



**Satellite Earth Stations and Systems (SES);  
Harmonised Standard for Mobile Earth Stations (MES)  
operating in the 1 980 MHz to 2 010 MHz (earth-to-space) and  
2 170 MHz to 2 200 MHz (space-to-earth) frequency bands  
covering the essential requirements  
of article 3.2 of the Directive 2014/53/EU;  
Part 2: User Equipment (UE) for wideband systems**

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## Foreword

This Harmonised European Standard (EN) has been produced by ETSI Technical Committee Satellite Earth Stations and Systems (SES).

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.13] to provide one voluntary means of conforming to the essential requirements of Directive 2014/53/EU on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC [9].

Once the present document is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of the present document given in Table A.1 confers, within the limits of the scope of the present document, a presumption of conformity with the corresponding essential requirements of that Directive, and associated EFTA regulations.

The present document is part 2 of a multi-part deliverable covering the Harmonised Standard for Mobile Earth Stations (MES) operating in the 1 980 MHz to 2 010 MHz (earth-to-space) and 2 170 MHz to 2 200 MHz (space-to-earth) frequency bands covering the essential requirements of article 3.2 of the Directive 2014/53/EU, as identified below:

Part 1: "Complementary Ground Component (CGC) for wideband systems";

**Part 2: "User Equipment (UE) for wideband systems";**

Part 3: "User Equipment (UE) for narrowband systems".

National transposition dates	
Date of adoption of this EN:	30 May 2016
Date of latest announcement of this EN (doa):	31 August 2016
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	28 February 2017
Date of withdrawal of any conflicting National Standard (dow):	28 February 2018

## Modal verbs terminology

In the present document **"shall"**, **"shall not"**, **"should"**, **"should not"**, **"may"**, **"need not"**, **"will"**, **"will not"**, **"can"** and **"cannot"** are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

**"must"** and **"must not"** are **NOT** allowed in ETSI deliverables except when used in direct citation.

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## Introduction

The present document is part of a set of standards developed by ETSI and is designed to fit in a modular structure to cover all radio and telecommunications terminal equipment within the scope of the RE Directive [9]. The modular structure is shown in ETSI EG 201 399 [i.3].

# 1 Scope

The present document applies to User Equipment (UE) radio equipment type which has the following characteristics:

- these UEs have both transmit and receive capabilities and operate in an hybrid Satellite/terrestrial network i.e. a satellite and/or Complementary Ground Component (CGC) network;
- the satellite component is based on GSO;
- these UEs operate with an assigned channel signal bandwidth (CBw) of 1 MHz or greater;
- these UEs may be handset, handheld, portable, vehicle-mounted, aircraft mounted device (in this case the present document refers to Aeronautical Terminal - AT) host connected, semi-fixed or fixed equipment, or may be an element in a multi-mode terminal. It may consist of a number of modules with associated connections and user interface, or may be a self contained single unit;
- if the UE is an element in a multi-mode terminal, unless otherwise stated in the present document, its requirements apply only to the UE element of the terminal operating in the Mobile Satellite Service (MSS) frequency bands given in Table 1;
- the present document applies for several class of UEs:
  - UE for terrestrial use Power Class 1 - clauses 4 and 5;
  - UE for terrestrial use Power Class 1bis - clauses 4 and 5;
  - UE for terrestrial use Power Class 2 - clauses 4 and 5;
  - UE for terrestrial use Power Class 3 - clauses 4 and 5;
  - UE for aeronautical use (Aeronautical Terminal - AT) - clauses 6 and 7;
  - UE for terrestrial use (non-aeronautical UE E-UTRA) - clauses 8 and 9;
- the Aeronautical Terminals (AT) operates at altitude of 1 000 m and higher above ground level.

This radio equipment type is capable of operating in all or any part of the frequency bands given in Table 1.

**Table 1: Mobile Satellite Service UE frequency bands**

Operating band	Direction of transmission	UE frequency bands
I	Transmit	1 980 MHz to 2 010 MHz
	Receive	2 170 MHz to 2 200 MHz

The present document is intended to cover the provisions of Directive 2014/53/EU [9] (RE Directive) article 3.2, which states that "*Radio equipment shall be so constructed that it both effectively uses and supports the efficient use of radio spectrum in order to avoid harmful interference*".

NOTE 1: In addition to the unwanted emission limits defined in clauses 4.2.4 and 4.2.5 of the present document, additional operational constraints may be required to prevent harmful interference into services operating in the neighbouring bands outside the operational band defined in Table 1.

In addition to the present document, other ENs that specify technical requirements in respect of essential requirements under other parts of article 3 of the RE Directive [9] may apply to equipment within the scope of the present document.

NOTE 2: A list of such ENs is included on the web site <http://www.newapproach.org>.

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## 2 References

### 2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at <http://docbox.etsi.org/Reference>.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

- [1] Void.
- [2] Void.
- [3] IEC 60068-2-1 (2007): "Environmental testing - Part 2-1: Tests - Test A: Cold".
- [4] IEC 60068-2-2 (2007): "Environmental testing - Part 2-2: Tests - Test B: Dry heat".
- [5] ETSI TS 136 521-1 (V11.1.0) (07-2013): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) conformance specification; Radio transmission and reception; Part 1: Conformance testing (3GPP TS 36.521-1 version 11.1.0 Release 11)".
- [6] ETSI TS 136 101 (V10.11.0) (07-2013): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception (3GPP TS 36.101 version 10.11.0 Release 10)".
- [7] ETSI TS 136 508 (V11.1.1) (08-2013): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Packet Core (EPC); Common test environments for User Equipment (UE) conformance testing (3GPP TS 36.508 version 11.1.1 Release 11)".
- [8] Void.
- [9] Directive 2014/53/EU of the European Parliament and of the Council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC (RE Directive).
- [10] Void.
- [11] ETSI EN 301 908-1 (V5.2.1) (05-2011): "IMT cellular networks; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive; Part 1: Introduction and common requirements".
- [12] ETSI EN 301 908-2 (V5.2.1) (07-2011): "IMT cellular networks; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive; Part 2: CDMA Direct Spread (UTRA FDD) User Equipment (UE)".

### 2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] ETSI TS 125 101: "Universal Mobile Telecommunications System (UMTS); User Equipment (UE) radio transmission and reception (FDD) (3GPP TS 25.101 version 12.6.0 Release 12)".
- [i.2] Directive 98/34/EC of the European Parliament and of the Council of 22 June 1998 laying down a procedure for the provision of information in the field of technical standards and regulations.
- [i.3] ETSI EG 201 399: "Electromagnetic compatibility and Radio spectrum Matters (ERM); A guide to the production of Harmonized Standards for application under the Radio & Telecommunication Terminal Equipment Directive 1999/5/EC (R&TTE) and a first guide on the impact of the Radio Equipment Directive 2014/53/EU (RED) on Harmonized Standards".
- [i.4] Void.
- [i.5] Void.
- [i.6] ETSI TS 136 509 (V10.0.0) (10-2012): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Packet Core (EPC); Special conformance testing functions for User Equipment (UE) (3GPP TS 36.509 version 10.0.0 Release 10)".
- [i.7] Recommendation ITU-R SM.329-12 (2012): "Unwanted emissions in the spurious domain".
- [i.8] ETSI TR 100 028 (all parts) (V1.4.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".
- [i.9] Commission Decision 2010/267/EU of 6 May 2010 on harmonised technical conditions of use in the 790-862 MHz frequency band for terrestrial systems capable of providing electronic communications services in the European Union.
- [i.10] ECC Decision (09)03 of 30 October 2009 on harmonised conditions for mobile/fixed communications networks (MFCN) operating in the band 790 - 862 MHz.
- [i.11] CEPT Report 30 of 30 October 2009 to the European Commission in response to the Mandate on "The identification of common and minimal (least restrictive) technical conditions for 790 - 862 MHz for the digital dividend in the European Union".
- [i.12] Void.
- [i.13] Commission Implementing Decision C(2015) 5376 final of 4.8.2015 on a standardisation request to the European Committee for Electrotechnical Standardisation and to the European Telecommunications Standards Institute as regards radio equipment in support of Directive 2014/53/EU of the European Parliament and of the Council.

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## 3 Definitions, symbols and abbreviations

### 3.1 Definitions

For the purposes of the present document, the terms and definitions given in the RE Directive [9] and the following apply:

**aeronautical CGC:** ground-based infrastructure at fixed locations where the antenna system up-tilted for communications with a terminal mounted on an aircraft (below the fuselage), used to enhance satellite coverage in zones where communications between the aircraft and one or several space stations cannot be ensured with the required quality

**ancillary equipment:** equipment (apparatus), used in connection with User Equipment (UE) is considered as ancillary equipment (apparatus) if:

- the equipment is intended for use in conjunction with a user equipment UE to provide additional operational and/or control features to the radio equipment, (e.g. to extend control to another position or location); and

- the equipment cannot be used on a stand alone basis to provide user functions independently of a UE; and
- the UE to which it is connected is capable of providing some intended operation, such as transmitting and/or receiving without the ancillary equipment (i.e. it is not a sub-unit of the main equipment essential to the main equipment basic functions).

**channel raster:** grade for a Centre Frequency

NOTE: The centre frequency should be an integer multiple of the channel raster.

## 3.2 Symbols

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

$\alpha$	roll-of factor of the transmitter filter
$\Delta F_{\text{OOB}}$	$\Delta$ Frequency of Out-of-band emission
$\text{Car\_Bw}$	Sub-Carrier spacing for multi carrier signals
$\text{CBw}$	Channel signal bandwidth (channel spacing)
$\text{CBw}_{\text{assigned}}$	Assigned channel signal bandwidth (channel spacing)
$\text{CBw}_{\text{adjacent}}$	Adjacent channel signal bandwidth (channel spacing)
$C_{\text{raster}}$	Channel raster
$F_{\text{uw}}$	Frequency of unwanted signal

NOTE: This is specified in bracket in terms of an absolute frequency(s) or a frequency offset from the assigned channel frequency.

$\text{NBw}$  Noise bandwidth

NOTE: In case of single carrier signal, it is equivalent to the Symbol Rate.  $\text{NBw (MHz)} = \text{Symbol\_rate}$ .

In case of Multicarrier signal (for example OFDM),  $\text{NBw (MHz)} = (N+1) \times \text{Car\_Bw (MHz)}$ , where N is the number of used sub-carriers.

$P_{\text{uw}}$	Modulated mean power of the unwanted signal
$P_{\text{w}}$	Modulated mean power of the wanted signal<REFSENS> Reference sensitivity level

NOTE: Corresponding to the minimum mean power received at the UE antenna port at which the Bit Error Ratio (BER) does not exceed a specific value (see ETSI TS 125 101 [i.1]).

## 3.3 Abbreviations

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

AC	Alternating Current
ACLR	Adjacent Channel Leakage power Ratio
ACS	Adjacent Channel Selectivity
AT	Aeronautical Terminal
BER	Bit Error Ratio
BW	Bandwidth
$\text{BW}_{\text{GB}}$	Bandwidth Guard Band
$\text{BW}_{\text{UTRA}}$	UTRA Bandwidth
CA	Carrier Aggregation
CC	Channel Control
CDMA	Code Division Multiple Access
CEPT	European Conference of Postal and Telecommunications Administrations
CGC	Complementary Ground Component
CW	Continuous Wave
DCI	Downlink Control Information



DL	Down Link
NOTE:	Unmodulated signal.
ECC	Electronic Communications Committee
EFTA	European Free Trade Association
EIRP	Equivalent Isotropically Radiated Power
EU	European Union
EUT	Equipment Under Test
FDD	Frequency Division Duplexing
FFS	For Further Study
$F_{uw}$	Frequency of unwanted signal
GSM	Global System for Mobile communications
GSO	GeoSynchronous Orbit
HARQ	Hybrid Automatic-Repeat-Request
IEC	International Electrotechnical Commission
IMT	International Mobile Telecommunications
ITU-R	International Telecommunication Union Radiocommunication Sector
MAC	Medium Access Control
MBW	Measurement Bandwidth
MIMO	Multiple Input Multiple Output
MSS	Mobile Satellite Services
OFDM	Orthogonal Frequency Division Multiplexing
OOB	Out-Of-Band
PCC	Primary Component Carrier
PDCCH	Physical Downlink Control CHannel
PDSCH	Physical Downlink Shared CHannel
PHICH	Physical Hybrid-ARQ Indicator CHannel
$P_{UMAX}$	Maximum UE Power
R&TTE	Radio and Telecommunications Terminal Equipment
RB	Resource Block
RE	Radio Equipment
RF	Radio Frequency
RMC	Reference Measurement Channel
RNTI	Radio Network Temporary Identifier
RRC	Root Raised Cosine
SCC	Secondary Component Carrier
SNR	Signal to Noise Ratio
SS	System Simulator
TBDSS	Test Bed Downlink System Simulation
TDD	Time Division Duplex
TDMA	Time Division Multiple Access
TH	Temperature High
TH/VH	Temperature High/Voltage High
TH/VL	Temperature High/Voltage Low
TL	Temperature Low
TL/VH	Temperature Low/Voltage High
TL/VL	Temperature Low/Voltage Low
ToL	Tolerance
TRP	Total Radiated Power
UE	User Equipment
UL	Up Link
UTRA	Universal Terrestrial Radio Access
VH	Voltage High
VL	Voltage Low

## 4 Technical requirements specifications for UE

### 4.1 Environmental profile

The technical requirements of the present document apply under the environmental profile for operation of the equipment, which shall be declared by the supplier. The equipment shall comply with all the technical requirements of the present document at all times when operating within the boundary limits of the declared operational environmental profile.

For guidance on how a supplier can declare the environmental profile, see annex B.

### 4.2 Conformance requirements

#### 4.2.1 Introduction

The requirements in the clause 4 are based on the assumption that the operating band is shared between systems of the IMT-2000 satellite family or systems having compatible characteristics.

To meet the essential requirements under article 3.2 of the RE Directive [9] for IMT-2000 User Equipment (UE) eight essential parameters have been identified. Table 2 provides a cross reference between these eight essential parameters and the corresponding twelve technical requirements for equipment within the scope of the present document.

**Table 2: Cross references**

Essential parameter	Corresponding technical requirements
Spectrum emissions mask	4.2.4 Spectrum emission mask
	4.2.7 Adjacent Channel Leakage Power Ratio (ACLR)
Conducted spurious emissions from the transmitter antenna connector	4.2.5 Transmitter spurious emissions
Accuracy of maximum output power	4.2.3 Maximum output power
Prevention of harmful interference through control of power	4.2.6 Minimum Output Power
Conducted spurious emissions from the receiver antenna connector	4.2.13 Receiver spurious emissions
Impact of interference on receiver performance	4.2.10 Blocking characteristics
	4.2.11 Receiver spurious response
	4.2.12 Receiver inter-modulation characteristics
Receiver adjacent channel selectivity	4.2.9 Receiver Adjacent Channel Selectivity (ACS)
Control and monitoring functions	4.2.2 Control and monitoring functions
	4.2.8 Out of synchronization handling of output power

#### 4.2.2 Control and monitoring functions

##### 4.2.2.1 Definition

This requirement, together with other control and monitoring technical requirements identified in the table of cross references in the applicable part, verifies that the control and monitoring functions of the UE prevent it from transmitting in the absence of a valid network.

This test is applicable to radio communications equipment and ancillary equipment.

This test shall be performed on the radio communications equipment and/or a representative configuration of the ancillary equipment.

##### 4.2.2.2 Limit

The maximum measured power during the duration of the test shall not exceed -30 dBm.

### 4.2.2.3 Conformance

Conformance tests described in clause 5.4.1 shall be carried out.

## 4.2.3 Maximum output power

### 4.2.3.1 Definition

The nominal maximum output power and its tolerance are defined according to the power class of the UE.

The nominal power defined is the broadband transmit power of the UE, i.e. the power in a bandwidth of at least  $(1 + \alpha)$  times the symbol rate of the radio access mode. The duration of the measurement shall be at least 50 % of one contiguous unit of transmission time.

NOTE: For both TDMA and OFDM, the unit of transmission time corresponds to a frame.

### 4.2.3.2 Limit

The UE maximum output power shall be within the shown value in Table 3 even for the multi-physical channel transmission mode.

**Table 3: UE power classes**

Power Class 1		Power Class 1bis		Power Class 2		Power Class 3	
Power (dBm)	Tol (dB)	Power (dBm)	Tol (dB)	Power (dBm)	Tol (dB)	Power (dBm)	Tol (dB)
+39	+2,7/-2,7	+33	+1/-3	+27	+1/-3	+24	+1,7/-3,7

Power class depends on the transmit power. Corresponding EIRP figure depends on the antenna gain.

### 4.2.3.3 Conformance

Conformance tests described in clause 5.4.2 shall be carried out.

## 4.2.4 Spectrum emissions mask

### 4.2.4.1 Definition

The spectrum emission mask of the UE applies to frequencies, which are between  $CBw/2$  and  $((CBw/2)+10)$  MHz away from the UE centre carrier frequency. The out of channel emission is specified relative to the filtered mean power of the UE carrier.

### 4.2.4.2 Limit

The power of any UE emission shall not exceed the levels specified in Table 4.

**Table 4: Spectrum emission mask requirement**

<b><math>\Delta f</math> in bandwidth units (Notes 1 and 5)</b>	<b>Minimum requirement (Notes 2, 5 and 6)</b>		<b>Measurement bandwidth (Note 4)</b>
	<b>Relative requirement</b>	<b>Absolute requirement</b>	
$\frac{CBw}{2} \leq \Delta f < \frac{CBw}{2} + 1 \text{ MHz}$	$\left\{ -33,5 - \Delta_p - 15 \cdot \left( \Delta f - \frac{CBw}{2} \right) \right\} \text{ dBc}$	-69,6 dBm	30 kHz (note 3)
$\frac{CBw}{2} + 1 \text{ MHz} \leq \Delta f < \frac{CBw}{2} + 5 \text{ MHz}$	$\left\{ -33,5 - \Delta_p - 1 \cdot \left( \Delta f - \left( \frac{CBw}{2} + 1 \right) \right) \right\} \text{ dBc}$	-54,3 dBm	1 MHz
$\frac{CBw}{2} + 5 \text{ MHz} \leq \Delta f < \frac{CBw}{2} + 6 \text{ MHz}$	$\left\{ -37,5 - \Delta_p - 10 \cdot \left( \Delta f - \left( \frac{CBw}{2} + 5 \right) \right) \right\} \text{ dBc}$	-54,3 dBm	1 MHz
$\frac{CBw}{2} + 6 \text{ MHz} \leq \Delta f \leq \frac{CBw}{2} + 10 \text{ MHz}$	-47,5- $\Delta_p$ dBc	-54,3 dBm	1 MHz

NOTE 1:  $\Delta f$  is the separation between the carrier frequency and the centre of the measurement bandwidth.  
NOTE 2: The minimum requirement is calculated from the relative requirement or the absolute requirement, whichever is the higher power.  
NOTE 3: The first and last measurement position with a 30 kHz filter is at  $\Delta f$  equals to  $(CBw/2)+15$  kHz and  $(CBw/2) + 985$  kHz.  
NOTE 4: 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.  
NOTE 5:  $\Delta f$  and CBw units are in MHz.  
NOTE 6:  $\Delta_p$  is a correction factor in dB that shall be determined by the UE Transmit Power (P) measured in dBm as follows:  
For  $P < 24$  dBm:  $\Delta_p = 0$  dB.  
For  $24 \text{ dBm} \leq P \leq 33 \text{ dBm}$ :  $\Delta_p = (P - 24)$  dB.  
For  $33 \text{ dBm} < P$ :  $\Delta_p = 9$  dB.

#### 4.2.4.3 Conformance

Conformance tests described in clause 5.4.3 shall be carried out.

### 4.2.5 Transmitter spurious emissions

#### 4.2.5.1 Definition

Spurious emissions are emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emission, intermodulation products and frequency conversion products, but exclude out-of-band emissions.

#### 4.2.5.2 Limits

The limits shown in Table 5 and Table 6 are only applicable for frequencies which are greater than  $((CBw/2)+10)$  MHz away from the UE centre carrier frequency.

**Table 5: General spurious emissions requirements**

<b>Frequency bandwidth</b>	<b>Measurement bandwidth</b>	<b>Minimum requirement</b>
$9 \text{ kHz} \leq f < 150 \text{ kHz}$	1 kHz	-36 dBm
$150 \text{ kHz} \leq f < 30 \text{ MHz}$	10 kHz	-36 dBm
$30 \text{ MHz} \leq f < 1\,000 \text{ MHz}$	100 kHz	-36 dBm
$1 \text{ GHz} \leq f < 12,75 \text{ GHz}$	1 MHz	-30 dBm

**Table 6: Additional spurious emissions requirements**

Operating Band	Frequency Bandwidth	Measurement Bandwidth	Minimum requirement
I	$925 \text{ MHz} \leq f \leq 935 \text{ MHz}$	100 kHz	-67 dBm
	$935 \text{ MHz} < f \leq 960 \text{ MHz}$	100 kHz	-79 dBm
	$1\,805 \text{ MHz} \leq f \leq 1\,880 \text{ MHz}$	100 kHz	-71 dBm
	$1\,893,5 \text{ MHz} < f < 1\,919,6 \text{ MHz}$	300 kHz	-41 dBm
	$2\,110 \text{ MHz} \leq f \leq 2\,170 \text{ MHz}$	3,84 MHz	-60 dBm
	$2\,170 \leq f \leq 2\,200 \text{ MHz}$	NBw	-60 dBm

### 4.2.5.3 Conformance

Conformance tests described in clause 5.4.3 shall be carried out.

## 4.2.6 Minimum output power

### 4.2.6.1 Definition

The minimum controlled output power of the UE is when the power is set to a minimum value. The minimum transmit power is defined as a mean power in one time slot.

### 4.2.6.2 Limits

The minimum output power shall be less than -49 dBm when a UE is connected to CGCs.

### 4.2.6.3 Conformance

Conformance tests described in clause 5.4.5 shall be carried out.

## 4.2.7 Adjacent Channel Leakage Power Ratio (ACLR)

### 4.2.7.1 Definition

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.

### 4.2.7.2 Limits

The limits to ACLR are measured at frequency offsets which are determined by both the assigned channel bandwidth  $CBW_{\text{assigned}}$  and the adjacent channel bandwidth  $CBW_{\text{adjacent}}$ .

In fact, it is necessary to distinguish two cases:

- Case 1: Adjacent channel bandwidth is the same as the assigned channel bandwidth.
  - This refers to  $CBW_{\text{assigned}} = CBW_{\text{adjacent}} = CBW$ .
  - If the adjacent channel power exceeds -50 dBm then the ACLR shall be higher than the value specified in Table 7.
- Case 2: Adjacent and assigned channel bandwidths are different.
  - This refers to  $CBW_{\text{assigned}} \neq CBW_{\text{adjacent}}$ .
  - If the adjacent channel power exceeds -50 dBm then the ACLR should be higher than the value specified in Table 8.

**Table 7: UE ACLR for same assigned and adjacent channel bandwidth characteristics**

Power Class	Adjacent channel frequency relative to assigned channel frequency	Minimum ACLR requirement
1	$\pm\text{CBw}$	42 dB (see note 4)
1	$\pm 2 \times \text{CBw}$	52 dB (see note 4)
1bis	$\pm\text{CBw}$	42 dB (see note 4)
1bis	$\pm 2 \times \text{CBw}$	52 dB (see note 4)
2	$\pm\text{CBw}$	36 dB
2	$\pm 2 \times \text{CBw}$	46 dB
3	$\pm\text{CBw}$	33 dB
3	$\pm 2 \times \text{CBw}$	43 dB

NOTE 1: The requirement shall still be met in the presence of switching transients.  
NOTE 2: The ACLR requirements reflect what can be achieved with present state of the art technology.  
NOTE 3: Requirement on the UE shall be reconsidered when the state of the art technology progresses.  
NOTE 4: If necessary a guard band may be introduced.

**Table 8: UE ACLR for different assigned and adjacent channel bandwidth characteristics**

Power Class	Adjacent channel frequency relative to assigned channel frequency	Minimum ACLR requirement
1	1 <sup>st</sup> adjacent channel centre	42 dB (see note 4)
1	2 <sup>nd</sup> adjacent channel centre	52 dB (see note 4)
1bis	1 <sup>st</sup> adjacent channel centre	42 dB (see note 4)
1bis	2 <sup>nd</sup> adjacent channel centre	52 dB (see note 4)
2	1 <sup>st</sup> adjacent channel centre	36 dB
2	2 <sup>nd</sup> adjacent channel centre	46 dB
3	1 <sup>st</sup> adjacent channel centre	33 dB
3	2 <sup>nd</sup> adjacent channel centre	43 dB

NOTE 1: The requirement shall still be met in the presence of switching transients.  
NOTE 2: The ACLR requirements reflect what can be achieved with present state of the art technology.  
NOTE 3: Requirement on the UE shall be reconsidered when the state of the art technology progresses.  
NOTE 4: If necessary a guard band may be introduced.

#### 4.2.7.3 Conformance

Conformance tests described in clause 5.4.6 shall be carried out.

### 4.2.8 Out of synchronization handling of output power

#### 4.2.8.1 Definition

The UE shall monitor the downlink signal (associated to the transmission signal of the two ways services) in order to detect a loss of the signal. Upon quality level threshold detection, the UE shall stop transmitting.

#### 4.2.8.2 Limits

Limits are dependent on the radio interface. In any case, in-band spurious emitted shall be lower than minimum output power defined in clause 5.2.6.

#### 4.2.8.3 Conformance

Conformance tests described in clause 5.4.7 shall be carried out.

## 4.2.9 Receiver Adjacent Channel Selectivity (ACS)

### 4.2.9.1 Definition

Adjacent Channel Selectivity (ACS) is a measure of a receiver's ability to receive a 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.

### 4.2.9.2 Limits

The limits to ACS are measured at frequency offsets which are determined by both the assigned channel bandwidth  $CBw_{\text{assigned}}$  and the adjacent channel bandwidth  $CBw_{\text{adjacent}}$ .

In fact, it is necessary to distinguish two cases:

- In the first case, adjacent channel bandwidth is the same as the assigned channel bandwidth:
  - $CBw_{\text{assigned}} = CBw_{\text{adjacent}} = CBw$
- In the second case, adjacent channel bandwidth is different:
  - $CBw_{\text{assigned}} \neq CBw_{\text{adjacent}}$

In the first case Table 9 applies. In the second case, Table 10 applies.

**Table 9: Adjacent Channel Selectivity for the same channel characteristic**

Case	ACS	Interference frequency offset
1	48 dB	$\pm CBw$
2	55 dB	$\pm 2 \times CBw$
3	55 dB	$> 2 \times CBw$

**Table 10: Adjacent Channel Selectivity for different channel characteristic**

Case	ACS	Interference frequency offset
1	48 dB	1 <sup>st</sup> adjacent channel centre
2	55 dB	2 <sup>nd</sup> adjacent channel centre
3	55 dB	$> 2^{\text{nd}}$ adjacent channel centre
NOTE: If necessary a guard band may be introduced.		

### 4.2.9.3 Conformance

Conformance tests described in clause 5.4.8 shall be carried out.

## 4.2.10 Blocking characteristics

### 4.2.10.1 Definition

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. Receiver blocking is specified separately for in-band and out-of-band signals. The blocking performance shall apply at all frequencies except those at which a spurious response occur.

In-band signals are signals in the 2 160 MHz to 2 210 MHz band, i.e. signals in the MSS and neighbouring bands.

Out-of-band signals are signals outside this band.

### 4.2.10.2 Limits

The BER shall not exceed 0,001 for the parameters specified in Table 11.

**Table 11: Test parameters for in-band blocking characteristics**

Parameter	Unit	Level	
Wanted signal	dBm	<REFSENS> + 3 dB	
Interfering signal	dBm	-56 (for $F_{uw}$ offset $\pm 2 \times CBw$ )	-44 (for $F_{uw}$ offset $\pm 3 \times CBw$ )

In-band blocking is defined for an unwanted interfering signal falling into the UE receive band or into the first ( $3 \times CBw$ ) below or above the UE receive band. The BER shall not exceed 0,001 for the parameters specified in Table 12.

**Table 12: Test parameters for out-of-band blocking characteristics**

Parameter	Unit	Frequency range 1	Frequency range 2	Frequency range 3
Wanted signal	dBm	<REFSENS> + 3 dB	<REFSENS> + 3 dB	<REFSENS> + 3 dB
Interfering signal (CW)	dBm	-44	-30	-15
$F_{uw}$	MHz	2 110 < f < 2 155 2 215 < f < 2 260	2 085 < f ≤ 2 110 2 260 ≤ f < 2 285	1 < f ≤ 2 085 2 285 ≤ f < 12 750

### 4.2.10.3 Conformance

Conformance tests described in clause 5.4.9 shall be carried out.

## 4.2.11 Receiver spurious response

### 4.2.11.1 Definition

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 tables is not met.

### 4.2.11.2 Limits

The BER shall not exceed 0,001 for the parameters specified in Table 13.

**Table 13: Test parameters for spurious response**

Parameter	Unit	Level
Wanted signal	dBm	<REFSENS> + 3 dB
Interfering signal (CW)	dBm	-44
$F_{uw}$	MHz	Spurious response frequencies

### 4.2.11.3 Conformance

Conformance tests described in clause 5.4.7 shall be carried out.

## 4.2.12 Receiver intermodulation characteristics

### 4.2.12.1 Definition

Third and higher order mixing of the two interfering RF signals can produce an interfering signal in the band of the desired channel. Intermodulation response rejection is a measure of the capability of the receiver to receive 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.



#### 4.2.12.2 Limits

The BER shall not exceed 0,001 for the parameters specified in Table 14.

**Table 14: Receive intermodulation characteristics**

Parameter	Level		Unit
Wanted signal	<REFSENS> + 3 dB		dBm
Interfering signal 1 (CW)	-46		dBm
Interfering signal 2 (same as wanted)	-46		dBm
F <sub>uw1</sub> (offset)	2 × CBw	-2 × CBw	
F <sub>uw2</sub> (offset)	4 × CBw	-4 × CBw	

#### 4.2.12.3 Conformance

Conformance tests described in clause 5.4.11 shall be carried out.

### 4.2.13 Receiver spurious emissions

#### 4.2.13.1 Definition

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

#### 4.2.13.2 Limits

The power of any narrow band CW spurious emission shall not exceed the maximum level specified in Table 15 and Table 16.

**Table 15: General receiver spurious emission requirements**

Frequency Band	Measurement Bandwidth	Maximum level
$30 \text{ MHz} \leq f < 1 \text{ GHz}$	100 kHz	-57 dBm
$1 \text{ GHz} \leq f \leq 12,75 \text{ GHz}$	1 MHz	-47 dBm

**Table 16: Additional receiver spurious emission requirements**

Band	Frequency Band	Measurement Bandwidth	Maximum level
I	$860 \text{ MHz} \leq f \leq 895 \text{ MHz}$	100 kHz	-60 dBm
	$921 \text{ MHz} \leq f < 925 \text{ MHz}$	100 kHz	-60 dBm (see note)
	$925 \text{ MHz} \leq f \leq 935 \text{ MHz}$	100 kHz	-67 dBm (see note) -60 dBm
	$935 \text{ MHz} < f \leq 960 \text{ MHz}$	100 kHz	-79 dBm (see note)
	$1\,805 \text{ MHz} \leq f \leq 1\,880 \text{ MHz}$	100 kHz	-71 dBm (see note)
	$1\,920 \text{ MHz} \leq f \leq 1\,980 \text{ MHz}$	NBw	-60 dBm
	$1\,980 \text{ MHz} \leq f \leq 2\,010 \text{ MHz}$	NBw	-60 dBm
	$2\,110 \text{ MHz} \leq f \leq 2\,170 \text{ MHz}$	NBw	-60 dBm
	$2\,170 \text{ MHz} \leq f \leq 2\,200 \text{ MHz}$	NBw	-60 dBm
	$2\,620 \text{ MHz} \leq f \leq 2\,690 \text{ MHz}$	NBw	-60 dBm
NOTE: The measurements are made on frequencies which are integer multiples of C <sub>raster</sub> . As exceptions, up to five measurements with a level up to the applicable requirements defined in Table 15 are permitted for each channel used in the measurement.			

### 4.2.13.3 Conformance

Conformance tests described in clause 5.4.12 shall be carried out.

## 5 Testing for compliance with technical requirements

### 5.1 Environmental conditions for testing

#### 5.1.1 Specification of the environmental test conditions

Tests defined in the present document shall be carried out at representative points within the boundary limits of the declared operational environmental profile.

Where technical performance varies subject to environmental conditions, tests shall be carried out under a sufficient variety of environmental conditions (within the boundary limits of the declared operational environmental profile) to give confidence of compliance for the affected technical requirements.

The tests shall be performed under the conditions given in Table 17.

**Table 17: Environmental test conditions**

Equipment Category	Temperature	Voltage
Handheld and handset	Normal	Normal condition voltage ( $\pm 1$ %)
other than handheld/handset	Normal	Higher extreme voltage (+0/-2 %)
other than handheld/handset	Normal	Lower extreme voltage (-0/+2 %)

Normal temperature shall be between +15 °C and +35 °C.

All other tests shall be performed under normal conditions for temperature and voltage, and without vibration.

#### 5.1.2 Tests under extreme voltage conditions

During tests under extreme voltage conditions, the power source of the equipment shall be replaced by a test power source, capable of producing extreme test voltages as specified in clause 5.1.1. The internal impedance of the test power source shall be low enough for its effect on the test results to be negligible. For the test purposes, the voltage of the power source shall be measured at the input terminals of the equipment.

If the equipment is provided with a permanently connected power cable, the test voltage shall be measured at the point of connection of the power cable to the equipment.

In equipment with incorporated batteries, the test power source shall be applied as close to the battery terminals as is practical. In each case connections shall be made readily available by the applicant.

During tests, the power source voltages shall be maintained within a tolerance of  $\pm 3$  % relative to the voltage at the beginning of each test.

### 5.2 Tests frequencies

MSS radio equipment is designed to operate in paired bands. The reference test frequencies for the common test environment are defined in Table 18.

**Table 18: Reference test frequencies**

Test Frequency ID	Frequency of Uplink	Frequency of Downlink
Low Range	1 982,6 MHz	2 172,6 MHz
Mid Range	1 990,0 MHz	2 180,0 MHz
High Range	2 007,4 MHz	2 197,4 MHz

The applicant shall declare the possible values of assigned and adjacent channel bandwidth used by the system. At a minimum, the test cases shall be defined to include all of the declared channel bandwidths. It is assumed that the assigned and adjacent channel bandwidth can respectively fall in the range of 1 MHz to 8 MHz.

## 5.3 Interpretation of the measurement results

The interpretation of the results recorded in a test report for the measurements described in the present document shall be as follows:

- the measured value related to the corresponding limit will be used to decide whether an equipment meets the requirements of the present document;
- the value of the measurement uncertainty for the measurement of each parameter shall be included in the test report;
- the recorded value of the measurement uncertainty shall be, for each measurement, equal to or lower than the figures in Table 19.

For the test methods, according to the present document, the measurement uncertainty figures shall be calculated in accordance with ETSI TR 100 028 [i.8] and shall correspond to an expansion factor (coverage factor)  $k = 1,96$  (which provides a confidence level of 95 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)).

Table 19 is based on this expansion factor.

**Table 19: Maximum measurement uncertainty of the test system**

Parameter	Conditions	Test system uncertainty
Transmitter maximum output power		$\pm 0,7$ dB
Transmitter spectrum emissions mask		$\pm 1,5$ dB
Transmitter spurious emissions	$f \leq 2,3$ GHz $2,3 \text{ GHz} < f \leq 4 \text{ GHz}$ $f > 4 \text{ GHz}$ Co-existence band ( $> -60$ dBm) Co-existence band ( $< -60$ dBm)	$\pm 1,5$ dB $\pm 2,0$ dB $\pm 4,0$ dB $\pm 2,0$ dB $\pm 3,0$ dB
Transmitter Minimum output power		$\pm 1,0$ dB
Receiver Adjacent Channel Selectivity (ACS)		$\pm 1,1$ dB
Receiver Blocking characteristics	$f < \pm(3 \times \text{CBw})$ offset: $\pm(3 \times \text{CBw})$ offset $\leq f \leq 2,3 \text{ GHz}$ $2,3 \text{ GHz} < f \leq 4 \text{ GHz}$ $f > 4 \text{ GHz}$	$\pm 1,4$ dB $\pm 1,0$ dB $\pm 1,7$ dB $\pm 3,1$ dB
Receiver spurious response	$f \leq 2,3 \text{ GHz}$ $2,3 \text{ GHz} < f \leq 4 \text{ GHz}$ $f > 4 \text{ GHz}$	$\pm 1,0$ dB $\pm 1,7$ dB $\pm 3,1$ dB
Receiver intermodulation characteristics		$\pm 1,3$ dB
Receiver spurious emissions	For UE receive band ( $-60$ dBm) For UE transmit band ( $-60$ dBm)  Outside the UE receive band: $f \leq 2,3 \text{ GHz}$ $2,3 \text{ GHz} < f \leq 4 \text{ GHz}$ $f > 4 \text{ GHz}$	$\pm 3,0$ dB $\pm 3,0$ dB  $\pm 2,0$ dB $\pm 2,0$ dB $\pm 4,0$ dB
Out of synchronization of handling power	Data channel $E_c/I_{or}$ Transmit OFF power	$\pm 0,4$ dB $\pm 1,0$ dB
Transmitter adjacent channel leakage power ratio	-	$\pm 0,8$ dB
NOTE 1: For RF tests it should be noted that the uncertainties in Table 19 apply to the test system operating into a nominal 50 $\Omega$ load and do not include system effects due to mismatch between the EUT and the test system.		
NOTE 2: Annex G of ETSI TR 100 028-2 [i.8] provides guidance for the calculation of the uncertainty components relating to mismatch.		

NOTE 3: If the test system for a test is known to have a measurement uncertainty greater than that specified in Table 19, this equipment can still be used provided that an adjustment is made follows: any additional uncertainty in the test system over and above that specified in Table 19 should be used to tighten the test requirements - making the test harder to pass (for some tests, e. g. receiver tests, this may require modification of stimulus signals). This procedure will ensure that a test system not compliant with Table 19 does not increase the probability of passing an EUT that would otherwise have failed a test if a test system compliant with Table 19 had been used.

## 5.4 Radio test suites

### 5.4.1 Control and monitoring functions

#### 5.4.1.1 Test method

- a) At the start of the test, the UE shall be switched off. The UE antenna connector shall be connected to a power measuring equipment, with the following characteristics:
  - the RF bandwidth shall exceed the total operating transmit frequency range of the UE for operation with an applicable part;
  - the response time of the power measuring equipment shall be such that the measured power has reached within 1 dB of its steady state value within 100  $\mu$ s of a CW signal being applied;
  - it shall record the maximum power measured.

NOTE: The equipment may include a video low pass filter to minimize its response to transients or Gaussian noise peaks.

- b) The UE shall be switched on for a period of approximately fifteen minutes, and then switched off.
- c) The UE shall remain switched off for a period of at least thirty seconds, and shall then be switched on for a period of approximately one minute.
- d) Step b) shall be repeated four times.
- e) The maximum power emitted from the UE throughout the duration of the test shall be recorded.

The results obtained shall be compared to the limits in clause 4.2.2.2 in order to prove compliance.

### 5.4.2 Maximum output power

#### 5.4.2.1 Method of test

##### 5.4.2.1.1 Initial conditions

Test environment: normal, TL/VL, TL/VH, TH/VL, TH/VH (for guidance see annex B).

The frequencies to be tested are low range, mid range and high range as defined in clause 5.2:

- 1) Connect the SS to the UE antenna connector.
- 2) A call is set up according to the Generic call setup procedure.
- 3) Enter the UE into loopback test mode and start the loopback test.

#### 5.4.2.1.2 Procedure

- 1) Set and send continuously Up power control commands to the UE.
- 2) Measure the mean power of the UE in a bandwidth of at least  $(1 + \alpha)$  times the symbol rate of the radio access mode. The mean power shall be averaged over at least one transmission time unit.

#### 5.4.2.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.3.2 in order to show compliance.

### 5.4.3 Spectrum emission mask

#### 5.4.3.1 Method of test

##### 5.4.3.1.1 Initial conditions

Test environment: normal, TL/VL, TL/VH, TH/VL, TH/VH (for guidance see annex B).

The frequencies to be tested are low range, mid range and high range as defined in clause 5.2:

- 1) Connect the SS to the UE antenna connector.
- 2) A call is set up according to the Generic call setup procedure.
- 3) Enter the UE into loopback test mode and start the loopback test.

##### 5.4.3.1.2 Procedure

- 1) Set and send continuously Up power control commands to the UE until the UE output power shall be at the maximum level.
- 2) Measure the power of the transmitted signal with a measurement filter of bandwidths according to Table 4. Measurements with an offset from the carrier centre frequency between  $((CBw/2) + 0,015)$  MHz and  $((CBw/2) + 0,985)$  MHz shall use a 30 kHz measurement filter. Measurements with an offset from the carrier centre frequency between 4 MHz and 12 MHz shall use 1 MHz measurement bandwidth and the result may be calculated by integrating multiple 50 kHz or narrower filter measurements. The characteristic of the filter shall be approximately Gaussian (typical spectrum analyser filter). The centre frequency of the filter shall be stepped in contiguous steps according to Table 4. The measured power shall be recorded for each step.
- 3) Measure the filtered mean power centred on the assigned channel frequency.
- 4) Calculate the ratio of the power 2) with respect to 3) in dBc.

#### 5.4.3.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.4.2 in order to show compliance.

### 5.4.4 Transmitter spurious emissions

#### 5.4.4.1 Method of test

##### 5.4.4.1.1 Initial conditions

Test environment: normal, TL/VL, TL/VH, TH/VL, TH/VH (for guidance see annex B).

The frequencies to be tested are low range, mid range and high range as defined in clause 5.2:

- 1) Connect the SS to the UE antenna connector.
- 2) A call is set up according to the Generic call setup procedure.

- 3) Enter the UE into loopback test mode and start the loopback test.

#### 5.4.4.1.2 Procedure

- 1) Set and send continuously Up power control commands to the UE until the UE output power shall be maximum level.
- 2) Sweep the spectrum analyser (or equivalent equipment) over a frequency range and measure the average power of spurious emission.

#### 5.4.4.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.3.2 in order to show compliance.

### 5.4.5 Minimum output power

#### 5.4.5.1 Method of test

##### 5.4.5.1.1 Initial conditions

Test environment: normal, TL/VL, TL/VH, TH/VL, TH/VH (for guidance see annex B).

The frequencies to be tested are mid range as defined in clause 5.2. Set the parameters of the interference signal generator as shown in Table 7 case 1:

- 1) Connect the SS to the UE antenna connector.
- 2) A call is set up according to the Generic call setup procedure.
- 3) Enter the UE into loopback test mode and start the loopback test.

##### 5.4.5.1.2 Procedure

- 1) Set and send continuously down power control commands to the UE.
- 2) Measure the mean power of the UE.

#### 5.4.5.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.3.2 in order to show compliance.

### 5.4.6 Adjacent Channel Leakage power Ratio (ACLR)

#### 5.4.6.0 General

The ACLR related tests shall take into account the two cases described in clause 4.2.7.2.

#### 5.4.6.1 Method of test

##### 5.4.6.1.1 Initial conditions

Test environment: normal, TL/VL, TL/VH, TH/VL, TH/VH (for guidance see annex B).

The frequencies to be tested are mid range as defined in clause 6.2:

- 1) Connect the SS to the UE antenna connector.
- 2) A call is set up according to the Generic call setup procedure.
- 3) Enter the UE into loopback test mode and start the loopback test.

#### 5.4.6.1.2 Procedure

- 1) The SS sends continuously Up power control commands to the UE until the UE transmitter power reach maximum level.
- 2) Measure the filtered mean power.
- 3) Measure the filtered mean power of the first adjacent channels and the second adjacent channels.
- 4) Calculate the ratio of the power between the values measured in 2) and 3) above.

#### 5.4.6.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.3.2 in order to show compliance.

### 5.4.7 Out of synchronization handling of output power

#### 5.4.7.1 Method of test

##### 5.4.7.1.1 Initial conditions

Test environment: normal (for guidance see annex B).

The frequencies to be tested are mid range as defined in clause 5.2:

- 1) Connect the SS to the UE antenna connector.
- 2) A call is set up according to the Generic call setup procedure, with the following exception.
- 3) RF parameters are set up.
- 4) Enter the UE into loopback test mode and start the loopback test.

##### 5.4.7.1.2 Procedure

- 1) The SS sends continuously up power control commands to the UE until the UE transmitter power reach maximum level.
- 2) The SS reduces the downlink synchronization signal level until the declared threshold is reached.
- 3) The SS waits 200 ms and then verifies that the UE transmitter has been switched off.
- 4) The SS monitors the UE transmitted power for 5 s and verifies that the UE transmitter is not switched on during this time.

#### 5.4.7.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.3.2 in order to show compliance.

### 5.4.8 Adjacent Channel Selectivity (ACS)

#### 5.4.8.1 Method of test

##### 5.4.8.1.1 Initial conditions

Test environment: normal, TL/VL, TL/VH, TH/VL, TH/VH (for guidance see annex B).

The frequencies to be tested are mid range defined in clause 4.2.3.2:

- 1) Connect the SS to the UE antenna connector.

- 2) A call is set up according to the Generic call setup procedure, and tested adjacent frequencies are set up according to Table 9 and Table 10.
- 3) Enter the UE into loopback test mode and start the loopback test.

#### 5.4.8.1.2 Procedure

The procedure basics are illustrated in Figure 1:

- 1) Set the parameters of the interference signal generator as shown in Table 9 and Table 10.
- 2) The wanted signal power is adjusted so that the wanted signal is received with 14 dB excess with respect to the SNR threshold, called  $(\text{SNR})_0$  corresponding to the reference BER.
- 3) The interference level signal can be adjusted and can exceed the wanted signal by an excess power  $M$ .
- 4) Measure the BER of data channel received from the UE at the SS.
- 5) The interference signal level is increased until the BER exceeds the reference value corresponding to a given SNR.
- 6) The ACS is given by the following formula in dB:  $\text{ACS} = M + (\text{SNR})_0 + 0,17$ . 0,17 is a correcting factor coming from bullet 2).

Channel frequencies are set according to Figure 1. The three channels are set to normalized 5 MHz channels (2 172,5 MHz, 2 177,5 MHz and 2 182,5 MHz). Figure 1 shows two possible interferers.

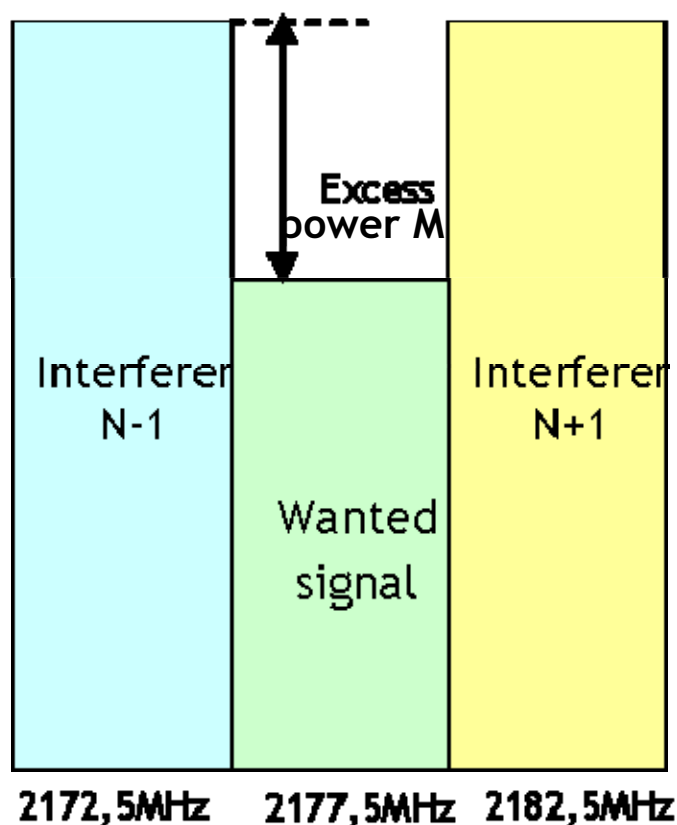


Figure 1: Adjacent channel spectrum

#### 5.4.8.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.3.2 in order to show compliance.



## 5.4.9 Blocking characteristics

### 5.4.9.1 Method of test

#### 5.4.9.1.1 Initial requirements

Test environment: normal, TL/VL, TL/VH, TH/VL, TH/VH (for guidance see annex B).

The frequencies to be tested are mid range as defined in clause 5.2.

For narrow band case, frequencies to be tested are mid range as defined in clause 4.2.3.2:

- 1) Connect the SS to the UE antenna connector.
- 2) A call is set up according to the Generic call setup procedure, and RF parameters are set up according to Table 11 and Table 12.
- 3) Enter the UE into loopback test mode and start the loopback test.

#### 5.4.9.1.2 Procedure

- 1) Set the parameters of the CW generator or the interference signal generator as shown in Table 11 and Table 12. For Table 12 the frequency step size is 1 MHz.
- 2) Set the power level of the UE according to Table 11 and Table 12 with a  $\pm 1$  dB tolerance.
- 3) Measure the BER of data channel received from the UE at the SS.
- 4) For Table 12 record the frequencies for which the BER exceeds the test requirements.

### 5.4.9.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.3.2 in order to show compliance.

## 5.4.10 Receiver spurious response

### 5.4.10.1 Method of test

#### 5.4.10.1.1 Initial conditions

Test environment: normal, TL/VL, TL/VH, TH/VL, TH/VH (for guidance see annex B):

- 1) The frequencies to be tested are mid range as defined in clause 5.2.
- 2) Connect the SS to the UE antenna connector.
- 3) A call is set up according to the Generic call setup procedure, and RF parameters are set up according to Table 13.
- 4) Enter the UE into loopback test mode and start the loopback test.

#### 5.4.10.1.2 Procedure

- 1) Set the parameter of the CW generator as shown in annex B. The spurious response frequencies are determined in step 4) of clause 5.4.9.1.2.
- 2) Set the power level of the UE according to Table 13 with a  $\pm 1$  dB tolerance.
- 3) Measure the BER of data channel received from the UE at the SS.

### 5.4.10.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.3.2 in order to show compliance.

## 5.4.11 Receiver intermodulation characteristics

### 5.4.11.1 Method of test

#### 5.4.11.1.1 Initial conditions

Test environment: normal, TL/VL, TL/VH, TH/VL, TH/VH (for guidance see annex B).

The frequencies to be tested are mid range as defined in clause 5.2:

- 1) Connect the SS to the UE antenna connector.
- 2) A call is set up according to the Generic call setup procedure, and RF parameters are set up according to Table 14.
- 3) Enter the UE into loopback test mode and start the loopback test.

#### 5.4.11.1.2 Procedure

- 1) Set the parameters of the CW generator and interference generator as shown in Table 14.
- 2) Set the power level of the UE according to Table 14 with a  $\pm 1$  dB tolerance.
- 3) Measure the BER of data channel received from the UE at the SS.

### 5.4.11.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.3.2 in order to show compliance.

## 5.4.12 Receiver spurious emissions

### 5.4.12.1 Method of test

#### 5.4.12.1.1 Initial conditions

Test environment: normal, TL/VL, TL/VH, TH/VL, TH/VH (for guidance see annex B).

The frequencies to be tested are mid range as defined in clause 5.2:

- 1) Connect a spectrum analyser (or other suitable test equipment) to the UE antenna connector.
- 2) The UE shall be setup such that UE will not transmit during the measurement.

#### 5.4.12.1.2 Procedure

Sweep the spectrum analyser (or other suitable test equipment) over a frequency range from 30 MHz to 12,75 GHz and measure the average power of the spurious emissions.

### 5.4.12.2 Test requirements

The results obtained shall be compared to the limits in clause 4.2.3.2 in order to show compliance.

## 6 Technical requirements specifications for the UE mounted on aircraft (Aeronautical Terminals)

### 6.1 Environmental profile

The technical requirements of the present document apply under the environmental profile for operation of the aeronautical terminal, which shall be declared by the supplier. The equipment shall comply with all the technical requirements of the present document at all times when operating within the boundary limits of the declared operational environmental profile.

For guidance on how a supplier can declare the environmental profile, see annex B.

### 6.2 Conformance requirements

#### 6.2.0 General

The requirements in this clause apply to ATs communicating with Aeronautical CGCs.

#### 6.2.1 Introduction

To meet the essential requirements under article 3.2 of the RE Directive [9] for AT 10 essential parameters have been identified. Table 20 provides a cross reference between these eight essential parameters and the corresponding eleven technical requirements for equipment within the scope of the present document.

**Table 20: Cross references**

Essential parameter	Corresponding technical requirements
Spectrum emissions mask	6.2.3 Spectrum emission mask
	6.2.6 Adjacent Channel Leakage Power Ratio (ACLR)
Conducted spurious emissions from the transmitter antenna connector	6.2.4 Transmitter spurious emissions
Accuracy of maximum output power	6.2.2 Transmitter Maximum output power
Prevention of harmful interference through control of power	6.2.5 Transmitter Minimum Output Power
Conducted spurious emissions from the receiver antenna connector	6.2.11 Receiver spurious emissions
Impact of interference on receiver performance	6.2.8 Blocking characteristics
	6.2.9 Receiver spurious response
	6.2.10 Receiver inter-modulation characteristics
Receiver adjacent channel selectivity	6.2.7 Receiver Adjacent Channel Selectivity (ACS)
Control and Monitoring functions	ETSI EN 301 908-1 [11], clause 4.2.4 Control and Monitoring functions
NOTE: Out of synchronization requirement in ETSI EN 301 908-2 [12] is not included in the present document due to fact that E-UTRA has network controlled dynamic resource allocation mitigating the risk of interference in out of synchronization situation.	

#### 6.2.2 Transmitter Maximum output power

##### 6.2.2.1 Definition

The nominal maximum output power and its tolerance are defined in Table 21.

### 6.2.2.2 Limit

The AT maximum output power shall be within the shown value in Table 21.

**Table 21: AT maximum output power and tolerance**

Power (dBm)	Tol (dB)
37	+2,7/-2,7

### 6.2.2.3 Conformance

Conformance tests described in clause 7.4.2 shall be carried out.

## 6.2.3 Transmitter Spectrum emissions mask

### 6.2.3.1 Definition

The spectrum emission mask of the AT applies to frequencies ( $\Delta f_{\text{OoB}}$ ) starting from the  $\pm$  edge of the assigned E-UTRA channel bandwidth.

### 6.2.3.2 Limit

The power of any AT emission shall not exceed the levels specified in Table 22.

**Table 22: Spectrum emission mask requirement**

$\Delta f_{\text{OoB}}$ (MHz)	Spectrum emission limit (dBm)/Channel bandwidth			
	5 MHz	10 MHz	15 MHz	Measurement bandwidth
$\pm 0$ to 1	-13,5	-16,5	-18,5	30 kHz
$\pm 1$ to 2,5	-8,5	-8,5	-8,5	1 MHz
$\pm 2,5$ to 2,8	-8,5	-8,5	-8,5	1 MHz
$\pm 2,8$ to 5	-8,5	-8,5	-8,5	1 MHz
$\pm 5$ to 6	-11,5	-11,5	-11,5	1 MHz
$\pm 6$ to 10	-23,5	-11,5	-11,5	1 MHz
$\pm 10$ to 15	N/A	-23,5	-11,5	1 MHz
$\pm 15$ to 20	N/A	N/A	-23,5	1 MHz

NOTE 1: The first and last measurement position with a 30 kHz filter is at  $\Delta f_{\text{OoB}}$  equals to 0,015 MHz and 0,985 MHz.

NOTE 2: The first and last measurement position with a 1 MHz filter for 1 MHz - 2,5 MHz offset range is at  $\Delta f_{\text{OoB}}$  equals to 1,5 MHz and 2,0 MHz. Similarly for other  $\Delta f_{\text{OoB}}$  ranges.

NOTE 3: The measurements are to be performed above the upper edge of the channel and below the lower edge of the channel.

### 6.2.3.3 Conformance

Conformance tests described in clause 7.4.3 shall be carried out.

## 6.2.4 Transmitter spurious emissions

### 6.2.4.1 Definition

Spurious emissions are emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emission, intermodulation products and frequency conversion products, but exclude out-of-band emissions.

### 6.2.4.2 Limits

The limits shown in Table 24 and Table 25 are only applicable for frequency ranges which are greater than  $\Delta f_{\text{OOB}}$  (MHz) from the edge of the channel bandwidth shown in Table 23.

**Table 23:  $\Delta f_{\text{OOB}}$  boundary between E-UTRA channel and spurious emission domain**

Channel bandwidth	5 MHz	10 MHz	15 MHz
$\Delta f_{\text{OOB}}$ (MHz)	10	15	20

**Table 24: General spurious emissions limits**

Frequency range	Maximum level	Measurement bandwidth
9 kHz $\leq f < 150$ kHz	-36 dBm	1 kHz
150 kHz $\leq f < 30$ MHz	-36 dBm	10 kHz
30 MHz $\leq f < 1\,000$ MHz	-36 dBm	100 kHz
1 GHz $\leq f < 12,75$ GHz	-30 dBm	1 MHz

**Table 25: Spurious emission band UE co-existence limits**

E-UTRA Band	Spurious emission						
	Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	Note
1	E-UTRA Band 1, 5, 7, 8, 11, 18, 19, 20, 21, 22, 26, 27, 28, 31, 32, 38, 40, 41, 42, 43, 44	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	
	E-UTRA Band 3, 34	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	1
	Frequency range	1 880	-	1 895	-40	1	1
	Frequency range	1 895	-	1 915	-15,5	5	1
	Frequency range	1 915	-	1 920	+1,6	5	1
	Frequency range	1 839,9	-	1 879,9	-50	1	1
NOTE:	These requirements also apply for the frequency ranges that are less than Δf <sub>OOB</sub> (MHz) in Table 23.						

### 6.2.4.3 Conformance

Conformance tests described in clause 7.4.4 shall be carried out.

## 6.2.5 Transmitter Minimum output power

### 6.2.5.1 Definition

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

### 6.2.5.2 Limits

The minimum output power measured shall not exceed the values specified in Table 26.

**Table 26: Minimum output power for Aeronautical Terminal**

	Channel bandwidth/minimum output power/measurement bandwidth		
	5 MHz	10 MHz	15 MHz
Minimum output power	$\leq -39$ dBm		
Measurement bandwidth	4,5 MHz	9,0 MHz	13,5 MHz

### 6.2.5.3 Conformance

Conformance tests described in clause 7.4.5 shall be carried out.

## 6.2.6 Adjacent Channel Leakage Power Ratio (ACLR)

### 6.2.6.1 Definition

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.

### 6.2.6.2 Limits

If the measured adjacent channel power is greater than -50 dBm then the measured ACLR shall be higher than the limits in Table 27.

**Table 27: AT ACLR**

	Channel bandwidth/ACLR/measurement bandwidth		
	5 MHz	10 MHz	15 MHz
<b>ACLR</b>	44 dB	44 dB	44 dB
<b>Channel Measurement bandwidth</b>	4,5 MHz	9,0 MHz	13,5 MHz
<b>Aeronautical terminal channel</b>	+5 MHz or -5 MHz	+10 MHz or -10 MHz	+15 MHz or -15 MHz

### 6.2.6.3 Conformance

Conformance tests described in clause 7.4.6 shall be carried out.

## 6.2.7 Receiver Adjacent Channel Selectivity (ACS)

### 6.2.7.1 Definition

Adjacent Channel Selectivity (ACS) is a measure of a receiver's ability to receive a 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.

### 6.2.7.2 Limits

Limits specified in Table 25 apply.

The throughput shall be  $\geq 95$  % of the maximum throughput of the reference measurement channels under the conditions specified in Table 29 and also under the conditions specified in Table 30.

**Table 28: Test parameters for Adjacent channel selectivity**

Rx Parameter	Channel bandwidth			
	Units	5 MHz	10 MHz	15 MHz
ACS	dB	33,0	33,0	30

**Table 29: Test parameters for Adjacent channel selectivity, Case 1**

Rx Parameter	Units	Channel bandwidth		
		5 MHz	10 MHz	15 MHz
Power in Transmission Bandwidth Configuration	dBm	REFSENS + 14 dB		
$P_{\text{Interferer}}$	dBm	REFSENS +45,5 dB	REFSENS +45,5 dB	REFSENS +42,5 dB
$BW_{\text{Interferer}}$	MHz	5	5	5
$F_{\text{Interferer}}$ (offset)	MHz	5,0025	7,5075	10,0125
NOTE 1: The transmitter shall be set to 4 dB below $P_{\text{CMAX\_L}}$ or $P_{\text{CMAX\_L\_CA}}$ as defined in clause 6.2.5 in ETSI TS 136 101 [6].				
NOTE 2: The interferer consists of the Reference measurement channel specified in clause A.3.2 of ETSI TS 136 521-1 [5] with set-up according to clause C.3.1 of ETSI TS 136 521-1 [5].				
NOTE 3: REFSENS as defined in ETSI TS 136 521-1 [5].				

**Table 30: Test parameters for Adjacent channel selectivity, Case 2**

Rx Parameter	Units	Channel bandwidth		
		5 MHz	10 MHz	15 MHz
Power in Transmission Bandwidth Configuration	dBm	-56,5	-56,5	-53,5
$P_{\text{Interferer}}$	dBm	-25		
$BW_{\text{Interferer}}$	MHz	5	5	5
$F_{\text{Interferer}}$ (offset)	MHz	5,0025	7,5075	10,0125
NOTE 1: The transmitter shall be set to 24 dB below $P_{\text{CMAX\_L}}$ or $P_{\text{CMAX\_L\_CA}}$ as defined in clause 6.2.5 in ETSI TS 136 101 [6].				
NOTE 2: The interferer consists of the Reference measurement channel specified in clause A.3.2 of ETSI TS 136 521-1 [5] with set-up according to clause C.3.1 of ETSI TS 136 521-1 [5].				

### 6.2.7.3 Conformance

Conformance tests described in clause 7.4.8 shall be carried out.

## 6.2.8 Blocking characteristics

### 6.2.8.1 Definition

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. Receiver blocking is specified separately for in-band and out-of-band signals. The blocking performance shall apply at all frequencies except those at which a spurious response occur.

In-band signals are signals in the 2 160 MHz to 2 210 MHz band, i.e. signals in the MSS and neighbouring bands.

Out-of-band signals are signals outside this band.

### 6.2.8.2 Limits

With parameters specified in Table 31 and Table 32, the throughput shall be  $\geq 95$  % of the maximum throughput of the reference measurement channels as specified in ETSI TS 136 521-1 [5].

With parameters specified in Table 33 and Table 34, the throughput shall be  $\geq 95$  % of the maximum throughput of the reference measurement channels as specified in ETSI TS 136 521-1 [5], except for the spurious response frequencies.

With parameters specified in Table 35, the throughput shall be  $\geq 95$  % of the maximum throughput of the reference measurement channels.

Table 31: In-band blocking parameters

Rx Parameter	Units	Channel bandwidth		
		5 MHz	10 MHz	15 MHz
Power in Transmission Bandwidth Configuration	dBm	REFSENS + channel bandwidth specific value below		
		6	6	7
BW <sub>Interferer</sub>	MHz	5	5	5
F <sub>offset, case 1</sub>	MHz	7,5125	7,5025	7,5075
F <sub>offset, case 2</sub>	MHz	12,5075	12,5125	12,5025
NOTE 1: The transmitter shall be set to 4 dB below P <sub>C<sub>MAX,L</sub></sub> at the minimum uplink configuration specified in ETSI TS 136 101 [6] (Table 7.3.1-2 with P <sub>C<sub>MAX,L</sub></sub> as defined in clause 6.2.5).				
NOTE 2: The interferer consists of the Reference measurement channel specified in clause A.3.2 of ETSI TS 136 521-1 [5] with a set-up according to clause C.3.1 of ETSI TS 136 521-1 [5].				
NOTE 3: REFSENS as defined in ETSI TS 136 521-1 [5].				

Table 32: In-band blocking

E-UTRA band	Parameter	Units	Case 1	Case 2
	P <sub>Interferer</sub>	dBm	-56	-44
	F <sub>Interferer</sub> (Offset)	MHz	$= -BW/2 - F_{\text{offset, case 1}}$ and $= +BW/2 + F_{\text{offset, case 1}}$	$\leq -BW/2 - F_{\text{offset, case 2}}$ and $\geq +BW/2 + F_{\text{offset, case 2}}$
NOTE 1: For certain bands, the unwanted modulated interfering signal may not fall inside the UE receive band, but within the first 15 MHz below or above the UE receive band.				
NOTE 2: F <sub>Interferer</sub> range values for unwanted modulated interfering signal are interferer center frequencies.				

Table 33: Out-of-band blocking parameters

Rx Parameter	Units	Channel bandwidth		
		5 MHz	10 MHz	15 MHz
Power in Transmission Bandwidth Configuration	dBm	REFSENS + channel bandwidth specific value below		
		6	6	7
NOTE 1: The transmitter shall be set to 4 dB below $P_{\text{CMAX,L}}$ at the minimum uplink configuration specified in ETSI TS 136 101 [6] (Table 7.3.1-2 with $P_{\text{CMAX,L}}$ as defined in clause 6.2.5).				
NOTE 2: Reference measurement channel is clause A.3.2 of ETSI TS 136 521-1 [5].				
NOTE 3: REFSENS as defined in ETSI TS 136 521-1 [5].				

Table 34: Out-of-band blocking

Parameter	Units	Frequency		
		Range 1	Range 2	Range 3
P <sub>Interferer</sub>	dBm	-44	-30	-15
F <sub>Interferer</sub> (CW)	MHz	2 110 < f < 2 155	2 085 < f ≤ 2 110	1 < f ≤ 2 085
		2 215 < f < 2 260	2 260 ≤ f < 2 285	2 285 ≤ f < 12 750
NOTE: Range 3 shall be tested only with the highest channel bandwidth.				



**Table 35: Narrow-band blocking**

Parameter	Unit	Channel Bandwidth		
		5 MHz	10 MHz	15 MHz
$P_w$	dBm	$P_{\text{REFSENS}}$ + channel-bandwidth specific value below		
		16	13	14
$P_{\text{uw}}$ (CW)	dBm	-55	-55	-55
$F_{\text{uw}}$ (offset for, $\Delta f = 15$ kHz)	MHz	2,7075	5,2125	7,7025
NOTE 1: The transmitter shall be set a 4 dB below $P_{\text{CMAX\_L}}$ at the minimum uplink configuration specified in ETSI TS 136 101 [6] (Table 7.3.1-2 with $P_{\text{CMAX\_L}}$ as defined in clause 6.2.5).				
NOTE 2: Reference measurement channel is in clause A.3.2 of ETSI TS 136 521-1 [5].				
NOTE 3: REFSENS as defined in ETSI TS 136 521-1 [5].				

### 6.2.8.3 Conformance

Conformance tests described in clause 7.4.9 shall be carried out.

## 6.2.9 Receiver spurious response

### 6.2.9.1 Definition

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 tables is not met.

### 6.2.9.2 Limits

The throughput shall be  $\geq 95$  % of the maximum throughput of the reference measurement channels as specified in ETSI TS 136 521-1 [5] with parameters specified in Table 36 and Table 37.

**Table 36: Spurious response parameters**

Rx Parameter	Units	Channel bandwidth		
		5 MHz	10 MHz	15 MHz
Power in Transmission Bandwidth Configuration	dBm	REFSENS + channel bandwidth specific value below		
		6	6	7
NOTE 1: The transmitter shall be set to 4 dB below $P_{\text{CMAX\_L}}$ at the minimum uplink configuration specified in ETSI TS 136 101 [6] (Table 7.3.1-2 with $P_{\text{CMAX\_L}}$ as defined in clause 6.2.5).				
NOTE 2: Reference measurement channel is clause A.3.2 of ETSI TS 136 521-1 [5].				
NOTE 3: REFSENS as defined in ETSI TS 136 521-1 [5].				

**Table 37: Spurious Response**

Parameter	Unit	Level
$P_{\text{Interferer}}$ (CW)	dBm	-44
$F_{\text{Interferer}}$	MHz	Spurious response frequencies

### 6.2.9.3 Conformance

Conformance tests described in clause 7.4.10 shall be carried out.

## 6.2.10 Receiver intermodulation characteristics

### 6.2.10.1 Definition

Third and higher order mixing of the two interfering RF signals can produce an interfering signal in the band of the desired channel. Intermodulation response rejection is a measure of the capability of the receiver to receive 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.

### 6.2.10.2 Limits

The throughput shall be  $\geq 95$  % of the maximum throughput of the reference measurement channels as specified in ETSI TS 136 521-1 [5] with parameters specified in Table 38 for the specified wanted signal mean power in the presence of two interfering signals.

**Table 38: AT test parameters for Wide band intermodulation**

Rx Parameter	Units	Channel bandwidth		
		5 MHz	10 MHz	15 MHz
Power in Transmission Bandwidth Configuration	dBm	REFSENS + channel bandwidth specific value below		
		6	6	7
P <sub>Interferer 1</sub> (CW)	dBm	-46		
P <sub>Interferer 2</sub> (Modulated)	dBm	-46		
BW <sub>Interferer 2</sub>		5		
F <sub>Interferer 1</sub> (Offset)	MHz	-BW/2 - 7,5 / +BW/2 + 7,5		
F <sub>Interferer 2</sub> (Offset)	MHz	2 × F <sub>Interferer 1</sub>		
NOTE 1: The transmitter shall be set to 4 dB below P <sub>CMAX_L</sub> at the minimum uplink configuration specified in ETSI TS 136 101 [6] (Table 7.3.1-2 with P <sub>CMAX_L</sub> as defined in clause 6.2.5).				
NOTE 2: Reference measurement channel is clause A.3.2 of ETSI TS 136 521-1 [5].				
NOTE 3: The modulated interferer consists of the Reference measurement channel specified in clause A.3.2 of ETSI TS 136 521-1 [5] with set-up according to clause C.3.1 of ETSI TS 136 521-1 [5]. The interfering modulated signal is 5 MHz E-UTRA signal as described in annex D of ETSI TS 136 521-1 [5] for channel bandwidth ≥ 5 MHz.				
NOTE 4: REFSENS as defined in ETSI TS 136 521-1 [5].				

### 6.2.10.3 Conformance

Conformance tests described in clause 7.4.11 shall be carried out.

## 6.2.11 Receiver spurious emissions

### 6.2.11.1 Definition

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

### 6.2.11.2 Limits

The measured spurious emissions derived in clause 7.4.12 shall not exceed the maximum level specified in Table 39 and Table 40.

**Table 39: General receiver spurious emission requirements**

Frequency Band	Measurement Bandwidth	Maximum level
$30 \text{ MHz} \leq f < 1 \text{ GHz}$	100 kHz	-57 dBm
$1 \text{ GHz} \leq f \leq 12,75 \text{ GHz}$	1 MHz	-47 dBm

### 6.2.11.3 Conformance

Conformance tests described in clause 7.4.12 shall be carried out.

## 7 Testing for compliance with technical requirements for Aeronautical Terminal (AT)

### 7.1 Environmental conditions for testing

#### 7.1.0 General

Tests defined in the present document shall be carried out at representative points within the boundary limits of the declared operational environmental profile.

Where technical performance varies subject to environmental conditions, tests shall be carried out under a sufficient variety of environmental conditions (within the boundary limits of the declared operational environmental profile) to give confidence of compliance for the affected technical requirements.

Many tests in the present document are performed with appropriate frequencies in the low, middle and high range of the operating frequency band of the UE. These frequencies are defined in ETSI TS 136 508 [7].

#### 7.1.1 Specification of the environmental test conditions

The tests shall be performed under the conditions given in Table 40.

**Table 40: Environmental test conditions**

Equipment Category	Temperature	Voltage
Handheld and handset	Normal	Normal condition voltage ( $\pm 1 \%$ )
other than handheld/handset	Normal	Higher extreme voltage ( $+0/-2 \%$ )
other than handheld/handset	Normal	Lower extreme voltage ( $-0/+2 \%$ )

Normal temperature shall be between  $+15 \text{ }^{\circ}\text{C}$  and  $+35 \text{ }^{\circ}\text{C}$ .

All other tests shall be performed under normal conditions for temperature and voltage, and without vibration.

### 7.2 Void

### 7.3 Interpretation of the measurement results

The interpretation of the results recorded in a test report for the measurements described in the present document shall be as follows:

- the measured value related to the corresponding limit will be used to decide whether an equipment meets the requirements of the present document;

- the value of the measurement uncertainty for the measurement of each parameter shall be included in the test report;
- the recorded value of the measurement uncertainty shall be, for each measurement, equal to or lower than the figures in Table 41.

For the test methods, according to the present document, the measurement uncertainty figures shall be calculated in accordance with ETSI TR 100 028 [i.8] and shall correspond to an expansion factor (coverage factor)  $k = 1,96$  (which provides a confidence level of 95 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)).

Table 41 is based on this expansion factor.

**Table 41: Maximum measurement uncertainty of the test system**

Parameter	Conditions	Test system uncertainty
Transmitter maximum output power		$\pm 0,7$ dB
Transmitter spectrum emissions mask		$\pm 1,5$ dB
Transmitter spurious emissions	9 kHz < $f \leq 4$ GHz: $\pm 2,0$ dB 4 GHz < $f \leq 12,75$ GHz: $\pm 4,0$ dB	$\pm 2,0$ dB $\pm 4,0$ dB
Transmitter Minimum output power		$\pm 1,0$ dB
Receiver Adjacent Channel Selectivity (ACS)		$\pm 1,1$ dB
Receiver Blocking characteristics	1 MHz < $f_{\text{interferer}} \leq 3$ GHz 3 GHz < $f_{\text{interferer}} \leq 12,75$ GHz	$\pm 1,3$ dB $\pm 3,2$ dB
Receiver spurious response	1 MHz < $f_{\text{interferer}} \leq 3$ GHz 3 GHz < $f_{\text{interferer}} \leq 12,75$ GHz	$\pm 1,3$ dB $\pm 3,2$ dB
Receiver intermodulation characteristics		$\pm 1,4$ dB
Receiver spurious emissions	30 MHz $\leq f \leq 4,0$ GHz: $\pm 2,0$ dB 4 GHz < $f \leq 12,75$ GHz: $\pm 4,0$ dB	$\pm 2,0$ dB $\pm 4,0$ dB
Transmitter adjacent channel leakage power ratio	-	$\pm 0,8$ dB
NOTE 1: For RF tests it should be noted that the uncertainties in Table 41 apply to the test system operating into a nominal 50 $\Omega$ load and do not include system effects due to mismatch between the EUT and the test system.		
NOTE 2: If the test system for a test is known to have a measurement uncertainty greater than that specified in Table 5.2-1 of ETSI TS 136 521-1 [5], this equipment can still be used provided that an adjustment is made follows: any additional uncertainty in the test system over and above that specified in Table 41 should be used to tighten the test requirements - making the test harder to pass (for some tests, e.g. receiver tests, this may require modification of stimulus signals). This procedure will ensure that a test system not compliant with Table 41 does not increase the probability of passing an EUT that would otherwise have failed a test if a test system compliant with Table 41 had been used.		

## 7.4 Radio test suites

### 7.4.1 Void

### 7.4.2 Maximum output power

#### 7.4.2.1 Method of test

##### 7.4.2.1.1 Initial conditions

Test environment: normal, TL/VL, TL/VH, TH/VL, TH/VH; as specified in annex B.

Frequencies to be tested: low range, mid range, high range; as specified in clause 7.1.

Channel bandwidths to be tested: lowest, 5 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [7], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [5]:

- 5) Connect the SS to the AT antenna connectors.
- 6) The parameter settings for the cell are set up according to ETSI TS 136 508 [7], clause 4.4.3.
- 7) Downlink signals are initially set up according to ETSI TS 136 521-1 [5], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.
- 8) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [5].
- 9) Propagation conditions are set according to ETSI TS 136 521-1 [5], clause B.0.
- 10) Ensure the AT is in State 3A-RF according to ETSI TS 136 508 [7], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [5], ETSI TS 136 508 [7] and ETSI TS 136 509 [i.6] respectively.

#### 7.4.2.1.2 Procedure

- 1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C\_RNTI to schedule the UL RMC according to Table 6.2.2.1.4.1-1 of ETSI TS 136 521-1 [5]. Since the AT has no payload and no loopback data to send the AT sends uplink MAC padding bits on the UL RMC.
- 2) Send continuously uplink power control "up" commands in every uplink scheduling information to the AT; allow at least 200 ms for the aircraft terminal to reach  $P_{UMAX}$  level.
- 3) Measure the mean power of the AT in the channel bandwidth of the radio access mode. The period of measurement shall be at least the continuous duration of one sub-frame (1 ms). For TDD slots with transient periods are not under test.
- 4) Repeat for applicable test frequencies, channel bandwidths, operating band combinations and environmental conditions.

Details of the test method can be found in ETSI TS 136 521-1 [5], clause 6.2.2.

#### 7.4.2.2 Test requirements

The results obtained shall be compared to the limits in clause 6.2.3 in order to show compliance.

### 7.4.3 Transmitter Spectrum emission mask

#### 7.4.3.1 Method of test

##### 7.4.3.1.1 initial conditions

Test Environment: normal, as specified in annex B.

Frequencies to be tested: low range, mid range, high range as specified in clause 7.1.

Channel bandwidth to be tested: lowest, 5 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [7].

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [5]:

- 1) Connect the SS to the AT antenna connectors.
- 2) The parameter settings for the cell are set up according to ETSI TS 136 508 [7], clause 4.4.3.
- 3) Downlink signals are initially set up according to ETSI TS 136 521-1 [5], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.
- 4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [5].
- 5) Propagation conditions are set according to ETSI TS 136 521-1 [5], clause B.0.

- 6) Ensure the AT is in State 3A-RF according to ETSI TS 136 508 [7], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [5], ETSI TS 136 508 [7] and ETSI TS 136 509 [i.6] respectively.

#### 7.4.3.1.2 Procedure

- 1) SS sends uplink scheduling information via PDCCH DCI format 0 for C\_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [5], Table 6.6.2.1.4.1-1. Since the AT has no payload data to send, the AT transmits uplink MAC padding bits on the UL RMC.
- 2) Send continuously uplink power control "up" commands in the uplink scheduling information to the AT until the AT transmits at  $P_{\text{UMAX}}$  level.
- 3) Measure the power of the transmitted signal with a measurement filter of bandwidths according to Table 22, as applicable. The center frequency of the filter shall be stepped in continuous steps according to the same table. The measured power shall be recorded for each step. The measurement period shall capture the active TSs.
- 4) Repeat for applicable test frequencies, channel bandwidths and operating band combinations.
- 5) Details of the test method can be found in ETSI TS 136 521-1 [5], clause 6.6.2.1.

#### 7.4.3.2 Test requirements

The results obtained shall be compared to the limits in clause 6.2.4.2 in order to show compliance.

### 7.4.4 Transmitter spurious emissions

#### 7.4.4.1 Method of test

##### 7.4.4.1.1 Initial conditions

Test Environment: normal, as specified in annex B.

Frequencies to be tested: low range, mid range, high range; as specified in clause 7.1.

Channel bandwidth to be tested: lowest, 5 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [7].

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [5]:

- 1) Connect the SS to the AT antenna connectors.
- 2) The parameter settings for the cell are set up according to ETSI TS 136 508 [7], clause 4.4.3.
- 3) Downlink signals are initially set up according to ETSI TS 136 521-1 [5], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.
- 4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [5].
- 5) Propagation conditions are set according to ETSI TS 136 521-1 [5], clause B.0.
- 6) Ensure the AT is in State 3A-RF according to ETSI TS 136 508 [7], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [5], ETSI TS 136 508 [7] and ETSI TS 136 509 [i.6] respectively.

#### 7.4.4.1.2 Procedure

- 1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C\_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [5], Table 6.6.3.1.4.1-1. Since the AT has no payload data to send, the AT transmits uplink MAC padding bits on the UL RMC.

- 2) Send continuously Up power control commands in the uplink scheduling information to the AT until the AT transmits at  $P_{UMAX}$  level.
- 3) For each applicable requirement in Table 24 and Table 25; measure the power of the transmitted signal with a measurement filter of bandwidths. The center frequency of the filter shall be stepped in contiguous steps according to the tables. The measured power shall be verified for each step. The measurement period shall capture the active time slots.
- 4) Repeat for applicable test frequencies, channel bandwidths and operating band combinations.

Details of the test method can be found in ETSI TS 136 521-1 [5], clauses 6.6.3.1 and 6.6.3.2.

#### 7.4.4.2 Test requirements

The results obtained shall be compared to the limits in clause 6.2.5.2 in order to show compliance.

### 7.4.5 Transmitter Minimum output power

#### 7.4.5.1 Method of test

##### 7.4.5.1.1 Initial conditions

Test Environment: normal, TL/VL, TL/VH, TH/VL, TH/VH; as specified in annex B.

Frequencies to be tested: low range, mid range and high range; as specified in clause 7.2.

Channel bandwidths to be tested: lowest, 5 MHz and highest channel bandwidth, as specified in ETSI TS 136 508 [7], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [5]:

- 1) Connect the SS to the AT antenna connectors.
- 2) The parameter settings for the cell are set up according to ETSI TS 136 508 [7], clause 4.4.3.
- 3) Downlink signals are initially set up according to ETSI TS 136 521-1 [5], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.
- 4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [5].
- 5) Propagation conditions are set according to ETSI TS 136 521-1 [5], clause B.0.
- 6) Ensure the AT is in State 3A-RF according to ETSI TS 136 508 [7], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [5], ETSI TS 136 508 [7] and ETSI TS 136 509 [i.6] respectively.

##### 7.4.5.1.2 Procedure

- 1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C\_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [5], Table 6.3.2.1.4.1-1. Since the AT has no payload and no loopback data to send the AT sends uplink MAC padding bits on the UL RMC.
- 2) Send continuous uplink power control "down" commands in the uplink scheduling information to the AT to ensure that the AT transmits at its minimum output power.
- 3) Measure the mean power of the AT in the associated measurement bandwidth specified in Table 26 for the specific channel bandwidth under test. The period of measurement shall be the continuous duration of one sub-frame (1 ms). For TDD slots with transient periods are not under test.
- 4) Repeat for applicable test frequencies, channel bandwidths, operating band combinations and environmental conditions.

Details of the test method can be found in ETSI TS 136 521-1 [5], clause 6.3.2.

#### 7.4.5.2 Test requirements

The results obtained shall be compared to the limits in clause 6.2.6 in order to show compliance.

### 7.4.6 Adjacent Channel Leakage power Ratio (ACLR)

#### 7.4.6.1 Method of test

##### 7.4.6.1.1 Initial conditions

Test Environment: normal, TL/VL, TL/VH, TH/VL, TH/VH; as specified in annex B.

Frequencies to be tested: low range, mid range and high range; as specified in clause 7.1.

Channel bandwidths to be tested: lowest, 5 MHz and highest channel bandwidth, as specified in ETSI TS 136 508 [7], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [5]:

- 1) Connect the SS to the AT antenna connectors.
- 2) The parameter settings for the cell are set up according to ETSI TS 136 508 [7], clause 4.4.3.
- 3) Downlink signals are initially set up according to ETSI TS 136 521-1 [5], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.
- 4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [5].
- 5) Propagation conditions are set according to ETSI TS 136 521-1 [5], clause B.0.
- 6) Ensure the AT is in State 3A-RF according to ETSI TS 136 508 [7], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [5], ETSI TS 136 508 [7] and ETSI TS 136 509 [i.6] respectively.

##### 7.4.6.1.2 Procedure

- 1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C\_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [5], Table 6.3.2.1.4.1-1. Since the AT has no payload and no loopback data to send the AT sends uplink MAC padding bits on the UL RMC.
- 2) Send continuously uplink power control "up" commands in the uplink scheduling information to the AT until the AT transmits at maximum output power level.
- 3) Measure the mean power of the AT in the associated measurement bandwidth specified in Table 27 for the specific channel bandwidth under test. The period of measurement shall be the continuous duration of one sub-frame (1 ms). For TDD slots with transient periods are not under test.
- 4) Repeat for applicable test frequencies, channel bandwidths, operating band combinations and environmental conditions.

Details of the test method can be found in ETSI TS 136 521-1 [5], clause 6.3.2.

#### 7.4.6.2 Test requirements

The results obtained shall be compared to the limits in clause 6.2.7 in order to show compliance.



## 7.4.7 Void

## 7.4.8 Receiver Adjacent Channel Selectivity (ACS)

### 7.4.8.1 Method of test

#### 7.4.8.1.1 Initial conditions

Test Environment: normal, as specified in annex B.

Frequencies to be tested: mid-range as specified in clause 7.1.

Channel bandwidth to be tested: lowest, 5 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [7], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [5]:

- 1) Connect the SS and interfering source to the air AT antenna connectors.
- 2) The parameter settings for the cell are set up according to ETSI TS 136 508 [7], clause 4.4.3.
- 3) Downlink signals are initially set up according to ETSI TS 136 521-1 [5], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.
- 4) The UL and DL Reference Measurement channels are set according to ETSI TS 136 521-1 [5], Table 7.5.4.1-1.
- 5) Propagation conditions are set according to ETSI TS 136 521-1 [5], clause B.0.
- 6) Ensure the AT is in State 3A-RF according to ETSI TS 136 508 [7], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [5], ETSI TS 136 508 [7] and ETSI TS 136 509 [i.6] respectively.

#### 7.4.8.1.2 Procedure

- 1) SS transmits PDSCH via PDCCH DCI format 1A for C\_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [5], Table 7.5.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.
- 2) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C\_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [5], Table 7.5.4.1-1. Since the AT has no payload data to send, the AT transmits uplink MAC padding bits on the UL RMC.
- 3) Set the Downlink signal level to the value as defined in Table 26 (Case 1). Send Uplink power control commands to the AT (less or equal to 1 dB step size should be used), to ensure that the AT output power is within +0, -3,4 dB of the target level in Table 26 (Case 1) for at least the duration of the Throughput measurement (obtain correct AT output power as specified in TS 136 521-1 [5]).
- 4) Set the Interferer signal level to the value as defined in Table 26 (Case 1) and frequency below the wanted signal, using a modulated interferer as defined in ETSI TS 136 521-1 [5], annex D.
- 5) Measure the average throughput for a duration sufficient to achieve statistical significance according to clause G.2 of ETSI TS 136 521-1 [5].
- 6) Set the Downlink signal level to the value as defined in Table 27 (Case 2). Send Uplink power control commands to the AT (less or equal to 1 dB step size should be used), to ensure that the AT output power is within +0, -3,4 dB of the target level in Table 27 (Case 2) for at least the duration of the throughput measurement (obtain correct AT output power as specified in TS 136 521-1 [5]).
- 7) Set the Interferer signal level to the value as defined in Table 27 (Case 2) and frequency below the wanted signal, using a modulated interferer as defined in ETSI TS 136 521-1 [5], annex D.

- 8) Measure the average throughput for a duration sufficient to achieve statistical significance according to ETSI TS 136 521-1 [5], annex G.

#### 7.4.8.2 Test requirements

The results obtained shall be compared to the limits in clause 6.2.9 in order to show compliance.

### 7.4.9 Blocking characteristics

#### 7.4.9.1 Method of test

##### 7.4.9.1.1 Initial requirements

Test Environment: normal, as specified in annex B.

For In-band blocking, the frequencies to be tested are mid range as specified in clause 7.1.

For Out-of-band blocking, the frequency to be tested is low or high range as specified in clause 7.1.

For Narrow-band blocking, the frequencies to be tested are mid range as specified in clause 7.1.

Channel bandwidth to be tested: lowest, 5 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [7], clause 4.3.1. Range 3 of out-of-band blocking is tested only with highest bandwidth.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [5]:

- 1) Connect the SS to the AT antenna connectors.
- 2) The parameter settings for the cell are set up according to ETSI TS 136 508 [7], clause 4.4.3.
- 3) Downlink signals are initially set up according to ETSI TS 136 521-1 [5], clauses C.0, C.1 and C.3.1 and uplink signals according to clauses H.1 and H.3.0.
- 4) The UL and DL Reference Measurement channels are set according to ETSI TS 136 521-1 [5], Table 7.6.2.4.1-1.
- 5) Propagation conditions are set according to ETSI TS 136 521-1 [5], clause B.0.
- 6) Ensure the AT is in State 3A-RF according to ETSI TS 136 508 [7], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [5], ETSI TS 136 508 [7] and ETSI TS 136 509 [i.6] respectively.

##### 7.4.9.1.2 In-Band Procedure

- 1) SS transmits PDSCH via PDCCH DCI format 1A for C\_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [5], Table 7.6.1.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.
- 2) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C\_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [5], Table 7.6.1.4.1-1. Since the AT has no payload data to send, the AT transmits uplink MAC padding bits on the UL RMC.
- 3) Set the parameters of the signal generator for an interfering signal below the wanted signal in Case 1 according to Table 28 and Table 29 as specified in ETSI TS 136 521-1 [5].
- 4) Set the downlink signal level according to the Table 28. Send uplink power control commands to the AT (less or equal to 1 dB step size should be used), to ensure that the AT output power is within +0, -3,4 dB of the target level in Table 28, for at least the duration of the throughput measurement as specified in ETSI TS 136 521-1 [5].
- 5) Measure the average throughput for a duration sufficient to achieve statistical significance according to clause G.2 of ETSI TS 136 521-1 [5].

- 6) Repeat steps from 3 to 5, using an interfering signal above the wanted signal in Case 1 at step 3.
- 7) Repeat steps from 3 to 6, using interfering signals in Case 2 at step 3) and 6). The ranges of case 2 are covered in steps equal to the interferer bandwidth. The test frequencies are chosen in analogy to ETSI TS 136 521-1 [5], Table 7.6.1.4.2-1.
- 8) Repeat for applicable test frequencies, channel bandwidths and operating band combinations.

Details of the test method can be found in ETSI TS 136 521-1 [5], clause 7.6.1.

#### 7.4.9.1.3 Out-Of-Band Procedure

- 1) SS transmits PDSCH via PDCCH DCI format 1A for C\_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [5], Table 7.6.2.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.
- 2) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C\_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [5], Table 7.6.2.4.1-1. Since the AT has no payload data to send, the AT transmits uplink MAC padding bits on the UL RMC.
- 3) Set the parameters of the CW signal generator for an interfering signal according to Table 31 as specified in ETSI TS 136 521-1 [5]. The frequency step size is 1 MHz.
- 4) Set the downlink signal level according to the Table 30. Send uplink power control commands to the AT (less or equal to 1 dB step size should be used), to ensure that the AT output power is within +0, -3,4 dB of the target level in Table 30, for at least the duration of the throughput measurement as specified in ETSI TS 136 521-1 [5].
- 5) Measure the average throughput for a duration sufficient to achieve statistical significance according to clause G.2 of ETSI TS 136 521-1 [5].
- 6) For Table 31 record the frequencies for which the throughput does not meet the requirements.
- 7) Repeat for applicable test frequencies, channel bandwidths and operating band combinations.

Details of the test method can be found in ETSI TS 136 521-1 [5], clause 7.6.2.

#### 7.4.9.1.4 Narrow-Band Procedure

- 1) SS transmits PDSCH via PDCCH DCI format 1A for C\_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [5], Table 7.6.3.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.
- 2) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C\_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [5], Table 7.6.3.4.1-1. Since the AT has no payload data to send, the AT transmits uplink MAC padding bits on the UL RMC.
- 3) Set the parameters of the CW signal generator for an interfering signal below the wanted signal according to Table 32 as specified in ETSI TS 136 521-1 [5].
- 4) Set the downlink signal level according to the Table 32. Send uplink power control commands to the AT (less or equal to 1 dB step size should be used), to ensure that the AT output power is within +0, -3,4 dB of the target level in Table 32 for at least the duration of the throughput measurement as specified in ETSI TS 136 521-1 [5].
- 5) Measure the average throughput for a duration sufficient to achieve statistical significance according to clause G.2 of ETSI TS 136 521-1 [5].
- 6) Repeat steps from 3 to 5, using an interfering signal above the wanted signal at step 3.
- 7) Repeat for applicable test frequencies, channel bandwidths and operating band combinations.

Details of the test method can be found in ETSI TS 136 521-1 [5], clause 7.6.3.

### 7.4.9.2 Test requirements

The results obtained shall be compared to the limits in clause 6.2.10.2 in order to show compliance.

## 7.4.10 Receiver spurious response

### 7.4.10.1 Method of test

#### 7.4.10.1.1 Initial conditions

The initial conditions shall be the same as for those in Out-of-band blocking in clause 7.4.9.1.1 in order to test spurious responses obtained in clause 7.4.9.1.2 under the same conditions.

#### 7.4.10.1.2 Procedure

- 1) TBDSS transmits PDSCH via PDCCH DCI format 1A for C\_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [5], Table 7.6.2.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.
- 2) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C\_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [5], Table 7.6.2.4.1-1. Since the AT has no payload data to send, the AT transmits uplink MAC padding bits on the UL RMC.
- 3) Set the parameters of the CW signal generator for an interfering signal according to Table 34. The spurious frequencies are taken from step 5) records in clause 7.4.9.1.2.
- 4) Set the downlink signal level according to Table 33. Send uplink power control commands to the AT (less or equal to 1 dB step size should be used), to ensure that the AT output power is within +0, -3,4 dB of the target level in Table 33, for at least the duration of the throughput measurement as specified in ETSI TS 136 521-1 [5].
- 5) For the spurious frequency, measure the average throughput for a duration sufficient to achieve statistical significance.

Details of the test method can be found in ETSI TS 136 521-1 [5], clause 7.7.

### 7.4.10.2 Test requirements

The results obtained shall be compared to the limits in clause 6.2.11.2 in order to show compliance.

## 7.4.11 Receiver intermodulation characteristics

### 7.4.11.1 Method of test

#### 7.4.11.1.1 Initial conditions

Test Environment: normal, as specified in annex B.

Frequencies to be tested: mid range; as specified in clause 7.1.

Channel bandwidths to be tested: lowest, 5 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [7], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [5]:

- 1) Connect the SS and interfering sources to the AT antenna connectors.
- 2) The parameter settings for the cell are set up according to ETSI TS 136 508 [7], clause 4.4.3.
- 3) Downlink signals are initially set up according to ETSI TS 136 521-1 [5], clauses C.0, C.1, C.3.1 and uplink signals according to clauses H.1 and H.3.1.

- 4) The UL and DL Reference Measurement channels are set according to ETSI TS 136 521-1 [5], Table 7.8.4.1-1.
- 5) Propagation conditions are set according to ETSI TS 136 521-1 [5], clause B.0.
- 6) Ensure the AT is in State 3A-RF according to ETSI TS 136 508 [7], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [5], ETSI TS 136 508 [7] and ETSI TS 136 509 [i.6] respectively.

#### 7.4.11.1.2 Procedure

- 1) SS transmits PDSCH via PDCCH DCI format 1A for C\_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [5], Table 7.8.1.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.
- 2) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C\_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [5], Table 7.8.1.4.1-1. Since the AT has no payload data to send, the AT transmits uplink MAC padding bits on the UL RMC.
- 3) Set the Downlink signal level to the value as defined in Table 35. Send uplink power control commands to the AT (less or equal to 1 dB step size should be used), to ensure that the AT output power is within +0, -3,4 dB of the target level in Table 35, for at least the duration of the throughput measurement as specified in ETSI TS 136 521-1 [5].
- 4) Set the Interfering signal levels to the values as defined in Table 35, using a modulated interferer bandwidth as defined in annex D of TS 136 521-1 [5].
- 5) Measure the average throughput for a duration sufficient to achieve statistical significance according to clause G.2 of ETSI TS 136 521-1 [5].
- 6) Repeat for applicable test frequencies, channel bandwidths and operating band combinations.

Details of the test method can be found in ETSI TS 136 521-1 [5], clause 7.8.

#### 7.4.11.2 Test Requirements

The results obtained shall be compared to the limits in clause 6.2.12.2 in order to show compliance.

### 7.4.12 Receiver spurious emissions

#### 7.4.12.1 Method of test

##### 7.4.12.1.1 Initial conditions

Test Environment: normal, as specified in annex B.

Frequencies to be tested: low range, mid range and high range; as specified in clause 7.1.

Channel bandwidth to be tested: highest channel bandwidth as defined in ETSI TS 136 508 [7], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [5]:

- 1) Connect a spectrum analyser (or other suitable test equipment) to the AT antenna connectors.
- 2) The parameter settings for the cell are set up according to ETSI TS 136 508 [7], clause 4.4.3.
- 3) Downlink signals are initially set up according to ETSI TS 136 521-1 [5], clauses C.0, C.1 and C.3.1.
- 4) The DL Reference Measurement channels are set according to TS 136 521-1 [5].
- 5) Propagation conditions are set according to ETSI TS 136 521-1 [5], clause B.0.

- 6) Ensure the AT is in State 3A-RF according to ETSI TS 136 508 [7], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [5], ETSI TS 136 508 [7] and ETSI TS 136 509 [i.6] respectively.

#### 7.4.12.1.2 Procedure

- 1) Sweep the spectrum analyser (or other suitable test equipment) over a frequency range from 30 MHz to 12,75 GHz and measure the average power of the spurious emissions.
- 2) Repeat step 1) for all E-UTRA Rx antennas of the AT.
- 3) Repeat for applicable test frequencies, channel bandwidths and operating band combinations.

Details of the test method can be found in ETSI TS 136 521-1 [5], clause 7.9.

#### 7.4.12.2 Test requirements

The results obtained shall be compared to the limits in clause 6.2.10.2 in order to show compliance.

## 8 Technical requirements specifications for non-aeronautical UE E-UTRA

### 8.0 General

The present clause applies to the following radio equipment type: User Equipment for Evolved Universal Terrestrial Radio Access (E-UTRA), for communicating with Conventional CGC.

This radio equipment type is capable of operating in all or any part of the frequency bands given in Tables 42 and 43.

**Table 42: Conventional CGC E-UTRA UE operating bands**

E-UTRA Band	Direction of transmission	E-UTRA operating bands
Table 1	Transmit	1 980 to 2 010 MHz
	Receive	2 170 to 2 200 MHz
1	Transmit	1 920 MHz to 1 980 MHz
	Receive	2 110 MHz to 2 170 MHz
3	Transmit	1 710 MHz to 1 785 MHz
	Receive	1 805 MHz to 1 880 MHz
7	Transmit	2 500 MHz to 2 570 MHz
	Receive	2 620 MHz to 2 690 MHz
8	Transmit	880 MHz to 915 MHz
	Receive	925 MHz to 960 MHz
20	Transmit	832 MHz to 862 MHz
	Receive	791 MHz to 821 MHz
33	Transmit and Receive	1 900 MHz to 1 920 MHz
34	Transmit and Receive	2 010 MHz to 2 025 MHz
38	Transmit and Receive	2 570 MHz to 2 620 MHz
40	Transmit and Receive	2 300 MHz to 2 400 MHz
42	Transmit and Receive	3 400 MHz to 3 600 MHz
43	Transmit and Receive	3 600 MHz to 3 800 MHz

**Table 43: E-UTRA UE Intra-band contiguous CA operating bands**

E-UTRA CA Band	E-UTRA Band	Direction of transmission	E-UTRA operating bands
CA_1	1	Transmit	1 920 MHz to 1 980 MHz
		Receive	2 110 MHz to 2 170 MHz
CA_7	7	Transmit	2 500 MHz to 2 570 MHz
		Receive	2 620 MHz to 2 690 MHz
CA_38	38	Transmit and Receive	2 570 MHz to 2 620 MHz
CA_40	40	Transmit and Receive	2 300 MHz to 2 400 MHz

The present clause covers requirements for E-UTRA FDD User Equipment from 3GPP Releases 8, 9 and 10.

NOTE: For Band 20:

- For user equipment designed to be mobile or nomadic, the requirements in the present document measured at the antenna port also show conformity to the corresponding requirement defined as TRP (total radiated power), as described in Commission Decision 2010/267/EU [i.9], ECC Decision (09)03 [i.10] and CEPT Report 30 [i.11].
- For user equipment designed to be fixed or installed, the present document does not address the requirements described in Commission Decision 2010/267/EU [i.9], ECC Decision (09)03 [i.10] and CEPT Report 30 [i.11].

## 8.1 Environmental profile

The technical requirements of the present document apply under the environmental profile for operation of the equipment, which shall be declared by the supplier. The equipment shall comply with all the technical requirements of the present document at all times when operating within the boundary limits of the declared operational environmental profile.

## 8.2 Conformance requirements

### 8.2.0 General

The requirements in this clause apply to non-aeronautical UE E-UTRA communicating with Conventional CGCs.

#### 8.2.1 Introduction

To meet the essential requirements under article 3.2 of RE Directive [i.2] for IMT User Equipment (UE) communicating with Conventional CGC, seven essential parameters in addition to those in ETSI EN 301 908-1 [11] have been identified. Table 44 provides a cross reference between these seven essential parameters and the corresponding nine technical requirements for equipment within the scope of the present document.

Table 44: Cross references

Essential parameter	Corresponding technical requirements
Spectrum emissions mask	8.2.3 Transmitter Spectrum emissions mask
	8.2.11 Transmitter adjacent channel leakage power ratio
Conducted spurious emissions in active mode	8.2.4 Transmitter spurious emissions
Accuracy of maximum output power	8.2.2 Transmitter maximum output power
Prevention of harmful interference through control of power	8.2.5 Transmitter minimum output power
Conducted spurious emission in idle mode	8.2.10 Receiver spurious emissions
Impact of interference on receiver performance	8.2.7 Receiver Blocking characteristics
	8.2.8 Receiver spurious response
	8.2.9 Receiver Intermodulation characteristics
Receiver adjacent channel selectivity	8.2.6 Receiver Adjacent Channel Selectivity (ACS)
Control and Monitoring functions	ETSI EN 301 908-1 [11], clause 4.2.4 Control and Monitoring functions
NOTE: Out of synchronization requirement in ETSI EN 301 908-2 [12] is not included in the present document due to fact that E-UTRA has network controlled dynamic resource allocation mitigating the risk of interference in out of synchronization situation.	

Unless otherwise stated, the transmitter and 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 should be assumed for each antenna port(s). A UE with integral antenna(s) may be taken into account by converting these power levels into field strength requirements, assuming a 0 dBi gain antenna.

## 8.2.2 Transmitter Maximum Output Power

### 8.2.2.1 Transmitter maximum output power for Single Carrier

#### 8.2.2.1.1 Definition

The following UE Power Classes define the maximum output power for any transmission bandwidth within the channel bandwidth. The period of measurement shall be at least one sub-frame (1 ms).

#### 8.2.2.1.2 Limits

The UE maximum output power shall be within the shown value in Table 45.

Table 45: UE power classes

E-UTRA Band	Power Class 3 (dBm)	Tolerance (dB)
Table 1	23	$\pm 2,7$
1	23	$\pm 2,7$
3	23	$\pm 2,7$ (see note)
7	23	$\pm 2,7$ (see note)
8	23	$\pm 2,7$ (see note)
20	23	$\pm 2,7$ (see note)
33	23	$\pm 2,7$
34	23	$\pm 2,7$
38	23	$\pm 2,7$
40	23	$\pm 2,7$
42	23	+3,0/-4,0
43	23	+3,0/-4,0
NOTE: For transmission bandwidths (ETSI TS 136 521-1 [5], clause 5) confined within $F_{UL\_low}$ and $F_{UL\_low} + 4$ MHz or $F_{UL\_high} - 4$ MHz and $F_{UL\_high}$ , the maximum output power requirement is relaxed by reducing the lower tolerance limit by 1,5 dB (tolerance = +2,7/-4,2).		



NOTE 1: These requirements do not take into account the maximum power reductions allowed to the UE in subject to certain transmission conditions specified in ETSI TS 136 101 [6], clauses 6.2.3 and 6.2.4.

NOTE 2: The range of UE maximum output power for the various power classes are specified in ETSI TS 136 101 [6], clause 6.2.2. The values in Table 45 correspond to the measurement limits taking into account the measurement uncertainty of measurement equipment (see clause 9.2).

NOTE 3: UE communicating with Conventional CGC (frequency band defined in Table 1) may also operate in all or any part of the frequency bands given in Table 45.

### 8.2.2.1.3 Conformance

Conformance tests described in clause 9.3.1 shall be carried out.

## 8.2.2.2 Transmitter output power for intra-band contiguous Carrier Aggregation (DL CA and UL CA)

### 8.2.2.2.1 Definition

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 (1 ms).

### 8.2.2.2.2 Limits

For intra-band contiguous carrier aggregation the maximum output power is specified in Table 46.

**Table 46: UE power class for CA**

E-UTRA CA band	Power Class 3 (dBm)	Tolerance (dB)
CA_1C	23	±2,7
CA_7C	23	±2,7 (see note 1)
CA_38C	23	±2,7
CA_40C	23	±2,7
NOTE 1: For transmission bandwidths (ETSI TS 136 521-1 [5], clause 5) confined within $F_{UL\_low}$ and $F_{UL\_low} + 4$ MHz or $F_{UL\_high} - 4$ MHz and $F_{UL\_high}$ , the maximum output power requirement is relaxed by reducing the lower tolerance limit by 1,5 dB.		
NOTE 2: For intra-band contiguous carrier aggregation the maximum power requirement should apply to the total transmitted power over all component carriers (per UE).		

NOTE 1: These requirements do not take into account the maximum power reductions allowed to the UE in subject to certain transmission conditions specified in ETSI TS 136 101 [6], clauses 6.2.3A and 6.2.4A.

NOTE 2: The range of UE maximum output power for the various power classes are specified in ETSI TS 136 101 [6], clause 6.2.2A. The values in Table 46 correspond to the measurement limits taking into account the measurement uncertainty of measurement equipment (see clause 9.2).

NOTE 3: UE communicating with Conventional CGC (frequency band defined in Table 1) may also operate in all or any part of the frequency bands given in Table 45.

### 8.2.2.2.3 Conformance

Conformance tests described in clause 9.3.1 shall be carried out.

### 8.2.2.3 Transmitter output power for UL-MIMO

#### 8.2.2.3.1 Definition

The following UE Power Classes define the maximum output power for UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme. The UL-MIMO configurations are specified in Table 47.

**Table 47: UL-MIMO configuration in closed-loop spatial multiplexing scheme**

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

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 (1 ms).

#### 8.2.2.3.2 Limits

The UE maximum output power shall be within the shown value in Table 48.

**Table 48: UE power class for UL-MIMO in closed loop spatial multiplexing scheme**

E-UTRA Band	Power Class 3 (dBm)	Tolerance (dB)
1	23	+2,7/-3,7
3	23	+2,7/-3,7 (see note)
7	23	+2,7/-3,7 (see note)
8	23	+2,7/-3,7 (see note)
20	23	+2,7/-3,7 (see note)
33	23	+2,7/-3,7
34	23	+2,7/-3,7
38	23	+2,7/-3,7
40	23	+2,7/-3,7
42	23	+3,0/-5,0
43	23	+3,0/-5,0
NOTE: For transmission bandwidths (ETSI TS 136 521-1 [5], clause 5) confined within $F_{UL\_low}$ and $F_{UL\_low} + 4$ MHz or $F_{UL\_high} - 4$ MHz and $F_{UL\_high}$ , the maximum output power requirement is relaxed by reducing the lower tolerance limit by 1,5 dB (tolerance = +2,7/-4,2).		

NOTE 1: These requirements do not take into account the maximum power reductions allowed to the UE in subject to certain transmission conditions specified in ETSI TS 136 101 [6], clauses 6.2.3 and 6.2.4.

NOTE 2: The range of UE maximum output power for the various power classes are specified in ETSI TS 136 101 [6], clause 6.2.2B. The values in Table 48 correspond to the measurement limits taking into account the measurement uncertainty of measurement equipment (see clause 9.2).

NOTE 3: UE communicating with Conventional CGC (frequency band defined in Table 1) may also operate in all or any part of the frequency bands given in Table 45.

#### 8.2.2.3.3 Conformance

Conformance tests described in clause 9.3.1 shall be carried out.

## 8.2.3 Transmitter Spectrum Emission Mask

### 8.2.3.1 Transmitter spectrum emission mask for Single Carrier

#### 8.2.3.1.1 Definition

The spectrum emission mask of the UE applies to frequencies ( $\Delta f_{\text{OoB}}$ ) starting from the  $\pm$  edge of the assigned E-UTRA channel bandwidth.

#### 8.2.3.1.2 Limits

The power of any UE emission shall fulfil requirements in Tables 49 and 50.

**Table 49: General E-UTRA spectrum emission mask, E UTRA bands  $\leq 3$  GHz**

$\Delta f_{\text{OoB}}$ (MHz)	1,4 MHz	3,0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Measurement bandwidth
$\pm 0$ to 1	-8,5	-11,5	-13,5	-16,5	-18,5	-19,5	30 kHz
$\pm 1$ to 2,5	-8,5	-8,5	-8,5	-8,5	-8,5	-8,5	1 MHz
$\pm 2,5$ to 2,8	-23,5	-8,5	-8,5	-8,5	-8,5	-8,5	1 MHz
$\pm 2,8$ to 5		-8,5	-8,5	-8,5	-8,5	-8,5	1 MHz
$\pm 5$ to 6		-23,5	-11,5	-11,5	-11,5	-11,5	1 MHz
$\pm 6$ to 10			-23,5	-11,5	-11,5	-11,5	1 MHz
$\pm 10$ to 15				-23,5	-11,5	-11,5	1 MHz
$\pm 15$ to 20					-23,5	-11,5	1 MHz
$\pm 20$ to 25						-23,5	1 MHz

NOTE 1: The first and last measurement position with a 30 kHz filter is at  $\Delta f_{\text{OoB}}$  equals to 0,015 MHz and 0,985 MHz.

NOTE 2: The first and last measurement position with a 1 MHz filter for 1 MHz - 2,5 MHz offset range is at  $\Delta f_{\text{OoB}}$  equals to 1,5 MHz and 2,0 MHz. Similarly for other  $\Delta f_{\text{OoB}}$  ranges.

NOTE 3: The measurements are to be performed above the upper edge of the channel and below the lower edge of the channel.

NOTE 4: For the 2,5 MHz - 2,8 MHz offset range with 1,4 MHz channel bandwidth, the measurement position is at  $\Delta f_{\text{OoB}}$  equals to 3 MHz.

**Table 50: General E-UTRA spectrum emission mask, 3 GHz < E-UTRA bands  $\leq 4,2$  GHz**

$\Delta f_{\text{OoB}}$ (MHz)	Spectrum emission limit (dBm)/Channel bandwidth						Measurement bandwidth
	1,4 MHz	3,0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
0 to 1	-8,2	-11,2	-13,2	-16,2	-18,2	-19,2	30 kHz
1 to 2,5	-8,2	-8,2	-8,2	-8,2	-8,2	-8,2	1 MHz
2,5 to 2,8	-23,2						1 MHz
2,8 to 5							1 MHz
5 to 6		-23,2	-11,2	-11,2	-11,2	-11,2	1 MHz
6 to 10			-23,2	-23,2	-23,2	-23,2	1 MHz
10 to 15							1 MHz
15 to 20							1 MHz
20 to 25						-23,2	1 MHz

NOTE 1: The first and last measurement position with a 30 kHz filter is at  $\Delta f_{\text{OoB}}$  equals to 0,015 MHz and 0,985 MHz.

NOTE 2: At the boundary of spectrum emission limit, the first and last measurement position with a 1 MHz filter is the inside of +0,5 MHz and -0,5 MHz, respectively.

NOTE 3: The measurements are to be performed above the upper edge of the channel and below the lower edge of the channel.

NOTE 4: For the 2,5 - 2,8 MHz offset range with 1,4 MHz channel bandwidth, the measurement position is at  $\Delta f_{\text{OOB}}$  equals to 3 MHz.

### 8.2.3.1.3 Conformance

Conformance tests described in clause 9.3.2 shall be carried out.

### 8.2.3.2 Transmitter spectrum emission mask for intra-band contiguous Carrier Aggregation (DL CA and UL CA)

#### 8.2.3.2.1 Definition

For intra-band contiguous carrier aggregation the spectrum emission mask of the UE applies to frequencies ( $\Delta f_{\text{OOB}}$ ) starting from the  $\pm$  edge of the aggregated channel bandwidth.

#### 8.2.3.2.2 Limits

For intra-band contiguous carrier aggregation the bandwidth class C, the power of any UE emission shall not exceed the levels specified in Tables 51 and 52 for the specified channel bandwidth.

**Table 51: General E-UTRA spectrum emission mask for CA, E UTRA bands  $\leq 3$  GHz**

Spectrum emission limit [dBm]/BW <sub>Channel_CA</sub>					
$\Delta f_{\text{OOB}}$ (MHz)	50RB+100RB (29,9 MHz)	75RB+75RB (30 MHz)	75RB+100RB (34,85 MHz)	100RB+100RB (39,8 MHz)	Measurement bandwidth
$\pm 0$ to 1	-21,0	-21,0	-22,0	-22,5	30 kHz
$\pm 1$ to 5	-8,5	-8,5	-8,5	-8,5	1 MHz
$\pm 5$ to 29,9	-11,5	-11,5	-11,5	-11,5	1 MHz
$\pm 29,9$ to 30	-23,5	-23,5	-23,5	-11,5	1 MHz
$\pm 30$ to 34,85					1 MHz
$\pm 34,85$ to 34,9					1 MHz
$\pm 34,9$ to 35					1 MHz
$\pm 35$ to 39,8				-23,5	1 MHz
$\pm 39,8$ to 39,85					1 MHz
$\pm 39,85$ to 44,8					1 MHz

**Table 52: General E-UTRA spectrum emission mask for CA, 3 GHz < E UTRA bands  $\leq 4,2$  GHz**

Spectrum emission limit [dBm]/BW <sub>Channel_CA</sub>					
$\Delta f_{\text{OOB}}$ (MHz)	50RB+100RB (29,9 MHz)	75RB+75RB (30 MHz)	75RB+100RB (34,85 MHz)	100RB+100RB (39,8 MHz)	Measurement bandwidth
$\pm 0$ to 1	-20,7	-20,7	-21,7	-22,2	30 kHz
$\pm 1$ to 5	-8,2	-8,2	-8,2	-8,2	1 MHz
$\pm 5$ to 29,9	-11,2	-11,2	-11,2	-11,2	1 MHz
$\pm 29,9$ to 30	-23,2	-23,2	-23,2	-11,2	1 MHz
$\pm 30$ to 34,85					1 MHz
$\pm 34,85$ to 34,9					1 MHz
$\pm 34,9$ to 35					1 MHz
$\pm 35$ to 39,8				-23,2	1 MHz
$\pm 39,8$ to 39,85					1 MHz
$\pm 39,85$ to 44,8					1 MHz

### 8.2.3.2.3 Conformance

Conformance tests described in clause 9.3.2 shall be carried out.

## 8.2.3.3 Transmitter spectrum emission mask for UL-MIMO

### 8.2.3.3.1 Definition

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.

The spectrum emission mask of the UE applies to frequencies ( $\Delta f_{\text{OOB}}$ ) starting from the edge of the assigned E-UTRA channel bandwidth.

### 8.2.3.3.2 Limits

For UEs with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the requirements in clause 8.2.3.1.2 apply to each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in Tables 47 and 48.

### 8.2.3.3.3 Conformance

Conformance tests described in clause 9.3.2 shall be carried out.

## 8.2.4 Transmitter Spurious Emissions

### 8.2.4.1 Transmitter spurious emissions for Single Carrier

#### 8.2.4.1.1 Definition

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. The spurious emission limits are specified in terms of general requirements in line with Recommendation ITU-R SM.329-12 [i.7] 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.

#### 8.2.4.1.2 Limits

The spurious emission limits in Table 54 apply for the frequency ranges that are more than  $\Delta f_{\text{OOB}}$  (MHz) from the edge of the channel bandwidth shown in Table 53.

The measured average power of spurious emission for general requirements shall not exceed the described values in Table 54.

The measured average power of spurious emission for E-UTRA operating band specific requirements to protected bands shall not exceed the described values in Tables 55 and 56.

**Table 53:  $\Delta f_{\text{OOB}}$  boundary between E-UTRA channel and spurious emission domain**

Channel bandwidth	1,4 MHz	3,0 MHz	5 MHz	10 MHz	15 MHz	20 MHz
$\Delta f_{\text{OOB}}$ (MHz)	2,8	6	10	15	20	25

**Table 54: General spurious emissions limits**

Frequency range	Maximum level	Measurement bandwidth	Comment
$9 \text{ kHz} \leq f < 150 \text{ kHz}$	-36 dBm	1 kHz	
$150 \text{ kHz} \leq f < 30 \text{ MHz}$	-36 dBm	10 kHz	
$30 \text{ MHz} \leq f < 1\,000 \text{ MHz}$	-36 dBm	100 kHz	
$1 \text{ GHz} \leq f < 12,75 \text{ GHz}$	-30 dBm	1 MHz	
$12,75 \text{ GHz} \leq f < 5^{\text{th}}$ harmonic of the upper frequency edge of the UL operating band in GHz	-30 dBm	1 MHz	See note
NOTE: Applies for Band 42 and Band 43.			

NOTE 1: In order that the measurement of spurious emissions falls within the frequency ranges that are more than  $\Delta f_{\text{OOB}}$  (MHz) from the edge of the channel bandwidth, the minimum offset of the measurement frequency from each edge of the channel should be  $\Delta f_{\text{OOB}} + \text{MBW}/2$ . MBW denotes the measurement bandwidth defined in Table 54.

The additional requirements in Table 55 apply for the frequency ranges that are more and less than  $\Delta f_{\text{OOB}}$  (MHz) from the edge of the channel bandwidth shown in Table 53.

**Table 55: Spurious emission band UE co-existence limits**

Band	Spurious emission						Comment
	Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	
Table 1	E-UTRA Band 1, 7, 8, 20, 22, 28, 31, 32, 38, 40, 42, 43, 65	$F_{\text{DL\_low}}$	-	$F_{\text{DL\_high}}$	-50	1	
	E-UTRA Band 3	$F_{\text{DL\_low}}$	-	$F_{\text{DL\_high}}$	-50	1	
	Frequency range	1 839,9	-	1 879,9	-50	1	
	Frequency range	1 895	-	1 915	-15,5	5	
	Frequency range	1 915	-	1 920	+1,6	5	
1	E-UTRA Band 1, 7, 8, 20, 38, 40, 42, 43	$F_{\text{DL\_low}}$	-	$F_{\text{DL\_high}}$	-50	1	
	E-UTRA Band 3, 34	$F_{\text{DL\_low}}$	-	$F_{\text{DL\_high}}$	-50	1	Note 3
	Frequency range	1 900	-	1 915	-15,5	5	
	Frequency range	1 915	-	1 920	+1,6	5	
3	E-UTRA Band 1, 7, 8, 20, 33, 34, 38, 43	$F_{\text{DL\_low}}$	-	$F_{\text{DL\_high}}$	-50	1	
	E-UTRA Band 3	$F_{\text{DL\_low}}$	-	$F_{\text{DL\_high}}$	-50	1	Note 3
	E-UTRA Band 42	$F_{\text{DL\_low}}$	-	$F_{\text{DL\_high}}$	-50	1	Note 2
7	E-UTRA Band 1, 3, 7, 8, 20, 33, 34, 42, 43	$F_{\text{DL\_low}}$	-	$F_{\text{DL\_high}}$	-50	1	
	Frequency range	2 570	-	2 575	+1,6	5	Note 3
	Frequency range	2 575	-	2 620	-15,5	5	Note 3
8	E-UTRA Band 1, 20, 33, 34, 38, 40	$F_{\text{DL\_low}}$	-	$F_{\text{DL\_high}}$	-50	1	
	E-UTRA band 3	$F_{\text{DL\_low}}$	-	$F_{\text{DL\_high}}$	-50	1	Note 2
	E-UTRA band 7	$F_{\text{DL\_low}}$	-	$F_{\text{DL\_high}}$	-50	1	Note 2
	E-UTRA Band 8	$F_{\text{DL\_low}}$	-	$F_{\text{DL\_high}}$	-50	1	Note 3
	E-UTRA Band 42, 43	$F_{\text{DL\_low}}$	-	$F_{\text{DL\_high}}$	-50	1	Note 2
20	E-UTRA Band 1, 3, 7, 8, 33, 34, 43	$F_{\text{DL\_low}}$	-	$F_{\text{DL\_high}}$	-50	1	
	E-UTRA Band 20	$F_{\text{DL\_low}}$	-	$F_{\text{DL\_high}}$	-50	1	Note 3
	E-UTRA Band 38, 42	$F_{\text{DL\_low}}$	-	$F_{\text{DL\_high}}$	-50	1	Note 2
33	E-UTRA Band 1, 7, 8, 20, 34, 38, 40, 42, 43	$F_{\text{DL\_low}}$	-	$F_{\text{DL\_high}}$	-50	1	
	E-UTRA Band 3	$F_{\text{DL\_low}}$	-	$F_{\text{DL\_high}}$	-50	1	Note 3
34	E-UTRA Band 1, 3, 7, 8, 20, 33, 38, 40, 42, 43	$F_{\text{DL\_low}}$	-	$F_{\text{DL\_high}}$	-50	1	

Band	Spurious emission						
	Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	Comment
38	E-UTRA Band 1, 3, 8, 20, 33, 34, 42, 43	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	
	Frequency range	2 620	-	2 690	-15,5	5	
40	E-UTRA Band 1, 3, 33, 34, 42, 43	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	
42	E-UTRA Band 1, 3, 7, 8, 20, 33, 34, 38, 40	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	
	E-UTRA Band 43	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	
43	E-UTRA Band 1, 3, 7, 8, 20, 33, 34, 38, 40	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	
	E-UTRA Band 42	F <sub>DL_low</sub>	-	F <sub>DL_high</sub>	-50	1	

NOTE 1: F<sub>DL\_low</sub> and F<sub>DL\_high</sub> refer to each frequency range of the protected E-UTRA band.

NOTE 2: As exceptions, measurements with a level up to the applicable requirements defined in Table 54 are permitted for each assigned E-UTRA carrier used in the measurement due to 2<sup>nd</sup>, 3<sup>rd</sup> or 4<sup>th</sup> harmonic spurious emissions. An exception is allowed if there is at least one individual RB within the transmission bandwidth (see Figure 9.4.2-1 in ETSI TS 136 521-1 [5]) for which the 2<sup>nd</sup>, 3<sup>rd</sup> or 4<sup>th</sup> harmonic totally or partially overlaps the measurement bandwidth (MBW). For frequency with 2<sup>nd</sup>, 3<sup>rd</sup> or 4<sup>th</sup> harmonic spurious emissions, the measurements are covered in Table 54.

NOTE 3: These requirements also apply for the frequency ranges that are less than Δf<sub>OOB</sub> (MHz) in Table 53 from the edge of the channel bandwidth.

NOTE 2: 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.

**Table 56: Additional spurious emissions limits**

Operating band	Frequency bandwidth	Maximum Level (dBm)	Measurement bandwidth (MHz)
20	$470 \text{ MHz} \leq f \leq 790 \text{ MHz}$	-65	8
NOTE: The conformance shall be assessed using the measurement position placed at the following centre frequencies: 474 MHz, 586 MHz, 690 MHz, 754 MHz, 770 MHz and 786 MHz.			

#### 8.2.4.1.3 Conformance

Conformance tests described in clause 9.3.3 shall be carried out.

#### 8.2.4.2 Transmitter spurious emissions for intra-band contiguous Carrier Aggregation (DL CA and UL CA)

##### 8.2.4.2.1 Definition

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. The spurious emission limits are specified in terms of general requirements in line with Recommendation ITU-R SM.329-12 [i.7] 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.

### 8.2.4.2.2 Limits

For intra-band contiguous carrier aggregation the spurious emission limits apply for the frequency ranges that are more than  $\Delta f_{\text{OOB}}$  (MHz) in Table 57 from the  $\pm$  edge of the aggregated channel bandwidth. For frequencies  $\Delta f_{\text{OOB}}$  greater than  $F_{\text{OOB}}$  as specified in Table 57 the spurious requirements in Table 58 are applicable.

For frequencies  $\Delta f_{\text{OOB}}$  greater than  $F_{\text{OOB}}$  as specified in Table 57 the measured average power of spurious emission for general requirements, shall not exceed the described values in Table 58.

For the specified carrier aggregation configurations for co-existence with protected bands, the measured average power of spurious emission, shall not exceed the described value in Table 59.

**Table 57: Boundary between E-UTRA  $\Delta f_{\text{OOB}}$  and spurious emission domain for intra-band contiguous CA**

CA Bandwidth Class	OOB boundary $F_{\text{OOB}}$ (MHz)
A	Table 53
C	$BW_{\text{Channel\_CA}} + 5$

**Table 58: General spurious emissions limits for intra-band contiguous CA**

Frequency Range	Maximum Level	Measurement Bandwidth	Comment
$9 \text{ kHz} \leq f < 150 \text{ kHz}$	-36 dBm	1 kHz	
$150 \text{ kHz} \leq f < 30 \text{ MHz}$	-36 dBm	10 kHz	
$30 \text{ MHz} \leq f < 1\,000 \text{ MHz}$	-36 dBm	100 kHz	
$1 \text{ GHz} \leq f < 12,75 \text{ GHz}$	-30 dBm	1 MHz	
$12,75 \text{ GHz} \leq f < 5^{\text{th}}$ harmonic of the upper frequency edge of the UL operating band in GHz	-30 dBm	1 MHz	See note
NOTE: Applicability of this test requirement is FFS.			

NOTE: In order that the measurement of spurious emissions falls within the frequency ranges that are more than  $\Delta f_{\text{OOB}}$  (MHz) from the edge of the channel bandwidth, the minimum offset of the measurement frequency from each edge of the channel should be  $\Delta f_{\text{OOB}} + \text{MBW}/2$ . MBW denotes the measurement bandwidth defined in Table 58.



**Table 59: Spurious emission band UE co-existence limits for intra-band contiguous CA**

E-UTRA CA Configuration	Spurious emission						Comment
	Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	
CA_1C	E-UTRA Band 1, 3, 7, 8, 20, 38, 40, 42, 43	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	
	Frequency range	1 900	-	1 915	-15,5	5	Note 3
	Frequency range	1 915	-	1 920	+1,6	5	Note 3
	E-UTRA band 34	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	Note 3
CA_7C	E-UTRA Band 1, 3, 7, 8, 20, 33, 34, 42, 43	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	
	Frequency range	2 570	-	2 575	+1,6	5	
	Frequency range	2 575	-	2 595	-15,5	5	Note 4
	Frequency range	2 595	-	2 620	-40	1	Note 4
CA_38C	E-UTRA Band 1, 3, 8, 20, 33, 34, 42, 43	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	
	Frequency range	2 620	-	2 645	-15,5	5	Notes 5, 6
	Frequency range	2 645	-	2 690	-40	1	Notes 5, 6
CA_40C	E-UTRA Band 1, 3, 33, 34, 42, 43	$F_{DL\_low}$	-	$F_{DL\_high}$	-50	1	
<p>NOTE 1: <math>F_{DL\_low}</math> and <math>F_{DL\_high}</math> refer to each E-UTRA frequency band specified in Table 5.2-1, in ETSI TS 136 521-1 [5].</p> <p>NOTE 2: As exceptions, measurements with a level up to the applicable requirements defined in Table 54 are permitted for each assigned E-UTRA carrier used in the measurement due to 2<sup>nd</sup> or 3<sup>rd</sup> harmonic spurious emissions. An exception is allowed if there is at least one individual RE within the transmission bandwidth (see Figure 5.4.2-1 in ETSI TS 136 521-1 [5]) for which the 2<sup>nd</sup> or 3<sup>rd</sup> harmonic, i.e. the frequency equal to two or three times the frequency of that RE, is within the measurement bandwidth (MBW).</p> <p>NOTE 3: Applicable when CA_NS_02 is signalled by the network.</p> <p>NOTE 4: Applicable when CA_NS_06 is signalled by the network.</p> <p>NOTE 5: Applicable when CA_NS_05 is signalled by the network.</p> <p>NOTE 6: This requirement is applicable for carriers with bandwidths are confined in 2 570 - 2 615 MHz. For assigned carriers with bandwidths overlapping the frequency range 2 615 - 2 620 MHz the requirements apply with the maximum output power configured to +20 dBm.</p>							

#### 8.2.4.2.3 Conformance

Conformance tests described in clause 9.3.3 shall be carried out.

#### 8.2.4.3 Transmitter spurious emissions for UL-MIMO

##### 8.2.4.3.1 Definition

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.

##### 8.2.4.3.2 Limits

For UEs with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the requirements in clause 8.2.4.1.2 apply to each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in Table 47.

For single-antenna port scheme, the general requirements in clause 8.2.4.1.2 apply.

##### 8.2.4.3.3 Conformance

Conformance tests described in clause 9.3.3 shall be carried out.

## 8.2.5 Transmitter Minimum Output Power

### 8.2.5.1 Transmitter minimum output power for Single Carrier

#### 8.2.5.1.1 Definition

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.

#### 8.2.5.1.2 Limits

The minimum output power measured shall not exceed the values specified in Table 60.

**Table 60: Minimum output power**

	Channel bandwidth/minimum output power/measurement bandwidth					
	1,4 MHz	3,0 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Minimum output power	For carrier frequency $f \leq 3,0$ GHz: $\leq -39$ dBm For carrier frequency $3,0$ GHz $< f \leq 4,2$ GHz: $\leq -38,7$ dBm					
Measurement bandwidth	1,08 MHz	2,7 MHz	4,5 MHz	9,0 MHz	13,5 MHz	18 MHz

#### 8.2.5.1.3 Conformance

Conformance tests described in clause 9.3.4 shall be carried out.

### 8.2.5.2 Transmitter minimum output power for intra-band contiguous Carrier Aggregation (DL CA and UL CA)

#### 8.2.5.2.1 Definition

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.

#### 8.2.5.2.2 Limits

For intra-band contiguous carrier aggregation the minimum output power is defined as the mean power in one sub-frame (1 ms). The minimum output power shall not exceed the values specified in Table 61.

**Table 61: Minimum output power for intra-band contiguous CA UE**

	CC Channel bandwidth/Minimum output power/Measurement bandwidth					
	1,4 MHz	3,0 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Minimum output power	For carrier frequency $f \leq 3,0$ GHz: $\leq -39$ dBm For carrier frequency $3,0$ GHz $< f \leq 4,2$ GHz: $\leq -38,7$ dBm					
Measurement bandwidth				9,0 MHz	13,5 MHz	18 MHz

#### 8.2.5.2.3 Conformance

Conformance tests described in clause 9.3.4 shall be carried out.

### 8.2.5.3 Transmitter minimum output power for UL-MIMO

#### 8.2.5.3.1 Definition

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.

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 UE antenna connector in one sub-frame (1 ms).

#### 8.2.5.3.2 Limits

The minimum sum of mean output power of the UE at each antenna connector measured shall not exceed the values specified in Table 62.

**Table 62: Minimum output power for UL-MIMO**

	Channel bandwidth/Minimum output power/Measurement bandwidth					
	1,4 MHz	3,0 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Minimum output power	For carrier frequency $f \leq 3,0$ GHz: $\leq -39$ dBm For carrier frequency $3,0$ GHz $< f \leq 4,2$ GHz: $\leq -38,7$ dBm					
Measurement bandwidth	1,08 MHz	2,7 MHz	4,5 MHz	9,0 MHz	13,5 MHz	18 MHz

#### 8.2.5.3.3 Conformance

Conformance tests described in clause 9.3.4 shall be carried out.

## 8.2.6 Receiver Adjacent Channel Selectivity (ACS)

#### 8.2.6.1 Definition

Adjacent Channel Selectivity (ACS) is a measure of a receiver's ability to receive an 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).

#### 8.2.6.2 Limits

The throughput  $R_{av}$  shall be  $\geq 95$  % of the maximum throughput of the reference measurement channels as specified in ETSI TS 136 521-1 [5] under the conditions specified in Table 64 and also under the conditions specified in Table 65.

**Table 63: Adjacent channel selectivity**

Rx Parameter	Units	Channel bandwidth					
		1,4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
ACS	dB	33,0	33,0	33,0	33,0	30	27

**Table 64: Test parameters for Adjacent channel selectivity, Case 1**

Rx Parameter	Units	Channel bandwidth					
		1,4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Power in Transmission Bandwidth Configuration	dBm	REFSENS + 14 dB					
$P_{\text{Interferer}}$	dBm	REFSENS +45,5 dB	REFSENS +45,5 dB	REFSENS +45,5 dB	REFSENS +45,5 dB	REFSENS +42,5 dB	REFSENS +39,5 dB
$BW_{\text{Interferer}}$	MHz	1,4	3	5	5	5	5
$F_{\text{Interferer}}$ (offset)	MHz	1,4025	3,0075	5,0025	7,5075	10,0125	12,5025
NOTE 1: The transmitter shall be set to 4 dB below $P_{\text{CMAX\_L}}$ or $P_{\text{CMAX\_L\_CA}}$ as defined in clause 6.2.5 in ETSI TS 136 101 [6].							
NOTE 2: The interferer consists of the Reference measurement channel specified in clause A.3.2 of ETSI TS 136 521-1 [5] with set-up according to clause C.3.1 of ETSI TS 136 521-1 [5].							
NOTE 3: REFSENS as defined in ETSI TS 136 521-1 [5].							

**Table 65: Test parameters for Adjacent channel selectivity, Case 2**

Rx Parameter	Units	Channel bandwidth					
		1,4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Power in Transmission Bandwidth Configuration	dBm	-56,5	-56,5	-56,5	-56,5	-53,5	-50,5
$P_{\text{Interferer}}$	dBm	-25					
$BW_{\text{Interferer}}$	MHz	1,4	3	5	5	5	5
$F_{\text{Interferer}}$ (offset)	MHz	1,4025	3,0075	5,0025	7,5075	10,0125	12,5025
NOTE 1: The transmitter shall be set to 24 dB below $P_{\text{CMAX\_L}}$ or $P_{\text{CMAX\_L\_CA}}$ as defined in clause 6.2.5 in ETSI TS 136 101 [6].							
NOTE 2: The interferer consists of the Reference measurement channel specified in clause A.3.2 of ETSI TS 136 521-1 [5] with set-up according to clause C.3.1 of ETSI TS 136 521-1 [5].							

### 8.2.6.3 Conformance

Conformance tests described in clause 9.3.5 shall be carried out.

## 8.2.7 Receiver Blocking Characteristics

### 8.2.7.1 Definition

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.

### 8.2.7.2 Limits

With parameters specified in Tables 66 and 67, the throughput shall be  $\geq 95$  % of the maximum throughput of the reference measurement channels as specified in ETSI TS 136 521-1 [5].

With parameters specified in Tables 68 and 69, the throughput shall be  $\geq 95$  % of the maximum throughput of the reference measurement channels as specified in ETSI TS 136 521-1 [5], except for the spurious response frequencies.

For Table 69 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 1 MHz step size, where  $N_{RB}$  is the number of resource blocks in the downlink transmission bandwidth configuration. For these exceptions the requirements of clause 8.2.8 Spurious response are applicable.

With parameters specified in Table 70, the throughput shall be  $\geq 95$  % of the maximum throughput of the reference measurement channels as specified in ETSI TS 136 521-1 [5].

**Table 66: In-band blocking parameters**

Rx Parameter	Units	Channel bandwidth					
		1,4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Power in Transmission Bandwidth Configuration	dBm	REFSENS + channel bandwidth specific value below					
		6	6	6	6	7	9
BW <sub>Interferer</sub>	MHz	1,4	3	5	5	5	5
F <sub>offset, case 1</sub>	MHz	2,1125	4,5075	7,5125	7,5025	7,5075	7,5125
F <sub>offset, case 2</sub>	MHz	3,5075	7,5075	12,5075	12,5125	12,5025	12,5075
NOTE 1: The transmitter shall be set to 4 dB below P <sub>CMAX,L</sub> at the minimum uplink configuration specified in ETSI TS 136 101 [6] (Table 7.3.1-2 with P <sub>CMAX,L</sub> as defined in clause 6.2.5).							
NOTE 2: The interferer consists of the Reference measurement channel specified in clause A.3.2 of ETSI TS 136 521-1 [5] with a set-up according to clause C.3.1 of ETSI TS 136 521-1 [5].							
NOTE 3: REFSENS as defined in ETSI TS 136 521-1 [5].							

**Table 67: In-band blocking**

E-UTRA band	Parameter	Units	Case 1	Case 2
	P <sub>Interferer</sub>	dBm	-56	-44
	F <sub>Interferer</sub> (Offset)	MHz	= -BW/2 - F <sub>offset, case 1</sub> and = +BW/2 + F <sub>offset, case 1</sub>	$\leq -BW/2 - F_{offset, case 2}$ and $\geq +BW/2 + F_{offset, case 2}$
1, 3, 7, 8, 20, 33, 34, 38, 40	F <sub>Interferer</sub>	MHz	(note 2)	F <sub>DL_low</sub> - 15 to F <sub>DL_high</sub> + 15
NOTE 1: For certain bands, the unwanted modulated interfering signal may not fall inside the UE receive band, but within the first 15 MHz below or above the UE receive band.				
NOTE 2: For each carrier frequency the requirement is valid for two frequencies: a) the carrier frequency -BW/2 - F <sub>offset, case 1</sub> ; and b) the carrier frequency + BW/2 + F <sub>offset, case 1</sub> .				
NOTE 3: F <sub>Interferer</sub> range values for unwanted modulated interfering signal are interferer center frequencies.				

**Table 68: Out-of-band blocking parameters**

Rx Parameter	Units	Channel bandwidth					
		1,4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Power in Transmission Bandwidth Configuration	dBm	REFSENS + channel bandwidth specific value below					
		6	6	6	6	7	9
NOTE 1: The transmitter shall be set to 4 dB below $P_{\text{CMAX,L}}$ at the minimum uplink configuration specified in ETSI TS 136 101 [6] (Table 7.3.1-2 with $P_{\text{CMAX,L}}$ as defined in clause 6.2.5).							
NOTE 2: Reference measurement channel is clause A.3.2 of ETSI TS 136 521-1 [5].							
NOTE 3: REFSENS as defined in ETSI TS 136 521-1 [5].							

Table 69: Out-of-band blocking

E-UTRA band	Parameter	Units	Frequency		
			Range 1	Range 2	Range 3
	$P_{\text{Interferer}}$	dBm	-44	-30	-15
1, 3, 7, 8, 20, 33, 34, 38, 40	$F_{\text{Interferer}} \text{ (CW)}$	MHz	$F_{\text{DL\_low}} - 15$ to $F_{\text{DL\_low}} - 60$	$F_{\text{DL\_low}} - 60$ to $F_{\text{DL\_low}} - 85$	$F_{\text{DL\_low}} - 85$ to 1 MHz
			$F_{\text{DL\_high}} + 15$ to $F_{\text{DL\_high}} + 60$	$F_{\text{DL\_high}} + 60$ to $F_{\text{DL\_high}} + 85$	$F_{\text{DL\_high}} + 85$ to +12 750 MHz

NOTE: Range 3 shall be tested only with the highest channel bandwidth.

Table 70: Narrow-band blocking

Parameter	Unit	Channel Bandwidth					
		1,4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
$P_w$	dBm	$P_{\text{REFSENS}} + \text{channel-bandwidth specific value below}$					
		22	18	16	13	14	16
$P_{\text{uw}} \text{ (CW)}$	dBm	-55	-55	-55	-55	-55	-55
$F_{\text{uw}} \text{ (offset for } \Delta f = 15 \text{ kHz)}$	MHz	0,9075	1,7025	2,7075	5,2125	7,7025	10,2075

NOTE 1: The transmitter shall be set a 4 dB below  $P_{\text{CMAX\_L}}$  at the minimum uplink configuration specified in ETSI TS 136 101 [6] (Table 7.3.1-2 with  $P_{\text{CMAX\_L}}$  as defined in clause 6.2.5).

NOTE 2: Reference measurement channel is in clause A.3.2 of ETSI TS 136 521-1 [5].

NOTE 3: REFSENS as defined in ETSI TS 136 521-1 [5].

### 8.2.7.3 Conformance

Conformance tests described in clause 9.3.6 shall be carried out.

## 8.2.8 Receiver Spurious Response

### 8.2.8.1 Definition

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 Table 69 is not met.

### 8.2.8.2 Limits

The throughput shall be  $\geq 95$  % of the maximum throughput of the reference measurement channels as specified in ETSI TS 136 521-1 [5] with parameters specified in Tables 71 and 72.

Table 71: Spurious response parameters

Rx Parameter	Units	Channel bandwidth					
		1,4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Power in Transmission Bandwidth Configuration	dBm	REFSENS + channel bandwidth specific value below					
		6	6	6	6	7	9

NOTE 1: The transmitter shall be set to 4 dB below  $P_{\text{CMAX\_L}}$  at the minimum uplink configuration specified in ETSI TS 136 101 [6] (Table 7.3.1-2 with  $P_{\text{CMAX\_L}}$  as defined in clause 6.2.5).

NOTE 2: Reference measurement channel is clause A.3.2 of ETSI TS 136 521-1 [5].

NOTE 3: REFSENS as defined in ETSI TS 136 521-1 [5].

**Table 72: Spurious Response**

Parameter	Unit	Level
$P_{\text{Interferer (CW)}}$	dBm	-44
$F_{\text{Interferer}}$	MHz	Spurious response frequencies

### 8.2.8.3 Conformance

Conformance tests described in clause 9.3.7 shall be carried out.

## 8.2.9 Receiver Intermodulation Characteristics

### 8.2.9.1 Definition

Intermodulation response rejection is a measure of the capability of the receiver to receive 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.

### 8.2.9.2 Limits

The throughput shall be  $\geq 95$  % of the maximum throughput of the reference measurement channels as specified in ETSI TS 136 521-1 [5] with parameters specified in Table 73 for the specified wanted signal mean power in the presence of two interfering signals.

**Table 73: Test parameters for Wide band intermodulation**

Rx Parameter	Units	Channel bandwidth					
		1,4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Power in Transmission Bandwidth Configuration	dBm	REFSENS + channel bandwidth specific value below					
		12	8	6	6	7	9
P <sub>Interferer 1</sub> (CW)	dBm	-46					
P <sub>Interferer 2</sub> (Modulated)	dBm	-46					
BW <sub>Interferer 2</sub>		1,4	3	5			
F <sub>Interferer 1</sub> (Offset)	MHz	-BW/2 - 2,1 / +BW/2 + 2,1	-BW/2 - 4,5 / +BW/2 + 4,5	-BW/2 - 7,5 / +BW/2 + 7,5			
F <sub>Interferer 2</sub> (Offset)	MHz	2 × F <sub>Interferer 1</sub>					
NOTE 1: The transmitter shall be set to 4 dB below P <sub>CMAX_L</sub> at the minimum uplink configuration specified in ETSI TS 136 101 [6] (Table 7.3.1-2 with P <sub>CMAX_L</sub> as defined in clause 6.2.5).							
NOTE 2: Reference measurement channel is clause A.3.2 of ETSI TS 136 521-1 [5].							
NOTE 3: The modulated interferer consists of the Reference measurement channel specified in clause A.3.2 of ETSI TS 136 521-1 [5] with set-up according to clause C.3.1 of ETSI TS 136 521-1 [5]. The interfering modulated signal is 5 MHz E-UTRA signal as described in annex D of ETSI TS 136 521-1 [5] for channel bandwidth ≥ 5 MHz.							
NOTE 4: REFSENS as defined in ETSI TS 136 521-1 [5].							

### 8.2.9.3 Conformance

Conformance tests described in clause 9.3.8 shall be carried out.

## 8.2.10 Receiver Spurious Emissions

### 8.2.10.1 Definition

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

### 8.2.10.2 Limits

The measured spurious emissions derived in clause 9.3.9 shall not exceed the maximum level specified in Table 74.

**Table 74: General receiver spurious emission requirements**

Frequency Band	Measurement bandwidth	Maximum level	Note
$30 \text{ MHz} \leq f < 1 \text{ GHz}$	100 kHz	-57 dBm	
$1 \text{ GHz} \leq f \leq 12,75 \text{ GHz}$	1 MHz	-47 dBm	
NOTE: Unused PDCCH resources are padded with resource element groups with power [5] level given by PDCCH_RA/RB as defined in ETSI TS 136 101 [6], clause C.3.1.			

### 8.2.10.3 Conformance

Conformance tests described in clause 9.3.9 shall be carried out.

## 8.2.11 Transmitter Adjacent Channel Leakage Power Ratio

### 8.2.11.1 Transmitter adjacent channel leakage power ratio for Single Carrier

#### 8.2.11.1.1 Definition

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.

#### 8.2.11.1.2 Limits

If the measured adjacent channel power is greater than -50 dBm then the measured  $E\text{-UTRA}_{\text{ACLR}}$  shall be higher than the limits in Table 75.

**Table 75: E-UTRA UE ACLR**

	Channel bandwidth/ $E\text{-UTRA}_{\text{ACLR1}}$ /measurement bandwidth					
	1,4 MHz	3,0 MHz	5 MHz	10 MHz	15 MHz	20 MHz
$E\text{-UTRA}_{\text{ACLR1}}$	29,2 dB	29,2 dB	29,2 dB	29,2 dB	29,2 dB	29,2 dB
E-UTRA channel Measurement bandwidth	1,08 MHz	2,7 MHz	4,5 MHz	9,0 MHz	13,5 MHz	18 MHz
UE channel	+1,4 MHz or -1,4 MHz	+3 MHz or -3 MHz	+5 MHz or -5 MHz	+10 MHz or -10 MHz	+15 MHz or -15 MHz	+20 MHz or -20 MHz

If the measured UTRA channel power is greater than -50 dBm then the measured  $UTRA_{\text{ACLR1}}$ ,  $UTRA_{\text{ACLR2}}$  shall be higher than the limits in Table 76.



Table 76: UTRA UE ACLR

	Channel bandwidth/UTRA <sub>ACLR1/2</sub> /measurement bandwidth					
	1,4 MHz	3,0 MHz	5 MHz	10 MHz	15 MHz	20 MHz
UTRA <sub>ACLR1</sub>	32,2 dB	32,2 dB	32,2 dB	32,2 dB	32,2 dB	32,2 dB
Adjacent channel centre frequency offset (in MHz)	0,7 + $BW_{UTRA}/2$ / -0,7 - $BW_{UTRA}/2$	1,5 + $BW_{UTRA}/2$ / -1,5 - $BW_{UTRA}/2$	2,5 + $BW_{UTRA}/2$ / -2,5 - $BW_{UTRA}/2$	5 + $BW_{UTRA}/2$ / -5 - $BW_{UTRA}/2$	7,5 + $BW_{UTRA}/2$ / -7,5 - $BW_{UTRA}/2$	10 + $BW_{UTRA}/2$ / -10 - $BW_{UTRA}/2$
UTRA <sub>ACLR2</sub>	-	-	35,2 dB	35,2 dB	35,2 dB	35,2 dB
Adjacent channel centre frequency offset (in MHz)	-	-	2,5 + 3 × $BW_{UTRA}/2$ / -2,5 - 3 × $BW_{UTRA}/2$	5 + 3 × $BW_{UTRA}/2$ / -5 - 3 × $BW_{UTRA}/2$	7,5 + 3 × $BW_{UTRA}/2$ / -7,5 - 3 × $BW_{UTRA}/2$	10 + 3 × $BW_{UTRA}/2$ / -10 - 3 × $BW_{UTRA}/2$
E-UTRA channel Measurement bandwidth	1,08 MHz	2,7 MHz	4,5 MHz	9,0 MHz	13,5 MHz	18 MHz
UTRA 5 MHz channel Measurement bandwidth (see note 1)	3,84 MHz	3,84 MHz	3,84 MHz	3,84 MHz	3,84 MHz	3,84 MHz
UTRA 1,6 MHz channel measurement bandwidth (see note 2)	1,28 MHz	1,28 MHz	1,28 MHz	1,28 MHz	1,28 MHz	1,28 MHz

NOTE 1: Applicable for E-UTRA FDD co-existence with UTRA FDD in paired spectrum.  
NOTE 2: Applicable for E-UTRA TDD co-existence with UTRA TDD in unpaired spectrum.  
NOTE 3:  $BW_{UTRA}$  for UTRA FDD is 5 MHz and for UTRA TDD is 1,6 MHz.

### 8.2.11.1.3 Conformance

Conformance tests described in clause 9.3.10 shall be carried out.

### 8.2.11.2 Transmitter adjacent channel leakage power ratio for intra-band contiguous Carrier Aggregation (DL CA and UL CA)

#### 8.2.11.2.1 Definition

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 assigned carrier 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 77.

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 and adjacent aggregated channel bandwidth power are measured with rectangular filters with measurement bandwidth specified in Table 78.

### 8.2.11.2.2 Limits

If the measured adjacent UTRA channel power is greater than -50 dBm then the measured  $UTRA_{ACLR1}$  and  $UTRA_{ACLR2}$ , shall be higher than the limits in Table 77.

**Table 77: UTRA UE ACLR for CA**

	CA bandwidth class/ $UTRA_{ACLR1/2}$ /measurement bandwidth
	<b>CA bandwidth class C</b>
$UTRA_{ACLR1}$	32,2 dB
Adjacent channel centre frequency offset (in MHz)	$\frac{+ BW_{Channel\_CA} / 2 + BW_{UTRA} / 2}{- BW_{Channel\_CA} / 2 - BW_{UTRA} / 2}$
$UTRA_{ACLR2}$	35,2 dB
Adjacent channel centre frequency offset (in MHz)	$\frac{+ BW_{Channel\_CA} / 2 + 3 \times BW_{UTRA} / 2}{- BW_{Channel\_CA} / 2 - 3 \times BW_{UTRA} / 2}$
CA E-UTRA channel Measurement bandwidth	$BW_{Channel\_CA} - 2 \times BW_{GB}$
UTRA 5 MHz channel Measurement bandwidth (note 1)	3,84 MHz
UTRA 1,6 MHz channel measurement bandwidth (note 2)	1,28 MHz
NOTE 1: Applicable for E-UTRA FDD co-existence with UTRA FDD in paired spectrum.	
NOTE 2: Applicable for E-UTRA TDD co-existence with UTRA TDD in unpaired spectrum.	

If the measured adjacent E-UTRA channel power is greater than -50 dBm then the measured CA E- $UTRA_{ACLR}$ , shall be higher than the limits in Table 78.

**Table 78: CA E-UTRA ACLR**

	CA bandwidth class/CA E- $UTRA_{ACLR}$ /Measurement bandwidth
	<b>CA bandwidth class C</b>
CA E- $UTRA_{ACLR}$	29,2 dB
CA E-UTRA channel Measurement bandwidth	$BW_{Channel\_CA} - 2 * BW_{GB}$
Adjacent channel centre frequency offset (in MHz)	$\frac{+ BW_{Channel\_CA}}{- BW_{Channel\_CA}}$

### 8.2.11.2.3 Conformance

Conformance tests described in clause 9.3.10 shall be carried out.

## 8.2.11.3 Transmitter adjacent channel leakage power ratio for UL-MIMO

### 8.2.11.3.1 Definition

E-UTRA ACLR (E- $UTRA_{ACLR}$ ) 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 at nominal channel spacing. The assigned E-UTRA channel power and adjacent E-UTRA channel power are measured with rectangular filters with measurement bandwidth specified in Table 79.

For UEs with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the requirements in Table 79 apply to each transmit antenna connector with the UL-MIMO configurations specified in Table 47.

UTRA ACLR ( $UTRA_{ACLR}$ ) 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 UTRA channel frequency.

UTRA ACLR is specified for both the first UTRA adjacent channel ( $UTRA_{ACLR1}$ ) and the 2<sup>nd</sup> UTRA adjacent channel ( $UTRA_{ACLR2}$ ). 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 80.

For UEs with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the requirements in Table 80 apply to each transmit antenna connector with the UL-MIMO configurations specified in Table 47.

### 8.2.11.3.2 Limits

If the measured E-UTRA adjacent channel power is greater than -50 dBm then the  $E-UTRA_{ACLR}$  shall be higher than the valued specified in Table 79.

**Table 79: General requirements for  $E-UTRA_{ACLR}$**

	Channel bandwidth/ $E-UTRA_{ACLR1}$ /measurement bandwidth					
	1,4 MHz	3,0 MHz	5 MHz	10 MHz	15 MHz	20 MHz
<b><math>E-UTRA_{ACLR1}</math></b>	29,2 dB	29,2 dB	29,2 dB	29,2 dB	29,2 dB	29,2 dB
<b>E-UTRA channel Measurement bandwidth</b>	1,08 MHz	2,7 MHz	4,5 MHz	9,0 MHz	13,5 MHz	18 MHz
<b>UE channel</b>	+1,4 MHz or -1,4 MHz	+3 MHz or -3 MHz	+5 MHz or -5 MHz	+10 MHz or -10 MHz	+15 MHz or -15 MHz	+20 MHz or -20 MHz

If the measured UTRA channel power is greater than -50 dBm then the  $UTRA_{ACLR1}$  and  $UTRA_{ACLR2}$  shall be higher than the valued specified in Table 80.

**Table 80: General requirements for  $UTRA_{ACLR1/2}$**

	Channel bandwidth/ $E-UTRA_{ACLR1/2}$ /measurement bandwidth					
	1,4 MHz	3,0 MHz	5 MHz	10 MHz	15 MHz	20 MHz
<b><math>E-UTRA_{ACLR1}</math></b>	32,2 dB	32,2 dB	32,2 dB	32,2 dB	32,2 dB	32,2 dB
<b>Adjacent channel centre frequency offset (in MHz)</b>	$0,7 + BW_{UTRA}/2$ / $-0,7 - BW_{UTRA}/2$	$1,5 + BW_{UTRA}/2$ / $-1,5 - BW_{UTRA}/2$	$2,5 + BW_{UTRA}/2$ / $-2,5 - BW_{UTRA}/2$	$5 + BW_{UTRA}/2$ / $-5 - BW_{UTRA}/2$	$7,5 + BW_{UTRA}/2$ / $-7,5 - BW_{UTRA}/2$	$10 + BW_{UTRA}/2$ / $-10 - BW_{UTRA}/2$
<b><math>UTRA_{ACLR2}</math></b>	-	-	35,2 dB	35,2 dB	35,2 dB	35,2 dB
<b>Adjacent channel centre frequency offset (in MHz)</b>	-	-	$2,5 + 3 \times BW_{UTRA}/2$ / $-2,5 - 3 \times BW_{UTRA}/2$	$5 + 3 \times BW_{UTRA}/2$ / $-5 - 3 \times BW_{UTRA}/2$	$7,5 + 3 \times BW_{UTRA}/2$ / $-7,5 - 3 \times BW_{UTRA}/2$	$10 + 3 \times BW_{UTRA}/2$ / $-10 - 3 \times BW_{UTRA}/2$
<b>E-UTRA channel Measurement bandwidth</b>	1,08 MHz	2,7 MHz	4,5 MHz	9,0 MHz	13,5 MHz	18 MHz
<b>UTRA 5 MHz channel Measurement bandwidth (see note 1)</b>	3,84 MHz	3,84 MHz	3,84 MHz	3,84 MHz	3,84 MHz	3,84 MHz
<b>UTRA 1,6 MHz channel measurement bandwidth (see note 2)</b>	1,28 MHz	1,28 MHz	1,28 MHz	1,28 MHz	1,28 MHz	1,28 MHz

NOTE 1: Applicable for E-UTRA FDD co-existence with UTRA FDD in paired spectrum.

NOTE 2: Applicable for E-UTRA TDD co-existence with UTRA TDD in unpaired spectrum.
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### 8.2.11.3.3 Conformance

Conformance tests described in clause 9.3.10 shall be carried out.

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## 9 Testing for compliance with technical requirements for non-aeronautical UE E-UTRA

### 9.1 Environmental conditions for testing

Tests defined in the present document shall be carried out at representative points within the boundary limits of the declared operational environmental profile.

Where technical performance varies subject to environmental conditions, tests shall be carried out under a sufficient variety of environmental conditions (within the boundary limits of the declared operational environmental profile) to give confidence of compliance for the affected technical requirements.

Normally it should be sufficient for all tests to be conducted using normal test conditions except where otherwise stated. For guidance on the use of other conditions to be used in order to show compliance reference can be made to ETSI TS 136 521-1 [5].

Many tests in the present document are performed with appropriate frequencies in the low, middle and high range of the operating frequency band of the UE. These frequencies are defined in ETSI TS 136 508 [7].

### 9.2 Interpretation of the measurement results

The interpretation of the results recorded in a test report for the measurements described in the present document shall be as follows:

- the measured value related to the corresponding limit shall be used to decide whether an equipment meets the requirements of the present document;
- the value of the measurement uncertainty for the measurement of each parameter shall be documented in the test report;
- the recorded value of the measurement uncertainty shall be, for each measurement, equal to or lower than the figures in Table 81.

For the test methods, according to the present document, the measurement uncertainty figures shall be calculated and shall correspond to an expansion factor (coverage factor)  $k = 1,96$  (which provides a confidence level of 95 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)). Principles for the calculation of measurement uncertainty are contained in ETSI TR 100 028 [i.8], in particular in annex D of ETSI TR 100 028-2 [i.8]. For guidance on other measurement conditions reference can be made to annex (s) of ETSI TS 136 521-1 [5].

Table 81 is based on this expansion factor.

**Table 81: Maximum measurement uncertainty of the test system**

Parameter	Conditions	Test system uncertainty
Transmitter maximum output power		$\pm 0,7$ dB
Transmitter spectrum emissions mask		$\pm 1,5$ dB
Transmitter spurious emissions	9 kHz < f ≤ 4 GHz: $\pm 2,0$ dB 4 GHz < f ≤ 12,75 GHz: $\pm 4,0$ dB	$\pm 2,0$ dB $\pm 4,0$ dB
Transmitter Minimum output power		$\pm 1,0$ dB
Receiver Adjacent Channel Selectivity (ACS)		$\pm 1,1$ dB
Receiver Blocking characteristics	1 MHz < f <sub>interferer</sub> ≤ 3 GHz 3 GHz < f <sub>interferer</sub> ≤ 12,75 GHz	$\pm 1,3$ dB $\pm 3,2$ dB
Receiver spurious response	1 MHz < f <sub>interferer</sub> ≤ 3 GHz 3 GHz < f <sub>interferer</sub> ≤ 12,75 GHz	$\pm 1,3$ dB $\pm 3,2$ dB
Receiver intermodulation characteristics		$\pm 1,4$ dB
Receiver spurious emissions	30 MHz ≤ f ≤ 4,0 GHz: $\pm 2,0$ dB 4 GHz < f ≤ 12,75 GHz: $\pm 4,0$ dB	$\pm 2,0$ dB $\pm 4,0$ dB
Transmitter adjacent channel leakage power ratio	-	$\pm 0,8$ dB
NOTE 1: For RF tests it should be noted that the uncertainties in Table 81 apply to the test system operating into a nominal 50 Ω load and do not include system effects due to mismatch between the EUT and the test system.		
NOTE 2: If the test system for a test is known to have a measurement uncertainty greater than that specified in Table 81, this equipment can still be used provided that an adjustment is made follows: any additional uncertainty in the test system over and above that specified in Table 81 should be used to tighten the test requirements - making the test harder to pass (for some tests, e.g. receiver tests, this may require modification of stimulus signals). This procedure will ensure that a test system not compliant with Table 81 does not increase the probability of passing an EUT that would otherwise have failed a test if a test system compliant with Table 81 had been used.		

## 9.3 Radio test suites

### 9.3.1 Transmitter Maximum Output Power

#### 9.3.1.1 Transmitter maximum output power for Single Carrier

##### 9.3.1.1.1 Method of test

##### 9.3.1.1.1.1 Initial conditions

Test environment: normal, TL/VL, TL/VH, TH/VL, TH/VH; as specified in annex B.

Frequencies to be tested: low range, mid range, high range; as specified in ETSI TS 136 508 [7], clause 4.3.1.

Channel bandwidths to be tested: lowest, 5 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [7], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [5]:

- 1) Connect the SS to the UE antenna connectors.
- 2) The parameter settings for the cell are set up according to ETSI TS 136 508 [7], clause 4.4.3.
- 3) Downlink signals are initially set up according to ETSI TS 136 521-1 [5], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.
- 4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [5].
- 5) Propagation conditions are set according to ETSI TS 136 521-1 [5], clause B.0.
- 6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [7], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [5], ETSI TS 136 508 [7] and ETSI TS 136 509 [i.6] respectively.

#### 9.3.1.1.1.2 Procedure

- 1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C\_RNTI to schedule the UL RMC according to Table 6.2.2.1.4.1-1 of ETSI TS 136 521-1 [5]. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.
- 2) Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms for the UE to reach  $P_{UMAX}$  level.
- 3) Measure the mean power of the UE in the channel bandwidth of the radio access mode. The period of measurement shall be at least the continuous duration of one sub-frame (1 ms). For TDD slots with transient periods are not under test.
- 4) Repeat for applicable test frequencies, channel bandwidths, operating band combinations and environmental conditions.

Details of the test method can be found in ETSI TS 136 521-1 [5], clause 6.2.2.

#### 9.3.1.1.2 Test requirements

The results obtained shall be compared to the limits in clause 8.2.2.1.2 in order to show compliance.

### 9.3.1.2 Transmitter maximum output power for intra-band contiguous Carrier Aggregation (DL CA and UL CA)

#### 9.3.1.2.1 Method of test

##### 9.3.1.2.1.1 Initial conditions

Test environment: normal, TL/VL, TL/VH, TH/VL, TH/VH; as specified in annex B.

Frequencies to be tested: low range, high range; as specified in ETSI TS 136 508 [7], clause 4.3.1.

Test CC Combination setting ( $N_{RB\_agg}$ ): lowest  $N_{RB\_agg}$ , highest  $N_{RB\_agg}$ , as specified in ETSI TS 136 521-1 [5], in clause 5.4.2A.1 for the CA Configuration.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [5]:

- 1) Connect the SS to the UE antenna connectors.
- 2) The parameter settings for the cell are set up according to ETSI TS 136 508 [7], clause 4.4.3.
- 3) Downlink signals for PCC are initially set up according to ETSI TS 136 521-1 [5], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.
- 4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [5], clause 6.2.2A.1.
- 5) Propagation conditions are set according to ETSI TS 136 521-1 [5], clause B.0.
- 6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [7], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [5], ETSI TS 136 508 [7] and ETSI TS 136 509 [i.6] respectively.

#### 9.3.1.2.1.2 Procedure

- 1) Configure SCC according to ETSI TS 136 521-1 [5], clauses C.0, C.1 and C.3.0 for all downlink physical channels, except PHICH.
- 2) The SS shall configure SCC as per ETSI TS 136 508 [7], clause 5.2A.4.

- 3) SS activates SCC by sending the activation MAC-CE. Wait for at least 2 seconds.
- 4) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C\_RNTI to schedule the UL RMC according to Table 6.2.2A.1.4.1-1 of ETSI TS 136 521-1 [5] on both PCC and SCC. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.
- 5) Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms for the UE to reach  $P_{UMAX}$  level.
- 6) Measure the mean transmitted power over all component carriers in the CA configuration of the radio access mode. The period of measurement shall be at least the continuous duration of one sub-frame (1 ms). For TDD slots with transient periods are not under test.
- 7) Repeat for applicable test frequencies, channel bandwidths, operating band combinations and environmental conditions.

Details of the test method can be found in ETSI TS 136 521-1 [5], clause 6.2.2A.1.

### 9.3.1.2.2 Test requirements

The results obtained shall be compared to the limits in clause 8.2.2.2.2 in order to show compliance.

### 9.3.1.3 Transmitter maximum output power for UL-MIMO

#### 9.3.1.3.1 Method of test

##### 9.3.1.3.1.1 Initial conditions

Test environment: normal, TL/VL, TL/VH, TH/VL, TH/VH; as specified in annex B.

Frequencies to be tested: low range, mid range, high range; as specified in ETSI TS 136 508 [7], clause 4.3.1.

Channel bandwidths to be tested: lowest, 5 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [7], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [5]:

- 1) Connect the SS to the UE antenna connectors.
- 2) The parameter settings for the cell are set up according to ETSI TS 136 508 [7], clause 4.4.3.
- 3) Downlink signals are initially set up according to ETSI TS 136 521-1 [5], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.
- 4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [5], clause 6.2.2B.
- 5) Propagation conditions are set according to ETSI TS 136 521-1 [5], clause B.0.
- 6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [7], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [5], ETSI TS 136 508 [7] and ETSI TS 136 509 [i.6] respectively.

##### 9.3.1.3.1.2 Procedure

- 1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C\_RNTI to schedule the UL RMC according to Table 6.2.2B.4.1-1 of ETSI TS 136 521-1 [5]. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.
- 2) Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms for the UE to reach  $P_{UMAX}$  level.

- 3) Measure the mean power of the UE in the channel bandwidth of the radio access mode. The period of measurement shall be at least the continuous duration of one sub-frame (1 ms). For TDD slots with transient periods are not under test.
- 4) Repeat for applicable test frequencies, channel bandwidths, operating band combinations and environmental conditions.

Details of the test method can be found in ETSI TS 136 521-1 [5], clause 6.2.2B.

### 9.3.1.3.2 Test requirements

The results obtained shall be compared to the limits in clause 8.2.2.3.2 in order to show compliance.

## 9.3.2 Transmitter Spectrum Emission Mask

### 9.3.2.1 Transmitter spectrum emission mask for Single Carrier

#### 9.3.2.1.1 Method of test

##### 9.3.2.1.1.1 Initial conditions

Test environment: normal, as specified in annex B.

Frequencies to be tested: low range, mid range and high range; as specified in ETSI TS 136 508 [7], clause 4.3.1.

Channel bandwidths to be tested: lowest, 5 MHz, 10 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [7], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [5]:

- 1) Connect the SS to the UE antenna connectors.
- 2) The parameter settings for the cell are set up according to ETSI TS 136 508 [7], clause 4.4.3.
- 3) Downlink signals are initially set up according to ETSI TS 136 521-1 [5], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.
- 4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [5].
- 5) Propagation conditions are set according to ETSI TS 136 521-1 [5], clause B.0.
- 6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [7], clause 5.2A.2.

#### 9.3.2.1.1.2 Procedure

- 1) SS sends uplink scheduling information via PDCCH DCI format 0 for C\_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [5], Table 6.6.2.1.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.
- 2) Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at  $P_{\text{UMAX}}$  level.
- 3) Measure the power of the transmitted signal with a measurement filter of bandwidths according to Tables 49 or 50, as applicable. The center frequency of the filter shall be stepped in continuous steps according to the same table. The measured power shall be recorded for each step. The measurement period shall capture the active TSs.
- 4) Repeat for applicable test frequencies, channel bandwidths and operating band combinations.

Details of the test method can be found in ETSI TS 136 521-1 [5], clause 6.6.2.1.



### 9.3.2.1.2 Test requirements

The results obtained shall be compared to the limits in clause 8.2.3.1.2 in order to show compliance.

### 9.3.2.2 Transmitter spectrum emission mask for intra-band contiguous Carrier Aggregation (DL CA and UL CA)

#### 9.3.2.2.1 Method of test

##### 9.3.2.2.1.1 Initial conditions

Test environment: normal, TL/VL, TL/VH, TH/VL, TH/VH; as specified in annex B.

Frequencies to be tested: low range, high range; as specified in ETSI TS 136 508 [7], clause 4.3.1.

Test CC Combination setting ( $N_{RB\_agg}$ ): lowest  $N_{RB\_agg}$ , highest  $N_{RB\_agg}$ , as specified in ETSI TS 136 521-1 [5], in clause 5.4.2A.1 for the CA Configuration.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [5]:

- 1) Connect the SS to the UE antenna connectors.
- 2) The parameter settings for the cell are set up according to ETSI TS 136 508 [7], clause 4.4.3.
- 3) Downlink signals for PCC are initially set up according to ETSI TS 136 521-1 [5], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.
- 4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [5], clause 6.6.2.1A.1.
- 5) Propagation conditions are set according to ETSI TS 136 521-1 [5], clause B.0.
- 6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [7], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [5], ETSI TS 136 508 [7] and ETSI TS 136 509 [i.6] respectively.

##### 9.3.2.2.1.2 Procedure

- 1) Configure SCC according to ETSI TS 136 521-1 [5], clauses C.0, C.1 and C.3.0 for all downlink physical channels, except PHICH.
- 2) The SS shall configure SCC as per ETSI TS 136 508 [7], clause 5.2A.4.
- 3) SS activates SCC by sending the activation MAC-CE. Wait for at least 2 seconds.
- 4) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C\_RNTI to schedule the UL RMC according to Table 6.6.2.1A.1.4.1-1 of ETSI TS 136 521-1 [5] on both PCC and SCC. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.
- 5) Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms for the UE to reach  $P_{UMAX}$  level.
- 6) Measure the power of the transmitted signal with a measurement filter of bandwidths according to Tables 51 or 52, as applicable. The centre frequency of the filter shall be stepped in continuous steps according to the same table. The measured power shall be recorded for each step. The measurement period shall capture the active TSs.
- 7) Repeat for applicable test frequencies, channel bandwidths, operating band combinations and environmental conditions.

Details of the test method can be found in ETSI TS 136 521-1 [5], clause 6.6.2.1A.1.

### 9.3.2.2.2 Test requirements

The results obtained shall be compared to the limits in clause 8.2.3.2.2 in order to show compliance.

### 9.3.2.3 Transmitter spectrum emission mask for UL-MIMO

#### 9.3.2.3.1 Method of test

##### 9.3.2.3.1.1 Initial conditions

Test environment: normal, as specified in annex B.

Frequencies to be tested: low range, mid range and high range; as specified in ETSI TS 136 508 [7], clause 4.3.1.

Channel bandwidths to be tested: lowest, 5 MHz, 10 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [7], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [5]:

- 1) Connect the SS to the UE antenna connectors.
- 2) The parameter settings for the cell are set up according to ETSI TS 136 508 [7], clause 4.4.3.
- 3) Downlink signals are initially set up according to ETSI TS 136 521-1 [5], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.
- 4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [5], clause 6.6.2.1B.
- 5) Propagation conditions are set according to ETSI TS 136 521-1 [5], clause B.0.
- 6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [7], clause 5.2A.2.

##### 9.3.2.3.1.2 Procedure

- 1) SS sends uplink scheduling information via PDCCH DCI format 0 for C\_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [5], Table 6.6.2.1B.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.
- 2) Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at  $P_{UMAX}$  level.
- 3) Measure the power of the transmitted signal with a measurement filter of bandwidths according to Tables 49 or 50, as applicable. The center frequency of the filter shall be stepped in continuous steps according to the same table. The measured power shall be recorded for each step. The measurement period shall capture the active TSs.
- 4) Repeat for applicable test frequencies, channel bandwidths and operating band combinations.

Details of the test method can be found in ETSI TS 136 521-1 [5], clause 6.6.2.1B.

### 9.3.2.3.2 Test requirements

The results obtained shall be compared to the limits in clause 8.2.3.3.2 in order to show compliance.

### 9.3.3 Transmitter Spurious Emissions

#### 9.3.3.1 Transmitter spurious emissions for Single Carrier

##### 9.3.3.1.1 Method of test

##### 9.3.3.1.1.1 Initial conditions

Test Environment: normal, as specified in annex B.

Frequencies to be tested: low range, mid range, high range; see ETSI TS 136 508 [7].

Channel bandwidth to be tested: lowest, 5 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [7].

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [5]:

- 1) Connect the SS to the UE antenna connectors.
- 2) The parameter settings for the cell are set up according to ETSI TS 136 508 [7], clause 4.4.3.
- 3) Downlink signals are initially set up according to ETSI TS 136 521-1 [5], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.
- 4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [5].
- 5) Propagation conditions are set according to ETSI TS 136 521-1 [5], clause B.0.
- 6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [7], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [5], ETSI TS 136 508 [7] and ETSI TS 136 509 [i.6] respectively.

##### 9.3.3.1.1.2 Procedure

- 1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C\_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [5], Table 6.6.3.1.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.
- 2) Send continuously Up power control commands in the uplink scheduling information to the UE until the UE transmits at  $P_{\text{UMAX}}$  level.
- 3) For each applicable requirement in Tables 54, 55 and 56; measure the power of the transmitted signal with a measurement filter of bandwidths. The center frequency of the filter shall be stepped in contiguous steps according to the tables. The measured power shall be verified for each step. The measurement period shall capture the active time slots.
- 4) Repeat for applicable test frequencies, channel bandwidths and operating band combinations.

Details of the test method can be found in ETSI TS 136 521-1 [5], clauses 6.6.3.1 and 6.6.3.2.

##### 9.3.3.1.2 Test requirements

The results obtained shall be compared to the limits in clause 8.2.4.1.2 in order to show compliance.

### 9.3.3.2 Transmitter spurious emissions for intra-band contiguous Carrier Aggregation (DL CA and UL CA)

#### 9.3.3.2.1 Method of test

##### 9.3.3.2.1.1 Initial conditions

Test environment: normal; as specified in annex B.

Frequencies to be tested: low range, high range; as specified in ETSI TS 136 508 [7], clause 4.3.1.

Test CC Combination setting ( $N_{RB\_agg}$ ): lowest  $N_{RB\_agg}$ , highest  $N_{RB\_agg}$ , as specified in ETSI TS 136 521-1 [5], in clause 5.4.2A.1 for the CA Configuration.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [5]:

- 1) Connect the SS to the UE antenna connectors.
- 2) The parameter settings for the cell are set up according to ETSI TS 136 508 [7], clause 4.4.3.
- 3) Downlink signals for PCC are initially set up according to ETSI TS 136 521-1 [5], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.
- 4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [5], clause 6.6.3.1A.1.
- 5) Propagation conditions are set according to ETSI TS 136 521-1 [5], clause B.0.
- 6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [7], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [5], ETSI TS 136 508 [7] and ETSI TS 136 509 [i.6] respectively.

##### 9.3.3.2.1.2 Procedure

- 1) Configure SCC according to ETSI TS 136 521-1 [5], clauses C.0, C.1 and C.3.0 for all downlink physical channels, except PHICH.
- 2) The SS shall configure SCC as per ETSI TS 136 508 [7], clause 5.2A.4.
- 3) SS activates SCC by sending the activation MAC-CE. Wait for at least 2 seconds.
- 4) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C\_RNTI to schedule the UL RMC according to Table 6.6.3.1A.1.4.1-1 of ETSI TS 136 521-1 [5] on both PCC and SCC. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.
- 5) Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms for the UE to reach  $P_{UMAX}$  level.
- 6) For each applicable requirement in Tables 58 and 59; measure the power of the transmitted signal with a measurement filter of bandwidths for each component carrier. The centre frequency of the filter shall be stepped in contiguous steps according to the tables. The measured power shall be verified for each step. The measurement period shall capture the active time slots.
- 7) Repeat for applicable test frequencies, channel bandwidths, operating band combinations and environmental conditions.

Details of the test method can be found in ETSI TS 136 521-1 [5], clauses 6.6.3.2A.1 and 6.6.3.2A.2.

#### 9.3.3.2.2 Test requirements

The results obtained shall be compared to the limits in clause 8.2.4.2.2 in order to show compliance.

### 9.3.3.3 Transmitter spurious emissions for UL-MIMO

#### 9.3.3.3.1 Method of test

##### 9.3.3.3.1.1 Initial conditions

Test Environment: normal, as specified in annex B.

Frequencies to be tested: low range, mid range, high range; see ETSI TS 136 508 [7].

Channel bandwidth to be tested: lowest, 5 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [7].

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [5]:

- 1) Connect the SS to the UE antenna connectors.
- 2) The parameter settings for the cell are set up according to ETSI TS 136 508 [7], clause 4.4.3.
- 3) Downlink signals are initially set up according to ETSI TS 136 521-1 [5], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.
- 4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [5], clause 6.6.3B.1.
- 5) Propagation conditions are set according to ETSI TS 136 521-1 [5], clause B.0.
- 6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [7], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [5], ETSI TS 136 508 [7] and ETSI TS 136 509 [i.6] respectively.

##### 9.3.3.3.1.2 Procedure

- 1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C\_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [5], Table 6.6.3B.1.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.
- 2) Send continuously Up power control commands in the uplink scheduling information to the UE until the UE transmits at  $P_{\text{UMAX}}$  level.
- 3) For each applicable requirement in Tables 54 and 55; measure the power of the transmitted signal with a measurement filter of bandwidths. The center frequency of the filter shall be stepped in contiguous steps according to the tables. The measured power shall be verified for each step. The measurement period shall capture the active time slots.
- 4) Repeat for applicable test frequencies, channel bandwidths and operating band combinations.

Details of the test method can be found in ETSI TS 136 521-1 [5], clauses 6.6.3B.1 and 6.6.3B.2.

#### 9.3.3.3.2 Test requirements

The results obtained shall be compared to the limits in clause 8.2.4.3.2 in order to show compliance.

### 9.3.4 Transmitter Minimum Output Power

#### 9.3.4.1 Transmitter minimum output power for Single Carrier

##### 9.3.4.1.1 Method of test

##### 9.3.4.1.1.1 Initial conditions

Test Environment: normal, TL/VL, TL/VH, TH/VL, TH/VH; as specified in annex B.

Frequencies to be tested: low range, mid range and high range; see ETSI TS 136 508 [7].

Channel bandwidths to be tested: lowest, 5 MHz and highest channel bandwidth, as specified in ETSI TS 136 508 [7], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [5]:

- 1) Connect the SS to the UE antenna connectors.
- 2) The parameter settings for the cell are set up according to ETSI TS 136 508 [7], clause 4.4.3.
- 3) Downlink signals are initially set up according to ETSI TS 136 521-1 [5], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.
- 4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [5].
- 5) Propagation conditions are set according to ETSI TS 136 521-1 [5], clause B.0.
- 6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [7], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [5], ETSI TS 136 508 [7] and ETSI TS 136 509 [i.6] respectively.

#### 9.3.4.1.1.2 Procedure

- 1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C\_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [5], Table 6.3.2.1.4.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.
- 2) Send continuous uplink power control "down" commands in the uplink scheduling information to the UE to ensure that the UE transmits at its minimum output power.
- 3) Measure the mean power of the UE in the associated measurement bandwidth specified in Table 60 for the specific channel bandwidth under test. The period of measurement shall be the continuous duration of one sub-frame (1 ms). For TDD slots with transient periods are not under test.
- 4) Repeat for applicable test frequencies, channel bandwidths, operating band combinations and environmental conditions.

Details of the test method can be found in ETSI TS 136 521-1 [5], clause 6.3.2.

#### 9.3.4.1.2 Test requirements

The results obtained shall be compared to the limits in clause 8.2.5.1.2 in order to show compliance.

### 9.3.4.2 Transmitter minimum output power for intra-band contiguous Carrier Aggregation (DL CA and UL CA)

#### 9.3.4.2.1 Method of test

##### 9.3.4.2.1.1 Initial conditions

Test environment: normal, TL/VL, TL/VH, TH/VL, TH/VH; as specified in annex B.

Frequencies to be tested: low range, high range; as specified in ETSI TS 136 508 [7], clause 4.3.1.

Test CC Combination setting ( $N_{RB\_agg}$ ): lowest  $N_{RB\_agg}$ , highest  $N_{RB\_agg}$ , as specified in ETSI TS 136 521-1 [5], in clause 9.4.2A.1 for the CA Configuration.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [5]:

- 1) Connect the SS to the UE antenna connectors.
- 2) The parameter settings for the cell are set up according to ETSI TS 136 508 [7], clause 4.4.3.

- 3) Downlink signals for PCC are initially set up according to ETSI TS 136 521-1 [5], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.
- 4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [5], clause 6.3.2A.1.
- 5) Propagation conditions are set according to ETSI TS 136 521-1 [5], clause B.0.
- 6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [7], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [5], ETSI TS 136 508 [7] and ETSI TS 136 509 [i.6] respectively.

#### 9.3.4.2.1.2 Procedure

- 1) Configure SCC according to ETSI TS 136 521-1 [5], clauses C.0, C.1 and C.3.0 for all downlink physical channels, except PHICH.
- 2) The SS shall configure SCC as per ETSI TS 136 508 [7], clause 5.2A.4.
- 3) SS activates SCC by sending the activation MAC-CE. Wait for at least 2 seconds.
- 4) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C\_RNTI to schedule the UL RMC according to Table 6.3.2A.1.4.1-1 of ETSI TS 136 521-1 [5] on both PCC and SCC. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.
- 5) Send continuously uplink power control "down" commands in every uplink scheduling information to the UE to ensure that the UE transmits at its minimum output power.
- 6) Measure the mean transmitted power of each component carrier in the CA configuration of the radio access mode. The period of measurement shall be at least the continuous duration of one sub-frame (1 ms). For TDD slots with transient periods are not under test.
- 7) Repeat for applicable test frequencies, channel bandwidths, operating band combinations and environmental conditions.

Details of the test method can be found in ETSI TS 136 521-1 [5], clause 6.3.2A.1.

#### 9.3.4.2.2 Test requirements

The results obtained shall be compared to the limits in clause 8.2.5.2.2 in order to show compliance.

#### 9.3.4.3 Transmitter minimum output power for UL-MIMO

##### 9.3.4.3.1 Method of test

##### 9.3.4.3.1.1 Initial conditions

Test environment: normal, TL/VL, TL/VH, TH/VL, TH/VH; as specified in annex B.

Frequencies to be tested: low range, mid range, high range; as specified in ETSI TS 136 508 [7], clause 4.3.1.

Channel bandwidths to be tested: lowest, 5 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [7], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [5]:

- 1) Connect the SS to the UE antenna connectors.
- 2) The parameter settings for the cell are set up according to ETSI TS 136 508 [7], clause 4.4.3.
- 3) Downlink signals are initially set up according to ETSI TS 136 521-1 [5], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.

- 4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [5], clause 6.3.2B.
- 5) Propagation conditions are set according to ETSI TS 136 521-1 [5], clause B.0.
- 6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [7], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [5], ETSI TS 136 508 [7] and ETSI TS 136 509 [i.6] respectively.

#### 9.3.4.3.1.2 Procedure

- 1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C\_RNTI to schedule the UL RMC according to Table 6.3.2B.1.4.1-1 of ETSI TS 136 521-1 [5]. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.
- 2) Send continuously uplink power control "down" commands in the uplink scheduling information to the UE to ensure that the UE transmits at its minimum output power.
- 3) Measure the sum of mean power of the UE at each UE antenna connector in the associated measurement bandwidth specified in Table 62 for the specific channel bandwidth under test. The period of measurement shall be the continuous duration of one sub-frame (1 ms). For TDD slots with transient periods are not under test.
- 4) Repeat for applicable test frequencies, channel bandwidths, operating band combinations and environmental conditions.

Details of the test method can be found in ETSI TS 136 521-1 [5], clause 6.3.2B.

#### 9.3.4.3.2 Test requirements

The results obtained shall be compared to the limits in clause 8.2.5.3.2 in order to show compliance.

### 9.3.5 Receiver Adjacent Channel Selectivity (ACS)

#### 9.3.5.1 Method of test

##### 9.3.5.1.1 Initial conditions

Test Environment: normal, as specified in annex B.

Frequencies to be tested: mid range see ETSI TS 136 508 [7].

Channel bandwidth to be tested: lowest, 5 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [7], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [5]:

- 1) Connect the SS and interfering source to the UE antenna connectors.
- 2) The parameter settings for the cell are set up according to ETSI TS 136 508 [7], clause 4.4.3.
- 3) Downlink signals are initially set up according to ETSI TS 136 521-1 [5], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.
- 4) The UL and DL Reference Measurement channels are set according to ETSI TS 136 521-1 [5], Table 7.5.4.1-1.
- 5) Propagation conditions are set according to ETSI TS 136 521-1 [5], clause B.0.
- 6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [7], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [5], ETSI TS 136 508 [7] and ETSI TS 136 509 [i.6] respectively.



### 9.3.5.1.2 Procedure

- 1) SS transmits PDSCH via PDCCH DCI format 1A for C\_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [5], Table 7.5.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.
- 2) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C\_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [5], Table 7.5.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.
- 3) Set the Downlink signal level to the value as defined in Table 64 (Case 1). Send Uplink power control commands to the UE (less or equal to 1 dB step size should be used), to ensure that the UE output power is within +0, -3,4 dB of the target level in Table 64 (Case 1) for carrier frequency  $f \leq 3,0$  GHz or within +0, -4,0 dB of the target level for carrier frequency  $3,0 \text{ GHz} < f \leq 4,2 \text{ GHz}$ , for at least the duration of the Throughput measurement (obtain correct UE output power as specified in ETSI TS 136 521-1 [5]).
- 4) Set the Interferer signal level to the value as defined in Table 64 (Case 1) and frequency below the wanted signal, using a modulated interferer as defined in ETSI TS 136 521-1 [5], annex D.
- 5) Measure the average throughput for a duration sufficient to achieve statistical significance according to clause G.2 of ETSI TS 136 521-1 [5].
- 6) Set the Downlink signal level to the value as defined in Table 65 (Case 2). Send Uplink power control commands to the UE (less or equal to 1 dB step size should be used), to ensure that the UE output power is within +0, -3,4 dB of the target level in Table 65 (Case 2) for carrier frequency  $f \leq 3,0$  GHz or within +0, -4,0 dB of the target level for carrier frequency  $3,0 \text{ GHz} < f \leq 4,2 \text{ GHz}$ , for at least the duration of the throughput measurement (obtain correct UE output power as specified in ETSI TS 136 521-1 [5]).
- 7) Set the Interferer signal level to the value as defined in Table 65 (Case 2) and frequency below the wanted signal, using a modulated interferer as defined in ETSI TS 136 521-1 [5], annex D.
- 8) Measure the average throughput for a duration sufficient to achieve statistical significance according to ETSI TS 136 521-1 [5], annex G.
- 9) Repeat for applicable channel bandwidths in both Case 1 and Case 2.
- 10) Repeat for applicable test frequencies, channel bandwidths and operating band combinations.

Details of the test method can be found in ETSI TS 136 521-1 [5], clause 7.5.

### 9.3.5.2 Test requirements

The results obtained shall be compared to the limits in clause 8.2.6.2 in order to show compliance.

## 9.3.6 Receiver Blocking Characteristics

### 9.3.6.1 Method of test

#### 9.3.6.1.1 Initial conditions

Test Environment: normal, as specified in annex B.

For In-band blocking, the frequencies to be tested are mid range as defined in ETSI TS 136 508 [7].

For Out-of-band blocking, the frequency to be tested is low or high range as defined in ETSI TS 136 508 [7].

For Narrow-band blocking, the frequencies to be tested are mid range as defined in ETSI TS 136 508 [7].

Channel bandwidth to be tested: lowest, 5 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [7], clause 4.3.1. Range 3 of out-of-band blocking is tested only with highest bandwidth.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [5]:

- 1) Connect the SS to the UE antenna connectors.

- 2) The parameter settings for the cell are set up according to ETSI TS 136 508 [7], clause 4.4.3.
- 3) Downlink signals are initially set up according to ETSI TS 136 521-1 [5], clauses C.0, C.1 and C.3.1 and uplink signals according to clauses H.1 and H.3.0.
- 4) The UL and DL Reference Measurement channels are set according to ETSI TS 136 521-1 [5], Table 7.6.2.4.1-1.
- 5) Propagation conditions are set according to ETSI TS 136 521-1 [5], clause B.0.
- 6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [7], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [5], ETSI TS 136 508 [7] and ETSI TS 136 509 [i.6] respectively.

#### 9.3.6.1.2 In-Band Procedure

- 1) SS transmits PDSCH via PDCCH DCI format 1A for C\_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [5], Table 7.6.1.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.
- 2) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C\_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [5], Table 7.6.1.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.
- 3) Set the parameters of the signal generator for an interfering signal below the wanted signal in Case 1 according to Tables 66 and 67 as specified in ETSI TS 136 521-1 [5].
- 4) Set the downlink signal level according to the Table 66. Send uplink power control commands to the UE (less or equal to 1 dB step size should be used), to ensure that the UE output power is within +0, -3,4 dB of the target level in Table 66 for carrier frequency  $f \leq 3,0$  GHz or within +0, -4,0 dB of the target level for carrier frequency  $3,0 \text{ GHz} < f \leq 4,2 \text{ GHz}$ , for at least the duration of the throughput measurement as specified in ETSI TS 136 521-1 [5].
- 5) Measure the average throughput for a duration sufficient to achieve statistical significance according to clause G.2 of ETSI TS 136 521-1 [5].
- 6) Repeat steps from 3 to 5, using an interfering signal above the wanted signal in Case 1 at step 3.
- 7) Repeat steps from 3 to 6, using interfering signals in Case 2 at step 3) and 6). The ranges of case 2 are covered in steps equal to the interferer bandwidth. The test frequencies are chosen in analogy to ETSI TS 136 521-1 [5], Table 7.6.1.4.2-1.
- 8) Repeat for applicable test frequencies, channel bandwidths and operating band combinations.

Details of the test method can be found in ETSI TS 136 521-1 [5], clause 7.6.1.

#### 9.3.6.1.3 Out-Of-Band Procedure

- 1) SS transmits PDSCH via PDCCH DCI format 1A for C\_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [5], Table 7.6.2.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.
- 2) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C\_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [5], Table 7.6.2.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.
- 3) Set the parameters of the CW signal generator for an interfering signal according to Table 69 as specified in ETSI TS 136 521-1 [5]. The frequency step size is 1 MHz.
- 4) Set the downlink signal level according to the Table 68. Send uplink power control commands to the UE (less or equal to 1 dB step size should be used), to ensure that the UE output power is within +0, -3,4 dB of the target level in Table 68 for carrier frequency  $f \leq 3,0$  GHz or within +0, -4,0 dB of the target level for carrier frequency  $3,0 \text{ GHz} < f \leq 4,2 \text{ GHz}$ , for at least the duration of the throughput measurement as specified in ETSI TS 136 521-1 [5].

- 5) Measure the average throughput for a duration sufficient to achieve statistical significance according to clause G.2 of ETSI TS 136 521-1 [5].
- 6) For Table 69 record the frequencies for which the throughput does not meet the requirements.
- 7) Repeat for applicable test frequencies, channel bandwidths and operating band combinations.

Details of the test method can be found in ETSI TS 136 521-1 [5], clause 7.6.2.

#### 9.3.6.1.4 Narrow-Band Procedure

- 1) SS transmits PDSCH via PDCCH DCI format 1A for C\_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [5], Table 7.6.3.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.
- 2) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C\_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [5], Table 7.6.3.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.
- 3) Set the parameters of the CW signal generator for an interfering signal below the wanted signal according to Table 70 as specified in ETSI TS 136 521-1 [5].
- 4) Set the downlink signal level according to the Table 70. Send uplink power control commands to the UE (less or equal to 1 dB step size should be used), to ensure that the UE output power is within +0, -3,4 dB of the target level in Table 70 for carrier frequency  $f \leq 3,0$  GHz or within +0, -4,0 dB of the target level for carrier frequency  $3,0 \text{ GHz} < f \leq 4,2 \text{ GHz}$ , for at least the duration of the throughput measurement as specified in ETSI TS 136 521-1 [5].
- 5) Measure the average throughput for a duration sufficient to achieve statistical significance according to clause G.2 of ETSI TS 136 521-1 [5].
- 6) Repeat steps from 3 to 5, using an interfering signal above the wanted signal at step 3.
- 7) Repeat for applicable test frequencies, channel bandwidths and operating band combinations.

Details of the test method can be found in ETSI TS 136 521-1 [5], clause 7.6.3.

#### 9.3.6.2 Test requirements

The results obtained shall be compared to the limits in clause 8.2.7.2 in order to show compliance.

### 9.3.7 Receiver Spurious Response

#### 9.3.7.1 Method of test

##### 9.3.7.1.1 Initial conditions

The initial conditions shall be the same as for those in Out-of-band blocking in clause 9.3.6.1.1 in order to test spurious responses obtained in clause 9.3.6.1.2 under the same conditions.

##### 9.3.7.1.2 Procedure

- 1) SS transmits PDSCH via PDCCH DCI format 1A for C\_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [5], Table 7.6.2.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.
- 2) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C\_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [5], Table 7.6.2.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.
- 3) Set the parameters of the CW signal generator for an interfering signal according to Table 72. The spurious frequencies are taken from step 5) records in clause 9.3.6.1.2.

- 4) Set the downlink signal level according to the Table 71. Send uplink power control commands to the UE (less or equal to 1 dB step size should be used), to ensure that the UE output power is within +0, -3,4 dB of the target level in Table 71 for carrier frequency  $f \leq 3,0$  GHz or within +0, -4,0 dB of the target level for carrier frequency  $3,0 \text{ GHz} < f \leq 4,2 \text{ GHz}$ , for at least the duration of the throughput measurement as specified in ETSI TS 136 521-1 [5].
- 5) For the spurious frequency, measure the average throughput for a duration sufficient to achieve statistical significance.

Details of the test method can be found in ETSI TS 136 521-1 [5], clause 7.7.

### 9.3.7.2 Test requirements

The results obtained shall be compared to the limits in clause 8.2.8.2 in order to show compliance.

## 9.3.8 Receiver Intermodulation Characteristics

### 9.3.8.1 Method of test

#### 9.3.8.1.1 Initial conditions

Test Environment: normal, as specified in annex B.

Frequencies to be tested: mid range; see ETSI TS 136 508 [7].

Channel bandwidths to be tested: lowest, 5 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [7], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [5]:

- 1) Connect the SS and interfering sources to the UE antenna connectors.
- 2) The parameter settings for the cell are set up according to ETSI TS 136 508 [7], clause 4.4.3.
- 3) Downlink signals are initially set up according to ETSI TS 136 521-1 [5], clauses C.0, C.1, C.3.1 and uplink signals according to clauses H.1 and H.3.1.
- 4) The UL and DL Reference Measurement channels are set according to ETSI TS 136 521-1 [5], Table 7.8.4.1-1.
- 5) Propagation conditions are set according to ETSI TS 136 521-1 [5], clause B.0.
- 6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [7], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [5], ETSI TS 136 508 [7] and ETSI TS 136 509 [i.6] respectively.

#### 9.3.8.1.2 Procedure

- 1) SS transmits PDSCH via PDCCH DCI format 1A for C\_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [5], Table 7.8.1.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.
- 2) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C\_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [5], Table 7.8.1.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.
- 3) Set the Downlink signal level to the value as defined in Table 73. Send uplink power control commands to the UE (less or equal to 1 dB step size should be used), to ensure that the UE output power is within +0, -3,4 dB of the target level in Table 73 for carrier frequency  $f \leq 3,0$  GHz or within +0, -4,0 dB of the target level for carrier frequency  $3,0 \text{ GHz} < f \leq 4,2 \text{ GHz}$ , for at least the duration of the throughput measurement as specified in ETSI TS 136 521-1 [5].

- 4) Set the Interfering signal levels to the values as defined in Table 73, using a modulated interferer bandwidth as defined in annex D of ETSI TS 136 521-1 [5].
- 5) Measure the average throughput for a duration sufficient to achieve statistical significance according to clause G.2 of ETSI TS 136 521-1 [5].
- 6) Repeat for applicable test frequencies, channel bandwidths and operating band combinations.

Details of the test method can be found in ETSI TS 136 521-1 [5], clause 7.8.

### 9.3.8.2 Test requirements

The results obtained shall be compared to the limits in clause 8.2.9.2 in order to show compliance.

## 9.3.9 Receiver Spurious Emissions

### 9.3.9.1 Method of test

#### 9.3.9.1.0 General

Test Environment: normal, as specified in annex B.

Frequencies to be tested: low range, mid range and high range; as specified in ETSI TS 136 508 [7], clause 4.3.1.

Channel bandwidth to be tested: highest channel bandwidth as defined in ETSI TS 136 508 [7], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [5]:

- 1) Connect a spectrum analyser (or other suitable test equipment) to the UE antenna connectors.
- 2) The parameter settings for the cell are set up according to ETSI TS 136 508 [7], clause 4.4.3.
- 3) Downlink signals are initially set up according to ETSI TS 136 521-1 [5], clauses C.0, C.1 and C.3.1.
- 4) The DL Reference Measurement channels are set according to ETSI TS 136 521-1 [5].
- 5) Propagation conditions are set according to ETSI TS 136 521-1 [5], clause B.0.
- 6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [7], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [5], ETSI TS 136 508 [7] and ETSI TS 136 509 [i.6] respectively.

#### 9.3.9.1.1 Procedure

- 1) Sweep the spectrum analyser (or other suitable test equipment) over a frequency range from 30 MHz to 12,75 GHz and measure the average power of the spurious emissions.
- 2) Repeat step 1) for all E-UTRA Rx antennas of the UE.
- 3) Repeat for applicable test frequencies, channel bandwidths and operating band combinations.

Details of the test method can be found in ETSI TS 136 521-1 [5], clause 7.9.

### 9.3.9.2 Test requirements

The results obtained shall be compared to the limits in clause 8.2.10.2 in order to show compliance.

## 9.3.10 Transmitter Adjacent Channel Leakage Power Ratio

### 9.3.10.1 Transmitter adjacent channel leakage power ratio for Single Carrier

#### 9.3.10.1.1 Method of test

##### 9.3.10.1.1.1 Initial conditions

Test Environment: normal, TL/VL, TL/VH, TH/VL and TH/VH, as specified in annex B.

Frequencies to be tested: low range, mid range and high range; see ETSI TS 136 508 [7].

Channel bandwidth to be tested: lowest, 5 MHz, 10 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [7], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [5]:

- 1) Connect the SS to the UE to the UE antenna connectors.
- 2) The parameter settings for the cell are set up according to ETSI TS 136 508 [7], clause 4.4.3.
- 3) Downlink signals are initially set up according to ETSI TS 136 521-1 [5], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.
- 4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [5].
- 5) Propagation conditions are set according to ETSI TS 136 521-1 [5], clause B.0.
- 6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [7], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [5], ETSI TS 136 508 [7] and ETSI TS 136 509 [i.6] respectively.

##### 9.3.10.1.1.2 Procedure

- 1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C\_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [5], Table 6.6.2.3.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.
- 2) Send continuous uplink power control "up" commands in the uplink scheduling information to the UE to ensure that the UE transmits at  $P_{\text{UMAX}}$  level.
- 3) Measure the mean power of the UE in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in Tables 75 and 76. The period of the measurement shall be at least the continuous duration of one sub-frame (1 ms). For TDD slots with transient periods are not under test.
- 4) Measure the filtered mean power for E-UTRA.
- 5) Measure the filtered mean power of the first E-UTRA adjacent channel.
- 6) Measure the RRC filtered mean power of the first and the second UTRA adjacent channel.
- 7) Calculate the ratio of the power between the values measured in step 4) over step 5) for  $\text{E-UTRA}_{\text{ACLR}}$ .
- 8) Calculated the ratio of the power between the values measured in step 4) over step 6) for  $\text{UTRA}_{\text{ACLR1}}$ ,  $\text{UTRA}_{\text{ACLR2}}$ .
- 9) Repeat for applicable test frequencies, channel bandwidths, operating band combinations and environmental conditions.

Details of the test method can be found in ETSI TS 136 521-1 [5], clause 6.6.2.3.

### 9.3.10.1.2 Test requirements

The results obtained shall be compared to the limits in clause 8.2.11.1-2 in order to show compliance.

### 9.3.10.2 Transmitter adjacent channel leakage power ratio for intra-band contiguous Carrier Aggregation (DL CA and UL CA)

#### 9.3.10.2.1 Method of test

##### 9.3.10.2.1.1 Initial conditions

Test environment: normal, TL/VL, TL/VH, TH/VL and TH/VH, as specified in annex B.

Frequencies to be tested: low range, high range; as specified in ETSI TS 136 508 [7], clause 4.3.1.

Test CC Combination setting ( $N_{RB\_agg}$ ): lowest  $N_{RB\_agg}$ , highest  $N_{RB\_agg}$ , as specified in ETSI TS 136 521-1 [5], in clause 5.4.2A.1 for the CA Configuration.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [5]:

- 1) Connect the SS to the UE antenna connectors.
- 2) The parameter settings for the cell are set up according to ETSI TS 136 508 [7], clause 4.4.3.
- 3) Downlink signals for PCC are initially set up according to ETSI TS 136 521-1 [5], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.
- 4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [5], clause 6.6.2.3A.1.
- 5) Propagation conditions are set according to ETSI TS 136 521-1 [5], clause B.0.
- 6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [7], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [5], ETSI TS 136 508 [7] and ETSI TS 136 509 [i.6] respectively.

##### 9.3.10.2.1.2 Procedure

- 1) Configure SCC according to ETSI TS 136 521-1 [5], clauses C.0, C.1 and C.3.0 for all downlink physical channels, except PHICH.
- 2) The SS shall configure SCC as per ETSI TS 136 508 [7], clause 5.2A.4.
- 3) SS activates SCC by sending the activation MAC-CE. Wait for at least 2 seconds.
- 4) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C\_RNTI to schedule the UL RMC according to Table 6.6.2.3A.1.4.1-1 of ETSI TS 136 521-1 [5] on both PCC and SCC. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.
- 5) Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms for the UE to reach  $P_{UMAX}$  level.
- 6) Measure the mean power over all component carriers of the UE in the CA configuration of the radio access mode according to the test configuration, which shall meet the requirements described in Tables 77 and 78. The period of the measurement shall be at least the continuous duration of one sub-frame (1 ms). For TDD slots with transient periods are not under test.
- 7) Measure the rectangular filtered mean power for CA E-UTRA.
- 8) Measure the rectangular filtered mean power of the first CA E-UTRA adjacent channel on both lower and upper side of the CA E-UTRA channel, respectively.

- 9) Measure the RRC filtered mean power of the first and the second UTRA for CA adjacent channel on both lower and upper side of the CA E-UTRA channel, respectively.
- 10) Calculate the ratio of the power between the values measured in step 7) over step 8) for CA E-UTRA<sub>ACLR</sub>.
- 11) Calculated the ratio of the power between the values measured in step 7) over step 9) for UTRA<sub>ACLR1</sub>, UTRA<sub>ACLR2</sub>.
- 12) Repeat for applicable test frequencies, channel bandwidths, operating band combinations and environmental conditions.

Details of the test method can be found in ETSI TS 136 521-1 [5], clause 6.6.2.3A.1.

### 9.3.10.2.2 Test requirements

The results obtained shall be compared to the limits in clause 8.2.11.2.2 in order to show compliance.

### 9.3.10.3 Transmitter adjacent channel leakage power ratio for UL-MIMO

#### 9.3.10.3.1 Method of test

##### 9.3.10.3.1.1 Initial conditions

Test environment: normal, TL/VL, TL/VH, TH/VL, TH/VH; as specified in annex B.

Frequencies to be tested: low range, mid range, high range; as specified in ETSI TS 136 508 [7], clause 4.3.1.

Channel bandwidths to be tested: lowest, 5 MHz, 10 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [7], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [5]:

- 1) Connect the SS to the UE antenna connectors.
- 2) The parameter settings for the cell are set up according to ETSI TS 136 508 [7], clause 4.4.3.
- 3) Downlink signals are initially set up according to ETSI TS 136 521-1 [5], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.
- 4) The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [5], clause 6.6.2.3B.
- 5) Propagation conditions are set according to ETSI TS 136 521-1 [5], clause B.0.
- 6) Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [7], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [5], ETSI TS 136 508 [7] and ETSI TS 136 509 [i.6] respectively.

##### 9.3.10.3.1.2 Procedure

- 1) SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C\_RNTI to schedule the UL RMC according to Table 6.6.2.3B.1.4.1-1 of ETSI TS 136 521-1 [5]. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.
- 2) Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms for the UE to reach P<sub>UMAX</sub> level.
- 3) Measure the sum of the mean power at each antenna connector of UE in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in Tables 79 and 80. The period of the measurement shall be at least the continuous duration of one sub-frame (1 ms). For TDD slots with transient periods are not under test.
- 4) Measure the rectangular filtered mean power for E-UTRA at each antenna connector of UE.



- 5) Measure the rectangular filtered mean power of the first E-UTRA adjacent channel at each antenna connector of UE.
- 6) Measure the RRC filtered mean power of the first and the second UTRA adjacent channel at each antenna connector of UE.
- 7) Calculate the ratio of the power between the values measured in step 4) over step 5) for  $E-UTRA_{ACLR}$ .
- 8) Calculated the ratio of the power between the values measured in step 4) over step 6) for  $UTRA_{ACLR1}$ ,  $UTRA_{ACLR2}$ .

Details of the test method can be found in ETSI TS 136 521-1 [5], clause 6.6.2.3B.

#### 9.3.10.3.2 Test requirements

The results obtained shall be compared to the limits in clause 8.2.11.3.2 in order to show compliance.

## Annex A (normative): Relationship between the present document and the essential requirements of Directive 2014/53/EU

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.13] to provide one voluntary means of conforming to the essential requirements of Directive 2014/53/EU on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC [9].

Once the present document is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of the present document given in Table A.1 confers, within the limits of the scope of the present document, a presumption of conformity with the corresponding essential requirements of that Directive, and associated EFTA regulations.

The present document is therefore intended to cover the provisions of Directive 2014/53/EU [9] (RE Directive) article 3.2 which states that *"Radio equipment shall be so constructed that it both effectively uses and supports the efficient use of radio spectrum in order to avoid harmful interference"*.

Recital 10 of Directive 2014/53/EU [9] states that *"In order to ensure that radio equipment uses the radio spectrum effectively and supports the efficient use of radio spectrum, radio equipment should be constructed so that: in the case of a transmitter, when the transmitter is properly installed, maintained and used for its intended purpose it generates radio waves emissions that do not create harmful interference, while unwanted radio waves emissions generated by the transmitter (e.g. in adjacent channels) with a potential negative impact on the goals of radio spectrum policy should be limited to such a level that, according to the state of the art, harmful interference is avoided; and, in the case of a receiver, it has a level of performance that allows it to operate as intended and protects it against the risk of harmful interference, in particular from shared or adjacent channels, and, in so doing, supports improvements in the efficient use of shared or adjacent channels"*.

Recital 11 of Directive 2014/53/EU [9] states that *"Although receivers do not themselves cause harmful interference, reception capabilities are an increasingly important factor in ensuring the efficient use of radio spectrum by way of an increased resilience of receivers against harmful interference and unwanted signals on the basis of the relevant essential requirements of Union harmonisation legislation"*.

As a consequence, the present document includes both transmitting and receiving parameters to maximize the efficient use of radio spectrum.

**Table A.1: Relationship between the present document and  
the essential requirements of Directive 2014/53/EU**

<b>Harmonised Standard ETSI EN 302 574-2</b> The following requirements are relevant to the presumption of conformity under the article 3.2 of Directive 2014/53/EU [9]						
Requirement					Requirement Conditionality	
No	Description	Reference: Clause No			U/C	Condition
		UE	Aeronautical Terminal	Non-Aeronautical UE		
1	Transmitter Maximum output power	4.2.3	5.2.2	8.2.2	U	
2	Spectrum emissions mask	4.2.4	5.2.3	8.2.3	U	
3	Transmitter spurious emissions	4.2.5	5.2.4	8.2.4	U	
4	Transmitter Minimum output power	4.2.6	5.2.5	8.2.5	U	
5	Adjacent Channel Leakage Power Ratio (ACLR)	4.2.7	5.2.6	8.2.11	U	
6	Receiver Adjacent Channel Selectivity (ACS)	4.2.9	5.2.7	8.2.6	U	
7	Blocking characteristics	4.2.10	5.2.8	8.2.7	U	
8	Receiver spurious response	4.2.11	5.2.9	8.2.8	U	

<b>Harmonised Standard ETSI EN 302 574-2</b> The following requirements are relevant to the presumption of conformity under the article 3.2 of Directive 2014/53/EU [9]						
Requirement					Requirement Conditionality	
No	Description	Reference: Clause No			U/C	Condition
		UE	Aeronautical Terminal	Non-Aeronautical UE		
9	Receiver intermodulation characteristics	4.2.12	5.2.10	8.2.9	U	
10	Receiver spurious emissions	4.2.13	5.2.11	8.2.10	U	
11	Control and monitoring function	4.2.2	4.2.4 in ETSI EN 301 908-1 [11]	4.2.4 in ETSI EN 301 908-1 [11]	U	

**Key to columns:****Requirement:**

**No** A unique identifier for one row of the table which may be used to identify a requirement.

**Description** A textual reference to the requirement.

**Clause Number** Identification of clause(s) defining the requirement in the present document unless another document is referenced explicitly.

**Requirement Conditionality:**

**U/C** Indicates whether the requirement shall be unconditionally applicable (U) or is conditional upon the manufacturers claimed functionality of the equipment (C).

**Condition** Explains the conditions when the requirement shall or shall not be applicable for a requirement which is classified "conditional".

Presumption of conformity stays valid only as long as a reference to the present document is maintained in the list published in the Official Journal of the European Union. Users of the present document should consult frequently the latest list published in the Official Journal of the European Union.

Other Union legislation may be applicable to the product(s) falling within the scope of the present document.

# Annex B (informative): Environmental profile specification

## B.0 General

The following environmental conditions may be declared by the supplier:

- barometric pressure: minimum and maximum;
- temperature: minimum and maximum;
- relative humidity: minimum and maximum;
- power supply: lower and upper voltage limit.

When operating outside the boundary limits of the declared operational environmental profile the equipment should not make ineffective use of the radio frequency spectrum so as to cause harmful interference.

## B.1 Introduction

This informative annex specifies the environmental profile of the UE.

## B.2 Temperature

The UE should fulfil all the requirements in the full temperature range as given in Table B.1.

**Table B.1: Temperatures**

Range	Conditions
+15 °C to +35 °C	For normal conditions (with relative humidity of 25 % to 75 %)
-10 °C to +55 °C	For extreme conditions (see IEC 60068-2-1 [3] and IEC 60068-2-2 [4])

The low and high extreme temperature conditions are denoted as TL (temperature low, -10 °C) and TH (temperature high, +55 °C).

## B.3 Voltage

The UE should fulfil all the requirements in the full voltage range, i.e. the voltage range between the extreme voltages.

The supplier should 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 should not be higher, and the higher extreme voltage should not be lower than that specified in Table B.2.

**Table B.2: Power sources**

Power source	Lower extreme voltage	Higher extreme 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/lithium	0,85 × nominal	nominal	nominal
Mercury/nickel and cadmium	0,90 × nominal	nominal	nominal

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## B.4 Test environment

Where a normal environment is required then the normal conditions shown in clauses B.2 and B.3 should be applied.

Where an extreme environment is required then the various combinations of extreme temperatures together with the extreme voltages shown in clauses B.2 and B.3 should be applied. The combinations are:

- low extreme temperature/low extreme voltage (TL/VL);
- low extreme temperature/high extreme voltage (TL/VH);
- high extreme temperature/low extreme voltage (TH/VL);
- high extreme temperature/high extreme voltage (TH/VH).

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## Annex C (informative): Bibliography

- Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (R&TTE Directive).
- Council Directive 89/336/EEC of 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility (EMC Directive).
- Directive 2004/108/EC of the European Parliament and of the Council of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC.
- Council Directive 73/23/EEC of 19 February 1973 on the harmonisation of the laws of Member States relating to electrical equipment designed for use within certain voltage limits (LV Directive).
- Recommendation ITU-R SM.329: "Unwanted emissions in the spurious domain".
- Recommendation ITU-R SM.1539: "Variation of the boundary between the out-of-band and spurious domains required for the application of Recommendations ITU-R SM.1541 and Recommendation ITU-R SM.329".
- ETSI EN 301 908-13 V6.2.1 (10-2013): "IMT cellular networks; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive; Part 13: Evolved Universal Terrestrial Radio Access (E-UTRA) User Equipment (UE)".
- ECC Report 233 (05-2015): "Adjacent band compatibility studies for aeronautical CGC systems operating in the bands 1980-2010 MHz and 2170-2200 MHz".
- ETSI EN 302 574-1: "Satellite Earth Stations and Systems (SES); Harmonised Standard for Satellite Earth Stations (MES) for MSS operating in the 2 GHz frequency band; Part 1: Complementary Ground Component (CGC) for wideband systems covering the essential requirements of article 3.2 of the Directive 2014/53/EU".
- ETSI EN 302 574-3: "Satellite Earth Stations and Systems (SES); Harmonised Standard for Satellite Earth Stations (MES) for MSS operating in the 1 980 MHz to 2 010 MHz (earth-to-space) and 2 170 MHz to 2 200 MHz (space-to-earth) frequency bands; Part 3: User Equipment (UE) for narrowband systems covering the essential requirements of article 3.2 of the Directive 2014/53/EU".
- Directive 98/48/EC of the European Parliament and of the Council of 20 July 1998 amending Directive 98/34/EC laying down a procedure for the provision of information in the field of technical standards and regulations.

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## History

Document history		
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