4    | 3/4   | 3/4   | 3/4   | 3/4   |  |  |
| Number of HARQ Processes   | Processes | 8      | 8      | 8     | 8     | 8     | 8     |  |  |
| Maximum number of HARQ transmissions   |           | 1      | 1      | 1     | 1     | 1     | 1     |  |  |
| Information Bit Payload per Sub-Frame  |           |        |        |       |       |       |       |  |  |
| For Sub-Frames 1,2,3,4,6,7,8,9   | Bits      | 2984   | 8504   | 14112 | 30576 | 46888 | 61664 |  |  |
| For Sub-Frame 5  | Bits      | N/A    | N/A    | N/A   | N/A   | N/A   | N/A   |  |  |
| For Sub-Frame 0  | Bits      | N/A    | 6456   | 12576 | 28336 | 45352 | 61664 |  |  |
| Transport block CRC  | Bits      | 24     | 24     | 24    | 24    | 24    | 24    |  |  |
| Number of Code Blocks per Sub-Frame  |           |        |        |       |       |       |       |  |  |
| (Note 3)   |           |        |        |       |       |       |       |  |  |
| For Sub-Frames 1,2,3,4,6,7,8,9   |           | 1      | 2      | 3     | 5     | 8     | 11    |  |  |
| For Sub-Frame 5  |           | N/A    | N/A    | N/A   | N/A   | N/A   | N/A   |  |  |
| For Sub-Frame 0  |           | N/A    | 2      | 3     | 5     | 8     | 11    |  |  |
| Binary Channel Bits Per Sub-Frame  |           |        |        |       |       |       |       |  |  |
| For Sub-Frames 1,2,3,4,6,7,8,9   | Bits      | 4104   | 11340  | 18900 | 41400 | 62100 | 82800 |  |  |
| For Sub-Frame 5  | Bits      | N/A    | N/A    | N/A   | N/A   | N/A   | N/A   |  |  |
| For Sub-Frame 0  | Bits      | N/A    | 8820   | 16380 | 38880 | 59580 | 80280 |  |  |
| Max. Throughput averaged over 1 frame  | kbps      | 2387.2 | 7448.8 | 12547 | 27294 | 42046 | 55498 |  |  |
| Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW. 3 symbols allocated to PDCCH for 5 MHz and 3 MHz. 4 symbols allocated to PDCCH for 1.4 MHz.<br>Note 2: Reference signal. Synchronization signals and PBCH allocated as per TS 36.211 [4]. |           |        |        |       |       |       |       |  |  |

#### Table A.3.2-3 Fixed Reference Channel for Maximum input level for UE Categories 3-8 (FDD)

Note 2: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].
Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

#### Table A.3.2-3a Fixed Reference Channel for Maximum input level for UE Category 1 (FDD)

| Parameter   | Unit            |            |            | Va           | lue           |             |        |  |
|---|-----------------|------------|------------|--------------|---------------|-------------|--------|--|
| Channel bandwidth   | MHz             | 1.4        | 3          | 5            | 10            | 15          | 20     |  |
| Allocated resource blocks   |                 | 6          | 15         | 18           | 17            | 17          | 17     |  |
| Subcarriers per resource block  |                 | 12         | 12         | 12           | 12            | 12          | 12     |  |
| Allocated subframes per Radio Frame   |                 | 8          | 9          | 9            | 9             | 9           | 9      |  |
| Modulation  |                 | 64QAM      | 64QAM      | 64QAM        | 64QAM         | 64QAM       | 64QAM  |  |
| Target Coding Rate  |                 | 3/4        | 3/4        | 3/4          | 3/4           | 3/4         | 3/4    |  |
| Number of HARQ Processes  | Processes       | 8          | 8          | 8            | 8             | 8           | 8      |  |
| Maximum number of HARQ transmissions  |                 | 1          | 1          | 1            | 1             | 1           | 1      |  |
| Information Bit Payload   |                 |            |            |              |               |             |        |  |
| For Sub-Frames 1,2,3,4,6,7,8,9  | Bits            | 2984       | 8504       | 10296        | 10296         | 10296       | 10296  |  |
| For Sub-Frame 5   | Bits            | N/A        | N/A        | N/A          | N/A           | N/A         | N/A    |  |
| For Sub-Frame 0   | Bits            | N/A        | 6456       | 8248         | 10296         | 10296       | 10296  |  |
| Transport block CRC   | Bits            | 24         | 24         | 24           | 24            | 24          | 24     |  |
| Number of Code Blocks per Sub-Frame   |                 |            |            |              |               |             |        |  |
| (Note 3)  |                 |            |            |              |               |             |        |  |
| For Sub-Frames 1,2,3,4,6,7,8,9  |                 | 1          | 2          | 2            | 2             | 2           | 2      |  |
| For Sub-Frame 5   |                 | N/A        | N/A        | N/A          | N/A           | N/A         | N/A    |  |
| For Sub-Frame 0   |                 | N/A        | 2          | 2            | 2             | 2           | 2      |  |
| Binary Channel Bits Per Sub-Frame   |                 |            |            |              |               |             |        |  |
| For Sub-Frames 1,2,3,4,6,7,8,9  | Bits            | 4104       | 11340      | 13608        | 14076         | 14076       | 14076  |  |
| For Sub-Frame 5   | Bits            | N/A        | N/A        | N/A          | N/A           | N/A         | N/A    |  |
| For Sub-Frame 0   | Bits            | N/A        | 8820       | 11088        | 14076         | 14076       | 14076  |  |
| Max. Throughput averaged over 1 frame   | kbps            | 2387.2     | 7448.8     | 9079.6       | 9266.4        | 9266.4      | 9266.4 |  |
| Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW. 3 symbols allocated to PDCCH |                 |            |            |              |               |             |        |  |
| for 5 MHz and 3 MHz. 4 symbols  |                 |            |            |              |               |             |        |  |
| Note 2: Reference signal, Synchronization   | n signals and F | PBCH alloc | ated as pe | r TS 36.21   | 1 [4].        |             |        |  |
| Note 3: If more than one Code Block is pr   | esent an addi   | tional CRC | sequence   | of $I = 24F$ | Bits is attac | ched to eac | h Code |  |

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

| Parameter  | Unit      | Value |       |       |       |       |       |  |  |
|--|-----------|-------|-------|-------|-------|-------|-------|--|--|
| Channel bandwidth  | MHz       | 1.4   | 3     | 5     | 10    | 15    | 20    |  |  |
| Allocated resource blocks  |           | 6     | 15    | 25    | 50    | 75    | 83    |  |  |
| Subcarriers per resource block   |           | 12    | 12    | 12    | 12    | 12    | 12    |  |  |
| Allocated subframes per Radio Frame  |           | 8     | 9     | 9     | 9     | 9     | 9     |  |  |
| Modulation   |           | 64QAM | 64QAM | 64QAM | 64QAM | 64QAM | 64QAM |  |  |
| Target Coding Rate   |           | 3/4   | 3/4   | 3/4   | 3/4   | 3/4   | 3/4   |  |  |
| Number of HARQ Processes   | Processes | 8     | 8     | 8     | 8     | 8     | 8     |  |  |
| Maximum number of HARQ transmissions   |           | 1     | 1     | 1     | 1     | 1     | 1     |  |  |
| Information Bit Payload  |           |       |       |       |       |       |       |  |  |
| For Sub-Frames 1,2,3,4,6,7,8,9   | Bits      | 2984  | 8504  | 14112 | 30576 | 46888 | 51024 |  |  |
| For Sub-Frame 5  | Bits      | N/A   | N/A   | N/A   | N/A   | N/A   | N/A   |  |  |
| For Sub-Frame 0  | Bits      | N/A   | 6456  | 12576 | 28336 | 45352 | 51024 |  |  |
| Transport block CRC  | Bits      | 24    | 24    | 24    | 24    | 24    | 24    |  |  |
| Number of Code Blocks per Sub-Frame  |           |       |       |       |       |       |       |  |  |
| (Note 3)   |           |       |       |       |       |       |       |  |  |
| For Sub-Frames 1,2,3,4,6,7,8,9   |           | 1     | 2     | 3     | 5     | 8     | 9     |  |  |
| For Sub-Frame 5  |           | N/A   | N/A   | N/A   | N/A   | N/A   | N/A   |  |  |
| For Sub-Frame 0  |           | N/A   | 2     | 3     | 5     | 8     | 9     |  |  |
| Binary Channel Bits Per Sub-Frame  |           |       |       |       |       |       |       |  |  |
| For Sub-Frames 1,2,3,4,6,7,8,9   | Bits      | 4104  | 11340 | 18900 | 41400 | 62100 | 68724 |  |  |
| For Sub-Frame 5  | Bits      | N/A   | N/A   | N/A   | N/A   | N/A   | N/A   |  |  |
| For Sub-Frame 0  | Bits      | N/A   | 8820  | 16380 | 38880 | 59580 | 66204 |  |  |
| Max. Throughput averaged over 1 frame         kbps         2387.2         7448.8         12547         27294         42046         45922   |           |       |       |       |       |       |       |  |  |
| Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW. 3 symbols allocated to PDCCH for 5 MHz and 3 MHz. 4 symbols allocated to PDCCH for 1.4 MHz.<br>Note 2: Reference signal, Synchronization signals and PBCH allocated as per TS 36,211 [4]. |           |       |       |       |       |       |       |  |  |

#### Table A.3.2-3b Fixed Reference Channel for Maximum input level for UE Category 2 (FDD)

Note 2: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].
Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

| Parameter   | Unit                         | Value        |             |             |              |             |           |  |  |  |
|---|------------------------------|--------------|-------------|-------------|--------------|-------------|-----------|--|--|--|
| Channel bandwidth   | MHz                          | 1.4          | 3           | 5           | 10           | 15          | 20        |  |  |  |
| Allocated resource blocks   |                              | 6            | 15          | 25          | 50           | 75          | 100       |  |  |  |
| Subcarriers per resource block  |                              | 12           | 12          | 12          | 12           | 12          | 12        |  |  |  |
| Uplink-Downlink Configuration (Note 5)  |                              | 1            | 1           | 1           | 1            | 1           | 1         |  |  |  |
| Allocated subframes per Radio Frame   |                              | 2            | 3+2         | 3+2         | 3+2          | 3+2         | 3+2       |  |  |  |
| Modulation  |                              | 64QAM        | 64QAM       | 64QAM       | 64QAM        | 64QAM       | 64QAM     |  |  |  |
| Target Coding Rate  |                              | 3/4          | 3/4         | 3/4         | 3/4          | 3/4         | 3/4       |  |  |  |
| Number of HARQ Processes  | Processes                    | 7            | 7           | 7           | 7            | 7           | 7         |  |  |  |
| Maximum number of HARQ transmissions  |                              | 1            | 1           | 1           | 1            | 1           | 1         |  |  |  |
| Information Bit Payload per Sub-Frame   |                              |              |             |             |              |             |           |  |  |  |
| For Sub-Frames 4,9  | Bits                         | 2984         | 8504        | 14112       | 30576        | 46888       | 61664     |  |  |  |
| For Sub-Frames 1,6  | Bits                         | N/A          | 6968        | 11448       | 23688        | 35160       | 46888     |  |  |  |
| For Sub-Frame 5   | Bits                         | N/A          | N/A         | N/A         | N/A          | N/A         | N/A       |  |  |  |
| For Sub-Frame 0   | Bits                         | N/A          | 6968        | 12576       | 30576        | 45352       | 61664     |  |  |  |
| Transport block CRC   | Bits                         | 24           | 24          | 24          | 24           | 24          | 24        |  |  |  |
| Number of Code Blocks per Sub-Frame   |                              |              |             |             |              |             |           |  |  |  |
| (Note 4)  |                              |              |             |             |              |             |           |  |  |  |
| For Sub-Frames 4,9  |                              | 1            | 2           | 3           | 5            | 8           | 11        |  |  |  |
| For Sub-Frames 1,6  |                              | N/A          | 2           | 2           | 4            | 6           | 8         |  |  |  |
| For Sub-Frame 5   |                              | N/A          | N/A         | N/A         | N/A          | N/A         | N/A       |  |  |  |
| For Sub-Frame 0   |                              | N/A          | 2           | 3           | 5            | 8           | 11        |  |  |  |
| Binary Channel Bits per Sub-Frame   |                              |              |             |             |              |             |           |  |  |  |
| For Sub-Frames 4,9  | Bits                         | 4104         | 11340       | 18900       | 41400        | 62100       | 82800     |  |  |  |
| For Sub-Frames 1,6  |                              | N/A          | 9828        | 16668       | 33768        | 50868       | 67968     |  |  |  |
| For Sub-Frame 5   | Bits                         | N/A          | N/A         | N/A         | N/A          | N/A         | N/A       |  |  |  |
| For Sub-Frame 0   | Bits                         | N/A          | 9252        | 16812       | 39312        | 60012       | 80712     |  |  |  |
| Max. Throughput averaged over 1 frame   | kbps                         | 596.8        | 3791.2      | 6369.6      | 13910        | 20945       | 27877     |  |  |  |
| Note 1: For normal subframes(0,4,5,9), 2  |                              |              |             |             |              |             |           |  |  |  |
| 3 symbols allocated to PDCCH for  |                              |              |             |             | OCCH for 1   | .4 MHz. Fo  | r special |  |  |  |
| subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for all BWs.<br>Note 2: For 1.4MHz, no data shall be scheduled on special subframes(1&6) to avoid problems with insufficient PDCCH |                              |              |             |             |              |             |           |  |  |  |
|   | eduled on spe                | cial subfran | nes(1&6) to | o avoid pro | blems with   | insufficien | t PDCCH   |  |  |  |
| performance.  |                              |              | - 4         | TO 00 04    | 4 [ 4]       |             |           |  |  |  |
| Note 3: Reference signal, Synchronization   |                              |              |             |             |              | had to cas  | h Cada    |  |  |  |
| Note 4: If more than one Code Block is pro  | esent, an addi               |              | sequence    | 01L = 24E   | ons is allac | neu lo eac  | n Coue    |  |  |  |
| Note 5: As per Table 4.2-2 in TS $36.211$ [4  | Block (otherwise L = 0 Bit). |              |             |             |              |             |           |  |  |  |
| 11010 J. AS PELTADE 4.2-2 11 13 30.211 [2   | †j.                          |              |             |             |              |             |           |  |  |  |

#### Table A.3.2-4 Fixed Reference Channel for Maximum input level for UE Categories 3-8 (TDD)

| Channel bandwidth         MHz         1.4         3         5         10         15         20           Allocated resource block         6         15         18         17         17         17           Subcarriers per resource block         12         1  | Parameter                                    | Unit      |       |       | Va    | lue        |            |           |  |
|--|--|-----------|-------|-------|-------|------------|------------|-----------|--|
| Allocated resource blocks         6         15         18         17         17         17           Subcarriers per resource block         12         14         14         11            |  |           | 1.4   | 3     |       |            | 15         | 20        |  |
| Uplink-Downlink Configuration (Note 5)         1   | Allocated resource blocks                    |           | 6     | 15    | 18    | 17         | 17         | 17        |  |
| Uplink-Downlink Configuration (Note 5)         1   | Subcarriers per resource block               |           | 12    | 12    | 12    | 12         | 12         | 12        |  |
| Allocated subframes per Radio Frame         2         3+2         3+2         3+2         3+2         3+2         3+2         3+2         Modulation         64QAM         64QA         64DE         64DE <td></td> <td></td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> <td>1</td>  |  |           | 1     | 1     | 1     | 1          | 1          | 1         |  |
| Target Coding Rate         3/4   |  |           | 2     | 3+2   | 3+2   | 3+2        | 3+2        | 3+2       |  |
| Number of HARQ Processes         Processes         7         <   | Modulation                                   |           | 64QAM | 64QAM | 64QAM | 64QAM      | 64QAM      | 64QAM     |  |
| Maximum number of HARQ transmissions         1 <th11< th="">         1         1</th11<>   | Target Coding Rate                           |           | 3/4   | 3/4   | 3/4   | 3/4        | 3/4        | 3/4       |  |
| Information Bit Payload per Sub-Frame         Bits         2984         8504         10296         1128         1128         1128         1128         1128 <t< td=""><td>Number of HARQ Processes</td><td>Processes</td><td>7</td><td>7</td><td>7</td><td>7</td><td>7</td><td>7</td></t<>   | Number of HARQ Processes                     | Processes | 7     | 7     | 7     | 7          | 7          | 7         |  |
| For Sub-Frames 4,9         Bits         2984         8504         10296         10296         10296           For Sub-Frames 1,6         Bits         N/A         6968         8248         7480         7480         7480           For Sub-Frame 5         Bits         N/A         6968         8248         7480         7480         7480           For Sub-Frame 0         Bits         N/A         6968         8248         10296         10296         10296           Transport block CRC         Bits         24   | Maximum number of HARQ transmissions         |           | 1     | 1     | 1     | 1          | 1          | 1         |  |
| For Sub-Frames 1,6         Bits         N/A         6968         8248         7480         7480         7480           For Sub-Frame 5         Bits         N/A  | Information Bit Payload per Sub-Frame        |           |       |       |       |            |            |           |  |
| For Sub-Frame 5BitsN/AN/AN/AN/AN/AN/AFor Sub-Frame 0BitsN/A69688248102961029610296Transport block CRCBits24242424242424Number of Code Blocks per Sub-Frame<br>(Note 4)1222222For Sub-Frames 4,9122222222For Sub-Frames 1,6N/A22222222For Sub-Frame 5N/AN/AN/AN/AN/AN/AN/AN/AFor Sub-Frame 6N/A2222222Binary Channel Bits per Sub-FrameN/AN/AN/AN/AN/AN/AN/AN/AFor Sub-Frames 1,6N/A982811880116281162811628For Sub-Frame 5BitsN/A925211520140761407614076Max. Throughput averaged over 1 framekbps596.83791.24533.64584.84584.8Note 1:For normal subframes(0,4,5,9), 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW;<br>3 symbols allocated to PDCCH for 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special<br>subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for all BWs.Note 2:For 1.4MHz, no data shall be scheduled on special subframes(1&6) to avoid problems with insufficient PDCCH<br>performance.Note 3:Reference   | For Sub-Frames 4,9                           | Bits      | 2984  | 8504  | 10296 | 10296      | 10296      | 10296     |  |
| For Sub-Frame 0BitsN/A696882481029610296Transport block CRCBits24242424242424Number of Code Blocks per Sub-Frame<br>(Note 4)1222222For Sub-Frames 1,6N/A2222222For Sub-Frame 5N/AN/AN/AN/AN/AN/AN/AN/AFor Sub-Frame 0N/A222222Binary Channel Bits per Sub-FrameN/AN/AN/AN/AN/AN/AFor Sub-Frames 1,6N/A982811860116281162811628For Sub-Frames 1,6N/A982811880116281162811628For Sub-Frame 5BitsN/AN/AN/AN/AN/AFor Sub-Frame 5BitsN/A9252115201407614076Max. Throughput averaged over 1 framekbps596.83791.24533.64584.84584.8Note 1:For normal subframes(0,4,5,9), 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW;<br>3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special<br>subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW;<br>3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special<br>subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for all BWs.Note 2:For 1.4MHz, no data shall be schedule  | For Sub-Frames 1,6                           | Bits      | N/A   | 6968  | 8248  | 7480       | 7480       | 7480      |  |
| Transport block CRCBits2424242424242424Number of Code Blocks per Sub-Frame<br>(Note 4)For Sub-Frames 4,9122222For Sub-Frames 1,6N/A222222For Sub-Frame 5N/AN/AN/AN/AN/AN/AN/AFor Sub-Frame 0N/AN/A22222Binary Channel Bits per Sub-FrameN/A1134013608140761407614076For Sub-Frames 1,6N/AN/A982811880116281162811628For Sub-Frame 5BitsN/A982811880116281162811628For Sub-Frame 5BitsN/A945211520140761407614076Max. Throughput averaged over 1 framekbps596.83791.24533.64584.84584.8Note 1:For normal subframes(0,4,5,9), 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW;<br>3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special<br>subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for all BWs.Note 2:For 1.4MHz, no data shall be scheduled on special subframes(1&6) to avoid problems with insufficient PDCCH<br>performance.Note 3:Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].Note 4:If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code<br>Block (otherwise L = 0 Bit). </td <td>For Sub-Frame 5</td> <td>Bits</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>N/A</td>  | For Sub-Frame 5                              | Bits      | N/A   | N/A   | N/A   | N/A        | N/A        | N/A       |  |
| Number of Code Blocks per Sub-Frame<br>(Note 4)12222For Sub-Frames 1,6N/A22222For Sub-Frame 5N/A22222For Sub-Frame 6N/A22222Binary Channel Bits per Sub-FrameN/A22222For Sub-Frames 4,9Bits41041134013608140761407614076For Sub-Frames 5N/A98281188011628116281162811628For Sub-Frame 5BitsN/A982811880116281162811628For Sub-Frame 5BitsN/A925211520140761407614076Max. Throughput averaged over 1 framekbps596.83791.24533.64584.84584.84584.8Note 1:For normal subframes(0,4,5,9), 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW;<br>3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special<br>subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for all BWs.Note 2:For 1.4MHz, no data shall be scheduled on special subframes(1&6) to avoid problems with insufficient PDCCH<br>performance.Note 3:Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].Note 4:If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code<br>Block (otherwise L = 0 Bit).  | For Sub-Frame 0                              | Bits      | N/A   | 6968  | 8248  | 10296      | 10296      | 10296     |  |
| (Note 4)12222For Sub-Frames 1,6N/A22222For Sub-Frame 5N/AN/AN/AN/AN/AN/AN/AFor Sub-Frame 0N/AN/AN/AN/AN/AN/AN/AFor Sub-Frame 0N/A22222Binary Channel Bits per Sub-FrameN/A22222For Sub-Frames 4,9Bits410411340136081407614076For Sub-Frames 1,6N/A982811880116281162811628For Sub-Frame 5BitsN/AN/AN/AN/AN/AFor Sub-Frame 0BitsN/A9828118201407614076Max. Throughput averaged over 1 framekbps596.83791.24533.64584.84584.8Note 1:For normal subframes(0,4,5,9), 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW;<br>3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special<br>subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for all BWs.Note 2:For 1.4MHz, no data shall be scheduled on special subframes(1&6) to avoid problems with insufficient PDCCH<br>performance.Note 3:Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].Note 4:If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code<br>Block (otherwise L = 0 Bit).   | Transport block CRC                          | Bits      | 24    | 24    | 24    | 24         | 24         | 24        |  |
| For Sub-Frames 4,9122222For Sub-Frames 1,6N/A22222For Sub-Frame 5N/AN/AN/AN/AN/AN/AN/AFor Sub-Frame 0N/A22222Binary Channel Bits per Sub-FrameN/A1134013608140761407614076For Sub-Frames 4,9Bits41041134013608140761407614076For Sub-Frames 1,6N/A982811880116281162811628For Sub-Frame 5BitsN/A9252115201407614076For Sub-Frame 0BitsN/A9252115201407614076Max. Throughput averaged over 1 framekbps596.83791.24533.64584.84584.8Note 1:For normal subframes(0,4,5,9), 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW;<br>3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special<br>subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for all BWs.Note 2:For 1.4MHz, no data shall be scheduled on special subframes(1&6) to avoid problems with insufficient PDCCH<br>performance.Note 3:Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].Note 4:If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code<br>Block (otherwise L = 0 Bit).  | Number of Code Blocks per Sub-Frame          |           |       |       |       |            |            |           |  |
| For Sub-Frames 1,6N/A22222For Sub-Frame 5N/AN/AN/AN/AN/AN/AN/AFor Sub-Frame 0N/A22222Binary Channel Bits per Sub-FrameN/A22222For Sub-Frames 4,9Bits41041134013608140761407614076For Sub-Frames 1,6N/A982811880116281162811628For Sub-Frame 5BitsN/AN/AN/AN/AN/AFor Sub-Frame 0BitsN/A9252115201407614076Max. Throughput averaged over 1 framekbps596.83791.24533.64584.84584.8Note 1:For normal subframes(0,4,5,9), 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW;<br>3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special<br>subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for all BWs.Note 2:For 1.4MHz, no data shall be scheduled on special subframes(1&6) to avoid problems with insufficient PDCCH<br>performance.Note 3:Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].Note 4:If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code<br>Block (otherwise L = 0 Bit).   |  |           |       |       |       |            |            |           |  |
| For Sub-Frame 5N/AN/AN/AN/AN/AN/AN/AFor Sub-Frame 0N/A22222Binary Channel Bits per Sub-Frame </td <td>For Sub-Frames 4,9</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>  | For Sub-Frames 4,9                           |           |       |       |       |            |            |           |  |
| For Sub-Frame 0N/A22222Binary Channel Bits per Sub-Frame   | For Sub-Frames 1,6                           |           |       |       |       |            | 2          |           |  |
| Binary Channel Bits per Sub-Frame       Image: Construct of the symbols and the symbol | For Sub-Frame 5                              |           | N/A   | N/A   | N/A   | N/A        | N/A        | N/A       |  |
| For Sub-Frames 4,9Bits41041134013608140761407614076For Sub-Frames 1,6N/A98281188011628116281162811628For Sub-Frame 5BitsN/AN/AN/AN/AN/AN/AN/AFor Sub-Frame 0BitsN/A925211520140761407614076Max. Throughput averaged over 1 framekbps596.83791.24533.64584.84584.84584.8Note 1:For normal subframes(0,4,5,9), 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW;<br>3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special<br>subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for all BWs.Note 2:For 1.4MHz, no data shall be scheduled on special subframes(1&6) to avoid problems with insufficient PDCCH<br>performance.Note 3:Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].Note 4:If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code<br>Block (otherwise L = 0 Bit).   |  |           | N/A   | 2     | 2     | 2          | 2          | 2         |  |
| For Sub-Frames 1,6N/A982811880116281162811628For Sub-Frame 5BitsN/AN/AN/AN/AN/AN/AFor Sub-Frame 0BitsN/A9252115201407614076Max. Throughput averaged over 1 framekbps596.83791.24533.64584.84584.8Note 1:For normal subframes(0,4,5,9), 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW;<br>3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special<br>subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for all BWs.Note 2:For 1.4MHz, no data shall be scheduled on special subframes(1&6) to avoid problems with insufficient PDCCH<br>performance.Note 3:Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].Note 4:If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code<br>Block (otherwise L = 0 Bit).   |  |           |       |       |       |            |            |           |  |
| For Sub-Frame 5BitsN/AN/AN/AN/AN/AFor Sub-Frame 0BitsN/A925211520140761407614076Max. Throughput averaged over 1 framekbps596.83791.24533.64584.84584.84584.8Note 1:For normal subframes(0,4,5,9), 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW;<br>3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special<br>subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for all BWs.Note 2:For 1.4MHz, no data shall be scheduled on special subframes(1&6) to avoid problems with insufficient PDCCH<br>performance.Note 3:Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].Note 4:If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code<br>Block (otherwise L = 0 Bit).  |  | Bits      |       |       | 13608 |            | 14076      |           |  |
| For Sub-Frame 0BitsN/A925211520140761407614076Max. Throughput averaged over 1 framekbps596.83791.24533.64584.84584.84584.8Note 1:For normal subframes(0,4,5,9), 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW;<br>3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special<br>subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for all BWs.Note 2:For 1.4MHz, no data shall be scheduled on special subframes(1&6) to avoid problems with insufficient PDCCH<br>performance.For 1.4MHz, no data shall be scheduled on special subframes(1&6) to avoid problems with insufficient PDCCH<br>performance.Note 3:Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].Note 4:If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code<br>Block (otherwise L = 0 Bit).  |  |           |       |       |       |            |            |           |  |
| Max. Throughput averaged over 1 framekbps596.83791.24533.64584.84584.84584.8Note 1:For normal subframes(0,4,5,9), 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW;<br>3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special<br>subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for all BWs.Note 2:For 1.4MHz, no data shall be scheduled on special subframes(1&6) to avoid problems with insufficient PDCCH<br>performance.Note 3:Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].Note 4:If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code<br>Block (otherwise L = 0 Bit).  |  |           |       |       |       |            |            |           |  |
| <ul> <li>Note 1: For normal subframes(0,4,5,9), 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special subframe (1&amp;6), only 2 OFDM symbols are allocated to PDCCH for all BWs.</li> <li>Note 2: For 1.4MHz, no data shall be scheduled on special subframes(1&amp;6) to avoid problems with insufficient PDCCH performance.</li> <li>Note 3: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].</li> <li>If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).</li> </ul>  |  |           |       |       |       |            |            |           |  |
| <ul> <li>3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special subframe (1&amp;6), only 2 OFDM symbols are allocated to PDCCH for all BWs.</li> <li>Note 2: For 1.4MHz, no data shall be scheduled on special subframes(1&amp;6) to avoid problems with insufficient PDCCH performance.</li> <li>Note 3: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].</li> <li>Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).</li> </ul>  |  |           |       |       |       |            |            |           |  |
| <ul> <li>subframe (1&amp;6), only 2 OFDM symbols are allocated to PDCCH for all BWs.</li> <li>Note 2: For 1.4MHz, no data shall be scheduled on special subframes(1&amp;6) to avoid problems with insufficient PDCCH performance.</li> <li>Note 3: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].</li> <li>Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).</li> </ul>  |  |           |       |       |       |            |            |           |  |
| <ul> <li>Note 2: For 1.4MHz, no data shall be scheduled on special subframes(1&amp;6) to avoid problems with insufficient PDCCH performance.</li> <li>Note 3: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].</li> <li>Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).</li> </ul>   |  |           |       |       |       | OCCH for 1 | .4 MHz. Fo | r special |  |
| <ul> <li>performance.</li> <li>Note 3: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].</li> <li>Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).</li> </ul>  |  |           |       |       |       |            | . "        |           |  |
| <ul> <li>Note 3: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].</li> <li>Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).</li> </ul>  |  |           |       |       |       |            |            |           |  |
| Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).  |  |           |       |       |       |            |            |           |  |
| Block (otherwise $L = 0$ Bit).   |  |           |       |       |       |            |            |           |  |
|  |  |           |       |       |       |            |            |           |  |
|  | Note 5: As per Table 4.2-2 in TS $36.211$ [4 | 11        |       |       |       |            |            |           |  |

#### Table A.3.2-4a Fixed Reference Channel for Maximum input level for UE Category 1 (TDD)

| Parameter  | Unit          |             |            | Va          | lue         |               |           |  |
|--|---------------|-------------|------------|-------------|-------------|---------------|-----------|--|
| Channel bandwidth  | MHz           | 1.4         | 3          | 5           | 10          | 15            | 20        |  |
| Allocated resource blocks  |               | 6           | 15         | 25          | 50          | 75            | 83        |  |
| Subcarriers per resource block   |               | 12          | 12         | 12          | 12          | 12            | 12        |  |
| Uplink-Downlink Configuration (Note 5)   |               | 1           | 1          | 1           | 1           | 1             | 1         |  |
| Allocated subframes per Radio Frame  |               | 2           | 3+2        | 3+2         | 3+2         | 3+2           | 3+2       |  |
| Modulation   |               | 64QAM       | 64QAM      | 64QAM       | 64QAM       | 64QAM         | 64QAM     |  |
| Target Coding Rate   |               | 3/4         | 3/4        | 3/4         | 3/4         | 3/4           | 3/4       |  |
| Number of HARQ Processes   | Processes     | 7           | 7          | 7           | 7           | 7             | 7         |  |
| Maximum number of HARQ transmissions   |               | 1           | 1          | 1           | 1           | 1             | 1         |  |
| Information Bit Payload per Sub-Frame  |               |             |            |             |             |               |           |  |
| For Sub-Frames 4,9   | Bits          | 2984        | 8504       | 14112       | 30576       | 46888         | 51024     |  |
| For Sub-Frames 1,6   | Bits          | N/A         | 6968       | 11448       | 23688       | 35160         | 39232     |  |
| For Sub-Frame 5  | Bits          | N/A         | N/A        | N/A         | N/A         | N/A           | N/A       |  |
| For Sub-Frame 0  | Bits          | N/A         | 6968       | 12576       | 30576       | 45352         | 51024     |  |
| Transport block CRC  | Bits          | 24          | 24         | 24          | 24          | 24            | 24        |  |
| Number of Code Blocks per Sub-Frame  |               |             |            |             |             |               |           |  |
| (Note 4)   |               |             |            |             |             |               |           |  |
| For Sub-Frames 4,9   |               | 1           | 2          | 3           | 5           | 8             | 9         |  |
| For Sub-Frames 1,6   |               | N/A         | 2          | 3           | 5           | 7             | 7         |  |
| For Sub-Frame 5  |               | N/A         | N/A        | N/A         | N/A         | N/A           | N/A       |  |
| For Sub-Frame 0  |               | N/A         | 2          | 3           | 5           | 8             | 9         |  |
| Binary Channel Bits per Sub-Frame  |               |             |            |             |             |               |           |  |
| For Sub-Frames 4,9   | Bits          | 4104        | 11340      | 18900       | 41400       | 62100         | 68724     |  |
| For Sub-Frames 1,6   |               | N/A         | 9828       | 16668       | 33768       | 50868         | 56340     |  |
| For Sub-Frame 5  | Bits          | N/A         | N/A        | N/A         | N/A         | N/A           | N/A       |  |
| For Sub-Frame 0  | Bits          | N/A         | 9252       | 16380       | 39312       | 60012         | 66636     |  |
| Max. Throughput averaged over 1 frame  | kbps          | 596.8       | 3791.2     | 6369.6      | 13910       | 20945         | 23154     |  |
| Note 1: For normal subframes(0,4,5,9), 2   |               |             |            |             |             |               |           |  |
| 3 symbols allocated to PDCCH for   |               |             |            |             | OCCH for 1  | .4 MHz. Fo    | r special |  |
| subframe (1&6), only 2 OFDM syn  |               |             |            |             |             |               |           |  |
| Note 2: For 1.4MHz, no data shall be sch   | eduled on spe | cial subfra | mes(1&6) t | o avoid pro | oblems with | n insufficier | nt        |  |
| PDCCH performance.   |               |             |            |             |             |               |           |  |
| Note 3: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].                           |               |             |            |             |             |               |           |  |
| Note 4: If more than one Code Block is present, an additional CRC sequence of $L = 24$ Bits is attached to each Code |               |             |            |             |             |               |           |  |
| Block (otherwise L = 0 Bit).<br>Note 5: As per Table 4.2-2 in TS 36.211 [4   | 11            |             |            |             |             |               |           |  |
| Note 5: As per Table 4.2-2 in TS 36.211 [4].   |               |             |            |             |             |               |           |  |

#### Table A.3.2-4b Fixed Reference Channel for Maximum input level for UE Category 2 (TDD)

# A.3.3 Reference measurement channels for PDSCH performance requirements (FDD)

## A.3.3.1 Single-antenna transmission (Common Reference Symbols)

| Parameter                                 | Unit   |       |       | Value |               |  |  |  |  |  |
|---|--|-------|-------|-------|---------------|--|--|--|--|--|
| Reference channel                         |  | R.4   | R.42  | R.2   |               |  |  |  |  |  |
|   |  | FDD   | FDD   | FDD   |               |  |  |  |  |  |
| Channel bandwidth                         | MHz  | 1.4   | 20    | 10    |               |  |  |  |  |  |
| Allocated resource blocks (Note 4)        |  | 6     | 100   | 50    |               |  |  |  |  |  |
| Allocated subframes per Radio Frame       |  | 9     | 9     | 9     |               |  |  |  |  |  |
| Modulation                                |  | QPSK  | QPSK  | QPSK  |               |  |  |  |  |  |
| Target Coding Rate                        |  | 1/3   | 1/3   | 1/3   |               |  |  |  |  |  |
| Information Bit Payload (Note 4)          |  |       |       |       |               |  |  |  |  |  |
| For Sub-Frames 1,2,3,4,6,7,8,9            | Bits   | 408   | 8760  | 4392  |               |  |  |  |  |  |
| For Sub-Frame 5                           | Bits   | N/A   | N/A   | N/A   |               |  |  |  |  |  |
| For Sub-Frame 0                           | Bits   | 152   | 8760  | 4392  |               |  |  |  |  |  |
| Number of Code Blocks                     |  |       |       |       |               |  |  |  |  |  |
| (Notes 3 and 4)                           |  |       |       |       |               |  |  |  |  |  |
| For Sub-Frames 1,2,3,4,6,7,8,9            |  | 1     | 2     | 1     |               |  |  |  |  |  |
| For Sub-Frame 5                           |  | N/A   | N/A   | N/A   |               |  |  |  |  |  |
| For Sub-Frame 0                           |  | 1     | 2     | 1     |               |  |  |  |  |  |
| Binary Channel Bits (Note 4)              |  |       |       |       |               |  |  |  |  |  |
| For Sub-Frames 1,2,3,4,6,7,8,9            | Bits   | 1368  | 27600 | 13800 |               |  |  |  |  |  |
| For Sub-Frame 5                           | Bits   | N/A   | N/A   | N/A   |               |  |  |  |  |  |
| For Sub-Frame 0                           | Bits   | 528   | 26760 | 12960 |               |  |  |  |  |  |
| Max. Throughput averaged over 1 frame     | Mbps   | 0.342 | 7.884 | 3.953 |               |  |  |  |  |  |
| (Note 4)                                  |  |       |       |       |               |  |  |  |  |  |
| UE Category                               |  | ≥ 1   | ≥ 1   | ≥ 1   |               |  |  |  |  |  |
| Note 1: 2 symbols allocated to PDCCH for  |  |       |       |       | ols allocated |  |  |  |  |  |
| to PDCCH for 5 MHz and 3 MHz;             |  |       |       |       |               |  |  |  |  |  |
| Note 2: Reference signal, synchronization |  |       |       |       |               |  |  |  |  |  |
|   | Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to |       |       |       |               |  |  |  |  |  |
| each Code Block (otherwise L = 0          |  |       |       |       |               |  |  |  |  |  |
| Note 4: Given per component carrier per c | odeword.   |       |       |       |               |  |  |  |  |  |

#### Table A.3.3.1-1: Fixed Reference Channel QPSK R=1/3

| Parameter                                 | Unit    | Value      |       |            |               |            |        |  |  |
|---|---------|------------|-------|------------|---------------|------------|--------|--|--|
| Reference channel                         |         |            |       | R.3-1      | R.3           |            |        |  |  |
|   |         |            |       | FDD        | FDD           |            |        |  |  |
| Channel bandwidth                         | MHz     | 1.4        | 3     | 5          | 10            | 15         | 20     |  |  |
| Allocated resource blocks                 |         |            |       | 25         | 50            |            |        |  |  |
| Allocated subframes per Radio Frame       |         |            |       | 9          | 9             |            |        |  |  |
| Modulation                                |         |            |       | 16QAM      | 16QAM         |            |        |  |  |
| Target Coding Rate                        |         |            |       | 1/2        | 1/2           |            |        |  |  |
| Information Bit Payload                   |         |            |       |            |               |            |        |  |  |
| For Sub-Frames 1,2,3,4,6,7,8,9            | Bits    |            |       | 6456       | 14112         |            |        |  |  |
| For Sub-Frame 5                           | Bits    |            |       | N/A        | N/A           |            |        |  |  |
| For Sub-Frame 0                           | Bits    |            |       | 5736       | 12960         |            |        |  |  |
| Number of Code Blocks per Sub-Frame       |         |            |       |            |               |            |        |  |  |
| (Note 3)                                  |         |            |       |            |               |            |        |  |  |
| For Sub-Frames 1,2,3,4,6,7,8,9            |         |            |       | 2          | 3             |            |        |  |  |
| For Sub-Frame 5                           |         |            |       | N/A        | N/A           |            |        |  |  |
| For Sub-Frame 0                           |         |            |       | 1          | 3             |            |        |  |  |
| Binary Channel Bits Per Sub-Frame         |         |            |       |            |               |            |        |  |  |
| For Sub-Frames 1,2,3,4,6,7,8,9            | Bits    |            |       | 12600      | 27600         |            |        |  |  |
| For Sub-Frame 5                           | Bits    |            |       | N/A        | N/A           |            |        |  |  |
| For Sub-Frame 0                           | Bits    |            |       | 10920      | 25920         |            |        |  |  |
| Max. Throughput averaged over 1 frame     | Mbps    |            |       | 5.738      | 12.586        |            |        |  |  |
| UE Category                               |         |            |       | ≥ 1        | ≥2            |            |        |  |  |
| Note 1: 2 symbols allocated to PDCCH for  |         |            |       |            |               | nbols allo | ocated |  |  |
| to PDCCH for 5 MHz and 3 MHz;             |         |            |       |            |               |            |        |  |  |
| Note 2: Reference signal, synchronization |         |            |       |            |               |            |        |  |  |
| Note 3: If more than one Code Block is pr |         | itional CR | C sec | uence of L | . = 24 Bits i | s attache  | ed to  |  |  |
| each Code Block (otherwise L = 0          | ) Bit). |            |       |            |               |            |        |  |  |

#### Table A.3.3.1-3: Fixed Reference Channel 64QAM R=3/4

| MHz  | 1.4  | R.5<br>FDD  | R.6   | R.7   | R.8   | R.9 FDD  |  |  |
|--|--|---|---|---|---|--|--|--|
| MHz  | 1.4  | FDD   |   |   | 1.10  | 1.3100   |  |  |
| MHz  | 1/   |   | FDD   | FDD   | FDD   |  |  |  |
|  | 1.7  | 3   | 5   | 10  | 15  | 20   |  |  |
|  |  | 15  | 25  | 50  | 75  | 100  |  |  |
|  |  | 9   | 9   | 9   | 9   | 9  |  |  |
|  | 64QAM  | 64QAM   | 64QAM   | 64QAM   | 64QAM   | 64QAM  |  |  |
|  | 3/4  | 3/4   | 3/4   | 3/4   | 3/4   | 3/4  |  |  |
|  |  |   |   |   |   |  |  |  |
| Bits   |  | 8504  | 14112   | 30576   | 46888   | 61664  |  |  |
| Bits   |  | N/A   | N/A   | N/A   | N/A   | N/A  |  |  |
| Bits   |  | 6456  | 12576   | 28336   | 45352   | 61664  |  |  |
|  |  |   |   |   |   |  |  |  |
|  |  |   |   |   |   |  |  |  |
|  |  | 2   | 3   | 5   | 8   | 11   |  |  |
|  |  | N/A   | N/A   | N/A   | N/A   | N/A  |  |  |
|  |  | 2   | 3   | 5   | 8   | 11   |  |  |
|  |  |   |   |   |   |  |  |  |
| Bits   |  | 11340   | 18900   | 41400   | 62100   | 82800  |  |  |
| Bits   |  | N/A   | N/A   | N/A   | N/A   | N/A  |  |  |
| Bits   |  | 8820  | 16380   | 38880   | 59580   | 80280  |  |  |
| Mbps   |  | 7.449   | 12.547  | 27.294  | 42.046  | 55.498   |  |  |
|  |  | ≥ 1   | ≥2  | ≥ 2   | ≥ 2   | ≥ 3  |  |  |
| Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH          |  |   |   |   |   |  |  |  |
| for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz.   |  |   |   |   |   |  |  |  |
| Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].                           |  |   |   |   |   |  |  |  |
| Note 3: If more than one Code Block is present, an additional CRC sequence of $L = 24$ Bits is attached to each Code |  |   |   |   |   |  |  |  |
|  | Bits<br>Bits<br>Bits<br>Bits<br>Bits<br>Bits<br>Bits<br>Bits | 64QAM       3/4       Bits       Bits       Bits       Bits       Bits       Sits       Bits       Comparison       Sits       Bits       Mbps       Comparison       Signals and PBCH alloc | 15964QAM $3/4$ $3/4$ $3/4$ BitsBitsN/ABits64562221Bits11340BitsBits11340BitsBits11340Bits11340Bits11340Bits120Mbps7.449212020MHz, 15MHz and 10MHz challocated to PDCCH for 1.4MHz.signals and PBCH allocated as p | 15       25         9       9         64QAM       64QAM         3/4       3/4         3/4       3/4         Bits       8504         14112         Bits       8504         14112         Bits       6456         12576         2       3         2       3         2       3         3/4       11340         1800       188         11340       18900         Bits       11340         181s       16380         Mbps       7.449         12.547 $\geq 1$ $\geq 2$ 20 MHz, 15 MHz and 10 MHz channel BW;         allocated to PDCCH for 1.4 MHz.         signals and PBCH allocated as per TS 36.2* | 15       25       50         9       9       9       9         64QAM       64QAM       64QAM       64QAM         3/4       3/4       3/4       3/4         Bits       8504       14112       30576         Bits       N/A       N/A       N/A         Bits       6456       12576       28336         2       3       5       5         1       2       3       5         2       3       5       5         1       2       3       5         1       1340       18900       41400         Bits       11340       18900       41400         Bits       11340       18900       41400         Bits       11340       18900       41400         Bits       11340       18900       41400         Bits       1430       18900       41400         Bits       12547       27.294 $\geq 1$ $\geq 2$ $\geq 2$ 20       MHz, 15       MHz and 10       MHz.         signals and PBCH allocated as per TS 36.211 [4].       4]. | 15       25       50       75         9       9       9       9       9       9         64QAM       64QAM       64QAM       64QAM       64QAM       64QAM         3/4       3/4       3/4       3/4       3/4       3/4         Bits       8504       14112       30576       46888         Bits       N/A       N/A       N/A       N/A         Bits       6456       12576       28336       45352         2       3       5       8         N/A       N/A       N/A       N/A         2       3       5       8         N/A       N/A       N/A       N/A         2       3       5       8         Bits       11340       18900       41400       62100         Bits       11340       18900       41400       62100         Bits       11340       18900       38880       59580         Mbps       7.449       12.547       27.294       42.046 $\geq 1$ $\geq 2$ |  |  |

Block (otherwise L = 0 Bit).

| Parameter  | Unit |  | Value |       |       |       |        |  |  |  |
|--|------|--|-------|-------|-------|-------|--------|--|--|--|
| Reference channel  |      |  | R.6-1 | R.7-1 | R.8-1 | R.9-1 | R.9-2  |  |  |  |
|  |      |  | FDD   | FDD   | FDD   | FDD   | FDD    |  |  |  |
| Channel bandwidth  | MHz  |  | 5     | 10    | 15    | 20    | 20     |  |  |  |
| Allocated resource blocks (Note 3)   |      |  | 18    | 17    | 17    | 17    | 83     |  |  |  |
| Allocated subframes per Radio Frame  |      |  | 9     | 9     | 9     | 9     | 9      |  |  |  |
| Modulation   |      |  | 64QAM | 64QAM | 64QAM | 64QAM | 64QAM  |  |  |  |
| Target Coding Rate   |      |  | 3/4   | 3/4   | 3/4   | 3/4   | 3/4    |  |  |  |
| Information Bit Payload  |      |  |       |       |       |       |        |  |  |  |
| For Sub-Frames 1,2,3,4,6,7,8,9   | Bits |  | 10296 | 10296 | 10296 | 10296 | 51024  |  |  |  |
| For Sub-Frame 5  | Bits |  | N/A   | N/A   | N/A   | N/A   | N/A    |  |  |  |
| For Sub-Frame 0  | Bits |  | 8248  | 10296 | 10296 | 10296 | 51024  |  |  |  |
| Number of Code Blocks per Sub-Frame  |      |  |       |       |       |       |        |  |  |  |
| (Note 4)   |      |  |       |       |       |       |        |  |  |  |
| For Sub-Frames 1,2,3,4,6,7,8,9   |      |  | 2     | 2     | 2     | 2     | 9      |  |  |  |
| For Sub-Frame 5  |      |  | N/A   | N/A   | N/A   | N/A   | N/A    |  |  |  |
| For Sub-Frame 0  |      |  | 2     | 2     | 2     | 2     | 9      |  |  |  |
| Binary Channel Bits Per Sub-Frame  |      |  |       |       |       |       |        |  |  |  |
| For Sub-Frames 1,2,3,4,6,7,8,9   | Bits |  | 13608 | 14076 | 14076 | 14076 | 68724  |  |  |  |
| For Sub-Frame 5  | Bits |  | N/A   | N/A   | N/A   | N/A   | N/A    |  |  |  |
| For Sub-Frame 0  | Bits |  | 11088 | 14076 | 14076 | 14076 | 66204  |  |  |  |
| Max. Throughput averaged over 1 frame  | Mbps |  | 9.062 | 9.266 | 9.266 | 9.266 | 45.922 |  |  |  |
| UE Category  |      |  | ≥ 1   | ≥1    | ≥1    | ≥1    | ≥ 2    |  |  |  |
| Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. |      |  |       |       |       |       |        |  |  |  |
| Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].   |      |  |       |       |       |       |        |  |  |  |
| Note 3: Localized allocation started from RB #0 is applied.  |      |  |       |       |       |       |        |  |  |  |
| Note 4: If more than one Code Block is present, an additional CRC sequence of $L = 24$ Bits is attached to each  |      |  |       |       |       |       |        |  |  |  |

| Table A.3.3.1-3a: Fixed Reference Channel 64QAM | R=3/4 |
|---|-------|
|---|-------|

 Note 3:
 Localized allocation started from RB #0 is applied.

 Note 4:
 If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

| Parameter   | Unit   | Value                   |                             |                      |            |    |    |  |  |
|---|--|-------------------------|-----------------------------|----------------------|------------|----|----|--|--|
| Reference channel   |  |                         | R.0<br>FDD                  |                      | R.1<br>FDD |    |    |  |  |
| Channel bandwidth   | MHz  | 1.4                     | 3                           | 5                    | 10/20      | 15 | 20 |  |  |
| Allocated resource blocks   |  |                         | 1                           |                      | 1          |    |    |  |  |
| Allocated subframes per Radio Frame   |  |                         | 9                           |                      | 9          |    |    |  |  |
| Modulation  |  |                         | 16QAM                       |                      | 16QAM      |    |    |  |  |
| Target Coding Rate  |  |                         | 1/2                         |                      | 1/2        |    |    |  |  |
| Information Bit Payload   |  |                         |                             |                      |            |    |    |  |  |
| For Sub-Frames 1,2,3,4,6,7,8,9  | Bits   |                         | 224                         |                      | 256        |    |    |  |  |
| For Sub-Frame 5   | Bits   |                         | N/A                         |                      | N/A        |    |    |  |  |
| For Sub-Frame 0   | Bits   |                         | 224                         |                      | 256        |    |    |  |  |
| Number of Code Blocks per Sub-Frame (Note 3)  |  |                         |                             |                      |            |    |    |  |  |
| For Sub-Frames 1,2,3,4,6,7,8,9  |  |                         | 1                           |                      | 1          |    |    |  |  |
| For Sub-Frame 5   |  |                         | N/A                         |                      | N/A        |    |    |  |  |
| For Sub-Frame 0   |  |                         | 1                           |                      | 1          |    |    |  |  |
| Binary Channel Bits Per Sub-Frame   |  |                         |                             |                      |            |    |    |  |  |
| For Sub-Frames 1,2,3,4,6,7,8,9  | Bits   |                         | 504                         |                      | 552        |    |    |  |  |
| For Sub-Frame 5   | Bits   |                         | N/A                         |                      | N/A        |    |    |  |  |
| For Sub-Frame 0   | Bits   |                         | 504                         |                      | 552        |    |    |  |  |
| Max. Throughput averaged over 1 frame   | Mbps   |                         | 0.202                       |                      | 0.230      |    |    |  |  |
| UE Category   |  |                         | ≥ 1                         |                      | ≥ 1        |    |    |  |  |
| Note 1:       2 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4         PDCCH for 5 MHz and 3 MHz; 4       Reference signal, synchronizatio         Note 2:       Reference signal, synchronizatio         Note 3:       If more than one Code Block is p         Code Block (otherwise L = 0 Bit). | symbols allocan signals and for a signals and for a signal | ated to PI<br>PBCH allo | DCCH for 1.<br>ocated as pe | 4 MHz.<br>er TS 36.2 | 211 [4].   |    |    |  |  |

|  | Parameter                         | Unit         | Value     |  |  |  |  |  |
|--|-----------------------------------|--------------|-----------|--|--|--|--|--|
| Referenc   | e channel                         |              | R.29 FDD  |  |  |  |  |  |
|  |                                   |              | (MBSFN)   |  |  |  |  |  |
| Channel  | bandwidth                         | MHz          | 10        |  |  |  |  |  |
| Allocated  | resource blocks                   |              | 1         |  |  |  |  |  |
| MBSFN (  | Configuration (Note 3)            |              | 111111    |  |  |  |  |  |
| Allocated  | subframes per Radio Frame         |              | 3         |  |  |  |  |  |
| Modulatio  | ึ่งท                              |              | 16QAM     |  |  |  |  |  |
| Target Co  | oding Rate                        |              | 1/2       |  |  |  |  |  |
| Informatio   | on Bit Payload                    |              |           |  |  |  |  |  |
|  | -Frames 4,9                       | Bits         | 256       |  |  |  |  |  |
| For Sub  | -Frame 5                          | Bits         | N/A       |  |  |  |  |  |
| For Sub  | -Frame 0                          | Bits         | 256       |  |  |  |  |  |
| For Sub  | -Frame 1,2,3,6,7,8                | Bits         | 0 (MBSFN) |  |  |  |  |  |
| Number of  | of Code Blocks per Sub-Frame      |              |           |  |  |  |  |  |
| (Note 4)   |                                   |              |           |  |  |  |  |  |
| For Sub  | -Frames 4,9                       |              | 1         |  |  |  |  |  |
| For Sub  | -Frame 5                          |              | N/A       |  |  |  |  |  |
| For Sub  | -Frame 0                          |              | 1         |  |  |  |  |  |
| For Sub  | -Frame 1,2,3,6,7,8                |              | 0 (MBSFN) |  |  |  |  |  |
| Binary Ch  | nannel Bits Per Sub-Frame         |              |           |  |  |  |  |  |
| For Sub  | -Frames 4,9                       | Bits         | 552       |  |  |  |  |  |
| For Sub  | -Frame 5                          | Bits         | N/A       |  |  |  |  |  |
|  | -Frame 0                          | Bits         | 552       |  |  |  |  |  |
|  | -Frame 1,2,3,6,7,8                | Bits         | 0 (MBSFN) |  |  |  |  |  |
| Max. Thre  | oughput averaged over 1 frame     | kbps         | 76.8      |  |  |  |  |  |
| UE Categ   | jory                              |              | ≥ 1       |  |  |  |  |  |
| Note 1:  | 2 symbols allocated to PDCCH.     |              |           |  |  |  |  |  |
| Note 2:  | Reference signal, synchronization | on signals a | and PBCH  |  |  |  |  |  |
| allocated as per TS 36.211 [4].                                |                                   |              |           |  |  |  |  |  |
| Note 3: MBSFN Subframe Allocation as defined in [7], one frame |                                   |              |           |  |  |  |  |  |
|  | with 6 bits is chosen for MBSFN   |              |           |  |  |  |  |  |
| Note 4:  | If more than one Code Block is p  |              |           |  |  |  |  |  |
|  | CRC sequence of $L = 24$ Bits is  | attached to  | each Code |  |  |  |  |  |
|  | Block (otherwise L = 0 Bit).      |              |           |  |  |  |  |  |

#### Table A.3.3.1-5: Fixed Reference Channel Single PRB (MBSFN Configuration)

| Parameter  | Unit           | Value     |       |           |             |           |       |
|--|----------------|-----------|-------|-----------|-------------|-----------|-------|
| Reference channel  |                |           |       |           | R.41<br>FDD |           |       |
| Channel bandwidth  | MHz            | 1.4       | 3     | 5         | 10          | 15        | 20    |
| Allocated resource blocks  |                |           |       |           | 50          |           |       |
| Allocated subframes per Radio Frame  |                |           |       |           | 9           |           |       |
| Modulation   |                |           |       |           | QPSK        |           |       |
| Target Coding Rate   |                |           |       |           | 1/10        |           |       |
| Information Bit Payload  |                |           |       |           |             |           |       |
| For Sub-Frames 1,2,3,4,6,7,8,9   | Bits           |           |       |           | 1384        |           |       |
| For Sub-Frame 5  | Bits           |           |       |           | N/A         |           |       |
| For Sub-Frame 0  | Bits           |           |       |           | 1384        |           |       |
| Number of Code Blocks per Sub-Frame  |                |           |       |           |             |           |       |
| (Note 3)   |                |           |       |           |             |           |       |
| For Sub-Frames 1,2,3,4,6,7,8,9   |                |           |       |           | 1           |           |       |
| For Sub-Frame 5  |                |           |       |           | N/A         |           |       |
| For Sub-Frame 0  |                |           |       |           | 1           |           |       |
| Binary Channel Bits Per Sub-Frame  |                |           |       |           |             |           |       |
| For Sub-Frames 1,2,3,4,6,7,8,9   | Bits           |           |       |           | 13800       |           |       |
| For Sub-Frame 5  | Bits           |           |       |           | N/A         |           |       |
| For Sub-Frame 0  | Bits           |           |       |           | 12960       |           |       |
| Max. Throughput averaged over 1 frame  | Mbps           |           |       |           | 1.246       |           |       |
| UE Category  |                |           |       |           | ≥1          |           |       |
| Note 1:         2 symbols allocated to PDCCH for           to PDCCH for 5 MHz and 3 MHz;           Note 2:         Reference signal, synchronization | 4 symbols all  | ocated to | PDCCH | for 1.4 N | 1Hz.        | bols allo | cated |
| Note 3: If more than one Code Block is p<br>each Code Block (otherwise L = 0   | resent, an add |           |       |           |             | s attache | ed to |

#### Table A.3.3.1-7: PCell Fixed Reference Channel for CA demodulation with power imbalance

| Parameter  | Unit           | Value    |
|--|----------------|----------|
| Reference channel  |                | R.49 FDD |
| Channel bandwidth  | MHz            | 20       |
| Allocated resource blocks  |                | 100      |
| Allocated subframes per Radio Frame  |                | 9        |
| Modulation   |                | 64QAM    |
| Coding Rate  |                |          |
| For Sub-Frame 1,2,3,4,6,7,8,9,   |                | 0.84     |
| For Sub-Frame 5  |                | N/A      |
| For Sub-Frame 0  |                | 0.87     |
| Information Bit Payload  |                |          |
| For Sub-Frames 0,1,2,3,4,6,7,8,9   | Bits           | 63776    |
| For Sub-Frame 5  | Bits           | N/A      |
| Number of Code Blocks per Sub-Frame (Note 3)   |                |          |
| For Sub-Frames 0,1,2,3,4,6,7,8,9   | Code<br>Blocks | 11       |
| For Sub-Frame 5  | Code<br>Blocks | N/A      |
| Binary Channel Bits Per Sub-Frame  |                |          |
| For Sub-Frames 1,2,3,4,6,7,8,9   | Bits           | 75600    |
| For Sub-Frame 5  | Bits           | N/A      |
| For Sub-Frame 0  | Bits           | 73080    |
| Max. Throughput averaged over 1 frame  | Mbps           | 57.398   |
| UE Category  |                | ≥5       |
| <ul> <li>Note 1: 3 symbols allocated to PDCCH.</li> <li>Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].</li> <li>Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).</li> </ul> |                |          |

# A.3.3.2 Multi-antenna transmission (Common Reference Symbols)

## A.3.3.2.1 Two antenna ports

| Table A.3.3.2.1-1: Fixed Reference Channel two antenna ports |
|--|
|--|

| Parameter  | Unit                           |                          |                        |                            |                  |                | Val            | ue               |                 |                |                 |            |                 |
|--|--------------------------------|--------------------------|------------------------|----------------------------|------------------|----------------|----------------|------------------|-----------------|----------------|-----------------|------------|-----------------|
| Reference  |                                | R.10                     | R.11                   | R.11-1                     | R.11-            | R.11-          | R.11-          | R.30             | R.30-           | R.35-          | R.35            | R.35-      | R.35-3          |
| channel  |                                | FDD                      | FDD                    | FDD                        | 2                | 3              | 4              | FDD              | 1               | 1              | FDD             | 2          | FDD             |
|  |                                |                          |                        |                            | FDD              | FDD<br>Note 5  | FDD            |                  | FDD             | FDD            |                 | FDD        |                 |
| Channel<br>bandwidth                                 | MHz                            | 10                       | 10                     | 10                         | 5                | 10             | 10             | 20               | 15              | 20             | 10              | 15         | 10              |
| Allocated  |                                | 50                       | 50                     | 50                         | 25               | 40             | 50             | 100              | 75              | 100            | 50              | 75         | 50              |
| resource blocks (Note 4)                             |                                |                          |                        |                            |                  |                |                |                  |                 |                |                 |            |                 |
| Allocated<br>subframes per<br>Radio Frame            |                                | 9                        | 9                      | 9                          | 9                | 9              | 9              | 9                | 8               | 8              | 9               | 8          | 8               |
| Modulation   |                                | QPSK                     | 16QAM                  | 16QAM                      | 16QA<br>M        | 16QA<br>M      | QPS<br>K       | 16QA<br>M        | 16QA<br>M       | 64QA<br>M      | 64QAM           | 64QA<br>M  | 64QA<br>M       |
| Target Coding<br>Rate                                |                                | 1/3                      | 1/2                    | 1/2                        | 1/2              | 1/2            | 1/2            | 1/2              | 1/2             | 0.39           | 1/2             | 0.39       | 0.39            |
| Information Bit<br>Payload (Note<br>4)               |                                |                          |                        |                            |                  |                |                |                  |                 |                |                 |            |                 |
| For Sub-<br>Frames<br>1,2,3,4,6,7,8,9                | Bits                           | 4392                     | 12960                  | 12960                      | 5736             | 1029<br>6      | 6968           | 2545<br>6        | 1908<br>0       | 3057<br>6      | 19848           | 2292<br>0  | 15264           |
| For Sub-<br>Frame 5                                  | Bits                           | N/A                      | N/A                    | N/A                        | N/A              | N/A            | N/A            | N/A              | N/A             | N/A            | N/A             | N/A        | N/A             |
| For Sub-<br>Frame 0                                  | Bits                           | 4392                     | 12960                  | N/A                        | 4968             | 1029<br>6      | 6968           | 2545<br>6        | N/A             | N/A            | 18336           | N/A        | N/A             |
| Number of<br>Code Blocks<br>(Notes 3 and 4)          |                                |                          |                        |                            |                  |                |                |                  |                 |                |                 |            |                 |
| For Sub-<br>Frames<br>1,2,3,4,6,7,8,9                | Bits                           | 1                        | 3                      | 3                          | 1                | 2              | 2              | 5                | 4               | 5              | 4               | 4          | 3               |
| For Sub-<br>Frame 5                                  | Bits                           | N/A                      | N/A                    | N/A                        | N/A              | N/A            | N/A            | N/A              | N/A             | N/A            | N/A             | N/A        | N/A             |
| For Sub-<br>Frame 0                                  | Bits                           | 1                        | 3                      | N/A                        | 1                | 2              | 2              | 5                | N/A             | N/A            | 3               | N/A        | N/A             |
| Binary Channel<br>Bits (Note 4)                      |                                |                          |                        |                            |                  |                |                |                  |                 |                |                 |            |                 |
| For Sub-<br>Frames<br>1,2,3,4,6,7,8,9                | Bits                           | 13200                    | 26400                  | 26400                      | 1200<br>0        | 2112<br>0      | 1320<br>0      | 5280<br>0        | 3960<br>0       | 7920<br>0      | 39600           | 5940<br>0  | 39600           |
| For Sub-<br>Frame 5                                  | Bits                           | N/A                      | N/A                    | N/A                        | N/A              | N/A            | N/A            | N/A              | N/A             | N/A            | N/A             | N/A        | N/A             |
| For Sub-<br>Frame 0                                  | Bits                           | 12384                    | 24768                  | N/A                        | 1036<br>8        | 1948<br>8      | 1238<br>4      | 5116<br>8        | N/A             | N/A            | 37152           | N/A        | N/A             |
| Max.<br>Throughput<br>averaged over<br>1 frame (Note | Mbps                           | 3.953                    | 11.664                 | 10.368                     | 5.086            | 9.266          | 6.271          | 22.91<br>0       | 15.26<br>4      | 24.46<br>1     | 17.712          | 18.33<br>6 | 12.211          |
| 4)   |                                |                          |                        |                            |                  |                |                |                  |                 |                |                 |            |                 |
| UE Category<br>Note 1: 2 symb                        | l<br>Jols alloc                | ≥1<br>ated to P          | ≥ 2<br>DCCH for        | ≥2<br>20 MHz 1             | ≥1<br>5 MHzan    | ≥ 1<br>d 10 MH | ≥1<br>z channe | ≥ 2<br>≥ BW: 3 • | ≥2<br>symbols a | 4<br>allocated | ≥ 2<br>to PDCCH | ≥ 2        | ≥ 2<br>Iz and 3 |
| MHz; 4<br>Note 2: Refere                             | symbols<br>nce sign<br>than on | s allocate<br>al, synchi | d to PDCC<br>onization | H for 1.4 M<br>signals and | ИНz.<br>I PBCH a | allocated      | as per TS      | 6 36.211         | [4].            |                | ach Code        |            |                 |
| Note 4: Given  | per comp                       | onent ca                 | rrier per co           | odeword.                   | - 11 4 -         | -1             |                |                  |                 |                |                 |            |                 |

Note 5: For R.11-3 resource blocks of RB6–RB45 are allocated.

| Parameter                             | Unit       |            |            |            | Va       | alue        |            |           |             |
|---------------------------------------|------------|------------|------------|------------|----------|-------------|------------|-----------|-------------|
| Reference channel                     |            | R.46       | R.47       | R.35-4     |          |             |            |           |             |
|                                       |            | FDD        | FDD        | FDD        |          |             |            |           |             |
| Channel bandwidth                     | MHz        | 10         | 10         | 10         |          |             |            |           |             |
| Allocated resource blocks (Note 4)    |            | 50         | 50         | 50         |          |             |            |           |             |
| Allocated subframes per Radio Frame   |            | 9          | 9          | 9          |          |             |            |           |             |
| Modulation                            |            | QPSK       | 16QAM      | 64QAM      |          |             |            |           |             |
| Target Coding Rate                    |            |            |            | 0.47       |          |             |            |           |             |
| Information Bit Payload (Note 4)      |            |            |            |            |          |             |            |           |             |
| For Sub-Frames 1,2,3,4,6,7,8,9        | Bits       | 5160       | 8760       | 18336      |          |             |            |           |             |
| For Sub-Frame 5                       | Bits       | N/A        | N/A        | N/A        |          |             |            |           |             |
| For Sub-Frame 0                       | Bits       | 5160       | 8760       | 16416      |          |             |            |           |             |
| Number of Code Blocks                 |            |            |            |            |          |             |            |           |             |
| (Notes 3 and 4)                       |            |            |            |            |          |             |            |           |             |
| For Sub-Frames 1,2,3,4,6,7,8,9        | Bits       | 1          | 2          | 3          |          |             |            |           |             |
| For Sub-Frame 5                       | Bits       | N/A        | N/A        | N/A        |          |             |            |           |             |
| For Sub-Frame 0                       | Bits       | 1          | 2          | 3          |          |             |            |           |             |
| Binary Channel Bits (Note 4)          |            |            |            |            |          |             |            |           |             |
| For Sub-Frames 1,2,3,4,6,7,8,9        | Bits       | 13200      | 26400      | 39600      |          |             |            |           |             |
| For Sub-Frame 5                       | Bits       | N/A        | N/A        | N/A        |          |             |            |           |             |
| For Sub-Frame 0                       | Bits       | 12384      | 24768      | 37152      |          |             |            |           |             |
| Max. Throughput averaged over 1       | Mbps       | 4.644      | 7.884      | 16.310     |          |             |            |           |             |
| frame (Note 4)                        |            |            |            |            |          |             |            |           |             |
| UE Category                           |            | ≥ 1        | ≥ 1        | ≥2         |          |             |            |           |             |
| Note 1: 2 symbols allocated to PDCCI  |            |            |            | IHz channe | I BW; 3  | symbols     | allocated  | to PDCCH  | I for 5 MHz |
| and 3 MHz; 4 symbols allocate         |            |            |            |            |          |             |            |           |             |
| Note 2: Reference signal, synchroniza |            |            |            |            |          |             |            |           |             |
| Note 3: If more than one Code Block i | s present, | an additio | nal CRC se | quence of  | L = 24 E | Bits is att | ached to e | each Code | Block       |
| (otherwise L = 0 Bit)                 |            |            |            |            |          |             |            |           |             |
| Note 4: Given per component carrier p | per codewo | ord.       |            |            |          |             |            |           |             |

Table A.3.3.2.1-2: Fixed Reference Channel two antenna ports

| Parameter  | Unit        | Value                        |
|--|-------------|------------------------------|
| Reference channel  |             | R.YY FDD                     |
| Channel bandwidth  | MHz         | 10                           |
| Number of CRS ports  |             | 2                            |
| Allocated resource blocks  |             | 50                           |
| Allocated subframes per Radio Frame  |             | 8                            |
| Modulation   |             | 64QAM                        |
| Coding Rate  |             |                              |
| For Sub-Frame 1,2,3,4,6,7,8,9,   |             | 0.54                         |
| For Sub-Frame 5  |             | n/a                          |
| For Sub-Frame 0  |             | n/a                          |
| Information Bit Payload  |             |                              |
| For Sub-Frames 1,2,3,4,6,7,8,9   | Bits        | 21384                        |
| For Sub-Frame 5  | Bits        | n/a                          |
| For Sub-Frame 0  | Bits        | n/a                          |
| Number of Code Blocks per Sub-Frame  |             |                              |
| (Note 3)   | Code        | 4                            |
| For Sub-Frames 1,2,3,4,6,7,8,9   | Blocks      | 4                            |
| For Sub-Frame 5  | Code        | n/a                          |
|  | Blocks      |                              |
| For Sub-Frame 0  | Code        | n/a                          |
|  | Blocks      |                              |
| Binary Channel Bits Per Sub-Frame (Note 4)                                     |             |                              |
| For Sub-Frames 1,2,3,4,6,7,8,9   | Bits        | 39600                        |
| For Sub-Frame 5  | Bits        | n/a                          |
| For Sub-Frame 0  | Bits        | n/a                          |
| Max. Throughput averaged over 1 frame  | Mbps        | 17.11                        |
| (Note 4)   |             |                              |
| UE Category  |             | ≥ 3                          |
| Note 1:2 symbols allocated to PDCCH.Note 2:Reference signal, synchronization   | n signals a | and PBCH allocated as per TS |
| 36.211 [4].  |             |                              |
| Note 3: If more than one Code Block is p<br>L = 24 Bits is attached to each Co |             |                              |
| Note 4: Given per component carrier per  |             |                              |

# Table A.3.3.2.1-3: PCell and SCell Fixed Reference Channel for NC CA demodulation with timing offset and power imbalance

## A.3.3.2.2 Four antenna ports

| Parameter   | Unit      |       |       |        | Value       |            |             |          |
|---|-----------|-------|-------|--------|-------------|------------|-------------|----------|
| Reference channel   |           | R.12  | R.13  | R.14   | R.14-1      | R.14-2     | R.14-3      | R.36     |
|   |           | FDD   | FDD   | FDD    | FDD         | FDD        | FDD         | FDD      |
| Channel bandwidth   | MHz       | 1.4   | 10    | 10     | 10          | 10         | 20          | 10       |
| Allocated resource blocks (Note 4)                                |           | 6     | 50    | 50     | 6           | 3          | 100         | 50       |
| Allocated subframes per Radio Frame                               |           | 9     | 9     | 9      | 8           | 8          | 9           | 9        |
| Modulation  |           | QPSK  | QPSK  | 16QAM  | 16QAM       | 16QAM      | 16QAM       | 64QAM    |
| Target Coding Rate  |           | 1/3   | 1/3   | 1/2    | 1/2         | 1/2        | 1/2         | 1/2      |
| Information Bit Payload (Note 4)                                  |           |       |       |        |             |            |             |          |
| For Sub-Frames 1,2,3,4,6,7,8,9                                    | Bits      | 408   | 4392  | 12960  | 1544        | 744        | [25456]     | 18336    |
| For Sub-Frame 5   | Bits      | N/A   | N/A   | N/A    | N/A         | N/A        | n/a         | N/A      |
| For Sub-Frame 0   | Bits      | 152   | 3624  | 11448  | N/A         | N/A        | [22920]     | 18336    |
| Number of Code Blocks   |           |       |       |        |             |            |             |          |
| (Notes 3 and 4)   |           |       |       |        |             |            |             |          |
| For Sub-Frames 1,2,3,4,6,7,8,9                                    |           | 1     | 1     | 3      | 1           | 1          | 5           | 3        |
| For Sub-Frame 5   |           | N/A   | N/A   | N/A    | N/A         | N/A        | n/a         | N/A      |
| For Sub-Frame 0   |           | 1     | 1     | 2      | N/A         | N/A        | 4           | 3        |
| Binary Channel Bits (Note 4)                                      |           |       |       |        |             |            |             |          |
| For Sub-Frames 1,2,3,4,6,7,8,9                                    | Bits      | 1248  | 12800 | 25600  | 3072        | 1536       | 51200       | 38400    |
| For Sub-Frame 5   | Bits      | N/A   | N/A   | N/A    | N/A         | N/A        | n/a         | N/A      |
| For Sub-Frame 0   | Bits      | 480   | 12032 | 24064  | N/A         | N/A        | 49664       | 36096    |
| Max. Throughput averaged over 1                                   | Mbps      | 0.342 | 3.876 | 11.513 | 1.235       | 0.595      | [22.656]    | 16.502   |
| frame (Note 4)  |           |       |       |        |             |            |             |          |
| UE Category   |           | ≥ 1   | ≥ 1   | ≥ 2    | ≥ 1         | ≥ 1        | ≥2          | ≥ 2      |
| Note 1: 2 symbols allocated to PDCC<br>5 MHz and 3 MHz; 4 symbols |           |       |       |        | el BW; 3 sy | mbols allo | cated to PD | OCCH for |
| Note 2: Reference signal, synchroniz                              |           |       |       |        | S 36.211 [4 | 41.        |             |          |
| Note 3: If more than one Code Block                               |           |       |       |        |             |            | d to each C | Code     |
| Block (otherwise $L = 0$ Bit).                                    |           | .,    |       |        |             |            |             |          |
| Note 4: Given per component carrier                               | per codev | word. |       |        |             |            |             |          |

#### Table A.3.3.2.2-1: Fixed Reference Channel four antenna ports

Note 4: Given per component carrier per codeword.

# A.3.3.3 Reference Measurement Channel for UE-Specific Reference Symbols

## A.3.3.3.1 Two antenna port (CSI-RS)

The reference measurement channels in Table A.3.3.3.1-1 apply for verifying demodulation performance for UE-specific reference symbols with two cell-specific antenna ports and two CSI-RS antenna ports.

|           | Parameter                       | Unit        | Value        |
|-----------|---------------------------------|-------------|--------------|
| Poforono  | e channel                       | Onic        | R.51 FDD     |
|           | bandwidth                       | MHz         |              |
|           |                                 | IVIHZ       | 10           |
|           | I resource blocks               |             | 50 (Note 3)  |
|           | I subframes per Radio Frame     |             | 9            |
| Modulatio |                                 |             | 16QAM        |
|           | oding Rate                      |             | 1/2          |
|           | on Bit Payload                  | 5.          |              |
|           | -Frames 1,4,6,9                 | Bits        | 11448        |
|           | -Frames 2,3,7,8                 | Bits        | 11448        |
|           | -Frame 5                        | Bits        | N/A          |
|           | -Frame 0                        | Bits        | 9528         |
| Number    | of Code Blocks (Note 4)         |             |              |
| For Sub   | o-Frames 1,4,6,9                | Code        | 2            |
|           |                                 | blocks      |              |
| For Sub   | -Frames 2,3,7,8                 | Code        | 2            |
|           |                                 | blocks      |              |
| For Sub   | -Frame 5                        | Bits        | N/A          |
| For Sub   | -Frame 0                        | Bits        | 2            |
| Binary Cl | hannel Bits                     |             |              |
| For Sub   | -Frames 1,4,6,9                 | Bits        | 24000        |
| For Sub   | -Frames 2,7                     |             | 23600        |
| For Sub   | -Frames 3,8                     |             | 23200        |
| For Sub   | -Frame 5                        | Bits        | N/A          |
| For Sub   | -Frame 0                        | Bits        | 19680        |
| Max. Thr  | oughput averaged over 1         | Mbps        | 10.1112      |
| frame     |                                 | -           |              |
| UE Categ  | gory                            |             | ≥ 2          |
| Note 1:   | 2 symbols allocated to PDCC     | Η.          |              |
| Note 2:   | Reference signal, synchroniza   |             | s and PBCH   |
|           | allocated as per TS 36.211 [4   |             |              |
| Note 3:   | 50 resource blocks are allocat  |             |              |
|           | 4, 6, 7, 8, 9 and 41 resource b |             |              |
|           | RB30–RB49) are allocated in     |             |              |
| Note 4:   | If more than one Code Block i   |             |              |
|           | CRC sequence of $L = 24$ Bits   | is attached | to each Code |
|           | Block (otherwise L = 0 Bit).    |             |              |

# Table A.3.3.3.1-1: Fixed Reference Channel for CDM-multiplexed DM RS with two CSI-RS antenna ports

The reference measurement channels in Table A.3.3.3.1-2 apply for verifying demudlation performance for UE-specific reference symbols with two cell specific antenna ports and two CSI-RS antenna ports with ZP CSI-RS and NZP CSI-RS in same subframe.

| Parameter                              | Unit        |                   | Value                  |                   |
|--|-------------|-------------------|------------------------|-------------------|
| Reference channel                      |             | R.52 FDD          | R.53 FDD               | R.54 FDD          |
| Channel bandwidth                      | MHz         | 10                | 10                     | 10                |
| Allocated resource blocks              |             | 50 (Note 3)       | 50 (Note 3)            | 50 (Note 3)       |
| Allocated subframes per Radio Frame    |             | 9                 | 9                      | 9                 |
| Modulation                             |             | 64QAM             | 64QAM                  | 16QAM             |
| Target Coding Rate                     |             | 1/2               | 1/2                    | 1/2               |
| Information Bit Payload                |             |                   |                        |                   |
| For Sub-Frames 1,3,4,6,8,9             | Bits        | 18336             | 18336                  | 11448             |
| For Sub-Frames 2,7                     | Bits        | 16416             | 16416                  | 11448             |
| For Sub-Frame 5                        | Bits        | n/a               | n/a                    | n/a               |
| For Sub-Frame 0                        | Bits        | 14688             | 14688                  | 9528              |
| Number of Code Blocks (Note 4)         |             |                   |                        |                   |
| For Sub-Frames 1,3,4,6,8,9             | Code        | 3                 | 3                      | 2                 |
|  | blocks      |                   |                        |                   |
| For Sub-Frames 2, 7                    | Code        | 3                 | 3                      | 2                 |
|  | blocks      |                   |                        |                   |
| For Sub-Frame 5                        | Bits        | n/a               | n/a                    | n/a               |
| For Sub-Frame 0                        | Bits        | 3                 | 3                      | 2                 |
| Binary Channel Bits                    |             |                   |                        |                   |
| For Sub-Frames 1,3,4,6,8,9             | Bits        | 36000             | 36000                  | 24000             |
| For Sub-Frames 2,7                     |             | 34200             | 33600                  | 22800             |
| For Sub-Frame 5                        | Bits        | n/a               | n/a                    | n/a               |
| For Sub-Frame 0                        | Bits        | 29520             | 29520                  | 19680             |
| Max. Throughput averaged over 1        | Mbps        | 15.7536           | 15.7536                | 10.1112           |
| frame                                  |             |                   |                        |                   |
| Note 1: 2 symbols allocated to PDCC    |             |                   |                        |                   |
| Note 2: Reference signal, synchroniza  |             |                   |                        |                   |
| Note 3: 50 resource blocks are allocat |             |                   | 7, 8, 9 and 41 resourc | ce blocks (RB0–   |
| RB20 and RB30–RB49) are a              |             |                   | · · · · ·              |                   |
| Note 4: If more than one Code Block i  |             | an additional CRC | sequence of L = 24 Bi  | ts is attached to |
| each Code Block (otherwise L           | . = 0 Bit). |                   |                        |                   |

# Table A.3.3.3.1-2: Fixed Reference Channel for CDM-multiplexed DM RS with two CSI-RS antenna ports with ZP CSI-RS and NZP CSI-RS

# A.3.3.3.2 Four antenna ports (CSI-RS)

The reference measurement channels in Table A.3.3.3.2-1 apply for verifying demodulation performance for UE-specific reference symbols with two cell-specific antenna ports and four CSI-RS antenna ports.

| Parameter   | Unit  |              | Value          |                |  |  |  |  |
|---|---|--------------|----------------|----------------|--|--|--|--|
| Reference channel   |   | R.43 FDD     | R.50 FDD       | R.48 FDD       |  |  |  |  |
| Channel bandwidth   | MHz   | 10           | 10             | 10             |  |  |  |  |
| Allocated resource blocks   |   | 50 (Note 3)  | 50 (Note 3)    | 50 (Note       |  |  |  |  |
| Allocated subframes per Radio Frame                                     |   | 9            | 9              | <u>3)</u><br>9 |  |  |  |  |
| Modulation  |   | QPSK         | 64QAM          | QPSK           |  |  |  |  |
| Target Coding Rate  |   | 1/3          | 1/2            |                |  |  |  |  |
| Information Bit Payload   |   |              |                |                |  |  |  |  |
| For Sub-Frames 1,4,6,9  | Bits  | 3624         | 18336          | 6200           |  |  |  |  |
| For Sub-Frames 2,3,7,8  | Bits  | 3624         | 16416          | 6200           |  |  |  |  |
| For Sub-Frame 5   | Bits  | N/A          | N/A            | N/A            |  |  |  |  |
| For Sub-Frame 0   | Bits  | 2984         | 14688          | 4968           |  |  |  |  |
| Number of Code Blocks (Note 4)  |   |              |                |                |  |  |  |  |
| For Sub-Frames 1,4,6,9  | Code  | 1            | 3              | 2              |  |  |  |  |
|   | blocks  |              |                |                |  |  |  |  |
| For Sub-Frames 2,3,7,8  | Code  | 1            | 3              | 2              |  |  |  |  |
|   | blocks  |              |                |                |  |  |  |  |
| For Sub-Frame 5   | Bits  | N/A          | N/A            | N/A            |  |  |  |  |
| For Sub-Frame 0   | Bits  | 1            | 3              | 1              |  |  |  |  |
| Binary Channel Bits   |   |              |                |                |  |  |  |  |
| For Sub-Frames 1,4,6,9  | Bits  | 12000 36000  |                | 12000          |  |  |  |  |
| For Sub-Frames 2,7  |   | 11600        | 34800          | 11600          |  |  |  |  |
| For Sub-Frames 3,8  |   | 11600        | 34800          | 12000          |  |  |  |  |
| For Sub-Frame 5   | Bits  | N/A          | N/A            | N/A            |  |  |  |  |
| For Sub-Frame 0   | Bits  | 9840         | 29520          | 9840           |  |  |  |  |
| Max. Throughput averaged over 1<br>frame                                | Mbps  | 3.1976       | 15.3696        | 5.4568         |  |  |  |  |
| UE Category   |   | ≥ 1          | ≥2             | ≥ 1            |  |  |  |  |
| Note 1: 2 symbols allocated to PDCC                                     | 4   | - 1          | - 2            | = 1            |  |  |  |  |
| Note 2: Reference signal, synchroniza                                   |   | s and PBCH a | llocated as pe | r TS 36.211    |  |  |  |  |
|   | [4].<br>For R.31-1 and R.34-1, 50 resource blocks are allocated in sub-frames 1, 2, 3, 4, 6, 7, 8, 9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in |              |                |                |  |  |  |  |
| Note 4: If more than one Code Block is<br>Bits is attached to each Code |   |              |                | e of L = 24    |  |  |  |  |

# Table A.3.3.3.2-1: Fixed Reference Channel for CDM-multiplexed DM RS with four CSI-RS antenna ports

The reference measurement channels in Table A.3.3.3.2-2 apply for verifying FDD PMI accuracy measurement with two CRS antenna ports and four CSI-RS antenna ports.

| Parameter   | Unit              |                 | Value        |         |
|---|-------------------|-----------------|--------------|---------|
| Reference channel   |                   | R.44            | R.45         | R.45-1  |
|   |                   | FDD             | FDD          | FDD     |
| Channel bandwidth   | MHz               | 10              | 10           | 10      |
| Allocated resource blocks   |                   | 50 <sup>3</sup> | $50^{3}$     | 39      |
| Allocated subframes per Radio Frame   |                   | 10              | 10           | 10      |
| Modulation  |                   | QPSK            | 16QAM        | 16QAM   |
| Target Coding Rate  |                   | 1/3             | 1/2          | 1/2     |
| Information Bit Payload   |                   |                 |              |         |
| For Sub-Frames (Non CSI-RS subframe)  | Bits              | 3624            | 11448        | 8760    |
| For Sub-Frames (CSI-RS subframe)  | Bits              | 3624            | 11448        | 8760    |
| For Sub-Frames (ZeroPowerCSI-RS subframe)   | Bits              | N/A             | N/A          | N/A     |
| For Sub-Frame 5   | Bits              | N/A             | N/A          | N/A     |
| For Sub-Frame 0   | Bits              | 2984            | 9528         | 8760    |
| Number of Code Blocks per Sub-Frame   | DIIS              | 2904            | 9520         | 8700    |
| (Note 4)  |                   |                 |              |         |
| For Sub-Frames (Non CSI-RS subframe)  |                   | 1               | 2            | 2       |
| For Sub-Frames (CSI-RS subframe)  |                   | 1               | 2            | 2       |
| For Sub-Frames (ZeroPowerCSI-RS   | Bits              | N/A             | N/A          | N/A     |
| subframe)   |                   |                 |              |         |
| For Sub-Frame 5   |                   | N/A             | N/A          | N/A     |
| For Sub-Frame 0   |                   | 1               | 2            | 2       |
| Binary Channel Bits Per Sub-Frame   |                   |                 |              |         |
| For Sub-Frames (Non CSI-RS subframe)  | Bits              | 12000           | 24000        | 18720   |
| For Sub-Frames (CSI-RS subframe)  | Bits              | 11600           | 23200        | 18096   |
| For Sub-Frames (ZeroPowerCSI-RS   | Bits              | N/A             | N/A          | N/A     |
| subframe)   |                   |                 |              |         |
| For Sub-Frame 5   | Bits              | N/A             | N/A          | N/A     |
| For Sub-Frame 0   | Bits              | 9840            | 19680        | 18720   |
| Max. Throughput averaged over 1 frame   | Mbps              | 3.1976          | 10.1112      | 7.884   |
| UE Category   |                   | ≥ 1             | ≥2           | ≥ 1     |
| Note 1: 2 symbols allocated to PDCCH for<br>symbols allocated to PDCCH for 5<br>for 1.4 MHz |                   |                 |              |         |
| Note 2: Reference signal, synchronization   | signals and PB    | CH allocated a  | s per TS 36. | 211 [4] |
| Note 3: For R. 44 and R.45, 50 resource b   |                   |                 |              |         |
| and 41 resource blocks (RB0-RB2   |                   |                 |              |         |
| Note 4: If more than one Code Block is pre<br>attached to each Code Block (othe             | esent, an additio |                 |              |         |

# A.3.4 Reference measurement channels for PDSCH performance requirements (TDD)

# A.3.4.1 Single-antenna transmission (Common Reference Symbols)

|           | Parameter                                    | Unit         |             | Valu       | е        |       |
|-----------|--|--------------|-------------|------------|----------|-------|
| Referenc  | e channel                                    |              | R.4         | R.42       |          | R.2   |
|           |  |              | TDD         | TDD        |          | TDD   |
| Channel   | bandwidth                                    | MHz          | 1.4         | 20         |          | 10    |
| Allocated | l resource blocks (Note 6)                   |              | 6           | 100        |          | 50    |
|           | ownlink Configuration (Note 4)               |              | 1           | 1          |          | 1     |
|           | subframes per Radio Frame (D+S)              |              | 3           | 3+2        |          | 3+2   |
| Modulatio |  |              | QPSK        | QPSK       |          | QPSK  |
| Target Co | oding Rate                                   |              | 1/3         | 1/3        |          | 1/3   |
|           | on Bit Payload (Note 6)                      |              |             |            |          |       |
|           | -Frames 4,9                                  | Bits         | 408         | 8760       |          | 4392  |
| For Sub   | -Frames 1,6                                  | Bits         | N/A         | 7736       |          | 3240  |
|           | -Frame 5                                     | Bits         | N/A         | N/A        |          | N/A   |
|           | -Frame 0                                     | Bits         | 208         | 8760       |          | 4392  |
| Number of | of Code Blocks                               |              |             |            |          |       |
| (Notes 5  | and 6)                                       |              |             |            |          |       |
| For Sub   | -Frames 4,9                                  |              | 1           | 2          |          | 1     |
| For Sub   | -Frames 1,6                                  |              | N/A         | 2          |          | 1     |
| For Sub   | -Frame 5                                     |              | N/A         | N/A        |          | N/A   |
| For Sub   | -Frame 0                                     |              | 1           | 2          |          | 1     |
| Binary Ch | nannel Bits (Note 6)                         |              |             |            |          |       |
| For Sub   | -Frames 4,9                                  | Bits         | 1368        | 27600      |          | 13800 |
| For Sub   | -Frames 1,6                                  | Bits         | N/A         | 22656      |          | 11256 |
| For Sub   | -Frame 5                                     | Bits         | N/A         | N/A        |          | N/A   |
| For Sub   | -Frame 0                                     | Bits         | 672         | 26904      |          | 13104 |
|           | oughput averaged over 1 frame                | Mbps         | 0.102       | 4.175      |          | 1.966 |
| (Note 6)  |  |              |             |            |          |       |
| UE Categ  | gory   |              | ≥ 1         | ≥ 1        |          | ≥1    |
| Note 1:   | 2 symbols allocated to PDCCH for 2           | 20 MHz, 15 I | MHz and     | 10 MHz ch  | annel E  | 3W; 3 |
|           | symbols allocated to PDCCH for 5 M           |              |             |            |          |       |
|           | PDCCH for 1.4 MHz. For subframe              | 1&6, only 2  | OFDM sy     | mbols are  | allocate | ed to |
|           | PDCCH.                                       |              |             |            |          |       |
| Note 2:   | For BW=1.4 MHz, the information bi           |              |             |            |          |       |
|           | zero (no scheduling) to avoid proble         | ms with insi | ufficient P | DCCH per   | forman   | ce at |
| Note 2:   | the test point.                              | ianala and F |             | aatad ac m | ~ TO 0   | 6 014 |
| Note 3:   | Reference signal, synchronization s          | ignais and F | BCH allo    | cated as p | er 153   | 0.211 |
| Note 4:   | [4].<br>As per Table 4.2-2 in TS 36.211 [4]. |              |             |            |          |       |
| Note 4:   | If more than one Code Block is pres          |              | itional CP  | C sequenc  | ofl-     | - 21  |
| 11010 0.  | Bits is attached to each Code Block          | (otherwise   | L = 0 Bit). | C Sequenc  |          | - 27  |
| Note 6:   | Given per component carrier per co           |              | ,.          |            |          |       |

### Table A.3.4.1-1: Fixed Reference Channel QPSK R=1/3

| Parameter  | Unit       |             |            |                 |               |             |      |
|--|------------|-------------|------------|-----------------|---------------|-------------|------|
| Reference channel  |            |             |            | R.3-1           | R.3           |             |      |
|  |            |             |            | TDD             | TDD           |             |      |
| Channel bandwidth  | MHz        | 1.4         | 3          | 5               | 10            | 15          | 20   |
| Allocated resource blocks  |            |             |            | 25              | 50            |             |      |
| Uplink-Downlink Configuration (Note 3)   |            |             |            | 1               | 1             |             |      |
| Allocated subframes per Radio Frame (D+S)  |            |             |            | 3+2             | 3+2           |             |      |
| Modulation   |            |             |            | 16QAM           | 16QAM         |             |      |
| Target Coding Rate   |            |             |            | 1/2             | 1/2           |             |      |
| Information Bit Payload  |            |             |            |                 |               |             |      |
| For Sub-Frames 4,9   | Bits       |             |            | 6456            | 14112         |             |      |
| For Sub-Frames 1,6   | Bits       |             |            | 5160            | 11448         |             |      |
| For Sub-Frame 5  | Bits       |             |            | N/A             | N/A           |             |      |
| For Sub-Frame 0  | Bits       |             |            | 5736            | 12960         |             |      |
| Number of Code Blocks per Sub-Frame  |            |             |            |                 |               |             |      |
| (Note 4)   |            |             |            |                 |               |             |      |
| For Sub-Frames 4,9   |            |             |            | 2               | 3             |             |      |
| For Sub-Frames 1,6   |            |             |            | 1               | 2             |             |      |
| For Sub-Frame 5  |            |             |            | N/A             | N/A           |             |      |
| For Sub-Frame 0  |            |             |            | 1               | 3             |             |      |
| Binary Channel Bits Per Sub-Frame  |            |             |            |                 |               |             |      |
| For Sub-Frames 4,9   | Bits       |             |            | 12600           | 27600         |             |      |
| For Sub-Frames 1,6   | Bits       |             |            | 11112           | 22512         |             |      |
| For Sub-Frame 5  | Bits       |             |            | N/A             | N/A           |             |      |
| For Sub-Frame 0  | Bits       |             |            | 11208           | 26208         |             |      |
| Max. Throughput averaged over 1 frame  | Mbps       |             |            | 2.897           | 6.408         |             |      |
| UE Category  |            |             |            | ≥ 1             | ≥2            |             |      |
| Note 1: 2 symbols allocated to PDCCH for 2                                       | 20 MHz, 1  | 5 MHz an    | d 10 MHz   | channel BW      | /; 3 symbol   | s allocated | d to |
| PDCCH for 5 MHz and 3 MHz; 4 sy  | mbols allo | cated to F  | DCCH for   | r 1.4 MHz. F    | or subfram    | ne 1&6, on  | ly 2 |
| OFDM symbols are allocated to PD   |            |             |            |                 |               |             |      |
| Note 2: Reference signal, synchronization s                                      |            | d PBCH al   | located as | s per TS 36.    | 211 [4]       |             |      |
| Note 3: As per Table 4.2-2 in TS 36.211 [4].                                     |            |             |            |                 |               |             |      |
| Note 4: If more than one Code Block is pres<br>Code Block (otherwise L = 0 Bit). | sent, an a | dditional C | RC seque   | ence of $L = 2$ | 24 Bits is at | tached to   | each |

### Table A.3.4.1-2: Fixed Reference Channel 16QAM R=1/2

| Parameter  | Unit       |             |             | Val         | ue           |             |        |  |
|--|------------|-------------|-------------|-------------|--------------|-------------|--------|--|
| Reference channel  |            |             | R.5         | R.6 TDD     | R.7          | R.8         | R.9    |  |
|  |            |             | TDD         |             | TDD          | TDD         | TDD    |  |
| Channel bandwidth  | MHz        | 1.4         | 3           | 5           | 10           | 15          | 20     |  |
| Allocated resource blocks  |            |             | 15          | 25          | 50           | 75          | 100    |  |
| Uplink-Downlink Configuration (Note 3)   |            |             | 1           | 1           | 1            | 1           | 1      |  |
| Allocated subframes per Radio Frame (D+S)  |            |             | 3+2         | 3+2         | 3+2          | 3+2         | 3+2    |  |
| Modulation   |            | 64QAM       | 64QAM       | 64QAM       | 64QAM        | 64QAM       | 64QAM  |  |
| Target Coding Rate   |            |             | 3/4         | 3/4         | 3/4          | 3/4         | 3/4    |  |
| Information Bit Payload  |            |             |             |             |              |             |        |  |
| For Sub-Frames 4,9   | Bits       |             | 8504        | 14112       | 30576        | 46888       | 61664  |  |
| For Sub-Frames 1,6   | Bits       |             | 6968        | 11448       | 23688        | 35160       | 46888  |  |
| For Sub-Frame 5  | Bits       |             | N/A         | N/A         | N/A          | N/A         | N/A    |  |
| For Sub-Frame 0  | Bits       |             | 6968        | 12576       | 30576        | 45352       | 61664  |  |
| Number of Code Blocks per Sub-Frame  |            |             |             |             |              |             |        |  |
| (Note 4)   |            |             |             |             |              |             |        |  |
| For Sub-Frames 4,9   |            |             | 2           | 3           | 5            | 8           | 11     |  |
| For Sub-Frames 1,6   |            |             | 2           | 2           | 4            | 6           | 8      |  |
| For Sub-Frame 5  |            |             | N/A         | N/A         | N/A          | N/A         | N/A    |  |
| For Sub-Frame 0  |            |             | 2           | 3           | 5            | 8           | 11     |  |
| Binary Channel Bits Per Sub-Frame  |            |             |             |             |              |             |        |  |
| For Sub-Frames 4,9   | Bits       |             | 11340       | 18900       | 41400        | 62100       | 82800  |  |
| For Sub-Frames 1,6   | Bits       |             | 9828        | 16668       | 33768        | 50868       | 67968  |  |
| For Sub-Frame 5  | Bits       |             | N/A         | N/A         | N/A          | N/A         | N/A    |  |
| For Sub-Frame 0  | Bits       |             | 9252        | 16812       | 39312        | 60012       | 80712  |  |
| Max. Throughput averaged over 1 frame  | Mbps       |             | 3.791       | 6.370       | 13.910       | 20.945      | 27.877 |  |
| UE Category  |            |             | ≥ 1         | ≥2          | ≥2           | ≥ 2         | ≥ 3    |  |
| Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols |            |             |             |             |              |             |        |  |
| are allocated to PDCCH.  | ianala ard |             | acted or -  | TO 26 24    | 4 [4]        |             |        |  |
| Note 2: Reference signal, synchronization s<br>Note 3: As per Table 4.2-2 TS 36.211 [4].   | ignais and |             | caleu as pe | 13 30.21    | 1 [4]        |             |        |  |
|  | ont an ad  | ditional CP |             | e of I = 24 | Rite is atta | ched to oor | h Code |  |
| Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code   |            |             |             |             |              |             |        |  |

Table A.3.4.1-3: Fixed Reference Channel 64QAM R=3/4

Block (otherwise L = 0 Bit).

| Parameter  | Unit |  |       | Va    | lue   |       |        |  |
|--|------|--|-------|-------|-------|-------|--------|--|
| Reference channel  |      |  | R.6-1 | R.7-1 | R.8-1 | R.9-1 | R.9-2  |  |
|  |      |  | TDD   | TDD   | TDD   | TDD   | TDD    |  |
| Channel bandwidth  | MHz  |  | 5     | 10    | 15    | 20    | 20     |  |
| Allocated resource blocks (Note 3)   |      |  | 18    | 17    | 17    | 17    | 83     |  |
| Uplink-Downlink Configuration (Note 4)   |      |  | 1     | 1     | 1     | 1     | 1      |  |
| Allocated subframes per Radio Frame (D+S)  |      |  | 3+2   | 3+2   | 3+2   | 3+2   | 3+2    |  |
| Modulation   |      |  | 64QAM | 64QAM | 64QAM | 64QAM | 64QAM  |  |
| Target Coding Rate   |      |  | 3/4   | 3/4   | 3/4   | 3/4   | 3/4    |  |
| Information Bit Payload  |      |  |       |       |       |       |        |  |
| For Sub-Frames 4,9   | Bits |  | 10296 | 10296 | 10296 | 10296 | 51024  |  |
| For Sub-Frames 1,6   | Bits |  | 8248  | 7480  | 7480  | 7480  | 39232  |  |
| For Sub-Frame 5  | Bits |  | N/A   | N/A   | N/A   | N/A   | N/A    |  |
| For Sub-Frame 0  | Bits |  | 8248  | 10296 | 10296 | 10296 | 51024  |  |
| Number of Code Blocks per Sub-Frame  |      |  |       |       |       |       |        |  |
| (Note 5)   |      |  |       |       |       |       |        |  |
| For Sub-Frames 4,9   |      |  | 2     | 2     | 2     | 2     | 9      |  |
| For Sub-Frames 1,6   |      |  | 2     | 2     | 2     | 2     | 7      |  |
| For Sub-Frame 5  |      |  | N/A   | N/A   | N/A   | N/A   | N/A    |  |
| For Sub-Frame 0  |      |  | 2     | 2     | 2     | 2     | 9      |  |
| Binary Channel Bits Per Sub-Frame  |      |  |       |       |       |       |        |  |
| For Sub-Frames 4,9   | Bits |  | 13608 | 14076 | 14076 | 14076 | 68724  |  |
| For Sub-Frames 1,6   | Bits |  | 11880 | 11628 | 11628 | 11628 | 56340  |  |
| For Sub-Frame 5  | Bits |  | N/A   | N/A   | N/A   | N/A   | N/A    |  |
| For Sub-Frame 0  | Bits |  | 11520 | 14076 | 14076 | 14076 | 66636  |  |
| Max. Throughput averaged over 1 frame  | Mbps |  | 4.534 | 4.585 | 4.585 | 4.585 | 23.154 |  |
| UE Category  |      |  | ≥1    | ≥ 1   | ≥ 1   | ≥ 1   | ≥ 2    |  |
| Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH. |      |  |       |       |       |       |        |  |
| Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]  |      |  |       |       |       |       |        |  |

| Table A.3.4.1-3a: Fixed Reference Ch | nannel 64QAM R=3/4 |
|--------------------------------------|--------------------|
|--------------------------------------|--------------------|

Note 3:

Note 4:

Localized allocation started from RB #0 is applied. As per Table 4.2-2 TS 36.211 [4]. If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit). Note 5:

| Parameter                                    | Unit        | Value       |              |             |                 |          |     |  |
|--|-------------|-------------|--------------|-------------|-----------------|----------|-----|--|
| Reference channel                            |             |             | R.0          |             | R.1 TDD         |          |     |  |
|  |             |             | TDD          |             |                 |          |     |  |
| Channel bandwidth                            | MHz         | 1.4         | 3            | 5           | 10/20           | 15       | 20  |  |
| Allocated resource blocks                    |             |             | 1            |             | 1               |          |     |  |
| Uplink-Downlink Configuration (Note 3)       |             |             | 1            |             | 1               |          |     |  |
| Allocated subframes per Radio Frame (D+S)    |             |             | 3+2          |             | 3+2             |          |     |  |
| Modulation                                   |             |             | 16QAM        |             | 16QAM           |          |     |  |
| Target Coding Rate                           |             |             | 1/2          |             | 1/2             |          |     |  |
| Information Bit Payload                      |             |             |              |             |                 |          |     |  |
| For Sub-Frames 4,9                           | Bits        |             | 224          |             | 256             |          |     |  |
| For Sub-Frames 1,6                           | Bits        |             | 208          |             | 208             |          |     |  |
| For Sub-Frame 5                              | Bits        |             | N/A          |             | N/A             |          |     |  |
| For Sub-Frame 0                              | Bits        |             | 224          |             | 256             |          |     |  |
| Number of Code Blocks per Sub-Frame          |             |             |              |             |                 |          |     |  |
| (Note 4)                                     |             |             |              |             |                 |          |     |  |
| For Sub-Frames 4,9                           |             |             | 1            |             | 1               |          |     |  |
| For Sub-Frames 1,6                           |             |             | 1            |             | 1               |          |     |  |
| For Sub-Frame 5                              |             |             | N/A          |             | N/A             |          |     |  |
| For Sub-Frame 0                              |             |             | 1            |             | 1               |          |     |  |
| Binary Channel Bits Per Sub-Frame            |             |             |              |             |                 |          |     |  |
| For Sub-Frames 4,9                           | Bits        |             | 504          |             | 552             |          |     |  |
| For Sub-Frames 1,6                           | Bits        |             | 456          |             | 456             |          |     |  |
| For Sub-Frame 5                              | Bits        |             | N/A          |             | N/A             |          |     |  |
| For Sub-Frame 0                              | Bits        |             | 504          |             | 552             |          |     |  |
| Max. Throughput averaged over 1 frame        | Mbps        |             | 0.109        |             | 0.118           |          |     |  |
| UE Category                                  |             |             | ≥ 1          |             | ≥ 1             |          |     |  |
| Note 1: 2 symbols allocated to PDCCH for 2   |             |             |              |             |                 |          |     |  |
| PDCCH for 5 MHz and 3 MHz; 4 syr             |             | ated to PI  | DCCH for 1.4 | 4 MHz. Fo   | or subframe 1   | &6, only | 2   |  |
| OFDM symbols are allocated to PD0            |             |             |              |             |                 |          |     |  |
| Note 2: Reference signal, synchronization si | ignals and  | PBCH allo   | ocated as pe | er TS 36.2  | 11 [4]          |          |     |  |
| Note 3: As per Table 4.2-2 in TS 36.211 [4]. |             |             |              |             |                 |          |     |  |
| Note 4: If more than one Code Block is pres  | ent, an ado | ditional CF | RC sequence  | e of L = 24 | 4 Bits is attac | hed to e | ach |  |
| Code Block (otherwise L = 0 Bit).            |             |             |              |             |                 |          |     |  |

| Table A.3.4.1-4: Fixed Reference Channel Single PRB |
|---|
|---|

|               | Parameter                            | Unit       | Value               |
|---------------|--------------------------------------|------------|---------------------|
| Reference cl  | nannel                               |            | R.29 TDD            |
|               |                                      |            | (MBSFN)             |
| Channel ban   | dwidth                               | MHz        | 10                  |
| Allocated res | ource blocks                         |            | 1                   |
| MBSFN Con     | figuration (Note 3)                  |            | 010010              |
| Uplink-Down   | link Configuration (Note 4)          |            | 1                   |
| Allocated sul | oframes per Radio Frame (D+S)        |            | 1+2                 |
| Modulation    |                                      |            | 16QAM               |
| Target Codir  | g Rate                               |            | 1/2                 |
| Information E | Bit Payload                          |            |                     |
| For Sub-Fra   | ames 4,9                             | Bits       | 0 (MBSFN)           |
| For Sub-Fra   | ames 1,6                             | Bits       | 208                 |
| For Sub-Fra   | ame 5                                | Bits       | N/A                 |
| For Sub-Fra   | ame 0                                | Bits       | 256                 |
| Number of C   | ode Blocks per Sub-Frame             |            |                     |
| (Note 5)      |                                      |            |                     |
| For Sub-Fra   | ames 4,9                             | Bits       | 0 (MBSFN)           |
| For Sub-Fra   | ames 1,6                             | Bits       | 1                   |
| For Sub-Fra   | ame 5                                | Bits       | N/A                 |
| For Sub-Fra   | ame 0                                | Bits       | 1                   |
| Binary Chan   | nel Bits Per Sub-Frame               |            |                     |
| For Sub-Fra   | ames 4,9                             | Bits       | 0 (MBSFN)           |
| For Sub-Fra   | ames 1,6                             | Bits       | 456                 |
| For Sub-Fra   |                                      | Bits       | N/A                 |
| For Sub-Fra   | ame 0                                | Bits       | 552                 |
| Max. Throug   | hput averaged over 1 frame           | kbps       | 67.2                |
| UE Category   |                                      |            | ≥1                  |
| Note 1: 2     | symbols allocated to PDCCH.          |            |                     |
|               | eference signal, synchronization s   | ignals and | PBCH allocated as   |
|               | er TS 36.211 [4].                    |            |                     |
|               | BSFN Subframe Allocation as def      |            | one frame with 6    |
| -             | ts is chosen for MBSFN subframe      |            |                     |
|               | per Table 4.2-2 in TS 36.211 [4].    |            |                     |
|               | more than one Code Block is pres     |            |                     |
|               | equence of $L = 24$ Bits is attached | to each Co | ae BIOCK (Otherwise |
| L             | = 0 Bit).                            |            |                     |

| Parameter                                   | Unit  |           |           | Va        | alue          |           |         |
|---|---|-----------|-----------|-----------|---------------|-----------|---------|
| Reference channel                           |   |           |           |           | R.41          |           |         |
|   |   |           |           |           | TDD           |           |         |
| Channel bandwidth                           | MHz   | 1.4       | 3         | 5         | 10            | 15        | 20      |
| Allocated resource blocks                   |   |           |           |           | 50            |           |         |
| Uplink-Downlink Configuration (Note 4)      |   |           |           |           | 1             |           |         |
| Allocated subframes per Radio Frame (D+S)   |   |           |           |           | 3+2           |           |         |
| Modulation                                  |   |           |           |           | QPSK          |           |         |
| Target Coding Rate                          |   |           |           |           | 1/10          |           |         |
| Information Bit Payload                     |   |           |           |           |               |           |         |
| For Sub-Frames 4,9                          | Bits  |           |           |           | 1384          |           |         |
| For Sub-Frames 1,6                          | Bits  |           |           |           | 1032          |           |         |
| For Sub-Frame 5                             | Bits  |           |           |           | N/A           |           |         |
| For Sub-Frame 0                             | Bits  |           |           |           | 1384          |           |         |
| Number of Code Blocks per Sub-Frame         |   |           |           |           |               |           |         |
| (Note 5)                                    |   |           |           |           |               |           |         |
| For Sub-Frames 4,9                          |   |           |           |           | 1             |           |         |
| For Sub-Frames 1,6                          |   |           |           |           | 1             |           |         |
| For Sub-Frame 5                             |   |           |           |           | N/A           |           |         |
| For Sub-Frame 0                             |   |           |           |           | 1             |           |         |
| Binary Channel Bits Per Sub-Frame           |   |           |           |           |               |           |         |
| For Sub-Frames 4,9                          | Bits  |           |           |           | 13800         |           |         |
| For Sub-Frames 1,6                          | Bits  |           |           |           | 11256         |           |         |
| For Sub-Frame 5                             | Bits  |           |           |           | N/A           |           |         |
| For Sub-Frame 0                             | Bits  |           |           |           | 13104         |           |         |
| Max. Throughput averaged over 1 frame       | Mbps  |           |           |           | 0.622         |           |         |
| UE Category                                 |   |           |           |           | ≥1            |           |         |
| Note 1: 2 symbols allocated to PDCCH for 2  |   |           |           |           |               |           |         |
| to PDCCH for 5 MHz and 3 MHz; 4             | symbols allo  | ocated to | PDCCH     | for 1.4 M | Hz. For su    | ıbframe   | 1&6,    |
| only 2 OFDM symbols are allocated           |   |           |           |           |               |           |         |
| Note 2: For BW=1.4 MHz, the information b   |   |           |           |           | et to zero (i | no sche   | duling) |
|   | pid problems with insufficient PDCCH performance at the test point. |           |           |           |               |           |         |
| Note 3: Reference signal, synchronization s |   | PBCH allo | ocated as | per TS 3  | 36.211 [4]    |           |         |
| Note 4: As per Table 4.2-2 in TS 36.211 [4] |   |           | _         |           |               |           |         |
| Note 5: If more than one Code Block is pres |   | tional CR | C seque   | nce of L  | = 24 Bits is  | s attache | ed to   |
| each Code Block (otherwise L = 0 E          | Bit).   |           |           |           |               |           |         |

Table A.3.4.1-6: Fixed Reference Channel QPSK R=1/10

| Parameter                                | Unit                            | Value     |  |  |  |  |  |
|--|---------------------------------|-----------|--|--|--|--|--|
| Reference channel                        |                                 | R.49 TDD  |  |  |  |  |  |
| Channel bandwidth                        | MHz                             | 20        |  |  |  |  |  |
| Allocated resource blocks                |                                 | 100       |  |  |  |  |  |
| Uplink-Downlink Configuration (Note 1)   |                                 | 1         |  |  |  |  |  |
| Allocated subframes per Radio Frame      |                                 | 3+2       |  |  |  |  |  |
| (D+S)                                    |                                 |           |  |  |  |  |  |
| Modulation                               |                                 | 64QAM     |  |  |  |  |  |
| Number of OFDM symbols for PDCCH         |                                 |           |  |  |  |  |  |
| per component carrier                    |                                 |           |  |  |  |  |  |
| For Sub-Frames 0,4,5,9                   | OFDM                            | 3         |  |  |  |  |  |
|  | symbols                         |           |  |  |  |  |  |
| For Sub-Frames 1,6                       | OFDM                            | 2         |  |  |  |  |  |
|  | symbols                         |           |  |  |  |  |  |
| Target Coding Rate                       |                                 |           |  |  |  |  |  |
| For Sub-Frames 4,9                       |                                 | 0.84      |  |  |  |  |  |
| For Sub-Frames 1,6                       |                                 | 0.81      |  |  |  |  |  |
| For Sub-Frames 5                         |                                 | N/A       |  |  |  |  |  |
| For Sub-Frames 0                         |                                 | 0.87      |  |  |  |  |  |
| Information Bit Payload                  |                                 |           |  |  |  |  |  |
| For Sub-Frames 0, 4, 9                   | Bits                            | 63776     |  |  |  |  |  |
| For Sub-Frame 1,6                        | Bits                            | 55056     |  |  |  |  |  |
| For Sub-Frame 5                          | Bits                            | N/A       |  |  |  |  |  |
| Number of Code Blocks per Sub-Frame      |                                 |           |  |  |  |  |  |
| (Note 2)                                 |                                 |           |  |  |  |  |  |
| For Sub-Frames 0, 4, 9                   | Code                            | 11        |  |  |  |  |  |
|  | Blocks                          |           |  |  |  |  |  |
| For Sub-Frame 1,6                        | Code                            | 9         |  |  |  |  |  |
|  | Blocks                          |           |  |  |  |  |  |
| For Sub-Frame 5                          | Code                            | N/A       |  |  |  |  |  |
|  | Blocks                          |           |  |  |  |  |  |
| Binary Channel Bits Per Sub-Frame        |                                 |           |  |  |  |  |  |
| For Sub-Frames 4,9                       | Bits                            | 75600     |  |  |  |  |  |
| For Sub-Frame 1,6                        | Bits                            | 67968     |  |  |  |  |  |
| For Sub-Frame 5                          | Bits                            | N/A       |  |  |  |  |  |
| For Sub-Frame 0                          | Bits                            | 73512     |  |  |  |  |  |
| Max. Throughput averaged over 1 frame    | Mbps                            | 30.144    |  |  |  |  |  |
| UE Category                              |                                 | ≥5        |  |  |  |  |  |
| Note 1: Reference signal, synchronizatio | n signals an                    | d PBC     |  |  |  |  |  |
| allocated as per TS 36.211 [4].          | allocated as per TS 36.211 [4]. |           |  |  |  |  |  |
| Note 2: If more than one Code Block is p |                                 |           |  |  |  |  |  |
| CRC sequence of $L = 24$ Bits is a       | attached to e                   | each Code |  |  |  |  |  |
| Block (otherwise $L = 0$ Bit).           |                                 |           |  |  |  |  |  |

## Table A.3.4.1-7: PCell Fixed Reference Channel for CA demodulation with power imbalance

# A.3.4.2 Multi-antenna transmission (Common Reference Signals)

### A.3.4.2.1 Two antenna ports

| Parameter  | Unit |             |             |               |               |                         | Value         |             |               |               |
|--|------|-------------|-------------|---------------|---------------|-------------------------|---------------|-------------|---------------|---------------|
| Reference channel                                    |      | R.10<br>TDD | R.11<br>TDD | R.11-1<br>TDD | R.11-2<br>TDD | R.11-3<br>TDD<br>Note 6 | R.11-4<br>TDD | R.30<br>TDD | R.30-1<br>TDD | R.30-2<br>TDD |
| Channel bandwidth                                    | MHz  | 10          | 10          | 10            | 5             | 10                      | 10            | 20          | 20            | 20            |
| Allocated resource blocks (Note 5)                   |      | 50          | 50          | 50            | 25            | 40                      | 50            | 100         | 100           | 100           |
| Uplink-Downlink<br>Configuration (Note<br>3)         |      | 1           | 1           | 1             | 1             | 1                       | 1             | 1           | 1             | 1             |
| Allocated subframes<br>per Radio Frame<br>(D+S)      |      | 3+2         | 3+2         | 2+2           | 3+2           | 3+2                     | 2             | 3+2         | 2+2           | 2             |
| Modulation   |      | QPSK        | 16QAM       | 16QAM         | 16QAM         | 16QAM                   | QPSK          | 16QAM       | 16QAM         | 16QAM         |
| Target Coding Rate                                   |      | 1/3         | 1/2         | 1/2           | 1/2           | 1/2                     | 1/2           | 1/2         | 1/2           | 1/2           |
| Information Bit<br>Payload (Note 5)                  |      |             |             |               |               |                         |               |             |               |               |
| For Sub-Frames 4,9                                   | Bits | 4392        | 12960       | 12960         | 5736          | 10296                   | 6968          | 25456       | 25456         | 25456         |
| For Sub-Frames 1,6                                   |      | 3240        | 9528        | 9528          | 5160          | 9144                    | N/A           | 22920       | 21384         | N/A           |
| For Sub-Frame 5                                      | Bits | N/A         | N/A         | N/A           | N/A           | N/A                     | N/A           | N/A         | N/A           | N/A           |
| For Sub-Frame 0                                      | Bits | 4392        | 12960       | N/A           | 4968          | 10296                   | N/A           | 25456       | N/A           | N/A           |
| Number of Code<br>Blocks<br>(Notes 4 and 5)          |      |             |             |               |               |                         |               |             |               |               |
| For Sub-Frames 4,9                                   |      | 1           | 3           | 3             | 1             | 2                       | 2             | 5           | 5             | 5             |
| For Sub-Frames 1,6                                   |      | 1           | 2           | 2             | 1             | 2                       | N/A           | 4           | 4             | N/A           |
| For Sub-Frame 5                                      |      | N/A         | N/A         | N/A           | N/A           | N/A                     | N/A           | N/A         | N/A           | N/A           |
| For Sub-Frame 0                                      |      | 1           | 3           | N/A           | 1             | 2                       | N/A           | 5           | N/A           | N/A           |
| Binary Channel Bits (Note 5)                         |      |             |             |               |               |                         |               |             |               |               |
| For Sub-Frames 4,9                                   | Bits | 13200       | 26400       | 26400         | 12000         | 21120                   | 13200         | 52800       | 52800         | 52800         |
| For Sub-Frames 1,6                                   |      | 10656       | 21312       | 21312         | 10512         | 16992                   | 10656         | 42912       | 42912         | N/A           |
| For Sub-Frame 5                                      | Bits | N/A         | N/A         | N/A           | N/A           | N/A                     | N/A           | N/A         | N/A           | N/A           |
| For Sub-Frame 0                                      | Bits | 12528       | 25056       | N/A           | 10656         | 19776                   | 12528         | 51456       | N/A           | N/A           |
| Max. Throughput<br>averaged over 1<br>frame (Note 5) | Mbps | 1.966       | 5.794       | 4.498         | 2.676         | 4.918                   | 1.39          | 12.221      | 9.368         | 5.091         |
| UE Category  |      | ≥ 1         | ≥2          | ≥2            | ≥ 1           | ≥1                      | ≥1            | ≥ 2         | ≥2            | 3             |

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz; symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: As per Table 4.2-2 in TS 36.211 [4].

Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (other

Note 5: Given per component carrier per codeword.

Note 6: For R.11-3 resource blocks of RB6–RB45 are allocated.

| Parameter                          | Unit        |                 |                 | Val          | ue              |               |               |
|------------------------------------|-------------|-----------------|-----------------|--------------|-----------------|---------------|---------------|
| Reference channel                  |             | R.46 TDD        | R.47 TDD        | R.35-2       |                 |               |               |
|                                    |             |                 |                 | TDD          |                 |               |               |
| Channel bandwidth                  | MHz         | 10              | 10              | 10           |                 |               |               |
| Allocated resource                 |             | 50              | 50              | 50           |                 |               |               |
| blocks (Note 5)                    |             |                 |                 |              |                 |               |               |
| Uplink-Downlink                    |             | 1               | 1               | 1            |                 |               |               |
| Configuration (Note                |             |                 |                 |              |                 |               |               |
| 3)                                 |             |                 |                 |              |                 |               |               |
| Allocated subframes                |             | 3+2             | 3+2             | 2+2          |                 |               |               |
| per Radio Frame                    |             |                 |                 |              |                 |               |               |
| (D+S)                              |             |                 |                 |              |                 |               |               |
| Modulation                         |             | QPSK            | 16QAM           | 64QAM        |                 |               |               |
| Target Coding Rate                 |             |                 |                 | 0.47         |                 |               |               |
| Information Bit                    |             |                 |                 |              |                 |               |               |
| Payload (Note 5)                   | 5.4         | 5100            | 0700            | 40000        |                 | _             |               |
| For Sub-Frames 4,9                 | Bits        | 5160            | 8760            | 18336        |                 | _             |               |
| For Sub-Frames 1,6                 | 51          | 3880            | 7480            | 14688        |                 |               |               |
| For Sub-Frame 5                    | Bits        | N/A             | N/A             | N/A          |                 |               |               |
| For Sub-Frame 0                    | Bits        | 5160            | 8760            | N/A          |                 |               |               |
| Number of Code                     |             |                 |                 |              |                 |               |               |
| Blocks                             |             |                 |                 |              |                 |               |               |
| (Notes 4 and 5)                    |             | 4               | 0               | 2            |                 |               |               |
| For Sub-Frames 4,9                 |             | 1               | 2               | 3            |                 |               |               |
| For Sub-Frames 1,6                 |             |                 |                 | 3<br>N/A     |                 |               |               |
| For Sub-Frame 5<br>For Sub-Frame 0 |             | N/A             | N/A             | N/A<br>N/A   |                 |               |               |
|                                    |             | 1               | 2               | IN/A         |                 |               |               |
| Binary Channel Bits (Note 5)       |             |                 |                 |              |                 |               |               |
| For Sub-Frames 4,9                 | Bits        | 13200           | 26400           | 39600        |                 | -             |               |
| For Sub-Frames 1,6                 | DIIS        | 10656           | 20400           | 31968        |                 | -             |               |
| For Sub-Frame 5                    | Bits        | N/A             | N/A             | N/A          |                 | -             |               |
| For Sub-Frame 0                    | Bits        | 12528           | 25056           | N/A          |                 | -             |               |
| Max. Throughput                    |             | 2.324           | 4.124           | 6.604        |                 | -             |               |
| averaged over 1                    | Mbps        | 2.324           | 4.124           | 0.004        |                 |               |               |
| frame (Note 5)                     |             |                 |                 |              |                 |               |               |
| UE Category                        |             | ≥ 1             | ≥ 1             | ≥2           |                 |               |               |
|                                    | llocated to | PDCCH for 2     |                 |              | l<br>Iz channel | BW/· 3 symb   | ole allocated |
|                                    |             | nd 3 MHz; 4 s   |                 |              |                 |               |               |
|                                    |             | are allocated   |                 |              |                 | 112. I UI SUL |               |
|                                    |             | hronization sig |                 | CH allocated | as per TS       | 36.211 [4]    |               |
|                                    |             | S 36.211 [4].   |                 |              |                 |               |               |
|                                    |             | Block is prese  | ent, an additio | nal CRC sec  | quence of L     | = 24 Bits is  | attached to   |
|                                    |             | rwise L = 0 Bi  |                 |              | •               |               |               |

Table A.3.4.2.1-2: Fixed Reference Channel two antenna ports

Note 5: Given per component carrier per codeword

### A.3.4.2.2 Four antenna ports

| Parameter  | Unit                                       |       |       |       | Value  |        |       |       |  |
|--|--|-------|-------|-------|--------|--------|-------|-------|--|
| Reference channel  |  | R.12  | R.13  | R.14  | R.14-1 | R.14-2 | R.43  | R.36  |  |
|  |  | TDD   | TDD   | TDD   | TDD    | TDD    | TDD   | TDD   |  |
| Channel bandwidth  | MHz  | 1.4   | 10    | 10    | 10     | 10     | 20    | 10    |  |
| Allocated resource blocks (Note 6)   |  | 6     | 50    | 50    | 6      | 3      | 100   | 50    |  |
| Uplink-Downlink Configuration (Note 4)   |  | 1     | 1     | 1     | 1      | 1      | 1     | 1     |  |
| Allocated subframes per Radio<br>Frame (D+S)   |  | 3     | 3+2   | 2+2   | 2      | 2      | 2+2   | 2+2   |  |
| Modulation   |  | QPSK  | QPSK  | 16QAM | 16QAM  | 16QAM  | 16QAM | 64QAM |  |
| Target Coding Rate   |  | 1/3   | 1/3   | 1/2   | 1/2    | 1/2    | 1/2   | 1/2   |  |
| Information Bit Payload (Note 6)   |  |       |       |       |        |        |       |       |  |
| For Sub-Frames 4,9   | Bits                                       | 408   | 4392  | 12960 | 1544   | 744    | 25456 | 18336 |  |
| For Sub-Frames 1,6   | Bits                                       | N/A   | 3240  | 9528  | N/A    | N/A    | 21384 | 15840 |  |
| For Sub-Frame 5  | Bits                                       | N/A   | N/A   | N/A   | N/A    | N/A    | N/A   | N/A   |  |
| For Sub-Frame 0  | Bits                                       | 208   | 4392  | N/A   | N/A    | N/A    | N/A   | N/A   |  |
| Number of Code Blocks       (Notes 5 and 6)  |  |       |       |       |        |        |       |       |  |
| For Sub-Frames 4,9   |  | 1     | 1     | 3     | 1      | 1      | 5     | 3     |  |
| For Sub-Frames 1,6   |  | N/A   | 1     | 2     | N/A    | N/A    | 4     | 3     |  |
| For Sub-Frame 5  |  | N/A   | N/A   | N/A   | N/A    | N/A    | N/A   | N/A   |  |
| For Sub-Frame 0  |  | 1     | 1     | N/A   | N/A    | N/A    | N/A   | N/A   |  |
| Binary Channel Bits (Note 6)   |  |       |       |       |        |        |       |       |  |
| For Sub-Frames 4,9   | Bits                                       | 1248  | 12800 | 25600 | 3072   | 1536   | 51200 | 38400 |  |
| For Sub-Frames 1,6   |  | N/A   | 10256 | 20512 | N/A    | N/A    | 41312 | 30768 |  |
| For Sub-Frame 5  | Bits                                       | N/A   | N/A   | N/A   | N/A    | N/A    | N/A   | N/A   |  |
| For Sub-Frame 0  | Bits                                       | 624   | 12176 | N/A   | N/A    | N/A    | N/A   | N/A   |  |
| Max. Throughput averaged over 1<br>frame (Note 6)  | Mbps                                       | 0.102 | 1.966 | 4.498 | 0.309  | 0.149  | 9.368 | 6.835 |  |
| UE Category  |  | ≥ 1   | ≥ 1   | ≥2    | ≥ 1    | ≥ 1    | ≥ 2   | ≥2    |  |
| UE Category       ≥1       ≥1       ≥2       ≥1       ≥2       ≥2       ≥2         Note 1:       2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5<br>MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are<br>allocated to PDCCH.         Note 2:       For BW=1.4 MHz, the information bit payloads of special subframes are set to zero (no scheduling) to avoid<br>problems with insufficient PDCCH performance at the test point.         Note 3:       Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].         Note 4:       As per Table 4.2-2 in TS 36.211 [4].         Note 5:       If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block<br>(otherwise L = 0 Bit). |  |       |       |       |        |        |       |       |  |
|  | Children par empegate certier per externet |       |       |       |        |        |       |       |  |

#### Table A.3.4.2.2-1: Fixed Reference Channel four antenna ports

Note 6: Given per component carrier per codeword.

# A.3.4.3 Reference Measurement Channels for UE-Specific Reference Symbols

### A.3.4.3.1 Single antenna port (Cell Specific)

The reference measurement channels in Table A.3.4.3.1-1 apply for verifying demodulation performance for UE-specific reference symbols with one cell-specific antenna port.

| Parameter Unit Value   |            |                 |                 |                 |                 |                 |             |
|--|------------|-----------------|-----------------|-----------------|-----------------|-----------------|-------------|
| Reference channel  |            | R.25<br>TDD     | R.26<br>TDD     | R.26-1<br>TDD   | R.27<br>TDD     | R.27-1<br>TDD   | R.28<br>TDD |
| Channel bandwidth  | MHz        | 10              | 10              | 5               | 10              | 10              | 10          |
| Allocated resource blocks  |            | 50 <sup>4</sup> | 50 <sup>4</sup> | 25 <sup>4</sup> | 50 <sup>4</sup> | 18 <sup>6</sup> | 1           |
| Uplink-Downlink Configuration (Note 3)   |            | 1               | 1               | 1               | 1               | 1               | 1           |
| Allocated subframes per Radio Frame<br>(D+S)   |            | 3+2             | 3+2             | 3+2             | 3+2             | 3+2             | 3+2         |
| Modulation   |            | QPSK            | 16QAM           | 16QAM           | 64QAM           | 64QAM           | 16QAM       |
| Target Coding Rate   |            | 1/3             | 1/2             | 1/2             | 3/4             | 3/4             | 1/2         |
| Information Bit Payload  |            |                 |                 |                 |                 |                 |             |
| For Sub-Frames 4,9   | Bits       | 4392            | 12960           | 5736            | 28336           | 10296           | 224         |
| For Sub-Frames 1,6   | Bits       | 3240            | 9528            | 4584            | 22920           | 8248            | 176         |
| For Sub-Frame 5  | Bits       | N/A             | N/A             | N/A             | N/A             | N/A             | N/A         |
| For Sub-Frame 0  | Bits       | 2984            | 9528            | 3880            | 22152           | 10296           | 224         |
| Number of Code Blocks per Sub-Frame       (Note 5)   |            |                 |                 |                 |                 |                 |             |
| For Sub-Frames 4,9   |            | 1               | 3               | 1               | 5               | 2               | 1           |
| For Sub-Frames 1,6   |            | 1               | 2               | 1               | 4               | 2               | 1           |
| For Sub-Frame 5  |            | N/A             | N/A             | N/A             | N/A             | N/A             | N/A         |
| For Sub-Frame 0  |            | 1               | 2               | 1               | 4               | 2               | 1           |
| Binary Channel Bits Per Sub-Frame  |            |                 |                 |                 |                 |                 |             |
| For Sub-Frames 4,9   | Bits       | 12600           | 25200           | 11400           | 37800           | 13608           | 504         |
| For Sub-Frames 1,6   | Bits       | 10356           | 20712           | 10212           | 31068           | 11340           | 420         |
| For Sub-Frame 5  | Bits       | N/A             | N/A             | N/A             | N/A             | N/A             | N/A         |
| For Sub-Frame 0  | Bits       | 10332           | 20664           | 7752            | 30996           | 13608           | 504         |
| Max. Throughput averaged over 1 frame  | Mbps       | 1.825           | 5.450           | 2.452           | 12.466          | 4.738           | 0.102       |
| UE Category  |            | ≥ 1             | ≥ 2             | ≥ 1             | ≥ 2             | ≥1              | ≥1          |
| <ul> <li>Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&amp;6, only 2 OFDM symbols are allocated to PDCCH.</li> <li>Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].</li> <li>Note 3: as per Table 4.2-2 in TS 36.211 [4].</li> <li>Note 4: For R.25, R.26 and R.27, 50 resource blocks are allocated in sub-frames 1, 4, 6, 9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0. For R.26-1, 25 resource blocks are allocated in sub-frames 1, 4, 6, 9 and 17 resource blocks (RB0–RB7 and RB16–RB24) are allocated in sub-frame 0.</li> <li>Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).</li> </ul> |            |                 |                 |                 |                 |                 |             |
| Note 6: Localized allocation started from  | RB #0 is a | pplied.         |                 |                 |                 |                 |             |

#### Two antenna ports (Cell Specific) A.3.4.3.2

The reference measurement channels in Table A.3.4.3.2-1 apply for verifying demodulation performance for CDMmultiplexed UE specific reference symbols with two cell-specific antenna ports.

| Reference channel  |      | R.31            | R.32            | R.32-1          | R.33            | R.33-1          | R.34            |  |  |
|--|------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|--|--|
|  |      | TDD             | TDD             | TDD             | TDD             | TDD             | TDD             |  |  |
| Channel bandwidth  | MHz  | 10              | 10              | 5               | 10              | 10              | 10              |  |  |
| Allocated resource   |      | 50 <sup>4</sup> | 50 <sup>4</sup> | 25 <sup>4</sup> | 50 <sup>4</sup> | 18 <sup>6</sup> | 50 <sup>4</sup> |  |  |
| blocks   |      |                 |                 | -               |                 | _               |                 |  |  |
| Uplink-Downlink  |      | 1               | 1               | 1               | 1               | 1               | 1               |  |  |
| Configuration (Note 3)   |      |                 |                 |                 |                 |                 |                 |  |  |
| Allocated subframes  |      | 3+2             | 3+2             | 3+2             | 3+2             | 3+2             | 3+2             |  |  |
| per Radio Frame (D+S)  |      |                 |                 |                 |                 |                 |                 |  |  |
| Modulation   |      | QPSK            | 16QAM           | 16QAM           | 64QAM           | 64QAM           | 64QAM           |  |  |
| Target Coding Rate   |      | 1/3             | 1/2             | 1/2             | 3/4             | 3/4             | 1/2             |  |  |
| Information Bit Payload  |      |                 |                 |                 |                 |                 |                 |  |  |
| For Sub-Frames 4,9   | Bits | 3624            | 11448           | 5736            | 27376           | 9528            | 18336           |  |  |
| For Sub-Frames 1,6   |      | 2664            | 7736            | 3112            | 16992           | 7480            | 11832           |  |  |
| For Sub-Frame 5 Bits N/A N/A N/A N/A N/A N/A                                   |      |                 |                 |                 |                 |                 |                 |  |  |
| For Sub-Frame 0  |      |                 |                 |                 |                 |                 |                 |  |  |
| Number of Code Blocks  |      |                 |                 |                 |                 |                 |                 |  |  |
| per Sub-Frame  |      |                 |                 |                 |                 |                 |                 |  |  |
| (Note 5)   |      |                 |                 |                 |                 |                 |                 |  |  |
| For Sub-Frames 4,9         1         2         1         5         2         3 |      |                 |                 |                 |                 |                 |                 |  |  |
| For Sub-Frames 1,6         1         2         1         3         2         2 |      |                 |                 |                 |                 |                 |                 |  |  |
| For Sub-Frame 5         N/A         N/A         N/A         N/A         N/A    |      |                 |                 |                 |                 |                 |                 |  |  |
| For Sub-Frame 0         1         2         1         4         2         3    |      |                 |                 |                 |                 |                 |                 |  |  |
| Binary Channel Bits Per  |      |                 |                 |                 |                 |                 |                 |  |  |
| Sub-Frame  |      |                 |                 |                 |                 |                 |                 |  |  |
| For Sub-Frames 4,9   | Bits | 12000           | 24000           | 10800           | 36000           | 12960           | 36000           |  |  |
| For Sub-Frames 1,6   | 5.4  | 7872            | 15744           | 6528            | 23616           | 10368           | 23616           |  |  |
| For Sub-Frame 5  | Bits | N/A             | N/A             | N/A             | N/A             | N/A             | N/A             |  |  |
| For Sub-Frame 0  | Bits | 9840            | 19680           | 7344            | 29520           | 12960           | 29520           |  |  |
| Max. Throughput  | Mbps | 1.556           | 4.79            | 2.119           | 11.089          | 4.354           | 7.502           |  |  |
| averaged over 1 frame  |      |                 | > 0             |                 | > 0             |                 | 2.0             |  |  |
| UE Category  |      | ≥ 1             | ≥2              | ≥ 1             | ≥2              | ≥ 1             | ≥ 2             |  |  |
| Note 1: 2 symbols allo   |      |                 |                 |                 |                 |                 |                 |  |  |
| allocated to PE<br>For subframe  |      |                 |                 |                 |                 |                 | .4 IVI⊓Z.       |  |  |
| Note 2: Reference sign   |      |                 |                 |                 |                 | or TS 36 21     | 1 [4]           |  |  |
| Note 3: as per Table 4   |      |                 | griais ariu     |                 | laieu as pe     | 10 30.21        | · [+].          |  |  |
| Note 4: For R.31, R.32   |      |                 | source blo      | cks are all     | ncated in si    | ub-frames 4     | 9 and 41        |  |  |
| resource block   |      |                 |                 |                 |                 |                 |                 |  |  |
| DwPTS portion  |      |                 |                 |                 |                 |                 |                 |  |  |
| frames 4,9 and   |      |                 |                 |                 |                 |                 |                 |  |  |
| 0 and the DwP  |      |                 |                 |                 |                 |                 |                 |  |  |
| Note 5: If more than or  |      |                 |                 | ditional CR     | C sequence      | e of L = 24 E   | Bits is         |  |  |
| attached to ea   |      |                 |                 |                 | •               |                 |                 |  |  |
| Note 6: Localized alloc  |      |                 |                 |                 |                 |                 |                 |  |  |

Table A.3.4.3.2-1: Fixed Reference Channel for CDM-multiplexed DM RS

## A.3.4.3.3 Two antenna ports (CSI-RS)

The reference measurement channels in Table A.3.4.3.3-1 apply for verifying demodulation performance for CDMmultiplexed UE specific reference symbols with two cell-specific antenna ports and two CSI-RS antenna ports.

| F          |                                 |             |              |  |  |  |  |  |  |
|------------|---------------------------------|-------------|--------------|--|--|--|--|--|--|
|            | Parameter                       | Unit        | Value        |  |  |  |  |  |  |
| Referenc   | e channel                       |             | R.51 TDD     |  |  |  |  |  |  |
|            | bandwidth                       | MHz         | 10           |  |  |  |  |  |  |
| Allocated  | resource blocks                 |             | 50 (Note 5)  |  |  |  |  |  |  |
| Uplink-Do  | ownlink Configuration (Note 3)  |             | 1            |  |  |  |  |  |  |
| Allocated  | subframes per Radio Frame       |             | 3+2          |  |  |  |  |  |  |
| (D+S)      | -                               |             |              |  |  |  |  |  |  |
| Modulatio  | n                               |             | 16QAM        |  |  |  |  |  |  |
| Target Co  | oding Rate                      |             | 1/2          |  |  |  |  |  |  |
| Informatio | on Bit Payload                  |             |              |  |  |  |  |  |  |
| For Sub    | -Frames 4,9 (non CSI-RS         | Bits        | 11448        |  |  |  |  |  |  |
| subframe   | )                               |             |              |  |  |  |  |  |  |
| For Sub    | -Frame 4,9                      | Bits        | 11448        |  |  |  |  |  |  |
| For Sub    | -Frames 1,6                     | Bits        | 7736         |  |  |  |  |  |  |
|            | -Frame 5                        | Bits        | N/A          |  |  |  |  |  |  |
| For Sub    | -Frame 0                        | Bits        | 9528         |  |  |  |  |  |  |
|            | of Code Blocks                  |             |              |  |  |  |  |  |  |
| (Note 4)   |                                 |             |              |  |  |  |  |  |  |
| For Sub    | -Frames 4, 9 (non CSI-RS        | Code        | 2            |  |  |  |  |  |  |
| subframe   |                                 | blocks      |              |  |  |  |  |  |  |
|            | -Frames 4,9                     | Code        | 2            |  |  |  |  |  |  |
|            |                                 | blocks      |              |  |  |  |  |  |  |
| For Sub    | For Sub-Frames 1,6              |             | 2            |  |  |  |  |  |  |
|            |                                 | blocks      |              |  |  |  |  |  |  |
| For Sub    | -Frame 5                        |             | N/A          |  |  |  |  |  |  |
|            | -Frame 0                        | Code        | 2            |  |  |  |  |  |  |
|            |                                 | blocks      |              |  |  |  |  |  |  |
| Binary Ch  | nannel Bits                     |             |              |  |  |  |  |  |  |
| For Sub    | -Frames 4, 9 (non CSI-RS        | Bits        | 24000        |  |  |  |  |  |  |
| subframe   | )                               |             |              |  |  |  |  |  |  |
| For Sub    | -Frames 4,9                     |             | 22800        |  |  |  |  |  |  |
| For Sub    | -Frames 1,6                     |             | 15744        |  |  |  |  |  |  |
| For Sub    | -Frame 5                        | Bits        | N/A          |  |  |  |  |  |  |
| For Sub    | -Frame 0                        | Bits        | 19680        |  |  |  |  |  |  |
| Max. Thre  | oughput averaged over 1         | Mbps        | 4.7896       |  |  |  |  |  |  |
| frame      |                                 |             |              |  |  |  |  |  |  |
| UE Categ   | jory                            |             | ≥ 2          |  |  |  |  |  |  |
| Note 1:    | 2 symbols allocated to PDCCH    | Ι.          |              |  |  |  |  |  |  |
| Note 2:    | Reference signal, synchronizat  | tion signal | s and PBCH   |  |  |  |  |  |  |
|            | allocated as per TS 36.211 [4]. |             |              |  |  |  |  |  |  |
| Note 3:    | as per Table 4.2-2 in TS 36.21  |             |              |  |  |  |  |  |  |
| Note 4:    | If more than one Code Block is  |             |              |  |  |  |  |  |  |
|            | CRC sequence of L = 24 Bits is  | s attached  | to each Code |  |  |  |  |  |  |
|            | Block (otherwise L = 0 Bit).    |             |              |  |  |  |  |  |  |
| Note 5:    | 50 resource blocks are allocate |             |              |  |  |  |  |  |  |
|            | 41 resource blocks (RB0–RB2     |             |              |  |  |  |  |  |  |
|            | allocated in sub-frame 0 and th | ie DwPTS    | portion of   |  |  |  |  |  |  |
|            | sub-frames 1,6.                 |             |              |  |  |  |  |  |  |

# Table A.3.4.3.3-1: Fixed Reference Channel for CDM-multiplexed DM RS with two CSI-RS antenna ports

The reference measurement channels in Table A.3.4.3.3-2 apply for verifying demudlation performance for UE-specific reference symbols with two cell specific antenna ports and two CSI-RS antenna ports with ZP CSI-RS and NZP CSI-RS in same subframe.

| Parameter                              | Unit         |                 | Value            |                |  |  |  |
|--|--------------|-----------------|------------------|----------------|--|--|--|
| Reference channel                      |              | R.52 TDD        | R.53 TDD         | R.54 TDD       |  |  |  |
| Channel bandwidth                      | MHz          | 10              | 10               | 10             |  |  |  |
| Allocated resource blocks              |              | 50 (Note 5)     | 50 (Note 5)      | 50 (Note 5)    |  |  |  |
| Uplink-Downlink Configuration (Note 3) |              | 1               | 1                | 1              |  |  |  |
| Allocated subframes per Radio Frame    |              | 3+2             | 3+2              | 3+2            |  |  |  |
| (D+S)                                  |              |                 |                  |                |  |  |  |
| Modulation                             |              | 64QAM           | 64QAM            | 16QAM          |  |  |  |
| Target Coding Rate                     |              | 1/2             | 1/2              | 1/2            |  |  |  |
| Information Bit Payload                |              |                 |                  |                |  |  |  |
| For Sub-Frame 4,9                      | Bits         | 16416           | 16416            | 11448          |  |  |  |
| For Sub-Frames 1,6                     | Bits         | 11832           | 11832            | 7736           |  |  |  |
| For Sub-Frame 5                        | Bits         | n/a             | n/a              | n/a            |  |  |  |
| For Sub-Frame 0                        | Bits         | 14688           | 14688            | 9528           |  |  |  |
| Number of Code Blocks                  |              |                 |                  |                |  |  |  |
| (Note 4)                               |              |                 |                  |                |  |  |  |
| For Sub-Frames 4,9                     | Code         | 3               | 3                | 2              |  |  |  |
|  | blocks       |                 |                  |                |  |  |  |
| For Sub-Frames 1,6                     | Code         | 2               | 2                | 2              |  |  |  |
|  | blocks       |                 |                  |                |  |  |  |
| For Sub-Frame 5                        |              | n/a             | n/a              | n/a            |  |  |  |
| For Sub-Frame 0                        | Code         | 3               | 3                | 2              |  |  |  |
|  | blocks       |                 |                  |                |  |  |  |
| Binary Channel Bits                    |              |                 |                  |                |  |  |  |
| For Sub-Frames 4,9                     |              | 34200           | 33600            | 22800          |  |  |  |
| For Sub-Frames 1,6                     |              | 23616           | 23616            | 15744          |  |  |  |
| For Sub-Frame 5                        | Bits         | n/a             | n/a              | n/a            |  |  |  |
| For Sub-Frame 0                        | Bits         | 29520           | 29520            | 19680          |  |  |  |
| Max. Throughput averaged over 1        | Mbps         | 7.1184          | 7.1184           | 4.7896         |  |  |  |
| frame                                  |              |                 |                  |                |  |  |  |
| UE Category                            |              | ≥ 2             | ≥ 2              | ≥ 2            |  |  |  |
| Note 1: 2 symbols allocated to PDCCI   |              |                 |                  |                |  |  |  |
| Note 2: Reference signal, synchroniza  | ation signal | s and PBCH allo | ocated as per TS | 36.211 [4].    |  |  |  |
| Note 3: as per Table 4.2-2 in TS 36.2  |              |                 | -                |                |  |  |  |
| Note 4: If more than one Code Block i  |              |                 | C sequence of L  | . = 24 Bits is |  |  |  |
| attached to each Code Block            |              |                 |                  |                |  |  |  |
| Note 5: 50 resource blocks are allocat |              |                 |                  |                |  |  |  |
| and RB30–RB49) are allocate            | d in sub-fr  | ame 0 and the D | WPIS portion of  | sub-frames 1,  |  |  |  |
| 6.                                     |              |                 |                  |                |  |  |  |

# Table A.3.4.3.3-2: Fixed Reference Channel for CDM-multiplexed DM RS with two CSI-RS antenna ports with ZP CSI-RS and NZP CSI-RS

## A.3.4.3.4 Four antenna ports (CSI-RS)

The reference measurement channels in Table A.3.4.3.4-1 apply for verifying demodulation performance for CDMmultiplexed UE specific reference symbols with two cell-specific antenna ports and four CSI-RS antenna ports.

| ParameterUnitValueReference channelR.44 TDDR.48 TDDChannel bandwidthMHz1010Allocated resource blocks50 (Note 4)50 (Note 4)Uplink-Downlink Configuration11(Note 3)11Allocated subframes per Radio3+23+2Frame (D+S)64QAMQPSKModulation64QAMQPSKTarget Coding Rate½Information Bit Payload1For Sub-Frames 4,9 (non CSI-RSBits16416For Sub-Frames 1,6118324264For Sub-Frames 1,6118324264For Sub-Frame 5Bits146884968Number of Code Blocks per Sub-Frame32Subframe)Sub-Frames 4,9 (non CSI-RS)32Sub-Frame 5Bits146884968Number of Code Blocks per Sub-Frame32For Sub-Frames 4,9 (non CSI-RS)32Subframe)Sub-Frames 4,9 (non CSI-RS)3For Sub-Frame 4,9 (non CSI-RS)32Subframe)Sub-Frame 4,9 (non CSI-RS)3For Sub-Frames 4,9 (non CSI-RS)32For Sub-Frames 4,9 (non CSI-RS)32Subframe)Sub-Frames 4,9 (non CSI-RS)3For Sub-Frames 4,9 (non CSI-RS)32Subframe)Sub-Frames 4,9 (non CSI-RS)3For Sub-Frames 4,9 (non CSI-RS)32Subframe)Sub-Frames 4,9 (non CSI-RS)3For Sub-Frames   |  |  |  |  |  |  |  |
|--|--|--|--|--|--|--|--|
| Channel bandwidthMHzTDDChannel bandwidthMHz1010Allocated resource blocks50 (Note 4)50 (Note 4)Uplink-Downlink Configuration11(Note 3)11Allocated subframes per Radio3+2Frame (D+S)64QAMQPSKModulation64QAMQPSKTarget Coding Rate½Information Bit Payload1For Sub-Frames 4,9 (non CSI-RSBits16416For Sub-Frames 1,6118324264For Sub-Frames 5BitsN/AN/AN/AN/AFor Sub-Frame 0Bits14688Number of Code Blocks per Sub-<br>Frame<br>(Note 5)32For Sub-Frames 4,9 (non CSI-RS<br>subframe)32  |  |  |  |  |  |  |  |
| Channel bandwidthMHz1010Allocated resource blocks50 (Note 4)50 (Note 4)Uplink-Downlink Configuration11(Note 3)11Allocated subframes per Radio3+2Frame (D+S)64QAMQPSKModulation64QAMQPSKTarget Coding Rate½Information Bit Payload1For Sub-Frames 4,9 (non CSI-RSBits16416For Sub-Frames 4,9 (CSI-RSBits16416Subframe)5Bits14688For Sub-Frames 1,6118324264For Sub-Frame 5Bits146884968Number of Code Blocks per Sub-FrameBits146884968Number of Code Blocks per Sub-Frame32Subframe)3232   |  |  |  |  |  |  |  |
| Allocated resource blocks50 (Note 4)50 (Note 4)Uplink-Downlink Configuration11(Note 3)11Allocated subframes per Radio3+2Frame (D+S)3+2Modulation64QAMQPSKTarget Coding Rate½Information Bit Payload1For Sub-Frames 4,9 (non CSI-RSBits16416For Sub-Frames 4,9 (CSI-RSBits16416Subframe)11For Sub-Frames 1,6118324264For Sub-Frame 5Bits14688Number of Code Blocks per Sub-FrameBits14688Number of Code Blocks per Sub-Frame32Subframe)32   |  |  |  |  |  |  |  |
| Uplink-Downlink Configuration<br>(Note 3)11Allocated subframes per Radio<br>Frame (D+S)3+23+2Modulation64QAMQPSKTarget Coding Rate1/2Information Bit Payload1For Sub-Frames 4,9 (non CSI-RS<br>subframe)Bits16416For Sub-Frames 4,9 (CSI-RS<br>subframe)Bits16416For Sub-Frames 1,6118324264For Sub-Frames 5BitsN/AN/AN/AN/AFor Sub-Frame 5Bits14688Number of Code Blocks per Sub-<br>Frame<br>(Note 5)32For Sub-Frames 4,9 (non CSI-RS<br>subframe)32   |  |  |  |  |  |  |  |
| Uplink-Downlink Configuration<br>(Note 3)11Allocated subframes per Radio<br>Frame (D+S)3+23+2Modulation64QAMQPSKTarget Coding Rate½Information Bit Payload1/2For Sub-Frames 4,9 (non CSI-RS<br>subframe)Bits18336For Sub-Frames 4,9 (CSI-RS<br>subframe)Bits16416For Sub-Frames 1,6118324264For Sub-Frames 5BitsN/AFor Sub-Frame 5Bits14688Number of Code Blocks per Sub-<br>Frame<br>(Note 5)32For Sub-Frames 4,9 (non CSI-RS<br>subframe)32  |  |  |  |  |  |  |  |
| (Note 3)11Allocated subframes per Radio<br>Frame (D+S)3+23+2Modulation64QAMQPSKTarget Coding Rate½Information Bit Payload1/2For Sub-Frames 4,9 (non CSI-RS<br>subframe)Bits18336For Sub-Frames 4,9 (CSI-RS<br>subframe)Bits16416For Sub-Frames 1,6118324264For Sub-Frames 5BitsN/AFor Sub-Frame 5Bits14688Number of Code Blocks per Sub-<br>Frame<br>(Note 5)32For Sub-Frames 4,9 (non CSI-RS<br>subframe)32   |  |  |  |  |  |  |  |
| Allocated subframes per Radio3+23+2Frame (D+S)Modulation64QAMQPSKModulation64QAMQPSKTarget Coding Rate½Information Bit Payload1/2For Sub-Frames 4,9 (non CSI-RSBits18336Subframe)N/AFor Sub-Frames 4,9 (CSI-RSBits16416For Sub-Frames 1,6118324264For Sub-Frames 5BitsN/AFor Sub-Frame 0Bits14688Number of Code Blocks per Sub-Frame8For Sub-Frames 4,9 (non CSI-RS3Subframe)2   |  |  |  |  |  |  |  |
| Frame (D+S)64QAMQPSKModulation64QAMQPSKTarget Coding Rate½Information Bit Payload'/2For Sub-Frames 4,9 (non CSI-RSBits18336N/Asubframe)Bits164166200For Sub-Frames 4,9 (CSI-RSBits164166200subframe)Bits118324264For Sub-Frames 1,6118324264For Sub-Frame 5BitsN/AN/AFor Sub-Frame 0Bits146884968Number of Code Blocks per Sub-FrameImage: Sub-Frame 4,9 (non CSI-RS)32For Sub-Frames 4,9 (non CSI-RS)32subframe)Sub-Frame 532   |  |  |  |  |  |  |  |
| Modulation64QAMQPSKTarget Coding Rate½Information Bit Payload1/2For Sub-Frames 4,9 (non CSI-RSBits18336N/Asubframe)Bits164166200For Sub-Frames 4,9 (CSI-RSBits164166200subframe)Bits118324264For Sub-Frames 1,6118324264For Sub-Frame 5BitsN/AN/AFor Sub-Frame 0Bits146884968Number of Code Blocks per Sub-FrameImage: Sub-Frame 4,9 (non CSI-RS)32For Sub-Frames 4,9 (non CSI-RS)32subframe)Subframe)Subframe32   |  |  |  |  |  |  |  |
| Target Coding Rate½Information Bit PayloadFor Sub-Frames 4,9 (non CSI-RS<br>subframe)Bits18336N/AFor Sub-Frames 4,9 (CSI-RS<br>subframe)Bits164166200For Sub-Frames 1,6118324264For Sub-Frames 5<br>For Sub-Frame 0BitsN/AN/AFor Sub-Frame 0Bits146884968Number of Code Blocks per Sub-<br>Frame<br>(Note 5)Sub-Frames 4,9 (non CSI-RS)32Subframe)Sub-Frames 4,9 (non CSI-RS)32  |  |  |  |  |  |  |  |
| Information Bit PayloadInformation Bit PayloadFor Sub-Frames 4,9 (non CSI-RS<br>subframe)Bits18336N/AFor Sub-Frames 4,9 (CSI-RS<br>subframe)Bits164166200For Sub-Frames 1,6118324264For Sub-Frame 5BitsN/AN/AFor Sub-Frame 0Bits146884968Number of Code Blocks per Sub-<br>Frame<br>(Note 5)For Sub-Frames 4,9 (non CSI-RS<br>subframe)32  |  |  |  |  |  |  |  |
| For Sub-Frames 4,9 (non CSI-RS<br>subframe)Bits18336N/AFor Sub-Frames 4,9 (CSI-RS<br>subframe)Bits164166200For Sub-Frames 1,6118324264For Sub-Frame 5BitsN/AN/AFor Sub-Frame 0Bits146884968Number of Code Blocks per Sub-<br>Frame<br>(Note 5)Image: Comparison of the state of the stat  |  |  |  |  |  |  |  |
| subframe)Image: constraint of the subframe)Image: constraint of the subframeFor Sub-Frames 1,6Bits164166200For Sub-Frames 1,6118324264For Sub-Frame 5BitsN/AN/AFor Sub-Frame 0Bits146884968Number of Code Blocks per Sub-FrameImage: constraint of the subframeImage: constraint of the subframe(Note 5)Image: constraint of the subframeImage: constraint of the subframeImage: constraint of the subframeFor Sub-Frames 4,9 (non CSI-RSImage: constraint of the subframeImage: constraint of the subframeImage: constraint of the subframeFor Sub-Frames 4,9 (non CSI-RSImage: constraint of the subframeImage: constraint of the subframeImage: constraint of the subframe  |  |  |  |  |  |  |  |
| subframe)Image: constraint of the subframe subfram      |  |  |  |  |  |  |  |
| subframe)4264For Sub-Frames 1,611832For Sub-Frame 5BitsN/AN/AFor Sub-Frame 0BitsNumber of Code Blocks per Sub-<br>Frame<br>(Note 5)For Sub-Frames 4,9 (non CSI-RS<br>subframe)3  |  |  |  |  |  |  |  |
| For Sub-Frames 1,6118324264For Sub-Frame 5BitsN/AN/AFor Sub-Frame 0Bits146884968Number of Code Blocks per Sub-<br>Frame<br>(Note 5)Image: Comparison of Code Blocks per Sub-<br>Frame<br>(Note 5)Image: Comparison of Code Blocks per Sub-<br>Frame<br>Sub-Frames 4,9 (non CSI-RS)32   |  |  |  |  |  |  |  |
| For Sub-Frame 5BitsN/AN/AFor Sub-Frame 0Bits146884968Number of Code Blocks per Sub-<br>Frame<br>(Note 5)   |  |  |  |  |  |  |  |
| Number of Code Blocks per Sub-<br>Frame<br>(Note 5)     Image: Constant of Constan |  |  |  |  |  |  |  |
| Number of Code Blocks per Sub-<br>Frame<br>(Note 5)     Image: Constant of Constan |  |  |  |  |  |  |  |
| Frame     Image: Constraint of the second seco       |  |  |  |  |  |  |  |
| For Sub-Frames 4,9 (non CSI-RS 3 2<br>subframe)  |  |  |  |  |  |  |  |
| subframe)  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
| For Sub-Frames 4,9 (CSI-RS 3 2   |  |  |  |  |  |  |  |
| subframe)  |  |  |  |  |  |  |  |
| For Sub-Frames 1,6 2 1   |  |  |  |  |  |  |  |
| For Sub-Frame 5 N/A N/A  |  |  |  |  |  |  |  |
| For Sub-Frame 0 3 1  |  |  |  |  |  |  |  |
| Binary Channel Bits Per Sub-   |  |  |  |  |  |  |  |
| Frame  |  |  |  |  |  |  |  |
| For Sub-Frames 4,9 (non CSI-RS Bits 36000 12000  |  |  |  |  |  |  |  |
| subframe)  |  |  |  |  |  |  |  |
| For Sub-Frames 4,9 (CSI-RS         Bits         33600         11600  |  |  |  |  |  |  |  |
| subframe)  |  |  |  |  |  |  |  |
| For Sub-Frames 1,6         23616         7872  |  |  |  |  |  |  |  |
| For Sub-Frame 5 Bits N/A N/A   |  |  |  |  |  |  |  |
| For Sub-Frame 0         Bits         29520         9840  |  |  |  |  |  |  |  |
| Max. Throughput averaged over 1 Mbps 7.1184 2.5896   |  |  |  |  |  |  |  |
| frame  |  |  |  |  |  |  |  |
| UE Category $\geq 2 \geq 1$  |  |  |  |  |  |  |  |
| Note 1:2 symbols allocated to PDCCH.Note 2:Reference signal, synchronization signals and PBCH  |  |  |  |  |  |  |  |
| allocated as per TS 36.211 [4].  |  |  |  |  |  |  |  |
| Note 3: as per Table 4.2-2 in TS 36.211 [4].   |  |  |  |  |  |  |  |
| Note 4: 50 resource blocks are allocated in sub-frames 4,9 and 41  |  |  |  |  |  |  |  |
| resource blocks (RB0–RB20 and RB30–RB49) are allocated   |  |  |  |  |  |  |  |
| in sub-frame 0 and the DwPTS portion of sub-frames 1,6.  |  |  |  |  |  |  |  |
| Note 5: If more than one Code Block is present, an additional CRC  |  |  |  |  |  |  |  |
| sequence of $L = 24$ Bits is attached to each Code Block   |  |  |  |  |  |  |  |
| (otherwise $L = 0$ Bit).   |  |  |  |  |  |  |  |

# Table A.3.4.3.4-1: Fixed Reference Channel for CDM-multiplexed DM RS with four CSI-RS antenna ports

## A.3.4.3.5 Eight antenna ports (CSI-RS)

The reference measurement channels in Table A.3.4.3.5-1 apply for verifying demodulation performance for CDMmultiplexed UE specific reference symbols with two cell-specific antenna ports and eight CSI-RS antenna ports.

|                             | Parameter   | Unit                       | Value         |
|-----------------------------|---|----------------------------|---------------|
| Reference                   | e channel   |                            | R.50 TDD      |
|                             | bandwidth   | MHz                        | 10            |
|                             | l resource blocks   |                            | 50 (Note 4)   |
| Uplink-D<br>3)              | ownlink Configuration (Note   |                            | 1             |
| Allocated<br>Frame (I       | l subframes per Radio<br>0+S)   |                            | 3+2           |
| Modulati                    |   |                            | QPSK          |
| Target C                    | oding Rate  |                            | 1/3           |
|                             | on Bit Payload  |                            |               |
|                             | o-Frames 4,9 (non CSI-RS  | Bits                       | 3624          |
|                             | -Frames 4,9 (CSI-RS   | Bits                       | 3624          |
|                             | o-Frames 1,6  |                            | 2664          |
|                             | -Frame 5  | Bits                       | N/A           |
|                             | p-Frame 0   | Bits                       | 2984          |
| Number<br>Frame<br>(Note 5) | of Code Blocks per Sub-   |                            |               |
| For Sub                     | o-Frames 4,9 (non CSI-RS  |                            | 1             |
| For Sub<br>subframe         | -Frames 4,9 (CSI-RS   |                            | 1             |
|                             | -Frames 1,6   |                            | 1             |
| For Sub                     | o-Frame 5   |                            | N/A           |
| For Sub                     | o-Frame 0   |                            | 1             |
| Binary C                    | hannel Bits Per Sub-Frame   |                            |               |
|                             | o-Frames 4,9 (non CSI-RS  | Bits                       | 12000         |
| For Sub-<br>subframe        | Frames 4,9 (CSI-RS  | Bits                       | 10400         |
|                             | -Frames 1,6   |                            | 7872          |
|                             | p-Frame 5   | Bits                       | N/A           |
|                             | p-Frame 0   | Bits                       | 9840          |
| Max. Thr<br>frame           | oughput averaged over 1   | Mbps                       | 1.556         |
| <b>UE</b> Cate              | gory  |                            | ≥ 1           |
| Note 1:<br>Note 2:          | 2 symbols allocated to PDC<br>Reference signal, synchron<br>allocated as per TS 36.211  | ization signa<br>[4].      | als and PBCH  |
| Note 3:<br>Note 4:          | as per Table 4.2-2 in TS 36<br>50 resource blocks are allo<br>41 resource blocks (RB0–R<br>allocated in sub-frame 0 an<br>frames 1.6. | cated in sub<br>B20 and RE | 330-RB49) are |
| Note 5:                     | If more than one Code Bloc<br>CRC sequence of $L = 24$ B<br>Block (otherwise $L = 0$ Bit).  |                            |               |

# Table A.3.4.3.5-1: Fixed Reference Channel for CDM-multiplexed DM RS with eight CSI-RS antenna ports

The reference measurement channels in Table A.3.4.3.5-2 apply for verifying TDD PMI accuracy measurement with two CRS antenna ports and eight CSI-RS antenna ports.

|  | Parameter   | Unit           | Val             | ue         |  |  |  |  |  |
|--|---|----------------|-----------------|------------|--|--|--|--|--|
| Reference  |   |                | R.45            | R.45-1     |  |  |  |  |  |
|  |   |                | TDD             | TDD        |  |  |  |  |  |
| Channel ba                                       | andwidth  | MHz            | 10              | 10         |  |  |  |  |  |
|  | esource blocks  | IVITIZ         | 50 <sup>4</sup> | 39         |  |  |  |  |  |
|  | vnlink Configuration (Note 3)   |                | 1               | 1          |  |  |  |  |  |
|  | subframes per Radio Frame   |                | 4+2             | 4+2        |  |  |  |  |  |
| (D+S)  | ubitallies per Radio Frante   |                | 472             | 472        |  |  |  |  |  |
|  | ubframes per Radio Frame  |                | 10              | 10         |  |  |  |  |  |
| Modulation                                       |   |                | 16QAM           | 16QAM      |  |  |  |  |  |
| Target Cod                                       |   |                | 1/2             | 1/2        |  |  |  |  |  |
|  |   |                | 1/2             | 1/2        |  |  |  |  |  |
|  | Bit Payload   | Dite           | N1/A            | N1/A       |  |  |  |  |  |
|  | Frames 4 and 9  | Bits           | N/A             | N/A        |  |  |  |  |  |
|  | -RS subframe)   | Dite           | 44440           | 0700       |  |  |  |  |  |
|  | Frames 4 and 9  | Bits           | 11448           | 8760       |  |  |  |  |  |
| (CSI-RS s  | ,   | D'             | 7700            | 7400       |  |  |  |  |  |
| For Sub-Fr                                       | •   | Bits           | 7736            | 7480       |  |  |  |  |  |
| For Sub-F  |   | Bits           | N/A             | N/A        |  |  |  |  |  |
| For Sub-F  |   | Bits           | 9528            | 8760       |  |  |  |  |  |
|  | Code Blocks per Sub-Frame   |                |                 |            |  |  |  |  |  |
| (Note 5)   |   |                |                 |            |  |  |  |  |  |
|  | Frames 4 and 9  |                | N/A             | N/A        |  |  |  |  |  |
|  | I-RS subframe)  |                |                 |            |  |  |  |  |  |
|  | ames 4 and 9  |                | 2               | 2          |  |  |  |  |  |
|  | subframe)   |                |                 |            |  |  |  |  |  |
| For Sub-Fr                                       |   |                | 2               | 2          |  |  |  |  |  |
| For Sub-F  |   |                | N/A             | N/A        |  |  |  |  |  |
| For Sub-F  |   |                | 2               | 2          |  |  |  |  |  |
| Binary Cha                                       | nnel Bits Per Sub-Frame   |                |                 |            |  |  |  |  |  |
|  | Frames 4 and 9  | Bits           | N/A             | N/A        |  |  |  |  |  |
| (Non CSI-  | -RS subframe)   |                |                 |            |  |  |  |  |  |
| For Sub-F  | Frames 4 and 9  | Bits           | 22400           | 17472      |  |  |  |  |  |
| (CSI-RS s  | subframe)   |                |                 |            |  |  |  |  |  |
| For Sub-Fr                                       | ames 1,6  | Bits           | 15744           | 14976      |  |  |  |  |  |
| For Sub-F  | rame 5  | Bits           | N/A             | N/A        |  |  |  |  |  |
| For Sub-F  | rame 0  | Bits           | 19680           | 18720      |  |  |  |  |  |
| Max. Throu                                       | ughput averaged over 1 frame  | Mbps           | 4.7896          | 4.1240     |  |  |  |  |  |
| UE Catego  |   | 1              | ≥2              | ≥ 1        |  |  |  |  |  |
|  | 2 symbols allocated to PDCCH for  | 20 MHz 15 M    | Hz and 10 MI    | Iz channel |  |  |  |  |  |
|  | BW; 3 symbols allocated to PDCC   |                |                 |            |  |  |  |  |  |
|  | allocated to PDCCH for 1.4 MHz. I   |                |                 |            |  |  |  |  |  |
|  | symbols are allocated to PDCCH.   |                |                 |            |  |  |  |  |  |
|  | Reference signal, synchronization   | signals and Pl | BCH allocated   | as per TS  |  |  |  |  |  |
|  | 36.211 [4].   | signalo una ri |                 |            |  |  |  |  |  |
|  | As per Table 4.2-2 in TS 36.211 [4  | 11.            |                 |            |  |  |  |  |  |
|  | for For R. 45, 50 resource blocks a                                       |                | sub-frames 4    | .9 and 41  |  |  |  |  |  |
|  | resource blocks (RB0–RB20 and F   |                |                 |            |  |  |  |  |  |
|  |   |                |                 |            |  |  |  |  |  |
| frame 0 and the DwPTS portion of sub-frames 1,6. |   |                |                 |            |  |  |  |  |  |
|  |   |                |                 |            |  |  |  |  |  |
| Note 5:  | If more than one Code Block is pre<br>L = 24 Bits is attached to each Coo |                |                 |            |  |  |  |  |  |

# A.3.5 Reference measurement channels for PDCCH/PCFICH performance requirements

# A.3.5.1 FDD

| Parameter                        | Unit    |          |            | Value      |          |          |
|----------------------------------|---------|----------|------------|------------|----------|----------|
| Reference channel                |         | R.15 FDD | R.15-1 FDD | R.15-2 FDD | R.16 FDD | R.17 FDD |
| Number of transmitter antennas   |         | 1        | 2          | 2          | 2        | 4        |
| Channel bandwidth                | MHz     | 10       | 10         | 10         | 10       | 5        |
| Number of OFDM symbols for PDCCH | symbols | 2        | 3          | 2          | 2        | 2        |
| Aggregation level                | CCE     | 8        | 8          | 8          | 4        | 2        |
| DCI Format                       |         | Format 1 | Format 1   | Format 1   | Format 2 | Format 2 |
| Cell ID                          |         | 0        | 0          | 0          | 0        | 0        |
| Payload (without CRC)            | Bits    | 31       | 31         | 31         | 43       | 42       |

#### Table A.3.5.1-1: Reference Channel FDD

# A.3.5.2 TDD

#### Table A.3.5.2-1: Reference Channel TDD

| Parameter                        | Unit    |          |            | Value      |          |          |
|----------------------------------|---------|----------|------------|------------|----------|----------|
| Reference channel                |         | R.15 TDD | R.15-1 TDD | R.15-2 TDD | R.16 TDD | R.17 TDD |
| Number of transmitter antennas   |         | 1        | 2          | 2          | 2        | 4        |
| Channel bandwidth                | MHz     | 10       | 10         | 10         | 10       | 5        |
| Number of OFDM symbols for PDCCH | symbols | 2        | 3          | 2          | 2        | 2        |
| Aggregation level                | CCE     | 8        | 8          | 8          | 4        | 2        |
| DCI Format                       |         | Format 1 | Format 1   | Format 1   | Format 2 | Format 2 |
| Cell ID                          |         | 0        | 0          | 0          | 0        | 0        |
| Payload (without CRC)            | Bits    | 34       | 34         | 34         | 46       | 45       |

# A.3.6 Reference measurement channels for PHICH performance requirements

#### Table A.3.6-1: Reference Channel FDD/TDD

| Pa                         | rameter   | Unit                       |                    | Value             | ;                 |             |
|----------------------------|---|----------------------------|--------------------|-------------------|-------------------|-------------|
| Reference cha              | nnel  |                            | R.18               | R.19              | R.20              | R.24        |
| Number of tran             | smitter antennas  |                            | 1                  | 2                 | 4                 | 1           |
| Channel bandv              | vidth   | MHz                        | 10                 | 10                | 5                 | 10          |
| User roles (Note 1)        |   |                            | W I1 I2            | W I1 I2           | W I1 I2           | W I1        |
| Resource alloc             | ation (Note 2)  |                            | (0,0) (0,1) (0,4)  | (0,0) (0,1) (0,4) | (0,0) (0,1) (0,4) | (0,0) (0,1) |
| Power offsets (            | Note 3)   | dB                         | -4 0 -3            | -4 0 -3           | -4 0 -3           | +3 0        |
| Payload (Note              | 4)  |                            | ARR                | ARR               | ARR               | A R         |
| Note 2: The<br>Note 3: The | vanted user, I1=interf<br>resource allocation p<br>power offsets (per us<br>ive to the first interfer | er user is g<br>er) repres | given as (N_group_ | PHICH, N_seq_PH   |                   | l per PHICH |

Note 4: A=fixed ACK, R=random ACK/NACK.

# A.3.7 Reference measurement channels for PBCH performance requirements

#### Table A.3.7-1: Reference Channel FDD/TDD

| Parameter                      | Unit | Value   |         |         |  |  |  |  |
|--------------------------------|------|---------|---------|---------|--|--|--|--|
| Reference channel              |      | R.21    | R.22    | R.23    |  |  |  |  |
| Number of transmitter antennas |      | 1       | 2       | 4       |  |  |  |  |
| Channel bandwidth              | MHz  | 1.4     | 1.4     | 1.4     |  |  |  |  |
| Modulation                     |      | QPSK    | QPSK    | QPSK    |  |  |  |  |
| Target coding rate             |      | 40/1920 | 40/1920 | 40/1920 |  |  |  |  |
| Payload (without CRC)          | Bits | 24      | 24      | 24      |  |  |  |  |

# A.3.8 Reference measurement channels for MBMS performance requirements

# A.3.8.1 FDD

| Parameter  |      |          | Р       | мсн    |                |           |    |
|--|------|----------|---------|--------|----------------|-----------|----|
|  | Unit |          |         | Va     | lue            |           |    |
| Reference channel  |      | R.40 FDD |         |        | R.37 FDD       |           |    |
| Channel bandwidth  | MHz  | 1.4      | 3       | 5      | 10             | 15        | 20 |
| Allocated resource blocks  |      | 6        |         |        | 50             |           |    |
| Allocated subframes per Radio<br>Frame (Note 1)                  |      | 6        |         |        | 6              |           |    |
| Modulation   |      | QPSK     |         |        | QPSK           |           |    |
| Target Coding Rate   |      | 1/3      |         |        | 1/3            |           |    |
| Information Bit Payload (Note 2)                                 |      |          |         |        |                |           |    |
| For Sub-Frames 1,2,3,6,7,8                                       | Bits | 408      |         |        | 3624           |           |    |
| For Sub-Frames 0,4,5,9   | Bits | N/A      |         |        | N/A            |           |    |
| Number of Code Blocks per<br>Subframe (Note 3)                   |      | 1        |         |        | 1              |           |    |
| Binary Channel Bits Per Subframe                                 |      |          |         |        |                |           |    |
| For Sub-Frames 1,2,3,6,7,8                                       | Bits | 1224     |         |        | 10200          |           |    |
| For Sub-Frames 0,4,5,9   | Bits | N/A      |         |        | N/A            |           |    |
| MBMS UE Category   |      | ≥ 1      |         |        | ≥ 1            |           |    |
| Note 1: For FDD mode, up to 6 sub 36.331.                        |      |          |         |        |                |           |    |
| Note 2: 2 OFDM symbols are reser<br>36.211.                      |      |          |         | Ū      |                |           |    |
| Note 3: If more than one Code Bloo<br>attached to each Code Bloo |      |          | nal CR0 | C sequ | ence of L = 24 | 4 Bits is | 6  |

#### Table A.3.8.1-1: Fixed Reference Channel QPSK R=1/3

| Parameter   |           |         |        | PM      | СН             |         |    |
|---|-----------|---------|--------|---------|----------------|---------|----|
|   | Unit      |         |        |         | Value          |         |    |
| Reference channel   |           |         |        |         | R.38 FDD       |         |    |
| Channel bandwidth   | MHz       | 1.4     | 3      | 5       | 10             | 15      | 20 |
| Allocated resource blocks   |           |         |        |         | 50             |         |    |
| Allocated subframes per Radio Frame (Note 1)  |           |         |        |         | 6              |         |    |
| Modulation  |           |         |        |         | 16QAM          |         |    |
| Target Coding Rate  |           |         |        |         | 1/2            |         |    |
| Information Bit Payload (Note 2)  |           |         |        |         |                |         |    |
| For Sub-Frames 1,2,3,6,7,8  | Bits      |         |        |         | 9912           |         |    |
| For Sub-Frames 0,4,5,9  | Bits      |         |        |         | N/A            |         |    |
| Number of Code Blocks per Subframe (Note 3)   |           |         |        |         | 2              |         |    |
| Binary Channel Bits Per Subframe  |           |         |        |         |                |         |    |
| For Sub-Frames 1,2,3,6,7,8  | Bits      |         |        |         | 20400          |         |    |
| For Sub-Frames 0,4,5,9  | Bits      |         |        |         | N/A            |         |    |
| MBMS UE Category  |           |         |        |         | ≥ 1            |         |    |
| Note 1: For FDD mode, up to 6 subframes (#1 36.331.                                   | /2/3/6/7/ | 8) are  | availa | ble for | MBMS, in lin   | e with  | TS |
| Note 2: 2 OFDM symbols are reserved for PD 36.211.                                    | CCH; an   | d refer | ences  | signal  | allocated as p | er TS   |    |
| Note 3: If more than one Code Block is preser<br>attached to each Code Block (otherwi | •         |         | CRC    | seque   | ence of L = 24 | Bits is | 1  |

Table A.3.8.1-2: Fixed Reference Channel 16QAM R=1/2

### Table A.3.8.1-3: Fixed Reference Channel 64QAM R=2/3

| Parameter   | РМСН          |          |         |             |               |    |     |  |  |  |
|---|---------------|----------|---------|-------------|---------------|----|-----|--|--|--|
|   | Unit          |          |         | Va          | alue          |    |     |  |  |  |
| Reference channel   |               |          |         | R.39-1      | R.39 FDD      |    |     |  |  |  |
|   |               |          |         | FDD         |               |    |     |  |  |  |
| Channel bandwidth   | MHz           | 1.4      | 3       | 5           | 10            | 15 | 20  |  |  |  |
| Allocated resource blocks   |               |          |         | 25          | 50            |    |     |  |  |  |
| Allocated subframes per Radio Frame(Note1)  |               |          |         | 6           | 6             |    |     |  |  |  |
| Modulation  |               |          |         | 64QAM       | 64QAM         |    |     |  |  |  |
| Target Coding Rate  |               |          |         | 2/3         | 2/3           |    |     |  |  |  |
| Information Bit Payload (Note 2)  |               |          |         | •           |               |    |     |  |  |  |
| For Sub-Frames 1,2,3,6,7,8  | Bits          |          |         | 9912        | 19848         |    |     |  |  |  |
| For Sub-Frames 0,4,5,9  | Bits          |          |         | N/A         | N/A           |    |     |  |  |  |
| Number of Code Blocks per Sub-Frame (Note 3)  |               |          |         | 2           | 4             |    |     |  |  |  |
| Binary Channel Bits Per Subframe  |               | 11       |         | 1           |               |    |     |  |  |  |
| For Sub-Frames 1,2,3,6,7,8  | Bits          |          |         | 15300       | 30600         |    |     |  |  |  |
| For Sub-Frames 0,4,5,9  | Bits          |          |         | N/A         | N/A           |    |     |  |  |  |
| MBMS UE Category  |               |          |         | ≥1          | ≥ 2           |    |     |  |  |  |
| Note 1:For FDD mode, up to 6 subframes (#1/2/3,Note 2:2 OFDM symbols are reserved for PDCCHNote 3:If more than one Code Block is present, arCode Block (otherwise L = 0 Bit). | l; and refere | ence sig | nal all | ocated as p | er TS 36.211. |    | ach |  |  |  |

# A.3.8.2 TDD

| Parameter   |            |               |        | РМСН     |                |          |     |  |  |  |
|---|------------|---------------|--------|----------|----------------|----------|-----|--|--|--|
|   | Unit       |               |        | Va       | lue            |          |     |  |  |  |
| Reference channel   |            | R.40 TDD      |        |          | R.37 TDD       |          |     |  |  |  |
| Channel bandwidth   | MHz        | 1.4           | 3      | 5        | 10             | 15       | 20  |  |  |  |
| Allocated resource blocks   |            | 6             |        |          | 50             |          |     |  |  |  |
| Uplink-Downlink Configuration(Note 1)   |            | 5             |        |          | 5              |          |     |  |  |  |
| Allocated subframes per Radio Frame   |            | 5             |        |          | 5              |          |     |  |  |  |
| Modulation  |            | QPSK          |        |          | QPSK           |          |     |  |  |  |
| Target Coding Rate  |            | 1/3           |        |          | 1/3            |          |     |  |  |  |
| Information Bit Payload (Note 2)  |            |               |        |          |                |          |     |  |  |  |
| For Sub-Frames 3,4,7,8,9  | Bits       | 408           |        |          | 3624           |          |     |  |  |  |
| For Sub-Frames 0,1,2,5,6  | Bits       | N/A           |        |          | N/A            |          |     |  |  |  |
| Number of Code Blocks per Subframe  |            | 1             |        |          | 1              |          |     |  |  |  |
| (Note 3)  |            |               |        |          |                |          |     |  |  |  |
| Binary Channel Bits Per Subframe  |            |               |        |          |                |          |     |  |  |  |
| For Sub-Frames 3,4,7,8,9  | Bits       | 1224          |        |          | 10200          |          |     |  |  |  |
| For Sub-Frames 0,1,2,5,6  | Bits       | N/A           |        |          | N/A            |          |     |  |  |  |
| MBMS UE Category  |            | ≥ 1           |        |          | ≥ 1            |          |     |  |  |  |
| Note 1: For TDD mode, in line with TS 3   | 6.331, Up  | link-Downlink | Config | juratior | n 5 is propose | d, up to | o 5 |  |  |  |
| subframes (#3/4/7/8/9) are availa   | able for M | BMS.          |        |          |                |          |     |  |  |  |
| Note 2: 2 OFDM symbols are reserved for   |            |               |        |          |                |          |     |  |  |  |
| Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached |            |               |        |          |                |          |     |  |  |  |
| to each Code Block (otherwise L   | = 0 Bit).  |               |        |          |                |          |     |  |  |  |

### Table A.3.8.2-1: Fixed Reference Channel QPSK R=1/3

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 Table A.3.8.2-2: Fixed Reference Channel 16QAM R=1/2

| Parameter                                     | PMCH       |          |        |        |                |         |       |  |  |
|---|------------|----------|--------|--------|----------------|---------|-------|--|--|
|   | Unit       |          |        |        | Value          |         |       |  |  |
| Reference channel                             |            |          |        |        | R.38 TDD       |         |       |  |  |
| Channel bandwidth                             | MHz        | 1.4      | 3      | 5      | 10             | 15      | 20    |  |  |
| Allocated resource blocks                     |            |          |        |        | 50             |         |       |  |  |
| Uplink-Downlink Configuration(Note 1)         |            |          |        |        | 5              |         |       |  |  |
| Allocated subframes per Radio Frame           |            |          |        |        | 5              |         |       |  |  |
| Modulation                                    |            |          |        |        | 16QAM          |         |       |  |  |
| Target Coding Rate                            |            |          |        |        | 1/2            |         |       |  |  |
| Information Bit Payload (Note 2)              |            |          |        |        |                |         |       |  |  |
| For Sub-Frames 3,4,7,8,9                      | Bits       |          |        |        | 9912           |         |       |  |  |
| For Sub-Frames 0,1,2,5,6                      | Bits       |          |        |        | N/A            |         |       |  |  |
| Number of Code Blocks per Subframe (Note 3)   |            |          |        |        | 2              |         |       |  |  |
| Binary Channel Bits Per Subframe              |            |          |        |        |                |         |       |  |  |
| For Sub-Frames 3,4,7,8,9                      | Bits       |          |        |        | 20400          |         |       |  |  |
| For Sub-Frames 0,1,2,5,6                      | Bits       |          |        |        | N/A            |         |       |  |  |
| MBMS UE Category                              |            |          |        |        | ≥ 1            |         |       |  |  |
| Note 1: For TDD mode, in line with TS 36.331  | , Uplink-l | Downlin  | nk Con | figura | tion 5 is prop | osed, i | up to |  |  |
| 5 subframes (#3/4/7/8/9) are available        |            |          |        |        |                |         |       |  |  |
| Note 2: 2 OFDM symbols are reserved for PD    |            |          |        |        |                |         |       |  |  |
| Note 3: If more than one Code Block is preser | nt, an ado | ditional | CRC s  | seque  | nce of L = 24  | Bits is |       |  |  |

attached to each Code Block (otherwise L = 0 Bit).

| Parameter  |                                     |                             |                         | PMCH              |                |        |    |
|--|-------------------------------------|-----------------------------|-------------------------|-------------------|----------------|--------|----|
|  | Unit                                |                             |                         | Val               | ue             |        |    |
| Reference channel  |                                     |                             |                         | R.39-1TDD         | R.39 TDD       |        |    |
| Channel bandwidth  | MHz                                 | 1.4                         | 3                       | 5                 | 10             | 15     | 20 |
| Allocated resource blocks  |                                     |                             |                         | 25                | 50             |        |    |
| Uplink-Downlink Configuration(Note 1)  |                                     |                             |                         | 5                 | 5              |        |    |
| Allocated subframes per Radio Frame  |                                     |                             |                         | 5                 | 5              |        |    |
| Modulation   |                                     |                             |                         | 64QAM             | 64QAM          |        |    |
| Target Coding Rate   |                                     |                             |                         | 2/3               | 2/3            |        |    |
| Information Bit Payload (Note 2)   |                                     | <b></b>                     |                         | •                 | l.             |        |    |
| For Sub-Frames 3,4,7,8,9   | Bits                                |                             |                         | 9912              | 19848          |        |    |
| For Sub-Frames 0,1,2,5,6   | Bits                                |                             |                         | N/A               | N/A            |        |    |
| Number of Code Blocks per Sub-Frame (Note 3)   |                                     |                             |                         | 2                 | 4              |        |    |
| Binary Channel Bits Per Subframe   |                                     |                             |                         |                   |                |        |    |
| For Sub-Frames 3,4,7,8,9   | Bits                                |                             |                         | 15300             | 30600          |        |    |
| For Sub-Frames 0,1,2,5,6   | Bits                                |                             |                         | N/A               | N/A            |        |    |
| MBMS UE Category   |                                     |                             |                         | ≥ 1               | ≥ 2            |        |    |
| Note 1:For TDD mode, in line with TS<br>subframes (#3/4/7/8/9) are ava<br>2 OFDM symbols are reserved<br>Note 3:Note 3:If more than one Code Block is<br>attached to each Code Block ( | ailable for<br>for PDC<br>s present | r MBMS<br>CH; re<br>, an ad | S.<br>ferenc<br>ditiona | ce signal allocat | ed as per TS 3 | 36.211 |    |

#### Table A.3.8.2-3: Fixed Reference Channel 64QAM R=2/3

# A.3.9 Reference measurement channels for sustained downlink data rate provided by lower layers

## A.3.9.1 FDD

#### Table A.3.9.1-1: Fixed Reference Channel for sustained data-rate test (FDD)

| Parameter                                     | Unit       |              |               |              | Va            | lue          |                        |                        |        |  |  |  |  |  |  |  |  |  |  |
|---|------------|--------------|---------------|--------------|---------------|--------------|------------------------|------------------------|--------|--|--|--|--|--|--|--|--|--|--|
| Reference channel                             |            | R.31-1       | R.31-2        | R.31-3       | R.31-3A       | R.31-3C      | R.31-4                 | R.31-4B                | R.31-5 |  |  |  |  |  |  |  |  |  |  |
|   |            | FDD          | FDD           | FDD          | FDD           | FDD          | FDD                    | FDD                    | FDD    |  |  |  |  |  |  |  |  |  |  |
| Channel bandwidth                             | MHz        | 10           | 10            | 20           | 10            | 15           | 20                     | 15                     | 15     |  |  |  |  |  |  |  |  |  |  |
| Allocated resource blocks (Note 8)            |            | Note 5       | Note 6        | Note 7       | Note 6        | Note 10      | Note 7                 | Note 11                | Note 9 |  |  |  |  |  |  |  |  |  |  |
| Allocated subframes per Radio                 |            | 10           | 10            | 10           | 10            | 10           | 10                     | 10                     | 10     |  |  |  |  |  |  |  |  |  |  |
| Frame   |            |              |               |              |               |              |                        |                        |        |  |  |  |  |  |  |  |  |  |  |
| Modulation                                    |            | 64QAM        | 64QAM         | 64QAM        | 64QAM         | 64QAM        | 64QAM                  | 64QAM                  | 64QAM  |  |  |  |  |  |  |  |  |  |  |
| Coding Rate                                   |            |              |               |              |               |              |                        |                        |        |  |  |  |  |  |  |  |  |  |  |
| For Sub-Frame 1,2,3,4,6,7,8,9,                |            | 0.40         | 0.59          | 0.59         | 0.85          | 0.87         | 0.88                   | 0.85                   | 0.85   |  |  |  |  |  |  |  |  |  |  |
| For Sub-Frame 5                               |            | 0.40         | 0.64          | 0.62         | 0.89          | 0.88         | 0.87                   | 0.87                   | 0.91   |  |  |  |  |  |  |  |  |  |  |
| For Sub-Frame 0                               |            | 0.40         | 0.63          | 0.61         | 0.90          | 0.91         | 0.90                   | 0.88                   | 0.88   |  |  |  |  |  |  |  |  |  |  |
| Information Bit Payload (Note 8)              |            |              |               |              |               |              |                        |                        |        |  |  |  |  |  |  |  |  |  |  |
| For Sub-Frames 1,2,3,4,6,7,8,9                | Bits       | 10296        | 25456         | 51024        | 36696         | 51024        | 75376                  | 55056                  | 55056  |  |  |  |  |  |  |  |  |  |  |
| For Sub-Frame 5                               | Bits       | 10296        | 25456         | 51024        | 35160         | 51024        | 71112                  | 52752                  | 52752  |  |  |  |  |  |  |  |  |  |  |
| For Sub-Frame 0                               | Bits       | 10296        | 25456         | 51024        | 36696         | 51024        | 75376                  | 55056                  | 55056  |  |  |  |  |  |  |  |  |  |  |
| Number of Code Blocks                         |            |              |               |              |               |              |                        |                        |        |  |  |  |  |  |  |  |  |  |  |
| (Notes 3 and 8)                               |            |              |               |              |               |              |                        |                        |        |  |  |  |  |  |  |  |  |  |  |
| For Sub-Frames 1,2,3,4,6,7,8,9                | Bits       | 2            | 5             | 9            | 6             | 9            | 13                     | 9                      | 9      |  |  |  |  |  |  |  |  |  |  |
| For Sub-Frame 5                               | Bits       | 2            | 5             | 9            | 6             | 9            | 12                     | 9                      | 9      |  |  |  |  |  |  |  |  |  |  |
| For Sub-Frame 0                               | Bits       | 2            | 5             | 9            | 6             | 9            | 13                     | 9                      | 9      |  |  |  |  |  |  |  |  |  |  |
| Binary Channel Bits (Note 8)                  |            |              |               |              |               |              |                        |                        |        |  |  |  |  |  |  |  |  |  |  |
| For Sub-Frames 1,2,3,4,6,7,8,9                | Bits       | 26100        | 43200         | 86400        | 43200         | 58752        | 86400                  | 64800                  | 64800  |  |  |  |  |  |  |  |  |  |  |
| For Sub-Frame 5                               | Bits       | 26100        | 39744         | 82080        | 39744         | 57888        | 82080                  | 60480                  | 60480  |  |  |  |  |  |  |  |  |  |  |
| For Sub-Frame 0                               | Bits       | 26100        | 40752         | 83952        | 40752         | 56304        | 83952                  | 62352                  | 62352  |  |  |  |  |  |  |  |  |  |  |
| Number of layers                              |            | 1            | 2             | 2            | 2             | 2            | 2                      | 2                      | 2      |  |  |  |  |  |  |  |  |  |  |
| Max. Throughput averaged over 1               | Mbps       | 10.296       | 25.456        | 51.024       | 36.542        | 51.024       | 74.950                 | 54.826                 | 54.826 |  |  |  |  |  |  |  |  |  |  |
| frame (Note 8)                                |            |              |               |              |               |              |                        |                        |        |  |  |  |  |  |  |  |  |  |  |
| UE Categories                                 |            | ≥1           | ≥ 2           | ≥ 2          | ≥2            | ≥ 3          | ≥ 3                    | ≥ 4                    | ≥ 3    |  |  |  |  |  |  |  |  |  |  |
| Note 1: 1 symbol allocated to PDC             |            |              |               |              |               |              |                        |                        |        |  |  |  |  |  |  |  |  |  |  |
| Note 2: Reference signal, synchro             |            |              |               |              |               |              |                        |                        |        |  |  |  |  |  |  |  |  |  |  |
| Note 3: If more than one Code Blo             | ck is pres | sent, an ad  | ditional CF   | RC sequen    | ce of L = 24  | Bits is atta | ched to ea             | ch Code Bl             | ock    |  |  |  |  |  |  |  |  |  |  |
| (otherwise $L = 0$ Bit).                      |            |              |               |              |               |              |                        |                        |        |  |  |  |  |  |  |  |  |  |  |
| Note 4: Resource blocks $n_{PRB} = 0$ .       |            |              |               |              |               |              | dwidths.               |                        |        |  |  |  |  |  |  |  |  |  |  |
| Note 5: Resource blocks $n_{PRB} = 6$ .       | .14,3049   | 9 are alloca | ated for the  | e user data  | in all sub-fr | ames.        |                        |                        |        |  |  |  |  |  |  |  |  |  |  |
| Note 6: Resource blocks n <sub>PRB</sub> = 3. | 49 are a   | llocated fo  | r the user of | data in sub  | -frame 5, ai  | nd resource  | blocks n <sub>Pl</sub> | <sub>RB</sub> = 049 ir | n sub- |  |  |  |  |  |  |  |  |  |  |
| frames 0,1,2,3,4,6,7,8,9.                     |            |              |               |              |               |              |                        |                        |        |  |  |  |  |  |  |  |  |  |  |
| Note 7: Resource blocks n <sub>PRB</sub> = 4. | 99 are a   | llocated fo  | r the user of | data in sub  | -frame 5, a   | nd resource  | blocks n <sub>Pl</sub> | <sub>RB</sub> = 099 ir | n sub- |  |  |  |  |  |  |  |  |  |  |
| frames 0,1,2,3,4,6,7,8,9.                     |            |              |               |              |               |              |                        |                        |        |  |  |  |  |  |  |  |  |  |  |
| Note 8: Given per component carr              |            |              |               |              |               |              |                        |                        |        |  |  |  |  |  |  |  |  |  |  |
| Note 9: Resource blocks nPRB =                | 474 are    | allocated f  | for the use   | r data in su | ub-frame 5.   | and resource | ce blocks n            | PRB = 07               |        |  |  |  |  |  |  |  |  |  |  |

Note 9: Resource blocks nPRB = 4..74 are allocated for the user data in sub-frame 5, and resource blocks nPRB = 0..74 in sub-frames 0,1,2,3,4,6,7,8,9.

Note 10: Resource blocks  $n_{PRB} = 4..71$  are allocated for the user data in sub-frames 0,1,2,3,4,5,6,7,8,9.

Note 11: Resource blocks n<sub>PRB</sub> = 4..74 are allocated for the user data in sub-frame 5, and resource blocks n<sub>PRB</sub> = 0..74 in sub-frames 0,1,2,3,4,6,7,8,9.

# A.3.9.2 TDD

| Parameter  | Unit          |            |             | Value       |                |          |  |  |
|--|---------------|------------|-------------|-------------|----------------|----------|--|--|
| Reference channel  |               | R.31-1     | R.31-2      | R.31-3      | R.31-3A        | R.31-4   |  |  |
|  |               | TDD        | TDD         | TDD         | TDD            | TDD      |  |  |
| Channel bandwidth  | MHz           | 10         | 10          | 20          | 15             | 20       |  |  |
| Allocated resource blocks  |               | Note 6     | Note 7      | Note 8      | Note 9         | Note 8   |  |  |
| Uplink-Downlink Configuration (Note 3)   |               | 5          | 5           | 5           | 1              | 1        |  |  |
| Number of HARQ Processes per   | Proces        | 15         | 15          | 15          | 7              | 7        |  |  |
| component carrier  | ses           |            |             |             |                |          |  |  |
| Allocated subframes per Radio Frame  |               | 8+1        | 8+1         | 8+1         | 4              | 4        |  |  |
| (D+S)  |               |            |             |             |                |          |  |  |
| Modulation   |               | 64QAM      | 64QAM       | 64QAM       | 64QAM          | 64QAM    |  |  |
| Target Coding Rate   |               |            |             |             |                |          |  |  |
| For Sub-Frames 4,9   |               | 0.40       | 0.59        | 0.59        | 0.87           | 0.88     |  |  |
| For Sub-Frames 3,7,8   |               | 0.40       | 0.59        | 0.59        | N/A            | N/A      |  |  |
| For Sub-Frames 1   |               | N/A        | N/A         | N/A         | N/A            | N/A      |  |  |
| For Sub-Frames 5   |               | 0.40       | 0.64        | 0.62        | 0.88           | 0.87     |  |  |
| For Sub-Frames 6   |               | 0.40       | 0.60        | 0.60        | N/A            | N/A      |  |  |
| For Sub-Frames 0   |               | 0.40       | 0.62        | 0.61        | 0.90           | 0.90     |  |  |
| Information Bit Payload  |               |            |             |             |                |          |  |  |
| For Sub-Frames 4,9   | Bits          | 10296      | 25456       | 51024       | 51024          | 75376    |  |  |
| For Sub-Frames 3,7,8   | Bits          | 10296      | 25456       | 51024       | 0              | 0        |  |  |
| For Sub-Frame 1  | Bits          | 0          | 0           | 0           | 0              | 0        |  |  |
| For Sub-Frame 5  | Bits          | 10296      | 25456       | 51024       | 51024          | 71112    |  |  |
| For Sub-Frame 6  | Bits          | 10296      | 25456       | 51024       | 0              | 0        |  |  |
| For Sub-Frame 0  | Bits          | 10296      | 25456       | 51024       | 51024          | 75376    |  |  |
| Number of Code Blocks per Sub-Frame  |               |            |             |             |                |          |  |  |
| (Note 4)   |               |            |             |             |                |          |  |  |
| For Sub-Frames 4,9   |               | 2          | 5           | 9           | 9              | 13       |  |  |
| For Sub-Frames 3,7,8   |               | 2          | 5           | 9           | N/A            | N/A      |  |  |
| For Sub-Frame 1  |               | N/A        | N/A         | N/A         | N/A            | N/A      |  |  |
| For Sub-Frame 5  |               | 2          | 5           | 9           | 9              | 12       |  |  |
| For Sub-Frame 6  | Bits          | 2          | 5           | 9           | n/a            | N/A      |  |  |
| For Sub-Frame 0  |               | 2          | 5           | 9           | 9              | 13       |  |  |
| Binary Channel Bits Per Sub-Frame  |               |            |             |             |                |          |  |  |
| For Sub-Frames 4,9   | Bits          | 26100      | 43200       | 86400       | 58752          | 86400    |  |  |
| For Sub-Frames 3,7,8   | Bits          | 26100      | 43200       | 86400       | 0              | 0        |  |  |
| For Sub-Frame 1  | Bits          | 0          | 0           | 0           | 0              | 0        |  |  |
| For Sub-Frame 5  | Bits          | 26100      | 40176       | 82512       | 58320          | 82512    |  |  |
| For Sub-Frame 6  | Bits          | 26100      | 42768       | 85968       | N/A            | N/A      |  |  |
| For Sub-Frame 0  | Bits          | 26100      | 41184       | 84384       | 56736          | 84384    |  |  |
| Number of layers   |               | 1          | 2           | 2           | 2              | 2        |  |  |
| Max. Throughput averaged over 1 frame  | Mbps          | 8.237      | 20.365      | 40.819      | 20.409         | 29.724   |  |  |
| (Note 10)  |               |            |             |             |                |          |  |  |
| UE Category  |               | ≥ 1        | ≥ 2         | ≥2          | ≥2             | ≥ 3      |  |  |
| Note 1: 1 symbol allocated to PDCCH for  | or all tests. |            |             |             | •              |          |  |  |
| Note 2: Reference signal, synchronization  |               | and PBCH   | allocated a | s per TS 3  | 6.211 [4].     |          |  |  |
| Note 3: As per Table 4.2-2 in TS 36.211  | [4].          |            |             | •           |                |          |  |  |
| Note 4: If more than one Code Block is   |               | additional | CRC sequ    | ence of L = | = 24 Bits is a | ittached |  |  |
| to each Code Block (otherwise  |               |            | •           |             |                |          |  |  |
| Note 5: Resource blocks n <sub>PRB</sub> = 02 are allocated for SIB transmissions in sub-frame 5 for all |               |            |             |             |                |          |  |  |
| bandwidths.  |               |            |             |             |                |          |  |  |
| Note 6: Resource blocks $n_{PRB} = 614,3049$ are allocated for the user data in all subframes.           |               |            |             |             |                |          |  |  |

Note 7: Resource blocks  $n_{PRB} = 3..49$  are allocated for the user data in sub-frame 5, and resource blocks  $n_{PRB} = 0..49$  in sub-frames 0,3,4,6,7,8,9.

Note 8: Resource blocks  $n_{PRB} = 4..99$  are allocated for the user data in sub-frame 5, and resource blocks  $n_{PRB} = 0..99$  in sub-frames 0,3,4,6,7,8,9.

Note 9: Resource blocks  $n_{PRB} = 4..71$  are allocated for the user data in all sub-frames

Note10: Given per component carrier per codeword.

# A.3.9.3 FDD (EPDCCH scheduling)

#### Table A.3.9.3-1: Fixed Reference Channel for sustained data-rate test with EPDCCH scheduling (FDD)

| Parameter                                | Unit      |        |        |        | Value  |        |        |          |
|--|-----------|--------|--------|--------|--------|--------|--------|----------|
| Reference channel                        | Onit      | R.31E- | R.31E- | R.31E- | R.31E- | R.31E- | R.31E- | R.31E-4B |
|  |           | 1 FDD  | 2 FDD  | 3 FDD  | 3A FDD | 3C FDD | 4 FDD  | FDD      |
| Channel bandwidth                        | MHz       | 10     | 10     | 20     | 10     | 15     | 20     | 15       |
| Allocated resource blocks (Note 8)       |           | Note 5 | Note 6 | Note 7 | Note 6 | Note 9 | Note 7 | Note 10  |
| Allocated subframes per Radio Frame      |           | 10     | 10     | 10     | 10     | 10     | 10     | 10       |
| Modulation                               |           | 64QAM    |
| Coding Rate                              |           |        |        |        |        |        |        |          |
| (subframes with PDCCH USS                |           |        |        |        |        |        |        |          |
| monitoring)                              |           |        |        |        |        |        |        |          |
| For Sub-Frame 1,2,3,4,6,7,8,9,           |           | 0.3972 | 0.5926 | 0.5933 | 0.8533 | 0.8725 | 0.8763 | 0.8533   |
| For Sub-Frame 5                          |           | 0.3972 | 0.6441 | 0.6246 | 0.8889 | 0.8855 | 0.8702 | 0.8762   |
| For Sub-Frame 0                          |           | 0.3972 | 0.6282 | 0.6106 | 0.9046 | 0.9105 | 0.9018 | 0.8868   |
| Coding Rate                              |           |        |        |        |        |        |        |          |
| (subframes with EPDCCH USS               |           |        |        |        |        |        |        |          |
| monitoring)                              |           |        |        |        |        |        |        |          |
| For Sub-Frame 1,2,3,4,6,7,8,9,           |           | 0.4114 | 0.6047 | 0.5993 | 0.8707 | 0.8855 | 0.8851 | 0.8649   |
| For Sub-Frame 5                          |           | 0.4114 | 0.6584 | 0.6312 | 0.9086 | 0.8990 | 0.8794 | 0.8889   |
| For Sub-Frame 0                          |           | 0.4114 | 0.6418 | 0.6170 | 0.9242 | 0.9246 | 0.9112 | 0.8993   |
| Information Bit Payload (Note 8)         |           |        |        |        |        |        |        |          |
| For Sub-Frames 1,2,3,4,6,7,8,9           | Bits      | 10296  | 25456  | 51024  | 36696  | 51024  | 75376  | 55056    |
| For Sub-Frame 5                          | Bits      | 10296  | 25456  | 51024  | 35160  | 51024  | 71112  | 52752    |
| For Sub-Frame 0                          | Bits      | 10296  | 25456  | 51024  | 36696  | 51024  | 75376  | 55056    |
| Number of Code Blocks                    |           |        |        |        |        |        |        |          |
| (Notes 3 and 8)                          |           | -      | _      |        |        |        |        |          |
| For Sub-Frames 1,2,3,4,6,7,8,9           | Bits      | 2      | 5      | 9      | 6      | 9      | 13     | 9        |
| For Sub-Frame 5                          | Bits      | 2      | 5      | 9      | 6      | 9      | 12     | 9        |
| For Sub-Frame 0                          | Bits      | 2      | 5      | 9      | 6      | 9      | 13     | 9        |
| Binary Channel Bits (Note 8)             |           |        |        |        |        |        |        |          |
| (subframes with PDCCH USS<br>monitoring) |           |        |        |        |        |        |        |          |
| For Sub-Frames 1,2,3,4,6,7,8,9           | Bits      | 26100  | 43200  | 86400  | 43200  | 58752  | 86400  | 64800    |
| For Sub-Frame 5                          | Bits      | 26100  | 39744  | 82080  | 39744  | 57888  | 82080  | 60480    |
| For Sub-Frame 0                          | Bits      | 26100  | 40752  | 83952  | 40752  | 56304  | 83952  | 62352    |
| Binary Channel Bits (Note 8)             | Dita      | 20100  | 407.52 | 03932  | 40732  | 30304  | 00902  | 02332    |
| (subframes with EPDCCH USS               |           |        |        |        |        |        |        |          |
| monitoring)                              |           |        |        |        |        |        |        |          |
| For Sub-Frames 1,2,3,4,6,7,8,9           | Bits      | 25200  | 42336  | 85536  | 42336  | 57888  | 85536  | 63936    |
| For Sub-Frame 5                          | Bits      | 25200  | 38880  | 81216  | 38880  | 57024  | 81216  | 59616    |
| For Sub-Frame 0                          | Bits      | 25200  | 39888  | 83088  | 39888  | 55440  | 83088  | 61488    |
| Number of layers                         |           | 1      | 2      | 2      | 2      | 2      | 2      | 2        |
| Max. Throughput averaged over 1          | Mbps      | 10.296 | 25.456 | 51.024 | 36.542 | 51.024 | 74.950 | 54.826   |
| frame (Note 8)                           | 1.000     | 10.200 | _000   | 51.021 | 501012 | 511021 |        | 0        |
| UE Categories                            |           | ≥ 1    | ≥2     | ≥2     | ≥2     | ≥ 3    | ≥ 3    | ≥ 4      |
| Note 1: 1 symbol allocated to PDCCH      | for all t | oete   | •      | •      |        |        |        |          |

Note 1: 1 symbol allocated to PDCCH for all tests.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211.

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 4: Resource blocks n<sub>PRB</sub> = 0..2 are allocated for SIB transmissions in sub-frame 5 for all bandwidths.

Note 5: Resource blocks  $n_{PRB} = 6..14,30..49$  are allocated for the user data in all sub-frames.

Note 6: Resource blocks  $n_{PRB} = 3..49$  are allocated for the user data in sub-frame 5, and resource blocks  $n_{PRB} = 0..49$  in sub-frames 0,1,2,3,4,6,7,8,9.

Note 7: Resource blocks n<sub>PRB</sub> = 4..99 are allocated for the user data in sub-frame 5, and resource blocks n<sub>PRB</sub> = 0..99 in sub-frames 0,1,2,3,4,6,7,8,9.

Note 8: Given per component carrier per codeword.

Note 9: Resource blocks n<sub>PRB</sub> = 4..71 are allocated for the user data in sub-frames 0,1,2,3,4,5,6,7,8,9.

Note 10: Resource blocks  $n_{PRB} = 4..74$  are allocated for the user data in sub-frame 5, and resource blocks  $n_{PRB} = 0..74$  in sub-frames 0,1,2,3,4,6,7,8,9.

# A.3.9.4 TDD (EPDCCH scheduling)

### Table A.3.9.4-1: Fixed Reference Channel for sustained data-rate with EPDCCH scheduling (TDD)

| Parameter   | Unit         |            |            | Value      |                |              |
|---|--------------|------------|------------|------------|----------------|--------------|
| Reference channel   |              | R.31E-1    | R.31E-2    | R.31E-3    | R.31E-3A       | R.31E-4      |
|   |              | TDD        | TDD        | TDD        | TDD            | TDD          |
| Channel bandwidth   | MHz          | 10         | 10         | 20         | 15             | 20           |
| Allocated resource blocks   |              | Note 6     | Note 7     | Note 8     | Note 9         | Note 8       |
| Uplink-Downlink Configuration (Note 3)  |              | 5          | 5          | 5          | 1              | 1            |
| Number of HARQ Processes per<br>component carrier                             | Processes    | 15         | 15         | 15         | 7              | 7            |
| Allocated subframes per Radio   |              | 8+1        | 8+1        | 8+1        | 4              | 4            |
| Frame (D+S)   |              |            |            |            |                |              |
| Coding Rate   |              |            |            |            |                |              |
| (subframes with PDCCH USS   |              |            |            |            |                |              |
| monitoring)   |              |            |            |            |                |              |
| For Sub-Frames 4,9  |              | 0.3972     | 0.5926     | 0.5933     | 0.8725         | 0.8763       |
| For Sub-Frames 3,7,8  |              | 0.3972     | 0.5926     | 0.5933     | N/A            | N/A          |
| For Sub-Frames 1  |              | N/A        | N/A        | N/A        | N/A            | N/A          |
| For Sub-Frames 5  |              | 0.3972     | 0.6372     | 0.6213     | 0.8790         | 0.8656       |
| For Sub-Frames 6  |              | 0.3972     | 0.5986     | 0.5963     | N/A            | N/A          |
| For Sub-Frames 0  |              | 0.3972     | 0.6216     | 0.6075     | 0.9036         | 0.8972       |
| Coding Rate<br>(subframes with EPDCCH USS                                     |              |            |            |            |                |              |
| monitoring)   |              |            |            |            |                |              |
| For Sub-Frames 4,9  |              | 0.4114     | 0.6047     | 0.5993     | 0.8856         | 0.8851       |
| For Sub-Frames 3,7,8  |              | 0.4114     | 0.6047     | 0.5993     | N/A            | N/A          |
| For Sub-Frames 1  |              | <u>N/A</u> | N/A        | N/A        | N/A            | N/A          |
| For Sub-Frames 5  |              | 0.4114     | 0.6512     | 0.6279     | 0.8922         | 0.8748       |
| For Sub-Frames 6  |              | 0.4114     | 0.6109     | 0.6024     | N/A            | N/A          |
| For Sub-Frames 0  |              | 0.4114     | 0.6349     | 0.6138     | 0.9175         | 0.9065       |
| Information Bit Payload   |              |            |            |            |                |              |
| For Sub-Frames 4,9  | Bits         | 10296      | 25456      | 51024      | 51024          | 75376        |
| For Sub-Frames 3,7,8  | Bits         | 10296      | 25456      | 51024      | N/A            | N/A          |
| For Sub-Frame 1   | Bits         | 0          | 0          | 0          | N/A            | N/A          |
| For Sub-Frame 5   | Bits         | 10296      | 25456      | 51024      | 51024          | 71112        |
| For Sub-Frame 6   | Bits         | 10296      | 25456      | 51024      | N/A            | N/A          |
| For Sub-Frame 0   | Bits         | 10296      | 25456      | 51024      | 51024          | 75376        |
| Number of Code Blocks per Sub-<br>Frame (Note 4)                              |              |            |            |            |                |              |
| For Sub-Frames 4,9  |              | 2          | 5          | 9          | 9              | 13           |
| For Sub-Frames 3,7,8  |              | 2          | 5          | 9          | N/A            | N/A          |
| For Sub-Frame 1   |              | N/A        | N/A        | N/A        | N/A            | N/A          |
| For Sub-Frame 5   |              | 2          | 5          | 9          | 9              | 12           |
| For Sub-Frame 6   | Bits         | 2          | 5          | 9          | N/A            | N/A          |
| For Sub-Frame 0   |              | 2          | 5          | 9          | 9              | 13           |
| Binary Channel Bits per Sub-Frame<br>(subframes with PDCCH USS<br>monitoring) |              |            |            |            |                |              |
| For Sub-Frames 4,9  | Bits         | 26100      | 43200      | 86400      | 58752          | 86400        |
| For Sub-Frames 3,7,8  | Bits         | 26100      | 43200      | 86400      | N/A            | N/A          |
| For Sub-Frame 1   | Bits         | 0          | 0          | 0          | N/A            | N/A          |
| For Sub-Frame 5   | Bits         | 26100      | 40176      | 82512      | 58320          | 82512        |
| For Sub-Frame 6   | Bits         | 26100      | 42768      | 85968      | N/A            | N/A          |
| For Sub-Frame 0   | Bits         | 26100      | 41184      | 84384      | 56736          | 84384        |
| Binary Channel Bits per Sub-Frame<br>(subframes with EPDCCH USS               |              |            |            |            |                |              |
| monitoring)   | Dite         | 05000      | 40000      | 05500      | E7000          | 05500        |
| For Sub-Frames 4,9  | Bits         | 25200      | 42336      | 85536      | 57888          | 85536        |
| For Sub-Frames 3,7,8  | Bits         | 25200      | 42336      | 85536      | N/A            | N/A          |
| For Sub-Frame 1<br>For Sub-Frame 5  | Bits<br>Bits | 0<br>25200 | 0<br>39312 | 0<br>81648 | N/A<br>57456   | N/A<br>81648 |
| For Sub-Frame 6   | Bits         | 25200      | 41904      | 85104      | 57456<br>N/A   | N/A          |
|   |              | 20200      | 41304      | 03104      | IN/ <i>F</i> \ | IN/A         |

| For Sub-Frame 0   |   | Bits | 25200 | 40320  | 83520  | 55872  | 83520  |  |  |  |
|---|---|------|-------|--------|--------|--------|--------|--|--|--|
| Number of layers  |   |      | 1     | 2      | 2      | 2      | 2      |  |  |  |
| Max. Throughput averaged over 1   |   | Mbps | 8.237 | 20.365 | 40.819 | 20.409 | 29.724 |  |  |  |
| frame (Note 10)   |   | -    |       |        |        |        |        |  |  |  |
| UE Category   |   |      | ≥ 1   | ≥2     | ≥2     | ≥ 2    | ≥ 3    |  |  |  |
| Note 1:   | Note 1: 1 symbol allocated to PDCCH for all tests.  |      |       |        |        |        |        |  |  |  |
| Note 2:   | Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].                                  |      |       |        |        |        |        |  |  |  |
| Note 3:   |   |      |       |        |        |        |        |  |  |  |
| Note 4:   | Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code          |      |       |        |        |        |        |  |  |  |
|   | Block (otherwise $L = 0$ Bit).  |      |       |        |        |        |        |  |  |  |
| Note 5:   | e 5: Resource blocks n <sub>PRB</sub> = 02 are allocated for SIB transmissions in sub-frame 5 for all bandwidths.           |      |       |        |        |        |        |  |  |  |
| Note 6:   | lote 6: Resource blocks n <sub>PRB</sub> = 614,3049 are allocated for the user data in all subframes.                       |      |       |        |        |        |        |  |  |  |
| Note 7: Resource blocks $n_{PRB} = 349$ are allocated for the user data in sub-frame 5, and resource blocks $n_{PRB} = 049$ |   |      |       |        |        |        |        |  |  |  |
| in sub-frames 0,3,4,6,7,8,9.  |   |      |       |        |        |        |        |  |  |  |
| Note 8:   | lote 8: Resource blocks $n_{PRB} = 499$ are allocated for the user data in sub-frame 5, and resource blocks $n_{PRB} = 099$ |      |       |        |        |        |        |  |  |  |
|   | in sub-frames 0,3,4,6,7,8,9.  |      |       |        |        |        |        |  |  |  |
| Note 9:   | ote 9: Resource blocks n <sub>PRB</sub> = 471 are allocated for the user data in all sub-frames                             |      |       |        |        |        |        |  |  |  |
| Note10:   | : Given per component carrier per codeword.   |      |       |        |        |        |        |  |  |  |

# A.3.10 Reference Measurement Channels for EPDCCH performance requirements

A.3.10.1 FDD

#### Table A.3.10.1-1: Reference Channel FDD

| Parameter                           | Unit    | Value    |          |          |          |          |  |  |
|-------------------------------------|---------|----------|----------|----------|----------|----------|--|--|
| Reference channel                   |         | R.55 FDD | R.56 FDD | R.57 FDD | R.58 FDD | R.59 FDD |  |  |
| Number of transmitter antennas      |         | 2        | 2        | 2        | 2        | 2        |  |  |
| Channel bandwidth                   | MHz     | 10       | 10       | 10       | 10       | 10       |  |  |
| Number of OFDM symbols for<br>PDCCH | symbols | 2        | 2        | 1        | 1        | 1        |  |  |
| Aggregation level                   | ECCE    | 4        | 16       | 2        | 8        | 2        |  |  |
| DCI Format                          |         | 2A       | 2A       | 2C       | 2C       | 2D       |  |  |

# A.3.10.2 TDD

#### Table A.3.10.2-1: Reference Channel TDD

| Parameter                           | Unit    | Value    |          |          |          |          |  |  |
|-------------------------------------|---------|----------|----------|----------|----------|----------|--|--|
| Reference channel                   |         | R.55 TDD | R.56 TDD | R.57 TDD | R.58 TDD | R.59 TDD |  |  |
| Number of transmitter antennas      |         | 2        | 2        | 2        | 2        | 2        |  |  |
| Channel bandwidth                   | MHz     | 10       | 10       | 10       | 10       | 10       |  |  |
| Number of OFDM symbols for<br>PDCCH | symbols | 2        | 2        | 1        | 1        | 1        |  |  |
| Aggregation level                   | CCE     | 4        | 16       | 2        | 8        | 2        |  |  |
| DCI Format                          |         | 2A       | 2A       | 2C       | 2C       | 2D       |  |  |

# A.4 CSI reference measurement channels

This section defines the DL signal applicable to the reporting of channel status information (Clause 9.2, 9.3 and 9.5).

In Table A.4-1 are specified the reference channels. Table A.4-13 specifies the mapping of CQI index to modulation coding scheme, which complies with the CQI definition specified in Section 7.2.3 of [6].

Table A.4-0: Void

| RMC<br>Name | Duplex   | CH-BW    | Alloc.<br>RB-s | UL/DL<br>Config | Alloc.<br>SF-s         | MCS<br>Scheme | Nr.<br>HARQ<br>Proc. | Max. nr<br>HARQ<br>Trans. | Notes  |  |
|-------------|----------|----------|----------------|-----------------|------------------------|---------------|----------------------|---------------------------|--------|--|
| 1 CRS Port  |          |          |                |                 |                        |               |                      |                           |        |  |
| RC.1 FDD    | FDD      | 10       | 50             | -               |                        | MCS.1         | 8                    | 1                         |        |  |
| RC.1 TDD    | TDD      | 10       | 50             | Note 3          |                        | MCS.1         | 10                   | 1                         |        |  |
| RC.3 FDD    | FDD      | 10       | 6              | -               |                        | MCS.10        | 8                    | 1                         |        |  |
| RC.3 TDD    | TDD      | 10       | 6              | Note 3          |                        | MCS.10        | 10                   | 1                         |        |  |
| RC.4 FDD    | FDD      | 10       | 15             | -               |                        | MCS.15        | 8                    | 1                         | Note 6 |  |
| RC.4 TDD    | TDD      | 10       | 15             | Note 3          |                        | MCS.15        | 10                   | 1                         | Note 6 |  |
| RC.5 FDD    | FDD      | 10       | 3              | -               |                        | MCS.17        | 8                    | 1                         |        |  |
| RC.5 TDD    | TDD      | 10       | 3              | Note 3          |                        | MCS.17        | 10                   | 1                         |        |  |
| 2 CRS Ports |          |          |                |                 |                        |               |                      |                           |        |  |
| RC.2 FDD    | FDD      | 10       | 50             | -               |                        | MCS.2         | 8                    | 1                         |        |  |
| RC.2 TDD    | TDD      | 10       | 50             | Note 3          |                        | MCS.2         | 10                   | 1                         |        |  |
| RC.6 FDD    | FDD      | 10       | 15             | -               |                        | MCS.16        | 8                    | 1                         | Note 6 |  |
| RC.6 TDD    | TDD      | 10       | 15             | Note 3          |                        | MCS.16        | 10                   | 1                         | Note 6 |  |
|             |          |          |                | 1 CRS Por       | t + CSI-RS             |               |                      |                           |        |  |
|             | 500      | 40       |                |                 | Non<br>CSI-RS          | MCS.11        | 0                    | 0                         | 4      |  |
| RC.8 FDD    | FDD      | 10       | 6              | -               | 2 CSI-RS               | MCS.12        | 8                    | 1                         |        |  |
| RC.8 TDD    | TDD      | 10       | 6              | Note 3          | Non<br>CSI-RS          | MCS.11        | 10                   | 1                         |        |  |
| NO.0 TOD    | TUU      | 10       | 0              | NOLE 5          | 2 CSI-RS               | MCS.12        | 10                   | 1                         |        |  |
| RC.9 FDD    | FDD      | 10       | 50             | _               | Non<br>CSI-RS          | MCS.3         | 8                    | 1                         |        |  |
| 10.5100     | 100      | 10       | 50             |                 | 2 CSI-RS               | MCS.4         | 0                    |                           |        |  |
| RC.9 TDD    | TDD      | 10       | 50             | Note 3          | Non<br>CSI-RS          | MCS.3         | 10                   | 1                         |        |  |
|             |          |          |                |                 | 2 CSI-RS               | MCS.4         |                      | I                         |        |  |
| 2 CRS Port  | + CSI-RS |          |                |                 |                        |               |                      |                           |        |  |
| RC.7 FDD    | FDD      | 10       | 50             | -               | Non<br>CSI-RS          | MCS.5         | 8                    | 1                         |        |  |
|             |          |          |                |                 | 4 CSI-RS               | MCS.7         |                      |                           |        |  |
| RC.7 TDD    | TDD      | 10       | 50             | Note 3          | Non<br>CSI-RS          | MCS.5         | 10                   | 1                         |        |  |
|             |          |          |                |                 | 8 CSI-RS               | MCS.8         |                      |                           |        |  |
| RC.11 FDD   | FDD      | 10       | 50             | _               | Non<br>CSI-RS          | MCS.5         | 8                    | 1                         |        |  |
| 10.11100    | 100      | 10       | 00             |                 | 2 CSI-RS               | MCS.6         | 0                    |                           |        |  |
| RC.11 TDD   | TDD      | 10       | 50             | Note 3          | Non<br>CSI-RS          | MCS.5         | 10                   | 1                         |        |  |
| -           |          | -        |                |                 | 2 CSI-RS               | MCS.6         | -                    |                           |        |  |
| 1 CRS Port  | + CSI-RS | + CSI-IM |                |                 |                        |               |                      | _                         |        |  |
|             |          |          |                |                 | Non CSI-<br>RS/IM      | MCS.3         |                      |                           |        |  |
| RC.13 FDD   | FDD      | 10       | 50             | -               | CSI-<br>RS/IM          | N/A           | 8                    | 1                         |        |  |
|             | TDD      | 10       | 50             | Note 2          | Non CSI-<br>RS/IM      | MCS.3         | 10                   |                           |        |  |
| RC.13 TDD   | TDD      | 10       | 50             | Note 3          | CSI-<br>RS/IM          | N/A           | 10                   | 1                         |        |  |
| 2 CRS Port  | + CSI-RS | + CSI-IM |                |                 |                        | ·             |                      |                           |        |  |
|             |          |          |                |                 | Non<br>CSI-RS          | MCS.5         |                      |                           |        |  |
| RC.10 FDD   | FDD      | 10       | 50             | -               | 4 CSI-<br>RS,<br>1 CSI | MCS.8         | 8                    | 1                         |        |  |

### Table A.4-1: CSI reference measurement channels

|   |     |       |    |        | process                           |        |    |   |  |
|---|-----|-------|----|--------|-----------------------------------|--------|----|---|--|
|   |     |       |    |        | Non<br>CSI-RS                     | MCS.5  |    |   |  |
| RC.10 TDD   | TDD | 10    | 50 | Note 3 | 8 CSI-<br>RS,<br>1 CSI<br>process | MCS.9  | 10 | 1 |  |
| RC.12 FDD   | FDD |       | 0  |        | Non CSI-<br>RS/IM                 | MCS.13 | 8  | 1 |  |
| RG. 12 FDD  | FDD | 10    | 6  | -      | CSI-<br>RS/IM                     | N/A    |    |   |  |
| RC.12 TDD   | TDD | 10    | 6  | Noto 2 | Non CSI-<br>RS/IM                 | MCS.13 | 10 | 1 |  |
| RC.12 TDD   | עטי | 10 10 | 6  | Note 3 | CSI-<br>RS/IM                     | N/A    | 10 | 1 |  |
| Note 1: 3 symbols allocated to PDCCH.   |     |       |    |        |                                   |        |    |   |  |
| Note 2: For FDD only subframes 1, 2, 3, 4, 6, 7, 8 and 9 are allocated to avoid PBCH and synchronization signal overhead. |     |       |    |        |                                   |        |    |   |  |
| Note 2: TOD LIL DL configuration as specified in the individual tests   |     |       |    |        |                                   |        |    |   |  |

TDD UL-DL configuration as specified in the individual tests. Note 3:

Note 4: For TDD when UL-DL configuration 1 is used only subframes 4 and 9 are allocated to avoide PBCH and synchronizaiton signal overhead.

For TDD when UL-DL configuration 2 is used only subframes 3, 4, 8, and 9 are allocated to avoid Note 5: PBCH and synchronization signal overhead. Centered within the Transmission Bandwidth Configuration (Figure 5.6-1).

Note 6:

Only subframes 2, 3, 4, 7, 8 and 9 are allocated to avoid PBCH and synchronization signal overhead. Note 7:

| Table A.4-1a: Void |
|--------------------|
| Table A.4-1b: Void |
| Table A.4-1c: Void |
| Table A.4-1d: Void |
| Table A.4-1e: Void |
| Table A.4-2: Void  |
| Table A.4-2a: Void |
| Table A.4-2b: Void |
| Table A.4-2c: Void |
| Table A.4-2d: Void |
| Table A.4-2e: Void |
| Table A.4-3: Void  |
| Table A.4-3a: Void |
| Table A.4-3b: Void |
| Table A.4-3c: Void |
| Table A.4-3d: Void |
| Table A.4-3e: Void |
| Table A.4-3f: Void |
| Table A.4-3g: Void |
| Table A.4-3h: Void |
| Table A.4-3i: Void |
| Table A.4-3j: Void |
| Table A.4-3k: Void |
| Table A.4-31: Void |
| Table A.4-4: Void  |
| Table A.4-4a: Void |
| Table A.4-4b: Void |
| Table A.4-5: Void  |
| Table A.4-5a: Void |

Table A.4-5b: Void

Table A.4-6a: Void Table A.4-6b: Void

Table A.4-6: Void

Table A.4-6c: Void

Table A.4-6d: Void

Table A.4-6e: Void

Table A.4-6f: Void

Table A.4-7: Void

Table A.4-8: Void

Table A.4-9: Void

Table A.4-10: Void

Table A.4-11: Void

Table A.4-12: Void

### Table A.4-13: Mapping of CQI Index to Modulation coding scheme (MCS)

| C                             | QI Inde  | X                 | 0        | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9      | 10     | 11     | 12     | 13     | 14     | 15     |       |
|-------------------------------|--|-------------------|----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| Targe                         | t Codin  | g Rate            | OOR      | 0.0762 | 0.1172 | 0.1885 | 0.3008 | 0.4385 | 0.5879 | 0.3691 | 0.4785 | 0.6016 | 0.4551 | 0.5537 | 0.6504 | 0.7539 | 0.8525 | 0.9258 | Notes |
|                               | odulati  | -                 | OOR      |        |        | QP     | SK     |        |        | 1      | 6QAN   | Λ      |        |        | 64Q    | AM     |        |        |       |
| MCS<br>Scheme                 | PRB  | Available<br>RE-s |          |        |        |        |        |        |        | Imo    | s      |        |        |        |        |        |        |        |       |
| MCS.1                         | 50   | 6300              | DTX      | 0      | 0      | 2      | 4      | 6      | 8      | 11     | 13     | 16     | 18     | 21     | 23     | 25     | 27     | 27     |       |
| MCS.2                         | 50   | 6000              | DTX      | 0      | 0      | 2      | 4      | 6      | 8      | 11     | 13     | 15     | 18     | 20     | 22     | 24     | 26     | 27     |       |
| MCS.3                         | 50   | 5700              | DTX      | 0      | 0      | 2      | 4      | 6      | 8      | 10     | 13     | 15     | 17     | 19     | 21     | 23     | 25     | 26     |       |
| MCS.4                         | 50   | 5600              | DTX      | 0      | 0      | 2      | 4      | 6      | 7      | 10     | 12     | 14     | 17     | 19     | 21     | 23     | 25     | 26     |       |
| MCS.5                         | 50   | 5400              | DTX      | 0      | 0      | 2      | 3      | 5      | 7      | 10     | 12     | 14     | 17     | 19     | 21     | 23     | 24     | 25     |       |
| MCS.6                         | 50   | 5300              | DTX      | 0      | 0      | 1      | 3      | 5      | 7      | 10     | 12     | 14     | 17     | 19     | 21     | 22     | 24     | 25     |       |
| MCS.7                         | 50   | 5200              | DTX      | 0      | 0      | 1      | 3      | 5      | 7      | 10     | 12     | 14     | 17     | 18     | 20     | 22     | 24     | 25     |       |
| MCS.8                         | 50   | 5000              | DTX      | 0      | 0      | 1      | 3      | 5      | 7      | 10     | 12     | 13     | 17     | 18     | 20     | 22     | 23     | 24     |       |
| MCS.9                         | 50   | 4800              | DTX      | 0      | 0      | 1      | 3      | 5      | 7      | 10     | 12     | 13     | 17     | 18     | 20     | 22     | 23     | 24     |       |
| MCS.10                        | 6  | 756               | DTX      | 0      | 0      | 2      | 4      | 6      | 8      | 11     | 13     | 16     | 19     | 21     | 23     | 25     | 27     | 27     |       |
| MCS.11                        | 6  | 684               | DTX      | 0      | 0      | 2      | 4      | 6      | 8      | 11     | 13     | 14     | 17     | 20     | 21     | 23     | 25     | 27     |       |
| MCS.12                        | 6  | 672               | DTX      | 0      | 0      | 1      | 4      | 6      | 8      | 10     | 12     | 14     | 17     | 19     | 21     | 23     | 25     | 26     |       |
| MCS.13                        | 6  | 648               | DTX      | 0      | 0      | 2      | 4      | 6      | 8      | 11     | 13     | 15     | 18     | 20     | 22     | 24     | 26     | 27     |       |
| MCS.14                        | 25   | 3150              | DTX      | 0      | 0      | 2      | 4      | 6      | 8      | 11     | 13     | 16     | 18     | 21     | 23     | 25     | 27     | 27     |       |
| MCS.15                        | 15   | 1890              | DTX      | 0      | 0      | 2      | 4      | 6      | 8      | 11     | 13     | 16     | 18     | 21     | 23     | 25     | 27     | 27     |       |
| MCS.16                        | 15   | 1800              | DTX      | 0      | 0      | 2      | 4      | 6      | 8      | 11     | 13     | 15     | 18     | 20     | 22     | 24     | 26     | 27     |       |
| MCS.17                        | 3  | 378               | DTX      | 0      | 1      | 2      | 5      | 7      | 9      | 12     | 13     | 16     | 19     | 21     | 23     | 25     | 27     | 27     |       |
| Note 1:<br>Note 2:<br>Note 3: | Mapping between Imcs and TBS according to Tables 7.1.7.1-1 and 7.1.7.2.1-1 in TS 36.213 [6].<br>3 symbols allocated to PDCCH.<br>Sub-frame#0 and #5 are not used for the corresponding requirement. The next subframe (i.e. sub-frame#1 or |                   |          |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |       |
|                               | #6) sh   | nall be used      | for pote | ential | retra  | nsmi   | ssion  | s.     |        |        |        |        |        |        |        |        |        |        |       |

## A.5 OFDMA Channel Noise Generator (OCNG)

## A.5.1 OCNG Patterns for FDD

The following OCNG patterns are used for modelling allocations to virtual UEs (which are not under test) and/or allocations used for MBSFN. The OCNG pattern for each sub frame specifies the allocations that shall be filled with OCNG, and furthermore, the relative power level of each such allocation.

In each test case the OCNG is expressed by parameters OCNG\_RA and OCNG\_RB which together with a relative power level ( $\gamma$ ) specifies the PDSCH EPRE-to-RS EPRE ratios in OFDM symbols with and without reference symbols, respectively. The relative power, which is used for modelling boosting per virtual UE allocation, is expressed by:

 $\gamma_i = PDSCH_i \_ RA / OCNG \_ RA = PDSCH_i \_ RB / OCNG \_ RB,$ 

where  $\gamma_i$  denotes the relative power level of the *i:th* virtual UE. The parameter settings of OCNG\_RA, OCNG\_RB, and the set of relative power levels  $\gamma$  are chosen such that when also taking allocations to the UE under test into account, as given by a PDSCH reference channel, a constant transmitted power spectral density that is constant on an OFDM symbol basis is targeted.

Moreover the OCNG pattern is accompanied by a PCFICH/PDCCH/PHICH reference channel which specifies the control region. For any aggregation and PHICH allocation, the PDCCH and any unused PHICH groups are padded with resource element groups with a power level given respectively by PDCCH\_RA/RB and PHICH\_RA/RB as specified in the test case such that a total power spectral density in the control region that is constant on an OFDM symbol basis is targeted.

For the performance requirements of UE with the CA capability, the OCNG patterns apply for each CC.

## A.5.1.1 OCNG FDD pattern 1: One sided dynamic OCNG FDD pattern

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the DL sub-frames, when the unallocated area is continuous in frequency domain (one sided).

|          |   | Relative power level $\gamma_{\scriptscriptstyle PRB}$ [di | B]   |        |  |  |
|----------|---|--|--|--------|--|--|
| Subframe |   |  |  |        |  |  |
|          | 0 5 1-4,6-9   |  |  |        |  |  |
|          |   | Allocation   |  | Data   |  |  |
| First u  | unallocated PRB   | First unallocated PRB                                      | First unallocated PRB  |        |  |  |
| Last     | –<br>unallocated PRB  | –<br>Last unallocated PRB                                  | <ul> <li>Last unallocated PRB</li> </ul>                                 |        |  |  |
|          | 0   | 0  | 0  | Note 1 |  |  |
| Note 1:  |   |  | arbitrary number of virtual UEs wit<br>PDSCHs shall be uncorrelated ps   |        |  |  |
|          | data, which is QPS  | K modulated. The parameter $\gamma_{_{Pl}}$                | $_{_{R\!B}}$ is used to scale the power of PI                            | DSCH.  |  |  |
| Note 2:  |   |  | I in the test, the OCNG shall be tra<br>RS according to transmission mod |        |  |  |
|          | parameter $\gamma_{_{PRB}}$ applies to each antenna port separately, so the transmit power is equal between all                 |  |  |        |  |  |
|          | the transmit antennas with CRS used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213. |  |  |        |  |  |

#### Table A.5.1.1-1: OP.1 FDD: One sided dynamic OCNG FDD Pattern

## A.5.1.2 OCNG FDD pattern 2: Two sided dynamic OCNG FDD pattern

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the DL sub-frames, when the unallocated area is discontinuous in frequency domain (divided in two parts by the allocated area – two sided), starts with PRB 0 and ends with PRB  $N_{_{RB}}-1$ .

|            | R   |  |                                  |                               |  |  |  |
|------------|---|--|----------------------------------|-------------------------------|--|--|--|
|            |   |  |                                  |                               |  |  |  |
|            | 0   | 5  | 1-4,6-9                          |                               |  |  |  |
|            |   | Allocation   |                                  | PDSCH Data                    |  |  |  |
| 0 – (First | t allocated PRB-1)  | 0 – (First allocated PRB-1)  | 0 – (First allocated PRB-1)      | 1 Doorn Data                  |  |  |  |
|            | and   | and  | and                              |                               |  |  |  |
| (Last all  | located PRB+1) –  | (Last allocated PRB+1) –   | (Last allocated PRB+1) –         |                               |  |  |  |
|            | $(N_{RB} - 1)$  | $(N_{RB} - 1)$   | $(N_{RB} - 1)$                   |                               |  |  |  |
|            | 0   | 0  | 0                                | Note 1                        |  |  |  |
| Note 1:    |   | ource blocks are assigned to a<br>nitted over the OCNG PDSCH       |                                  |                               |  |  |  |
|            | modulated. The pa   | rameter $\gamma_{\scriptscriptstyle PRB}$ is used to scale t       | he power of PDSCH.               |                               |  |  |  |
| Note 2:    | If two or more trans  | smit antennas with CRS are us                                      | ed in the test, the OCNG shall b | be transmitted to the virtual |  |  |  |
|            | users by all the transmit antennas with CRS according to transmission mode 2. The parameter $\gamma_{_{PRB}}$ applies |  |                                  |                               |  |  |  |
|            |   | ort separately, so the transmit p<br>ne antenna transmission modes |                                  |                               |  |  |  |

### Table A.5.1.2-1: OP.2 FDD: Two sided dynamic OCNG FDD Pattern

## A.5.1.3 OCNG FDD pattern 3: 49 RB OCNG allocation with MBSFN in 10 MHz

|                               |   | Re  | lative power  | evel $\gamma_{\scriptscriptstyle PRB}$ [d   | B]   |  |  |  |
|-------------------------------|---|---|---|---|--|--|--|--|
| Alloca                        |   |   | Subfi   | ame   |  | PDSCH<br>Data  | PMCH<br>Data   |  |
| n <sub>PRB</sub>              |   | 0   | Duiu  | Data  |  |  |  |  |
| 1 – 49                        |   | 0   | 0<br>(Allocation:<br>all empty<br>PRB-s)  | 0   | N/A  | Note 1   | N/A  |  |
| 0 —                           | - 49 N/A N/A N/A 0  |   |   |   | N/A  | Note 2   |  |  |
| Note 1:<br>Note 2:<br>Note 3: | one PDS<br>uncorrel<br>used to<br>Each ph<br>each PF<br>measure<br>contain<br>paramet<br>If two or<br>the virtu<br>transmit | hysical resource<br>SCH per virtual<br>ated pseudo ra<br>scale the powe<br>ysical resource<br>B shall be unce<br>ement. The MB<br>cell-specific Re<br>ter $\gamma_{PRB}$ is used<br>more transmit<br>al users by all to<br>power shall be | UE; the data t<br>ndom data, wh<br>r of PDSCH.<br>block (PRB) i<br>orrelated with<br>SFN data shal<br>ference Signal<br>I to scale the p<br>antennas are<br>he transmit an<br>equally split b | ransmitted over<br>hich is QPSK r<br>s assigned to I<br>data in other P<br>I be QPSK mo<br>is only in the fil<br>ower of PMCH<br>used in the tes<br>tennas accord<br>etween all the | er the OCNG F<br>nodulated. The<br>MBSFN transm<br>PRBs over the<br>idulated. PMCI<br>rst symbol of t<br>f.<br>t, the OCNG s<br>ling to transmis<br>transmit anter | PDSCHs sh<br>e paramete<br>nission. The<br>period of al<br>H subframe<br>he first time<br>shall be transsion mode<br>nnas used | hall be<br>be $\gamma_{PRB}$ is<br>e data in<br>my<br>es shall<br>e slot. The<br>hsmitted to<br>e 2. The<br>in the test. |  |
| N/A:                          | Not App   | enna transmiss<br>licable   | ion modes are   | specified in se   |  | 3FF 13 30  | .213.  |  |

### Table A.5.1.3-1: OP.3 FDD: OCNG FDD Pattern 3

## A.5.1.4 OCNG FDD pattern 4: One sided dynamic OCNG FDD pattern for MBMS transmission

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the DL sub-frames, when the unallocated area is continuous in frequency domain (one sided) and MBMS performance is tested.

|   |  | Re   |  |                            |        |        |  |  |
|---|--|--|--|----------------------------|--------|--------|--|--|
| Alloca  |  |  | Subframe                                 |                            |        |        |  |  |
| $n_{P_{e}}$   | RB   | 0, 4, 9 5 1 - 3, 6 - 8                       |  |                            | Data   | Data   |  |  |
| First unallocated<br>PRB<br>–<br>Last unallocated<br>PRB  |  | 0  | 0<br>(Allocation:<br>all empty<br>PRB-s) | N/A                        | Note 1 | N/A    |  |  |
| First unallocated<br>PRB<br>–<br>Last unallocated<br>PRB  |  | N/A  | N/A                                      | N/A                        | N/A    | Note 2 |  |  |
| Note 1:   | Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with<br>one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be |  |  |                            |        |        |  |  |
|   |  | •  |  | ich is QPSK modulated. The |        |        |  |  |
| Note 2:   | used to scale the power of PDSCH.  |  |  |                            |        |        |  |  |
|   | paramet  | er $\gamma_{\scriptscriptstyle PRB}$ is used | to scale the po                          | ower of PMCH.              |        |        |  |  |
| Note 3: If two or more transmit antennas are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas according to transmission mode 2. The transmit power shall be equally split between all the transmit antennas used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213. |  |  |  |                            |        |        |  |  |
| N/A:  | Not App  | licable                                      |  |                            |        |        |  |  |

Table A.5.1.4-1: OP.4 FDD: One sided dynamic OCNG FDD Pattern for MBMS transmission

### A.5.1.5 OCNG FDD pattern 5: One sided dynamic 16QAM modulated OCNG FDD pattern

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of DL sub-frames, when the unallocated area is continuous in the frequency domain (one sided).

|          | Relative power level $\gamma_{_{PRB}}$ [dB]   |   |  |         |  |  |  |  |
|----------|---|---|--|---------|--|--|--|--|
| Subframe |   |   |  |         |  |  |  |  |
|          | 0   | 5   | 1-4,6-9  | PDSCH   |  |  |  |  |
|          |   | Allocation  |  | Data    |  |  |  |  |
| First u  | unallocated PRB   | First unallocated PRB   | First unallocated PRB  |         |  |  |  |  |
| Last u   | unallocated PRB   | Last unallocated PRB  | Last unallocated PRB   |         |  |  |  |  |
|          | 0   | 0   | 0  | Note 1  |  |  |  |  |
| Note 1:  |   |   | arbitrary number of virtual UEs wit<br>PDSCHs shall be uncorrelated ps |         |  |  |  |  |
|          | data, which is 16QA   | AM modulated. The parameter $\gamma$                                | PRB is used to scale the power of F                                    | PDSCH.  |  |  |  |  |
| Note 2:  | e 2: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 3 (Large |   |  |         |  |  |  |  |
|          | Delay CDD). The parameter $\gamma_{_{PRB}}$ applies to each antenna port separately, so the transmit power is   |   |  |         |  |  |  |  |
|          |   | ne transmit antennas with CRS u<br>d in section 7.1 in 3GPP TS 36.2 | used in the test. The antenna trans<br>13.                             | mission |  |  |  |  |

### Table A.5.1.5-1: OP.5 FDD: One sided dynamic 16QAM modulated OCNG FDD Pattern

## A.5.1.6 OCNG FDD pattern 6: dynamic OCNG FDD pattern when user data is in 2 non-contiguous blocks

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the DL sub-frames, when the unallocated area is discontinuous in frequency domain (divided in two parts by the first allocated block). The second allocated block ends with PRB  $N_{RB} - 1$ .

|           | R   |   |                                  |                               |  |  |
|-----------|---|---|----------------------------------|-------------------------------|--|--|
|           |   |   |                                  |                               |  |  |
|           | 0 5 1-4,6-9   |   |                                  |                               |  |  |
|           |   | Allocation  |                                  |                               |  |  |
| 0 – (Firs | t allocated PRB of  | 0 – (First allocated PRB of   | 0 – (First allocated PRB of      | PDSCH Data                    |  |  |
| fir       | rst block -1)   | first block -1)   | first block -1)                  |                               |  |  |
|           | and   | and   | and                              |                               |  |  |
| ``        | ocated PRB of first   | (Last allocated PRB of first  | (Last allocated PRB of first     |                               |  |  |
|           | ) – (First allocated  | block +1) – (First allocated  | block +1) – (First allocated     |                               |  |  |
| PRB of    | second block -1)  | PRB of second block -1)   | PRB of second block -1)          |                               |  |  |
|           | 0   | 0 0   |                                  | Note 1                        |  |  |
| Note 1:   |   | ource blocks are assigned to an<br>nitted over the OCNG PDSCHs  |                                  |                               |  |  |
|           | modulated. The pa   | rameter ${\gamma}_{\scriptscriptstyle PRB}$ is used to scale the sc | he power of PDSCH.               |                               |  |  |
| Note 2:   | If two or more trans  | smit antennas with CRS are use  | ed in the test, the OCNG shall b | be transmitted to the virtual |  |  |
|           | users by all the transmit antennas with CRS according to transmission mode 2. The parameter $\gamma_{_{PRB}}$ applies   |   |                                  |                               |  |  |
|           | to each antenna port separately, so the transmit power is equal between all the transmit antennas with CRS used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213. |   |                                  |                               |  |  |

## A.5.1.7 OCNG FDD pattern 7: dynamic OCNG FDD pattern when user data is in multiple non-contiguous blocks

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data, EPDCCH or system information) of the DL sub-frames, when the unallocated area is discontinuous in frequency domain (divided in

multiple parts by the *M* allocated blocks for data transmission). The *m*-th allocated block starts with RPB  $N_{Start,m}$  and ends with PRB  $N_{End,m} - 1$ , where m = 1, ..., M. The system bandwidth starts with RPB 0 and ends with  $N_{RB} - 1$ .

| F                           |   |                                  |                               |  |  |  |  |
|-----------------------------|---|----------------------------------|-------------------------------|--|--|--|--|
|                             |   |                                  |                               |  |  |  |  |
| 0                           | 5   | 1-4,6-9                          |                               |  |  |  |  |
|                             | Allocation  |                                  |                               |  |  |  |  |
| $0 - (PRB N_{Start,1} - 1)$ | $0 - (PRB N_{Start,1} - 1)$   | $0 - (PRB N_{Start,1} - 1)$      |                               |  |  |  |  |
|                             |   |                                  | PDSCH Data                    |  |  |  |  |
| $(PRBN_{End,(m-1)}) - (PRB$ | $(PRBN_{End,(m-1)}) - (PRB$   | $(PRBN_{End,(m-1)}) - (PRB$      |                               |  |  |  |  |
| $N_{Start,m} - 1$ )         | $N_{Start,m} - 1$ )   | $N_{Start,m} - 1$ )              |                               |  |  |  |  |
|                             |   |                                  |                               |  |  |  |  |
| $(PRBN_{End,M}) - (PRB$     | $(PRBN_{End,M})$ – $(PRB$   | $(PRBN_{End,M})$ – $(PRB$        |                               |  |  |  |  |
| $N_{RB} - 1$ )              | $N_{RB} - 1$ )  | $N_{RB} - 1$ )                   |                               |  |  |  |  |
| 0                           | 0   | 0                                | Note 1                        |  |  |  |  |
|                             | source blocks are assigned to a<br>mitted over the OCNG PDSCHs  |                                  |                               |  |  |  |  |
| modulated. The pa           | rameter $\gamma_{\scriptscriptstyle PRB}$ is used to scale t  | he power of PDSCH.               |                               |  |  |  |  |
| Note 2: If two or more tran | smit antennas with CRS are us   | ed in the test, the OCNG shall I | be transmitted to the virtual |  |  |  |  |
| users by all the tra        | users by all the transmit antennas with CRS according to transmission mode 2. The parameter $\gamma_{_{PRB}}$ applies |                                  |                               |  |  |  |  |
|                             | ort separately, so the transmit p   |                                  |                               |  |  |  |  |

#### Table A.5.1.7-1: OP.7 FDD: OCNG FDD Pattern when user data is in multiple non-contiguous blocks

## A.5.1.8 OCNG FDD pattern 8: One sided dynamic OCNG FDD pattern for TM10 transmission

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the DL sub-frames, when the unallocated area is continuous in frequency domain (one sided).

|  |  | Relative power level $\gamma_{\scriptscriptstyle PRB}$ [dl | 3]                                  | _             |  |  |  |  |
|--|--|--|-------------------------------------|---------------|--|--|--|--|
| Subframe   |  |  |                                     |               |  |  |  |  |
| 0 5 1-4,6-9  |  |  |                                     |               |  |  |  |  |
|  | Allocation   |  |                                     |               |  |  |  |  |
| First unallocated PRB First unallocated PRB First unallocated PRB  |  |  |                                     |               |  |  |  |  |
| Last unallocated PRB Last unallocated PRB Last unallocated PRB   |  |  |                                     |               |  |  |  |  |
|  | 0 0 0 Note 1,2,3   |  |                                     |               |  |  |  |  |
| Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random |  |  |                                     |               |  |  |  |  |
|  | data, which is 16QAM modulated. The parameter ${\gamma}_{\scriptscriptstyle PRB}$ is used to scale the power of PDSCH.   |  |                                     |               |  |  |  |  |
| Note 2:  | Note 2: The OCNG shall be transmitted to the virtual users by all the transmit antennas according to transmission mode10. The the transmit power is equal between all the transmit antennas used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213. |  |                                     |               |  |  |  |  |
| Note 3:  | The detailed test se   | t-up for TM10 transmission i.e P                           | MI configuration is specified to ea | ch test case. |  |  |  |  |

| Table A.5.1.1-1: OP.8 FDD: One sided d | ynamic OCNG FDD Pattern |
|--|-------------------------|
|--|-------------------------|

## A.5.2 OCNG Patterns for TDD

The following OCNG patterns are used for modelling allocations to virtual UEs (which are not under test). The OCNG pattern for each sub frame specifies the allocations that shall be filled with OCNG, and furthermore, the relative power level of each such allocation.

In each test case the OCNG is expressed by parameters OCNG\_RA and OCNG\_RB which together with a relative power level ( $\gamma$ ) specifies the PDSCH EPRE-to-RS EPRE ratios in OFDM symbols with and without reference symbols, respectively. The relative power, which is used for modelling boosting per virtual UE allocation, is expressed by:

 $\gamma_i = PDSCH_i \_RA / OCNG \_RA = PDSCH_i \_RB / OCNG \_RB,$ 

where  $\gamma_i$  denotes the relative power level of the *i:th* virtual UE. The parameter settings of OCNG\_RA, OCNG\_RB, and the set of relative power levels  $\gamma$  are chosen such that when also taking allocations to the UE under test into account, as given by a PDSCH reference channel, a transmitted power spectral density that is constant on an OFDM symbol basis is targeted.

Moreover the OCNG pattern is accompanied by a PCFICH/PDCCH/PHICH reference channel which specifies the control region. For any aggregation and PHICH allocation, the PDCCH and any unused PHICH groups are padded with resource element groups with a power level given respectively by PDCCH\_RA/RB and PHICH\_RA/RB as specified in the test case such that a total power spectral density in the control region that is constant on an OFDM symbol basis is targeted.

### A.5.2.1 OCNG TDD pattern 1: One sided dynamic OCNG TDD pattern

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the subframes available for DL transmission (depending on TDD UL/DL configuration), when the unallocated area is continuous in frequency domain (one sided).

|           |  | Relative power  | level $\gamma_{\scriptscriptstyle PRB}$ [dB] |                           |                |  |  |
|-----------|--|---|--|---------------------------|----------------|--|--|
|           | Subframe (only if available for DL)  |   |  |                           |                |  |  |
|           | 0         5         3, 4, 7, 8, 9         1           and 6 (as normal subframe)         and 6 (as special subframe)         subframe)   |   |  |                           |                |  |  |
|           |  | Allo  | cation                                       |                           |                |  |  |
| First una | First unallocated PRB First unallocated PRB First unallocated PRB  |   |  |                           |                |  |  |
| Last una  | Last unallocated PRB Last unallocated PRB Last unallocated PRB Last unallocated PRB  |   |  |                           |                |  |  |
|           | 0 0 0 0 Note 1   |   |  |                           |                |  |  |
| Note 1:   | These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, |   |  |                           |                |  |  |
|           | which is QPS   | which is QPSK modulated. The parameter $\gamma_{_{PRR}}$ is used to scale the power of PDSCH. |  |                           |                |  |  |
| Note 2:   | Subframes available for DL transmission depends on the Uplink-Downlink configuration in Table 4.2-2 in 3GPP TS 36.211  |   |  |                           |                |  |  |
| Note 3:   | 3: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 2. The    |   |  |                           |                |  |  |
|           | parameter $\gamma_j$   | PRB applies to each anter   | nna port separately, so the                  | transmit power is equal b | etween all the |  |  |
|           |  | nnas with CRS used in th  | ne test. The antenna transr                  |                           |                |  |  |

### Table A.5.2.1-1: OP.1 TDD: One sided dynamic OCNG TDD Pattern

## A.5.2.2 OCNG TDD pattern 2: Two sided dynamic OCNG TDD pattern

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the subframes available for DL transmission (depending on TDD UL/DL configuration), when the unallocated area is

discontinuous in frequency domain (divided in two parts by the allocated area – two sided), starts with PRB 0 and ends with PRB  $N_{\rm _{RB}}$  –1.

|            |   | Relative power  | level $\gamma_{\scriptscriptstyle PRB}$ [dB] |   | PDSCH<br>Data |  |
|------------|---|---|--|---|---------------|--|
|            |   | Subframe (only in   | f available for DL)                          |   | Data          |  |
|            | 0 5 3, 4, 6, 7, 8, 9 1,6  |   |  |   |               |  |
|            |   |   | (6 as normal subframe)                       | (6 as special subframe)                                   |               |  |
|            |   | Alloc   | ation  |   |               |  |
|            | 0 -   | 0 —   | 0 —  | 0 —   |               |  |
| (First all | ocated PRB-1)   | (First allocated PRB-1)                                     | (First allocated PRB-1)                      | (First allocated PRB-1)                                   |               |  |
|            | and   | and   | and  | and   |               |  |
| -          | cated PRB+1) –  | (Last allocated PRB+1) –                                    | (Last allocated PRB+1) –                     | (Last allocated PRB+1) –                                  |               |  |
| ( )        | $(N_{RB} - 1)$ $(N_{RB} - 1)$ $(N_{RB} - 1)$ $(N_{RB} - 1)$   |   |  |   |               |  |
|            | 0   | 0   | 0  | 0   | Note 1        |  |
| Note 1:    |   |   |  | rtual UEs with one PDSCH p<br>pseudo random data, which i |               |  |
|            | modulated. The  | parameter $\gamma_{\scriptscriptstyle PRB}$ is used to set  | cale the power of PDSCH.                     |   |               |  |
| Note 2:    | : Subframes available for DL transmission depends on the Uplink-Downlink configuration in Table 4.2-2 in 3GPP TS 36.211 |   |  |   |               |  |
| Note 3:    | If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual            |   |  |   |               |  |
|            | users by all the transmit antennas with CRS according to transmission mode 2. The parameter $\gamma_{_{PRR}}$ ap        |   |  |   |               |  |
|            | •   | ort separately, so the transm<br>antenna transmission modes | • •  | the transmit antennas with C in 3GPP TS 36.213.           | RS used       |  |

# A.5.2.3 OCNG TDD pattern 3: 49 RB OCNG allocation with MBSFN in 10 MHz

| Table A.5.2.3-1: OP.3 TDD: OCNG TDD Pattern 3 for 5ms downlink-to-uplink switch-point periodicity |
|---|
|---|

|                                |   |           | Relative power | level $\gamma_{\scriptscriptstyle PRB}$ [dB] |           |  |  |  |  |  |
|--------------------------------|---|-----------|----------------|--|-----------|--|--|--|--|--|
| Allocation<br>n <sub>PRB</sub> |   |           | Subf           | PDSCH Data                                   | PMCH Data |  |  |  |  |  |
| n <sub>PR</sub>                | В   | 0         | 5              | 4, 9 <sup>Note 2</sup>                       | 1, 6      |  |  |  |  |  |
| 1 – 4                          | 1 – 49 0 (Allocation: all N/A 0 Note 1 N/A<br>empty PRB-s)  |           |                |  |           |  |  |  |  |  |
| 0 – 4                          | 0 – 49 N/A N/A 0 N/A N/A Note 3   |           |                |  |           |  |  |  |  |  |
|                                | Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter $\gamma_{PRB}$ is used to scale the power of PDSCH. |           |                |  |           |  |  |  |  |  |
| Note 2:                        | Note 2: Subframes available for DL transmission depends on the Uplink-Downlink configuration in Table 4.2-2 in  |           |                |  |           |  |  |  |  |  |
| Note 3:                        | uncorrelated with data in other PRBs over the period of any measurement. The MBSFN data shall be QPSK modulated. PMCH symbols shall not contain cell-specific Reference Signals.  |           |                |  |           |  |  |  |  |  |
| Note 4:                        |   |           |                |  |           |  |  |  |  |  |
| N/A                            | Not A   | pplicable |                |  |           |  |  |  |  |  |

### A.5.2.4 OCNG TDD pattern 4: One sided dynamic OCNG TDD pattern for MBMS transmission

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the DL sub-frames, when the unallocated area is continuous in frequency domain (one sided) and MBMS performance is tested.

|   |  | Relative power                                    | level $\gamma_{\scriptscriptstyle PRB}$ [dB] |             |             |             |  |  |
|---|--|---|--|-------------|-------------|-------------|--|--|
| Allocation  | cation Subframe (only for DL) PDSCH Data PMCH  |   |  |             |             |             |  |  |
| n <sub>PRB</sub>  | 0 and 6 (as<br>normal<br>subframe)   | 1 (as special subframe)                           | 5  | 3, 4, 7 – 9 | T Doon Data | T MOTT Data |  |  |
| First<br>unallocate<br>d PRB<br>–<br>Last<br>unallocate<br>d PRB  | 0  | 0<br>(Allocation: all<br>empty PRB-s<br>of DwPTS) | 0<br>(Allocation: all<br>empty PRB-s)        | N/A         | Note 1      | N/A         |  |  |
| First<br>unallocate<br>d PRB<br>–<br>Last<br>unallocate<br>d PRB  | unallocate<br>d PRB<br>- N/A N/A N/A N/A N/A Note<br>Last<br>unallocate  |   |  |             |             |             |  |  |
| Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter $\gamma_{PRB}$ is used to scale the power of PDSCH. |  |   |  |             |             |             |  |  |
| Note 2:   | Note 2: Each physical resource block (PRB) is assigned to MBSFN transmission. The data in each PRB shall be uncorrelated with data in other PRBs over the period of any measurement. The MBSFN data shall be QPSK modulated. PMCH symbols shall not contain cell-specific Reference Signals.   |   |  |             |             |             |  |  |
|   | If two or more transmit antennas are used in the test, the OCNG shall be transmitted to the virtual users<br>by all the transmit antennas according to transmission mode 2. The transmit power shall be equally split<br>between all the transmit antennas used in the test. The antenna transmission modes are specified in<br>section 7.1 in 3GPP TS 36.213. |   |  |             |             |             |  |  |
| N/A   | Not Applicable   |   |  |             |             |             |  |  |

### Table A.5.2.4-1: OP.4 TDD: One sided dynamic OCNG TDD Pattern for MBMS transmission

### A.5.2.5 OCNG TDD pattern 5: One sided dynamic 16QAM modulated OCNG TDD pattern

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the sub-frames available for DL transmission (depending on TDD UL/DL configuration), when the unallocated area is continuous in frequency domain (one sided).

|   |   | Relative power   | level $\gamma_{\scriptscriptstyle PRB}$ [dB] |                          |          |  |  |
|---|---|--|--|--------------------------|----------|--|--|
|   | Subframe (only if available for DL)   |  |  |                          |          |  |  |
|   | 0         5         3, 4, 7, 8, 9         1           and 6 (as normal subframe)         and 6 (as special subframe)         subframe)  |  |  |                          |          |  |  |
|   |   | Allo   | cation                                       |                          |          |  |  |
| First unallocated PRB First unallocated PRB First unallocated PRB First unallocated PRB |   |  |  |                          |          |  |  |
| Last una  | Last unallocated PRB Last unallocated PRB Last unallocated PRB Last unallocated PRB   |  |  |                          |          |  |  |
|   | 0 0 0 0 Note 1  |  |  |                          |          |  |  |
| Note 1:   | ote 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data,   |  |  |                          |          |  |  |
|   | which is 16QAM modulated. The parameter $\gamma_{_{PRB}}$ is used to scale the power of PDSCH.  |  |  |                          |          |  |  |
| Note 2:   | Subframes available for DL transmission depends on the Uplink-Downlink configuration in Table 4.2-2 in 3GPP TS 36.211   |  |  |                          |          |  |  |
| Note 3:   | ote 3: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 3 (Large Delay |  |  |                          |          |  |  |
|   | CDD). The parameter $\gamma_{_{PRB}}$ applies to each antenna port separately, so the transmit power is equal   |  |  |                          |          |  |  |
|   |   | he transmit antennas with<br>section 7.1 in 3GPP TS 36 | n CRS used in the test. The 5.213.           | e antenna transmission m | odes are |  |  |

### Table A.5.2.5-1: OP.5 TDD: One sided dynamic 16QAM modulated OCNG TDD Pattern

## A.5.2.6 OCNG TDD pattern 6: dynamic OCNG TDD pattern when user data is in 2 non-contiguous blocks

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the subframes available for DL transmission (depending on TDD UL/DL configuration), when the unallocated area is discontinuous in frequency domain (divided in two parts by the first allocated block). The second allocated block ends with PRB  $N_{RB} - 1$ .

| Relative power level $\gamma_{\scriptscriptstyle PRB}$ [dB]   |  |                          |   |                          | PDSCH<br>Data |
|---|--|--------------------------|---|--------------------------|---------------|
| Subframe (only if available for DL)   |  |                          |   |                          |               |
|   | 0  | 5                        | 3, 4, 6, 7, 8, 9  | 1,6                      |               |
|   |  |                          | (6 as normal subframe)  | (6 as special subframe)  |               |
|   |  | Alloc                    | ation   |                          |               |
| 0 – (Firs   | t allocated PRB  | 0 – (First allocated PRB | 0 – (First allocated PRB  | 0 – (First allocated PRB |               |
| of fir  | st block -1)   | of first block -1)       | of first block -1)  | of first block -1)       |               |
|   | and  | and                      | and   | and                      |               |
| (Last al  | located PRB of   | (Last allocated PRB of   | (Last allocated PRB of  | (Last allocated PRB of   |               |
|   | first block +1) – (First     |                          |   |                          |               |
| allocated   | allocated PRB of second allocated PRB of second allocated PRB of second allocated PRB of second                                  |                          |   |                          |               |
| block -1)         block -1)         block -1)   |  |                          |   | Note 1                   |               |
| 0 0 0 0   |  |                          |   |                          |               |
| Note 1:   |  |                          | d to an arbitrary number of vi<br>SCHs shall be uncorrelated (  |                          |               |
| modulated. The parameter ${\gamma}_{_{PRB}}$ is used to scale the power of PDSCH.                               |  |                          |   |                          |               |
| Note 2:   | Note 2: Subframes available for DL transmission depends on the Uplink-Downlink configuration in Table 4.2-2 in 3GPP<br>TS 36.211 |                          |   |                          |               |
| Note 3:   | If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual                     |                          |   |                          |               |
| users by all the transmit antennas with CRS according to transmission mode 2. The parameter $\gamma_{_{PRB}}$ a |  |                          |   |                          | applies to    |
|   |  |                          | it power is equal between all<br>are specified in section 7.1 i |                          | CRS used      |

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data, EPDCCH or system information) of the DL sub-frames, when the unallocated area is discontinuous in frequency domain (divided in multiple parts by the *M* allocated blocks for data transmission). The *m*-th allocated block starts with RPB  $N_{Start,m}$  and ends with PRB  $N_{End,m}$  -1, where m = 1, ..., M. The system bandwidth starts with RPB 0 and ends with  $N_{RB}$  -1.

## Table A.5.2.7-1: OP.7 TDD: OCNG TDD Pattern when user data is in multiple non-contiguous blocks

|                |                               | Relative power   | level ${\gamma}_{_{PRB}}$ [dB]                                  |   | PDSCH<br>Data |
|----------------|-------------------------------|--|---|---|---------------|
|                |                               | Subframe (only if  | available for DL)   |   | Dala          |
|                | 0                             | 5  | 3, 4, 6, 7, 8, 9<br>(6 as normal subframe)<br><sub>Note 2</sub> | 1,6<br>(6 as special subframe)<br><sub>Note 2</sub> |               |
|                |                               | Alloc  | ation   |   |               |
| 0 – (PRI       | $BN_{Start,1}-1$ )            | $0 - (PRBN_{Start,1} - 1)$   | $0 - (PRB N_{Start,1} - 1)$                                     | $0 - (PRB N_{Start,1} - 1)$                         |               |
| (PRB $\Lambda$ | <br>$V_{End,(m-1)}) -$        | <br>(PRB N <sub>End,(m-1)</sub> ) –  | <br>(PRB N <sub>End,(m-1)</sub> ) –                             | <br>(PRB N <sub>End,(m-1)</sub> ) –                 |               |
| (PRB           | $N_{Start,m} - 1$ )           | (PRB $N_{Start,m} - 1$ )   | (PRB $N_{Start,m} - 1$ )  | (PRB $N_{Start,m} - 1$ )                            |               |
| (PRB $N_{B}$   | <br><sub>End,M</sub> ) – (PRB | <br>(PRB $N_{End,M}$ ) – (PRB  | <br>(PRB $N_{End,M}$ ) – (PRB                                   | <br>(PRB $N_{End,M}$ ) – (PRB                       |               |
| Ν              | и <sub>RB</sub> —1)           | $N_{RB} - 1$ )   | $N_{RB} - 1$ )  | $N_{RB} - 1$ )                                      |               |
|                | 0                             | 0  | 0   | 0   | Note 1        |
| Note 1:        | UE; the data tra              | resource blocks are assigned normalized over the OCNG PD parameter $\gamma_{PRB}$ is used to s | SCHs shall be uncorrelated                                      |   |               |
| Note 2:        | Subframes avail TS 36.211.    | able for DL transmission dep   | pends on the Uplink-Downlin                                     | k configuration in Table 4.2-2                      | 2 in 3GPP     |
| Note 3:        |                               | ansmit antennas with CRS a<br>transmit antennas with CRS                                       |   |   |               |
|                |                               | ort separately, so the transmi<br>antenna transmission modes                                   |   |   | CRS used      |

## A.5.2.8 OCNG TDD pattern 8: One sided dynamic OCNG TDD pattern for TM10 transmission

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the DL sub-frames, when the unallocated area is continuous in frequency domain (one sided).

| Relative power level $\gamma_{\scriptscriptstyle PRB}$ [dB]  |  |                                   |  |                |  |
|--|--|-----------------------------------|--|----------------|--|
| Subframe   |  |                                   |  |                |  |
|  | 0 5 1-4,6-9  |                                   |  | PDSCH          |  |
|  |  | Allocation                        |  | Data           |  |
| First  | unallocated PRB  | First unallocated PRB             | First unallocated PRB                    |                |  |
| –<br>Last unallocated PRB  |  | –<br>Last unallocated PRB         | <ul> <li>Last unallocated PRB</li> </ul> |                |  |
| 0  |  | 0                                 | 0  | Note 1,2,3     |  |
| Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random |  |                                   |  |                |  |
|  | data, which is 16QAM modulated. The parameter ${\gamma}_{_{PRB}}$ is used to scale the power of PDSCH.   |                                   |  |                |  |
| Note 2:  | Note 2: The OCNG shall be transmitted to the virtual users by all the transmit antennas according to transmission mode10. The the transmit power is equal between all the transmit antennas used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213. |                                   |  |                |  |
| Note 3:  | The detailed test se   | et-up for TM10 transmission i.e P | MI configuration is specified to ea      | ach test case. |  |

### Table A.5.1.1-1: OP.8 TDD: One sided dynamic OCNG TDD Pattern

## Annex B (normative): Propagation conditions

## B.1 Static propagation condition

For 2 port transmission the channel matrix is defined in the frequency domain by

$$\mathbf{H} = \begin{pmatrix} 1 & j \\ 1 & -j \end{pmatrix}.$$

For 4 port transmission the channel matrix is defined in the frequency domain by

$$\mathbf{H} = \begin{bmatrix} 1 & 1 & j & j \\ 1 & 1 - j & -j \end{bmatrix}$$

For 8 port transmission the channel matrix is defined in the frequency domain by

$$\mathbf{H} = \begin{bmatrix} 1 & 1 & 1 & 1 & j & j & j & j \\ 1 & 1 & 1 & 1 & -j & -j & -j & -j \end{bmatrix}$$

## B.2 Multi-path fading propagation conditions

The multipath propagation conditions consist of several parts:

- A delay profile in the form of a "tapped delay-line", characterized by a number of taps at fixed positions on a sampling grid. The profile can be further characterized by the r.m.s. delay spread and the maximum delay spanned by the taps.

- A combination of channel model parameters that include the Delay profile and the Doppler spectrum, that is characterized by a classical spectrum shape and a maximum Doppler frequency

- A set of correlation matrices defining the correlation between the UE and eNodeB antennas in case of multi-antenna systems.

- Additional multi-path models used for CQI (Channel Quality Indication) tests

## B.2.1 Delay profiles

The delay profiles are selected to be representative of low, medium and high delay spread environments. The resulting model parameters are defined in Table B.2.1-1 and the tapped delay line models are defined in Tables B.2.1-2, B.2.1-3 and B.2.1-4.

| Model                              | Number of<br>channel taps | Delay spread<br>(r.m.s.) | Maximum excess<br>tap delay (span) |
|------------------------------------|---------------------------|--------------------------|------------------------------------|
| Extended Pedestrian A (EPA)        | 7                         | 45 ns                    | 410 ns                             |
| Extended Vehicular A model (EVA)   | 9                         | 357 ns                   | 2510 ns                            |
| Extended Typical Urban model (ETU) | 9                         | 991 ns                   | 5000 ns                            |

Table B.2.1-1 Delay profiles for E-UTRA channel models

| Excess tap delay<br>[ns] | Relative power<br>[dB] |
|--------------------------|------------------------|
| 0                        | 0.0                    |
| 30                       | -1.0                   |
| 70                       | -2.0                   |
| 90                       | -3.0                   |
| 110                      | -8.0                   |
| 190                      | -17.2                  |
| 410                      | -20.8                  |

Table B.2.1-2 Extended Pedestrian A model (EPA)

| Table B.2.1-3 Extended | Vehicular A | A model ( | (EVA) |
|------------------------|-------------|-----------|-------|
|------------------------|-------------|-----------|-------|

| Excess tap delay<br>[ns] | Relative power<br>[dB] |
|--------------------------|------------------------|
| 0                        | 0.0                    |
| 30                       | -1.5                   |
| 150                      | -1.4                   |
| 310                      | -3.6                   |
| 370                      | -0.6                   |
| 710                      | -9.1                   |
| 1090                     | -7.0                   |
| 1730                     | -12.0                  |
| 2510                     | -16.9                  |

#### Table B.2.1-4 Extended Typical Urban model (ETU)

| Excess tap delay<br>[ns] | Relative power<br>[dB] |
|--------------------------|------------------------|
| 0                        | -1.0                   |
| 50                       | -1.0                   |
| 120                      | -1.0                   |
| 200                      | 0.0                    |
| 230                      | 0.0                    |
| 500                      | 0.0                    |
| 1600                     | -3.0                   |
| 2300                     | -5.0                   |
| 5000                     | -7.0                   |

## B.2.2 Combinations of channel model parameters

The propagation conditions used for the performance measurements in multi-path fading environment are indicated as EVA[number], EPA[number] or ETU[number] where 'number' indicates the maximum Doppler frequency (Hz).

#### Table B.2.2-1 Void

## B.2.3 MIMO Channel Correlation Matrices

The MIMO channel correlation matrices defined in B.2.3 apply for the antenna configuration using uniform linear arrays at both eNodeB and UE.

### B.2.3.1 Definition of MIMO Correlation Matrices

Table B.2.3.1-1 defines the correlation matrix for the eNodeB

|                     | One antenna   | Two antennas   | Four antennas   |
|---------------------|---------------|--|---|
| eNode B Correlation | $R_{eNB} = 1$ | $R_{eNB} = \begin{pmatrix} 1 & \alpha \\ \alpha^* & 1 \end{pmatrix}$ | $R_{eNB} = \begin{pmatrix} 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{4}{9}} & \alpha \\ \alpha^{\frac{1}{9}} & 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{4}{9}} \\ \alpha^{\frac{4}{9}} & \alpha^{\frac{1}{9}} & 1 & \alpha^{\frac{1}{9}} \\ \alpha^{\ast} & \alpha^{\frac{4}{9}} & \alpha^{\frac{1}{9}} & 1 \end{pmatrix}$ |

### Table B.2.3.1-1 eNodeB correlation matrix

Table B.2.3.1-2 defines the correlation matrix for the UE:

|                | One antenna               | Two antennas  | Four antennas   |
|----------------|---------------------------|---|---|
| UE Correlation | <i>R<sub>UE</sub></i> = 1 | $R_{UE} = \begin{pmatrix} 1 & \beta \\ \beta^* & 1 \end{pmatrix}$ | $R_{UE} = \begin{pmatrix} 1 & \beta^{\frac{1}{9}} & \beta^{\frac{4}{9}} & \beta \\ \beta^{\frac{1}{9}^{*}} & 1 & \beta^{\frac{1}{9}} & \beta^{\frac{4}{9}} \\ \beta^{\frac{4}{9}^{*}} & \beta^{\frac{1}{9}^{*}} & 1 & \beta^{\frac{1}{9}} \\ \beta^{*} & \beta^{\frac{4}{9}^{*}} & \beta^{\frac{1}{9}^{*}} & 1 \end{pmatrix}$ |

### Table B.2.3.1-2 UE correlation matrix

Table B.2.3.1-3 defines the channel spatial correlation matrix  $R_{spat}$ . The parameters,  $\alpha$  and  $\beta$  in Table B.2.3.1-3 defines the spatial correlation between the antennas at the eNodeB and UE.

| Table B.2.3.1-3: | $R_{spat}$ | correlation matrices |
|------------------|------------|----------------------|
|------------------|------------|----------------------|

| 1x2 case | $R_{spat} = R_{UE} = \begin{bmatrix} 1 & \beta \\ \beta^* & 1 \end{bmatrix}$  |
|----------|---|
| 2x2 case | $R_{spat} = R_{eNB} \otimes R_{UE} = \begin{bmatrix} 1 & \alpha \\ \alpha^* & 1 \end{bmatrix} \otimes \begin{bmatrix} 1 & \beta \\ \beta^* & 1 \end{bmatrix} = \begin{bmatrix} 1 & \beta & \alpha & \alpha\beta \\ \beta^* & 1 & \alpha\beta^* & \alpha \\ \alpha^* & \alpha^*\beta & 1 & \beta \\ \alpha^*\beta^* & \alpha^* & \beta^* & 1 \end{bmatrix}$  |
| 4x2 case | $R_{spat} = R_{eNB} \otimes R_{UE} = \begin{bmatrix} 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{4}{9}} & \alpha \\ \alpha^{\frac{1}{9}} & 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{4}{9}} \\ \alpha^{\frac{4}{9}} & \alpha^{\frac{1}{9}} & 1 & \alpha^{\frac{1}{9}} \\ \alpha^{*} & \alpha^{\frac{4}{9}} & \alpha^{\frac{1}{9}} & 1 \end{bmatrix} \otimes \begin{bmatrix} 1 & \beta \\ \beta^{*} & 1 \end{bmatrix}$   |
| 4x4 case | $R_{spat} = R_{eNB} \otimes R_{UE} = \begin{bmatrix} 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{4}{9}} & \alpha \\ \alpha^{\frac{1}{9}} & 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{4}{9}} \\ \alpha^{\frac{4}{9}} & \alpha^{\frac{1}{9}} & 1 & \alpha^{\frac{1}{9}} \\ \alpha^{\frac{4}{9}} & \alpha^{\frac{4}{9}} & \alpha^{\frac{1}{9}} & 1 \end{bmatrix} \otimes \begin{bmatrix} 1 & \beta^{\frac{1}{9}} & \beta^{\frac{4}{9}} & \beta \\ \beta^{\frac{1}{9}} & 1 & \beta^{\frac{1}{9}} & \beta^{\frac{4}{9}} \\ \beta^{\frac{4}{9}} & \beta^{\frac{1}{9}} & 1 & \beta^{\frac{1}{9}} \\ \beta^{\frac{4}{9}} & \beta^{\frac{1}{9}} & \beta^{\frac{1}{9}} & 1 & \beta^{\frac{1}{9}} \\ \beta^{\ast} & \beta^{\frac{4}{9}} & \beta^{\frac{4}{9}} & 1 \end{bmatrix}$ |

For cases with more antennas at either eNodeB or UE or both, the channel spatial correlation matrix can still be expressed as the Kronecker product of  $R_{eNB}$  and  $R_{UE}$  according to  $R_{spat} = R_{eNB} \otimes R_{UE}$ .

### B.2.3.2 MIMO Correlation Matrices at High, Medium and Low Level

The  $\alpha$  and  $\beta$  for different correlation types are given in Table B.2.3.2-1.

| Low correlation |   | Medium Correlation |     | High Correlation |     |
|-----------------|---|--------------------|-----|------------------|-----|
| α               | β | α                  | β   | α                | β   |
| 0               | 0 | 0.3                | 0.9 | 0.9              | 0.9 |

### Table B.2.3.2-1

The correlation matrices for high, medium and low correlation are defined in Table B.2.3.1-2, B.2.3.2-3 and B.2.3.2-4, as below.

The values in Table B.2.3.2-2 have been adjusted for the  $4x^2$  and  $4x^4$  high correlation cases to insure the correlation matrix is positive semi-definite after round-off to 4 digit precision. This is done using the equation:

$$\mathbf{R}_{high} = [\mathbf{R}_{spatial} + aI_n]/(1+a)$$

Where the value "a" is a scaling factor such that the smallest value is used to obtain a positive semi-definite result. For the  $4x^2$  high correlation case, a=0.00010. For the  $4x^4$  high correlation case, a=0.00012.

The same method is used to adjust the 4x4 medium correlation matrix in Table B.2.3.2-3 to insure the correlation matrix is positive semi-definite after round-off to 4 digit precision with a = 0.00012.

| 1x2 case | $R_{high} = \begin{pmatrix} 1 & 0.9 \\ 0.9 & 1 \end{pmatrix}$   |  |
|----------|---|--|
| 2x2 case | $R_{high} = \begin{pmatrix} 1 & 0.9 & 0.9 & 0.81 \\ 0.9 & 1 & 0.81 & 0.9 \\ 0.9 & 0.81 & 1 & 0.9 \\ 0.81 & 0.9 & 0.9 & 1 \end{pmatrix}$   |  |
| 4x2 case | $R_{high} = \begin{bmatrix} 1.0000 & 0.8999 & 0.9883 & 0.8894 & 0.9542 & 0.8587 & 0.8999 & 0.8099 \\ 0.8999 & 1.0000 & 0.8894 & 0.9883 & 0.8587 & 0.9542 & 0.8099 & 0.8999 \\ 0.9883 & 0.8894 & 1.0000 & 0.8999 & 0.9883 & 0.8894 & 0.9542 & 0.8587 \\ 0.8894 & 0.9883 & 0.8999 & 1.0000 & 0.8894 & 0.9883 & 0.8587 & 0.9542 \\ 0.9542 & 0.8587 & 0.9883 & 0.8894 & 1.0000 & 0.8999 & 0.9883 & 0.8894 \\ 0.8587 & 0.9542 & 0.8894 & 0.9883 & 0.8999 & 1.0000 & 0.8894 & 0.9883 \\ 0.8999 & 0.8099 & 0.9542 & 0.8587 & 0.9542 & 0.8894 & 1.0000 & 0.8894 \\ 0.8099 & 0.8099 & 0.9542 & 0.8587 & 0.9542 & 0.8894 & 1.0000 & 0.8999 \\ 0.8099 & 0.8999 & 0.8587 & 0.9542 & 0.8894 & 0.9883 & 0.8999 & 1.0000 \end{bmatrix}$  |  |
| 4x4 case | $R_{high} = \begin{bmatrix} 1.0000 \ 0.9882 \ 0.9541 \ 0.8999 \ 0.9882 \ 0.9767 \ 0.9430 \ 0.8894 \ 0.9541 \ 0.9430 \ 0.9105 \ 0.8587 \ 0.8999 \ 0.8894 \ 0.8587 \ 0.8099 \\ 0.9882 \ 1.0000 \ 0.9882 \ 0.9541 \ 0.9767 \ 0.9882 \ 0.9767 \ 0.9430 \ 0.9430 \ 0.9541 \ 0.9430 \ 0.9105 \ 0.8587 \ 0.8999 \ 0.8894 \ 0.8587 \\ 0.9541 \ 0.9882 \ 1.0000 \ 0.9882 \ 0.9430 \ 0.9767 \ 0.9882 \ 0.9767 \ 0.9105 \ 0.9430 \ 0.9541 \ 0.9430 \ 0.8587 \ 0.8894 \ 0.8999 \ 0.8894 \ 0.8587 \\ 0.8999 \ 0.9541 \ 0.9882 \ 1.0000 \ 0.8894 \ 0.9430 \ 0.9767 \ 0.9882 \ 0.9767 \ 0.9105 \ 0.9430 \ 0.9541 \ 0.9430 \ 0.8587 \ 0.8894 \ 0.8999 \ 0.8587 \ 0.8894 \ 0.8999 \ 0.8587 \ 0.8894 \ 0.8999 \ 0.8587 \ 0.9899 \ 0.9541 \ 0.9430 \ 0.9767 \ 0.9882 \ 0.9767 \ 0.9430 \ 0.9541 \ 0.9430 \ 0.9541 \ 0.9430 \ 0.9767 \ 0.9882 \ 0.9767 \ 0.9430 \ 0.9767 \ 0.9882 \ 0.9767 \ 0.9430 \ 0.9767 \ 0.9882 \ 0.9767 \ 0.9430 \ 0.9767 \ 0.9882 \ 0.9767 \ 0.9430 \ 0.9767 \ 0.9882 \ 0.9767 \ 0.9430 \ 0.9767 \ 0.9882 \ 0.9767 \ 0.9430 \ 0.9767 \ 0.9882 \ 0.9767 \ 0.9430 \ 0.9767 \ 0.9882 \ 0.9767$ |  |

Table B.2.3.2-2: MIMO correlation matrices for high correlation

| 1x2<br>case |                       |   |   |  |  |  |  |  | N/A  |  |  |  |  |  |  |  |  |
|-------------|-----------------------|---|---|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| 2x2<br>case |                       | $R_{medium} = \begin{pmatrix} 1 & 0.9 & 0.3 & 0.27 \\ 0.9 & 1 & 0.27 & 0.3 \\ 0.3 & 0.27 & 1 & 0.9 \\ 0.27 & 0.3 & 0.9 & 1 \end{pmatrix}$ |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4x2<br>case |                       | R <sub>med</sub>  | lium =  | 0<br>0<br>0<br>0<br>0<br>0   | 0000<br>.9000<br>.8748<br>.7873<br>.5856<br>.5271<br>.3000<br>.2700  | 0.900<br>1.000<br>0.787<br>0.874<br>0.527<br>0.585<br>0.270<br>0.300   | 00       0.         73       1.         18       0.         71       0.         56       0.         00       0.                          | 8748<br>7873<br>0000<br>9000<br>8748<br>7873<br>.5856<br>.5271   | 0.787<br>0.874<br>0.900<br>1.000<br>0.787<br>0.874<br>0.527<br>0.585   | 8       0.         0       0.         0       0.         3       1.         8       0.         1       0.                                | 5271<br>8748<br>7873<br>0000<br>9000<br>8748   | 0.527<br>0.5856<br>0.7873<br>0.8748<br>0.9000<br>1.0000<br>0.7873<br>0.8748  | 5 0.2<br>3 0.5<br>8 0.5<br>0 0.8<br>0 0.7<br>3 1.0   | 700<br>856<br>271<br>748<br>873<br>000   | 0.2700<br>0.3000<br>0.5271<br>0.5856<br>0.7873<br>0.8748<br>0.9000<br>1.0000   |  |  |
| 4x4<br>case | R <sub>medium</sub> = |   | .0000<br>0.9882<br>0.9541<br>0.8645<br>0.8747<br>0.8645<br>0.8347<br>0.5787<br>0.5787<br>0.5588<br>0.2965<br>0.3000<br>0.2965 | 0.9882<br>1.0000<br>0.9882<br>0.8347<br>0.8645<br>0.8747<br>0.8645<br>0.5588<br>0.5787<br>0.5855<br>0.5787<br>0.2862<br>0.2965<br>0.3000 | 0.9541<br>0.9882<br>1.0000<br>0.7872<br>0.8347<br>0.8645<br>0.8747<br>0.5270<br>0.5588<br>0.5787<br>0.5855<br>0.2700<br>0.2862<br>0.2965 | 0.8645<br>0.8347<br>0.7872<br>1.0000<br>0.9882<br>0.9541<br>0.8999<br>0.8747<br>0.8645<br>0.8347<br>0.7872<br>0.5855<br>0.5787<br>0.5588 | 0.8747<br>0.8645<br>0.8347<br>0.9882<br>1.0000<br>0.9882<br>0.9541<br>0.8645<br>0.8747<br>0.8645<br>0.8347<br>0.5787<br>0.5855<br>0.5787 | 0.8645<br>0.8747<br>0.8645<br>0.9541<br>0.9882<br>1.0000<br>0.9882<br>0.8347<br>0.8645<br>0.8747<br>0.8645<br>0.5588<br>0.5787<br>0.5855 | 0.8347<br>0.8645<br>0.8747<br>0.8999<br>0.9541<br>0.9882<br>1.0000<br>0.7872<br>0.8347<br>0.8645<br>0.8747<br>0.5270<br>0.5588<br>0.5787 | 0.5787<br>0.5588<br>0.5270<br>0.8747<br>0.8645<br>0.8347<br>0.7872<br>1.0000<br>0.9882<br>0.9541<br>0.8999<br>0.8747<br>0.8645<br>0.8347 | <ul> <li>3 0.5787</li> <li>) 0.5588</li> <li>) 0.5588</li> <li>7 0.8645</li> <li>5 0.8747</li> <li>) 0.8645</li> <li>2 0.8347</li> <li>) 0.9882</li> <li>2 1.0000</li> <li>1 0.9882</li> <li>2 1.0000</li> <li>1 0.9882</li> <li>) 0.9541</li> <li>7 0.8645</li> <li>5 0.8747</li> <li>7 0.8645</li> </ul> | 0.5787<br>0.5855<br>0.5787<br>0.8347<br>0.8645<br>0.8747<br>0.8645<br>0.9541<br>0.9882<br>1.0000<br>0.9882<br>0.8347<br>0.8645<br>0.8747 | 0.5588<br>0.5787<br>0.5855<br>0.7872<br>0.8347<br>0.8645<br>0.8747<br>0.8999<br>0.9541<br>0.9882<br>1.0000<br>0.7872<br>0.8347<br>0.8645 | 0.2965<br>0.2862<br>0.2700<br>0.5855<br>0.5787<br>0.5588<br>0.5270<br>0.8747<br>0.8645<br>0.8347<br>0.7872<br>1.0000<br>0.9882<br>0.9541 | 0.3000<br>0.2965<br>0.2862<br>0.5787<br>0.5588<br>0.8645<br>0.8747<br>0.8645<br>0.8347<br>0.9882<br>1.0000<br>0.9882 | 0.2965<br>0.3000<br>0.2965<br>0.5588<br>0.5787<br>0.5855<br>0.5787<br>0.8347<br>0.8645<br>0.8747<br>0.8645<br>0.9541<br>0.9882<br>1.0000 | 0.2862<br>0.2965<br>0.3000<br>0.5270<br>0.5588<br>0.5787<br>0.5855<br>0.7872<br>0.8347<br>0.8645<br>0.8747<br>0.8999<br>0.9541<br>0.9882 |

| Table B.2.3.2-3: MIMO | correlation matrices | s for medium correlation |
|-----------------------|----------------------|--------------------------|
|                       |                      |                          |

Table B.2.3.2-4: MIMO correlation matrices for low correlation

| 1x2 case | $R_{low} = \mathbf{I}_2$    |
|----------|-----------------------------|
| 2x2 case | $R_{low} = \mathbf{I}_4$    |
| 4x2 case | $R_{low} = \mathbf{I}_8$    |
| 4x4 case | $R_{low} = \mathbf{I}_{16}$ |

In Table B.2.3.2-4,  $\mathbf{I}_d$  is the  $d \times d$  identity matrix.

# B.2.3A MIMO Channel Correlation Matrices using cross polarized antennas

The MIMO channel correlation matrices defined in B.2.3A apply for the antenna configuration using cross polarized antennas at both eNodeB and UE. The cross-polarized antenna elements with +/-45 degrees polarization slant angles are deployed at eNB and cross-polarized antenna elements with +90/0 degrees polarization slant angles are deployed at UE.

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For the cross-polarized antennas, the N antennas are labelled such that antennas for one polarization are listed from 1 to N/2 and antennas for the other polarization are listed from N/2+1 to N, where N is the number of transmit or receive antennas.

## B.2.3A.1 Definition of MIMO Correlation Matrices using cross polarized antennas

For the channel spatial correlation matrix, the following is used:

$$R_{spat} = P(R_{eNB} \otimes \Gamma \otimes R_{UE})P^{T}$$

where

- $R_{UE}$  is the spatial correlation matrix at the UE with same polarization,
- $R_{eNB}$  is the spatial correlation matrix at the eNB with same polarization,
- $\Gamma$  is a polarization correlation matrix, and
- $(\bullet)^T$  denotes transpose.

The matrix  $\Gamma$  is defined as

$$\Gamma = \begin{bmatrix} 1 & 0 & -\gamma & 0 \\ 0 & 1 & 0 & \gamma \\ -\gamma & 0 & 1 & 0 \\ 0 & \gamma & 0 & 1 \end{bmatrix}$$

A permutation matrix P elements are defined as

$$P(a,b) = \begin{cases} 1 & for \ a = (j-1)Nr + i \ and \ b = 2(j-1)Nr + i, \\ 1 & for \ a = (j-1)Nr + i \ and \ b = 2(j-Nt/2)Nr - Nr + i, \\ 0 & otherwise \end{cases} i = 1, \dots, Nr, \ j = Nt/2 + 1, \dots, Nt + i \\ 0 & otherwise \end{cases}$$

where  $N_t$  and  $N_r$  is the number of transmitter and receiver respectively. This is used to map the spatial correlation coefficients in accordance with the antenna element labelling system described in B.2.3A.

## B.2.3A.2 Spatial Correlation Matrices using cross polarized antennas at eNB and UE sides

#### B.2.3A.2.1 Spatial Correlation Matrices at eNB side

For 2-antenna transmitter using one pair of cross-polarized antenna elements,  $R_{eNB} = 1$ .

For 4-antenna transmitter using two pairs of cross-polarized antenna elements,  $R_{eNB} = \begin{pmatrix} 1 & \alpha \\ \alpha^* & I \end{pmatrix}$ .

For 8-antenna transmitter using four pairs of cross-polarized antenna elements, 
$$R_{eNB} = \begin{pmatrix} 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{4}{9}} & \alpha \\ \alpha^{\frac{1}{9}} & 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{4}{9}} \\ \alpha^{\frac{4}{9}} & \alpha^{\frac{1}{9}} & 1 & \alpha^{\frac{1}{9}} \\ \alpha^{\frac{4}{9}} & \alpha^{\frac{4}{9}} & \alpha^{\frac{1}{9}} & 1 \\ \alpha^{\frac{4}{9}} & \alpha^{\frac{4}{9}} & \alpha^{\frac{1}{9}} & 1 \end{pmatrix}$$

### B.2.3A.2.2 Spatial Correlation Matrices at UE side

For 2-antenna receiver using one pair of cross-polarized antenna elements,  $R_{UE} = 1$ .

For 4-antenna receiver using two pairs of cross-polarized antenna elements,  $R_{UE} = \begin{pmatrix} 1 & \beta \\ \beta^* & 1 \end{pmatrix}$ .

### B.2.3A.3 MIMO Correlation Matrices using cross polarized antennas

The values for parameters  $\alpha$ ,  $\beta$  and  $\gamma$  for high spatial correlation are given in Table B.2.3A.3-1.

| Table | B.2.3A.3-1 |  |
|-------|------------|--|
|       |            |  |

|         |                                  | High spatial correlation                 |                             |
|---------|----------------------------------|--|-----------------------------|
|         |                                  |  |                             |
|         | 0.9                              | 0.9                                      | 0.3                         |
| Note 1: | Value of $\alpha$ applies when n | nore than one pair of cross-polarized ar | tenna elements at eNB side. |
| Note 2: | Value of $\beta$ applies when n  | nore than one pair of cross-polarized an | tenna elements at UE side.  |

The correlation matrices for high spatial correlation are defined in Table B.2.3A.3-2 as below.

The values in Table B.2.3A.3-2 have been adjusted to insure the correlation matrix is positive semi-definite after roundoff to 4 digit precision. This is done using the equation:

$$\mathbf{R}_{high} = [\mathbf{R}_{spat} + aI_n]/(1+a)$$

Where the value "a" is a scaling factor such that the smallest value is used to obtain a positive semi-definite result. For the 8x2 high spatial correlation case, a=0.00010.

#### Table B.2.3A.3-2: MIMO correlation matrices for high spatial correlation

|          |              | 1.0000  | 0.0000 | 0.9883  | 0.0000 | 0.9542  | 0.0000 | 0.8999  | 0.0000 | -0.3000 | 0.0000 | -0.2965 | 0.0000 | -0.2862 | 0.0000 | -0.2700 | 0.0000 |
|----------|--------------|---------|--------|---------|--------|---------|--------|---------|--------|---------|--------|---------|--------|---------|--------|---------|--------|
|          |              | 0.0000  | 1.0000 | 0.0000  | 0.9883 | 0.0000  | 0.9542 | 0.0000  | 0.8999 | 0.0000  | 0.3000 | 0.0000  | 0.2965 | 0.0000  | 0.2862 | 0.0000  | 0.2700 |
|          |              | 0.9883  | 0.0000 | 1.0000  | 0.0000 | 0.9883  | 0.0000 | 0.9542  | 0.0000 | -0.2965 | 0.0000 | -0.3000 | 0.0000 | -0.2965 | 0.0000 | -0.2862 | 0.0000 |
|          |              | 0.0000  | 0.9883 | 0.0000  | 1.0000 | 0.0000  | 0.9883 | 0.0000  | 0.9542 | 0.0000  | 0.2965 | 0.0000  | 0.3000 | 0.0000  | 0.2965 | 0.0000  | 0.2862 |
|          |              | 0.9542  | 0.0000 | 0.9883  | 0.0000 | 1.0000  | 0.0000 | 0.9883  | 0.0000 | -0.2862 | 0.0000 | -0.2965 | 0.0000 | -0.3000 | 0.0000 | -0.2965 | 0.0000 |
|          |              | 0.0000  | 0.9542 | 0.0000  | 0.9883 | 0.0000  | 1.0000 | 0.0000  | 0.9883 | 0.0000  | 0.2862 | 0.0000  | 0.2965 | 0.0000  | 0.3000 | 0.0000  | 0.2965 |
|          |              | 0.8999  | 0.0000 | 0.9542  | 0.0000 | 0.9883  | 0.0000 | 1.0000  | 0.0000 | -0.2700 | 0.0000 | -0.2862 | 0.0000 | -0.2965 | 0.0000 | -0.3000 | 0.0000 |
| 8x2 case | R -          | 0.0000  | 0.8999 | 0.0000  | 0.9542 | 0.0000  | 0.9883 | 0.0000  | 1.0000 | 0.0000  | 0.2700 | 0.0000  | 0.2862 | 0.0000  | 0.2965 | 0.0000  | 0.3000 |
| oxz case | $R_{high} =$ | -0.3000 | 0.0000 | -0.2965 | 0.0000 | -0.2862 | 0.0000 | -0.2700 | 0.0000 | 1.0000  | 0.0000 | 0.9883  | 0.0000 | 0.9542  | 0.0000 | 0.8999  | 0.0000 |
|          |              | 0.0000  | 0.3000 | 0.0000  | 0.2965 | 0.0000  | 0.2862 | 0.0000  | 0.2700 | 0.0000  | 1.0000 | 0.0000  | 0.9883 | 0.0000  | 0.9542 | 0.0000  | 0.8999 |
|          |              | -0.2965 | 0.0000 | -0.3000 | 0.0000 | -0.2965 | 0.0000 | -0.2862 | 0.0000 | 0.9883  | 0.0000 | 1.0000  | 0.0000 | 0.9883  | 0.0000 | 0.9542  | 0.0000 |
|          |              | 0.0000  | 0.2965 | 0.0000  | 0.3000 | 0.0000  | 0.2965 | 0.0000  | 0.2862 | 0.0000  | 0.9883 | 0.0000  | 1.0000 | 0.0000  | 0.9883 | 0.0000  | 0.9542 |
|          |              | -0.2862 | 0.0000 | -0.2965 | 0.0000 | -0.3000 | 0.0000 | -0.2965 | 0.0000 | 0.9542  | 0.0000 | 0.9883  | 0.0000 | 1.0000  | 0.0000 | 0.9883  | 0.0000 |
|          |              | 0.0000  | 0.2862 | 0.0000  | 0.2965 | 0.0000  | 0.3000 | 0.0000  | 0.2965 | 0.0000  | 0.9542 | 0.0000  | 0.9883 | 0.0000  | 1.0000 | 0.0000  | 0.9883 |
|          |              | -0.2700 | 0.0000 | -0.2862 | 0.0000 | -0.2965 | 0.0000 | -0.3000 | 0.0000 | 0.8999  | 0.0000 | 0.9542  | 0.0000 | 0.9883  | 0.0000 | 1.0000  | 0.0000 |
|          |              | 0.0000  | 0.2700 | 0.0000  | 0.2862 | 0.0000  | 0.2965 | 0.0000  | 0.3000 | 0.0000  | 0.8999 | 0.0000  | 0.9542 | 0.0000  | 0.9883 | 0.0000  | 1.0000 |

### B.2.3A.4 Beam steering approach

Given the channel spatial correlation matrix in B.2.3A.1, the corresponding random channel matrix H can be calculated. The signal model for the k-th subframe is denoted as

$$y = HD_{\theta_{L}}Wx + n$$

Where

- H is the Nr xNt channel matrix per subcarrier.

- 
$$D_{\theta_k}$$
 is the steering matrix, which is  $D_{\theta_k} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \otimes \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & e^{j\theta_k} & 0 & 0 \\ 0 & 0 & e^{j2\theta_k} & 0 \\ 0 & 0 & 0 & e^{j3\theta_k} \end{bmatrix}$ ,

-  $\theta_k$  controls the phase variation, and the phase for k-th subframe is denoted by  $\theta_k = \theta_0 + \Delta \theta \cdot k$ , where  $\theta_0$  is the random start value with the uniform distribution, i.e.,  $\theta_0 \in [0, 2\pi]$ ,  $\Delta \theta$  is the step of phase variation, which is defined in Table B.2.3A.4-1, and *k* is the linear increment of 1 for every subframe throughout the simulation,

- W is the precoding matrix for 8 transmission antennas,
- y is the received signal, x is the transmitted signal, and n is AWGN.

Table B.2.3A.4-1: The step of phase variation

| Variation Step | Value (rad/subframe) |
|----------------|----------------------|
| $\Delta 	heta$ | 1.2566×10⁻³          |

## B.2.4 Propagation conditions for CQI tests

For Channel Quality Indication (CQI) tests, the following additional multi-path profile is used:

$$h(t,\tau) = \delta(\tau) + a \exp(-i2\pi f_D t) \delta(\tau - \tau_d),$$

in continuous time  $(t, \tau)$  representation, with  $\tau_d$  the delay, *a* a constant and  $f_D$  the Doppler frequency. The same  $h(t, \tau)$  is used to describe the fading channel between every pair of Tx and Rx.

### B.2.4.1 Propagation conditions for CQI tests with multiple CSI processes

For CQI tests with multiple CSI processes, the following additional multi-path profile is used for 2 port transmission:

$$H = \begin{bmatrix} 1 & j \\ 1 & -j \end{bmatrix} \circ H_{MP}$$

Where  $\circ$  represents Hadamard product,  $H_{MP}$  indicates the 2x2 propagation channel generated in the manner defined in Clause B.2.4.

### B.2.5 Void

## **B.2.6 MBSFN Propagation Channel Profile**

Table B.2.6-1 shows propagation conditions that are used for the MBSFN performance requirements in multi-path fading environment in an extended delay spread environment.

| Table B.2.6-1: Propagation Conditions for Multi-Path Fading Environments for MBSFN Performance |
|--|
| Requirements in an extended delay spread environment   |

| Exte                | nded Delay Spread        |  |  |  |  |  |
|---------------------|--------------------------|--|--|--|--|--|
| Maximum             | Doppler frequency [5Hz]  |  |  |  |  |  |
| Relative Delay [ns] | Relative Mean Power [dB] |  |  |  |  |  |
|                     |                          |  |  |  |  |  |
| 0                   | 0                        |  |  |  |  |  |
| 30                  | -1.5                     |  |  |  |  |  |
| 150                 | -1.4                     |  |  |  |  |  |
| 310                 | -3.6                     |  |  |  |  |  |
| 370                 | -0.6                     |  |  |  |  |  |
| 1090                | -7.0                     |  |  |  |  |  |
| 12490               | -10                      |  |  |  |  |  |
| 12520               | -11.5                    |  |  |  |  |  |
| 12640               | -11.4                    |  |  |  |  |  |
| 12800               | -13.6                    |  |  |  |  |  |
| 12860               | -10.6                    |  |  |  |  |  |
| 13580               | -17.0                    |  |  |  |  |  |
| 27490               | -20                      |  |  |  |  |  |
| 27520               | -21.5                    |  |  |  |  |  |
| 27640               | -21.4                    |  |  |  |  |  |
| 27800               | -23.6                    |  |  |  |  |  |
| 27860               | -20.6                    |  |  |  |  |  |
| 28580               | -27.0                    |  |  |  |  |  |

## B.3 High speed train scenario

The high speed train condition for the test of the baseband performance is a non fading propagation channel with one tap. Doppler shift is given by

$$f_s(t) = f_d \cos \theta(t) \tag{B.3.1}$$

where  $f_s(t)$  is the Doppler shift and  $f_d$  is the maximum Doppler frequency. The cosine of angle  $\theta(t)$  is given by

$$\cos\theta(t) = \frac{D_s/2 - vt}{\sqrt{D_{\min}^2 + (D_s/2 - vt)^2}}, \ 0 \le t \le D_s/v$$
(B.3.2)

$$\cos\theta(t) = \frac{-1.5D_s + vt}{\sqrt{D_{\min}^2 + (-1.5D_s + vt)^2}}, \ D_s/v < t \le 2D_s/v$$
(B.3.3)

$$\cos\theta(t) = \cos\theta(t \mod (2D_s/v)), t > 2D_s/v \tag{B.3.4}$$

where  $D_s/2$  is the initial distance of the train from eNodeB, and  $D_{\min}$  is eNodeB Railway track distance, both in meters; v is the velocity of the train in m/s, t is time in seconds.

Doppler shift and cosine angle are given by equation B.3.1 and B.3.2-B.3.4 respectively, where the required input parameters listed in table B.3-1 and the resulting Doppler shift shown in Figure B.3-1 are applied for all frequency bands.

| Parameter  | Value    |
|------------|----------|
| $D_s$      | 300 m    |
| $D_{\min}$ | 2 m      |
| ν          | 300 km/h |
| $f_d$      | 750 Hz   |

Table B.3-1: High speed train scenario

NOTE 1: Parameters for HST conditions in table B.3-1 including  $f_d$  and Doppler shift trajectories presented on figure B.3-1 were derived from Band 7 and are applied for performance verification in all frequency bands.

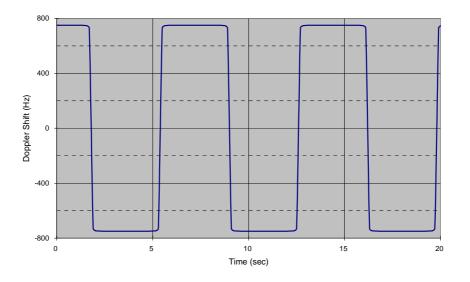


Figure B.3-1: Doppler shift trajectory

For 1x2 antenna configuration, the same  $h(t,\tau)$  is used to describe the channel between every pair of Tx and Rx.

For 2x2 antenna configuration, the same  $h(t,\tau)$  is used to describe the channel between every pair of Tx and Rx with phase shift according to  $\mathbf{H} = \begin{pmatrix} 1 & j \\ 1 & -j \end{pmatrix}$ .

## B.4 Beamforming Model

## B.4.1 Single-layer random beamforming (Antenna port 5, 7, or 8)

Single-layer transmission on antenna port 5 or on antenna port 7 or 8 without a simultaneous transmission on the other antenna port, is defined by using a precoder vector W(i) of size 2×1 randomly selected with the number of layers v = 1 from Table 6.3.4.2.3-1 in [4] as beamforming weights. This precoder takes as an input the signal  $y^{(p)}(i)$ ,  $i = 0,1,...,M_{\text{symb}}^{\text{ap}} -1$ , for antenna port  $p \in \{5, 7, 8\}$ , with  $M_{\text{symb}}^{\text{ap}}$  the number of modulation symbols including the

user-specific reference symbols (DRS), and generates a block of signals  $y_{bf}(i) = \begin{bmatrix} y_{bf}(i) & \tilde{y}_{bf}(i) \end{bmatrix}^T$  the elements of which are to be mapped onto the same physical RE but transmitted on different antenna elements:

$$\begin{bmatrix} y_{bf}(i) \\ \tilde{y}_{bf}(i) \end{bmatrix} = W(i)y^{(p)}(i)$$

Single-layer transmission on antenna port 7 or 8 with a simultaneous transmission on the other antenna port, is defined by using a pair of precoder vectors  $W_1(i)$  and  $W_2(i)$  each of size 2×1, which are not identical and randomly selected with the number of layers v = 1 from Table 6.3.4.2.3-1 in [4], as beamforming weights, and normalizing the transmit power as follows:

$$\begin{bmatrix} y_{bf}(i) \\ \tilde{y}_{bf}(i) \end{bmatrix} = \frac{1}{\sqrt{2}} \left( W_1(i) y^{(7)}(i) + W_2(i) y^{(8)}(i) \right)$$

The precoder update granularity is specific to a test case.

The CSI reference symbols  $a_{k,l}^{(p)}$  satisfying  $p \mod 2 = 1$ ,  $p \in \{15,16,..,22\}$ , are transmitted on the same physical antenna element as the modulation symbols  $y_{bf}(i)$ . The CSI reference symbols  $a_{k,l}^{(p)}$  satisfying  $p \mod 2 = 0$ ,  $p \in \{15,16,..,22\}$ , are transmitted on the same physical antenna element as the modulation symbols  $\tilde{y}_{bf}(i)$ .

### B.4.2 Dual-layer random beamforming (antenna ports 7 and 8)

Dual-layer transmission on antenna ports 7 and 8 is defined by using a precoder matrix W(i) of size  $2 \times 2$  randomly selected with the number of layers v = 2 from Table 6.3.4.2.3-1 in [4] as beamforming weights. This precoder takes as an input a block of signals for antenna ports 7 and 8,  $y(i) = \begin{bmatrix} y^{(7)}(i) & y^{(8)}(i) \end{bmatrix}^T$ ,  $i = 0, 1, ..., M_{symb}^{ap} - 1$ , with  $M_{symb}^{ap}$  being the number of modulation symbols per antenna port including the user-specific reference symbols, and generates a block of signals  $y_{bf}(i) = \begin{bmatrix} y_{bf}(i) & \tilde{y}_{bf}(i) \end{bmatrix}^T$  the elements of which are to be mapped onto the same physical RE but transmitted on different antenna elements:

$$\begin{bmatrix} y_{bf}(i) \\ \tilde{y}_{bf}(i) \end{bmatrix} = W(i) \begin{bmatrix} y^{(7)}(i) \\ y^{(8)}(i) \end{bmatrix},$$

The precoder update granularity is specific to a test case.

The CSI reference symbols  $a_{k,l}^{(p)}$  satisfying  $p \mod 2 = 1$ ,  $p \in \{15, 16, ..., 22\}$ , are transmitted on the same physical antenna element as the modulation symbols  $y_{bf}(i)$ . The CSI reference symbols  $a_{k,l}^{(p)}$  satisfying  $p \mod 2 = 0$ ,  $p \in \{15, 16, ..., 22\}$ , are transmitted on the same physical antenna element as the modulation symbols  $\tilde{y}_{bf}(i)$ .

### B.4.3 Generic beamforming model (antenna ports 7-14)

The transmission on antenna port(s) p = 7,8,...,v + 6 is defined by using a precoder matrix W(i) of size  $N_{CSI} \times v$ , where  $N_{CSI}$  is the number of CSI reference signals configured per test and v is the number of spatial layers. This precoder takes as an input a block of signals for antenna port(s) p = 7,8,...,v + 6,  $y^{(p)}(i) = \left[y^{(7)}(i) \quad y^{(8)}(i) \quad \cdots \quad y^{(6+v)}(i)\right], i = 0,1,...,M_{symb}^{ap} - 1$ , with  $M_{symb}^{ap}$  being the number of modulation symbols per antenna port including the user-specific reference symbols (DM-RS), and generates a block of signals  $y_{bf}^{(q)}(i) = \left[y_{bf}^{(0)}(i) \quad y_{bf}^{(1)}(i) \quad \ldots \quad y_{bf}^{(N_{CSI}-1)}(i)\right]^{T}$  the elements of which are to be mapped onto the same time-frequency index pair (k, l) but transmitted on different physical antenna elements:

$$\begin{bmatrix} y_{bf}^{(0)}(i) \\ y_{bf}^{(1)}(i) \\ \vdots \\ y_{bf}^{(N_{CSI}-1)}(i) \end{bmatrix} = W(i) \begin{bmatrix} y^{(7)}(i) \\ y^{(8)}(i) \\ \vdots \\ y^{(6+\nu)}(i) \end{bmatrix}$$

The precoder matrix W(i) is specific to a test case.

The physical antenna elements are identified by indices  $j = 0, 1, ..., N_{ANT} - 1$ , where  $N_{ANT} = N_{CSI}$  is the number of physical antenna elements configured per test.

Modulation symbols  $y_{bf}^{(q)}(i)$  with  $q \in \{0,1,...,N_{CSI}-1\}$  (i.e. beamformed PDSCH and DM-RS) are mapped to the physical antenna index j = q.

Modulation symbols  $y^{(p)}(i)$  with  $p \in \{0,1,..., P-1\}$  (i.e. PBCH, PDCCH, PHICH, PCFICH) are mapped to the physical antenna index j = p, where P is the number of cell-specific reference signals configured per test.

Modulation symbols  $a_{k,l}^{(p)}$  with  $p \in \{0,1,..., P-1\}$  (i.e. CRS) are mapped to the physical antenna index j = p, where P is the number of cell-specific reference signals configured per test.

Modulation symbols  $a_{k,l}^{(p)}$  with  $p \in \{15, 16, ..., 14 + N_{CSI}\}$  (i.e. CSI-RS) are mapped to the physical antenna index j = p - 15, where  $N_{CSI}$  is the number of CSI reference signals configured per test.

# B.4.4 Random beamforming for EPDCCH distributed transmission (Antenna port 107 and 109)

EPDCCH distributed transmission on antenna port 107 and antenna port 109 is defined by using a pair of precoder vectors  $W_1(i)$  and  $W_2(i)$  each of size 2×1, which are not identical and randomly selected per EPDCCH PRB pair with the number of layers v = 1 from Table 6.3.4.2.3-1 in [4], as beamforming weights. This precoder takes as an input the signal  $y^{(p)}(i)$ ,  $i = 0,1,...,M_{symb}^{ap} - 1$ , for antenna port  $p \in \{107, 109\}$ , with  $M_{symb}^{ap}$  the number of modulation symbols including the user-specific reference symbols (DMRS), and generates a block of signals  $y_{bf}(i) = [y_{bf}(i) \ \tilde{y}_{bf}(i)]^{t}$ . When EPDCCH is associated with port 107, the transmitted block of signals is deonted as

$$\begin{bmatrix} y_{bf}(i) \\ \tilde{y}_{bf}(i) \end{bmatrix} = W_1(i) y^{(107)}(i).$$

When EPDCCH is associated with port 109, the transmitted block of signals is denoted as

$$\begin{bmatrix} y_{bf}(i) \\ \tilde{y}_{bf}(i) \end{bmatrix} = W_2(i) y^{(109)}(i).$$

## B.4.5 Random beamforming for EPDCCH localized transmission (Antenna port 107, 108, 109 or 110)

EPDCCH localized transmission on antenna port 107, 108, 109 or 110 is defined by using a precoder vector W(i) of size 2×1 randomly selected with the number of layers v = 1 from Table 6.3.4.2.3-1 in [4] as beamforming weights. This precoder takes as an input the signal  $y^{(p)}(i)$ ,  $i = 0,1,...,M_{symb}^{ap} - 1$ , for antenna port  $p \in \{107, 108, 109, 110\}$ , with  $M_{symb}^{ap}$  the number of modulation symbols including the user-specific reference symbols (DMRS), and generates a

block of signals  $y_{bf}(i) = [y_{bf}(i) \quad \tilde{y}_{bf}(i)]^T$  the elements of which are to be mapped onto the same physical RE but transmitted on different antenna elements:

$$\begin{bmatrix} y_{bf}(i) \\ \tilde{y}_{bf}(i) \end{bmatrix} = W(i) y^{(p)}(i) .$$

# B.5 Interference models for enhanced performance requirements Type-A

This clause provides a description for the modelling of interfering cell transmissions for enhanced performance requirements Type-A including: definition of dominant interferer proportion, transmission mode 3, 4 and 9 type of interference modelling.

## B.5.1 Dominant interferer proportion

Each interfering cell involved in enhanced performance requirements Type-A is characterized by its associated dominant interferer proportion (DIP) value:

$$DIP_i = \frac{\hat{I}_{or(i+1)}}{N_{oc}}$$

where is  $\hat{I}_{or(i+1)}$  is the average received power spectral density from the i-th strongest interfering cell involved in the requirement scenario ( $\hat{I}_{or(1)}$  is assumed to be the power spectral density associated with the serving cell) and

 $N_{oc}' = \sum_{i=2}^{N} \hat{I}_{or(j)} + N_{oc}$  where  $N_{oc}$  is the average power spectral density of a white noise source consistent with the

definition provided in subclause 3.2 and N is the total number of cells involved in a given requirement scenario.

### B.5.2 Transmission mode 3 interference model

This subclause provides transmission mode 3 interference modelling for each explicitly modelled interfering cell in the requirement scenario. In each subframe, each interfering cell shall transmit randomly modulated data over the entire PDSCH region and the full transmission bandwidth. Transmitted physical channels shall include PSS, SSS and PBCH.

For each subframe and each CQI subband as defined in subclause 7.2 of [6], a transmission rank shall be randomly determined independently from other CQI subbands as well as other interfering cells. Probabilities of occurrence of each possible transmission rank are as specified in the requirement scenario.

For rank-1 transmission over a subband, precoding for transmit diversity for the number of antenna ports in the requirement scenario shall be applied to 16QAM randomly modulated layer symbols, as specified in subclause 6.3.4.3 of [4].

For rank-2 transmission over a subband, precoding for spatial multiplexing with large delay CDD over two layers for the number of antenna ports in the requirement scenario shall be applied to 16QAM randomly modulated layer symbols, as specified in subclause 6.3.4.2.2 of [4].

For unallocated REs in the control region, precoding for transmit diversity for the number of antenna ports in the requirement scenario shall be applied to QPSK randomly modulated layer symbols, as specified in subclause 6.3.4.3 of [4]. The EPRE ratio for these REs shall be as defined for PDCCH in Annex C.3.2.

## B.5.3 Transmission mode 4 interference model

This subclause provides transmission mode 4 interference modelling for each explicitly modelled interfering cell in the requirement scenario. In each subframe, each interfering cell shall transmit randomly modulated data over the entire PDSCH region and the full transmission bandwidth. Transmitted physical channels shall include PSS, SSS and PBCH.

For each subframe and each CQI subband as defined in subclause 7.2 of [6], a transmission rank shall be randomly determined independently from other CQI subbands as well as other interfering cells. Probabilities of occurrence of each possible transmission rank are as specified in the requirement scenario.

For each subframe and CQI subband, a precoding matrix for the number of layers v associated to the selected rank shall be selected randomly from Table 6.3.4.2.3-1 of [4]. Note that codebook index 0 shall be excluded from random precoder selection when the number of layers is v = 2.

Precoding for spatial multiplexing with cell-specific reference signals for the number of antenna ports in the requirement scenario shall be applied to 16QAM randomly modulated layer symbols, as specified in subclause 6.3.4.2.1 of [4] with the selected precoding matrices for each subframe and each CQI subband.

For unallocated REs in the control region, precoding for transmit diversity for the number of antenna ports in the requirement scenario shall be applied to QPSK randomly modulated layer symbols, as specified in subclause 6.3.4.3 of [4]. The EPRE ratio for these REs shall be as defined for PDCCH in Annex C.3.2.

## B.5.4 Transmission mode 9 interference model

This subclause provides transmission mode 9 interference modelling for each explicitly modelled interfering cell in the requirement scenario. In each subframe, each interfering cell shall transmit randomly modulated data over the entire PDSCH region and the full transmission bandwidth. Transmitted physical channels shall include PSS, SSS and PBCH.

For each subframe and each CQI subband as defined in subclause 7.2 of [6], a transmission rank shall be randomly determined independently from other CQI subbands as well as other interfering cells. Probabilities of occurrence of each possible transmission rank are as specified in the requirement scenario.

For each subframe and each CQI subband, a precoding matrix for the number of layers v associated to the selected rank shall be selected randomly from Table 6.3.4.2.3-2 of [4].

The generic beamforming model in subclause B.4.3 shall be applied assuming cell-specific reference signals and CSI reference signals as specified in the requirement scenario. Random precoding with selected rank and precoding matrices for each subframe and each CQI subband shall be applied to 16QAM randomly modulated layer symbols including the user-specific reference symbols over antenna port 7 when the rank is one and antenna ports 7, 8 when the rank is two.

For unallocated REs in the control region, precoding for transmit diversity for the number of antenna ports in the requirement scenario shall be applied to QPSK randomly modulated layer symbols, as specified in subclause 6.3.4.3 of [4]. The EPRE ratio for these REs shall be as defined for PDCCH in Annex C.3.2.

## Annex C (normative): Downlink Physical Channels

## C.1 General

This annex specifies the downlink physical channels that are needed for setting a connection and channels that are needed during a connection.

## C.2 Set-up

Table C.2-1 describes the downlink Physical Channels that are required for connection set up.

| Physical Channel |
|------------------|
| PBCH             |
| SSS              |
| PSS              |
| PCFICH           |
| PDCCH            |
| EPDCCH           |
| PHICH            |
| PDSCH            |

## Table C.2-1: Downlink Physical Channels required for connection set-up

## C.3 Connection

The following clauses, describes the downlink Physical Channels that are transmitted during a connection i.e., when measurements are done.

## C.3.1 Measurement of Receiver Characteristics

Table C.3.1-1 is applicable for measurements on the Receiver Characteristics (clause 7).

| Table C.3.1-1: Downlink Physical Channels transmitted during a connection (FDD and TDD) |
|---|
|   |

| Physical Channel | EPRE Ratio         |
|------------------|--------------------|
| PBCH             | $PBCH_RA = 0 dB$   |
|                  | $PBCH_RB = 0 dB$   |
| PSS              | $PSS_RA = 0 dB$    |
| SSS              | $SSS_RA = 0 dB$    |
| PCFICH           | $PCFICH_RB = 0 dB$ |
| PDCCH            | $PDCCH_RA = 0 dB$  |
|                  | $PDCCH_RB = 0 dB$  |
| PDSCH            | $PDSCH_RA = 0 dB$  |
|                  | $PDSCH_RB = 0 dB$  |
| OCNG             | $OCNG_RA = 0 dB$   |
|                  | $OCNG_RB = 0 dB$   |

NOTE 1: No boosting is applied.

| Parameter  | Unit       | Value         | Note   |
|--|------------|---------------|--|
| Transmitted power spectral density $I_{\it or}$                        | dBm/15 kHz | Test specific | 1. $I_{or}$ shall be kept constant throughout all OFDM symbols |
| Cell-specific reference signal power ratio $E_{\rm RS}$ / $I_{\rm or}$ |            | 0 dB          |  |

Table C.3.1-2: Power allocation for OFDM symbols and reference signals

## C.3.2 Measurement of Performance requirements

Table C.3.2-1 is applicable for measurements in which uniform RS-to-EPRE boosting for all downlink physical channels.

Table C.3.2-1: Downlink Physical Channels transmitted during a connection (FDD and TDD)

| Physical Channel | EPRE Ratio                      |
|------------------|---------------------------------|
| PBCH             | $PBCH_RA = \rho_A + \sigma$     |
|                  | $PBCH_RB = \rho_B + \sigma$     |
| PSS              | PSS_RA = 0 (Note 3)             |
| SSS              | $SSS_RA = 0$ (Note 3)           |
| PCFICH           | PCFICH_RB = $\rho_B$ + $\sigma$ |
| PDCCH            | PDCCH_RA = $\rho_A$ + $\sigma$  |
|                  | PDCCH_RB = $\rho_B$ + $\sigma$  |
| EPDCCH           | EPDCCH_RA = $\rho_A + \delta$   |
|                  | EPDCCH_RB = $\rho_B + \delta$   |
| PDSCH            | PDSCH_RA = $\rho_A$             |
|                  | PDSCH_RB = $\rho_B$             |
| PMCH             | PMCH_RA = $\rho_A$              |
|                  | $PMCH_RB = \rho_B$              |
| MBSFN RS         | MBSFN RS_RA = $\rho_A$          |
|                  | MBSFN RS_RB = $\rho_B$          |
| OCNG             | OCNG_RA = $\rho_A$ + $\sigma$   |
|                  | OCNG_RB = $\rho_B$ + $\sigma$   |

NOTE 1:  $\rho_A = \rho_B = 0$  dB means no RS boosting.

NOTE 2: MBSFN RS and OCNG are not defined downlink physical channels in [4].

NOTE 3: Assuming PSS and SSS transmitted on a single antenna port.

NOTE 4:  $\rho_A$ ,  $\rho_B$ ,  $\sigma$  and  $\delta$  are test specific.

NOTE 5: For TM 8, TM 9 and TM10  $\rho_A$ ,  $\rho_B$  are used for the purpose of the test set up only.

| Parameter  | Unit       | Value         | Note  |
|--|------------|---------------|---|
| Total transmitted power  | dBm/15 kHz | Test specific | 1. $I_{or}$ shall be kept   |
| spectral density $I_{or}$  |            |               | constant throughout all OFDM symbols  |
| Cell-specific reference  |            | Test specific | 1. Applies for antenna  |
| signal power ratio $E_{\scriptscriptstyle RS}$ / $I_{\scriptscriptstyle or}$ |            |               | port p  |
| Energy per resource<br>element EPRE  |            | Test specific | 1. The complex-valued symbols $y^{(p)}(i)$ and  |
|  |            |               | $a_{k,l}^{(p)}$ defined in [4] shall  |
|  |            |               | conform to the given<br>EPRE value.<br>2. For TM8, TM9, and<br>TM10 the reference point<br>for EPRE is before the<br>precoder in Annex B.4. |

Table C.3.2-2: Power allocation for OFDM symbols and reference signals

## C.3.3 Aggressor cell power allocation for Measurement of Performance Requirements when ABS is Configured

For the performance requirements and channel state information reporting when ABS is configured, the power allocation for the physical channels of the aggressor cell in non-ABS and ABS is listed in Table C.3.3-1.

## Table C.3.3-1: Downlink physical channels transmitted in aggressor cell when ABS is configured in this cell

| Physical Channel             | Parameters                   | Unit | EPRE Ratio     |        |  |
|------------------------------|------------------------------|------|----------------|--------|--|
| Physical Channel             |                              |      | Non-ABS        | ABS    |  |
| PBCH                         | PBCH_RA                      | dB   | ρ <sub>Α</sub> | Note 1 |  |
| FBCH                         | PBCH_RB                      | dB   | ρ <sub>B</sub> | Note 1 |  |
| PSS                          | PSS_RA                       | dB   | ρΑ             | Note 1 |  |
| SSS                          | SSS_RA                       | dB   | ρΑ             | Note 1 |  |
| PCFICH                       | PCFICH_RB                    | dB   | ρ <sub>B</sub> | Note 1 |  |
| PHICH                        | PHICH_RA                     | dB   | ρ <sub>Α</sub> | Note 1 |  |
| РПСП                         | PHICH_RB                     | dB   | ρв             | Note 1 |  |
| PDCCH                        | PDCCH_RA                     | dB   | ρΑ             | Note 1 |  |
| PDCCH                        | PDCCH_RB                     | dB   | ρ <sub>в</sub> | Note 1 |  |
| PDSCH                        | PDSCH_RA                     | dB   | N/A            | Note 1 |  |
| FDSCH                        | PDSCH_RB                     | dB   | N/A            | Note 1 |  |
| OCNG                         | OCNG_RA                      | dB   | ρΑ             | Note 1 |  |
| OCING                        | OCNG_RB                      | dB   | ρв             | Note 1 |  |
| Note 1: -∞ dB is allocated f | or this channel in this test |      |                |        |  |

| AdBAdBAdBAdBAdBRBdBAdBAdB     | Non-AB\$           ρA           ρB           ρA           ρA | ρA           ρB           ρA           ρA           ρA           Note 1           Note 1 |
|-------------------------------|---|--|
| A dB<br>A dB<br>A dB<br>RB dB | ρ <sub>B</sub><br>ρ <sub>A</sub><br>ρ <sub>A</sub><br>ρ <sub>B</sub><br>ρ <sub>B</sub>  | ρ <sub>B</sub> ρ <sub>A</sub> ρ <sub>A</sub> Note 1           Note 1                     |
| A dB<br>A dB<br>RB dB         | ρA           ρA           ρA           ρA           ρA           ρA           ρA  | ρ <sub>A</sub><br>ρ <sub>A</sub><br>Note 1<br>Note 1                                     |
| A dB<br>RB dB                 | ρ <sub>Α</sub><br>ρ <sub>Α</sub>  | PA<br>Note 1<br>Note 1   |
| RB dB                         | ρ <sub>Β</sub><br>ρ <sub>Α</sub>  | Note 1<br>Note 1   |
|                               | ρΑ  | Note 1   |
| RA dB                         | - 73  |  |
|                               |   |  |
| RB dB                         | ρ <sub>B</sub>  | Note 1   |
| RA dB                         | ρΑ  | Note 1   |
| RB dB                         | ρ <sub>Β</sub>  | Note 1   |
| RA dB                         | N/A   | Note 1   |
| RB dB                         | N/A   | Note 1   |
|                               | ρΑ  | Note 1   |
| KA OB                         |   | Note 1   |
|                               |   |  |

| Table C.3.3-2: Downlink physical channels transmitted in aggressor cell when ABS is configured in |
|---|
| this cell when the CRS assistance information is provided   |

## C.3.4 Power Allocation for Measurement of Performance Requirements when Quasi Co-location Type B: same Cell ID

For the performance requirements related to quasi-colocation type B behaviour when transmission points share the same Cell ID, the power allocation for the physical channels of the serving cell is listed in table C.3.4-1 and the power allocation for the physical channels of the cell transmitting PDSCH is listed in table C.3-4-2

| Physical Channel | EPRE Ratio                      |
|------------------|---------------------------------|
| PBCH             | $PBCH_RA = \rho_A + \sigma$     |
|                  | PBCH_RB = $\rho_B$ + $\sigma$   |
| PSS              | PSS_RA = 0 (Note 2)             |
| SSS              | $SSS_RA = 0$ (Note 2)           |
| PDSCH            | PDSCH_RA = $\rho_A$             |
|                  | PDSCH_RB = $\rho_B$             |
| PCFICH           | PCFICH_RB = $\rho_B$ + $\sigma$ |
| PDCCH            | PDCCH_RA = $\rho_A$ + $\sigma$  |
|                  | PDCCH_RB = $\rho_B + \sigma$    |

Table C.3.4-1: Downlink physical channels transmitted in the serving cell (TP1)

NOTE 1:  $\rho_A = \rho_B = 0$  dB means no RS boosting.

NOTE 2: Assuming PSS and SSS transmitted on a single antenna port.

NOTE 3:  $\rho_A$ ,  $\rho_B$  and  $\sigma$  are test specific.

#### Table C.3.4-2: Downlink physical channels for the transmission point transmitting PDSCH (TP2)

| Physical Channel | Value         |
|------------------|---------------|
| PDSCH            | Test Specific |
|                  |               |

## Annex D (normative): Characteristics of the interfering signal

## D.1 General

When the channel band width is wider or equal to 5MHz, a modulated 5MHz full band width E-UTRA down link signal and CW signal are used as interfering signals when RF performance requirements for E-UTRA UE receiver are defined. For channel band widths below 5MHz, the band width of modulated interferer should be equal to band width of the received signal.

## D.2 Interference signals

Table D.2-1 describes the modulated interferer for different channel band width options.

|                      | Channel bandwidth |       |       |        |        |        |
|----------------------|-------------------|-------|-------|--------|--------|--------|
|                      | 1.4 MHz           | 3 MHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz |
| <b>BW</b> Interferer | 1.4 MHz           | 3 MHz | 5 MHz | 5 MHz  | 5 MHz  | 5 MHz  |
| RB                   | 6                 | 15    | 25    | 25     | 25     | 25     |

### Table D.2-1: Description of modulated E-UTRA interferer

## Annex E (normative): Environmental conditions

#### E.1 General

This normative annex specifies the environmental requirements of the UE. Within these limits the requirements of the present documents shall be fulfilled.

#### E.2 Environmental

The requirements in this clause apply to all types of UE(s).

#### E.2.1 Temperature

The UE shall fulfil all the requirements in the full temperature range of:

Table E.2.1-1

| +15°C to +35°C                           | for normal conditions (with relative humidity of 25 % to 75 %)  |
|--|---|
| -10 <sup>°</sup> C to +55 <sup>°</sup> C | for extreme conditions (see IEC publications 68-2-1 and 68-2-2) |

Outside this temperature range the UE, if powered on, shall not make ineffective use of the radio frequency spectrum. In no case shall the UE exceed the transmitted levels as defined in clause 6.2 for extreme operation.

#### E.2.2 Voltage

The UE shall fulfil all the requirements in the full voltage range, i.e. the voltage range between the extreme voltages.

The manufacturer shall declare the lower and higher extreme voltages and the approximate shutdown voltage. For the equipment that can be operated from one or more of the power sources listed below, the lower extreme voltage shall not be higher, and the higher extreme voltage shall not be lower than that specified below.

| Power source                | Lower extreme<br>voltage | Higher extreme<br>voltage | Normal conditions voltage |
|-----------------------------|--------------------------|---------------------------|---------------------------|
| AC mains                    | 0,9 * nominal            | 1,1 * nominal             | nominal                   |
| Regulated lead acid battery | 0,9 * nominal            | 1,3 * nominal             | 1,1 * nominal             |
| Non regulated batteries:    |                          |                           |                           |
| Leclanché                   | 0,85 * nominal           | Nominal                   | Nominal                   |
| Lithium                     | 0,95 * nominal           | 1,1 * Nominal             | 1,1 * Nominal             |
| Mercury/nickel & cadmium    | 0,90 * nominal           |                           | Nominal                   |

Outside this voltage range the UE if powered on, shall not make ineffective use of the radio frequency spectrum. In no case shall the UE exceed the transmitted levels as defined in clause 6.2 for extreme operation. In particular, the UE shall inhibit all RF transmissions when the power supply voltage is below the manufacturer declared shutdown voltage.

#### E.2.3 Vibration

The UE shall fulfil all the requirements when vibrated at the following frequency/amplitudes.

| Frequency       | ASD (Acceleration Spectral Density) random vibration                  |
|-----------------|---|
| 5 Hz to 20 Hz   | 0,96 m <sup>2</sup> /s <sup>3</sup>                                   |
| 20 Hz to 500 Hz | 0,96 m <sup>2</sup> /s <sup>3</sup> at 20 Hz, thereafter –3 dB/Octave |

#### Table E.2.3-1

Outside the specified frequency range the UE, if powered on, shall not make ineffective use of the radio frequency spectrum. In no case shall the UE exceed the transmitted levels as defined in TS 36.101 for extreme operation.

#### Annex F (normative): Transmit modulation

#### F.1 Measurement Point

Figure F.1-1 shows the measurement point for the unwanted emission falling into non-allocated RB(s) and the EVM for the allocated RB(s).

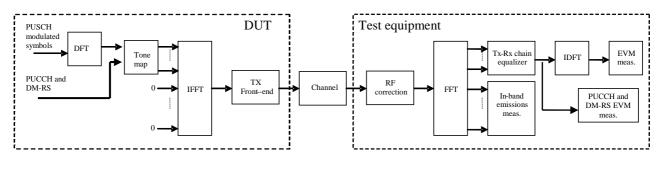


Figure F.1-1: EVM measurement points

## F.2 Basic Error Vector Magnitude measurement

The EVM is the difference between the ideal waveform and the measured waveform for the allocated RB(s)

$$EVM = \sqrt{\frac{\sum_{v \in T_m} |z'(v) - i(v)|^2}{|T_m| \cdot P_0}}$$

where

 $T_m$  is a set of  $|T_m|$  modulation symbols with the considered modulation scheme being active within the measurement period,

z'(v) are the samples of the signal evaluated for the EVM,

i(v) is the ideal signal reconstructed by the measurement equipment, and

 $P_0$  is the average power of the ideal signal. For normalized modulation symbols  $P_0$  is equal to 1.

The basic EVM measurement interval is defined over one slot in the time domain for PUCCH and PUSCH and over one preamble sequence for the PRACH.

#### F.3 Basic in-band emissions measurement

The in-band emissions are a measure of the interference falling into the non-allocated resources blocks. The in-band emission requirement is evaluated for PUCCH and PUSCH transmissions. The in-band emission requirement is not evaluated for PRACH transmissions.

The in-band emissions are measured as follows

$$Emissions_{absolute}(\Delta_{RB}) = \begin{cases} \frac{1}{|T_s|} \sum_{t \in T_s} \sum_{\substack{max(f_{\min}, f_l + 12 \cdot \Delta_{RB} + \Delta f) \\ min(f_{\max}, f_l + 12 \cdot \Delta_{RB} + \Delta f) \\ min(f_{\max}, f_h + 12 \cdot \Delta_{RB} + \Delta f) \\ \frac{1}{|T_s|} \sum_{t \in T_s} \sum_{\substack{f_h + (12 \cdot \Delta_{RB} - 11) + \Delta f \\ f_h + (12 \cdot \Delta_{RB} - 11) + \Delta f}} |Y(t, f)|^2, \Delta_{RB} > 0 \end{cases}$$

where

 $T_s$  is a set of  $|T_s|$  SC-FDMA symbols with the considered modulation scheme being active within the measurement period,

 $\Delta_{RB}$  is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g.  $\Delta_{RB} = 1$  or  $\Delta_{RB} = -1$  for the first adjacent RB),

 $f_{\min}$  (resp.  $f_{\max}$ ) is the lower (resp. upper) edge of the UL system BW,

 $f_l$  and  $f_h$  are the lower and upper edge of the allocated BW, and

Y(t, f) is the frequency domain signal evaluated for in-band emissions as defined in the subsection (ii)

The relative in-band emissions are, given by

$$Emissions_{relative}(\Delta_{RB}) = \frac{Emissions_{absolute}(\Delta_{RB})}{\frac{1}{|T_s| \cdot N_{RB}} \sum_{t \in T_s} \sum_{f_l}^{f_l + (12 \cdot N_{RB} - 1)\Delta f} |Y(t, f)|^2}$$

where

 $N_{RB}$  is the number of allocated RBs

The basic in-band emissions measurement interval is defined over one slot in the time domain. When the PUSCH or PUCCH transmission slot is shortened due to multiplexing with SRS, the in-band emissions measurement interval is reduced by one SC-FDMA symbol, accordingly.

In the evaluation of in-band emissions, the timing is set according to  $\Delta \tilde{t} = \Delta \tilde{c}$ , where sample time offsets  $\Delta \tilde{t}$  and  $\Delta \tilde{c}$  are defined in subclause F.4.

# F.4 Modified signal under test

Implicit in the definition of EVM is an assumption that the receiver is able to compensate a number of transmitter impairments.

The PUSCH data or PRACH signal under test is modified and, in the case of PUSCH data signal, decoded according to::

$$Z'(t,f) = IDFT\left\{\frac{FFT\left\{z(v - \Delta \tilde{t}) \cdot e^{-j2\pi\Delta \tilde{j}v}\right\}}{\tilde{a}(t,f) \cdot e^{j\tilde{\varphi}(t,f)}}\right\}$$

where

z(v) is the time domain samples of the signal under test.

The PUCCH or PUSCH demodulation reference signal or PUCCH data signal under test is equalised and, in the case of PUCCH data signal decoded according to:

$$Z'(t,f) = \frac{FFT\left\{z(v - \Delta \tilde{t}) \cdot e^{-j2\pi\Delta \tilde{f}v}\right\}}{\tilde{a}(t,f) \cdot e^{j\tilde{\varphi}(t,f)}} e^{j2\pi j\Delta \tilde{t}}$$

where

z(v) is the time domain samples of the signal under test.

To minimize the error, the signal under test should be modified with respect to a set of parameters following the procedure explained below.

Notation:

 $\Delta \tilde{t}$  is the sample timing difference between the FFT processing window in relation to nominal timing of the ideal signal.

 $\Delta \tilde{f}$  is the RF frequency offset.

 $\tilde{\varphi}(t, f)$  is the phase response of the TX chain.

 $\tilde{a}(t, f)$  is the amplitude response of the TX chain.

In the following  $\Delta \tilde{c}$  represents the middle sample of the EVM window of length W (defined in the next subsections) or the last sample of the first window half if W is even.

The EVM analyser shall

- > detect the start of each slot and estimate  $\Delta \tilde{t}$  and  $\Delta \tilde{f}$ ,
- > determine  $\Delta \tilde{c}$  so that the EVM window of length W is centred
  - on the time interval determined by the measured cyclic prefix minus 16 samples of the considered OFDM symbol for symbol 0 for normal CP, i.e. the first 16 samples of the CP should not be taken into account for this step. In the determination of the number of excluded samples, a sampling rate of 30.72MHz was assumed. If a different sampling rate is used, the number of excluded samples is scaled linearly.
  - on the measured cyclic prefix of the considered OFDM symbol symbol for symbol 1 to 6 for normal CP and for symbol 0 to 5 for extended CP.
  - on the measured preamble cyclic prefix for the PRACH

To determine the other parameters a sample timing offset equal to  $\Delta \tilde{c}$  is corrected from the signal under test. The EVM analyser shall then

> correct the RF frequency offset  $\Delta \tilde{f}$  for each time slot, and

> apply an FFT of appropriate size. The chosen FFT size shall ensure that in the case of an ideal signal under test, there is no measured inter-subcarrier interference.

The IQ origin offset shall be removed from the evaluated signal before calculating the EVM and the in-band emissions; however, the removed relative IQ origin offset power (relative carrier leakage power) also has to satisfy the applicable requirement.

At this stage the allocated RBs shall be separated from the non-allocated RBs. In the case of PUCCH and PUSCH EVM, the signal on the non-allocated RB(s), Y(t, f), is used to evaluate the in-band emissions.

Moreover, the following procedure applies only to the signal on the allocated RB(s).

- In the case of PUCCH and PUSCH, the UL EVM analyzer shall estimate the TX chain equalizer coefficients  $\tilde{a}(t, f)$  and  $\tilde{\varphi}(t, f)$  used by the ZF equalizer for all subcarriers by time averaging at each signal subcarrier of the amplitude and phase of the reference and data symbols. The time-averaging length is 1 slot. This process creates an average amplitude and phase for each signal subcarrier used by the ZF equalizer. The knowledge of data modulation symbols may be required in this step because the determination of symbols by demodulation is not reliable before signal equalization.
- In the case of PRACH, the UL EVM analyzer shall estimate the TX chain coefficients  $\tilde{a}(t)$  and  $\tilde{\varphi}(t)$  used for phase and amplitude correction and are seleted so as to minimize the resulting EVM. The TX chain coefficients are not dependent on frequency, i.e.  $\tilde{a}(t, f) = \tilde{a}(t)$  and  $\tilde{\varphi}(t, f) = \tilde{\varphi}(t)$ . The TX chain coefficient are chosen independently for each preamble transmission and for each  $\Delta \tilde{t}$ .

At this stage estimates of  $\Delta \tilde{f}$ ,  $\tilde{a}(t, f)$ ,  $\tilde{\varphi}(t, f)$  and  $\Delta \tilde{c}$  are available.  $\Delta \tilde{t}$  is one of the extremities of the window W, i.e.  $\Delta \tilde{t}$  can be  $\Delta \tilde{c} + \alpha - \left|\frac{W}{2}\right|$  or  $\Delta \tilde{c} + \left|\frac{W}{2}\right|$ , where  $\alpha = 0$  if W is odd and  $\alpha = 1$  if W is even. The EVM

analyser shall then

- > calculate EVM<sub>1</sub> with  $\Delta \tilde{t}$  set to  $\Delta \tilde{c} + \alpha \left\lfloor \frac{W}{2} \right\rfloor$ ,
- > calculate EVM<sub>h</sub> with  $\Delta \tilde{t}$  set to  $\Delta \tilde{c} + \left\lfloor \frac{W}{2} \right\rfloor$ .

#### F.5 Window length

#### F.5.1 Timing offset

As a result of using a cyclic prefix, there is a range of  $\Delta \tilde{t}$ , which, at least in the case of perfect Tx signal quality, would give close to minimum error vector magnitude. As a first order approximation, that range should be equal to the length of the cyclic prefix. Any time domain windowing or FIR pulse shaping applied by the transmitter reduces the  $\Delta \tilde{t}$  range within which the error vector is close to its minimum.

#### F.5.2 Window length

The window length W affects the measured EVM, and is expressed as a function of the configured cyclic prefix length. In the case where equalization is present, as with frequency domain EVM computation, the effect of FIR is reduced. This is because the equalization can correct most of the linear distortion introduced by the FIR. However, the time domain windowing effect can't be removed.

#### F.5.3 Window length for normal CP

The table below specifies the EVM window length at channel bandwidths 1.4, 3, 5, 10, 15, 20 MHz, for normal CP. The nominal window length for 3 MHz is rounded down one sample to allow the window to be centered on the symbol.

| Channel<br>Bandwidth<br>MHz  | Cyclic prefix<br>length <sup>1</sup><br>N <sub>cp</sub> for<br>symbol 0 | Cyclic prefix length <sup>1</sup><br>$N_{cp}$ for symbols 1 to 6 | Nominal<br>FFT size | Cyclic prefix<br>for symbols 1<br>to 6 in FFT<br>samples | EVM<br>window<br>length <i>W</i><br>in FFT<br>samples | Ratio of <i>W</i><br>to CP for<br>symbols 1<br>to 6 <sup>2</sup> |
|--|---|--|---------------------|--|---|--|
| 1.4  |   |  | 128                 | 9  | 5   | 55.6   |
| 3  |   |  | 256                 | 18   | 12  | 66.7   |
| 5  | 160   | 144  | 512                 | 36   | 32  | 88.9   |
| 10   | 100   | 144  | 1024                | 72   | 66  | 91.7   |
| 15   |   |  | 1536                | 108  | 102   | 94.4   |
| 20   |   |  | 2048                | 144  | 136   | 94.4   |
| Note 1: The unit is number of samples, sampling rate of 30.72MHz is assumed.   |   |  |                     |  |   |  |
| Note 2: These percentages are informative and apply to symbols 1 through 6. Symbol 0 has a longer CP and therefore a lower percentage. |   |  |                     |  |   |  |

Table F.5.3-1 EVM window length for normal CP

#### F.5.4 Window length for Extended CP

The table below specifies the EVM window length at channel bandwidths 1.4, 3, 5, 10, 15, 20 MHz, for extended CP. The nominal window lengths for 3 MHz and 15 MHz are rounded down one sample to allow the window to be centered on the symbol.

Table F.5.4-1 EVM window length for extended CP

| Channel<br>Bandwidth<br>MHz   | Cyclic prefix length $N_{cp}$ | Nominal<br>FFT size | Cyclic<br>prefix in<br>FFT<br>samples | EVM<br>window<br>length <i>W</i><br>in FFT<br>samples | Ratio of W<br>to CP <sup>2</sup> |
|---|-------------------------------|---------------------|---------------------------------------|---|----------------------------------|
| 1.4   |                               | 128                 | 32                                    | 28  | 87.5                             |
| 3   |                               | 256                 | 64                                    | 58  | 90.6                             |
| 5   | 512                           | 512                 | 128                                   | 124   | 96.9                             |
| 10  | 512                           | 1024                | 256                                   | 250   | 97.4                             |
| 15  |                               | 1536                | 384                                   | 374   | 97.4                             |
| 20  |                               | 2048                | 512                                   | 504   | 98.4                             |
| Note 1:The unit is number of samples, sampling rate of 30.72MHz is assumed.Note 2:These percentages are informative |                               |                     |                                       |   |                                  |

#### F.5.5 Window length for PRACH

The table below specifies the EVM window length for PRACH preamble formats 0-4.

| Table F.5.5-1 EVM window length for PRACH |
|---|
|---|

| Preamble<br>format | $\begin{array}{c} \textbf{Cyclic} \\ \textbf{prefix} \\ \textbf{length}^1 \ N_{cp} \end{array}$                  | Nominal<br>FFT size <sup>2</sup> | EVM window<br>length <i>W</i> in<br>FFT samples | Ratio of <i>W</i><br>to CP* |  |  |
|--------------------|--|----------------------------------|---|-----------------------------|--|--|
| 0                  | 3168   | 24576                            | 3072  | 96.7%                       |  |  |
| 1                  | 1 21024  |                                  | 20928   | 99.5%                       |  |  |
| 2                  | 2 6240   |                                  | 6144  | 98.5%                       |  |  |
| 3                  | 3 21024  |                                  | 20928   | 99.5%                       |  |  |
| 4                  | 4 448  |                                  | 432   | 96.4%                       |  |  |
|                    | Note 1: The unit is number of samples, sampling rate of 30.72MHz is assumed                                      |                                  |   |                             |  |  |
|                    | Note 2: The use of other FFT sizes is possible as long as appropriate<br>scaling of the window length is applied |                                  |   |                             |  |  |
| Note 3: T          | hese percentage  | es are informat                  | ive   |                             |  |  |

## F.6 Averaged EVM

The general EVM is averaged over basic EVM measurements for 20 slots in the time domain.

$$\overline{EVM} = \sqrt{\frac{1}{20} \sum_{i=1}^{20} EVM_i^2}$$

The EVM requirements shall be tested against the maximum of the RMS average at the window W extremities of the EVM measurements:

Thus  $\overline{\text{EVM}}_1$  is calculated using  $\Delta \tilde{t} = \Delta \tilde{t}_1$  in the expressions above and  $\overline{\text{EVM}}_h$  is calculated using  $\Delta \tilde{t} = \Delta \tilde{t}_h$ .

Thus we get:

$$EVM = \max(EVM_1, EVM_h)$$

The calculation of the EVM for the demodulation reference signal,  $EVM_{DMRS}$ , follows the same procedure as calculating the general EVM, with the exception that the modulation symbol set  $T_m$  defined in clause F.2 is restricted to symbols containing uplink demodulation reference signals.

The basic  $EVM_{DMRS}$  measurements are first averaged over 20 slots in the time domain to obtain an intermediate average  $\overline{EVM}_{DMRS}$ .

$$\overline{EVM}_{DMRS} = \sqrt{\frac{1}{20} \sum_{i=1}^{20} EVM_{DMRS,i}^2}$$

In the determination of each  $EVM_{DMRS,i}$ , the timing is set to  $\Delta \tilde{t} = \Delta \tilde{t}_i$  if  $\overline{EVM}_1 > \overline{EVM}_h$ , and it is set to  $\Delta \tilde{t} = \Delta \tilde{t}_i$  otherwise, where  $\overline{EVM}_1$  and  $\overline{EVM}_h$  are the general average EVM values calculated in the same 20 slots over which the intermediate average  $\overline{EVM}_{DMRS}$  is calculated. Note that in some cases, the general average EVM may be calculated only for the purpose of timing selection for the demodulation reference signal EVM.

Then the results are further averaged to get the EVM for the demodulation reference signal, EVM DMRS,

$$EVM_{DMRS} = \sqrt{\frac{1}{6} \sum_{j=1}^{6} \overline{EVM}_{DMRS,j}^2}$$

The PRACH EVM,  $EVM_{PRACH}$ , is averaged over two preamble sequence measurements for preamble formats 0, 1, 2, 3, and it is averaged over 10 preamble sequence measurements for preamble format 4.

The EVM requirements shall be tested against the maximum of the RMS average at the window *W* extremities of the EVM measurements:

Thus  $\overline{\text{EVM}}_{\text{PRACH,1}}$  is calculated using  $\Delta \tilde{t} = \Delta \tilde{t}_l$  and  $\overline{\text{EVM}}_{\text{PRACH,h}}$  is calculated using  $\Delta \tilde{t} = \Delta \tilde{t}_h$ .

Thus we get:

 $EVM_{PRACH} = \max(\overline{EVM}_{PRACH,1}, \overline{EVM}_{PRACH,h})$ 

# F.7 Spectrum Flatness

The data shall be taken from FFT coded data symbols and the demodulation reference symbols of the allocated resource block.

# Annex G (informative): Reference sensitivity level in lower SNR

This annex contains information on typical receiver sensitivity when HARQ transmission is enabled allowing operation in lower SNR regions (HARQ is disabled in conformance testing), thus representing the configuration normally used in live network operation under noise-limited conditions.

#### G.1 General

The reference sensitivity power level  $P_{SENS}$  with HARQ retransmission enabled (operation in lower SNR) is the minimum mean power applied to both the UE antenna ports at which the residual BLER after HARQ shall meet the requirements for the specified reference measurement channel. The residual BLER after HARQ transmission is defined as follows:

$$BLER_{residual} = 1 - \frac{A}{R}$$

A: Number of correctly decoded MAC PDUs

B: Number of transmitted MAC PDUs (Retransmitted MAC PDUs are not counted)

# G.2 Typical receiver sensitivity performance (QPSK)

The residual BLER after HARQ shall be lower than 1% for the reference measurement channels as specified in Annexes G.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table G.2-1 and Table G.2-2

|                |  | Ch                           | annel bar                 | ndwidth                     |                 |                 |                |
|----------------|--|------------------------------|---------------------------|-----------------------------|-----------------|-----------------|----------------|
| E-UTRA<br>Band | 1.4 MHz<br>(dBm)                                   | 3 MHz<br>(dBm)               | 5 MHz<br>(dBm)            | 10 MHz<br>(dBm)             | 15 MHz<br>(dBm) | 20 MHz<br>(dBm) | Duplex<br>Mode |
| 1              |  |                              |                           | [-102]                      |                 |                 | FDD            |
| 2              |  |                              |                           | TBD                         |                 |                 | FDD            |
| 3              |  |                              |                           | TBD                         |                 |                 | FDD            |
| 4              |  |                              |                           | TBD                         |                 |                 | FDD            |
| 5              |  |                              |                           | TBD                         |                 |                 | FDD            |
| 6              |  |                              |                           | TBD                         |                 |                 | FDD            |
| 7              |  |                              |                           | TBD                         |                 |                 | FDD            |
| 8              |  |                              |                           | TBD                         |                 |                 | FDD            |
| 9              |  |                              |                           | TBD                         |                 |                 | FDD            |
| 10             |  |                              |                           | TBD                         |                 |                 | FDD            |
| 11             |  |                              |                           | TBD                         |                 |                 | FDD            |
| 12             |  |                              |                           | TBD                         |                 |                 | FDD            |
| 13             |  |                              |                           | TBD                         |                 |                 | FDD            |
| 14             |  |                              |                           | TBD                         |                 |                 | FDD            |
|                |  |                              |                           | 100                         |                 |                 | 100            |
| 17             |  |                              |                           | TBD                         |                 |                 | FDD            |
| 18             |  |                              |                           | TBD                         |                 |                 | FDD            |
| 19             |  |                              |                           | TBD                         |                 |                 | FDD            |
| 20             |  |                              |                           | TBD                         |                 |                 | FDD            |
| 20             |  |                              |                           | TBD                         |                 |                 | FDD            |
| 22             |  |                              |                           | TBD                         |                 |                 | FDD            |
| 23             |  |                              |                           | TBD                         |                 |                 | FDD            |
| 26             |  |                              |                           | TBD                         |                 |                 | FDD            |
| 20             |  |                              |                           | TBD                         |                 |                 | FDD            |
| 28             |  |                              |                           | TBD                         |                 |                 | FDD            |
|                |  |                              |                           | 100                         |                 |                 | 100            |
| <br>33         |  |                              |                           | [-102]                      |                 |                 | TDD            |
| 34             |  |                              |                           | [-102]                      |                 |                 | TDD            |
| 35             |  |                              |                           | [-102]                      |                 |                 | TDD            |
| 36             |  |                              |                           | [-102]                      |                 |                 | TDD            |
| 30             |  |                              |                           | [-102]                      |                 |                 | TDD            |
| 37             |  |                              | }                         | [-102]                      |                 |                 | TDD            |
| 38             |  |                              |                           |                             |                 |                 | TDD            |
|                |  |                              |                           | [-102]                      |                 |                 |                |
| 40             |  |                              |                           | [-102]                      |                 |                 | TDD            |
| 42             |  |                              |                           | [-102]                      |                 |                 | TDD            |
| 43             |  |                              |                           | [-102]                      |                 |                 | TDD            |
| 44             |  |                              | to Power                  | [-102]                      | in clause f     | 2.5             | TDD            |
| Note 2: F      | The transmitter a Reference meas<br>OP.1 FDD/TDD   | surement cl<br>as describe   | hannel is (<br>ed in Anne | G.3 with on<br>ex A.5.1.1// | e sided dy      | namic OCN       | IG Pattern     |
| Note 4: F      | The signal powe<br>For the UE whic<br>evel is FFS. | er is specifie<br>h supports | ed per por<br>both Band   | t<br>d 3 and Bai            | nd 9 the ret    | ference ser     | nsitivity      |
| Note 5: F      | For the UE whic evel is FFS.                       | h supports                   | both Band                 | 11 and Ba                   | and 21 the      | reference s     | sensitivity    |

| Table G.2-1: Reference | sensitivity QPSK P <sub>SENS</sub> |
|------------------------|------------------------------------|
|------------------------|------------------------------------|

Table G.2-2 specifies the minimum number of allocated uplink resource blocks for which the reference receive sensitivity requirement in lower SNR must be met.

|  | E-UTRA Band / Channel bandwidth / NRB / Duplex mode           |  |   |  |   |                                   |                 |
|--|---|--|---|--|---|-----------------------------------|-----------------|
| E-UTRA<br>Band   | 1.4 MHz   | 3 MHz  | 5 MHz   | 10 MHz   | 15 MHz  | 20 MHz                            | Duplex<br>Mode  |
| 1  |   |  |   | [6] <sup>1</sup>   |   |                                   | FDD             |
| 2  |   |  |   | [6] <sup>1</sup>   |   |                                   | FDD             |
| 3  |   |  |   | [6] <sup>1</sup>   |   |                                   | FDD             |
| 4  |   |  |   | [6] <sup>1</sup>   |   |                                   | FDD             |
| 5  |   |  |   | [6] <sup>1</sup>   |   |                                   | FDD             |
| 6  |   |  |   | [6] <sup>1</sup>   |   |                                   | FDD             |
| 7  |   |  |   | [6] <sup>1</sup>   |   |                                   | FDD             |
| 8  |   |  |   | [6] <sup>1</sup>   |   |                                   | FDD             |
| 9  |   |  |   | [6] <sup>1</sup>   |   |                                   | FDD             |
| 10   |   |  |   | [6] <sup>1</sup>   |   |                                   | FDD             |
| 11   |   |  |   | [6] <sup>1</sup>   |   |                                   | FDD             |
| 12   |   |  |   | [6] <sup>1</sup>   |   |                                   | FDD             |
| 13   |   |  |   | [6] <sup>1</sup>   |   |                                   | FDD             |
| 14   |   |  |   | [6] <sup>1</sup>   |   |                                   | FDD             |
|  |   |  |   |  |   |                                   |                 |
| 17   |   |  |   | [6] <sup>1</sup>   |   |                                   | FDD             |
| 18   |   |  |   | [6] <sup>1</sup>   |   |                                   | FDD             |
| 19   |   |  |   | [6] <sup>1</sup>   |   |                                   | FDD             |
| 20   |   |  |   | [6] <sup>1</sup>   |   |                                   | FDD             |
| 22   |   |  |   | [6] <sup>1</sup>   |   |                                   | FDD             |
| 21   |   |  |   | [6] <sup>1</sup>   |   |                                   | FDD             |
| 23   |   |  |   | [6] <sup>1</sup>   |   |                                   | FDD             |
| 26   |   |  |   | [6] <sup>1</sup>   |   |                                   | FDD             |
| 27   |   |  |   | [6] <sup>1</sup>   |   |                                   | FDD             |
| 28   |   |  |   | [6] <sup>1</sup>   |   |                                   | FDD             |
|  |   |  |   | [-]  |   |                                   |                 |
| 33   |   |  |   | 50   |   |                                   | TDD             |
| 34   |   |  |   | 50   |   |                                   | TDD             |
| 35   |   |  |   | 50   |   |                                   | TDD             |
| 36   |   |  |   | 50   |   |                                   | TDD             |
| 37   |   |  |   | 50   |   |                                   | TDD             |
| 38   |   |  |   | 50   |   |                                   | TDD             |
| 39   |   |  |   | 50   |   |                                   | TDD             |
| 40   |   |  |   | 50   |   |                                   | TDD             |
| 40   |   |  |   | 50   |   |                                   | TDD             |
| 42   |   |  |   | 50   |   |                                   | TDD             |
| 43   |   |  |   | 50   |   |                                   | TDD             |
|  | L<br>The UL resc  |  | ks shall h  |  | s close as  | nossihla to                       |                 |
| Note 2:  | downlink op<br>configuration<br>For the UE v<br>uplink config | erating ban<br>for the c<br>which sup<br>guration fo | and but co<br>hannel ba<br>ports both<br>or reference | nfined with<br>andwidth (T<br>a Band 11 a<br>ce sensitivit | in the trans<br>able 5.6-1)<br>and Band 2<br>ty is FFS. | smission ba<br>).<br>21 the minir | andwidth<br>num |
| Note 3: For Band 20; in the case of 15MHz channel bandwidth, the UL resource<br>blocks shall be located at RBstart _11 and in the case of 20MHz channel<br>bandwidth, the UL resource blocks shall be located at RBstart _16 |   |  |   |  | l in the cas  |                                   |                 |

 Table G.2-2: Minimum uplink configuration for reference sensitivity

Unless given by Table G.2-3, the minimum requirements specified in Tables G.2-1 and G.2-2 shall be verified with the network signalling value NS\_01 (Table 6.2.4-1) configured.

| E-UTRA<br>Band | Network<br>Signalling<br>value |
|----------------|--------------------------------|
| 2              | NS_03                          |
| 4              | NS_03                          |
| 10             | NS_03                          |
| 12             | NS_06                          |
| 13             | NS_06                          |
| 14             | NS_06                          |
| 17             | NS_06                          |
| 19             | NS_08                          |
| 21             | NS_09                          |
| 23             | NS_03                          |
| 35             | NS_03                          |
| 36             | NS_03                          |

| Table G.2-3: Network Signalling | Value for reference sensitivity |
|---------------------------------|---------------------------------|
|                                 |                                 |

# G.3 Reference measurement channel for REFSENSE in lower SNR

Tables G.3-1 and G.3-2 are applicable for Annex G.2 (Reference sensitivity level in lower SNR).

| Table G.3-1 Fixed Reference Channel for Receiver Requ | uirements (FDD) |
|---|-----------------|
|---|-----------------|

| Parameter                                 | Unit             | Value   |
|---|------------------|---|
| Channel bandwidth                         | MHz              | 10  |
| Allocated resource blocks                 |                  | 50  |
| Subcarriers per resource block            |                  | 12  |
| Allocated subframes per Radio Frame       |                  | 10  |
| Modulation                                |                  | QPSK  |
| Target Coding Rate                        |                  | 1/3   |
| Number of HARQ Processes                  | Processes        | 8   |
| Maximum number of HARQ transmissions      |                  | [4]   |
| Information Bit Payload per Sub-Frame     |                  |   |
| For Sub-Frames 1,2,3,4,6,7,8,9            | Bits             | 4392  |
| For Sub-Frame 5                           | Bits             | N/A   |
| For Sub-Frame 0                           | Bits             | 4392  |
| Transport block CRC                       | Bits             | 24  |
| Number of Code Blocks per Sub-Frame       |                  |   |
| (Note 4)                                  |                  |   |
| For Sub-Frames 1,2,3,4,6,7,8,9            | Bits             |   |
| For Sub-Frame 5                           | Bits             | N/A   |
| For Sub-Frame 0                           | Bits             |   |
| Binary Channel Bits Per Sub-Frame         |                  |   |
| For Sub-Frames 1,2,3,4,6,7,8,9            | Bits             | 13800   |
| For Sub-Frame 5                           | Bits             | N/A   |
| For Sub-Frame 0                           | Bits             | 12960   |
| Max. Throughput averaged over 1 frame     | kbps             | 3952.   |
|   |                  | 8   |
| UE Category                               |                  | 1-8   |
|   |                  | /IHz and 10MHz channel BW. 3 symbols allocated to   |
| PDCCH for 5 MHz and 3 MHz. 4              |                  |   |
| Note 2: Reference signal, Synchronization | n signals and F  | BCH allocated as per TS 36.211 [4]                  |
|   |                  | tional CRC sequence of $L = 24$ Bits is attached to |
| each Code Block (otherwise $L = 0$        |                  |   |
| Note 4: Redundancy version coding sequ    | ence is {0, 1, 2 | , 3} for QPSK.                                      |

| Parameter  | Unit             | Va                     | alue           |            |  |
|--|------------------|------------------------|----------------|------------|--|
| Channel Bandwidth  | MHz              |                        | 10             |            |  |
| Allocated resource blocks  |                  |                        | 50             |            |  |
| Uplink-Downlink Configuration (Note 5)   |                  |                        | 1              |            |  |
| Allocated subframes per Radio Frame  |                  |                        | 4+2            |            |  |
| (D+S)  |                  |                        |                |            |  |
| Number of HARQ Processes   | Processes        |                        | 7              |            |  |
| Maximum number of HARQ transmission  |                  |                        | [4]            |            |  |
| Modulation   |                  |                        | QPSK           |            |  |
| Target coding rate   |                  |                        | 1/3            |            |  |
| Information Bit Payload per Sub-Frame  | Bits             |                        |                |            |  |
| For Sub-Frame 4, 9   |                  |                        | 4392           |            |  |
| For Sub-Frame 1, 6   |                  |                        | 3240           |            |  |
| For Sub-Frame 5  |                  |                        | N/A            |            |  |
| For Sub-Frame 0  |                  |                        | 4392           |            |  |
| Transport block CRC  | Bits             |                        | 24             |            |  |
| Number of Code Blocks per Sub-Frame  |                  |                        |                |            |  |
| (Note 5)   |                  |                        |                |            |  |
| For Sub-Frame 4, 9   |                  |                        | 1              |            |  |
| For Sub-Frame 1, 6   |                  |                        | 1              |            |  |
| For Sub-Frame 5  |                  |                        | N/A            |            |  |
| For Sub-Frame 0  |                  |                        | 1              |            |  |
| Binary Channel Bits Per Sub-Frame  | Bits             |                        |                |            |  |
| For Sub-Frame 4, 9   |                  |                        | 13800          |            |  |
| For Sub-Frame 1, 6   |                  |                        | 11256          |            |  |
| For Sub-Frame 5  |                  |                        | N/A            |            |  |
| For Sub-Frame 0  |                  |                        | 13104          |            |  |
| Max. Throughput averaged over 1 frame  | kbps             |                        | 1965.          |            |  |
|  |                  |                        | 6              |            |  |
| UE Category  |                  |                        | 1-5            |            |  |
| Note 1: For normal subframes(0,4,5,9), 2<br>channel BW; 3 symbols allocated<br>for 1.4 MHz. For special subframe | to PDCCH for     | 5 MHz and 3 MHz; 4 sym | bols allocated | to PDCCH   |  |
| Note 2: For 1.4MHz, no data shall be sch<br>insufficient PDCCH performance                                       |                  |                        |                |            |  |
| Note 3: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4]                        |                  |                        |                |            |  |
| Note 4: If more than one Code Block is pr<br>each Code Block (otherwise L = 0                                    | resent, an addi  |                        |                | ttached to |  |
| Note 5: As per Table 4.2-2 in TS 36.211 [  | 4]               |                        |                |            |  |
| Note 6: Redundancy version coding sequ   | ence is {0, 1, 2 | 2, 3} for QPSK.        |                |            |  |

#### Table G.3-2 Fixed Reference Channel for Receiver Requirements (TDD)

# Annex H (normative): Modified MPR behavior

#### H.1 Indication of modified MPR behavior

This annex contains the definitions of the bits in the field *modifiedMPRbehavior* indicated in the IE UE Radio Access Capability [7] by a UE supporting an MPR or A-MPR modified in a later release of this specification.

| Index of field<br>(bit number) | <b>Definition</b><br>(description of the supported functionality if indicator   | Notes   |
|--------------------------------|---|---|
|                                | set to one)   |   |
| 0 (leftmost bit)               | - The MPR for intra-band contiguous carrier<br>aggregation bandwidth class C with non-contiguous<br>resource allocation specified in Clause 6.2.3A in<br>version 12.5.0 of this specification | - This bit can be set to 1 by<br>a UE supporting intra-band<br>contiguous CA bandwidth<br>class C |

Table H.1-1: Definitions of the bits in the field modifiedMPRbehavior

# Annex H (informative): Change history

#### Table H-1: Change History

| 11-2007         R4445         R4-7206         TS36.101V0.1.0 approved by RAN4         -           122007         R493         RP-080123         3         TS36.101 - Combined updates of E-UTRA LE requirements         8.0.0         8.0.0           052008         RP441         RP-080325         4         TS36.101 - Combined updates of E-UTRA LE requirements         8.1.0         8.2.0           052008         RP441         RP-080638         5r1         bandwildfhs         62.0         8.3.0           09-2008         RP441         RP-080638         10         CR for darification of additional spurious emission requirement         8.2.0         8.3.0           09-2008         RP441         RP-080638         15         Correction of In-band Blocking Requirement         8.2.0         8.3.0           09-2008         RP441         RP-080638         19r1         TS36.101: CR for section 6: NS_06         8.2.0         8.3.0           09-2008         RP441         RP-080638         21r1         TS36.101: CR for section 6: NL and blacking neguirement         8.2.0         8.3.0           09-2008         RP441         RP-080638         21r1         TS36.101: CR for section 6: NL and 17.8         8.2.0         8.3.0           09-2008         RP441         RP-080731         32.3  | Date    | TSG#  | TSG Doc.  | CR    | Subject  | Old   | New   |
|--|---------|-------|-----------|-------|--|-------|-------|
| 13-2008         RP#39         RP-409123         3         T\$36.101 - Combined updates of E-UTRA UE requirements         8.1.0         8.2.0           05-2008         RP#44         RP-080325         4         T\$36.101 - Combined updates of E-UTRA UE requirements         8.2.0         8.3.0           09-2008         RP#44         RP-080638         fr1         Transmitter intermodulation requirements         8.2.0         8.3.0           09-2008         RP#41         RP-080638         15         Connection of In-band Blocking Requirement         8.2.0         8.3.0           09-2008         RP#41         RP-080638         1911         T\$36.101: CR for section 6: NS, 00         8.2.0         8.3.0           09-2008         RP#41         RP-080638         1911         T\$36.101: CR for section 7: X modulation         8.2.0         8.3.0           09-2008         RP#41         RP-080638         2111         T\$36.101: CR for section 7: X modulation         8.2.0         8.3.0           09-2008         RP#41         RP-080638         211         T\$36.101: CR for section 7: X modulation         8.2.0         8.3.0           09-2008         RP#41         RP-080638         211         T\$36.101: CR for section 7: Lend 13 K sensitivity         8.2.0         8.3.0           09-2008 <t< td=""><td>11-2007</td><td>R4#45</td><td>R4-72206</td><td></td><td>TS36.101V0.1.0 approved by RAN4</td><td>-</td><td></td></t<>  | 11-2007 | R4#45 | R4-72206  |       | TS36.101V0.1.0 approved by RAN4                                  | -     |       |
| Op 2008         RP#40         RP-080325         4         TS36.101 - Combined updates of E-UTRA UE requirements         8.1.0         8.2.0           09-2008         RP#41         RP-080638         5r1         Addition of Ref Sens figures for 1.4MHz and 3MHz Channel         8.2.0         8.3.0           09-2008         RP#41         RP-080638         10         CR for clarification of additional spurious emission requirement         8.2.0         8.3.0           09-2008         RP#41         RP-080638         115         Correction of In-band Blocking Requirement         8.2.0         8.3.0           09-2008         RP#41         RP-080638         1911         TS36.101: CR for section 6: Tx modulation         8.2.0         8.3.0           09-2008         RP#41         RP-080638         2111         TS36.101: CR for section 7: Rond 13 Rx sensitivity         8.2.0         8.3.0           09-2008         RP#41         RP-080638         224         TS36.101: CR for section 7: Rond 13 Rx sensitivity         8.2.0         8.3.0           09-2008         RP#41         RP-0806731         30         Correction of VLE for Section 7: Band 13 Rx sensitivity         8.2.0         8.3.0           09-2008         RP#41         RP-080731         30         Correction of VLE for Section 6: Tx modulation         8.2.0 <td< td=""><td>12-2007</td><td>RP#38</td><td>RP-070979</td><td></td><td>Approved version at TSG RAN #38</td><td>1.0.0</td><td>8.0.0</td></td<> | 12-2007 | RP#38 | RP-070979 |       | Approved version at TSG RAN #38                                  | 1.0.0 | 8.0.0 |
| 09-2008         RP#41         RP-080638         5r1         Addition of Ref Sens figures for 1.4MHz and 3MHz Channel         8.2.0         8.3.0           09-2008         RP#41         RP-080633         10         CR for clanification of additional spurious emission requirement         8.2.0         8.3.0           09-2008         RP#41         RP-080633         15         Correction of In-band Blocking Requirement         8.2.0         8.3.0           09-2008         RP#41         RP-080638         19r1         TS36.101: CR for section 6: Nr. modulation         8.2.0         8.3.0           09-2008         RP#41         RP-080638         20r1         TS36.101: CR for UE OFF power         8.2.0         8.3.0           09-2008         RP#41         RP-080638         21r1         TS36.101: CR for UE OFF power         8.2.0         8.3.0           09-2008         RP#41         RP-080638         21r1         TS36.101: CR for section 7: Left 15K sensitivity         8.2.0         8.3.0           09-2008         RP#41         RP-080638         29         Absolute ACLR limit         8.2.0         8.3.0           09-2008         RP#41         RP-080731         372         UE EVM Windwing         8.2.0         8.3.0           09-2008         RP#41         RP-080731  | 03-2008 | RP#39 | RP-080123 | 3     | TS36.101 - Combined updates of E-UTRA UE requirements            | 8.0.0 | 8.1.0 |
| User-Solution         Construction   | 05-2008 | RP#40 | RP-080325 | 4     |  | 8.1.0 | 8.2.0 |
| Ope2008         RP#41         RP-080633         10         CR for clarification of additional spurious amission requirement         8.2.0         8.3.0           09-2008         RP#41         RP-080633         15         Correction of In-band Blocking Requirement         8.2.0         8.3.0           09-2008         RP#41         RP-080638         19r1         TS36.101: CR for section 6: NS.06         8.2.0         8.3.0           09-2008         RP#41         RP-080638         2011         TS36.101: CR for JEC for Section 6: TX modulation         8.2.0         8.3.0           09-2008         RP#41         RP-080638         211         TS36.101: CR for JEC for section 7: Band 13 Rx sensitivity         8.2.0         8.3.0           09-2008         RP#41         RP-080638         23         Absolute ACLR limit         6.2.0         8.3.0           09-2008         RP#41         RP-080731         30         Cerroschord PA, PB definition to align with RAM1 specification         8.2.0         8.3.0           09-2008         RP#41         RP-080731         317         Correction of PA, PB definition to align with RAM1 specification         8.2.0         8.3.0           09-2008         RP#41         RP-080731         317         Correction of PA, PB definition to align with RAM1 specification         8.2.0         8  | 09-2008 | RP#41 | RP-080638 | 5r1   |  |       |       |
| Op         RP#41         RP-080638         15         Correction of In-band Blocking Regurement         8.2.0         8.3.0           09-2008         RP#41         RP-080638         19r1         TS36.101: CR for section 6: Ns.06         8.2.0         8.3.0           09-2008         RP#41         RP-080638         19r1         TS36.101: CR for section 6: Ns.modulation         8.2.0         8.3.0           09-2008         RP#41         RP-080638         21r1         TS36.101: CR for section 7: Band 13 Rx sensitivity         8.2.0         8.3.0           09-2008         RP#41         RP-080638         29         Absolute ACLR limit         8.2.0         8.3.0           09-2008         RP#41         RP-080731         292         Absolute ACLR limit         8.2.0         8.3.0           09-2008         RP#41         RP-080731         30         Removal 0[1] for UE Rel Sen's figures         8.2.0         8.3.0           09-2008         RP#41         RP-080731         31         Correction of PA, PB definition to align with RAN1 specification         8.2.0         8.3.0           09-2008         RP#41         RP-080731         441         Definition of specified bandwidths         8.2.0         8.3.0           09-2008         RP#41         RP-080731         52/1<   | 09-2008 | RP#41 | RP-080638 | 7r1   | Transmitter intermodulation requirements                         | 8.2.0 | 8.3.0 |
| 09-2008         RP#41         RP-080638         18r1         T336.101: CR for section 6: NS_06         8.2.0         8.3.0           09-2008         RP#41         RP-080638         2011         T358.010: CR for section 6: Tx modulation         8.2.0         8.3.0           09-2008         RP#41         RP-080638         2011         T358.010: CR for UE Iminium power         8.2.0         8.3.0           09-2008         RP#41         RP-080638         2411         T358.010: CR for section 7: Band 13 Rx sensitivity         8.2.0         8.3.0           09-2008         RP#41         RP-080638         26         UE EVM Windowing         Band 12 Rx sensitivity         8.2.0         8.3.0           09-2008         RP#41         RP-080731         232         T358.0101: CR for section 7: Band 13 Rx sensitivity         8.2.0         8.3.0           09-2008         RP#41         RP-080731         30         Removal of [] for UE Ref Sens figures         8.2.0         8.3.0           09-2008         RP#41         RP-080731         31         Correction of PA.PB definition to align with RAN1 specification         8.2.0         8.3.0           09-2008         RP#41         RP-080731         44         Definition of zence for LCS requirement         8.2.0         8.3.0           09-2008 </td <td>09-2008</td> <td>RP#41</td> <td>RP-080638</td> <td>10</td> <td>CR for clarification of additional spurious emission requirement</td> <td>8.2.0</td> <td></td>      | 09-2008 | RP#41 | RP-080638 | 10    | CR for clarification of additional spurious emission requirement | 8.2.0 |       |
| 199-2008         RP#41         RP-080638         19r1         TS36.101: CR for section 6: Tx modulation         8.2.0         8.3.0           09-2008         RP#41         RP-080638         20r1         TS36.101: CR for UE OFF power         8.2.0         8.3.0           09-2008         RP#41         RP-080638         24r1         TS36.101: CR for section 7: Band 13 Rx sensitivity         8.2.0         8.3.0           09-2008         RP#41         RP-080638         29         Absolute ACIR limit         8.2.0         8.3.0           09-2008         RP#41         RP-080731         23r2         TS36.101: CR for section 6: UE to UE co-existence         8.2.0         8.3.0           09-2008         RP#41         RP-080731         31         Correction of PA. PB definition to align with RAHT specification         8.2.0         8.3.0           09-2008         RP#41         RP-080731         44         Definition of specified bandwidths         8.2.0         8.3.0           09-2008         RP#41         RP-080731         44/d         Definition for specified bandwidths         8.2.0         8.3.0           09-2008         RP#41         RP-080731         52r1         Frequency range for Band 12         8.2.0         8.3.0           09-2008         RP#41         RP-080731 <td>09-2008</td> <td>RP#41</td> <td>RP-080638</td> <td>15</td> <td></td> <td></td> <td></td>  | 09-2008 | RP#41 | RP-080638 | 15    |  |       |       |
| 09-2008         RP#41         RP-080638         20r1         TS36.101: CR for UE ofF power         8.2.0         8.3.0           09-2008         RP#41         RP-080638         21r1         TS36.101: CR for UE OFF power         8.2.0         8.3.0           09-2008         RP#41         RP-080638         24         UE EVM Windowing         8.2.0         8.3.0           09-2008         RP#41         RP-080638         24         UE EVM Windowing         8.2.0         8.3.0           09-2008         RP#41         RP-080638         24         UE EVM Windowing         8.2.0         8.3.0           09-2008         RP#41         RP-080731         30         Removal off    for UE Ref Sens figures         8.2.0         8.3.0           09-2008         RP#41         RP-080731         3772         UE Spurious emission band UE co-existence         8.2.0         8.3.0           09-2008         RP#41         RP-080731         44         Definition of spacified bandwidths         8.2.0         8.3.0           09-2008         RP#41         RP-080731         487         Addition of Band 17         8.2.0         8.3.0           09-2008         RP#41         RP-080731         567         TS36.101 section 6r. Tx modulation         8.2.0         8.3.0  | 09-2008 | RP#41 | RP-080638 | 18r1  | TS36.101: CR for section 6: NS_06                                | 8.2.0 | 8.3.0 |
| D9-2008         RP#41         RP-080638         21r1         TS36.101: CR for UE OFF power         8.2.0         8.3.0           09-2008         RP#41         RP-080638         24r1         TS36.101: CR for section 7: Band 13 Rx sensitivity         8.2.0         8.3.0           09-2008         RP#41         RP-080638         29         Absolute ACLR limit         8.2.0         8.3.0           09-2008         RP#41         RP-080638         29         Absolute ACLR limit         8.2.0         8.3.0           09-2008         RP#41         RP-080731         30         Removal of [] for UE Ref Sens figures         8.2.0         8.3.0           09-2008         RP#41         RP-080731         31         Correction of PA. PB definition to align with RAN1 specification         8.2.0         8.3.0           09-2008         RP#41         RP-080731         44         Definition of specified bandwidths         8.2.0         8.3.0           09-2008         RP#41         RP-080731         50         Alignment of the UE ACS requirement         8.2.0         8.3.0           09-2008         RP#41         RP-080731         51         Frequency range for Band 12         8.2.0         8.3.0           09-2008         RP#41         RP.080731         55         TS36.101  | 09-2008 | RP#41 | RP-080638 | 19r1  | TS36.101: CR for section 6: Tx modulation                        | 8.2.0 | 8.3.0 |
| 09-2008         RP441         RP-080638         24r1         TS36.101: CR for section 7: Band 13 Rx sensitivity         8.2.0         8.3.0           09-2008         RP441         RP-080638         26         UE EVM Windowing         8.2.0         8.3.0           09-2008         RP441         RP-080638         23         Absolute ACLR limit         8.2.0         8.3.0           09-2008         RP441         RP-080731         30         Removal of [1 for UE Ref Sens figures         8.2.0         8.3.0           09-2008         RP441         RP-080731         31         Correction of PA, PB definition to align with RAN1 specification         8.2.0         8.3.0           09-2008         RP441         RP-080731         441         Definition of specified bandwidths         8.2.0         8.3.0           09-2008         RP441         RP-080731         521         Frequency range for Band 12         8.2.0         8.3.0           09-2008         RP441         RP-080731         521         Frequency range for Band 12         8.2.0         8.3.0           09-2008         RP441         RP-080731         521         Ts modulation         8.2.0         8.3.0           09-2008         RP441         RP-080732         612         DL FRC definition for UE woroutr  |         |       | RP-080638 |       | TS36.101: CR for UE minimum power                                |       |       |
| 09-2008         RP#41         RP-080638         26         UE EVM Windowing         8.2.0         8.3.0           09-2008         RP#41         RP-080638         29         Absolute ACLR limit         8.2.0         8.3.0           09-2008         RP#41         RP-080731         232         TS36.101: CR for section 6: UE to UE co-existence         8.2.0         8.3.0           09-2008         RP#41         RP-080731         31         Correction of PA, PB definition to align with RAN1 specification         8.2.0         8.3.0           09-2008         RP#41         RP-080731         44         Definition of specified bandwidths         8.2.0         8.3.0           09-2008         RP#41         RP-080731         44         Definition of specified bandwidths         8.2.0         8.3.0           09-2008         RP#41         RP-080731         50         Alignment of the UE ACS requirement         8.2.0         8.3.0           09-2008         RP#41         RP-080731         521         Frequency range for Band 12         8.2.0         8.3.0           09-2008         RP#41         RP-080731         551         TS36.101 section 6: Tx modulation         8.2.0         8.3.0           09-2008         RP#41         RP-080732         47         Updated desc  | 09-2008 | RP#41 | RP-080638 | 21r1  | TS36.101: CR for UE OFF power                                    | 8.2.0 | 8.3.0 |
| 09-2008         RP#41         RP-080638         29         Absolute ACLR limit         8 2.0         8.3.0           09-2008         RP441         RP.080731         2342         TS36.101: CR for section 6: UE to UE co-existence         8.2.0         8.3.0           09-2008         RP441         RP.080731         31         Correction of PA, PB definition to align with RAN1 specification         8.2.0         8.3.0           09-2008         RP441         RP-080731         31         Correction of PA, PB definition to align with RAN1 specification         8.2.0         8.3.0           09-2008         RP441         RP-080731         443         Definition of specified bandwidths         8.2.0         8.3.0           09-2008         RP441         RP.080731         521         Frequency range for Band 12         8.2.0         8.3.0           09-2008         RP441         RP.080731         521         Frequency range for Band 12         8.2.0         8.3.0           09-2008         RP441         RP.080731         521         Frequency range for Band 12         8.2.0         8.3.0           09-2008         RP441         RP.080732         61         S.5.0         8.3.0         8.2.0         8.3.0           09-2008         RP441         RP.080732         6  | 09-2008 | RP#41 | RP-080638 | 24r1  | TS36.101: CR for section 7: Band 13 Rx sensitivity               | 8.2.0 |       |
| 09-2008         RP#41         RP-080731         23/2         TS36.101: CR for section 6: UE to UE co-existence         8.2.0         8.3.0           09-2008         RP#41         RP-080731         30         Removal of [] for UE Ref Sens figures         8.2.0         8.3.0           09-2008         RP#41         RP-080731         37/2         UE Spurious emission band UE co-existence         8.2.0         8.3.0           09-2008         RP#41         RP-080731         44         Definition of specified bandwidths         8.2.0         8.3.0           09-2008         RP#41         RP-080731         54         Addition of Band 17         8.2.0         8.3.0           09-2008         RP#41         RP-080731         52/1         Frequency range for Band 12         8.2.0         8.3.0           09-2008         RP#41         RP-080731         55/1         TS36.101 section 6: Tx modulation         8.2.0         8.3.0           09-2008         RP#41         RP-080732         46         Additional UE demodulation test cases         8.2.0         8.3.0           09-2008         RP#41         RP-080732         47         Updated descriptions of FRC         8.2.0         8.3.0           09-2008         RP#41         RP-080732         51         Clarification   | 09-2008 | RP#41 | RP-080638 |       | UE EVM Windowing   |       |       |
| 09-2006         RP#41         RP-080731         30         Removal of [] for UE Ref Sens figures         8.2.0         8.3.0           09-2008         RP#41         RP-080731         31         Correction of PA, PB definition to align with RAN1 specification         8.2.0         8.3.0           09-2008         RP#41         RP-080731         44         Definition of specified bandwidths         8.2.0         8.3.0           09-2008         RP#41         RP-080731         443         Addition of Band 17         8.2.0         8.3.0           09-2008         RP#41         RP-080731         52/1         Frequency range for Band 12         8.2.0         8.3.0           09-2008         RP#41         RP-080731         54/1         Absolute power tolerance for LTE UE power control         8.2.0         8.3.0           09-2008         RP#41         RP-080732         6/2         DL FRC definition for UE Receiver tests         8.2.0         8.3.0           09-2008         RP#41         RP-080732         47         Updated descriptions of FRC         8.2.0         8.3.0           09-2008         RP#41         RP-080732         53         Update description of definitions         8.2.0         8.3.0           09-2008         RP#41         RP-080732         53  | 09-2008 | RP#41 | RP-080638 | 29    | Absolute ACLR limit  | 8.2.0 | 8.3.0 |
| Op-2008         RP#41         RP-080731         31         Correction of PA, PB definition to align with RAN1 specification         8.2.0         8.3.0           09-2008         RP#41         RP-080731         37/2         UE Spurious emission band UE co-existence         8.2.0         8.3.0           09-2008         RP#41         RP-080731         48r3         Addition of Band 17         8.2.0         8.3.0           09-2008         RP#41         RP-080731         50         Alignment of the UE ACS requirement         8.2.0         8.3.0           09-2008         RP#41         RP-080731         52r1         Frequency range for Band 12         8.2.0         8.3.0           09-2008         RP#41         RP-080731         54r1         Absolute power tolerance for LTE UE power control         8.2.0         8.3.0           09-2008         RP#41         RP-080732         6f2         DL FRC definition for UE Receiver tests         8.2.0         8.3.0           09-2008         RP#41         RP-080732         4f2         Definition of UE transmission gap         8.2.0         8.3.0           09-2008         RP#41         RP-080732         51         Clafification on High Speed train model in 36.101         8.2.0         8.3.0           09-2008         RP#41         RP-0807  | 09-2008 | RP#41 | RP-080731 | 23r2  | TS36.101: CR for section 6: UE to UE co-existence                | 8.2.0 |       |
| 09-2008         RP#41         RP-080731         37r2         UE Spurious emission band UE co-existence         8.2.0         8.3.0           09-2008         RP#41         RP-080731         44         Definition of specified bandwidths         8.2.0         8.3.0           09-2008         RP#41         RP-080731         44r3         Addition of Band 17         8.2.0         8.3.0           09-2008         RP#41         RP-080731         52r1         Frequency range for Band 12         8.2.0         8.3.0           09-2008         RP#41         RP-080731         55r1         TS36.101 section 6: Tx modulation         8.2.0         8.3.0           09-2008         RP#41         RP-080732         6f2         DL FRC definition for UE Receiver tests         8.2.0         8.3.0           09-2008         RP#41         RP-080732         46         Additional UE demodulation test cases         8.2.0         8.3.0           09-2008         RP#41         RP-080732         47         Updated descriptions of FRC         8.2.0         8.3.0           09-2008         RP#41         RP-080732         53         Update of symbol and definitions         8.2.0         8.3.0           09-2008         RP#41         RP-080732         53         Update of symbol and definit  |         |       | RP-080731 |       |  | 8.2.0 |       |
| Op-2008         RP#41         RP-080731         44         Definition of specified bandwidths         8.2.0         8.3.0           09-2008         RP#41         RP-080731         48r3         Addition of Band 17         8.2.0         8.3.0           09-2008         RP#41         RP-080731         50         Alignment of the UE ACS requirement         8.2.0         8.3.0           09-2008         RP#41         RP-080731         52r1         Frequency range for Band 12         8.2.0         8.3.0           09-2008         RP#41         RP-080731         55         TS36.101 section 6r TLF UE power control         8.2.0         8.3.0           09-2008         RP#41         RP-080732         6f2         DL FRC definition for UE Receiver tests         8.2.0         8.3.0           09-2008         RP#41         RP-080732         46         Additional UE demodulation test cases         8.2.0         8.3.0           09-2008         RP#41         RP-080732         49         Definition of UE transmission gap         8.2.0         8.3.0           09-2008         RP#41         RP-080732         51         Clarification on High Speed train model in 36.101         8.2.0         8.3.0           12-2008         RP#41         RP-080743         56         Addition  | 09-2008 |       |           | 31    | Correction of PA, PB definition to align with RAN1 specification | 8.2.0 |       |
| 09-2008         RP#41         RP-080731         48r3         Addition of Band 17         8.2.0         8.3.0           09-2008         RP#41         RP-080731         50         Alignment of the UE ACS requirement         8.2.0         8.3.0           09-2008         RP#41         RP-080731         5211         Frequency range for Band 12         8.2.0         8.3.0           09-2008         RP#41         RP-080731         55         TS36.101 section 6: Tx modulation         8.2.0         8.3.0           09-2008         RP#41         RP-080732         6r2         DL FRC definition for UE Receiver tests         8.2.0         8.3.0           09-2008         RP#41         RP-080732         46         Additional UE demodulation test cases         8.2.0         8.3.0           09-2008         RP#41         RP-080732         47         Updated descriptions of FRC         8.2.0         8.3.0           09-2008         RP#41         RP-080732         51         Clarification on High Speed train model in 36.101         8.2.0         8.3.0           09-2008         RP#41         RP-080732         53         Update of symbol and definition         8.2.0         8.3.0           12-2008         RP#42         RP-080909         60         UE Maximum output power   | 09-2008 | RP#41 | RP-080731 | 37r2  |  |       |       |
| 09-2008         RP#41         RP-080731         50         Alignment of the UE ACS requirement         8.2.0         8.3.0           09-2008         RP#41         RP-080731         52r1         Frequency range for Band 12         8.2.0         8.3.0           09-2008         RP#41         RP-080731         55         TS36.101 section 6: Tx modulation         8.2.0         8.3.0           09-2008         RP#41         RP-080732         6r2         DL FRC definition for UE Receiver tests         8.2.0         8.3.0           09-2008         RP#41         RP-080732         46         Additional UE demodulation test cases         8.2.0         8.3.0           09-2008         RP#41         RP-080732         47         Updated descriptions of FRC         8.2.0         8.3.0           09-2008         RP#41         RP-080732         51         Clarification on High Speed train model in 36.101         8.2.0         8.3.0           09-2008         RP#41         RP-080733         56         Addition of MIMO (4x2) and (4x4) Correlation Matrices         8.2.0         8.3.0           12-2008         RP#42         RP-080909         105r1         UE Maximum output power for Band 13         8.3.0         8.4.0           12-2008         RP#42         RP-080909         60 <td>09-2008</td> <td>RP#41</td> <td>RP-080731</td> <td>44</td> <td>Definition of specified bandwidths</td> <td>8.2.0</td> <td>8.3.0</td>   | 09-2008 | RP#41 | RP-080731 | 44    | Definition of specified bandwidths                               | 8.2.0 | 8.3.0 |
| 09-2008         RP#41         RP-080731         52r1         Frequency range for Band 12         8.2.0         8.3.0           09-2008         RP#41         RP-080731         54r1         Absolute power tolerance for LTE UE power control         8.2.0         8.3.0           09-2008         RP#41         RP-080731         55         TS36.101 section 6: Tx modulation         8.2.0         8.3.0           09-2008         RP#41         RP-080732         6r2         DL FRC definition for UE Receiver tests         8.2.0         8.3.0           09-2008         RP#41         RP-080732         46         Additional UE demodulation test cases         8.2.0         8.3.0           09-2008         RP#41         RP-080732         47         Updated descriptions of FRC         8.2.0         8.3.0           09-2008         RP#41         RP-080732         51         Clarification on High Speed train model in 36.101         8.2.0         8.3.0           09-2008         RP#41         RP-080732         53         Update of symbol and definitions         8.2.0         8.3.0           12-2008         RP#42         RP-080909         105r1         UE Maximum output power for Band 13         8.3.0         8.4.0           12-2008         RP#42         RP-080909         60   | 09-2008 | RP#41 | RP-080731 | 48r3  | Addition of Band 17  |       |       |
| Op-2008         RP#41         RP-080731         54r1         Absolute power tolerance for LTE UE power control         8.2.0         8.3.0           09-2008         RP#41         RP-080731         55         TS36.101 section 6: Tx modulation         8.2.0         8.3.0           09-2008         RP#41         RP-080732         6r2         DL FRC definition for UE Receiver tests         8.2.0         8.3.0           09-2008         RP#41         RP-080732         46         Additional UE demodulation test cases         8.2.0         8.3.0           09-2008         RP#41         RP-080732         47         Updated descriptions of FRC         8.2.0         8.3.0           09-2008         RP#41         RP-080732         51         Clarification on High Speed train model in 36.101         8.2.0         8.3.0           09-2008         RP#41         RP-080732         53         Update of symbol and definitions         8.2.0         8.3.0           12-2008         RP#41         RP-080733         56         Addition of MIMO (4x2) and (4x4) Correlation Matrices         8.2.0         8.3.0           12-2008         RP#42         RP-080909         105r1         UE Maximum output power for Band 13         8.3.0         8.4.0           12-2008         RP#42         RP-0809090 <td></td> <td></td> <td>RP-080731</td> <td></td> <td>Alignment of the UE ACS requirement</td> <td></td> <td></td>   |         |       | RP-080731 |       | Alignment of the UE ACS requirement                              |       |       |
| 09-2008         RP#41         RP-080731         55         TS36.101 section 6: Tx modulation         8.2.0         8.3.0           09-2008         RP#41         RP-080732         6r2         DL FRC definition for UE Receiver tests         8.2.0         8.3.0           09-2008         RP#41         RP-080732         46         Additional UE demodulation test cases         8.2.0         8.3.0           09-2008         RP#41         RP-080732         47         Updated descriptions of FRC         8.2.0         8.3.0           09-2008         RP#41         RP-080732         51         Clarification on High Speed train model in 36.101         8.2.0         8.3.0           09-2008         RP#41         RP-080732         53         Update of symbol and definitions         8.2.0         8.3.0           09-2008         RP#41         RP-080733         56         Addition of MIMO (4x2) and (4x4) Correlation Matrices         8.2.0         8.3.0           09-2008         RP#42         RP-080909         105r1         UE Maximum output power for Band 13         8.3.0         8.4.0           12-2008         RP#42         RP-080909         63         Correction of UE spurious emissions         8.3.0         8.4.0           12-2008         RP#42         RP-080909         72   |         |       | RP-080731 |       | Frequency range for Band 12                                      | 8.2.0 |       |
| 09-2008         RP#41         RP-080732         6r2         DL FRC definition for UE Receiver tests         8.2.0         8.3.0           09-2008         RP#41         RP-080732         46         Additional UE demodulation test cases         8.2.0         8.3.0           09-2008         RP#41         RP-080732         47         Updated descriptions of FRC         8.2.0         8.3.0           09-2008         RP#41         RP-080732         51         Clarification on High Speed train model in 36.101         8.2.0         8.3.0           09-2008         RP#41         RP-080732         53         Update of symbol and definitions         8.2.0         8.3.0           09-2008         RP#41         RP-080732         56         Addition of MIMO (4x2) and (4x4) Correlation Matrices         8.2.0         8.3.0           12-2008         RP#42         RP-080909         105r1         UE Maximum output power for Band 13         8.3.0         8.4.0           12-2008         RP#42         RP-080909         63         Correction of UE spurious emissions         8.3.0         8.4.0           12-2008         RP#42         RP-080909         62         Clarification for VE additional spurious emissions         8.3.0         8.4.0           12-2008         RP#42         RP-080909 <td>09-2008</td> <td>RP#41</td> <td></td> <td>54r1</td> <td></td> <td>8.2.0</td> <td></td>  | 09-2008 | RP#41 |           | 54r1  |  | 8.2.0 |       |
| 09-2008         RP#41         RP-080732         46         Additional UE demodulation test cases         8.2.0         8.3.0           09-2008         RP#41         RP-080732         47         Updated descriptions of FRC         8.2.0         8.3.0           09-2008         RP#41         RP-080732         49         Definition of UE transmission gap         8.2.0         8.3.0           09-2008         RP#41         RP-080732         51         Clarification on High Speed train model in 36.101         8.2.0         8.3.0           09-2008         RP#41         RP-080732         53         Update of symbol and definitions         8.2.0         8.3.0           09-2008         RP#41         RP-080743         56         Addition of MIMO (4x2) and (4x4) Correlation Matrices         8.2.0         8.3.0           12-2008         RP#42         RP-080909         105r1         UE Maximum output power for Band 13         8.3.0         8.4.0           12-2008         RP#42         RP-080909         60         UL EVM equalizer definition         8.3.0         8.4.0           12-2008         RP#42         RP-080909         63         Correction of UE spurious emissions         8.3.0         8.4.0           12-2008         RP#42         RP-080909         72  | 09-2008 | RP#41 | RP-080731 | 55    | TS36.101 section 6: Tx modulation                                |       |       |
| 09-2008         RP#41         RP-080732         47         Updated descriptions of FRC         8.2.0         8.3.0           09-2008         RP#41         RP-080732         49         Definition of UE transmission gap         8.2.0         8.3.0           09-2008         RP#41         RP-080732         51         Clarification on High Speed train model in 36.101         8.2.0         8.3.0           09-2008         RP#41         RP-080732         53         Update of symbol and definitions         8.2.0         8.3.0           09-2008         RP#41         RP-080732         56         Addition of MIMO (4x2) and (4x4) Correlation Matrices         8.2.0         8.3.0           09-2008         RP#42         RP-080909         105r1         UE Maximum output power for Band 13         8.3.0         8.4.0           12-2008         RP#42         RP-080909         60         Clarification for UE additional spurious emissions         8.3.0         8.4.0           12-2008         RP#42         RP-080909         62         Clarification for UE additional spurious emissions         8.3.0         8.4.0           12-2008         RP#42         RP-080909         75         Removal of [] from 36.803         8.4.0           12-2008         RP#42         RP-080909         75  |         |       | RP-080732 |       | DL FRC definition for UE Receiver tests                          |       |       |
| 09-2008         RP#41         RP-080732         49         Definition of UE transmission gap         8.2.0         8.3.0           09-2008         RP#41         RP-080732         51         Clarification on High Speed train model in 36.101         8.2.0         8.3.0           09-2008         RP#41         RP-080732         53         Update of symbol and definitions         8.2.0         8.3.0           09-2008         RP#41         RP-080733         56         Addition of MIMO (4x2) and (4x4) Correlation Matrices         8.2.0         8.3.0           12-2008         RP#42         RP-080909         94r2         CR TX RX channel frequency separation         8.3.0         8.4.0           12-2008         RP#42         RP-080909         60         UL EVM equalizer definition         8.3.0         8.4.0           12-2008         RP#42         RP-080909         63         Correction of UE spurious emissions         8.3.0         8.4.0           12-2008         RP#42         RP-080909         66         Clarification for UE additional spurious emissions         8.3.0         8.4.0           12-2008         RP#42         RP-080909         75         Removal of [] from Section 6 transmitter characteristcs         8.3.0         8.4.0           12-2008         RP#42   | 09-2008 | RP#41 | RP-080732 |       | Additional UE demodulation test cases                            |       |       |
| 09-2008         RP#41         RP-080732         51         Clarification on High Speed train model in 36.101         8.2.0         8.3.0           09-2008         RP#41         RP-080732         53         Update of symbol and definitions         8.2.0         8.3.0           09-2008         RP#41         RP-080743         56         Addition of MIMO (4x2) and (4x4) Correlation Matrices         8.2.0         8.3.0           12-2008         RP#42         RP-080908         94r2         CR TX RX channel frequency separation         8.3.0         8.4.0           12-2008         RP#42         RP-080909         60         UL EVM equalizer definition         8.3.0         8.4.0           12-2008         RP#42         RP-080909         66         Clarification for UE additional spurious emissions         8.3.0         8.4.0           12-2008         RP#42         RP-080909         72         Introducing ACLR requirement for coexistance with UTRA         8.3.0         8.4.0           12-2008         RP#42         RP-080909         75         Removal of [] from Section 6 transmitter characteristcs         8.3.0         8.4.0           12-2008         RP#42         RP-080909         81         Clarification for PHS band protection         8.3.0         8.4.0           12-2008  |         |       |           |       |  |       |       |
| 09-2008         RP#41         RP-080732         53         Update of symbol and definitions         8.2.0         8.3.0           09-2008         RP#41         RP-080743         56         Addition of MIMO (4x2) and (4x4) Correlation Matrices         8.2.0         8.3.0           12-2008         RP#42         RP-080908         94r2         CR TX RX channel frequency separation         8.3.0         8.4.0           12-2008         RP#42         RP-080909         105r1         UE Maximum output power for Band 13         8.3.0         8.4.0           12-2008         RP#42         RP-080909         60         UL EVM equalizer definition         8.3.0         8.4.0           12-2008         RP#42         RP-080909         63         Correction of UE spurious emissions         8.3.0         8.4.0           12-2008         RP#42         RP-080909         66         Clarification for UE additional spurious emissions         8.3.0         8.4.0           12-2008         RP#42         RP-080909         72         Introducing ACLR requirement for coexistance with UTRA         8.3.0         8.4.0           12-2008         RP#42         RP-080909         75         Removal of [] from Section 6 transmitter characteristcs         8.3.0         8.4.0           12-2008         RP#42   |         |       | RP-080732 |       |  |       |       |
| 09-2008         RP#41         RP-080743         56         Addition of MIMO (4x2) and (4x4) Correlation Matrices         8.2.0         8.3.0           12-2008         RP#42         RP-080908         94r2         CR TX RX channel frequency separation         8.3.0         8.4.0           12-2008         RP#42         RP-080909         105r1         UE Maximum output power for Band 13         8.3.0         8.4.0           12-2008         RP#42         RP-080909         60         UL EVM equalizer definition         8.3.0         8.4.0           12-2008         RP#42         RP-080909         63         Correction of UE spurious emissions         8.3.0         8.4.0           12-2008         RP#42         RP-080909         66         Clarification for UE additional spurious emissions         8.3.0         8.4.0           12-2008         RP#42         RP-080909         72         Introducing ACLR requirement for coexistance with UTRA         8.3.0         8.4.0           12-2008         RP#42         RP-080909         75         Removal of [] from Section 6 transmitter characteristcs         8.3.0         8.4.0           12-2008         RP#42         RP-080909         81         Clarification for PHS band protection         8.3.0         8.4.0           12-2008         RP#42 <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>  |         |       |           |       |  |       |       |
| 12:2008         RP#42         RP-080908         94r2         CR TX RX channel frequency separation         8.3.0         8.4.0           12:2008         RP#42         RP-080909         105r1         UE Maximum output power for Band 13         8.3.0         8.4.0           12:2008         RP#42         RP-080909         60         UL EVM equalizer definition         8.3.0         8.4.0           12:2008         RP#42         RP-080909         63         Correction of UE spurious emissions         8.3.0         8.4.0           12:2008         RP#42         RP-080909         66         Clarification for UE additional spurious emissions         8.3.0         8.4.0           12:2008         RP#42         RP-080909         72         Introducing ACLR requirement for coexistance with UTRA 1.6MHZ channel from 36.803         8.3.0         8.4.0           12:2008         RP#42         RP-080909         75         Removal of [] from Section 6 transmitter characteristcs         8.3.0         8.4.0           12:2008         RP#42         RP-080909         81         Clarification for PHS band protection         8.3.0         8.4.0           12:2008         RP#42         RP-080909         98r1         Maximum power         8.3.0         8.4.0           12:2008         RP#42   |         |       |           |       |  |       |       |
| 12:2008         RP#42         RP-080909         105r1         UE Maximum output power for Band 13         8.3.0         8.4.0           12:2008         RP#42         RP-080909         60         UL EVM equalizer definition         8.3.0         8.4.0           12:2008         RP#42         RP-080909         63         Correction of UE spurious emissions         8.3.0         8.4.0           12:2008         RP#42         RP-080909         66         Clarification for UE additional spurious emissions         8.3.0         8.4.0           12:2008         RP#42         RP-080909         72         Introducing ACLR requirement for coexistance with UTRA         8.3.0         8.4.0           12:2008         RP#42         RP-080909         75         Removal of [] from Section 6 transmitter characteristcs         8.3.0         8.4.0           12:2008         RP#42         RP-080909         81         Clarification for PHS band protection         8.3.0         8.4.0           12:2008         RP#42         RP-080909         101         Alignement for the measurement interval for transmit signal quality         8.3.0         8.4.0           12:2008         RP#42         RP-080909         57r1         CR UE spectrum flatness         8.3.0         8.4.0           12:2008         RP#42 </td <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>  |         |       |           |       |  |       |       |
| 12:2008         RP#42         RP-080909         60         UL EVM equalizer definition         8.3.0         8.4.0           12:2008         RP#42         RP-080909         63         Correction of UE spurious emissions         8.3.0         8.4.0           12:2008         RP#42         RP-080909         66         Clarification for UE additional spurious emissions         8.3.0         8.4.0           12:2008         RP#42         RP-080909         72         Introducing ACLR requirement for coexistance with UTRA 1.6MHZ channel from 36.803         8.3.0         8.4.0           12:2008         RP#42         RP-080909         75         Removal of [] from Section 6 transmitter characteristcs         8.3.0         8.4.0           12:2008         RP#42         RP-080909         81         Clarification for PHS band protection         8.3.0         8.4.0           12:2008         RP#42         RP-080909         101         Alignement for the measurement interval for transmit signal quality         8.3.0         8.4.0           12:2008         RP#42         RP-080909         98r1         Maximum power         8.3.0         8.4.0           12:2008         RP#42         RP-080909         57r1         CR UE spectrum flatness         8.3.0         8.4.0           12:2008         RP#   |         |       |           |       |  |       |       |
| 12:2008         RP#42         RP-080909         63         Correction of UE spurious emissions         8.3.0         8.4.0           12:2008         RP#42         RP-080909         66         Clarification for UE additional spurious emissions         8.3.0         8.4.0           12:2008         RP#42         RP-080909         72         Introducing ACLR requirement for coexistance with UTRA 1.6MHZ channel from 36.803         8.3.0         8.4.0           12:2008         RP#42         RP-080909         75         Removal of [] from Section 6 transmitter characteristcs         8.3.0         8.4.0           12:2008         RP#42         RP-080909         81         Clarification for PHS band protection         8.3.0         8.4.0           12:2008         RP#42         RP-080909         101         Alignement for the measurement interval for transmit signal quality         8.3.0         8.4.0           12:2008         RP#42         RP-080909         98r1         Maximum power         8.3.0         8.4.0           12:2008         RP#42         RP-080909         57r1         CR UE spectrum flatness         8.3.0         8.4.0           12:2008         RP#42         RP-080909         58r1         CR Number of TX exceptions         8.3.0         8.4.0           12:2008         RP   |         |       |           |       |  |       |       |
| 12-2008         RP#42         RP-080909         66         Clarification for UE additional spurious emissions         8.3.0         8.4.0           12-2008         RP#42         RP-080909         72         Introducing ACLR requirement for coexistance with UTRA<br>1.6MHZ channel from 36.803         8.3.0         8.4.0           12-2008         RP#42         RP-080909         75         Removal of [] from Section 6 transmitter characteristcs         8.3.0         8.4.0           12-2008         RP#42         RP-080909         81         Clarification for PHS band protection         8.3.0         8.4.0           12-2008         RP#42         RP-080909         81         Clarification for PHS band protection         8.3.0         8.4.0           12-2008         RP#42         RP-080909         101         Alignement for the measurement interval for transmit signal<br>quality         8.3.0         8.4.0           12-2008         RP#42         RP-080909         57r1         CR UE spectrum flatness         8.3.0         8.4.0           12-2008         RP#42         RP-080909         58r1         CR Number of TX exceptions         8.3.0         8.4.0           12-2008         RP#42         RP-080909         58r1         CR Number of TX exceptions         8.3.0         8.4.0           12-2008   |         |       |           |       |  |       |       |
| 12-2008         RP#42         RP-080909         72         Introducing ACLR requirement for coexistance with UTRA<br>1.6MHZ channel from 36.803         8.3.0         8.4.0           12-2008         RP#42         RP-080909         75         Removal of [] from Section 6 transmitter characteristcs         8.3.0         8.4.0           12-2008         RP#42         RP-080909         81         Clarification for PHS band protection         8.3.0         8.4.0           12-2008         RP#42         RP-080909         101         Alignement for the measurement interval for transmit signal<br>quality         8.3.0         8.4.0           12-2008         RP#42         RP-080909         98r1         Maximum power         8.3.0         8.4.0           12-2008         RP#42         RP-080909         57r1         CR UE spectrum flatness         8.3.0         8.4.0           12-2008         RP#42         RP-080909         58r1         CR Number of TX exceptions         8.3.0         8.4.0           12-2008         RP#42         RP-080909         58r1         CR Number of TX exceptions         8.3.0         8.4.0           12-2008         RP#42         RP-080951         99r2         CR UE output power dynamic         8.3.0         8.4.0           12-2008         RP#42         RP-08095  |         |       |           |       |  |       |       |
| 12-2008       RP#42       RP-080909       72       1.6MHZ channel from 36.803       3.3.0       3.4.0         12-2008       RP#42       RP-080909       75       Removal of [] from Section 6 transmitter characteristcs       8.3.0       8.4.0         12-2008       RP#42       RP-080909       81       Clarification for PHS band protection       8.3.0       8.4.0         12-2008       RP#42       RP-080909       101       Alignement for the measurement interval for transmit signal quality       8.3.0       8.4.0         12-2008       RP#42       RP-080909       98r1       Maximum power       8.3.0       8.4.0         12-2008       RP#42       RP-080909       57r1       CR UE spectrum flatness       8.3.0       8.4.0         12-2008       RP#42       RP-080909       71r1       UE in-band emission       8.3.0       8.4.0         12-2008       RP#42       RP-080909       58r1       CR Number of TX exceptions       8.3.0       8.4.0         12-2008       RP#42       RP-080951       99r2       CR UE output power dynamic       8.3.0       8.4.0         12-2008       RP#42       RP-080951       79r1       LTE UE transmitter intermodulation       8.3.0       8.4.0         12-2008       RP#42   | 12-2008 | RP#42 | RP-080909 | 66    |  | 8.3.0 | 8.4.0 |
| 12-2008         RP#42         RP-080909         81         Clarification for PHS band protection         8.3.0         8.4.0           12-2008         RP#42         RP-080909         101         Alignement for the measurement interval for transmit signal quality         8.3.0         8.4.0           12-2008         RP#42         RP-080909         98r1         Maximum power         8.3.0         8.4.0           12-2008         RP#42         RP-080909         98r1         Maximum power         8.3.0         8.4.0           12-2008         RP#42         RP-080909         57r1         CR UE spectrum flatness         8.3.0         8.4.0           12-2008         RP#42         RP-080909         58r1         CR Number of TX exceptions         8.3.0         8.4.0           12-2008         RP#42         RP-080951         99r2         CR UE output power dynamic         8.3.0         8.4.0           12-2008         RP#42         RP-080951         79r1         LTE UE transmitter intermodulation         8.3.0         8.4.0           12-2008         RP#42         RP-080950         106r1         Structure of Clause 8         8.3.0         8.4.0           12-2008         RP#42         RP-080950         106r1         Structure of Clause 9 including CSI requirement  |         |       |           |       | 1.6MHZ channel from 36.803                                       |       |       |
| 12-2008         RP#42         RP-080909         101         Alignement for the measurement interval for transmit signal quality         8.3.0         8.4.0           12-2008         RP#42         RP-080909         98r1         Maximum power         8.3.0         8.4.0           12-2008         RP#42         RP-080909         98r1         Maximum power         8.3.0         8.4.0           12-2008         RP#42         RP-080909         57r1         CR UE spectrum flatness         8.3.0         8.4.0           12-2008         RP#42         RP-080909         71r1         UE in-band emission         8.3.0         8.4.0           12-2008         RP#42         RP-080909         58r1         CR Number of TX exceptions         8.3.0         8.4.0           12-2008         RP#42         RP-080951         99r2         CR UE output power dynamic         8.3.0         8.4.0           12-2008         RP#42         RP-080951         79r1         LTE UE transmitter intermodulation         8.3.0         8.4.0           12-2008         RP#42         RP-080910         91         Update of Clause 8         8.3.0         8.4.0           12-2008         RP#42         RP-080950         106r1         Structure of Clause 9 including CSI requirements for PUCCH mode 1-0 </td <td>-</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>  | -       |       |           |       |  |       |       |
| 12-2008       RP#42       RP-080909       101       quality       5.3.0       5.4.0         12-2008       RP#42       RP-080909       98r1       Maximum power       8.3.0       8.4.0         12-2008       RP#42       RP-080909       57r1       CR UE spectrum flatness       8.3.0       8.4.0         12-2008       RP#42       RP-080909       57r1       CR UE spectrum flatness       8.3.0       8.4.0         12-2008       RP#42       RP-080909       58r1       CR Number of TX exceptions       8.3.0       8.4.0         12-2008       RP#42       RP-080951       99r2       CR UE output power dynamic       8.3.0       8.4.0         12-2008       RP#42       RP-080951       79r1       LTE UE transmitter intermodulation       8.3.0       8.4.0         12-2008       RP#42       RP-080951       79r1       LTE UE transmitter intermodulation       8.3.0       8.4.0         12-2008       RP#42       RP-080910       91       Update of Clause 8       8.3.0       8.4.0         12-2008       RP#42       RP-080950       106r1       Structure of Clause 9 including CSI requirements for PUCCH mode 1-0       8.3.0       8.4.0         12-2008       RP#42       RP-080911       59 <td< td=""><td>12-2008</td><td>RP#42</td><td>RP-080909</td><td>81</td><td></td><td>8.3.0</td><td>8.4.0</td></td<>  | 12-2008 | RP#42 | RP-080909 | 81    |  | 8.3.0 | 8.4.0 |
| 12-2008         RP#42         RP-080909         57r1         CR UE spectrum flatness         8.3.0         8.4.0           12-2008         RP#42         RP-080909         71r1         UE in-band emission         8.3.0         8.4.0           12-2008         RP#42         RP-080909         58r1         CR Number of TX exceptions         8.3.0         8.4.0           12-2008         RP#42         RP-080951         99r2         CR UE output power dynamic         8.3.0         8.4.0           12-2008         RP#42         RP-080951         79r1         LTE UE transmitter intermodulation         8.3.0         8.4.0           12-2008         RP#42         RP-080951         79r1         LTE UE transmitter intermodulation         8.3.0         8.4.0           12-2008         RP#42         RP-080910         91         Update of Clause 8         8.3.0         8.4.0           12-2008         RP#42         RP-080950         106r1         Structure of Clause 9 including CSI requirements for PUCCH mode 1-0         8.3.0         8.4.0           12-2008         RP#42         RP-080950         106r1         Structure of Clause 9 including CSI requirements for PUCCH mode 1-0         8.3.0         8.4.0           12-2008         RP#42         RP-080911         59   | 12-2008 | RP#42 | RP-080909 | 101   | quality  |       |       |
| 12-2008         RP#42         RP-080909         71r1         UE in-band emission         8.3.0         8.4.0           12-2008         RP#42         RP-080909         58r1         CR Number of TX exceptions         8.3.0         8.4.0           12-2008         RP#42         RP-080909         58r1         CR Number of TX exceptions         8.3.0         8.4.0           12-2008         RP#42         RP-080951         99r2         CR UE output power dynamic         8.3.0         8.4.0           12-2008         RP#42         RP-080951         79r1         LTE UE transmitter intermodulation         8.3.0         8.4.0           12-2008         RP#42         RP-080950         91         Update of Clause 8         8.3.0         8.4.0           12-2008         RP#42         RP-080950         106r1         Structure of Clause 9 including CSI requirements for PUCCH mode 1-0         8.3.0         8.4.0           12-2008         RP#42         RP-080950         106r1         Structure of Clause 9 including CSI requirements for PUCCH mode 1-0         8.3.0         8.4.0           12-2008         RP#42         RP-080911         59         CR UE ACS test frequency offset         8.3.0         8.4.0  | 12-2008 | RP#42 | RP-080909 | 98r1  | Maximum power  | 8.3.0 | 8.4.0 |
| 12-2008         RP#42         RP-080909         58r1         CR Number of TX exceptions         8.3.0         8.4.0           12-2008         RP#42         RP-080951         99r2         CR UE output power dynamic         8.3.0         8.4.0           12-2008         RP#42         RP-080951         99r2         CR UE output power dynamic         8.3.0         8.4.0           12-2008         RP#42         RP-080951         79r1         LTE UE transmitter intermodulation         8.3.0         8.4.0           12-2008         RP#42         RP-080910         91         Update of Clause 8         8.3.0         8.4.0           12-2008         RP#42         RP-080950         106r1         Structure of Clause 9 including CSI requirements for PUCCH mode 1-0         8.3.0         8.4.0           12-2008         RP#42         RP-080950         106r1         Structure of Clause 9 including CSI requirements for PUCCH mode 1-0         8.3.0         8.4.0           12-2008         RP#42         RP-080911         59         CR UE ACS test frequency offset         8.3.0         8.4.0   | 12-2008 | RP#42 | RP-080909 | 57r1  | CR UE spectrum flatness  | 8.3.0 | 8.4.0 |
| 12-2008         RP#42         RP-080951         99r2         CR UE output power dynamic         8.3.0         8.4.0           12-2008         RP#42         RP-080951         79r1         LTE UE transmitter intermodulation         8.3.0         8.4.0           12-2008         RP#42         RP-080951         79r1         LTE UE transmitter intermodulation         8.3.0         8.4.0           12-2008         RP#42         RP-080910         91         Update of Clause 8         8.3.0         8.4.0           12-2008         RP#42         RP-080950         106r1         Structure of Clause 9 including CSI requirements for PUCCH mode 1-0         8.3.0         8.4.0           12-2008         RP#42         RP-080950         106r1         Structure of Clause 9 including CSI requirements for PUCCH mode 1-0         8.3.0         8.4.0           12-2008         RP#42         RP-080911         59         CR UE ACS test frequency offset         8.3.0         8.4.0   |         | RP#42 | RP-080909 | 71r1  |  |       |       |
| 12-2008         RP#42         RP-080951         79r1         LTE UE transmitter intermodulation         8.3.0         8.4.0           12-2008         RP#42         RP-080910         91         Update of Clause 8         8.3.0         8.4.0           12-2008         RP#42         RP-080950         106r1         Structure of Clause 9 including CSI requirements for PUCCH mode 1-0         8.3.0         8.4.0           12-2008         RP#42         RP-080950         106r1         Structure of Clause 9 including CSI requirements for PUCCH mode 1-0         8.3.0         8.4.0           12-2008         RP#42         RP-080911         59         CR UE ACS test frequency offset         8.3.0         8.4.0   |         |       |           |       |  |       |       |
| 12-2008         RP#42         RP-080910         91         Update of Clause 8         8.3.0         8.4.0           12-2008         RP#42         RP-080950         106r1         Structure of Clause 9 including CSI requirements for PUCCH mode 1-0         8.3.0         8.4.0           12-2008         RP#42         RP-080951         59         CR UE ACS test frequency offset         8.3.0         8.4.0   |         |       |           |       |  |       |       |
| 12-2008         RP#42         RP-080950         106r1         Structure of Clause 9 including CSI requirements for PUCCH mode 1-0         8.3.0         8.4.0           12-2008         RP#42         RP-080911         59         CR UE ACS test frequency offset         8.3.0         8.4.0   |         |       |           |       |  |       |       |
| 12-2008         RP#42         RP-080950         10611         mode 1-0         5.5.0         5.4.0           12-2008         RP#42         RP-080911         59         CR UE ACS test frequency offset         8.3.0         8.4.0  | 12-2008 | RP#42 | RP-080910 | 91    |  | 8.3.0 | 8.4.0 |
|  | 12-2008 | RP#42 | RP-080950 | 106r1 | mode 1-0   |       |       |
| 12-2008 RP#42 RP-080911 65 Correction of spurious response parameters 8.3.0 8.4.0  | 12-2008 | RP#42 | RP-080911 | 59    | CR UE ACS test frequency offset                                  | 8.3.0 | 8.4.0 |
|  | 12-2008 | RP#42 | RP-080911 | 65    | Correction of spurious response parameters                       | 8.3.0 | 8.4.0 |
| 12-2008         RP#42         RP-080911         80         Removal of LTE UE narrowband intermodulation         8.3.0         8.4.0  | 12-2008 | RP#42 | RP-080911 | 80    | Removal of LTE UE narrowband intermodulation                     | 8.3.0 | 8.4.0 |

| 12-2008<br>12-2008 | RP#42<br>RP#42 | RP-080912<br>RP-080912 | 62<br>78     | Alignement of TB size n Ref Meas channel for RX characteristics<br>TDD Reference Measurement channel for RX characterisctics                       | 8.3.0<br>8.3.0 | 8.4.0<br>8.4.0 |
|--------------------|----------------|------------------------|--------------|--|----------------|----------------|
| 12-2008            | RP#42          | RP-080912              | 73r1         | Addition of 64QAM DL referenbce measurement channel  | 8.3.0          | 8.4.0          |
| 12-2008            | RP#42          | RP-080912              | 74r1         | Addition of UL Reference Measurement Channels  | 8.3.0          | 8.4.0          |
| 12-2008            | RP#42          | RP-080912              | 104          | Reference measurement channels for PDSCH performance requirements (TDD)  | 8.3.0          | 8.4.0          |
| 12-2008            | RP#42          | RP-080913              | 68           | MIMO Correlation Matrix Corrections  | 8.3.0          | 8.4.0          |
| 12-2008            | RP#42          | RP-080915              | 67           | Correction to the figure with the Transmission Bandwidth<br>configuration  | 8.3.0          | 8.4.0          |
| 12-2008            | RP#42          | RP-080916              | 77           | Modification to EARFCN   | 8.3.0          | 8.4.0          |
| 12-2008            | RP#42          | RP-080917              | 85r1         | New Clause 5 outline<br>Introduction of Bands 12 and 17 in 36.101  | 8.3.0<br>8.3.0 | 8.4.0<br>8.4.0 |
| 12-2008<br>12-2008 | RP#42<br>RP#42 | RP-080919<br>RP-080927 | 102<br>84r1  | Clarification of HST propagation conditions  | 8.3.0          | 8.4.0<br>8.4.0 |
| 03-2009            | RP#42          | RP-090170              | 156r2        | A-MPR table for NS 07  | 8.4.0          | 8.5.0          |
| 03-2009            | RP#43          | RP-090170              | 170          | Corrections of references (References to tables and figures)   | 8.4.0          | 8.5.0          |
| 03-2009            | RP#43          | RP-090170              | 108          | Removal of [] from Transmitter Intermodulation   | 8.4.0          | 8.5.0          |
| 03-2009            | RP#43          | RP-090170              | 155          | E-UTRA ACLR for below 5 MHz bandwidths   | 8.4.0          | 8.5.0          |
| 03-2009            | RP#43          | RP-090170              | 116          | Clarification of PHS band including the future plan  | 8.4.0          | 8.5.0          |
| 03-2009            | RP#43          | RP-090170              | 119          | Spectrum emission mask for 1.4 MHz and 3 MHz bandwidhts  | 8.4.0          | 8.5.0          |
| 03-2009            | RP#43          | RP-090170              | 120          | Removal of "Out-of-synchronization handling of output power" heading   | 8.4.0          | 8.5.0          |
| 03-2009            | RP#43          | RP-090170              | 126          | UE uplink power control  | 8.4.0          | 8.5.0          |
| 03-2009            | RP#43          | RP-090170              | 128          | Transmission BW Configuration  | 8.4.0          | 8.5.0          |
| 03-2009            | RP#43<br>RP#43 | RP-090170<br>RP-090170 | 130<br>132r2 | Spectrum flatness PUCCH EVM  | 8.4.0<br>8.4.0 | 8.5.0<br>8.5.0 |
| 03-2009            | RP#43<br>RP#43 | RP-090170<br>RP-090170 | 13212        | UL DM-RS EVM   | 8.4.0          | 8.5.0          |
| 03-2009            | RP#43          | RP-090170<br>RP-090170 | 134          | Removal of ACLR2bis requirements   | 8.4.0          | 8.5.0          |
| 03-2009            | RP#43          | RP-090171              | 113          | In-band blocking   | 8.4.0          | 8.5.0          |
| 03-2009            | RP#43          | RP-090171              | 127          | In-band blocking and sensitivity requirement for band 17   | 8.4.0          | 8.5.0          |
| 03-2009            | RP#43          | RP-090171              | 137r1        | Wide band intermodulation  | 8.4.0          | 8.5.0          |
| 03-2009            | RP#43          | RP-090171              | 141          | Correction of reference sensitivity power level of Band 9  | 8.4.0          | 8.5.0          |
| 03-2009            | RP#43          | RP-090172              | 109          | AWGN level for UE DL demodulation performance tests  | 8.4.0          | 8.5.0          |
| 03-2009            | RP#43          | RP-090172              | 124          | Update of Clause 8: additional test cases  | 8.4.0          | 8.5.0          |
| 03-2009            | RP#43          | RP-090172              | 139r1        | Performance requirement structure for TDD PDSCH  | 8.4.0          | 8.5.0          |
| 03-2009            | RP#43          | RP-090172              | 142r1        | Performance requirements and reference measurement<br>channels for TDD PDSCH demodulation with UE-specific<br>reference symbols                    | 8.4.0          | 8.5.0          |
| 03-2009            | RP#43          | RP-090172              | 145          | Number of information bits in DwPTS  | 8.4.0          | 8.5.0          |
| 03-2009            | RP#43          | RP-090172              | 160r1        | MBSFN-Unicast demodulation test case   | 8.4.0          | 8.5.0          |
| 03-2009            | RP#43          | RP-090172              | 163r1        | MBSFN-Unicast demodulation test case for TDD   | 8.4.0          | 8.5.0          |
| 03-2009            | RP#43          | RP-090173              | 162          | Clarification of EARFCN for 36.101   | 8.4.0          | 8.5.0          |
| 03-2009            | RP#43          | RP-090369              | 110          | Correction to UL Reference Measurement Channel   | 8.4.0          | 8.5.0          |
| 03-2009            | RP#43          | RP-090369              | 114          | Addition of MIMO (4x4, medium) Correlation Matrix  | 8.4.0          | 8.5.0          |
| 03-2009            | RP#43          | RP-090369              | 121          | Correction of 36.101 DL RMC table notes  | 8.4.0          | 8.5.0          |
| 03-2009            | RP#43          | RP-090369              | 125          | Update of Clause 9   | 8.4.0          | 8.5.0          |
| 03-2009            | RP#43          | RP-090369              | 138r1        | Clarification on OCNG  | 8.4.0          | 8.5.0          |
| 03-2009            | RP#43          | RP-090369              | 161          | CQI reference measurement channels   | 8.4.0          | 8.5.0          |
| 03-2009            | RP#43          | RP-090369              | 164          | PUCCH 1-1 Static Test Case   | 8.4.0          | 8.5.0          |
| 03-2009            | RP#43          | RP-090369              | 111          | Reference Measurement Channel for TDD  | 8.4.0          | 8.5.0          |
| 03-2009            | RP#44          |                        |              | Editorial correction in Table 6.2.4-1  | 8.5.0          | 8.5.1          |
| 05-2009            | RP#44          | RP-090540              | 167          | Boundary between E-UTRA fOOB and spurious emission<br>domain for 1.4 MHz and 3 MHz bandwiths. (Technically<br>Endorsed CR in R4-50bis - R4-091205) | 8.5.1          | 8.6.0          |
| 05-2009            | RP#44          | RP-090540              | 168          | EARFCN correction for TDD DL bands. (Technically Endorsed CR in R4-50bis - R4-091206)  | 8.5.1          | 8.6.0          |
| 05-2009            | RP#44          | RP-090540              | 169          | Editorial correction to in-band blocking table. (Technically   | 8.5.1          | 8.6.0          |

|         |       |           |       | Endorsed CR in R4-50bis - R4-091238)  |       |       |
|---------|-------|-----------|-------|---|-------|-------|
| 05-2009 | RP#44 | RP-090540 | 171   | CR PRACH EVM. (Technically Endorsed CR in R4-50bis - R4-<br>091308)   | 8.5.1 | 8.6.0 |
| 05-2009 | RP#44 | RP-090540 | 172   | CR EVM correction. (Technically Endorsed CR in R4-50bis - R4-<br>091309)  | 8.5.1 | 8.6.0 |
| 05-2009 | RP#44 | RP-090540 | 177   | CR power control accuracy. (Technically Endorsed CR in R4-<br>50bis - R4-091418)  | 8.5.1 | 8.6.0 |
| 05-2009 | RP#44 | RP-090540 | 179   | Correction of SRS requirements. (Technically Endorsed CR in R4-50bis - R4-091426)   | 8.5.1 | 8.6.0 |
| 05-2009 | RP#44 | RP-090540 | 186   | Clarification for EVM. (Technically Endorsed CR in R4-50bis -<br>R4-091512)   | 8.5.1 | 8.6.0 |
| 05-2009 | RP#44 | RP-090540 | 187   | Removal of [] from band 17 Refsens values and ACS offset  | 8.5.1 | 8.6.0 |
| 05-2009 | RP#44 | RP-090540 | 191   | frequencies<br>Completion of band17 requirements  | 8.5.1 | 8.6.0 |
| 05-2009 | RP#44 | RP-090540 | 192   | Removal of 1.4 MHz and 3 MHz bandwidths from bands 13, 14   | 8.5.1 | 8.6.0 |
| 05-2009 | RP#44 | RP-090540 | 223   | and 17.<br>CR: 64 QAM EVM   | 8.5.1 | 8.6.0 |
| 05-2009 | RP#44 | RP-090540 | 201   | CR In-band emissions  | 8.5.1 | 8.6.0 |
| 05-2009 | RP#44 | RP-090540 | 203   | CR EVM exclusion period   | 8.5.1 | 8.6.0 |
| 05-2009 | RP#44 | RP-090540 | 204   | CR In-band emissions timing   | 8.5.1 | 8.6.0 |
| 05-2009 | RP#44 | RP-090540 | 206   | CR Minimum Rx exceptions  | 8.5.1 | 8.6.0 |
| 05-2009 | RP#44 | RP-090540 | 207   | CR UL DM-RS EVM   | 8.5.1 | 8.6.0 |
| 05-2009 | RP#44 | RP-090540 | 218r1 | A-MPR table for NS_07   | 8.5.1 | 8.6.0 |
| 05-2009 | RP#44 | RP-090540 | 205r1 | CR In-band emissions in shortened subframes   | 8.5.1 | 8.6.0 |
| 05-2009 | RP#44 | RP-090540 | 200r1 | CR PUCCH EVM  | 8.5.1 | 8.6.0 |
| 05-2009 | RP#44 | RP-090540 | 178r2 | No additional emission mask indication. (Technically Endorsed CR in R4-50bis - R4-091421)   | 8.5.1 | 8.6.0 |
| 05-2009 | RP#44 | RP-090540 | 220r1 | Spectrum emission requirements for band 13  | 8.5.1 | 8.6.0 |
| 05-2009 | RP#44 | RP-090540 | 197r2 | CR on aggregate power tolerance   | 8.5.1 | 8.6.0 |
| 05-2009 | RP#44 | RP-090540 | 196r2 | CR: Rx IP2 performance  | 8.5.1 | 8.6.0 |
| 05-2009 | RP#44 | RP-090541 | 198r1 | Maximum output power relaxation   | 8.5.1 | 8.6.0 |
| 05-2009 | RP#44 | RP-090542 | 166   | Update of performance requirement for TDD PDSCH with<br>MBSFN configuration. (Technically Endorsed CR in R4-50bis -<br>R4-091180) | 8.5.1 | 8.6.0 |
| 05-2009 | RP#44 | RP-090542 | 175   | Adding AWGN levels for some TDD DL performance<br>requirements. (Technically Endorsed CR in R4-50bis - R4-<br>091406)             | 8.5.1 | 8.6.0 |
| 05-2009 | RP#44 | RP-090542 | 182   | OCNG Patterns for Single Resource Block FRC Requirements.<br>(Technically Endorsed CR in R4-50bis - R4-091504)                    | 8.5.1 | 8.6.0 |
| 05-2009 | RP#44 | RP-090542 | 170r1 | Update of Clause 8: PHICH and PMI delay. (Technically<br>Endorsed CR in R4-50bis - R4-091275)                                     | 8.5.1 | 8.6.0 |
| 05-2009 | RP#44 | RP-090543 | 183   | Requirements for frequency-selective fading test. (Technically Endorsed CR in R4-50bis - R4-091505)                               | 8.5.1 | 8.6.0 |
| 05-2009 | RP#44 | RP-090543 | 199   | CQI requirements under AWGN conditions  | 8.5.1 | 8.6.0 |
| 05-2009 | RP#44 | RP-090543 | 188r1 | Adaptation of UL-RMC-s for supporting more UE categories  | 8.5.1 | 8.6.0 |
| 05-2009 | RP#44 | RP-090543 | 193r1 | Correction of the LTE UE downlink reference measurement<br>channels   | 8.5.1 | 8.6.0 |
| 05-2009 | RP#44 | RP-090543 | 184r1 | Requirements for frequency non-selective fading tests.<br>(Technically Endorsed CR in R4-50bis - R4-091506)                       | 8.5.1 | 8.6.0 |
| 05-2009 | RP#44 | RP-090543 | 185r1 | Requirements for PMI reporting. (Technically Endorsed CR in R4-50bis - R4-091510)   | 8.5.1 | 8.6.0 |
| 05-2009 | RP#44 | RP-090543 | 221r1 | Correction to DL RMC-s for Maximum input level for supporting more UE-Categories  | 8.5.1 | 8.6.0 |
| 05-2009 | RP#44 | RP-090543 | 216   | Addition of 15 MHz and 20 MHz bandwidths into band 38   | 8.5.1 | 8.6.0 |
| 05-2009 | RP#44 | RP-090559 | 180   | Introduction of Extended LTE800 requirements. (Technically Endorsed CR in R4-50bis - R4-091432)                                   | 8.6.0 | 9.0.0 |
| 09-2009 | RP#45 | RP-090826 | 239   | A-MPR for Band 19   | 9.0.0 | 9.1.0 |
| 09-2009 | RP#45 | RP-090822 | 225   | LTE UTRA ACLR1 centre frequency definition for 1.4 and 3 MHz<br>BW  | 9.0.0 | 9.1.0 |
| 09-2009 | RP#45 | RP-090822 | 227   | Harmonization of text for LTE Carrier leakage   | 9.0.0 | 9.1.0 |
| 09-2009 | RP#45 | RP-090822 | 229   | Sensitivity requirements for Band 38 15 MHz and 20 MHz bandwidths   | 9.0.0 | 9.1.0 |
| 09-2009 | RP#45 | RP-090822 | 236   | Operating band edge relaxation of maximum output power for<br>Band 18 and 19  | 9.0.0 | 9.1.0 |
| 09-2009 | RP#45 | RP-090822 | 238   | Addition of 5MHz channel bandwidth for Band 40  | 9.0.0 | 9.1.0 |
| 09-2009 | RP#45 | RP-090822 | 245   | Removal of unnecessary requirements for 1.4 and 3 MHz bandwidths on bands 13 and 17   | 9.0.0 | 9.1.0 |
| 09-2009 | RP#45 | RP-090877 | 261   | Correction of LTE UE ACS test parameter   | 9.0.0 | 9.1.0 |
| 09-2009 | RP#45 | RP-090877 | 263R1 | Correction of LTE UE ACLR test parameter  | 9.0.0 | 9.1.0 |
| 09-2009 | RP#45 | RP-090877 | 286   | Uplink power and RB allocation for receiver tests   | 9.0.0 | 9.1.0 |
| 09-2009 | RP#45 | RP-090877 | 320   | CR Sensitivity relaxation for small BW  | 9.0.0 | 9.1.0 |

| 09-2009            | RP#45          | RP-090877              | 324            | Correction of Band 3 spurious emission band UE co-existence   | 9.0.0          | 9.1.0          |
|--------------------|----------------|------------------------|----------------|---|----------------|----------------|
| 09-2009            | RP#45          | RP-090877              | 249R1          | CR Pcmax definition (working assumption)  | 9.0.0          | 9.1.0          |
| 09-2009            | RP#45          | RP-090877              | 330            | Spectrum flatness clarification   | 9.0.0          | 9.1.0          |
| 09-2009            | RP#45          | RP-090877              | 332            | Transmit power: removal of TC and modification of REFSENS note  | 9.0.0          | 9.1.0          |
| 09-2009            | RP#45          | RP-090877              | 282R1          | Additional SRS relative power requirement and update of<br>measurement definition   | 9.0.0          | 9.1.0          |
| 09-2009            | RP#45          | RP-090877              | 284R1          | Power range applicable for relative tolerance   | 9.0.0          | 9.1.0          |
| 09-2009            | RP#45          | RP-090878              | 233            | TDD UL/DL configurations for CQI reporting  | 9.0.0          | 9.1.0          |
| 09-2009            | RP#45          | RP-090878              | 235            | Further clarification on CQI test configurations  | 9.0.0          | 9.1.0          |
| 09-2009            | RP#45          | RP-090878              | 243            | Corrections to UL- and DL-RMC-s   | 9.0.0          | 9.1.0          |
| 09-2009            | RP#45          | RP-090878              | 247            | Reference measurement channel for multiple PMI requirements   | 9.0.0          | 9.1.0          |
| 09-2009            | RP#45          | RP-090878              | 290            | CQI reporting test for a scenario with frequency-selective interference   | 9.0.0          | 9.1.0          |
| 09-2009            | RP#45          | RP-090878              | 265R2          | CQI reference measurement channels  | 9.0.0          | 9.1.0          |
| 09-2009            | RP#45          | RP-090878              | 321R1          | CR RI Test<br>Correction of parameters for demodulation performance   | 9.0.0          | 9.1.0          |
| 09-2009            | RP#45          | RP-090875              | 231            | requirement   | 9.0.0          | 9.1.0          |
| 09-2009            | RP#45          | RP-090875              | 241R1          | UE categories for performance tests and correction to RMC references  | 9.0.0          | 9.1.0          |
| 09-2009            | RP#45          | RP-090875              | 333            | Clarification of Es definition in the demodulation requirement  | 9.0.0          | 9.1.0          |
| 09-2009            | RP#45          | RP-090875              | 326            | Editorial corrections and updates to PHICH PBCH test cases.   | 9.0.0          | 9.1.0          |
| 09-2009            | RP#45          | RP-090875              | 259R3          | Test case numbering in section 8 Performance tests Test case numbering in TDD PDSCH performance test                                | 9.0.0          | 9.1.0          |
| 12-2009            | RP-46          | RP-091264              | 335            | (Technically endorsed at RAN 4 52bis in R4-093523)<br>Adding beamforming model for user-specific reference signal                   | 9.1.0          | 9.2.0          |
| 12-2009            | RP-46          | RP-091261              | 337            | (Technically endorsed at RAN 4 52bis in R4-093525)  | 9.1.0          | 9.2.0          |
| 12-2009            | RP-46          | RP-091263              | 339R1          | Adding redundancy sequences to PMI test (Technically<br>endorsed at RAN 4 52bis in R4-093581)                                       | 9.1.0          | 9.2.0          |
| 12-2009            | RP-46          | RP-091264              | 341            | Throughput value correction at FRC for Maximum input level<br>(Technically endorsed at RAN 4 52bis in R4-093660)                    | 9.1.0          | 9.2.0          |
| 12-2009            | RP-46          | RP-091261              | 343            | Correction to the modulated E-UTRA interferer (Technically<br>endorsed at RAN 4 52bis in R4-093662)                                 | 9.1.0          | 9.2.0          |
| 12-2009            | RP-46          | RP-091264              | 345R1          | OCNG: Patterns and present use in tests (Technically endorsed<br>at RAN 4 52bis in R4-093664)                                       | 9.1.0          | 9.2.0          |
| 12-2009            | RP-46          | RP-091264              | 347            | OCNG: Use in receiver and performance tests (Technically<br>endorsed at RAN 4 52bis in R4-093666)                                   | 9.1.0          | 9.2.0          |
| 12-2009            | RP-46          | RP-091263              | 349            | Miscellaneous corrections on CSI requirements (Technically<br>endorsed at RAN 4 52bis in R4-093676)                                 | 9.1.0          | 9.2.0          |
| 12-2009            | RP-46          | RP-091261              | 351            | Removal of RLC modes (Technically endorsed at RAN 4 52bis in R4-093677)   | 9.1.0          | 9.2.0          |
| 12-2009            | RP-46          | RP-091261              | 353            | CR Rx diversity requirement (Technically endorsed at RAN 4<br>52bis in R4-093703)   | 9.1.0          | 9.2.0          |
| 12-2009            | RP-46          | RP-091261              | 355            | A-MPR notation in NS_07 (Technically endorsed at RAN 4 52bis<br>in R4-093706)   | 9.1.0          | 9.2.0          |
| 12-2009            | RP-46          | RP-091263              | 359            | Single- and multi-PMI requirements (Technically endorsed at RAN 4 52bis in R4-093846)   | 9.1.0          | 9.2.0          |
| 12-2009            | RP-46          | RP-091263              | 363            | CQI reference measurement channel (Technically endorsed at RAN 4 52bis in R4-093970)  | 9.1.0          | 9.2.0          |
| 12-2009            | RP-46          | RP-091292              | 364            | LTE MBSFN Channel Model (Technically endorsed at RAN 4<br>52bis in R4-094020)   | 9.1.0          | 9.2.0          |
| 12-2009            | RP-46          | RP-091264              | 367            | Numbering of PDSCH (User-Specific Reference Symbols)<br>Demodulation Tests  | 9.1.0          | 9.2.0          |
| 12-2009            | RP-46          | RP-091264              | 369            | Numbering of PDCCH/PCFICH, PHICH, PBCH Demod Tests  | 9.1.0          | 9.2.0          |
| 12-2009<br>12-2009 | RP-46<br>RP-46 | RP-091261<br>RP-091264 | 371<br>373R1   | Remove [] from Reference Measurement Channels in Annex A<br>Corrections to RMC-s for Maximum input level test for low UE            | 9.1.0<br>9.1.0 | 9.2.0<br>9.2.0 |
| 12-2009            | RP-46          | RP-091264<br>RP-091261 | 373R1          | categories<br>Correction of UE-category for R.30  | 9.1.0          | 9.2.0          |
| 12-2009            | RP-46<br>RP-46 | RP-091261<br>RP-091286 | 378            | Introduction of Extended LTE1500 requirements for TS36.101  | 9.1.0          | 9.2.0          |
| 12-2009            | RP-46          | RP-091262              | 384            | CR: Removal of 1.4 MHz and 3 MHz channel bandwidths from<br>additional spurious emissions requirements for Band 1 PHS<br>protection | 9.1.0          | 9.2.0          |
| 12-2009            | RP-46          | RP-091262              | 386R3          | Clarification of measurement conditions of spurious emission requirements at the edge of spurious domain                            | 9.1.0          | 9.2.0          |
| 12-2009            | RP-46          | RP-091262              | 390            | Spurious emission table correction for TDD bands 33 and 38.   | 9.1.0          | 9.2.0          |
| 12-2009            | RP-46<br>RP-46 | RP-091262              | 392R2          | 36.101 Symbols and abreviations for Pcmax<br>UTRAACLR1 requirement definition for 1.4 and 3 MHz BW                                  | 9.1.0          | 9.2.0          |
| 12-2009            |                | RP-091262              | 394            | completed<br>Introduction of the ACK/NACK feedback modes for TDD  | 9.1.0          | 9.2.0          |
| 12-2009            | RP-46          | RP-091263              | 396            | requirements  | 9.1.0          | 9.2.0          |
| 12-2009<br>12-2009 | RP-46<br>RP-46 | RP-091262<br>RP-091262 | 404R3<br>416R1 | CR Power control exception R8<br>Relative power tolerance: special case for receiver tests  | 9.1.0<br>9.1.0 | 9.2.0<br>9.2.0 |
| 12-2009            | RP-46<br>RP-46 | RP-091262<br>RP-091263 | 416R1<br>420R1 | CSI reporting: test configuration for CQI fading requirements   | 9.1.0          | 9.2.0          |
|                    | ю              |                        |                |   | 0.1.0          | · ·            |

| 10.000             |                | DD 001284              | 404.04          | Inducion of Dond 20 LIE DE norometers  | 010            |                |
|--------------------|----------------|------------------------|-----------------|--|----------------|----------------|
| 12-2009            | RP-46          | RP-091284              | 421R1           | Inclusion of Band 20 UE RF parameters<br>Editorial corrections and updates to Clause 8.2.1 FDD                   | 9.1.0          | 9.2.0          |
| 12-2009            | RP-46          | RP-091264              | 425             | demodulation test cases  | 9.1.0          | 9.2.0          |
| 12-2009            | RP-46          | RP-091262              | 427             | CR: time mask  | 9.1.0          | 9.2.0          |
| 12-2009            | RP-46          | RP-091264              | 430             | Correction of the payload size for PDCCH/PCFICH performance requirements   | 9.1.0          | 9.2.0          |
| 12-2009            | RP-46          | RP-091263              | 432             | Transport format and test point updates to RI reporting test<br>cases  | 9.1.0          | 9.2.0          |
| 12-2009            | RP-46          | RP-091263              | 434             | Transport format and test setup updates to frequency-selective<br>interference CQI tests                         | 9.1.0          | 9.2.0          |
| 12-2009            | RP-46          | RP-091263              | 436             | CR RI reporting configuration in PUCCH 1-1 test  | 9.1.0          | 9.2.0          |
| 12-2009            | RP-46          | RP-091261              | 438             | Addition of R.11-1 TDD references  | 9.1.0          | 9.2.0          |
| 12-2009            | RP-46          | RP-091292              | 439             | Performance requirements for LTE MBMS  | 9.1.0          | 9.2.0          |
| 12-2009            | RP-46<br>RP-46 | RP-091262              | 442R1<br>444R1  | In Band Emissions Requirements Correction CR<br>PCMAX definition   | 9.1.0<br>9.1.0 | 9.2.0          |
| 12-2009<br>03-2010 | RP-46<br>RP-47 | RP-091262<br>RP-100246 | 444R 1<br>453r1 | Corrections of various errors in the UE RF requirements  | 9.1.0          | 9.2.0<br>9.3.0 |
| 03-2010            | RP-47          | RP-100240              | 462r1           | UTRA ACLR measurement bandwidths for 1.4 and 3 MHz   | 9.2.0          | 9.3.0          |
| 03-2010            | RP-47          | RP-100246              | 493             | Band 8 Coexistence Requirement Table Correction  | 9.2.0          | 9.3.0          |
| 03-2010            | RP-47          | RP-100246              | 489r1           | Rel 9 CR for Band 14   | 9.2.0          | 9.3.0          |
| 03-2010            | RP-47          | RP-100246              | 485r1           | CR Band 1- PHS coexistence   | 9.2.0          | 9.3.0          |
| 03-2010            | RP-47          | RP-100247              | 501             | Fading CQI requirements for FDD mode   | 9.2.0          | 9.3.0          |
| 03-2010            | RP-47          | RP-100247              | 499             | CR correction to RI test   | 9.2.0          | 9.3.0          |
| 03-2010            | RP-47          | RP-100249              | 451             | Reporting mode, Reporting Interval and Editorial corrections for<br>demodulation                                 | 9.2.0          | 9.3.0          |
| 03-2010            | RP-47          | RP-100249              | 464r1           | Corrections to 1PRB PDSCH performance test in presence of<br>MBSFN.  | 9.2.0          | 9.3.0          |
| 03-2010            | RP-47          | RP-100249              | 458r1           | OCNG corrections   | 9.2.0          | 9.3.0          |
| 03-2010            | RP-47          | RP-100249              | 467             | Addition of ONCG configuration in DRS performance test   | 9.2.0          | 9.3.0          |
| 03-2010            | RP-47          | RP-100249              | 465r1           | PDSCH performance tests for low UE categories  | 9.2.0          | 9.3.0          |
| 03-2010            | RP-47          | RP-100250              | 460r1<br>491r1  | Use of OCNG in CSI tests<br>Corrections to CQI test configurations   | 9.2.0<br>9.2.0 | 9.3.0          |
| 03-2010            | RP-47<br>RP-47 | RP-100250<br>RP-100250 | 49111<br>469r1  | Corrections of some CSI test parameters  | 9.2.0          | 9.3.0<br>9.3.0 |
| 03-2010            | RP-47          | RP-100251              | 456r1           | TBS correction for RMC UL TDD 16QAM full allocation BW 1.4<br>MHz  | 9.2.0          | 9.3.0          |
| 03-2010            | RP-47          | RP-100262              | 449             | Editorial corrections on Band 19 REFSENS   | 9.2.0          | 9.3.0          |
| 03-2010            | RP-47          | RP-100263              | 470r1           | Band 20 UE RF requirements   | 9.2.0          | 9.3.0          |
| 03-2010            | RP-47          | RP-100264              | 446r1           | A-MPR for Band 21  | 9.2.0          | 9.3.0          |
| 03-2010            | RP-47          | RP-100264              | 448             | RF requirements for UE in later releases   | 9.2.0          | 9.3.0          |
| 03-2010            | RP-47          | RP-100268              | 445             | 36.101 CR: Editorial corrections on LTE MBMS reference<br>measurement channels                                   | 9.2.0          | 9.3.0          |
| 03-2010            | RP-47          | RP-100268              | 454             | The definition of the Doppler shift for LTE MBSFN Channel<br>Model   | 9.2.0          | 9.3.0          |
| 03-2010            | RP-47          | RP-100239              | 478r3           | Modification of the spectral flatness requirement and some editorial corrections                                 | 9.2.0          | 9.3.0          |
| 06-2010            | RP-48          | RP-100619              | 559             | Corrections of tables for Additional Spectrum Emission Mask  | 9.3.0          | 9.4.0          |
| 06-2010            | RP-48          | RP-100619              | 538             | Correction of transient time definition for EVM requirements   | 9.3.0          | 9.4.0          |
| 06-2010            | RP-48          | RP-100619              | 557r2           | CR on UE coexistence requirement<br>Correction of antenna configuration and beam-forming model for               | 9.3.0          | 9.4.0          |
|                    | RP-48          | RP-100619              | 547r1           | DRS<br>CR: Corrections on MIMO demodulation performance  | 9.3.0          | 9.4.0          |
| 06-2010            | RP-48          | RP-100619              | 536r1           | requirements   | 9.3.0          | 9.4.0          |
| 06-2010            | RP-48          | RP-100619              | 528r1           | Corrections on the definition of PCMAX   | 9.3.0          | 9.4.0          |
| 06-2010            | RP-48          | RP-100619              | 568             | Relaxation of the PDSCH demodulation requirements due to<br>control channel errors                               | 9.3.0          | 9.4.0          |
| 06-2010            | RP-48          | RP-100619              | 566             | Correction of the UE output power definition for RX tests  | 9.3.0          | 9.4.0          |
| 06-2010            | RP-48          | RP-100620              | 505r1           | Fading CQI requirements for TDD mode   | 9.3.0          | 9.4.0          |
| 06-2010            | RP-48          | RP-100620              | 521             | Correction to FRC for CQI index 0  | 9.3.0          | 9.4.0          |
| 06-2010            | RP-48          | RP-100620              | 516r1           | Correction to CQI test configuration   | 9.3.0          | 9.4.0          |
| 06-2010            | RP-48          | RP-100620              | 532             | Correction of CQI and PMI delay configuration description for TDD  | 9.3.0          | 9.4.0          |
| 06-2010            | RP-48          | RP-100620              | 574             | Correction to FDD and TDD CSI test configurations  | 9.3.0          | 9.4.0          |
| 06-2010            | RP-48          | RP-100620              | 571             | Minimum requirements for Rank indicator reporting  | 9.3.0          | 9.4.0          |
| 06-2010            | RP-48          | RP-100628              | 563             | LTE MBMS performance requirements (FDD)  | 9.3.0          | 9.4.0          |
| 06-2010            | RP-48          | RP-100628              | 564             | LTE MBMS performance requirements (TDD)  | 9.3.0          | 9.4.0          |
| 06-2010            | RP-48          | RP-100629              | 553r2           | Performance requirements for dual-layer beamforming  | 9.3.0          | 9.4.0          |
| 06-2010<br>06-2010 | RP-48<br>RP-48 | RP-100630<br>RP-100630 | 524r2<br>519    | CR: low Category CSI requirement<br>Correction of FRC reference and test case numbering                          | 9.3.0<br>9.3.0 | 9.4.0<br>9.4.0 |
| 06-2010            | 117-40         | NF-100030              | 018             | Correction of FRC reference and test case numbering<br>Correction of carrier frequency and EARFCN of Band 21 for |                |                |
| 06-2010            | RP-48          | RP-100630              | 526             | TS36.101<br>Addition of PDSCH TDD DRS demodulation tests for Low UE  | 9.3.0          | 9.4.0          |
| 06-2010            | RP-48          | RP-100630              | 508r1           | categories<br>Specification of minimum performance requirements for low UE                                       | 9.3.0          | 9.4.0          |
| 06-2010            | RP-48          | RP-100630              | 539             | category   | 9.3.0          | 9.4.0          |
| 1 116 20110        | RP-48          | RP-100630              | 569             | Addition of minimum performance requirements for low UE  | 9.3.0          | 9.4.0          |

|                               |                |                        |              | category TDD CRS single-antenna port tests  |                  |                  |
|-------------------------------|----------------|------------------------|--------------|---|------------------|------------------|
| 06-2010                       |                |                        |              | Introduction of sustained downlink data-rate performance  | 9.3.0            | 9.4.0            |
|                               | RP-48          | RP-100631              | 549r3        | requirements  |                  |                  |
| 06-2010                       | RP-48          | RP-100683              | 530r1        | Band 20 Rx requirements   | 9.3.0            | 9.4.0            |
| 09-2010                       | RP-49          | RP-100920              | 614r2        | Add OCNG to MBMS requirements   | 9.4.0            | 9.5.0            |
| 09-2010                       | RP-49          | RP-100916              | 599          | Correction of PDCCH content for PHICH test  | 9.4.0            | 9.5.0            |
| 09-2010                       | RP-49          | RP-100920              | 597r1        | Beamforming model for transmission on antenna port 7/8  | 9.4.0            | 9.5.0            |
| 09-2010                       | RP-49          | RP-100920              | 600r1        | Correction of full correlation in frequency-selective CQI test  | 9.4.0            | 9.5.0            |
| 09-2010                       |                | DD 400000              | CO1          | Correction on single-antenna transmission fixed reference   | 0.4.0            | 0.5.0            |
|                               | RP-49          | RP-100920              | 601          | channel<br>Reference sensitivity requirements for the 1.4 and 3 MHz   | 9.4.0            | 9.5.0            |
| 09-2010                       | RP-49          | RP-100914              | 605          | bandwidths  | 9.4.0            | 9.5.0            |
| 09-2010                       | RP-49          | RP-100914<br>RP-100920 | 608r1        | CR for DL sustained data rate test  | 9.4.0            | 9.5.0            |
| 09-2010                       | NF -49         | KF-100920              | 00011        | Correction of references in section 10 (MBMS performance  | 9.4.0            | 9.3.0            |
| 03-2010                       | RP-49          | RP-100919              | 611          | requirements)   | 9.4.0            | 9.5.0            |
| 09-2010                       | RP-49          | RP-100914              | 613          | Band 13 and Band 14 spurious emission corrections   | 9.4.0            | 9.5.0            |
| 09-2010                       | RP-49          | RP-100919              | 617r1        | Rx Requirements   | 9.4.0            | 9.5.0            |
| 09-2010                       | RP-49          | RP-100926              | 576r1        | Clarification on DL-BF simulation assumptions   | 9.4.0            | 9.5.0            |
| 09-2010                       | RP-49          | RP-100920              | 582r1        | Introduction of additional Rel-9 scenarios  | 9.4.0            | 9.5.0            |
| 09-2010                       | RP-49          | RP-100925              | 575r1        | Correction to band 20 ue to ue Co-existence table   | 9.4.0            | 9.5.0            |
| 09-2010                       | RP-49          | RP-100916              | 581r1        | Test configuration corrections to CQI reporting in AWGN   | 9.4.0            | 9.5.0            |
| 09-2010                       | RP-49          | RP-100916              | 595          | Corrections to RF OCNG Pattern OP.1 and 2   | 9.4.0            | 9.5.0            |
| 09-2010                       | RP-49          | RP-100919              | 583          | Editorial corrections of 36.101   | 9.4.0            | 9.5.0            |
| 09-2010                       |                |                        |              | Addition of minimum performance requirements for low UE   |                  | T                |
|                               | RP-49          | RP-100920              | 586          | category TDD tests  | 9.4.0            | 9.5.0            |
| 09-2010                       | RP-49          | RP-100914              | 590r1        | Downlink power for receiver tests   | 9.4.0            | 9.5.0            |
| 09-2010                       | RP-49          | RP-100920              | 591          | OCNG use and power in beamforming tests   | 9.4.0            | 9.5.0            |
| 09-2010                       | RP-49          | RP-100916              | 593          | Throughput for multi-datastreams transmissions  | 9.4.0            | 9.5.0            |
| 09-2010                       | RP-49          | RP-100914              | 588          | Missing note in Additional spurious emission test with NS_07  | 9.4.0            | 9.5.0            |
| 09-2010                       | RP-49          | RP-100927              | 596r2        | CR LTE_TDD_2600_US spectrum band definition additions to TS 36.101  | 9.5.0            | 10.0.0           |
| 12-2010                       | RP-50          | RP-101309              | 680          | Demodulation performance requirements for dual-layer  | 10.0.0           | 10.1.0           |
| 12-2010                       | RP-50          | RP-101325              | 672          | beamforming<br>Correction on the statement of TB size and subband selection in  | 10.0.0           | 10.1.0           |
|                               |                |                        |              | CSI tests   |                  |                  |
| 12-2010                       | RP-50          | RP-101327              | 652          | Correction to Band 12 frequency range   | 10.0.0           | 10.1.0           |
| 12-2010                       | RP-50          | RP-101329              | 630          | Removal of [] from TDD Rank Indicator requirements  | 10.0.0           | 10.1.0           |
| 12-2010                       | RP-50          | RP-101329              | 635r1        | Test configuration corrections to CQI TDD reporting in AWGN   | 10.0.0           | 10.1.0           |
| 40.0040                       | <b>DD</b> 50   | <b>DD</b> 404000       | 0.45         | (Rel-10)  | 10.0.0           | 10.1.0           |
| 12-2010                       | RP-50          | RP-101330              | 645          | EVM window length for PRACH   | 10.0.0           | 10.1.0           |
| 12-2010                       | RP-50          | RP-101330<br>RP-101330 | 649<br>642r1 | Removal of NS signalling from TDD REFSENS tests   | 10.0.0           | 10.1.0           |
| 12-2010                       | RP-50          | RP-101330              | 642r1        | Correction of Note 4 In Table 7.3.1-1: Reference sensitivity<br>QPSK PREFSENS   | 10.0.0           | 10.1.0           |
| 12-2010                       | RP-50          | RP-101341              | 627          | Add 20 RB UL Ref Meas channel   | 10.0.0           | 10.1.0           |
| 12-2010                       | RP-50          | RP-101341              | 654r1        | Additional in-band blocking requirement for Band 12   | 10.0.0           | 10.1.0           |
| 12-2010                       | RP-50          | RP-101341              | 678          | Further clarifications for the Sustained Downlink Data Rate Test  | 10.0.0           | 10.1.0           |
| 12-2010                       | RP-50          | RP-101341              | 673r1        | Correction on MBMS performance requirements   | 10.0.0           | 10.1.0           |
| 12-2010                       | RP-50          | RP-101349              | 667r3        | CR Removing brackets of Band 41 reference sensitivity to TS 36.101  | 10.0.0           | 10.1.0           |
| 12-2010                       | RP-50          | RP-101356              | 666r2        | Band 42 and 43 parameters for UMTS/LTE 3500 (TDD) for TS  | 10.0.0           | 10.1.0           |
|                               |                |                        |              | 36.101  |                  |                  |
| 12-2010                       | RP-50          | RP-101359              | 646r1        | CR for CA, UL-MIMO, eDL-MIMO, CPE   | 10.0.0           | 10.1.0           |
| 12-2010                       | RP-50          | RP-101361              | 620r1        | Introduction of L-band in TS 36.101   | 10.0.0           | 10.1.0           |
| 12-2010                       | RP-50          | RP-101379              | 670r1        | Correction on the PMI reporting in Multi-Laye Spatial<br>Multiplexing performance test  | 10.0.0           | 10.1.0           |
| 12-2010                       | RP-50          | RP-101380              | 679r1        | Adding antenna configuration in CQI fading test case  | 10.0.0           | 10.1.0           |
| 01-2011                       | 14 00          | 14 101000              | 01011        | Clause numbering correction   | 10.1.0           | 10.1.1           |
| 03-2011                       | RP-51          | RP-110359              | 695          | Removal of E-UTRA ACLR for CA   | 10.1.1           | 10.2.0           |
| 03-2011                       | RP-51          | RP-110338              | 699          | PDCCH and PHICH performance: OCNG and power settings  | 10.1.1           | 10.2.0           |
| 03-2011                       | RP-51          | RP-110336              | 706r1        | Spurious emissions measurement uncertainty  | 10.1.1           | 10.2.0           |
| 03-2011                       | RP-51          | RP-110352              | 707r1        | REFSENSE in lower SNR   | 10.1.1           | 10.2.0           |
| 03-2011                       | RP-51          | RP-110338              | 710          | PMI performance: Power settings and precoding granularity   | 10.1.1           | 10.2.0           |
| 03-2011                       | RP-51          | RP-110359              | 715r2        | Definition of configured transmitted power for Rel-10   | 10.1.1           | 10.2.0           |
| 03-2011                       | RP-51          | RP-110359              | 717          | Introduction of requirement for adjacent intraband CA image rejection   | 10.1.1           | 10.2.0           |
| 03-2011                       | RP-51          | RP-110343              | 719          | Minimum requirements for the additional Rel-9 scenarios   | 10.1.1           | 10.2.0           |
| 03-2011                       | RP-51          | RP-110343              | 723          | Corrections to power settings for Single layer beamforming with   | 10.1.1           | 10.2.0           |
| 03-2011                       |                | RP-110343              | 726r1        | simultaneous transmission<br>Correction to the PUSCH3-0 subband tests for Rel-10  | 10.1.1           | 10.2.0           |
| 03-2011                       | RP-51<br>RP-51 | RP-110343<br>RP-110338 | 72611        | Removing the square bracket for TS36.101  | 10.1.1           | 10.2.0           |
| 03-2011                       | RP-51<br>RP-51 | RP-110338<br>RP-110349 | 730          | Removal of square brackets for dual-layer beamforming   | 10.1.1           | 10.2.0           |
| 03,2011                       |                | 1 111 - 110349         | 159          |   | 10.1.1           | 10.2.0           |
| 03-2011                       |                |                        |              | demodulation performance requirements   |                  |                  |
| 03-2011<br>03-2011<br>03-2011 | RP-51<br>RP-51 | RP-110359<br>RP-110349 | 751<br>754r2 | demodulation performance requirements<br>CR: Maximum input level for intra band CA<br>UE category coverage for dual-layer beamforming | 10.1.1<br>10.1.1 | 10.2.0<br>10.2.0 |

| 03-2011            | RP-51          | RP-110343              | 756r1          | Further clarifications for the Sustained Downlink Data Rate Test                             | 10.1.1           | 10.2.0           |
|--------------------|----------------|------------------------|----------------|--|------------------|------------------|
| 03-2011            | RP-51          | RP-110343              | 759            | Removal of square brackets in sustained data rate tests                                      | 10.1.1           | 10.2.0           |
| 03-2011            | RP-51          | RP-110337              | 762r1          | Clarification to LTE relative power tolerance table  | 10.1.1           | 10.2.0           |
| 03-2011            | RP-51          | RP-110343              | 764            | Introducing UE-selected subband CQI tests  | 10.1.1           | 10.2.0           |
| 03-2011            | RP-51          | RP-110343              | 765            | Verification framework for PUSCH 2-2 and PUCCH 2-1 reporting                                 | 10.1.1           | 10.2.0           |
| 04-2011            |                |                        |                | Editorial: Spec Title correction, removal of "Draft"   | 10.2.0           | 10.2.1           |
| 06-2011            | RP-52          | RP-110804              | 766            | Add Expanded 1900MHz Band (Band 25) in 36.101  | 10.2.1           | 10.3.0           |
| 06-2011            | RP-52          | RP-110795              | 768            | Fixing Band 24 inclusion in TS 36.101  | 10.2.1           | 10.3.0           |
| 06-2011            | RP-52          | RP-110788              | 772            | CR: Corrections for UE to UE co-existence requirements of Band                               | 10.2.1           | 10.3.0           |
| 06-2011            | RP-52          | RP-110812              | 774            | Add 2GHz S-Band (Band 23) in 36.101  | 10.2.1           | 10.3.0           |
| 06-2011            | RP-52          | RP-110789              | 782            | CR: Band 19 A-MPR refinement   | 10.2.1           | 10.3.0           |
| 06-2011            | RP-52          | RP-110796              | 787            | REFSENS in lower SNR   | 10.2.1           | 10.3.0           |
| 06-2011            | RP-52          | RP-110789              | 805            | Clarification for MBMS reference signal levels   | 10.2.1           | 10.3.0           |
| 06-2011            | RP-52          | RP-110792              | 810            | FDD MBMS performance requirements for 64QAM mode   | 10.2.1           | 10.3.0           |
| 06-2011            | RP-52          | RP-110787              | 814            | Correction on CQI mapping index of RI test   | 10.2.1           | 10.3.0           |
| 06-2011            | RP-52          | RP-110789              | 824            | Corrections to in-band blocking table  | 10.2.1           | 10.3.0           |
| 06-2011            | RP-52          | RP-110794              | 826            | Correction of TDD Category 1 DRS and DMRS RMCs   | 10.2.1           | 10.3.0           |
| 06-2011            | RP-52          | RP-110794              | 828            | TDD MBMS performance requirements for 64QAM mode   | 10.2.1           | 10.3.0           |
| 06-2011            | RP-52          | RP-110796              | 829            | Correction of TDD RMC for Low SNR Demodulation test  | 10.2.1           | 10.3.0           |
| 06-2011            | RP-52          | RP-110796              | 830            | Informative reference sensitivity requirements for Low SNR for TDD                           | 10.2.1           | 10.3.0           |
| 06-2011            | RP-52          | RP-110787              | 778r1          | Minor corrections to DL-RMC-s for Maximum input level  | 10.2.1           | 10.3.0           |
| 06-2011            | RP-52          | RP-110789              | 832            | PDCCH and PHICH performance: OCNG and power settings   | 10.2.1           | 10.3.0           |
| 06-2011            | RP-52          | RP-110789              | 818r1          | Correction on 2-X PMI test for R10   | 10.2.1           | 10.3.0           |
| 06-2011            | RP-52          | RP-110791              | 816r1          | Addition of performance requirements for dual-layer<br>beamforming category 1 UE test        | 10.2.1           | 10.3.0           |
| 06-2011            | RP-52          | RP-110789              | 834            | Performance requirements for PUCCH 2-0, PUCCH 2-1 and  | 10.2.1           | 10.3.0           |
| 00.0011            |                |                        | 005-4          | PUSCH 2-2 tests  | 10.0.1           | 40.0.0           |
| 06-2011            | RP-52          | RP-110807              | 835r1          | CR for UL MIMO and CA  | 10.2.1           | 10.3.0           |
| 09-2011            | RP-53          | RP-111248              | 862r1          | Removal of unnecessary channel bandwidths from REFSENS tables                                | 10.3.0           | 10.4.0           |
| 09-2011            | RP-53          | RP-111248              | 869r1          | Clarification on BS precoding information field for RI FDD and<br>PUCCH 2-1 PMI tests        | 10.3.0           | 10.4.0           |
| 09-2011            | RP-53          | RP-111248              | 872r1          | CR for B14Rx requirement Rrel 10   | 10.3.0           | 10.4.0           |
| 09-2011            | RP-53          | RP-111248              | 890r1          | CR to TS36.101: Correction on the accuracy test of CQI.                                      | 10.3.0           | 10.4.0           |
| 09-2011            | RP-53          | RP-111248              | 893            | CR to TS36.101: Correction on CQI mapping index of TDD RI test                               | 10.3.0           | 10.4.0           |
| 09-2011            | RP-53          | RP-111248              | 904            | Correction of code block numbers for some RMCs   | 10.3.0           | 10.4.0           |
| 09-2011            | RP-53          | RP-111248              | 907            | Correction to UL RMC for FDD and TDD   | 10.3.0           | 10.4.0           |
| 09-2011            | RP-53          | RP-111248              | 914r1          | Adding codebook subset restriction for single layer closed-loop spatial multiplexing test    | 10.3.0           | 10.4.0           |
| 09-2011            | RP-53          | RP-111251              | 883            | Sustained data rate: Correction of the ACK/NACK feedback                                     | 10.3.0           | 10.4.0           |
| 09-2011            | RP-53          | RP-111251              | 929            | mode   | 10.3.0           | 10.4.0           |
| 09-2011            | RP-53          | RP-111251<br>RP-111251 | 929<br>938     | 36.101 CR on MBSFN FDD requirements(R10)<br>TDD MBMS performance requirements for 64QAM mode | 10.3.0           | 10.4.0           |
| 09-2011            | RP-53          | RP-111251              | 895            | Further clarification for the dual-layer beamforming demodulation                            | 10.3.0           | 10.4.0           |
|                    |                |                        |                | requirements   |                  |                  |
| 09-2011            | RP-53          | RP-111255              | 908r1          | Introduction of Band 22  | 10.3.0           | 10.4.0           |
| 09-2011            | RP-53          | RP-111255              | 939            | Modifications of Band 42 and 43  | 10.3.0           | 10.4.0           |
| 09-2011            | RP-53          | RP-111260              | 944            | CR for TS 36.101 Annex B: Static channels for CQI tests                                      | 10.3.0           | 10.4.0           |
| 09-2011            | RP-53          | RP-111262              | 878r1          | Correction of CSI reference channel subframe description                                     | 10.3.0           | 10.4.0           |
| 09-2011<br>09-2011 | RP-53<br>RP-53 | RP-111262<br>RP-111262 | 887<br>926r1   | Correction to UL MIMO<br>Power control accuracy for intra-band carrier aggregation           | 10.3.0<br>10.3.0 | 10.4.0<br>10.4.0 |
| 09-2011            | RP-53<br>RP-53 | RP-111262<br>RP-111262 | 926F1<br>927r1 | In-band emissions requirements for intra-band carrier  | 10.3.0           | 10.4.0           |
| 00 2011            | DD 50          | DD 111060              | 020+1          | aggregation<br>Adding the operating band for UL-MIMO   | 10.2.0           | 10.4.0           |
| 09-2011<br>09-2011 | RP-53<br>RP-53 | RP-111262<br>RP-111265 | 930r1<br>848   | Corrections to intra-band contiguous CA RX requirements                                      | 10.3.0<br>10.3.0 | 10.4.0           |
| 09-2011            | RP-53<br>RP-53 | RP-111265<br>RP-111265 | 863            | Intra-band contiguos CA MPR requirement refinement   | 10.3.0           | 10.4.0           |
| 09-2011            | RP-53          | RP-111265              | 866r1          | Intra-band contiguous CA KIP K requirement remement  | 10.3.0           | 10.4.0           |
| 09-2011            | RP-53          | RP-111266              | 935            | Introduction of the downlink CA demodulation requirements                                    | 10.3.0           | 10.4.0           |
| 09-2011            | RP-53          | RP-111266              | 936r1          | Introduction of CA UE demodulation requirements for TDD                                      | 10.3.0           | 10.4.0           |
| 12-2011            | RP-54          |                        |                | Corrections of UE categories of Rel-10 reference channels for                                | 10.4.0           | 10.5.0           |
| 12-2011            | RP-54          | RP-111684              | 947            | RF requirements<br>Alternative way to define channel bandwidths per operating band           | 10.4.0           | 10.5.0           |
|                    |                | RP-111684              | 948            | for  |                  |                  |
| 12-2011            | RP-54          | RP-111686              | 949            | CR for TS36.101: Adding note to the function of MPR  | 10.4.0           | 10.5.0           |
| 12-2011            | RP-54          | RP-111680              | 950            | Clarification on applying CSI reports during rank switching in RI<br>FDD test - Rel-10       | 10.4.0           | 10.5.0           |
| 12-2011            | RP-54          | RP-111734              | 953r1          | Corrections for Band 42 and 43 introduction  | 10.4.0           | 10.5.0           |
| 12-2011            | RP-54          | RP-111680              | 956            | UE spurious emissions  | 10.4.0           | 10.5.0           |
| 12-2011            | RP-54          | RP-111682              | 959            | Add scrambling identity n_SCID for MU-MIMO test  | 10.4.0           | 10.5.0           |
| 40.0044            | RP-54          | RP-111690              | 960r1          | P-MPR definition   | 10.4.0           | 10.5.0           |
| 12-2011<br>12-2011 | RP-54          | RP-111693              | 962            | Pcmax,c Computation Assumptions  | 10.4.0           | 10.5.0           |

| 12-2011            | RP-54          |                        |                  | Correction of frequency range for spurious emission  | 10.4.0           | 10.5.0           |
|--------------------|----------------|------------------------|------------------|--|------------------|------------------|
| 12 2011            |                | RP-111733              | 963r1            | requirements   | 10.4.0           | 10.0.0           |
| 12-2011            | RP-54          | RP-111680              | 966              | General review of the reference measurement channels   | 10.4.0           | 10.5.0           |
| 12-2011            | RP-54          | RP-111691              | 945              | Corrections of Rel-10 demodulation performance requirements<br>This CR is only partially implemented due to confliction with CR<br>966       | 10.4.0           | 10.5.0           |
| 12-2011            | RP-54          | RP-111684              | 946              | Corrections of UE categories for Rel-10 CSI requirements<br>This CR is only partially implemented due to confliction with CR<br>966          | 10.4.0           | 10.5.0           |
| 12-2011            | RP-54          | RP-111691              | 982r2            | Introduction of SDR TDD test scenario for CA UE demodulation<br>This CR is only partially implemented due to confliction with CR<br>966      | 10.4.0           | 10.5.0           |
| 12-2011            | RP-54          | RP-111693              | 971r1            | CR on Colliding CRS for non-MBSFN ABS  | 10.4.0           | 10.5.0           |
| 12-2011            | RP-54          | RP-111693              | 972r1            | Introduction of eICIC demodulation performance requirements<br>for FDD and TDD   | 10.4.0           | 10.5.0           |
| 12-2011            | RP-54          | RP-111686              | 985              | Adding missing UL configuration specification in some UE receiver requirements for case of 1 CC UL capable UE                                | 10.4.0           | 10.5.0           |
| 12-2011            | RP-54          | RP-111684              | 998              | Correction and maintenance on CQI and PMI requirements (Rel-<br>10)  | 10.4.0           | 10.5.0           |
| 12-2011            | RP-54          | RP-111735              | 1004             | MPR for CA Multi-cluster   | 10.4.0           | 10.5.0           |
| 12-2011            | RP-54          | RP-111691              | 1005             | CA demodulation performance requirements for LTE FDD   | 10.4.0           | 10.5.0           |
| 12-2011            | RP-54          | RP-111692              | 1006             | CQI reporting accuracy test on frequency non-selective<br>scheduling on eDL MIMO   | 10.4.0           | 10.5.0           |
| 12-2011            | RP-54          | RP-111692              | 1007             | CQI reporting accuracy test on frequency-selective scheduling<br>on eDL MIMO   | 10.4.0           | 10.5.0           |
| 12-2011            | RP-54          | RP-111692              | 1008             | PMI reporting accuracy test for TDD on eDL MIMO  | 10.4.0           | 10.5.0           |
| 12-2011            | RP-54          | RP-111692              | 1009r1           | CR for TS 36.101: RI performance requirements  | 10.4.0           | 10.5.0           |
| 12-2011            | RP-54          | RP-111692              | 1010r1           | CR for TS 36.101: Introduction of static CQI tests (Rel-10)  | 10.4.0           | 10.5.0           |
| 03-2012            | RP-55          | RP-120291              | 1014             | RF: Updates and corrections to the RMC-s related annexes (Rel-<br>10)  | 10.5.0           | 10.6.0           |
| 03-2012            | RP-55          | RP-120300              | 1015r1           | On elCIC ABS pattern   | 10.5.0           | 10.6.0           |
| 03-2012            | RP-55          | RP-120300              | 1016r1           | On elCIC interference models   | 10.5.0           | 10.6.0           |
| 03-2012            | RP-55          | RP-120299              | 1017r1           | TS36.101 CR: on eDL-MIMO channel model using cross-<br>polarized antennas  | 10.5.0           | 10.6.0           |
| 03-2012            | RP-55          | RP-120304              | 1020r1           | TS36.101 CR: Correction to MBMS Performance Test<br>Parameters   | 10.5.0           | 10.6.0           |
| 03-2012            | RP-55          | RP-120303              | 1021             | Harmonic exceptions in LTE UE to UE co-ex tests  | 10.5.0           | 10.6.0           |
| 03-2012<br>03-2012 | RP-55<br>RP-55 | RP-120304<br>RP-120300 | 1023<br>1033r1   | Unified titles for Rel-10 CSI tests<br>Introduction of reference channel for eICIC demodulation  | 10.5.0<br>10.5.0 | 10.6.0<br>10.6.0 |
| 03-2012            | RP-55          | RP-120304              | 103311<br>1040r1 | Correction of Actual code rate for CSI RMCs  | 10.5.0           | 10.6.0           |
| 03-2012            | RP-55          | RP-120304              | 1040r1           | Definition of synchronized operation   | 10.5.0           | 10.6.0           |
| 03-2012            | RP-55          | RP-120296              | 1048r1           | Intra band contiguos CA Ue to Ue Co-ex   | 10.5.0           | 10.6.0           |
| 03-2012            | RP-55          | RP-120296              | 1049r1           | REL-10 CA specification editorial consistency  | 10.5.0           | 10.6.0           |
| 03-2012            | RP-55          | RP-120299              | 1053             | Beamforming model for TM9  | 10.5.0           | 10.6.0           |
| 03-2012            | RP-55          | RP-120296              | 1054             | Requirement for CA demodulation with power imbalance   | 10.5.0           | 10.6.0           |
| 03-2012            | RP-55          | RP-120298              | 1057             | Updating Band 23 duplex specifications   | 10.5.0           | 10.6.0           |
| 03-2012            | RP-55          | RP-120298              | 1058r1           | Correcting UE Coexistence Requirements for Band 23   | 10.5.0           | 10.6.0           |
| 03-2012            | RP-55          | RP-120304              | 1059r1           | CA demodulation performance requirements for LTE TDD   | 10.5.0           | 10.6.0           |
| 03-2012            | RP-55          | RP-120304              | 1061             | Requirement for CA SDR FDD test scenario   | 10.5.0           | 10.6.0           |
| 03-2012            | RP-55          | RP-120293              | 1064r1           | TS36.101 RF editorial corrections Rel 10   | 10.5.0           | 10.6.0           |
| 03-2012<br>03-2012 | RP-55<br>RP-55 | RP-120299<br>RP-120304 | 1067r1<br>1071r1 | Introduction of TM9 demodulation performance requirements<br>Introduction of a CA demodulation test for UE soft buffer<br>management testing | 10.5.0<br>10.5.0 | 10.6.0<br>10.6.0 |
| 03-2012            | RP-55          | RP-120296              | 1072             | MPR formula correction For intra-band contiguous CA<br>Bandwidth Class C   | 10.5.0           | 10.6.0           |
| 03-2012            | RP-55          | RP-120303              | 1077r1           | CR for 36.101: B41 REFSENS and MOP changes to accommodate single filter architecture   | 10.5.0           | 10.6.0           |
| 03-2012            | RP-55          | RP-120300              | 1082             | TM3 tests for elCIC  | 10.5.0           | 10.6.0           |
| 03-2012            | RP-55          | RP-120300              | 1083r1           | Introduction of requirements of CQI reporting definition for ecICIC  | 10.5.0           | 10.6.0           |
| 03-2012            | RP-55          | RP-120304              | 1084             | eDL MIMO CSI requirements  | 10.5.0           | 10.6.0           |
| 03-2012            | RP-55          | RP-120306              | 1070r1           | Introduction of Band 26/XXVI to TS 36.101  | 10.6.0           | 11.0.0           |
| 03-2012            | RP-55          | RP-120310              | 1074             | Band 41 CA CR for TS36.101, section 5  | 10.6.0           | 11.0.0           |
| 03-2012            | RP-55          | RP-120310              | 1075r1           | Band 41 CA CR for TS36.101, section 6  | 10.6.0           | 11.0.0           |
| 03-2012            | RP-55          | RP-120310              | 1076             | Band 41 CA CR for TS36.101, section 7  | 10.6.0           | 11.0.0           |
| 06-2012            | RP-56          | RP-120795              | 1085r2           | Modulator specification tightening   | 11.0.0           | 11.1.0           |
| 06-2012            | RP-56          | RP-120777              | 1087r1           | Carrier aggregation Relative power tolerance, removal of TBD.  | 11.0.0           | 11.1.0           |
| 06-2012            | RP-56          | RP-120783              | 1089             | UE spurious emissions for Band 7 and Band 38 coexistence   | 11.0.0           | 11.1.0           |
| 06-2012            | RP-56          | RP-120780              | 1092             | Deleting square brackets in Reference Measurement Channels<br>CR to TS36.101: Correction on parameters for the eDL-MIMO                      | 11.0.0           | 11.1.0           |
| 06-2012            | RP-56          | RP-120779              | 1097             | CQI and PMI tests<br>CR to TS36.101: Fixed reference channel for PDSCH   | 11.0.0           | 11.1.0           |
| 06-2012            | RP-56          | RP-120780              | 1098r1           | demodulation performance requirements on eDL-MIMO – NOT<br>implemented as it is based on a wrong version of the spec                         | 11.0.0           | 11.1.0           |

| 06-2012            | RP-56          | RP-120774              | 1107           | RMC correction on eDL-MIMO RI test  | 11.0.0           | 11.1.0           |
|--------------------|----------------|------------------------|----------------|---|------------------|------------------|
| 06-2012            | RP-56          | RP-120774<br>RP-120774 | 1107<br>1108r1 | FRC correction on frequency selective CQI and PMI test (Rel-  | 11.0.0           | 11.1.0           |
| 00 2012            | 111 50         | 111120114              | 110011         |   | 11.0.0           | 11.1.0           |
| 06-2012            | RP-56          | RP-120774              | 1111           | Correction on test point for PMI test (Rel-11)  | 11.0.0           | 11.1.0           |
| 06-2012            | RP-56          | RP-120784              | 1114r1         | Corrections and clarifications on eICIC demodulation test   | 11.0.0           | 11.1.0           |
| 06-2012            | RP-56          | RP-120784              | 1117r1         | Corrections and clarifications on eICIC CSI tests   | 11.0.0           | 11.1.0           |
| 06-2012            | RP-56          | RP-120783              | 1119r1         | Corrections on UE performance requirements  | 11.0.0           | 11.1.0           |
| 06-2012            | RP-56          | RP-120773              | 1120           | Introduction of CA band combination Band1 + Band19 to TS  | 11.0.0           | 11.1.0           |
| 06-2012            | RP-56          | RP-120769              | 1127           | 36.101<br>Addition of ETU30 channel model   | 11.0.0           | 11.1.0           |
| 06-2012            | RP-56          | RP-120709              | 1127           | Addition of Maximum Throughput for R.30-1 TDD RMC   | 11.0.0           | 11.1.0           |
| 06-2012            | RP-56          | RP-120779              | 1140           | CR for 36.101: The clarification of MPR and A-MPR for CA  | 11.0.0           | 11.1.0           |
| 06-2012            | RP-56          | RP-120784              | 1142           | Corrections for eICIC demod test case with MBSN ABS   | 11.0.0           | 11.1.0           |
| 06-2012            | RP-56          | RP-120785              | 1144           | Removing brackets of contiguous allocation A-MPR for  | 11.0.0           | 11.1.0           |
|                    |                |                        |                | CA_NS_04  |                  |                  |
| 06-2012            | RP-56          | RP-120784              | 1149r1         | Introduction of PDCCH test with colliding RS on MBSFN-ABS   | 11.0.0           | 11.1.0           |
| 06-2012            | RP-56          | RP-120784              | 1153r1         | Some clarifications and OCNG pattern for eICIC demodulation   | 11.0.0           | 11.1.0           |
| 06-2012            |                | RP-120773              | 1155           | requirements Introduction of TDD CA Soft Buffer Limitation  | 11.0.0           | 11 1 0           |
| 06-2012            | RP-56<br>RP-56 | RP-120773<br>RP-120795 | 1155           | B26 and other editorial corrections   | 11.0.0           | 11.1.0           |
| 06-2012            | RP-56          | RP-120793              | 1161           | Corrections on CQI and PMI test   | 11.0.0           | 11.1.0           |
| 06-2012            | RP-56          | RP-120780              | 1163           | FRC for TDD PMI test  | 11.0.0           | 11.1.0           |
| 06-2012            | RP-56          | RP-120778              | 1165r1         | Clean-up of UL-MIMO for TS36.101  | 11.0.0           | 11.1.0           |
| 06-2012            | RP-56          | RP-120782              | 1171           | Removal of unnecessary references to single carrier   | 11.0.0           | 11.1.0           |
|                    |                |                        |                | requirements from Interband CA subclauses   |                  |                  |
| 06-2012            | RP-56          | RP-120781              | 1174           | PDCCH wrong detection in receiver spurious emissions test   | 11.0.0           | 11.1.0           |
| 06-2012            | RP-56          | RP-120776              | 1184           | Corrections to 3500 MHz   | 11.0.0           | 11.1.0           |
| 06-2012            | RP-56          | RP-120793              | 1189r2         | Introduction of Band 44   | 11.0.0           | 11.1.0           |
| 06-2012<br>06-2012 | RP-56<br>RP-56 | RP-120784              | 1193r1<br>1196 | Target SNR setting for eICIC demodulation requirement   | 11.0.0           | 11.1.0<br>11.1.0 |
| 06-2012            | RP-56          | RP-120780<br>RP-120778 | 1196           | Editorial simplification to CA REFSENS UL allocation table<br>Correction of wrong table references in CA receiver tests | 11.0.0           | 11.1.0           |
| 06-2012            | RP-56          | RP-120778              | 1200r1         | Introduction of e850_LB (Band 27) to TS 36.101  | 11.0.0           | 11.1.0           |
| 06-2012            | RP-56          | RP-120764              | 120011         | Correction of PHS protection requirements for TS 36.101   | 11.0.0           | 11.1.0           |
| 06-2012            | RP-56          | RP-120793              | 1213r1         | Introduction of Band 28 into TS36.101   | 11.0.0           | 11.1.0           |
| 06-2012            | RP-56          | RP-120781              | 1215r1         | Proposed revision of subclause 4.3A for TS36.101  | 11.0.0           | 11.1.0           |
| 06-2012            | RP-56          | RP-120781              | 1217r1         | Proposed revision on subclause 6.3.4A for TS36.101  | 11.0.0           | 11.1.0           |
| 06-2012            | RP-56          | RP-120795              | 1219r1         | Aligning requirements between Band 18 and Band 26 in  | 11.0.0           | 11.1.0           |
|                    |                |                        |                | TS36.101  |                  |                  |
| 06-2012            | RP-56          | RP-120782              | 1221           | SNR definition  | 11.0.0           | 11.1.0           |
| 06-2012            | RP-56          | RP-120778              | 1223           | Correction of CSI configuration for CA TM4 tests R11  | 11.0.0           | 11.1.0           |
| 06-2012<br>06-2012 | RP-56<br>RP-56 | RP-120773<br>RP-120784 | 1225<br>1226   | CR on CA UE receiver timing window R11<br>Extension of static eICIC CQI test  | 11.0.0<br>11.0.0 | 11.1.0<br>11.1.0 |
| 09-2012            | RP-57          | RP-120784<br>RP-121294 | 1220           | Correct Transport Block size in 9RB 16QAM Uplink Reference  | 11.1.0           | 11.2.0           |
| 00 2012            | 101            | 111 121204             | 1200           | Measurement Channel   | 11.1.0           | 11.2.0           |
| 09-2012            | RP-57          | RP-121313              | 1233r1         | RF: Corrections to power allocation parameters for transmission   | 11.1.0           | 11.2.0           |
|                    |                |                        |                | mode 8 (Rel-11)   |                  |                  |
| 09-2012            | RP-57          | RP-121304              | 1235           | RF-CA: non-CA notation and applicability of test points in  | 11.1.0           | 11.2.0           |
|                    |                |                        |                | scenarios without and with CA operation (Rel-11)  |                  |                  |
| 09-2012            | RP-57          | RP-121305              | 1237           | ACK/NACK feedback modes for FDD and TDD TM4 CA  | 11.1.0           | 11.2.0           |
| 09-2012            | RP-57          | RP-121305              | 1239           | demodulation requirements (Rel-11)<br>Correction of feedback mode for CA TDD demodulation                               | 11.1.0           | 11.2.0           |
| 09-2012            | KE-21          | RF-121305              | 1239           | requirements (resubmission of R4-63AH-0194 for Rel-11)  | 11.1.0           | 11.2.0           |
| 09-2012            | RP-57          | RP-121302              | 1241           | ABS pattern setup for MBSFN ABS test (resubmission of R4-   | 11.1.0           | 11.2.0           |
|                    |                |                        |                | 63AH-0204 for Rel-11)   |                  |                  |
| 09-2012            | RP-57          | RP-121302              | 1243           | CR on eICIC CQI definition test (resubmission of R4-63AH-0205   | 11.1.0           | 11.2.0           |
|                    |                |                        | 10:-           | for Rel-11)   |                  |                  |
| 09-2012            | RP-57          | RP-121302              | 1245           | Transmission of CQI feedback and other corrections (Rel-11)   | 11.1.0           | 11.2.0           |
| 09-2012            | RP-57          | RP-121302              | 1247           | Target SNR setting for eICIC MBSFN-ABS demodulation   | 11.1.0           | 11.2.0           |
| 09-2012            | RP-57          | RP-121335              | 1248           | requirements (Rel-11)<br>Introduction of CA_1_21 RF requirements into TS36.101  | 11 1 0           | 11.2.0           |
| 09-2012            | RP-57<br>RP-57 | RP-121335<br>RP-121300 | 1246           | Corrections of spurious emission band UE co-existence   | 11.1.0           | 11.2.0           |
| 00 2012            | 1.1 07         | 1.1 121000             |                | applicable in Japan   |                  |                  |
| 09-2012            | RP-57          | RP-121306              | 1253           | Correction on RMC for frequency non-selective CQI test  | 11.1.0           | 11.2.0           |
| 09-2012            | RP-57          | RP-121306              | 1255           | Requirements for the eDL-MIMO CQI test  | 11.1.0           | 11.2.0           |
| 09-2012            | RP-57          | RP-121302              | 1257           | Clarification on PDSCH test setup under MBSFN ABS   | 11.1.0           | 11.2.0           |
| 09-2012            | RP-57          | RP-121316              | 1258           | Update of Band 28 requirements  | 11.1.0           | 11.2.0           |
| 09-2012            | RP-57          | RP-121313              | 1262           | Applicability of statement allowing RBW < Meas BW for spurious  | 11.1.0           | 11.2.0           |
| 09-2012            | RP-57          | RP-121298              | 1265           | Clarification of RB allocation for DRS demodulation tests   | 11.1.0           | 11.2.0           |
| 09-2012            | RP-57          | RP-121304              | 1267           | Removal of brackets for CA Tx   | 11.1.0           | 11.2.0           |
| 09-2012<br>09-2012 | RP-57          | RP-121337<br>RP-121327 | 1268r1<br>1269 | TS 36.101 CR for CA_38<br>Introduction of CA_B7_B20 in 36.101   | 11.1.0<br>11.1.0 | 11.2.0           |
| 09-2012            | RP-57<br>RP-57 | RP-121327<br>RP-121313 | 1269           | Corrections of FRC subframe allocations and other minor   | 11.1.0           | 11.2.0<br>11.2.0 |
| 00 2012            | 11 -07         | 121010                 |                | problems  | 11.1.0           | 11.2.0           |
| 09-2012            | RP-57          | RP-121305              | 1274           | Introduction of requirements for TDD CA Soft Buffer Limitation  | 11.1.0           | 11.2.0           |
|                    |                |                        |                |   |                  |                  |

| 09-2012   | RP-57   | RP-121307   | 1276   | Correction of eDL-MIMIO CSI RMC tables and references   | 11.1.0  | 11.2.0  |
|---|---|---|--|---|---|---|
| 09-2012   | RP-57   | RP-121307   | 1278   | Correction of MIMO channel model for polarized antennas   | 11.1.0  | 11.2.0  |
| 09-2012   | RP-57   | RP-121303   | 1280   | Addition of 15 and 20MHz Bandwidths for Band 23 to TS 36.101<br>(Rel-11)  | 11.1.0  | 11.2.0  |
| 09-2012   | RP-57   | RP-121334   | 1283r1   | Add requirements for inter-band CA of B_1-18 and B_11-18 in TS36.101  | 11.1.0  | 11.2.0  |
| 09-2012   | RP-57   | RP-121304   | 1285r1   | CR for MPR mask for multi-clustered simultaneous transmission<br>in single CC in Rel-11   | 11.1.0  | 11.2.0  |
| 09-2012   | RP-57   | RP-121447   | 1288r2   | Introduction of Japanese Regulatory Requirements to LTE Band 8(R11)   | 11.1.0  | 11.2.0  |
| 09-2012   | RP-57   | RP-121315   | 1289   | CR for Band 27 MOP  | 11.1.0  | 11.2.0  |
| 09-2012   | RP-57   | RP-121315   | 1290   | CR for Band 27 A-MPR  | 11.1.0  | 11.2.0  |
| 09-2012   | RP-57   | RP-121316   | 1291   | CR to replace protected frequency range with new band number 27   | 11.1.0  | 11.2.0  |
| 09-2012   | RP-57   | RP-121215   | 1292r1   | Introduction of CA band combination Band3 + Band5 to TS<br>36.101   | 11.1.0  | 11.2.0  |
| 09-2012   | RP-57   | RP-121306   | 1300r1   | Requirements for eDL-MIMO RI test   | 11.1.0  | 11.2.0  |
| 09-2012   | RP-57   | RP-121306   | 1304   | Corrections to TM9 demodulation tests   | 11.1.0  | 11.2.0  |
| 09-2012   | RP-57   | RP-121313   | 1306   | Correction to PCFICH power parameter setting  | 11.1.0  | 11.2.0  |
| 09-2012   | RP-57   | RP-121306   | 1310r1   | Correction on frequency non-selective CQI test  | 11.1.0  | 11.2.0  |
| 09-2012   | RP-57   | RP-121306   | 1313r1   | eDL-MIMO CQI/PMI test   | 11.1.0  | 11.2.0  |
| 09-2012   | RP-57   | RP-121313   | 1316   | Correction of the definition of unsynchronized operation  | 11.1.0  | 11.2.0  |
| 09-2012   | RP-57   | RP-121304   | 1320r1   | Correction to Transmit Modulation Quality Tests for Intra-Band<br>CA  | 11.1.0  | 11.2.0  |
| 09-2012   | RP-57   | RP-121338   | 1324r2   | 36.101 CR for LTE_CA_B7   | 11.1.0  | 11.2.0  |
| 09-2012   | RP-57   | RP-121331   | 1325   | Introduction of CA_3_20 RF requirements into TS36.101   | 11.1.0  | 11.2.0  |
| 09-2012<br>09-2012  | RP-57<br>RP-57  | RP-121316<br>RP-121304  | 1326<br>1332r1   | A-MPR table correction for NS_18<br>Bandwidth combination sets for intra-band and inter-band carrier  | 11.1.0<br>11.1.0  | 11.2.0  |
| 09-2012   | RP-57   | RP-121304   | 133211   | aggregation<br>Introduction of LTE Advanced Carrier Aggregation of Band 4 and   | 11.1.0  | 11.2.0  |
|   |   |   |  | Band 13   |   |   |
| 09-2012<br>09-2012  | RP-57<br>RP-57  | RP-121326<br>RP-121324  | 1340r1<br>1341   | Introduction of CA configurations CA-12A-4A and CA-17A-4A<br>Introduction of CA_B3_B7 in 36.101   | 11.1.0<br>11.1.0  | 11.2.0  |
| 09-2012   | RP-57<br>RP-57  | RP-121324<br>RP-121328  | 1341   | Introduction of Band 2 + Band 17 inter-band CA configuration  | 11.1.0  | 11.2.0  |
| 09-2012   | RF-37   | KF-121320   | 1343   | into 36.101   | 11.1.0  | 11.2.0  |
| 09-2012   | RP-57   | RP-121306   | 1351   | FRC for TM9 FDD   | 11.1.0  | 11.2.0  |
| 09-2012   | RP-57   | RP-121295   | 1352   | Random precoding granularity in PMI tests   | 11.1.0  | 11.2.0  |
| 09-2012   | RP-57   | RP-121302   | 1358   | Introduction of RI test for eICIC   | 11.1.0  | 11.2.0  |
| 09-2012   | RP-57   | RP-121304   | 1360   | Notes for deltaTib and deltaRib tables  | 11.1.0  | 11.2.0  |
| 09-2012   | RP-57   | RP-121304   | 1361   | CR for A-MPR masks for NS_CA_1C   | 11.1.0  | 11.2.0  |
| 12-2012   | RP-58   | RP-121884   | 1362   | Introduction of CA_3_8 RF requirements to TS 36.101   | 11.2.0  | 11.3.0  |
| 12-2012<br>12-2012  | RP-58<br>RP-58  | RP-121870<br>RP-121861  | 1363<br>1366   | Removal of square brackets for Band 27 in Table 5.6.1-1<br>Some changes related to CA tests and overview table of DL  | 11.2.0<br>11.2.0  | 11.3.0<br>11.3.0  |
|   |   |   |  | measurement channels  |   |   |
| 12-2012   | RP-58   | RP-121860   | 1368   | Correction of eICIC CQI tests   | 11.2.0  | 11.3.0  |
| 12-2012   |   |   | 1370   | Correction of eICIC demodulation tests  | 11.2.0  | 11.3.0  |
|   | RP-58   | RP-121860   | 4074   |   |   |   |
| 12-2012   | RP-58   | RP-121862   | 1374   | Correction on CSI-RS subframe offset parameter  | 11.2.0  | 11.3.0  |
| 12-2012<br>12-2012<br>12-2012   |   |   | 1374<br>1376<br>1382   | Correction on FRC table in CSI test<br>Correction of reference channel table for TDD eDL-MIMIO RI   |   |   |
| 12-2012<br>12-2012  | RP-58<br>RP-58<br>RP-58   | RP-121862<br>RP-121862<br>RP-121862   | 1376<br>1382   | Correction on FRC table in CSI test<br>Correction of reference channel table for TDD eDL-MIMIO RI<br>test   | 11.2.0<br>11.2.0<br>11.2.0  | 11.3.0<br>11.3.0<br>11.3.0  |
| 12-2012   | RP-58<br>RP-58<br>RP-58<br>RP-58  | RP-121862<br>RP-121862  | 1376   | Correction on FRC table in CSI test<br>Correction of reference channel table for TDD eDL-MIMIO RI   | 11.2.0<br>11.2.0  | 11.3.0<br>11.3.0  |
| 12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012   | RP-58<br>RP-58<br>RP-58   | RP-121862<br>RP-121862<br>RP-121862<br>RP-121850  | 1376<br>1382<br>1386   | Correction on FRC table in CSI test<br>Correction of reference channel table for TDD eDL-MIMIO RI<br>test<br>OCNG patterns for Sustained Data rate testing<br>Introduction of one periodic CQI test for CA deployments<br>Introduction of CA_B5_B12 in 36.101   | 11.2.0<br>11.2.0<br>11.2.0<br>11.2.0  | 11.3.0<br>11.3.0<br>11.3.0<br>11.3.0  |
| 12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012  | RP-58<br>RP-58<br>RP-58<br>RP-58<br>RP-58<br>RP-58<br>RP-58   | RP-121862<br>RP-121862<br>RP-121862<br>RP-121850<br>RP-121867<br>RP-121894<br>RP-121850   | 1376<br>1382<br>1386<br>1388r1   | Correction on FRC table in CSI test<br>Correction of reference channel table for TDD eDL-MIMIO RI<br>test<br>OCNG patterns for Sustained Data rate testing<br>Introduction of one periodic CQI test for CA deployments<br>Introduction of CA_B5_B12 in 36.101<br>Introducing the additional frequency bands of 5 MHz x 2 in 1.7<br>GHz in Japan to Band 3   | 11.2.0<br>11.2.0<br>11.2.0<br>11.2.0<br>11.2.0  | 11.3.0<br>11.3.0<br>11.3.0<br>11.3.0<br>11.3.0  |
| 12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012   | RP-58<br>RP-58<br>RP-58<br>RP-58<br>RP-58<br>RP-58  | RP-121862<br>RP-121862<br>RP-121862<br>RP-121850<br>RP-121867<br>RP-121894  | 1376<br>1382<br>1386<br>1388r1<br>1396   | Correction on FRC table in CSI test<br>Correction of reference channel table for TDD eDL-MIMIO RI<br>test<br>OCNG patterns for Sustained Data rate testing<br>Introduction of one periodic CQI test for CA deployments<br>Introduction of CA_B5_B12 in 36.101<br>Introducing the additional frequency bands of 5 MHz x 2 in 1.7   | 11.2.0<br>11.2.0<br>11.2.0<br>11.2.0<br>11.2.0<br>11.2.0  | 11.3.0<br>11.3.0<br>11.3.0<br>11.3.0<br>11.3.0<br>11.3.0  |
| 12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012  | RP-58<br>RP-58<br>RP-58<br>RP-58<br>RP-58<br>RP-58<br>RP-58<br>RP-58<br>RP-58   | RP-121862<br>RP-121862<br>RP-121862<br>RP-121850<br>RP-121867<br>RP-121894<br>RP-121850<br>RP-121887<br>RP-121887   | 1376<br>1382<br>1386<br>1388r1<br>1396<br>1401<br>1406r1<br>1407   | Correction on FRC table in CSI test<br>Correction of reference channel table for TDD eDL-MIMIO RI<br>test<br>OCNG patterns for Sustained Data rate testing<br>Introduction of one periodic CQI test for CA deployments<br>Introduction of CA_B5_B12 in 36.101<br>Introducing the additional frequency bands of 5 MHz x 2 in 1.7<br>GHz in Japan to Band 3<br>Reference sensitivity for the small bandwidth of CA_4-12<br>CR on eICIC RI test  | 11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0  | 11.3.0           11.3.0           11.3.0           11.3.0           11.3.0           11.3.0           11.3.0           11.3.0           11.3.0           11.3.0           11.3.0           11.3.0           11.3.0  |
| 12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012   | RP-58<br>RP-58<br>RP-58<br>RP-58<br>RP-58<br>RP-58<br>RP-58<br>RP-58<br>RP-58<br>RP-58  | RP-121862           RP-121862           RP-121862           RP-121850           RP-121867           RP-121894           RP-121850           RP-121850           RP-121850           RP-121850           RP-121850           RP-121850           RP-121887           RP-121860           RP-121862   | 1376           1382           1386           1388r1           1396           1401           1406r1           1407           1409   | Correction on FRC table in CSI test<br>Correction of reference channel table for TDD eDL-MIMIO RI<br>test<br>OCNG patterns for Sustained Data rate testing<br>Introduction of one periodic CQI test for CA deployments<br>Introduction of CA_B5_B12 in 36.101<br>Introducing the additional frequency bands of 5 MHz x 2 in 1.7<br>GHz in Japan to Band 3<br>Reference sensitivity for the small bandwidth of CA_4-12<br>CR on eICIC RI test<br>Cleaning of 36.101 Performance sections Rel-11  | 11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0   | 11.3.0           11.3.0           11.3.0           11.3.0           11.3.0           11.3.0           11.3.0           11.3.0           11.3.0           11.3.0           11.3.0           11.3.0           11.3.0           11.3.0   |
| 12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012  | RP-58   | RP-121862           RP-121862           RP-121862           RP-121862           RP-121867           RP-121894           RP-121850           RP-121850           RP-121850           RP-121850           RP-121850           RP-121850           RP-121867           RP-121860           RP-121860           RP-121861   | 1376           1382           1386           1388r1           1396           1401           1406r1           1407           1409           1416  | Correction on FRC table in CSI test<br>Correction of reference channel table for TDD eDL-MIMIO RI<br>test<br>OCNG patterns for Sustained Data rate testing<br>Introduction of one periodic CQI test for CA deployments<br>Introduction of CA_B5_B12 in 36.101<br>Introducing the additional frequency bands of 5 MHz x 2 in 1.7<br>GHz in Japan to Band 3<br>Reference sensitivity for the small bandwidth of CA_4-12<br>CR on elCIC RI test<br>Cleaning of 36.101 Performance sections Rel-11<br>Out-of-band blocking requirements for inter-band carrier<br>aggregation   | 11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0  | 11.3.0           11.3.0           11.3.0           11.3.0           11.3.0           11.3.0           11.3.0           11.3.0           11.3.0           11.3.0           11.3.0           11.3.0           11.3.0           11.3.0           11.3.0           11.3.0   |
| 12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012   | RP-58   | RP-121862           RP-121862           RP-121862           RP-121862           RP-121850           RP-121894           RP-121850           RP-121887           RP-121860           RP-121860           RP-121861   | 1376           1382           1386           1388r1           1396           1401           1406r1           1407           1409           1416           1418   | Correction on FRC table in CSI test<br>Correction of reference channel table for TDD eDL-MIMIO RI<br>test<br>OCNG patterns for Sustained Data rate testing<br>Introduction of one periodic CQI test for CA deployments<br>Introduction of CA_B5_B12 in 36.101<br>Introducing the additional frequency bands of 5 MHz x 2 in 1.7<br>GHz in Japan to Band 3<br>Reference sensitivity for the small bandwidth of CA_4-12<br>CR on elCIC RI test<br>Cleaning of 36.101 Performance sections Rel-11<br>Out-of-band blocking requirements for inter-band carrier<br>aggregation<br>Adding missed SNR reference values for CA soft buffer tests  | 11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0           11.2.0   | 11.3.0         11.3.0         11.3.0         11.3.0         11.3.0         11.3.0         11.3.0         11.3.0         11.3.0         11.3.0         11.3.0         11.3.0         11.3.0         11.3.0         11.3.0         11.3.0         11.3.0         11.3.0   |
| 12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012  | RP-58   | RP-121862           RP-121862           RP-121862           RP-121862           RP-121850           RP-121894           RP-121850           RP-121887           RP-121860           RP-121860           RP-121861           RP-121861   | 1376<br>1382<br>1386<br>1388r1<br>1396<br>1401<br>1406r1<br>1406r1<br>1409<br>1416<br>1418<br>1422   | Correction on FRC table in CSI test<br>Correction of reference channel table for TDD eDL-MIMIO RI<br>test<br>OCNG patterns for Sustained Data rate testing<br>Introduction of one periodic CQI test for CA deployments<br>Introduction of CA_B5_B12 in 36.101<br>Introducing the additional frequency bands of 5 MHz x 2 in 1.7<br>GHz in Japan to Band 3<br>Reference sensitivity for the small bandwidth of CA_4-12<br>CR on elCIC RI test<br>Cleaning of 36.101 Performance sections Rel-11<br>Out-of-band blocking requirements for inter-band carrier<br>aggregation<br>Adding missed SNR reference values for CA soft buffer tests<br>Introduction of CA_4A-5A into 36.101  | 11.2.0            | 11.3.0         11.3.0         11.3.0         11.3.0         11.3.0         11.3.0         11.3.0         11.3.0         11.3.0         11.3.0         11.3.0         11.3.0         11.3.0         11.3.0         11.3.0         11.3.0         11.3.0         11.3.0         11.3.0  |
| 12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012   | RP-58   | RP-121862           RP-121862           RP-121862           RP-121862           RP-121850           RP-121894           RP-121850           RP-121887           RP-121860           RP-121861           RP-121861           RP-121867   | 1376           1382           1386           1388r1           1396           1401           1406r1           1407           1409           1416           1418           1422           1431   | Correction on FRC table in CSI test<br>Correction of reference channel table for TDD eDL-MIMIO RI<br>test<br>OCNG patterns for Sustained Data rate testing<br>Introduction of one periodic CQI test for CA deployments<br>Introduction of CA_B5_B12 in 36.101<br>Introducing the additional frequency bands of 5 MHz x 2 in 1.7<br>GHz in Japan to Band 3<br>Reference sensitivity for the small bandwidth of CA_4-12<br>CR on eICIC RI test<br>Cleaning of 36.101 Performance sections Rel-11<br>Out-of-band blocking requirements for inter-band carrier<br>aggregation<br>Adding missed SNR reference values for CA soft buffer tests<br>Introduction of CA_4A-5A into 36.101<br>Clean up of specification R11   | 11.2.0             | 11.3.0           |
| 12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012  | RP-58   | RP-121862           RP-121862           RP-121862           RP-121862           RP-121850           RP-121894           RP-121850           RP-121887           RP-121862           RP-121862           RP-121861           RP-121861           RP-121867           RP-121867   | 1376<br>1382<br>1386<br>1388r1<br>1396<br>1401<br>1406r1<br>1407<br>1409<br>1416<br>1418<br>1422<br>1431<br>1436   | Correction on FRC table in CSI test<br>Correction of reference channel table for TDD eDL-MIMIO RI<br>test<br>OCNG patterns for Sustained Data rate testing<br>Introduction of one periodic CQI test for CA deployments<br>Introduction of CA_B5_B12 in 36.101<br>Introducing the additional frequency bands of 5 MHz x 2 in 1.7<br>GHz in Japan to Band 3<br>Reference sensitivity for the small bandwidth of CA_4-12<br>CR on elCIC RI test<br>Cleaning of 36.101 Performance sections Rel-11<br>Out-of-band blocking requirements for inter-band carrier<br>aggregation<br>Adding missed SNR reference values for CA soft buffer tests<br>Introduction of CA_4A-5A into 36.101<br>Clean up of specification R11<br>Band 1 to Band 33 and Band 39 UE coexistence requirements  | 11.2.0            | 11.3.0          |
| 12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012   | RP-58   | RP-121862           RP-121862           RP-121862           RP-121862           RP-121850           RP-121894           RP-121850           RP-121887           RP-121860           RP-121861           RP-121861           RP-121867   | 1376           1382           1386           1388r1           1396           1401           1406r1           1407           1409           1416           1418           1422           1431   | Correction on FRC table in CSI test<br>Correction of reference channel table for TDD eDL-MIMIO RI<br>test<br>OCNG patterns for Sustained Data rate testing<br>Introduction of one periodic CQI test for CA deployments<br>Introduction of CA_B5_B12 in 36.101<br>Introducing the additional frequency bands of 5 MHz x 2 in 1.7<br>GHz in Japan to Band 3<br>Reference sensitivity for the small bandwidth of CA_4-12<br>CR on eICIC RI test<br>Cleaning of 36.101 Performance sections Rel-11<br>Out-of-band blocking requirements for inter-band carrier<br>aggregation<br>Adding missed SNR reference values for CA soft buffer tests<br>Introduction of CA_4A-5A into 36.101<br>Clean up of specification R11<br>Band 1 to Band 33 and Band 39 UE coexistence requirements<br>Editorial corrections for Band 26<br>Introduction of Band 5 + Band 17 inter-band CA configuration   | 11.2.0             | 11.3.0          |
| 12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012   | RP-58           RP-58 </td <td>RP-121862           RP-121862           RP-121862           RP-121862           RP-121850           RP-121867           RP-121887           RP-1218860           RP-121861           RP-121861           RP-121861           RP-121867           RP-121867           RP-121867           RP-121867           RP-121867           RP-121867           RP-121890</td> <td>1376           1382           1386           1388r1           1396           1401           1406r1           1407           1409           1416           1418           1422           1431           1436           1437r1</td> <td>Correction on FRC table in CSI test<br/>Correction of reference channel table for TDD eDL-MIMIO RI<br/>test<br/>OCNG patterns for Sustained Data rate testing<br/>Introduction of one periodic CQI test for CA deployments<br/>Introduction of CA_B5_B12 in 36.101<br/>Introducing the additional frequency bands of 5 MHz x 2 in 1.7<br/>GHz in Japan to Band 3<br/>Reference sensitivity for the small bandwidth of CA_4-12<br/>CR on eICIC RI test<br/>Cleaning of 36.101 Performance sections Rel-11<br/>Out-of-band blocking requirements for inter-band carrier<br/>aggregation<br/>Adding missed SNR reference values for CA soft buffer tests<br/>Introduction of CA_4A-5A into 36.101<br/>Clean up of specification R11<br/>Band 1 to Band 33 and Band 39 UE coexistence requirements<br/>Editorial corrections for Band 26<br/>Introduction of Band 5 + Band 17 inter-band CA configuration<br/>into 36.101</td> <td>11.2.0           11.2.0</td> <td>11.3.0         11.3.0</td>  | RP-121862           RP-121862           RP-121862           RP-121862           RP-121850           RP-121867           RP-121887           RP-1218860           RP-121861           RP-121861           RP-121861           RP-121867           RP-121867           RP-121867           RP-121867           RP-121867           RP-121867           RP-121890  | 1376           1382           1386           1388r1           1396           1401           1406r1           1407           1409           1416           1418           1422           1431           1436           1437r1   | Correction on FRC table in CSI test<br>Correction of reference channel table for TDD eDL-MIMIO RI<br>test<br>OCNG patterns for Sustained Data rate testing<br>Introduction of one periodic CQI test for CA deployments<br>Introduction of CA_B5_B12 in 36.101<br>Introducing the additional frequency bands of 5 MHz x 2 in 1.7<br>GHz in Japan to Band 3<br>Reference sensitivity for the small bandwidth of CA_4-12<br>CR on eICIC RI test<br>Cleaning of 36.101 Performance sections Rel-11<br>Out-of-band blocking requirements for inter-band carrier<br>aggregation<br>Adding missed SNR reference values for CA soft buffer tests<br>Introduction of CA_4A-5A into 36.101<br>Clean up of specification R11<br>Band 1 to Band 33 and Band 39 UE coexistence requirements<br>Editorial corrections for Band 26<br>Introduction of Band 5 + Band 17 inter-band CA configuration<br>into 36.101  | 11.2.0            | 11.3.0           |
| 12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012   | RP-58   | RP-121862           RP-121862           RP-121862           RP-121862           RP-121850           RP-121867           RP-121887           RP-121887           RP-121860           RP-121861           RP-121861           RP-121861           RP-121867           RP-121867           RP-121867           RP-121867           RP-121890           RP-121867           RP-121896           RP-121862   | 1376           1382           1386           1388r1           1396           1401           1406r1           1407           1409           1416           1418           1422           1431           1436           1437r1           1438           1442                               | Correction on FRC table in CSI test<br>Correction of reference channel table for TDD eDL-MIMIO RI<br>test<br>OCNG patterns for Sustained Data rate testing<br>Introduction of one periodic CQI test for CA deployments<br>Introduction of CA_B5_B12 in 36.101<br>Introducing the additional frequency bands of 5 MHz x 2 in 1.7<br>GHz in Japan to Band 3<br>Reference sensitivity for the small bandwidth of CA_4-12<br>CR on elCIC RI test<br>Cleaning of 36.101 Performance sections Rel-11<br>Out-of-band blocking requirements for inter-band carrier<br>aggregation<br>Adding missed SNR reference values for CA soft buffer tests<br>Introduction of CA_4A-5A into 36.101<br>Clean up of specification R11<br>Band 1 to Band 33 and Band 39 UE coexistence requirements<br>Editorial corrections for Band 26<br>Introduction of Band 5 + Band 17 inter-band CA configuration<br>into 36.101<br>Correction of eDL-MIMO RI test and RMC table for the CSI test   | 11.2.0          | 11.3.0           |
| 12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012                                  | RP-58   | RP-121862           RP-121862           RP-121862           RP-121862           RP-121867           RP-121887           RP-121887           RP-121860           RP-121861           RP-121861           RP-121861           RP-121867           RP-121866           RP-121862           RP-121861 | 1376           1382           1388           1388           1396           1401           1406           1407           1409           1416           1418           1422           1431           1436           1437           1438           1444                                     | Correction on FRC table in CSI test<br>Correction of reference channel table for TDD eDL-MIMIO RI<br>test<br>OCNG patterns for Sustained Data rate testing<br>Introduction of one periodic CQI test for CA deployments<br>Introduction of CA_B5_B12 in 36.101<br>Introducing the additional frequency bands of 5 MHz x 2 in 1.7<br>GHz in Japan to Band 3<br>Reference sensitivity for the small bandwidth of CA_4-12<br>CR on eICIC RI test<br>Cleaning of 36.101 Performance sections Rel-11<br>Out-of-band blocking requirements for inter-band carrier<br>aggregation<br>Adding missed SNR reference values for CA soft buffer tests<br>Introduction of CA_4A-5A into 36.101<br>Clean up of specification R11<br>Band 1 to Band 33 and Band 39 UE coexistence requirements<br>Editorial corrections for Band 26<br>Introduction of Band 5 + Band 17 inter-band CA configuration<br>into 36.101<br>Correction of eDL-MIMO RI test and RMC table for the CSI test<br>Minor correction to ceiling function example - rel11   | 11.2.0          | 11.3.0           |
| 12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012                       | RP-58   | RP-121862           RP-121862           RP-121862           RP-121862           RP-121850           RP-121867           RP-121887           RP-121887           RP-121860           RP-121861           RP-121861           RP-121861           RP-121867           RP-121862           RP-121862                     | 1376           1382           1386           1388r1           1396           1401           1406r1           1407           1409           1416           1422           1431           1436           1437r1           1438           1442           1444           1449                | Correction on FRC table in CSI test<br>Correction of reference channel table for TDD eDL-MIMIO RI<br>test<br>OCNG patterns for Sustained Data rate testing<br>Introduction of one periodic CQI test for CA deployments<br>Introduction of CA_B5_B12 in 36.101<br>Introducing the additional frequency bands of 5 MHz x 2 in 1.7<br>GHz in Japan to Band 3<br>Reference sensitivity for the small bandwidth of CA_4-12<br>CR on eICIC RI test<br>Cleaning of 36.101 Performance sections Rel-11<br>Out-of-band blocking requirements for inter-band carrier<br>aggregation<br>Adding missed SNR reference values for CA soft buffer tests<br>Introduction of CA_4A-5A into 36.101<br>Clean up of specification R11<br>Band 1 to Band 33 and Band 39 UE coexistence requirements<br>Editorial corrections for Band 26<br>Introduction of Band 5 + Band 17 inter-band CA configuration<br>into 36.101<br>Correction of eDL-MIMO RI test and RMC table for the CSI test<br>Minor correction to ceiling function example - rel11   | 11.2.0          | 11.3.0          |
| 12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012 | RP-58           RP-58 </td <td>RP-121862           RP-121862           RP-121862           RP-121862           RP-121867           RP-121887           RP-121887           RP-121887           RP-121860           RP-121861           RP-121861           RP-121861           RP-121867           RP-121860</td> <td>1376           1382           1386           1388r1           1396           1401           1406r1           1407           1409           1416           1422           1431           1436           1437r1           1438           1442           1444           1449           1450</td> <td>Correction on FRC table in CSI test<br/>Correction of reference channel table for TDD eDL-MIMIO RI<br/>test<br/>OCNG patterns for Sustained Data rate testing<br/>Introduction of one periodic CQI test for CA deployments<br/>Introduction of CA_B5_B12 in 36.101<br/>Introducing the additional frequency bands of 5 MHz x 2 in 1.7<br/>GHz in Japan to Band 3<br/>Reference sensitivity for the small bandwidth of CA_4-12<br/>CR on elCIC RI test<br/>Cleaning of 36.101 Performance sections Rel-11<br/>Out-of-band blocking requirements for inter-band carrier<br/>aggregation<br/>Adding missed SNR reference values for CA soft buffer tests<br/>Introduction of CA_4A-5A into 36.101<br/>Clean up of specification R11<br/>Band 1 to Band 33 and Band 39 UE coexistence requirements<br/>Editorial corrections for Band 26<br/>Introduction of Band 5 + Band 17 inter-band CA configuration<br/>into 36.101<br/>Correction of eDL-MIMO RI test and RMC table for the CSI test<br/>Minor correction to ceiling function example - rel11<br/>Correction of SNR definition<br/>Brackets clean up for elCIC CSI/demodulation</td> <td>11.2.0         11.2.0</td> <td>11.3.0         11.3.0</td> | RP-121862           RP-121862           RP-121862           RP-121862           RP-121867           RP-121887           RP-121887           RP-121887           RP-121860           RP-121861           RP-121861           RP-121861           RP-121867           RP-121860   | 1376           1382           1386           1388r1           1396           1401           1406r1           1407           1409           1416           1422           1431           1436           1437r1           1438           1442           1444           1449           1450 | Correction on FRC table in CSI test<br>Correction of reference channel table for TDD eDL-MIMIO RI<br>test<br>OCNG patterns for Sustained Data rate testing<br>Introduction of one periodic CQI test for CA deployments<br>Introduction of CA_B5_B12 in 36.101<br>Introducing the additional frequency bands of 5 MHz x 2 in 1.7<br>GHz in Japan to Band 3<br>Reference sensitivity for the small bandwidth of CA_4-12<br>CR on elCIC RI test<br>Cleaning of 36.101 Performance sections Rel-11<br>Out-of-band blocking requirements for inter-band carrier<br>aggregation<br>Adding missed SNR reference values for CA soft buffer tests<br>Introduction of CA_4A-5A into 36.101<br>Clean up of specification R11<br>Band 1 to Band 33 and Band 39 UE coexistence requirements<br>Editorial corrections for Band 26<br>Introduction of Band 5 + Band 17 inter-band CA configuration<br>into 36.101<br>Correction of eDL-MIMO RI test and RMC table for the CSI test<br>Minor correction to ceiling function example - rel11<br>Correction of SNR definition<br>Brackets clean up for elCIC CSI/demodulation | 11.2.0         11.2.0 | 11.3.0         11.3.0 |
| 12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012<br>12-2012                       | RP-58   | RP-121862           RP-121862           RP-121862           RP-121862           RP-121850           RP-121867           RP-121887           RP-121887           RP-121860           RP-121861           RP-121861           RP-121861           RP-121867           RP-121862           RP-121862                     | 1376           1382           1386           1388r1           1396           1401           1406r1           1407           1409           1416           1422           1431           1436           1437r1           1438           1442           1444           1449                | Correction on FRC table in CSI test<br>Correction of reference channel table for TDD eDL-MIMIO RI<br>test<br>OCNG patterns for Sustained Data rate testing<br>Introduction of one periodic CQI test for CA deployments<br>Introduction of CA_B5_B12 in 36.101<br>Introducing the additional frequency bands of 5 MHz x 2 in 1.7<br>GHz in Japan to Band 3<br>Reference sensitivity for the small bandwidth of CA_4-12<br>CR on eICIC RI test<br>Cleaning of 36.101 Performance sections Rel-11<br>Out-of-band blocking requirements for inter-band carrier<br>aggregation<br>Adding missed SNR reference values for CA soft buffer tests<br>Introduction of CA_4A-5A into 36.101<br>Clean up of specification R11<br>Band 1 to Band 33 and Band 39 UE coexistence requirements<br>Editorial corrections for Band 26<br>Introduction of Band 5 + Band 17 inter-band CA configuration<br>into 36.101<br>Correction of eDL-MIMO RI test and RMC table for the CSI test<br>Minor correction to ceiling function example - rel11   | 11.2.0          | 11.3.0          |

| 12-2012 | RP-58        | RP-121862              | 1464           | Adding references to the appropriate beamforming model (Rel-<br>11)                                       | 11.2.0 | 11.3.0 |
|---------|--------------|------------------------|----------------|---|--------|--------|
| 12-2012 | RP-58        | RP-121898              | 1465r1         | Introduction of CA_8_20 RF requirements into TS36.101   | 11.2.0 | 11.3.0 |
| 12-2012 | RP-58        | RP-121882              | 1468r1         | Introduction of inter-band CA_11-18 into TS36.101   | 11.2.0 | 11.3.0 |
| 12-2012 | RP-58        | RP-121903              | 1472r1         | Introduction of advanced receivers demodulation performance   | 11.2.0 | 11.3.0 |
|         |              | RP-121903              |                | (FDD)   |        |        |
| 12-2012 | RP-58        | RP-121903              | 1473r1         | Introduction of performance requirements for verifying the receiver type for advanced receivers (FDD/TDD) | 11.2.0 | 11.3.0 |
| 12-2012 | RP-58        | RP-121886              | 1474           | CR to remove the square bracket of A-MPR in TS36.101  | 11.2.0 | 11.3.0 |
| 12-2012 | RP-58        | RP-121861              | 1476           | Correction of some errors in reference sensitivity for CA in TS   | 11.2.0 | 11.3.0 |
| 12-2012 | RP-58        | RP-121903              | 1480r1         | 36.101 (R11)<br>Introduction of Advanced Receivers Test Cases for TDD                                     | 11.2.0 | 11.3.0 |
| 12-2012 | RP-58        | RP-121903              | 1490r1         | Introduction of Band 29   | 11.2.0 | 11.3.0 |
| 12-2012 | RP-58        | RP-121901<br>RP-121849 | 1494           | Low-channel Band 1 coexistence with PHS   | 11.2.0 | 11.3.0 |
| 12-2012 | RP-58        | RP-121861              | 1494<br>1498r1 | Completion of the tables of bandwidth combinations specified for  | 11.2.0 | 11.3.0 |
| 12-2012 | RP-58        | RP-121861              | 1499r1         | CA<br>Exceptions to REFSENS requirements for class A2 CA  | 11.2.0 | 11.3.0 |
| 10.0010 | <b>DD</b> 50 | <b>DD</b> 404000       | 4500           | combinations  | 11.0.0 | 11.0.0 |
| 12-2012 | RP-58        | RP-121892              | 1500           | Introduction of carrier aggregation configuration CA_4-7  | 11.2.0 | 11.3.0 |
| 12-2012 | RP-58        | RP-121870              | 1504           | Editorial corrections to Band 27 specifications   | 11.2.0 | 11.3.0 |
| 12-2012 | RP-58        | RP-121878              | 1505           | Band 28 AMPR for DTV protection   | 11.2.0 | 11.3.0 |
| 12-2012 | RP-58        | RP-121852              | 1509r1         | UE-UE coexistence between bands with small frequency separation   | 11.2.0 | 11.3.0 |
| 12-2012 | RP-58        | RP-121911              | 1510           | Adding UE-UE Coexistence Requirement for Band 3 and Band 26   | 11.2.0 | 11.3.0 |
| 12-2012 | RP-58        | RP-121866              | 1513           | Maintenance of Band 23 UE Coexistence   | 11.2.0 | 11.3.0 |
| 12-2012 | RP-58        | RP-121851              | 1515           | Corrections to TM4 rank indicator Test 3  | 11.2.0 | 11.3.0 |
| 12-2012 | RP-58        | RP-121861              | 1517           | Correction of test configuraitons and FRC for CA demodulation with power imbalance                        | 11.2.0 | 11.3.0 |
| 12-2012 | RP-58        | RP-121860              | 1518           | Applicable OFDM symbols of Noc_2 for PDCCH/PCFICH ABS-<br>MBSFN test cases                                | 11.2.0 | 11.3.0 |
| 03-2013 | RP-59        | RP-130279              | 1519           | OCNG patterns for Enhanced Performance Requirements Type<br>A   | 11.3.0 | 11.4.0 |
| 03-2013 | RP-59        | RP-130277              | 1520           | Corrections on in-band blocking for Band 29 for carrier aggregation                                       | 11.3.0 | 11.4.0 |
| 03-2013 | RP-59        | RP-130268              | 1523           | Brackets removal in Rel-11 TM4 rank indicator Test 3  | 11.3.0 | 11.4.0 |
| 03-2013 | RP-59        | RP-130279              | 1524r1         | Cleanup of Advanced Receivers requirement scenarios for   | 11.3.0 | 11.4.0 |
|         |              |                        |                | demodulation and CSI (FDD/TDD)  |        |        |
| 03-2013 | RP-59        | RP-130258              | 1528           | Corrections to CQI reporting  | 11.3.0 | 11.4.0 |
| 03-2013 | RP-59        | RP-130262              | 1536           | Corrections for eICIC performance requirements (rel-11)   | 11.3.0 | 11.4.0 |
| 03-2013 | RP-59        | RP-130264              | 1539           | Correction of CA power imbalance performance requirements   | 11.3.0 | 11.4.0 |
| 03-2013 | RP-59        | RP-130287              | 1543           | Correction of a symbol for MPR in single carrier for TS 36.101(R11)                                       | 11.3.0 | 11.4.0 |
| 03-2013 | RP-59        | RP-130287              | 1544r1         | Correction of some inter-band CA requiements for TS 36.101 (R11)  | 11.3.0 | 11.4.0 |
| 03-2013 | RP-59        | RP-130276              | 1546           | Correction of contigous allocation A-MPR for CA_NS_05   | 11.3.0 | 11.4.0 |
| 03-2013 | RP-59        | RP-130263              | 1547r1         | Clarification of spurious emission domain for CA in TS 36.101 (R11)                                       | 11.3.0 | 11.4.0 |
| 03-2013 | RP-59        | RP-130264              | 1548           | CR for CA performance requirements  | 11.3.0 | 11.4.0 |
| 03-2013 | RP-59        | RP-130284              | 1553r1         | Introduction of downlink non-contiguous CA into REL -11 TS  | 11.3.0 | 11.4.0 |
|         |              |                        |                | 36.101  |        |        |
| 03-2013 | RP-59        | RP-130263              | 1557           | CA_1C: CA_NS_02 and CA_NS_03 A-MPR REL-11   | 11.3.0 | 11.4.0 |
| 03-2013 | RP-59        | RP-130287              | 1560           | Editorial corrections to subclause 5  | 11.3.0 | 11.4.0 |
| 03-2013 | RP-59        | RP-130267              | 1562           | Addition of UE Regional Requirements to Band 23 Based on<br>New Regulatory Order in the US                | 11.3.0 | 11.4.0 |
| 03-2013 | RP-59        | RP-130272              | 1567           | Band 26: modification of A-MPR for 'NS_15'  | 11.3.0 | 11.4.0 |
| 03-2013 | RP-59        | RP-130287              | 1571r1         | Band 41 requirements for operation in China and Japan   | 11.3.0 | 11.4.0 |
| 03-2013 | RP-59        | RP-130260              | 1574           | Remove [] from CSI test case parameters   | 11.3.0 | 11.4.0 |
| 03-2013 | RP-59        | RP-130287              | 1575           | Corrections to UE co-existence  | 11.3.0 | 11.4.0 |
| 03-2013 | RP-59        | RP-130287              | 1579           | UE-UE co-existence between Band 1 and Band 33/39  | 11.3.0 | 11.4.0 |
| 03-2013 | RP-59        | RP-130287              | 1580           | Correction on reference to note for Band 7 and 38 co-existence  | 11.3.0 | 11.4.0 |
| 03-2013 | RP-59        | RP-130263              | 1584r1         | Cleanup for CA UE RF requirements   | 11.3.0 | 11.4.0 |
| 03-2013 | RP-59        | RP-130263              | 1586           | Corrections on UL configuration for CA UE receiver<br>requirements  | 11.3.0 | 11.4.0 |
| 03-2013 | RP-59        | RP-130263              | 1588           | Correction of Transmit modulation quality requirements for CA   | 11.3.0 | 11.4.0 |
| 03-2013 | RP-59        | RP-130268              | 1590           | Revision of Common Test Parameters for User-specific<br>Demodulation Tests                                | 11.3.0 | 11.4.0 |
| 03-2013 | RP-59        | RP-130278              | 1595           | Correction for a Band 27 A-MPR table  | 11.3.0 | 11.4.0 |
| 03-2013 | RP-59        | RP-130264              | 1597           | Correction of CA CQI test setup   | 11.3.0 | 11.4.0 |
| 03-2013 | RP-59        | RP-130287              | 1600r1         | Correction of B12 DL Specification in Table 5.5A-2  | 11.3.0 | 11.4.0 |
| 03-2013 | RP-59        | RP-130263              | 1602           | Correction of table reference   | 11.3.0 | 11.4.0 |
| 06-2013 | RP-60        | RP-130765              | 1604r1         | Complementary description for definition of MIMO Correlation  | 11.4.0 | 11.5.0 |
| 06-2013 | RP-60        | RP-130763              | 1607           | Matrices using cross polarized antennas<br>Correction of transport format parameters for CQI index 10 (15 | 11.4.0 | 11.5.0 |
| 00-2013 | NT-00        | KE-130/03              | 1007           | Conection of transport format parameters for CQI muex 10 (15  | 11.4.0 | 11.3.0 |

|   |  |  | 1  | RBs) - Rel 11   | 1  |   |
|---|--|--|--|---|--|---|
| 06-2013   | RP-60  | RP-130765  | 1610   | Maintenance of Band 23 A-MPR (NS_11) in TS 36.101 (Rel-11)  | 11.4.0   | 11.5.0  |
| 06-2013   | RP-60  | RP-130770  | 1613   | CR for 36.101 : Adding the definition of CA_NS_05 and CA_NS_06 for additional spurious emissions for CA   | 11.4.0   | 11.5.0  |
| 06-2013   | RP-60  | RP-130770  | 1619   | CR for introducing UE TM3 demodulation performance<br>requirements under high speed   | 11.4.0   | 11.5.0  |
| 06-2013   | RP-60  | RP-130765  | 1623   | Correction of test parameters for elCIC performance<br>requirements   | 11.4.0   | 11.5.0  |
| 06-2013   | RP-60  | RP-130765  | 1625   | Correction of test parameters for eICIC CSI requirements  | 11.4.0   | 11.5.0  |
| 06-2013   | RP-60  | RP-130765  | 1627   | Correction of resource allocation for the multiple PMI Cat 1 UE test  | 11.4.0   | 11.5.0  |
| 06-2013   | RP-60  | RP-130766  | 1629   | Removal of note 2 from band 28  | 11.4.0   | 11.5.0  |
| 06-2013   | RP-60  | RP-130770  | 1641   | Correction of the CSI-RS parameter configuration  | 11.4.0   | 11.5.0  |
| 06-2013   | RP-60  | RP-130770  | 1650r1   | Addition of Band 41 for intra-band non-contiguous CA for 36.101   | 11.4.0   | 11.5.0  |
| 06-2013<br>06-2013  | RP-60<br>RP-60   | RP-130770<br>RP-130765   | 1654r1<br>1656   | MPR for intra-band non-contiguous CA<br>Modification of configured output power to account for larger   | 11.4.0<br>11.4.0   | 11.5.0<br>11.5.0  |
| 06-2013   | RP-60  | RP-130769  | 1658r1   | tolerance<br>Missing symbols in the NS_15 table   | 11.4.0   | 11.5.0  |
| 06-2013   | RP-60  | RP-130766  | 1673   | Corrections to Rx requirements for inter-band CA configurations<br>with REFSENS exceptions  | 11.4.0   | 11.5.0  |
| 06-2013   | RP-60  | RP-130770  | 1681r1   | Correction for TS 36.101  | 11.4.0   | 11.5.0  |
| 06-2013   | RP-60  | RP-130763  | 1684   | RF: Corrections to RMC-s for sustained data rate test   | 11.4.0   | 11.5.0  |
| 06-2013   | RP-60  | RP-130770  | 1685   | Non-contiguous intraband CA channel spacing   | 11.4.0   | 11.5.0  |
| 06-2013   | RP-60  | RP-130766  | 1689   | Carrier aggregation in multi RAT and multiple band combination terminals  | 11.4.0   | 11.5.0  |
| 06-2013   | RP-60  | RP-130766  | 1691   | Completion of out-of-band blocking requirements for inter-band<br>CA with one UL  | 11.4.0   | 11.5.0  |
| 06-2013   | RP-60  | RP-130767  | 1695r1   | CR on the bandwidth coverage issue of CA demodulation performance (Rel-11)  | 11.4.0   | 11.5.0  |
| 06-2013   | RP-60  | RP-130765  | 1697   | Correction on UE maximum output power for intra-band CA (R11)   | 11.4.0   | 11.5.0  |
| 06-2013   | RP-60  | RP-130770  | 1698r1   | CR for introduction of FelCIC demodulation performance requirements   | 11.4.0   | 11.5.0  |
| 06-2013<br>06-2013  | RP-60<br>RP-60   | RP-130770<br>RP-130767   | 1701<br>1703   | Removing bracket from CA_11A-18A requirments<br>CR on the bandwidth coverage issue of CA CQI performance  | 11.4.0   | 11.5.0  |
| 06-2013   | RP-60  | RP-130767  | 1703   | (Rel-11)<br>Corrections to ACLR for Rel-11 CA   | 11.4.0   | 11.5.0<br>11.5.0  |
| 06-2013   | RP-60  | RP-130765  | 1705   | Corrections to NS_11 A-MPR Table  | 11.4.0   | 11.5.0  |
| 06-2013   | RP-60  | RP-130769  | 1717   | Corrections to NS_12 A-MPR Table  | 11.4.0   | 11.5.0  |
| 09-2013   | RP-61  | RP-131285  | 1731r1   | CR on performance requirements of CA soft buffer managemen (Rel-11)   | 11.5.0   | 11.6.0  |
| 09-2013   | RP-61  | RP-131281  | 1735   | CR on applicability of CA sustained data rate tests (Rel-11)  | 11.5.0   | 11.6.0  |
| 09-2013   | RP-61  | RP-131293  | 1738r1   | Performance requirement for UE under EVA200   | 11.5.0   | 11.6.0  |
| 09-2013   | RP-61  | RP-131290  | 1742r1   | CR for introduction of FeICIC PBCH performance requirement  | 11.5.0   | 11.6.0  |
| 09-2013   | RP-61  | RP-131290  | 1744r1   | CR for introduction of FeICIC RI reporting requirements   | 11.5.0   | 11.6.0  |
| 09-2013   | RP-61  | RP-131292  | 1746   | Beamforming model for EPDCCH test   | 11.5.0   | 11.6.0  |
| 09-2013<br>09-2013  | RP-61<br>RP-61   | RP-131285<br>RP-131285   | 1753r1<br>1754r1   | Introduction of performance requirements for verifying the receiver type for CSI-RS based advanced receivers (FDD/TDD) CR for 36.101 : Add the definition of 5+20MHz for spectrum   | 11.5.0   | 11.6.0<br>11.6.0  |
| 09-2013   | RP-61  | RP-131281  | 1766   | emission mask for CA<br>UE REFSENS when supporting intra-band CA and inter-band   | 11.5.0   | 11.6.0  |
| 09-2013   | RP-61  | RP-131279  | 1771   | CA<br>Correlation matrix for high speed train demodulation scenarios  | 11.5.0   | 11.6.0  |
| 09-2013   | RP-61  | RP-131279<br>RP-131280   | 1775   | (Rel-11)<br>Corrections to sustained data rate test (Rel-11)  | 11.5.0   | 11.6.0  |
| 09-2013   | RP-61  | RP-131280  | 1785r1   | CR for introduction of FelCIC CQI requirements  | 11.5.0   | 11.6.0  |
| 09-2013   | RP-61  | RP-131281  | 1793   | Clarification of multi-cluster transmission   | 11.5.0   | 11.6.0  |
| 09-2013   | RP-61  | RP-131293  | 1799r1   | CA UE Coexistence Table update (Release 11)   | 11.5.0   | 11.6.0  |
|   |  |  |  |   |  | -   |
| 09-2013   | RP-61  | RP-131302  | 1801   | Coexistence between Band 27 and Band 38 (Release 11)  | 11.5.0   | 11.6.0  |
| 09-2013   | RP-61<br>RP-61   | RP-131302<br>RP-131281   | 1806   | Coexistence between Band 27 and Band 38 (Release 11)<br>Incorrect REFSENS UL allocation for CA_1C   | 11.5.0   | 11.6.0  |
| 09-2013<br>09-2013  | RP-61<br>RP-61<br>RP-61  | RP-131302<br>RP-131281<br>RP-131281  | 1806<br>1810   | Coexistence between Band 27 and Band 38 (Release 11)<br>Incorrect REFSENS UL allocation for CA_1C<br>Contiguous intraband CA REFSENS with one UL  | 11.5.0<br>11.5.0   | 11.6.0<br>11.6.0  |
| 09-2013<br>09-2013<br>09-2013   | RP-61<br>RP-61<br>RP-61<br>RP-61   | RP-131302<br>RP-131281<br>RP-131281<br>RP-131293   | 1806<br>1810<br>1812r1   | Coexistence between Band 27 and Band 38 (Release 11)<br>Incorrect REFSENS UL allocation for CA_1C<br>Contiguous intraband CA REFSENS with one UL<br>Remianed Transmitter requirements for intra-band non-<br>contiguous CA  | 11.5.0<br>11.5.0<br>11.5.0   | 11.6.0<br>11.6.0<br>11.6.0  |
| 09-2013<br>09-2013<br>09-2013<br>09-2013  | RP-61<br>RP-61<br>RP-61<br>RP-61<br>RP-61  | RP-131302<br>RP-131281<br>RP-131281<br>RP-131293<br>RP-131281  | 1806<br>1810<br>1812r1<br>1816   | Coexistence between Band 27 and Band 38 (Release 11)<br>Incorrect REFSENS UL allocation for CA_1C<br>Contiguous intraband CA REFSENS with one UL<br>Remianed Transmitter requirements for intra-band non-<br>contiguous CA<br>Correction to Rel-11 A-MPR for CA_NS_04   | 11.5.0<br>11.5.0<br>11.5.0<br>11.5.0   | 11.6.0<br>11.6.0<br>11.6.0<br>11.6.0  |
| 09-2013<br>09-2013<br>09-2013<br>09-2013<br>09-2013   | RP-61<br>RP-61<br>RP-61<br>RP-61<br>RP-61<br>RP-61                                     | RP-131302<br>RP-131281<br>RP-131281<br>RP-131293<br>RP-131281<br>RP-131281   | 1806<br>1810<br>1812r1<br>1816<br>1820   | Coexistence between Band 27 and Band 38 (Release 11)<br>Incorrect REFSENS UL allocation for CA_1C<br>Contiguous intraband CA REFSENS with one UL<br>Remianed Transmitter requirements for intra-band non-<br>contiguous CA<br>Correction to Rel-11 A-MPR for CA_NS_04<br>The Pcmax clauses restructured   | 11.5.0<br>11.5.0<br>11.5.0<br>11.5.0<br>11.5.0   | 11.6.0<br>11.6.0<br>11.6.0<br>11.6.0<br>11.6.0  |
| 09-2013<br>09-2013<br>09-2013<br>09-2013  | RP-61<br>RP-61<br>RP-61<br>RP-61<br>RP-61  | RP-131302<br>RP-131281<br>RP-131281<br>RP-131293<br>RP-131281  | 1806<br>1810<br>1812r1<br>1816   | Coexistence between Band 27 and Band 38 (Release 11)         Incorrect REFSENS UL allocation for CA_1C         Contiguous intraband CA REFSENS with one UL         Remianed Transmitter requirements for intra-band non-contiguous CA         Correction to Rel-11 A-MPR for CA_NS_04         The Pcmax clauses restructured         MPR for intra-band non-contiguous CA         Corrections to the notes in the band UE co-existence  | 11.5.0<br>11.5.0<br>11.5.0<br>11.5.0   | 11.6.0<br>11.6.0<br>11.6.0<br>11.6.0  |
| 09-2013<br>09-2013<br>09-2013<br>09-2013<br>09-2013<br>09-2013<br>12-2013                       | RP-61<br>RP-61<br>RP-61<br>RP-61<br>RP-61<br>RP-61<br>RP-62                            | RP-131302<br>RP-131281<br>RP-131281<br>RP-131293<br>RP-131281<br>RP-131281<br>RP-131285<br>RP-131928                           | 1806<br>1810<br>1812r1<br>1816<br>1820<br>1830<br>1846r1                           | Coexistence between Band 27 and Band 38 (Release 11)<br>Incorrect REFSENS UL allocation for CA_1C<br>Contiguous intraband CA REFSENS with one UL<br>Remianed Transmitter requirements for intra-band non-<br>contiguous CA<br>Correction to Rel-11 A-MPR for CA_NS_04<br>The Pcmax clauses restructured<br>MPR for intra-band non-contiguous CA<br>Corrections to the notes in the band UE co-existence<br>requirements table (Rel-11)  | 11.5.0         11.5.0         11.5.0         11.5.0         11.5.0         11.5.0         11.5.0         11.5.0         11.5.0   | 11.6.0         11.6.0         11.6.0         11.6.0         11.6.0         11.6.0         11.7.0  |
| 09-2013<br>09-2013<br>09-2013<br>09-2013<br>09-2013<br>09-2013                                  | RP-61<br>RP-61<br>RP-61<br>RP-61<br>RP-61<br>RP-61                                     | RP-131302<br>RP-131281<br>RP-131281<br>RP-131293<br>RP-131281<br>RP-131281<br>RP-131285  | 1806<br>1810<br>1812r1<br>1816<br>1820<br>1830                                     | Coexistence between Band 27 and Band 38 (Release 11)<br>Incorrect REFSENS UL allocation for CA_1C<br>Contiguous intraband CA REFSENS with one UL<br>Remianed Transmitter requirements for intra-band non-<br>contiguous CA<br>Correction to Rel-11 A-MPR for CA_NS_04<br>The Pcmax clauses restructured<br>MPR for intra-band non-contiguous CA<br>Corrections to the notes in the band UE co-existence<br>requirements table (Rel-11)<br>Clean-up of uplink reference measurement channels (Rel-11)<br>Introduction of test 1-A for CoMP                       | 11.5.0<br>11.5.0<br>11.5.0<br>11.5.0<br>11.5.0<br>11.5.0   | 11.6.0<br>11.6.0<br>11.6.0<br>11.6.0<br>11.6.0<br>11.6.0  |
| 09-2013<br>09-2013<br>09-2013<br>09-2013<br>09-2013<br>09-2013<br>12-2013<br>12-2013<br>12-2013 | RP-61<br>RP-61<br>RP-61<br>RP-61<br>RP-61<br>RP-61<br>RP-62<br>RP-62<br>RP-62<br>RP-62 | RP-131302<br>RP-131281<br>RP-131281<br>RP-131293<br>RP-131281<br>RP-131281<br>RP-131285<br>RP-131928<br>RP-131924              | 1806<br>1810<br>1812r1<br>1816<br>1820<br>1830<br>1846r1<br>1851<br>1853r2<br>1866 | Coexistence between Band 27 and Band 38 (Release 11)<br>Incorrect REFSENS UL allocation for CA_1C<br>Contiguous intraband CA REFSENS with one UL<br>Remianed Transmitter requirements for intra-band non-<br>contiguous CA<br>Correction to Rel-11 A-MPR for CA_NS_04<br>The Pcmax clauses restructured<br>MPR for intra-band non-contiguous CA<br>Corrections to the notes in the band UE co-existence<br>requirements table (Rel-11)<br>Clean-up of uplink reference measurement channels (Rel-11)<br>Introduction of test 1-A for CoMP<br>CA_NS_05 Emissions | 11.5.0           11.5.0           11.5.0           11.5.0           11.5.0           11.5.0           11.5.0           11.5.0           11.5.0           11.5.0           11.5.0           11.5.0           11.6.0           11.6.0           11.6.0 | 11.6.0           11.6.0           11.6.0           11.6.0           11.6.0           11.6.0           11.6.0           11.7.0           11.7.0           11.7.0 |
| 09-2013<br>09-2013<br>09-2013<br>09-2013<br>09-2013<br>09-2013<br>12-2013<br>12-2013<br>12-2013 | RP-61<br>RP-61<br>RP-61<br>RP-61<br>RP-61<br>RP-61<br>RP-62<br>RP-62<br>RP-62          | RP-131302<br>RP-131281<br>RP-131281<br>RP-131293<br>RP-131281<br>RP-131281<br>RP-131285<br>RP-131928<br>RP-131924<br>RP-131937 | 1806<br>1810<br>1812r1<br>1816<br>1820<br>1830<br>1846r1<br>1851<br>1853r2         | Coexistence between Band 27 and Band 38 (Release 11)<br>Incorrect REFSENS UL allocation for CA_1C<br>Contiguous intraband CA REFSENS with one UL<br>Remianed Transmitter requirements for intra-band non-<br>contiguous CA<br>Correction to Rel-11 A-MPR for CA_NS_04<br>The Pcmax clauses restructured<br>MPR for intra-band non-contiguous CA<br>Corrections to the notes in the band UE co-existence<br>requirements table (Rel-11)<br>Clean-up of uplink reference measurement channels (Rel-11)<br>Introduction of test 1-A for CoMP                       | 11.5.0           11.5.0           11.5.0           11.5.0           11.5.0           11.5.0           11.5.0           11.5.0           11.5.0           11.5.0           11.5.0           11.5.0           11.6.0           11.6.0                  | 11.6.0           11.6.0           11.6.0           11.6.0           11.6.0           11.6.0           11.7.0           11.7.0                                   |

| 12-2013         RP-62         RP-131939         1886         CR on correction of test configurations of CA soft buffer tests         11.6.0         1           12-2013         RP-62         RP-131939         1888         CR on on test configurations of CA soft buffer tests         11.6.0         1           12-2013         RP-62         RP-131936         18991         CR on R TepOring equirement         11.6.0         1           12-2013         RP-62         RP-131938         189963         CR on R TepOring equirement         11.6.0         1           12-2013         RP-62         RP-131938         19900         Demains guirement         11.6.0         1           12-2013         RP-62         RP-131938         19900         Centrection on the User for EPDCCH test         11.6.0         1           12-2013         RP-62         RP-131936         19902         Linorduce tright State for FeICC PDSCH         11.6.0         1           12-2013         RP-62         RP-131937         19810         UB-tric demasteria for Audition         11.6.0         1           12-2013         RP-62         RP-131937         19841         UB-tric demasteria for Audition of Audition for Audition         11.6.0         1           12-2013         RP-62         RP-131937         <   |         |        |           |        | CSI-RS resources)   |        | 1      |
|--|---------|--------|-----------|--------|---|--------|--------|
| Throughput for CA         Throughput for CA           12:013         RP-62         RP-131936         1888         Ch on carrection of test configurations of CA soft buffer tests         11.6.0           12:013         RP-62         RP-131936         1894d         Ch on FalCC PECIC demodulation performance requirement         11.6.0           12:013         RP-62         RP-131936         1894d         Ch on R1 reporting requences         11.6.0         1           12:013         RP-62         RP-131936         1990         Correction on the UE category for eICC COI test         11.6.0         1           12:2013         RP-62         RP-131936         1995C         Correction on the UE category for eICC COI test         11.6.0         1           12:2013         RP-62         RP-131936         1955C         Moved pover reductions for multiple transmissions in a         11.6.0         1           12:2013         RP-62         RP-131937         19341         Ch rescuesting COI and rescuesting of the Coi And rescuesting COI and rescue test         11.6.0         1           12:2013         RP-62         RP-131937         19344  | 12-2013 | RP-62  | RP-131030 | 1886   |   | 1160   | 11.7.0 |
| 12_2013         RP-62         RP-131939         1888         CR on correction of test configurations of CA soft buffer tests         11.6.0         1           12_2013         RP-62         RP-131936         18941. GK to FeICC Genochalation performance requirement         11.6.0         1           12_2013         RP-62         RP-131936         18961. GK on Reporting requirement         11.6.0         1           12_2013         RP-62         RP-131936         18960. GK on Reporting requirement         11.6.0         1           12_2013         RP-62         RP-131926         1900. Downlink physical actu of CCP/H localized test         11.6.0         1           12_2013         RP-62         RP-131926         1900. Downlink physical actu of CCP/H localized test         11.6.0         1           12_2013         RP-62         RP-131926         1900. Downlink physical actu of CCP/H localized test         11.6.0         1           12_2013         RP-62         RP-131927         19331. CK no correction of RPC op ownlinablance test         11.6.0         1           12_2013         RP-62         RP-131927         19392. CK no correction of RPC op ownlinablance test         11.6.0         1           12_2013         RP-62         RP-131931         1980. CK performance requirements for TDD inta-band NC CA         11.6.0 <td>12-2013</td> <td>111-02</td> <td>11-131333</td> <td>1000</td> <td></td> <td>11.0.0</td> <td>11.7.0</td>   | 12-2013 | 111-02 | 11-131333 | 1000   |   | 11.0.0 | 11.7.0 |
| 122013         RP-62         RP-13936         18943         CR on FeICIC PROLE demodulation performance requirements         11.6.0           122013         RP-62         RP-13936         1896         CR on R1 requirement         11.6.0         1           122013         RP-62         RP-131936         1898         Beamforming model for FPOCCH tealized test         11.6.0         1           122013         RP-62         RP-131938         1900         Downlink physical setup for EPOCCH test         11.6.0         1           122013         RP-62         RP-131928         19052         Cr from recover type verification test of CS-R5 based advanced         11.6.0         1           122013         RP-62         RP-131928         19252         Introduce high SNR TM3 test for FeICIC PDSCH         11.6.0         1           122013         RP-62         RP-131927         1936         U-UE coexistence of Rand 40         116.0         1           122013         RP-62         RP-131937         1936         U-UE coexistence of Rand 40         116.0         1           122013         RP-62         RP-131937         1946         CR Maintropic CS-R5 second         16.0         1           122013         RP-62         RP-131938         19671         Introduce high SMR 10   | 12-2013 | RP-62  | RP-131939 | 1888   |   | 11.6.0 | 11.7.0 |
| 12:2013         RP-62         RP-131936         1886/3         C on RI regoring requirement         11.6.0         1           12:2013         RP-62         RP-131938         1898         Deaming myscale setup for EPDCCH localized test         11.6.0         1           12:2013         RP-62         RP-131938         1900         Downink physcale setup for EPDCCH localized test         11.6.0         1           12:2013         RP-62         RP-131926         1915/2         Allowed power reductions for multiple transmissions in a         11.6.0         1           12:2013         RP-62         RP-131926         195/2         Introduce high SNR TM3 test for FaCIC PDSCH         11.6.0         1           12:2013         RP-62         RP-131927         19360         UE-UE coasistence for Band 40         11.6.0         1           12:2013         RP-62         RP-131927         1939/2         C Re Introduce for GMP (FDD)         11.6.0         1           12:2013         RP-62         RP-131937         194/4         C R enoremetion requirement two Different Coll 10 and Colliding 11.6.0         1           12:2013         RP-62         RP-131937         194/2         C RN initrim requirement two Different Coll 10 and Colliding 11.6.0         1           12:2013         RP-62         RP-1  |         |        |           |        |   |        | 11.7.0 |
| 12 2013         RP-62         RP-131936         16.0         1           12 2013         RP-62         RP-131938         1980         Dewnlink physical setup for EPDCCH test         11.6.0         1           12 2013         RP-62         RP-131938         1900         Downlink physical setup for EPDCCH test         11.6.0         1           12 2013         RP-62         RP-131931         1005         CR for receiver type verification test of CSI-RS based advanced         11.6.0         1           12 2013         RP-62         RP-131927         10361         Introduce high SNR TM3 test for FaCIC PDSCH         11.6.0         1           12 2013         RP-62         RP-131927         19362         Introduce high SNR TM3 test for FaCIC PDSCH         11.6.0         1           12 2013         RP-62         RP-131937         19362         CR to introduce fading OL test for CMP FDD         11.6.0         1           12 2013         RP-62         RP-131937         19362         CR to introduce fading oL test for FACIC PDSCH         11.6.0         1           12 2013         RP-62         RP-131937         19362         CR to introduce fading oL test for FACIC PDSCH         11.6.0         1           12 2013         RP-62         RP-1319383         19071         Introdu  |         |        |           |        |   |        | 11.7.0 |
| 12:2013         RP-62         RP-131338         1900         Downink physical subg for EPDCCH localized test         11.6.0           12:2013         RP-62         RP-131928         1900         Correction on the UE category for eICIC COI test         11.6.0           12:2013         RP-62         RP-131928         1905         Correction on the UE category for eICIC COI test         11.6.0           12:2013         RP-62         RP-131926         Test of the test of CSIRS based dynamed         11.6.0           12:2013         RP-62         RP-131927         19366         CE on correction of FR CG force imbalance test         11.6.0           12:2013         RP-62         RP-131927         19366         UE-UE coexistence for Band 40         11.6.0           12:2013         RP-62         RP-131927         19364         CE Natimizement with Direct Col 10 and Colliding         11.6.0           12:2013         RP-62         RP-131937         19942         CR Is introduce anguirement with Direct Col 10 and Colliding         11.6.0           12:2013         RP-62         RP-131937         19942         CR Is introduce anguirement with Direct Col 10 and Colliding         11.6.0         1           12:2013         RP-62         RP-131939         19611         Introduction of UE MA denoulation performance requirement with Direct Land N   |         |        |           |        |   |        | 11.7.0 |
| 12-2013         RP-62         RP-131938         1900         Downlink physical setup for EPDCCH test         11.6.0         1           12-2013         RP-62         RP-131931         1905         CR for receiver type verification test of CSLRS based advanced         11.6.0         1           12-2013         RP-62         RP-131921         1915/c         Allowed power reductions for multiple transmissions in a         11.6.0         1           12-2013         RP-62         RP-131927         1936/c         CR on correction of RE of power muslance test         11.6.0         1           12-2013         RP-62         RP-131927         1936/c         CR on correction of RE of power muslance test         11.6.0         1           12-2013         RP-62         RP-131937         1936/c         CR on correction of RE of power muslance test         11.6.0         1           12-2013         RP-62         RP-131937         194/c         CR momong Addition of ATc to PMPE         11.6.0         1           12-2013         RP-62         RP-131937         194/c         CR momong Addition of ATc to PMPE         11.6.0         1           12-2013         RP-62         RP-131937         194/c         CR momong Addition of ATc to PMPE         11.6.0         1           12-2013         RP-   |         |        |           |        |   |        | 11.7.0 |
| 12:2013         RP-62         RP-131926         1903         Correction on the UE category for EICIC CDI test         116.0           12:2013         RP-62         RP-131931         1905         CR for receiver py evenfication test of CSI-RS based advanced<br>receivers (ReI-11)           12:2013         RP-62         RP-131936         1925/2         116.0         1           12:2013         RP-62         RP-131927         13331         CR or orceiver of advance for Band 40         116.0         1           12:2013         RP-62         RP-131927         13331         CR or correction of FRC dp over imbalance test         116.0         1           12:2013         RP-62         RP-131937         1844         CR for timoduce ladition of ATc to PAMR         116.0         1           12:2013         RP-62         RP-131937         1954/2         CR for timoduce ladition of ATc to PAMR         116.0         1           12:2013         RP-62         RP-131938         1969         CoR just marked VZ CSLR8 issuade)         16.0         1         16.0         1           12:2013         RP-62         RP-131938         1963         COReceiver MW CDI States         16.0         1         16.0         1         16.0         1         16.0         1         1         16.0   |         |        |           |        |   |        | 11.7.0 |
| 12-2013         RP-62         RP-131931         1905         CR for receivers (Rel-11)         116.0         1           12-2013         RP-62         RP-131928         1915/2         Allowed power reductions for multiple transmissions in a subframe         116.0         1           12-2013         RP-62         RP-131936         1252/2         Introduce high SNR TM stept for FGCI CPDSCH         116.0         1           12-2013         RP-62         RP-131927         19331         CG no correction of FR Gd power imbalance test         116.0         1           12-2013         RP-62         RP-131927         19342         CR no introduce fading COI test for CoMP (FDD)         116.0         1           12-2013         RP-62         RP-131937         19460         CRR for introduce fading COI test for CoMP (FDD)         116.0         1           12-2013         RP-62         RP-131931         1960         CAR patriamement with Dip intrabano NC CA         116.0         1           12-2013         RP-62         RP-131938         19611         Introduction of test no for CoMP TDD         116.0         1           12-2013         RP-62         RP-131938         19671         Introduction of test 1-A for CoMP TDD         116.0         1           12-2013         RP-62  |         |        |           |        |   |        | 11.7.0 |
| receivers (ReI-11)         receivers (ReI-11)         receivers (ReI-11)           12-2013         RP-62         RP-131926         119522         Allowed power reductions for multiple transmissions in a subframe           12-2013         RP-62         RP-131927         193911         CR on correction of FRC of power imbalance test         11.6.0         1           12-2013         RP-62         RP-131927         193912         CR no correction of FRC of power imbalance test         11.6.0         1           12-2013         RP-62         RP-131937         19542         CR Removing Addition of A1 to PAMPR         11.6.0         1           12-2013         RP-62         RP-131937         19542         CR Romoving MeZ/D SIR Sequence         11.6.0         1           12-2013         RP-62         RP-1319381         19601         CA pathermatic requirements for TDD Intra-band NC CA         11.6.0         1           12-2013         RP-62         RP-1319381         196611         Introduction of UE TM3 demodulation performance requirements         11.6.0         1           12-2013         RP-62         RP-131939         196711         Introduction of UE TM3 demodulation performance requirements         11.6.0         1           12-2013         RP-62         RP-1319393         196711         Introduction  |         |        |           |        | CR for receiver type verification test of CSI-RS based advanced |        | 11.7.0 |
| subframe         subframe         subframe           12-2013         RP-62         RP-131936         1125201         Introduce high SNR TM3 test for FeICIC PDSCH         11.6.0         1           12-2013         RP-62         RP-131937         193912         CR to correction of FRC of power imbalance test         11.6.0         1           12-2013         RP-62         RP-131937         193912         CR to Introduce fading COI test for CoMP (FDD)         11.6.0         1           12-2013         RP-62         RP-131937         195442         CR Removing IPL/PC SIRS For Source)         11.6.0         1           12-2013         RP-62         RP-131936         196611         Introduction of reference SNR- so for FeICIC demodulation         11.6.0         1           12-2013         RP-62         RP-131938         196671         Introduction of TM9 test to verify correct SNR estimation         11.6.0         1           12-2013         RP-62         RP-131939         196711         Introduction of TM9 test to verify correct SNR estimation         11.6.0         1           12-2013         RP-62         RP-131939         19671         Introduction of Social gregulements and use of AR  |         |        |           |        |   |        |        |
| 12:2013         RP-62         RP-131936         1929/27         193371         CR on correction of FRC of pover imbalance test         11.6.0         1           12:2013         RP-62         RP-131927         19336         UE-UE coexistence for Band 40         11.6.0         1           12:2013         RP-62         RP-131937         19396         UE-UE coexistence for Band 40         11.6.0         1           12:2013         RP-62         RP-131937         19444         CR Removing Addition of ATC to P-MPR         11.6.0         1           12:2013         RP-62         RP-131937         19644         CR Removing Addition of ATC to P-MPR         11.6.0         1           12:2013         RP-62         RP-131938         19667         CA performance requirements for TDD intra-band NC CA         11.6.0         1           12:2013         RP-62         RP-131938         19671         Introduction of UE TM3 demodulation performance requirements         11.6.0         1           12:2013         RP-62         RP-131938         19671         Introduction of UE TM3 demodulation performance requirements         11.6.0         1           12:2013         RP-62         RP-131937         199671         Correction to blocking requirements and use of Afa_0         11.6.0         1         1   | 12-2013 | RP-62  | RP-131928 | 1915r2 | Allowed power reductions for multiple transmissions in a        | 11.6.0 | 11.7.0 |
| 12:2013         RP-62         RP-131927         1936         UE-UE coexistence for Band 40         11.6.0         1           12:2013         RP-62         RP-131937         1939µ2         CR to Introduce fading COI test for CoMP (FDD)         11.6.0         1           12:2013         RP-62         RP-131937         1934µ2         CR Removing (Addition 47 to EP MAPR         11.6.0         1           12:2013         RP-62         RP-131937         1954µ2         CR Minimum requirement with Different Cell ID and Colliding         11.6.0         1           12:2013         RP-62         RP-131938         19601         CA performance requirements for TDD Intra-band NC CA         11.6.0         1           12:2013         RP-62         RP-131938         19661         Introduction of TM9 test to verify corred SNR estimation         11.6.0         1           12:2013         RP-62         RP-131937         196911         Introduction of TM9 test to verify corred SNR estimation         11.6.0         1           12:2013         RP-62         RP-131937         196911         Correction to blocking requirements and use of AR <sub>in</sub> 11.6.0         1           12:2013         RP-62         RP-131937         196911         Correction to blocking requirements and use of AR <sub>in</sub> 11.6.0         1  |         |        |           |        |   |        |        |
| 12:2013         RP-62         RP-131927         1936         UE-UE coexistence for Band 40         11.6.0         1           12:2013         RP-62         RP-131937         19392         CR to Introduce fading COL test for CoMP (FDD)         11.6.0         1           12:2013         RP-62         RP-131937         1944         CR Removing Addition of ATc to P-MPR         11.6.0         1           12:2013         RP-62         RP-131937         1954/2         CR Minimu requirement with Different Cell ID and Colliding         11.6.0         1           12:2013         RP-62         RP-131938         19671         Introduction of referance SNR-s for FeICIC demodulation         11.6.0         1           12:2013         RP-62         RP-131939         19671         Introduction of test 1-4 for CoMP TDD         11.6.0         1           12:2013         RP-62         RP-131939         19671         Introduction of test 1-4 for CoMP TDD         11.6.0         1           12:2013         RP-62         RP-131937         199671         Correction to blocking requirements and use of ARa         11.6.0         1           12:2013         RP-62         RP-131937         199871         Correction to blocking requirements and use of ARa         11.6.0         1           12:2013         <   | 12-2013 | RP-62  | RP-131936 | 1925r2 | Introduce high SNR TM3 test for FeICIC PDSCH                    | 11.6.0 | 11.7.0 |
| 12:2013         RP-62         RP-131937         1939r.2         CR to Introduce fading COI test for CoMP (FDD)         11.6.0         1           12:2013         RP-62         RP-131937         1954r.2         CR Minimum requirement with Different Cell ID and Colliding         11.6.0         1           12:2013         RP-62         RP-131937         1954r.2         CR Minimum requirements for TDD intra-band NC CA         11.6.0         1           12:2013         RP-62         RP-131938         1963         OCNG pattern for EPDCCH test         11.6.0         1           12:2013         RP-62         RP-131938         1963         OCNG pattern for EPDCCH test         11.6.0         1           12:2013         RP-62         RP-131938         1967r.1         Introduction of TMB test overly correct SNR estimation         11.6.0         1           12:2013         RP-62         RP-131939         1971.1         CR oneto to biocking requirements and use of AR <sub>a</sub> 11.6.0         1           12:2013         RP-62         RP-131937         1993r1         CR on Introduce channel model for CAMP ftoDID         11.6.0         1           12:2013         RP-62         RP-131937         1993r1         CR to Introduce channel model for CAMP ftoDID         11.6.0         1           12:2013 </td <td></td> <td>RP-62</td> <td>RP-131927</td> <td>1933r1</td> <td>CR on correction of FRC of power imbalance test</td> <td></td> <td>11.7.0</td>  |         | RP-62  | RP-131927 | 1933r1 | CR on correction of FRC of power imbalance test                 |        | 11.7.0 |
| 12-2013         RP-62         RP-131927         1944         CR Removing Addition of ΔTc to P-MPR         11.6.0         1           12-2013         RP-62         RP-131937         1964/2         CR Minimur requirement with Different Cell ID and Colliding         11.6.0         1           12-2013         RP-62         RP-131937         1965/1         Introduction of reference SNR-s for FeICIC demodulation         11.6.0         1           12-2013         RP-62         RP-131937         1969/1         Introduction of test 1-A for CoMP TDD         11.6.0         1           12-2013         RP-62         RP-131937         1969/1         Introduction of test 1-A for CoMP TDD         11.6.0         1           12-2013         RP-62         RP-131937         1969/1         Introduction of test 1-A for CoMP TDD         11.6.0         1           12-2013         RP-62         RP-131937         1969/1         Correction to blocking requirements and use of AR_s         116.0         1           12-2013         RP-62         RP-131937         1969/1         CR to introduce drang Col test for CoMP (TDD)         11.6.0         1           12-2013         RP-62         RP-131937         1969/1         CR to introduce drang Col test for CoMP (TDD)         11.6.0         1           12-2013  |         | RP-62  |           | 1936   | UE-UE coexistence for Band 40                                   | 11.6.0 | 11.7.0 |
| 12:2013         RP-62         RP-131937         1954/2         CR Minimum requirement with Different Cell ID and Coliding         11.6.0         1           12:2013         RP-62         RP-131931         1960         CA performance requirements for TDD intra-band NC CA         11.6.0         1           12:2013         RP-62         RP-131936         19611         Introduction of reference SNRs for FeICIC demodulation         11.6.0         1           12:2013         RP-62         RP-131938         1963         OCNG pattern for EPDCCH test         11.6.0         1           12:2013         RP-62         RP-131937         1969/1         Introduction of TM9 test perify correct SNR estimation         11.6.0         1           12:2013         RP-62         RP-131939         1937.1         CR orection to blocking requirements and use of AR <sub>a</sub> 11.6.0         1           12:2013         RP-62         RP-131937         1993.1         CR orection to blocking requirements and use of AR <sub>a</sub> 11.6.0         1           12:2013         RP-62         RP-131937         1993.1         CR orection requirement for CA Mergodualian test         11.6.0         1           12:2013         RP-62         RP-131937         1996.7         CR to Introduce channel model for CAMF Eding COI test is 16.0         1  | 12-2013 | RP-62  | RP-131937 | 1939r2 | CR to Introduce fading CQI test for CoMP (FDD)                  | 11.6.0 | 11.7.0 |
| CR8 (with single NZP CSI-RS resource)         116.0           12:2013         RP-62         RP-131931         1960         CA performance requirements for TDD Intra-band NC CA         11.6.0         1           12:2013         RP-62         RP-131936         19611         Introduction of referance SNRs for FeICIC demodulation         11.6.0         1           12:2013         RP-62         RP-131937         196971         Introduction of UE TM3 demodulation performance requirements           12:2013         RP-62         RP-131937         196971         Introduction of test 1-A for CoMP TDD         11.6.0         1           12:2013         RP-62         RP-131937         196971         Correction to Ibocking requirements and use of Ana         11.6.0         1           12:2013         RP-62         RP-131937         196971         Correction to Ibocking requirements and use of Ana         11.6.0         1           12:2013         RP-62         RP-131937         199871         CR no Intrabude change Cole Method Ibocking requirements         11.6.0         1           12:2013         RP-62         RP-131937         199871         CR no Intrabude change Cole Method Ibocking requirements         11.6.0         1           12:2013         RP-62         RP-131937         199871         CR no Intrabude ColMP (TDD   |         |        |           |        |   |        | 11.7.0 |
| 12-2013         RP-42         RP-131931         1960         CA performance requirements for TDD intra-band NC CA         11.6.0         1           12-2013         RP-62         RP-131938         1961r1         Introduction of reference SNR-s for FeICIC demodulation         11.6.0         1           12-2013         RP-62         RP-131938         1967r1         Introduction of UE TM3 demodulation performance requirements         11.6.0         1           12-2013         RP-62         RP-131937         1969r1         Introduction of tMI test to verify correct SNR estimation         11.6.0         1           12-2013         RP-62         RP-131938         1983r1         Correction to blocking requirements and use of AR <sub>a</sub> 11.6.0         1           12-2013         RP-62         RP-131937         1983r1         CR on test point clarification for CA demodulation test         11.6.0         1           12-2013         RP-62         RP-131937         1993r1         CR to Introduce faing CO Lest for CoMP (TDD)         11.6.0         1           12-2013         RP-62         RP-131937         1995r1         CR to Introduce faing CO Lest for CoMP (TDD)         11.6.0         1           12-2013         RP-62         RP-131937         1999r1         CR to Introduce RI test CO Lest COMP (TDD)         11.6.0  | 12-2013 | RP-62  | RP-131937 | 1954r2 |   | 11.6.0 | 11.7.0 |
| 12-2013         RP-62         RP-131936         1961r1         Introduction of reference SNR-5 for FeICIC demodulation         11.6.0         1           12-2013         RP-62         RP-131939         1963         OCNG pattern for EPDCCH test         11.6.0         1           12-2013         RP-62         RP-131939         1967r1         Introduction of UE TM3 demodulation performance requirements         11.6.0         1           12-2013         RP-62         RP-131939         1967r1         Correction to blocking requirements and use of Ag <sub>m</sub> 11.6.0         1           12-2013         RP-62         RP-131939         1987r1         CR not introduce fading CQI test for CoMP (TDD)         11.6.0         1           12-2013         RP-62         RP-131937         1998r1         CR to Introduce channel model for CoMP (TDD)         11.6.0         1           12-2013         RP-62         RP-131937         1997r1         CR to Introduce channel model for CoMP (TDD)         11.6.0         1           12-2013         RP-62         RP-131938         2000r1         Distributed EPDCCH Demodulation Test         11.6.0         1           12-2013         RP-62         RP-131937         2006r1         Introduction of DL CoMP TDD static CQI test         11.6.0         1           12-20  |         |        |           |        | CRS (with single NZP CSI-RS resource)                           |        |        |
| Image: Constraint of the |         |        |           |        |   |        | 11.7.0 |
| 12:2013         RP-62         RP-131938         1963         OCNG pattern for EPDCCH test         11.6.0         1           12:2013         RP-62         RP-131939         19671         Introduction of UE TM3 demodulation performance requirements         11.6.0         1           12:2013         RP-62         RP-131939         19871         Correction of test 1.4 for CoMP TDD         11.6.0         1           12:2013         RP-62         RP-131928         19871         C correction to blocking requirements and use of AR <sub>10</sub> 11.6.0         1           12:2013         RP-62         RP-131937         199571         C R to introduce channel modulation for CA demodulation test         11.6.0         1           12:2013         RP-62         RP-131937         19957         C R to introduce channel model for CoMP fading CQL test         11.6.0         1           12:2013         RP-62         RP-131937         19957         C R to introduce channel model for CoMP fading CQL test         11.6.0         1           12:2013         RP-62         RP-131938         200071         Distributed EPDCCH bemodulation Test         11.6.0         1           12:2013         RP-62         RP-131938         200071         Introduction of DL CoMP TDD static CQL test         11.6.0         1   | 12-2013 | RP-62  | RP-131936 | 1961r1 |   | 11.6.0 | 11.7.0 |
| 12:2013         RP-62         RP-131939         1967r1         Introduction of UE TM3 demodulation performance requirements<br>under ETU300         11.6.0         1           12:2013         RP-62         RP-131937         1960r1         Introduction of TM9 test to verify correct SNR estimation         11.6.0         1           12:2013         RP-62         RP-131939         1971         Correction to blocking requirements and use of AR <sub>m</sub> 11.6.0         1           12:2013         RP-62         RP-131937         1995r1         CR to Introduce channel model for CoMP fdm0 test         11.6.0         1           12:2013         RP-62         RP-131937         1995r1         CR to Introduce Channel model for CoMP fdm2 CoHP for CoMP fdm2 CoHP for PD         11.6.0         1           12:2013         RP-62         RP-131937         1997r1         CR to Introduce Channel model for CoMP fdm2 CoHP for PD         11.6.0         1           12:2013         RP-62         RP-131938         2002r1         Introduce TeDPCCH Demodulation Test         11.6.0         1           12:2013         RP-62         RP-131938         2006r1         Introduction of DL CoMP FDD static COI test         11.6.0         1           12:2013         RP-62         RP-131937         2006r1         Introduction of DL CoMP FDD static COI test   |         |        |           |        |   |        |        |
| under ETU300         under ETU300           12:2013         RP-62         RP-131937         19671         Introduction of test 1-A for CoMP TDD         11.6.0         11           12:2013         RP-62         RP-131938         19831         Correction to blocking requirements and use of ARm         11.6.0         11           12:2013         RP-62         RP-131938         198371         CR to Introduce fading CQI test for CoMP (FDD)         11.6.0         11           12:2013         RP-62         RP-131937         199971         CR to Introduce fading CQI test for CoMP (FDD)         11.6.0         11           12:2013         RP-62         RP-131938         200071         Distributed EPDCCH Demodulation Test         11.6.0         11           12:2013         RP-62         RP-131938         200071         Distributed EPDCCH Demodulation Test         11.6.0         11           12:2013         RP-62         RP-131938         200471         Reference Measurement Channels for EPDCCH         11.6.0         11           12:2013         RP-62         RP-131937         2006r1         Introduction of DL CoMP TDD static CQI test         11.6.0         11           12:2013         RP-62         RP-131937         2004r1         Introduction of DL CoMP TDD static CQI test         11.6.0   |         |        |           |        | OCNG pattern for EPDCCH test                                    |        | 11.7.0 |
| 12:2013         RP-62         RP-131937         1969r1         Introduction of TMs test to verify cornect SNR estimation         11.6.0         1           12:2013         RP-62         RP-131939         1987r1         Correction to blocking requirements and use of ΔR <sub>IB</sub> 11.6.0         1           12:2013         RP-62         RP-131937         1993r1         CR to introduce fading CQI test for COMP (TDD)         11.6.0         1           12:2013         RP-62         RP-131937         1995r1         CR to introduce channel model for COMP (TDD)         11.6.0         1           12:2013         RP-62         RP-131937         1999r1         CR to introduce channel model for COMP fdmg CQI tests         11.6.0         1           12:2013         RP-62         RP-131938         2002r1         CR to introduce R test to rcMP (FDD)         11.6.0         1           12:2013         RP-62         RP-131938         2002r1         Localized EPDCCH Demodulation Test         11.6.0         1           12:2013         RP-62         RP-131937         2006r1         introduction of DL CoMP FDD static CQI test         11.6.0         1           12:2013         RP-62         RP-131937         2006r1         introduction of DL CoMP FDD static CQI test         11.6.0         1           12   | 12-2013 | RP-62  | RP-131939 | 1967r1 |   | 11.6.0 | 11.7.0 |
| 12:2013         RP-62         RP-131939         1971         Modification of TMB test to verify correct SNR estimation         11.6.0         1           12:2013         RP-62         RP-131939         1987r1         CR on test point clarification for CA demodulation test         11.6.0         1           12:2013         RP-62         RP-131937         1993r1         CR to Introduce fading CQI test for CoMP fading CQI tests         11.6.0         1           12:2013         RP-62         RP-131937         1993r1         CR to Introduce Annel model for CoMP fading CQI tests         11.6.0         1           12:2013         RP-62         RP-131938         2000r1         Distributed EPDCCH Demodulation Test         11.6.0         1           12:2013         RP-62         RP-131938         2000r1         Distributed EPDCCH Demodulation Test         11.6.0         1           12:2013         RP-62         RP-131938         2004r1         Reference Measurement Channels for EPDCCH         11.6.0         1           12:2013         RP-62         RP-131937         2006r1         Introduction of D. CoMP FDD static CQI test         11.6.0         1           12:2013         RP-62         RP-131937         2026r2         CR (with single NZP CS/RS resource) TDD         11.6.0         1           <  |         |        |           |        |   |        |        |
| 12:2013         RP-62         RP-131928         1983r1         Correction to blocking requirements and use of AR <sub>B</sub> 11.6.0         1           12:2013         RP-62         RP-131937         1983r1         CR to introduce fading QQI test for CoMP (TDD)         11.6.0         1           12:2013         RP-62         RP-131937         1993r1         CR to introduce fading QQI test for CoMP fading QQI tests         11.6.0         1           12:2013         RP-62         RP-131937         1997r1         CR to introduce thest for CoMP (FDD)         11.6.0         1           12:2013         RP-62         RP-131938         2000r1         Distributed EPDCCH Demodulation Test         11.6.0         1           12:2013         RP-62         RP-131938         2004r1         Reference Measurement Channels for EPDCCH         11.6.0         1           12:2013         RP-62         RP-131937         2008r1         Introduction of DL CoMP EDD static CQI test         11.6.0         1           12:2013         RP-62         RP-131937         2008r1         Introduction of DL CoMP EDD static CQI test         11.6.0         1           12:2013         RP-62         RP-131937         2023r2         CR Minimum requirement with Same Cell ID (with multiple NZP CSI-RESouce) TDD         11.6.0         1   |         |        |           |        |   |        | 11.7.0 |
| 12:2013         RP-62         RP-131937         1987/1         CR on test point clarification for CA demodulation test         11.6.0         1           12:2013         RP-62         RP-131937         1993         CR to Introduce falses for CoMP (TDD)         11.6.0         1           12:2013         RP-62         RP-131937         1995         CR to Introduce channel model for CoMP (FDD)         11.6.0         1           12:2013         RP-62         RP-131924         1999/1         Simplification of Band 12/17 in-band blocking test cases         11.6.0         1           12:2013         RP-62         RP-131938         2000r1         Distributed EPDCCH Demodulation Test         11.6.0         1           12:2013         RP-62         RP-131938         2004r1         Reference Measurement Channels for EPDCCH         11.6.0         1           12:2013         RP-62         RP-131937         2008r1         Introduction of DL CoMP TDD static CQI test         11.6.0         1           12:2013         RP-62         RP-131937         2002r2         Rimimum requirement with Different Cell D and Colliding         11.6.0         1           12:2013         RP-62         RP-131937         2027r2         CR Minimum requirement with Different Cell D and Colliding         11.6.0         1  | 12-2013 |        |           |        |   |        | 11.7.0 |
| 12:2013         RP-62         RP-131937         1993r1         CR to Introduce fading COI test for CoMP (TDD)         11.6.0         1           12:2013         RP-62         RP-131937         1996         CR to Introduce RI test for CoMP (FDD)         11.6.0         1           12:2013         RP-62         RP-131937         1997r1         CR to Introduce RI test for CoMP (FDD)         11.6.0         1           12:2013         RP-62         RP-131938         2000r1         Distributed EPDCCH Demodulation Test         11.6.0         1           12:2013         RP-62         RP-131938         2000r1         Localized EPDCCH Demodulation Test         11.6.0         1           12:2013         RP-62         RP-131937         2006r1         Introduction of DL CoMP TDD static COI test         11.6.0         1           12:2013         RP-62         RP-131937         2008r1         Introduction of DL CoMP TDD static COI test         11.6.0         1           12:2013         RP-62         RP-131937         2023r2         Minimum requirement with Different Cell ID and Colliding         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td>11.7.0</td></t<>  |         |        |           |        |   |        | 11.7.0 |
| 12:2013         RP-62         RP-131937         19971         CR to Introduce Annel model for CoMP (FDD)         11.6.0         1           12:2013         RP-62         RP-131934         19971         CR to Introduce R Itest for CoMP (FDD)         11.6.0         1           12:2013         RP-62         RP-131938         2000r1         Distributed EPDCCH Demodulation Test         11.6.0         1           12:2013         RP-62         RP-131938         2004r1         Reference Measurement Channels for EPDCCH         11.6.0         1           12:2013         RP-62         RP-131937         2008r1         Introduction of DL CoMP FDD static CQI test         11.6.0         1           12:2013         RP-62         RP-131937         2008r1         Introduction of DL CoMP FDD static CQI test         11.6.0         1           12:2013         RP-62         RP-131937         2023r2         Minimum requirement with Same Cell ID (with multiple NZP CSI-         11.6.0         1           12:2013         RP-62         RP-131937         2026r2         CR Minimum requirement with Same Cell ID (with multiple NZP CSI-         11.6.0         1           12:2013         RP-62         RP-131936         2027         Editoral change on FeICIC PBCH Noc setup         11.6.0         1           12:2013<  |         |        |           |        |   |        | 11.7.0 |
| 12:2013         RP-62         RP-131937         1997r1         CR to Introduce RI test for CoMP (FDD)         11.6.0         1           12:2013         RP-62         RP-131938         2000r1         Distributed EPDCCH Demodulation Test         11.6.0         1           12:2013         RP-62         RP-131938         2002r1         Localized EPDCCH Demodulation Test         11.6.0         1           12:2013         RP-62         RP-131938         2002r1         Localized EPDCCH Demodulation Test         11.6.0         1           12:2013         RP-62         RP-131937         2006r1         Introduction of DL CoMP FDD static COI test         11.6.0         1           12:2013         RP-62         RP-131937         2008r1         Introduction of DL CoMP TDD static COI test         11.6.0         1           12:2013         RP-62         RP-131937         2023r2         Minimum requirement with Same Cell ID and Colliding         11.6.0         1           12:2013         RP-62         RP-131937         2025r2         CR Minimum requirement with Different Cell ID and Colliding         11.6.0         1           12:2013         RP-62         RP-131931         2034r1         Correction on rominal guard bands for bandwidth classes A and         C         1         1         1 <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td>11.7.0</td></td<>  |         |        |           |        |   |        | 11.7.0 |
| 12:2013         RP-62         RP-131924         1999r1         Simplification of Band 12/17 in-band blocking test cases         11.6.0         1           12:2013         RP-62         RP-131938         2000r1         Distributed EPDCCH Demodulation Test         11.6.0         1           12:2013         RP-62         RP-131938         2004r1         Reference Measurement Channels for EPDCCH         11.6.0         1           12:2013         RP-62         RP-131937         2006r1         Introduction of DL CoMP FDD static CQI test         11.6.0         1           12:2013         RP-62         RP-131937         2008r1         Introduction of DL CoMP FDD static CQI test         11.6.0         1           12:2013         RP-62         RP-131937         2023r2         Minimum requirement with Same Cell ID (with multiple NZP CSI-         1.6.0         1           12:2013         RP-62         RP-131937         2023r2         Editoral change on FeICIC PBCH Noc setup         11.6.0         1           12:2013         RP-62         RP-131937         2024r1         Correction of nominal guard bands for bandwidth classes A and         11.6.0         1           12:2013         RP-62         RP-131931         2044r1         Correction on CA_NS_02 A-MPR table         11.6.0         1 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td>11.7.0</td></t<>  |         |        |           |        |   |        | 11.7.0 |
| 12:2013         RP-62         RP-131938         2000r1         Distributed EPDCCH Demodulation Test         11.6.0         1           12:2013         RP-62         RP-131938         2002r1         Localized EPDCCH Demodulation Test         11.6.0         1           12:2013         RP-62         RP-131937         2006r1         Introduction of DL CoMP PDD static COI test         11.6.0         1           12:2013         RP-62         RP-131937         2008r1         Introduction of DL CoMP PDD static COI test         11.6.0         1           12:2013         RP-62         RP-131937         2008r1         Introduction of DL CoMP PDD static COI test         11.6.0         1           12:2013         RP-62         RP-131937         2023r2         CR Minimum requirement with Same Cell ID and Colliding         11.6.0         1           12:2013         RP-62         RP-131937         2025r2         CR Minimum requirement with Different Cell ID and Colliding         11.6.0         1           12:2013         RP-62         RP-131937         2027r         Editoral change on FeICIC PBCH Noc setup         11.6.0         1           12:2013         RP-62         RP-131937         204r1         Correction of nominal guard bands for bandwidth classes A and C         11.6.0         1 <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td>11.7.0</td></td<>   |         |        |           |        |   |        | 11.7.0 |
| 12:2013         RP-62         RP-131938         2002r1         Localized EPDCCH Demodulation Test         11.6.0         1           12:2013         RP-62         RP-131938         2006r1         Introduction of DL CoMP PDD static CQI test         11.6.0         1           12:2013         RP-62         RP-131937         2006r1         Introduction of DL CoMP PDD static CQI test         11.6.0         1           12:2013         RP-62         RP-131937         2003r1         Introduction of DL CoMP PDD static CQI test         11.6.0         1           12:2013         RP-62         RP-131937         2023r2         Minimum requirement with Same Cell ID (with multiple NZP CSI-         1.6.0         1           12:2013         RP-62         RP-131937         2025r2         CR Minimum requirement with Different Cell ID and Colliding CRS (with single NZP CSI-RS resource) TDD         11.6.0         1           12:2013         RP-62         RP-131936         2027         Editoral change on FeICIC PBCH Noce setup         11.6.0         1           12:2013         RP-62         RP-131937         2041r1         Crection of TDD PCFICH/PDCCH test parameter table         11.6.0         1           12:2013         RP-62         RP-131938         2064         Add EVA200 to table of channel model parameters         11.6.0  |         |        |           |        |   |        | 11.7.0 |
| 12:2013         RP-62         RP-131937         2006r1         Introduction of DL COMP FDD static CQI test         11.6.0         1           12:2013         RP-62         RP-131937         2008r1         Introduction of DL COMP FDD static CQI test         11.6.0         1           12:2013         RP-62         RP-131924         2013         P-max for Band 36 to Band 7 coexistence         11.6.0         1           12:2013         RP-62         RP-131937         2023r2         Minimum requirement with Same Cell ID (with multiple NZP CSI-         11.6.0         1           12:2013         RP-62         RP-131937         2025r2         CR Minimum requirement with Different Cell ID and Colliding         11.6.0         1           12:2013         RP-62         RP-131937         2024r1         Correction of nominal guard bands for bandwidth classes A and         11.6.0         1           12:2013         RP-62         RP-131931         2034r1         Correction of TDD PCFICHPDCH test parameter table         11.6.0         1           12:2013         RP-62         RP-131933         2044         Correction of CA_NS_02 A-MPR table         11.6.0         1           12:2013         RP-62         RP-131933         2046         Add EVA200 to table of channel model parameters table         11.6.0         1 <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>11.7.0</td>   |         |        |           |        |   |        | 11.7.0 |
| 12:2013         RP-62         RP-131937         2006r1         Introduction of DL CoMP FDD static CQI test         11.6.0         1           12:2013         RP-62         RP-131937         2008r1         Introduction of DL CoMP TDD static CQI test         11.6.0         1           12:2013         RP-62         RP-131924         2013         P-max for Band 38 to Band 7 coexistence         11.6.0         1           12:2013         RP-62         RP-131937         2023r2         Minimum requirement with Same Cell ID (with multiple NZP CSI-<br>RS resources) TDD         11.6.0         1           12:2013         RP-62         RP-131937         2027r         Editoral change on FeIC PBCH Noc setup         11.6.0         1           12:2013         RP-62         RP-131931         2034r1         Correction of nominal guard bands for bandwidth classes A and<br>C         11.6.0         1           12:2013         RP-62         RP-131937         2041r1         CR to Introduce RI test for CoMP (TDD)         11.6.0         1           12:2013         RP-62         RP-131937         2044         Correction on CA_NS_02 A-MPR table         11.6.0         1           12:2013         RP-62         RP-131938         2066         Introduction of SDR test for PDSCH with EPDCCH scheduling         11.6.0         1 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td>11.7.0</td></t<>   |         |        |           |        |   |        | 11.7.0 |
| 12:2013         RP-62         RP-131937         2008r1         Introduction of DL CoMP TDD static CQI test         11.6.0         1           12:2013         RP-62         RP-131937         2023r2         Minimum requirement with Same Cell ID (with multiple NZP CSI-<br>RS resources) TDD         11.6.0         1           12:2013         RP-62         RP-131937         2025r2         CR Minimum requirement with Different Cell ID and Colliding<br>CRS (with single NZP CSI-RS resource) TDD         11.6.0         1           12:2013         RP-62         RP-131937         2025r2         CR Minimum requirement with Different Cell ID and Colliding<br>CRS (with single NZP CSI-RS resource) TDD         11.6.0         1           12:2013         RP-62         RP-131937         204r1         Correction of nominal guard bands for bandwidth classes A and<br>C         11.6.0         1           12:2013         RP-62         RP-131937         204r11         CR to Introduce RI test for CoMP (TDD)         11.6.0         1           12:2013         RP-62         RP-131931         204r11         Carrection of TDD PCFICH/PDCCH test parameter table         11.6.0         1           12:2013         RP-62         RP-131938         2065         Introduction of SDR test for PDSCH with EPDCCH scheduling         11.6.0         1           12:2013         RP-62         RP-140374 <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>11.7.0</td>  |         |        |           |        |   |        | 11.7.0 |
| 12:2013         RP-62         RP-131924         2013         P-max for Band 38 to Band 7 coexistence         11.6.0         1           12:2013         RP-62         RP-131937         2023r2         Minimum requirement with Same Cell ID (with multiple NZP CSI-<br>RS resources) TDD         11.6.0         1           12:2013         RP-62         RP-131937         2025r2         CR Minimum requirement with Different Cell ID and Colliding<br>CRS (with single NZP CSI-RS resource) TDD         11.6.0         1           12:2013         RP-62         RP-131936         2027         Editoral change on FeICIC PECH Noc setup         11.6.0         1           12:2013         RP-62         RP-131936         2024r1         Correction of nominal guard bands for bandwidth classes A and<br>C         11.6.0         1           12:2013         RP-62         RP-131937         2041r1         CR to Introduce RI test for CoMP (TDD)         11.6.0         1           12:2013         RP-62         RP-131939         2044         Correction of Channel model parameters         11.6.0         1           12:2013         RP-62         RP-131938         2065         Introduction of SDR test for PDSCH with EPDCCH scheduling         11.6.0         1           12:2013         RP-62         RP-131938         2065         Introduction of SDR test for PDSCH with EPDCCH  |         |        |           |        |   |        | 11.7.0 |
| 12-2013         RP-62         RP-131937         2023r2         Minimum requirement with Same Cell ID (with multiple NZP CSI-<br>RS resources) TDD         11.6.0         1           12-2013         RP-62         RP-131937         2025r2         CR Minimum requirement with Different Cell ID and Colliding<br>CRS (with single NZP CSI-RS resource) TDD         11.6.0         1           12-2013         RP-62         RP-131931         2034r1         Correction of nominal guard bands for bandwidth classes A and<br>C         11.6.0         1           12-2013         RP-62         RP-131931         2041r1         CR to Introduce RI test for CoMP (TDD)         11.6.0         1           12-2013         RP-62         RP-131931         2044         Correction of TDD PCFICH/PDCCH test parameter table         11.6.0         1           12-2013         RP-62         RP-131932         2046         Add EVA200 to table of channel model parameters         11.6.0         1           12-2013         RP-62         RP-131938         2065         Introduction of EDCCH TM10 localized test R-11         11.6.0         1           12-2013         RP-62         RP-131938         2067         Introduction of SDR test for PDSCH with EPDCCH scheduling         11.6.0         1           12-2013         RP-63         RP-140374         2100r1         CR nor ference mea   |         |        |           |        |   |        | 11.7.0 |
| RS resources) TDD         RS resources) TDD           12-2013         RP-62         RP-131937         202572         CR Minimum requirement with Different Cell ID and Colliding<br>CRS (with single NZP CSI-RS resource) TDD         11.6.0         1           12-2013         RP-62         RP-131936         2027         Editoral change on FeICIC PBCH Noc setup         11.6.0         1           12-2013         RP-62         RP-131931         2034r1         Correction of nominal guard bands for bandwidth classes A and<br>C         11.6.0         1           12-2013         RP-62         RP-131937         2041r1         CR to Introduce RI test for CoMP (TDD)         11.6.0         1           12-2013         RP-62         RP-131939         2046         Add EVA200 to table of channel model parameters         11.6.0         1           12-2013         RP-62         RP-131938         2065         Introduction of EPDCCH TM10 localized test R-11         11.6.0         1           12-2013         RP-62         RP-131938         2067         Introduction of SDR test for PDSCH with EPDCCH scheduling         11.6.0         1           12-2013         RP-62         RP-140374         2096r1         CR on TM9 localized ePDCCH test         11.7.0         1           12-2014         RP-63         RP-140374         2096r1   |         |        |           |        |   |        | 11.7.0 |
| 12:2013         RP-62         RP-131937         2025r2         CR Minimum requirement with Different Cell ID and Colliding<br>CRS (with single NZP CSI-RS resource) TDD         11.6.0         1           12:2013         RP-62         RP-131936         2027         Editoral change on FeICIC PBCH Noc setup         11.6.0         1           12:2013         RP-62         RP-131931         2034r1         Correction of nominal guard bands for bandwidth classes A and<br>C         11.6.0         1           12:2013         RP-62         RP-131937         2041r1         CR to Introduce RI test for CoMP (TDD)         11.6.0         1           12:2013         RP-62         RP-131939         2046         Add EVA200 to table of channel model parameters         11.6.0         1           12:2013         RP-62         RP-131938         2065         Introduction of SDR test for PDSCH with EPDCCH scheduling         11.6.0         1           12:2013         RP-62         RP-140374         2096r1         CR for maintanence of CA soft buffer tests in Rel-11         11.7.0         1           10:2014         RP-63         RP-140374         2096r1         CR on Test for both for tests in Rel-11         11.7.0         1           03:2014         RP-63         RP-140374         2096r1         CR on reference measurement channel for ePDCCH test  | 12-2013 | RP-62  | RP-131937 | 2023r2 |   | 11.6.0 | 11.7.0 |
| CRS (with single NZP CSI-RS resource) TDD           12-2013         RP-62         RP-131936         2027         Editoral change on FeICIC PBCH Noc setup         11.6.0         1           12-2013         RP-62         RP-131931         2034r1         Correction of nominal guard bands for bandwidth classes A and C         11.6.0         1           12-2013         RP-62         RP-131937         2041r1         CR to Introduce RI test for CoMP (TDD)         11.6.0         1           12-2013         RP-62         RP-131939         2044         Correction of TDD PCFICH/PDCCH test parameter table         11.6.0         1           12-2013         RP-62         RP-131926         2058         CA_1C: Correction on CA_NS_02 AMPR table         11.6.0         1           12-2013         RP-62         RP-131938         2065         Introduction of SDR test for PDSCH with EPDCCH scheduling         11.6.0         1           12-2013         RP-63         RP-140368         2091r1         CR for maintanence of CA soft buffer tests in Rel-11         11.7.0         1           103-2014         RP-63         RP-140374         2096r1         CR on TM9 localized ePDCCH test         11.7.0         1           103-2014         RP-63         RP-140371         2105         Cleanup of the specification for FeICIC (Rel-11) </td <td>40.0040</td> <td></td> <td>DD 404007</td> <td>0005-0</td> <td></td> <td>44.0.0</td> <td>44 7 0</td>   | 40.0040 |        | DD 404007 | 0005-0 |   | 44.0.0 | 44 7 0 |
| 12-2013         RP-62         RP-131936         2027         Editoral change on FeICIC PBCH Noc setup         11.6.0         1           12-2013         RP-62         RP-131931         2034r1         Correction of nominal guard bands for bandwidth classes A and<br>C         11.6.0         1           12-2013         RP-62         RP-131937         2041r1         CR to Introduce RI test for CoMP (TDD)         11.6.0         1           12-2013         RP-62         RP-131931         2044         Correction of TDD PCFICH/PDCCH test parameter table         11.6.0         1           12-2013         RP-62         RP-131939         2046         Add EVA200 to table of channel model parameters         11.6.0         1           12-2013         RP-62         RP-131938         2065         Introduction of SD2 A-MPR table         11.6.0         1           12-2013         RP-62         RP-140378         20967         Introduction of SDR test for PDSCH with EPDCCH scheduling         11.6.0         1           13-2014         RP-63         RP-140374         2096r1         CR on reference measurement channel for ePDCCH test         11.7.0         1           03-2014         RP-63         RP-140371         2105         Cleanup of the specification for FeICIC (ReI-11)         11.7.0         1           <   | 12-2013 | RP-62  | RP-131937 | 202512 |   | 11.6.0 | 11.7.0 |
| 12:2013         RP-62         RP-131931         2034r1         Correction of nominal guard bands for bandwidth classes A and C         11.6.0         1           12:2013         RP-62         RP-131937         2041r1         CR to Introduce RI test for COMP (TDD)         11.6.0         1           12:2013         RP-62         RP-131931         2044         Correction of TDD PCFICH/PDCCH test parameter table         11.6.0         1           12:2013         RP-62         RP-131939         2046         Add EVA200 to table of channel model parameters         11.6.0         1           12:2013         RP-62         RP-131938         2065         Introduction of CA_NS_02 A-MPR table         11.6.0         1           12:2013         RP-62         RP-131938         2065         Introduction of SDR test for PDSCH with EPDCCH scheduling         11.6.0         1           12:2013         RP-63         RP-140374         2096r1         CR on TM9 localized ePDCCH test         11.7.0         1           03:2014         RP-63         RP-140374         2000r1         CR on reference measurement channel for ePDCCH test         11.7.0         1           03:2014         RP-63         RP-140371         2105         Cleanup of the specification for FeICIC (Rel-11)         11.7.0         1   | 10.0010 | DD 60  | DD 121026 | 2027   |   | 11 6 0 | 11.7.0 |
| C         C           12-2013         RP-62         RP-131937         2041r1         CR to Introduce RI test for CoMP (TDD)         11.6.0         1           12-2013         RP-62         RP-131939         2044         Correction of TDD PCFICH/PDCCH test parameter table         11.6.0         1           12-2013         RP-62         RP-131939         2046         Add EVA200 to table of channel model parameters         11.6.0         1           12-2013         RP-62         RP-131938         2065         Introduction of EPDCCH TM10 localized test R-11         11.6.0         1           12-2013         RP-62         RP-131938         2067         Introduction of SDR test for PDSCH with EPDCCH scheduling         11.6.0         1           12-2013         RP-62         RP-131938         2067         Introduction of SDR test for PDSCH with EPDCCH scheduling         11.6.0         1           103-2014         RP-63         RP-140374         2096r1         CR on TM9 localized ePDCCH test         11.7.0         1           03-2014         RP-63         RP-140371         2105r         Cleanup of the specification for FelCIC (Rel-11)         11.7.0         1           03-2014         RP-63         RP-140371         2107r1         UL-D configuration and other parameters for FelCIC TDD CQI  |         |        |           |        |   |        | 11.7.0 |
| 12-2013         RP-62         RP-131937         2041r1         CR to Introduce RI test for CoMP (TDD)         11.6.0         1           12-2013         RP-62         RP-131931         2044         Correction of TDD PCFICH/PDCCH test parameter table         11.6.0         1           12-2013         RP-62         RP-131939         2046         Add EVA200 to table of channel model parameters         11.6.0         1           12-2013         RP-62         RP-131938         2065         Introduction of EPDCCH TM10 localized test R-11         11.6.0         1           12-2013         RP-62         RP-131938         2067         Introduction of SDR test for PDSCH with EPDCCH scheduling         11.6.0         1           12-2013         RP-63         RP-140368         2091r1         CR for maintanence of CA soft buffer tests in Rel-11         11.7.0         1           03-2014         RP-63         RP-140374         2096r1         CR on TM9 localized PDCCH test         11.7.0         1           03-2014         RP-63         RP-140371         2105         Cleanup of the specification for FelCIC (Rel-11)         11.7.0         1           03-2014         RP-63         RP-140371         2109r1         CR for introduction of 15MHz based SDR tests in Rel-11         11.7.0         1 <t< td=""><td>12-2013</td><td>KP-02</td><td>RP-131931</td><td>203411</td><td>5</td><td>11.6.0</td><td>11.7.0</td></t<>  | 12-2013 | KP-02  | RP-131931 | 203411 | 5   | 11.6.0 | 11.7.0 |
| 12-2013         RP-62         RP-131931         2044         Correction of TDD PCFICH/PDCCH test parameter table         11.6.0         1           12-2013         RP-62         RP-131939         2046         Add EVA200 to table of channel model parameters         11.6.0         1           12-2013         RP-62         RP-131926         2058         CA_1C: Correction on CA_NS_02 A-MPR table         11.6.0         1           12-2013         RP-62         RP-131938         2065         Introduction of EPDCCH TM10 localized test R-11         11.6.0         1           12-2013         RP-62         RP-131938         2067         Introduction of SDR test for PDSCH with EPDCCH scheduling         11.6.0         1           03-2014         RP-63         RP-140374         209671         CR on TM9 localized ePDCCH test         11.7.0         1           03-2014         RP-63         RP-140374         210071         CR on reference measurement channel for ePDCCH test         11.7.0         1           03-2014         RP-63         RP-140371         210771         UL-DL configuration and other parameters for FeICIC TDD CQI         11.7.0         1           03-2014         RP-63         RP-140371         210771         UL-DL configuration and other parameters         11.7.0         1 <t< td=""><td>12-2012</td><td>BD-60</td><td>RP-131027</td><td>20/1r1</td><td></td><td>1160</td><td>11.7.0</td></t<>   | 12-2012 | BD-60  | RP-131027 | 20/1r1 |   | 1160   | 11.7.0 |
| 12-2013         RP-62         RP-131939         2046         Add EVA200 to table of channel model parameters         11.6.0         1           12-2013         RP-62         RP-131926         2058         CA_1C: Correction on CA_NS_02 A-MPR table         11.6.0         1           12-2013         RP-62         RP-131938         2065         Introduction of SDR test for PDCCH TM10 localized test R-11         11.6.0         1           12-2013         RP-62         RP-131938         2067         Introduction of SDR test for PDSCH with EPDCCH scheduling         11.6.0         1           03-2014         RP-63         RP-140374         2096r1         CR on TM9 localized ePDCCH test         11.7.0         1           03-2014         RP-63         RP-140374         2096r1         CR on TM9 localized ePDCCH test         11.7.0         1           03-2014         RP-63         RP-140374         2100r1         CR on reference measurement channel for ePDCCH test         11.7.0         1           03-2014         RP-63         RP-140371         2107r1         UL-DL configuration and other parameters for FeICIC TDD CQI         11.7.0         1           03-2014         RP-63         RP-140371         2109r1         CR for introduction of 15MHz based SDR tests in ReI-11         11.7.0         1   |         |        |           |        |   |        | 11.7.0 |
| 12-2013         RP-62         RP-131926         2058         CA_1C: Correction on CA_NS_02 A-MPR table         11.6.0         1           12-2013         RP-62         RP-131938         2065         Introduction of EPDCCH TM10 localized test R-11         11.6.0         1           12-2013         RP-62         RP-131938         2067         Introduction of SDR test for PDSCH with EPDCCH scheduling         11.6.0         1           12-2014         RP-63         RP-140368         2091r1         CR for maintanence of CA soft buffer tests in Rel-11         11.7.0         1           03-2014         RP-63         RP-140374         2096r1         CR on TM9 localized ePDCCH test         11.7.0         1           03-2014         RP-63         RP-140374         2100r1         CR on reference measurement channel for ePDCCH test         11.7.0         1           03-2014         RP-63         RP-140371         2105         Cleanup of the specification for FelCIC (Rel-11)         11.7.0         1           03-2014         RP-63         RP-140371         2109r1         UL-DL configuration and other parameters for FelCIC TDD CQI         11.7.0         1           03-2014         RP-63         RP-140371         2109r1         CR for TS36.101 COMP demodulation requirements         11.7.0         1   |         |        |           |        | Add EVA200 to table of channel model parameters                 |        | 11.7.0 |
| 12-2013         RP-62         RP-131938         2065         Introduction of EPDCCH TM10 localized test R-11         11.6.0         1           12-2013         RP-62         RP-131938         2067         Introduction of SDR test for PDSCH with EPDCCH scheduling         11.6.0         1           03-2014         RP-63         RP-140368         209111         CR for maintanence of CA soft buffer tests in Rel-11         11.7.0         1           03-2014         RP-63         RP-140374         209671         CR on TM9 localized ePDCCH test         11.7.0         1           03-2014         RP-63         RP-140374         210071         CR on reference measurement channel for ePDCCH test         11.7.0         1           03-2014         RP-63         RP-140371         21057         Cleanup of the specification for FeICIC (Rel-11)         11.7.0         1           03-2014         RP-63         RP-140371         210711         UL-DL configuration and other parameters for FeICIC TDD CQI         11.7.0         1           03-2014         RP-63         RP-140371         2109r1         CR for TS86.101 COMP demodulation requirements         11.7.0         1           03-2014         RP-63         RP-140371         2109r1         CR for Combinations of channel model parameters         11.7.0         1  |         |        |           |        |   |        | 11.7.0 |
| 12-2013         RP-62         RP-131938         2067         Introduction of SDR test for PDSCH with EPDCCH scheduling         11.6.0         1           03-2014         RP-63         RP-140368         2091r1         CR for maintanence of CA soft buffer tests in Rel-11         11.7.0         1           03-2014         RP-63         RP-140374         2096r1         CR on TM9 localized ePDCCH test         11.7.0         1           03-2014         RP-63         RP-140374         2100r1         CR on reference measurement channel for ePDCCH test         11.7.0         1           03-2014         RP-63         RP-140371         2105         Cleanup of the specification for FeICIC (Rel-11)         11.7.0         1           03-2014         RP-63         RP-140371         2107r1         UL-DL configuration and other parameters for FeICIC TDD CQI         11.7.0         1           03-2014         RP-63         RP-140375         2088         CR for introduction of 15MHz based SDR tests in Rel-11         11.7.0         1           03-2014         RP-63         RP-140371         2109r1         CR for Combinations of channel model parameters         11.7.0         1           03-2014         RP-63         RP-140371         2111r1         CR for EPDCCH power allocation (Rel-11)         11.7.0         1   |         |        |           |        |   |        | 11.7.0 |
| 03-2014         RP-63         RP-140368         2091r1         CR for maintanence of CA soft buffer tests in Rel-11         11.7.0         1           03-2014         RP-63         RP-140374         2096r1         CR on TM9 localized ePDCCH test         11.7.0         1           03-2014         RP-63         RP-140374         2100r1         CR on reference measurement channel for ePDCCH test         11.7.0         1           03-2014         RP-63         RP-140371         2105         Cleanup of the specification for FelCIC (Rel-11)         11.7.0         1           03-2014         RP-63         RP-140371         2105         Cleanup of the specification for FelCIC (Rel-11)         11.7.0         1           03-2014         RP-63         RP-140371         2107r1         UL-DL configuration and other parameters for FelCIC TDD CQI         11.7.0         1           03-2014         RP-63         RP-140371         2109r1         CR for introduction of 15MHz based SDR tests in Rel-11         11.7.0         1           03-2014         RP-63         RP-140371         2109r1         CR for TS36.101 COMP demodulation requirements         11.7.0         1           03-2014         RP-63         RP-140374         2112         CR for EPDCCH power allocation (Rel-11)         11.7.0         1   |         |        |           |        |   |        | 11.7.0 |
| 03-2014         RP-63         RP-140374         2096r1         CR on TM9 localized ePDCCH test         11.7.0         1           03-2014         RP-63         RP-140374         2100r1         CR on reference measurement channel for ePDCCH test         11.7.0         1           03-2014         RP-63         RP-140371         2105         Cleanup of the specification for FelCIC (Rel-11)         11.7.0         1           03-2014         RP-63         RP-140371         2107r1         UL-DL configuration and other parameters for FelCIC TDD CQI fading test (Rel-11)         11.7.0         1           03-2014         RP-63         RP-140375         2088         CR for introduction of 15MHz based SDR tests in Rel-11         11.7.0         1           03-2014         RP-63         RP-140371         2109r1         CR for TS36.101 COMP demodulation requirements         11.7.0         1           03-2014         RP-63         RP-140371         2111r1         CR for Combinations of channel model parameters         11.7.0         1           03-2014         RP-63         RP-140374         2112         CR for EPDCCH power allocation (Rel-11)         11.7.0         1           03-2014         RP-63         RP-140374         2073r1         CR of EPDCCH localzied test with TM10 QCL Type-B         11.7.0         1     <   |         |        |           |        |   |        | 11.8.0 |
| 03-2014         RP-63         RP-140374         2100r1         CR on reference measurement channel for ePDCCH test         11.7.0         1           03-2014         RP-63         RP-140371         2105         Cleanup of the specification for FelCIC (Rel-11)         11.7.0         1           03-2014         RP-63         RP-140371         2107r1         UL-DL configuration and other parameters for FelCIC TDD CQI fading test (Rel-11)         11.7.0         1           03-2014         RP-63         RP-140375         2088         CR for introduction of 15MHz based SDR tests in Rel-11         11.7.0         1           03-2014         RP-63         RP-140371         2109r1         CR for TS36.101 COMP demodulation requirements         11.7.0         1           03-2014         RP-63         RP-140371         2111r1         CR for TS36.101 COMP demodulation requirements         11.7.0         1           03-2014         RP-63         RP-140374         2112         CR for EPDCCH power allocation (Rel-11)         11.7.0         1           03-2014         RP-63         RP-140374         2073r1         CR on reference measurement channel for TM10 PDSCH         11.7.0         1           03-2014         RP-63         RP-140374         2073r1         CR of EPDCCH localzied test with TM10 QCL Type-B         11.7.0   |         |        |           |        |   |        | 11.8.0 |
| 03-2014         RP-63         RP-140371         2105         Cleanup of the specification for FeICIC (Rel-11)         11.7.0         1           03-2014         RP-63         RP-140371         2107r1         UL-DL configuration and other parameters for FeICIC TDD CQI<br>fading test (Rel-11)         11.7.0         1           03-2014         RP-63         RP-140375         2088         CR for introduction of 15MHz based SDR tests in Rel-11         11.7.0         1           03-2014         RP-63         RP-140371         2109r1         CR for TS36.101 COMP demodulation requirements         11.7.0         1           03-2014         RP-63         RP-140371         2111r1         CR for TS36.101 COMP demodulation requirements         11.7.0         1           03-2014         RP-63         RP-140374         2112         CR for EPDCCH power allocation (Rel-11)         11.7.0         1           03-2014         RP-63         RP-140374         2085         CR on reference measurement channel for TM10 PDSCH         11.7.0         1           03-2014         RP-63         RP-140374         2073r1         CR of EPDCCH localzied test with TM10 QCL Type-B         11.7.0         1           03-2014         RP-63         RP-140374         2073r1         CR of EPDCCH localzied test with TM10 QCL Type-B         11.7.0 <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td>11.8.0</td></td<>  |         |        |           |        |   |        | 11.8.0 |
| 03-2014         RP-63         RP-140371         2107r1         UL-DL configuration and other parameters for FeICIC TDD CQI<br>fading test (ReI-11)         11.7.0         1           03-2014         RP-63         RP-140375         2088         CR for introduction of 15MHz based SDR tests in ReI-11         11.7.0         1           03-2014         RP-63         RP-140371         2109r1         CR for TS36.101 COMP demodulation requirements         11.7.0         1           03-2014         RP-63         RP-140371         2111r1         CR for Combinations of channel model parameters         11.7.0         1           03-2014         RP-63         RP-140374         2112         CR for EPDCCH power allocation (ReI-11)         11.7.0         1           03-2014         RP-63         RP-140374         212         CR for EPDCCH power allocation (ReI-11)         11.7.0         1           03-2014         RP-63         RP-140371         2085         CR on reference measurement channel for TM10 PDSCH         11.7.0         1           03-2014         RP-63         RP-140374         2073r1         CR of EPDCCH localzied test with TM10 QCL Type-B         11.7.0         1           03-2014         RP-63         RP-140371         2130r1         CR to finalize RI test for CoMP         11.7.0         1   |         |        |           |        |   |        | 11.8.0 |
| Image: Second |         |        |           |        |   |        | 11.8.0 |
| 03-2014         RP-63         RP-140375         2088         CR for introduction of 15MHz based SDR tests in Rel-11         11.7.0         1           03-2014         RP-63         RP-140371         2109r1         CR for TS36.101 COMP demodulation requirements         11.7.0         1           03-2014         RP-63         RP-140371         2119r1         CR for TS36.101 COMP demodulation requirements         11.7.0         1           03-2014         RP-63         RP-140371         2111r1         CR for Combinations of channel model parameters         11.7.0         1           03-2014         RP-63         RP-140374         2112         CR for EPDCCH power allocation (Rel-11)         11.7.0         1           03-2014         RP-63         RP-140371         2085         CR on reference measurement channel for TM10 PDSCH         11.7.0         1           03-2014         RP-63         RP-140374         2073r1         CR of EPDCCH localzied test with TM10 QCL Type-B         11.7.0         1           03-2014         RP-63         RP-140368         2146         Correction of coding rate for 18RBs in UL RMC table         11.7.0         1           03-2014         RP-63         RP-140371         2130r1         CR to finalize RI test for CoMP         11.7.0         1           03-2014<  | 00 2017 | 11 00  |           | 210/11 |   | 11.7.0 | 11.0.0 |
| 03-2014         RP-63         RP-140371         2109r1         CR for TS36.101 COMP demodulation requirements         11.7.0         1           03-2014         RP-63         RP-140371         2111r1         CR for Combinations of channel model parameters         11.7.0         1           03-2014         RP-63         RP-140371         2111r1         CR for EPDCCH power allocation (Rel-11)         11.7.0         1           03-2014         RP-63         RP-140374         2112         CR for EPDCCH power allocation (Rel-11)         11.7.0         1           03-2014         RP-63         RP-140371         2085         CR on reference measurement channel for TM10 PDSCH         11.7.0         1           03-2014         RP-63         RP-140374         2073r1         CR of EPDCCH localzied test with TM10 QCL Type-B         11.7.0         1           03-2014         RP-63         RP-140368         2146         Correction of coding rate for 18RBs in UL RMC table         11.7.0         1           03-2014         RP-63         RP-140371         2130r1         CR to finalize RI test for CoMP         11.7.0         1           03-2014         RP-63         RP-140374         2162r1         Distributed EPDCCH Demodulation Test         11.7.0         1           03-2014         RP-63<   | 03-2014 | RP-63  | RP-140375 | 2088   |   | 11.7.0 | 11.8.0 |
| 03-2014         RP-63         RP-140371         2111r1         CR for Combinations of channel model parameters         11.7.0         1           03-2014         RP-63         RP-140374         2112         CR for EPDCCH power allocation (Rel-11)         11.7.0         1           03-2014         RP-63         RP-140374         2112         CR for EPDCCH power allocation (Rel-11)         11.7.0         1           03-2014         RP-63         RP-140371         2085         CR on reference measurement channel for TM10 PDSCH         11.7.0         1           03-2014         RP-63         RP-140374         2073r1         CR of EPDCCH localzied test with TM10 QCL Type-B         11.7.0         1           03-2014         RP-63         RP-140368         2146         Correction of coding rate for 18RBs in UL RMC table         11.7.0         1           03-2014         RP-63         RP-140371         2130r1         CR to finalize RI test for CoMP         11.7.0         1           03-2014         RP-63         RP-140374         2162r1         Distributed EPDCCH Demodulation Test         11.7.0         1           03-2014         RP-63         RP-140371         2128r1         CR to finalize fading CQI test for CoMP         11.7.0         1   |         |        |           |        |   |        | 11.8.0 |
| 03-2014         RP-63         RP-140374         2112         CR for EPDCCH power allocation (Rel-11)         11.7.0         1           03-2014         RP-63         RP-140371         2085         CR on reference measurement channel for TM10 PDSCH         11.7.0         1           03-2014         RP-63         RP-140371         2085         CR on reference measurement channel for TM10 PDSCH         11.7.0         1           03-2014         RP-63         RP-140374         2073r1         CR of EPDCCH localzied test with TM10 QCL Type-B         11.7.0         1           03-2014         RP-63         RP-140368         2146         Correction of coding rate for 18RBs in UL RMC table         11.7.0         1           03-2014         RP-63         RP-140371         2130r1         CR to finalize RI test for CoMP         11.7.0         1           03-2014         RP-63         RP-140374         2162r1         Distributed EPDCCH Demodulation Test         11.7.0         1           03-2014         RP-63         RP-140371         2128r1         CR to finalize fading CQI test for CoMP         11.7.0         1  |         |        |           |        |   |        | 11.8.0 |
| 03-2014         RP-63         RP-140371         2085         CR on reference measurement channel for TM10 PDSCH         11.7.0         1           03-2014         RP-63         RP-140374         2073r1         CR of EPDCCH localzied test with TM10 QCL Type-B         11.7.0         1           03-2014         RP-63         RP-140374         2073r1         CR of EPDCCH localzied test with TM10 QCL Type-B         11.7.0         1           03-2014         RP-63         RP-140368         2146         Correction of coding rate for 18RBs in UL RMC table         11.7.0         1           03-2014         RP-63         RP-140371         2130r1         CR to finalize RI test for CoMP         11.7.0         1           03-2014         RP-63         RP-140374         2162r1         Distributed EPDCCH Demodulation Test         11.7.0         1           03-2014         RP-63         RP-140371         2128r1         CR to finalize fading CQI test for CoMP         11.7.0         1  |         |        |           |        |   |        | 11.8.0 |
| og         demodulation test           03-2014         RP-63         RP-140374         2073r1         CR of EPDCCH localzied test with TM10 QCL Type-B         11.7.0         1           03-2014         RP-63         RP-140368         2146         Correction of coding rate for 18RBs in UL RMC table         11.7.0         1           03-2014         RP-63         RP-140371         2130r1         CR to finalize RI test for CoMP         11.7.0         1           03-2014         RP-63         RP-140374         2162r1         Distributed EPDCCH Demodulation Test         11.7.0         1           03-2014         RP-63         RP-140371         2128r1         CR to finalize fading CQI test for CoMP         11.7.0         1   |         |        |           |        |   |        | 11.8.0 |
| 03-2014         RP-63         RP-140374         2073r1         CR of EPDCCH localzed test with TM10 QCL Type-B         11.7.0         1           03-2014         RP-63         RP-140368         2146         Correction of coding rate for 18RBs in UL RMC table         11.7.0         1           03-2014         RP-63         RP-140368         2146         Correction of coding rate for 18RBs in UL RMC table         11.7.0         1           03-2014         RP-63         RP-140371         2130r1         CR to finalize RI test for CoMP         11.7.0         1           03-2014         RP-63         RP-140374         2162r1         Distributed EPDCCH Demodulation Test         11.7.0         1           03-2014         RP-63         RP-140371         2128r1         CR to finalize fading CQI test for CoMP         11.7.0         1   |         |        |           |        |   |        |        |
| O3-2014         RP-63         RP-140368         2146         Correction of coding rate for 18RBs in UL RMC table         11.7.0         1           03-2014         RP-63         RP-140371         2130r1         CR to finalize RI test for CoMP         11.7.0         1           03-2014         RP-63         RP-140371         2130r1         CR to finalize RI test for CoMP         11.7.0         1           03-2014         RP-63         RP-140374         2162r1         Distributed EPDCCH Demodulation Test         11.7.0         1           03-2014         RP-63         RP-140371         2128r1         CR to finalize fading CQI test for CoMP         11.7.0         1   | 03-2014 | RP-63  | RP-140374 | 2073r1 |   | 11.7.0 | 11.8.0 |
| 03-2014         RP-63         RP-140368         2146         Correction of coding rate for 18RBs in UL RMC table         11.7.0         1           03-2014         RP-63         RP-140371         2130r1         CR to finalize RI test for CoMP         11.7.0         1           03-2014         RP-63         RP-140371         2130r1         CR to finalize RI test for CoMP         11.7.0         1           03-2014         RP-63         RP-140374         2162r1         Distributed EPDCCH Demodulation Test         11.7.0         1           03-2014         RP-63         RP-140371         2128r1         CR to finalize fading CQI test for CoMP         11.7.0         1   |         |        |           |        |   |        |        |
| 03-2014         RP-63         RP-140371         2130r1         CR to finalize RI test for CoMP         11.7.0         1           03-2014         RP-63         RP-140374         2162r1         Distributed EPDCCH Demodulation Test         11.7.0         1           03-2014         RP-63         RP-140374         2162r1         Distributed EPDCCH Demodulation Test         11.7.0         1           03-2014         RP-63         RP-140371         2128r1         CR to finalize fading CQI test for CoMP         11.7.0         1  | 03-2014 | RP-63  | RP-140368 | 2146   |   | 11.7.0 | 11.8.0 |
| 03-2014         RP-63         RP-140374         2162r1         Distributed EPDCCH Demodulation Test         11.7.0         1           03-2014         RP-63         RP-140371         2128r1         CR to finalize fading CQI test for CoMP         11.7.0         1   |         |        |           |        |   |        | 11.8.0 |
| 03-2014 RP-63 RP-140371 2128r1 CR to finalize fading CQI test for CoMP 11.7.0 1  |         |        |           |        |   |        | 11.8.0 |
|  |         |        |           |        |   |        | 11.8.0 |
|  |         |        |           |        |   |        | 11.8.0 |
| requirements   |         |        |           |        |   | -      | -      |

| 00.0014                       |                | DD 440200              | 0400             |   | 44 7 0           | 44.0.0           |
|-------------------------------|----------------|------------------------|------------------|---|------------------|------------------|
| 03-2014<br>03-2014            | RP-63<br>RP-63 | RP-140368<br>RP-140371 | 2136<br>2143r1   | Configured transmitted power for CA<br>Channel spacing for non-contiguous intra-band carrier          | 11.7.0<br>11.7.0 | 11.8.0<br>11.8.0 |
| 03-2014                       | KF-03          | KF-140371              | 214311           | aggregation   | 11.7.0           | 11.0.0           |
| 03-2014                       | RP-63          | RP-140371              | 2141             | Clarification of contiguous and non-contiguous intra-band UE  | 11.7.0           | 11.8.0           |
| 00 2011                       |                |                        |                  | capabilities in the same band   |                  |                  |
| 03-2014                       | RP-63          | RP-140368              | 2158             | Correction of a table note for Pcmax  | 11.7.0           | 11.8.0           |
| 03-2014                       | RP-63          | RP-140368              | 2121             | CR for 36.101. Editorial correction on OCNG pattern   | 11.7.0           | 11.8.0           |
| 03-2014                       | RP-63          | RP-140374              | 2124r1           | CR on correction of downlink SDR tests with EPDCCH  | 11.7.0           | 11.8.0           |
|                               |                |                        |                  | scheduling  |                  |                  |
| 03-2014                       | RP-63          | RP-140375              | 2118             | Introduction of requirements for SNR test for TM9   | 11.7.0           | 11.8.0           |
| 03-2014                       | RP-63          | RP-140371              | 2126r2           | Correction on DL CoMP static CQI tests (Rel 11)   | 11.7.0           | 11.8.0           |
| 06-2014                       | RP-64          | RP-140909              | 2176r2           | RF: Corrections to spurious emission requirements with NS   | 11.8.0           | 11.9.0           |
| 06-2014                       | RP-64          | RP-140914              | 2197r1           | different than NS_01 (Rel-11)<br>CR on correction on TDD IRC CQI test                                 | 11.8.0           | 11.9.0           |
| 06-2014                       | RP-64          | RP-140914<br>RP-140917 | 219711<br>2206r1 | CR of EPDCCH localzied test with TM10 QCL Type-B  | 11.8.0           | 11.9.0           |
| 00-2014                       | 111-04         | 111-140317             | 220011           | configuration (Rel-11): correction of CSI-RS configurations   | 11.0.0           | 11.3.0           |
| 06-2014                       | RP-64          | RP-140918              | 2208             | Clean up of TM9 SNR tests   | 11.8.0           | 11.9.0           |
| 06-2014                       | RP-64          | RP-140914              | 2214r1           | Correction of UE TM3 demodulation performance requirements  | 11.8.0           | 11.9.0           |
| 06-2014                       | RP-64          | RP-140917              | 2215r1           | CR for EPDCCH test (Rel-11)   | 11.8.0           | 11.9.0           |
| 06-2014                       | RP-64          | RP-140911              | 2217r1           | CR of modification on FeICIC rank testing (Rel-11)  | 11.8.0           | 11.9.0           |
| 06-2014                       | RP-64          | RP-140914              | 2219r1           | CR on FeICIC PBCH performance requirement (Rel-11)  | 11.8.0           | 11.9.0           |
| 06-2014                       | RP-64          | RP-140918              | 2221r1           | Correction on out-of-band blocking for CA   | 11.8.0           | 11.9.0           |
| 06-2014                       | RP-64          | RP-140918              | 2225             | Update demodualtion performance requirements with new UE  | 11.8.0           | 11.9.0           |
| 00.00                         |                |                        | 0007             | categories  | 44.5.5           | 44.5.5           |
| 06-2014                       | RP-64          | RP-140911              | 2227r1           | Correction for CA sustained data rate test (Rel-11)   | 11.8.0           | 11.9.0           |
| 06-2014                       | RP-64          | RP-140918              | 2230r1           | CR on OCNG and propagation conditions for dual layer TM9 test   | 11.8.0           | 11.9.0           |
| 06-2014                       | RP-64          | RP-140911              | 2232             | Clarification of Intra-band contiguous CA class C Narrow band   | 11.8.0           | 11.9.0           |
| 06-2014                       | RP-64          | RP-140911              | 2238             | blocking requirements<br>Correction for CA soft buffer test (Rel-11)                                  | 11.8.0           | 11.9.0           |
| 06-2014                       | RP-64          | RP-140911              | 2236<br>2246r1   | Remove [] from eICIC TDD RI requirement   | 11.8.0           | 11.9.0           |
| 06-2014                       | RP-64          | RP-140914              | 2255             | Verification of exceptions of REFSENS requirements for carrier  | 11.8.0           | 11.9.0           |
| 00 2014                       | 111 04         | 111-140014             | 2200             | aggregation   | 11.0.0           | 11.5.0           |
| 06-2014                       | RP-64          | RP-140914              | 2257             | Applicability of exceptions to reference sensitivity requirements                                     | 11.8.0           | 11.9.0           |
|                               | -              |                        | _                | for CA  |                  |                  |
| 06-2014                       | RP-64          | RP-140918              | 2261r1           | Editorial corrections for UE performance requirments for R11  | 11.8.0           | 11.9.0           |
| 06-2014                       | RP-64          | RP-140909              | 2268             | In-band blocking case nubering re-establisment  | 11.8.0           | 11.9.0           |
| 06-2014                       | RP-64          | RP-140918              | 2272             | CR for TS36.101 FRC tables for COMP demodulation  | 11.8.0           | 11.9.0           |
|                               |                |                        |                  | requirements  |                  |                  |
| 06-2014                       | RP-64          | RP-140911              | 2281r1           | Finalization of CoMP demodulation test cases  | 11.8.0           | 11.9.0           |
| 06-2014                       | RP-64          | RP-140914              | 2285             | CR for finalizing DL COMP CSI reporting requirements<br>CR for adding DL CoMP CSI RMC tables (Rel-11) | 11.8.0           | 11.9.0           |
| 06-2014<br>06-2014            | RP-64<br>RP-64 | RP-140914<br>RP-140911 | 2287r1<br>2313   | UE to UE co-existence between B42/B43   | 11.8.0<br>11.8.0 | 11.9.0<br>11.9.0 |
| 06-2014                       | RP-64          | RP-140911<br>RP-140911 | 2313             | Perf: Corrections to CA (Class C) performance with power  | 11.8.0           | 11.9.0           |
| 00-2014                       | 111-04         | 111-140311             | 2317             | imbalance (Rel-11)  | 11.0.0           | 11.3.0           |
| 06-2014                       | RP-64          | RP-140914              | 2320r1           | CR of modification on FelCIC rank testing (Rel-11)  | 11.8.0           | 11.9.0           |
| 06-2014                       | RP-64          | RP-140914              | 2322r1           | CR of introducing FeICIC TM9 testing (Rel-11)   | 11.8.0           | 11.9.0           |
| 06-2014                       | RP-64          | RP-140917              | 2324r1           | CR for EPDCCH SDR test (Rel-11)   | 11.8.0           | 11.9.0           |
| 06-2014                       | RP-64          | RP-140911              | 2327             | Clean-up CR for demodulation requirements (Rel-11)  | 11.8.0           | 11.9.0           |
| 06-2014                       | RP-64          | RP-140911              | 2332             | Throughput calculation for eICIC demodulation requirements  | 11.8.0           | 11.9.0           |
| 06-2014                       | RP-64          | RP-140914              | 2334r1           | Introduction of Band 28 requirements for flexible operation in  | 11.8.0           | 11.9.0           |
|                               |                |                        |                  | Japan   |                  |                  |
| 06-2014                       | RP-64          | RP-140911              | 2336r1           | Add missing Uplink downlink configuration to eICIC TDD RI   | 11.8.0           | 11.9.0           |
| 06-2014                       | RP-64          | RP-140911              | 2340             | requirement<br>Cleanup of terminology for Rx requirements   | 11.8.0           | 11.9.0           |
| 06-2014                       | RP-64          | RP-140911              | 2340             | CR on separating CA UE demodulation tests from single carrier   | 11.8.0           | 11.9.0           |
| 00-2014                       | 111-04         | 111-140910             | 2040             | tests in Rel-11   | 11.0.0           | 11.3.0           |
| 06-2014                       | RP-64          | RP-140911              | 2350             | Test configuration for intra-band contiguous carrier aggregation                                      | 11.8.0           | 11.9.0           |
|                               |                |                        |                  | power control   |                  |                  |
| 06-2014                       | RP-64          | RP-140914              | 2361r1           | Correction of test configurations for intra-band non-contiguous                                       | 11.8.0           | 11.9.0           |
|                               |                |                        |                  | aggregation   |                  |                  |
| 06-2014                       | RP-64          | RP-140911              | 2364             | Clarification on CA bandwidth classes   | 11.8.0           | 11.9.0           |
| 06-2014                       | RP-64          | RP-140917              | 2373             | CR on correction of downlink SDR tests with EPDCCH  | 11.8.0           | 11.9.0           |
| 00.0011                       |                |                        | 0070             | scheduling  | 44.0.0           | 44.0.0           |
| 06-2014                       | RP-64          | RP-140911              | 2376             | Corrections on CA CQI tests   | 11.8.0           | 11.9.0           |
| 06-2014<br>06-2014            | RP-64<br>RP-64 | RP-140911<br>RP-140914 | 2386r1<br>2390   | CR on PDSCH transmission for eICIC CSI requirements (Rel-11)<br>CA_7C A-MPR Corrections               | 11.8.0<br>11.8.0 | 11.9.0<br>11.9.0 |
| 06-2014                       | RP-64          | RP-140914<br>RP-140918 | 2390             | CR for TS36.101 CSI RMC table   | 11.8.0           | 11.9.0           |
| 06-2014                       | RP-64          | RP-140918              | 2393             | CR on correction for TM10 CSI reporting requirements  | 11.8.0           | 11.9.0           |
|                               |                | RP-141525              | 2503             | Perf: Cleanup and better description of DL-RMC-s with dynamic   | 11.9.0           | 11.10.0          |
|                               | KP-nn          |                        |                  |   |                  |                  |
| 09-2014                       | RP-65          |                        |                  | coding rate for CSI requirements (Rei-11)   |                  |                  |
|                               | RP-65          | RP-141525              | 2564             | coding rate for CSI requirements (Rel-11)<br>Corrections to UE coex table                             | 11.9.0           | 11.10.0          |
| 09-2014<br>09-2014<br>09-2014 | RP-65<br>RP-65 | RP-141527              | 2433             | Corrections to UE coex table<br>Correction on support of a bandwidth combination set                  | 11.9.0           | 11.10.0          |
| 09-2014<br>09-2014            | RP-65          |                        |                  | Corrections to UE coex table  |                  |                  |

| 09-2014 | RP-65  | RP-141527 | 2483   | Corrections on delta Tc for UE MOP for intra-band contiguous  | 11.9.0  | 11.10.0 |
|---------|--------|-----------|--------|---|---------|---------|
|         |        |           |        | CA  |         |         |
| 09-2014 | RP-65  | RP-141527 | 2486   | Removal of Class B in UE TX requirement   | 11.9.0  | 11.10.0 |
| 09-2014 | RP-65  | RP-141527 | 2515r1 | CR for CA applicability rule in 36.101 in Rel-11  | 11.9.0  | 11.10.0 |
| 09-2014 | RP-65  | RP-141527 | 2518   | Editorial CR for CA performance tests in 36.101 in Rel-11   | 11.9.0  | 11.10.0 |
| 09-2014 | RP-65  | RP-141527 | 2547   | Correction to NS_20 A-MPR for Band 23   | 11.9.0  | 11.10.0 |
| 09-2014 | RP-65  | RP-141530 | 2446r1 | CR of introducing FeICIC TM9 testing (Rel-11)   | 11.9.0  | 11.10.0 |
| 09-2014 | RP-65  | RP-141530 | 2453   | Maintenance of CoMP demodulation performance requirements (Rel-11)  | 11.9.0  | 11.10.0 |
| 09-2014 | RP-65  | RP-141530 | 2455   | Clean-up CR for EPDCCH and FelCIC PBCH (Rel-11)   | 11.9.0  | 11.10.0 |
| 09-2014 | RP-65  | RP-141530 | 2470   | Throughput calculation for feICIC demodulation requirements   | 11.9.0  | 11.10.0 |
| 09-2014 | RP-65  | RP-141532 | 2438   | CR on correction on CQI reporting TDD CSI meas in case two<br>CSI subframe sets with CRS test (Rel-11)          | 11.9.0  | 11.10.0 |
| 09-2014 | RP-65  | RP-141532 | 2440   | CR on correction on RI reporting CSI meas in case two CSI subframe sets with CRS tests (Rel-11)                 | 11.9.0  | 11.10.0 |
| 09-2014 | RP-65  | RP-141532 | 2443   | Clarification of high speed train scenario in 36.101 (Rel-11)   | 11.9.0  | 11.10.0 |
| 09-2014 | RP-65  | RP-141532 | 2472r1 | Max input for Intra-band non-contiguous CA  | 11.9.0  | 11.10.0 |
| 09-2014 | RP-65  | RP-141532 | 2477   | CQI reporting under fading: CQI indices in set  | 11.9.0  | 11.10.0 |
| 09-2014 | RP-65  | RP-141532 | 2489   | Correction on A-MPR table   | 11.9.0  | 11.10.0 |
| 09-2014 | RP-65  | RP-141532 | 2498   | RF: Corrections to spurious emission band co-existence requirement for Band 44                                  | 11.9.0  | 11.10.0 |
| 09-2014 | RP-65  | RP-141532 | 2521   | CR on CA power imbalance tests in Rel-11  | 11.9.0  | 11.10.0 |
| 12-2014 | RP-66  | RP-142144 | 2573   | CR for REFSENSE in lower SNR and change history   | 11.10.0 | 11.11.0 |
| 12-2014 | RP-66  | RP-142142 | 2586   | CR for 1 PRB allocation performance in presence of MBSFN (rel-11)   | 11.10.0 | 11.11.0 |
| 12-2014 | RP-66  | RP-142144 | 2589   | Maintenance of CA demodulation performance requirements (Rel-11)  | 11.10.0 | 11.11.0 |
| 12-2014 | RP-66  | RP-142147 | 2591   | Clean up for FeICIC demodulation performance requirements (Rel-11)  | 11.10.0 | 11.11.0 |
| 12-2014 | RP-66  | RP-142147 | 2628   | CR to fix error of CA capability for CA performance tests in 36.101 in Rel-11                                   | 11.10.0 | 11.11.0 |
| 12-2014 | RP-66  | RP-142147 | 2633   | Editorial CR for UL configuration table for intra-band contiguous and non-contiguous CA in 36.101, Rel-11       | 11.10.0 | 11.11.0 |
| 12-2014 | RP-66  | RP-142144 | 2636   | Definition of the bits in the bitmap for indication of modified MPR behavior                                    | 11.10.0 | 11.11.0 |
| 12-2014 | RP-66  | RP-142147 | 2660   | Maintenance of TM10 demodulation test configurations on PQI set and ZP-CSIRS (Rel-11 test 8.3.1.3.2, 8.3.2.4.2) | 11.10.0 | 11.11.0 |
| 12-2014 | RP-66  | RP-142149 | 2608r1 | Correction on UE TM3 demodulation performance requirements  | 11.10.0 | 11.11.0 |
| 12-2014 | RP-66  | RP-142147 | 2619r1 | CQI reporting in AWGN: CQI indices in set   | 11.10.0 | 11.11.0 |
| 12-2014 | RP-66  | RP-142147 | 2670r1 | Correction of CoMP TDD CSI tests (Rel-11)   | 11.10.0 | 11.11.0 |
| 12-2014 | RP-66  | RP-142147 | 2640r1 | Applicability of in-gap and out-of-gap measurements for intra-<br>band NC CA                                    | 11.10.0 | 11.11.0 |
| 12-2014 | RP-66  | RP-142144 | 2699   | Delete the incorrect notes for FDD DMRS demodulation tests (Rel-11)   | 11.10.0 | 11.11.0 |
| 12-2014 | RP-66  | RP-142144 | 2719   | Band 22 correction in UE to UE co-existance table.  | 11.10.0 | 11.11.0 |
| 12-2014 | RP-66  | RP-142148 | 2707r1 | Introduction of minimum requirements for intra-band NC CA with timing offset                                    | 11.10.0 | 11.11.0 |
| 12-2014 | RP-66  | RP-142144 | 2726r1 | CR for CA applicability rule in 36.101 in Rel-11  | 11.10.0 | 11.11.0 |
| 12-2014 | RP-66  | RP-142149 | 2675r1 | CR to remove CA capability column in CA performance test<br>tables (Rel-11)                                     | 11.10.0 | 11.11.0 |
| 12-2014 | RP-66  | RP-142149 | 2677r1 | CR to specify applicability of CoMP RI test (Rel-11)  | 11.10.0 | 11.11.0 |
| 12-2014 | RP-66  | RP-142147 | 2746r1 | TS36.101 removal of brackets (RF)   | 11.10.0 | 11.11.0 |
| 12-2014 | RP-66  | RP-142144 | 2754   | Correction to Transmit Modulation Quality for CA  | 11.10.0 | 11.11.0 |
| 12-2014 | RP-66  | RP-142144 | 2709r1 | Clarification of UL and DL CA configuration   | 11.10.0 | 11.11.0 |
| 12-2014 | RP-66  | RP-142144 | 2716r1 | Clarification of notes relating to interferer offsets in intraband CA receiver requirement tables.              | 11.10.0 | 11.11.0 |
| 12-2014 | RP-66  | RP-142147 | 2734r1 | Band 28 and NS_24   | 11.10.0 | 11.11.0 |
| 12-2014 | RP-66  | RP-142144 | 2757   | Correction to Note 2 of Harmonic Signal Exceptions in Spurious<br>Emissions                                     | 11.10.0 | 11.11.0 |
| 12-2014 | RP-66  | RP-142144 | 2750r1 | Removal of brackets and TBD from CA feature   | 11.10.0 | 11.11.0 |
| 12-2014 | RP-66  | RP-142144 | 2687r1 | Removal of brackets and TBD from CA realitie  | 11.10.0 | 11.11.0 |
| 12-2014 | RP-66  | RP-142144 | 2696r1 | Maintenance of CA performance requirements (Rel-11)   | 11.10.0 | 11.11.0 |
| 12-2014 | RP-66  | RP-142144 | 2703r2 | UE to UE co-existence between B42/B43   | 11.10.0 | 11.11.0 |
| 12 2017 | 111 00 |           | 210012 |   | 11.10.0 | 11.11.0 |

# History

|          | Document history |             |  |  |  |  |
|----------|------------------|-------------|--|--|--|--|
| V11.2.0  | November 2012    | Publication |  |  |  |  |
| V11.3.0  | February 2013    | Publication |  |  |  |  |
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| V11.5.0  | July 2013        | Publication |  |  |  |  |
| V11.6.0  | October 2013     | Publication |  |  |  |  |
| V11.7.0  | March 2014       | Publication |  |  |  |  |
| V11.8.0  | April 2014       | Publication |  |  |  |  |
| V11.9.0  | August 2014      | Publication |  |  |  |  |
| V11.10.0 | November 2014    | Publication |  |  |  |  |
| V11.11.0 | April 2015       | Publication |  |  |  |  |