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**ElectroMagnetic Compatibility (EMC)
standard for radio equipment and services;
Part 52: Specific conditions for Cellular Communication
User Equipment (UE) radio and ancillary equipment;
Harmonised Standard for ElectroMagnetic Compatibility**

Reference
DEN/ERM-EMC-354

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Foreword

This draft Harmonised European Standard (EN) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM), and is now submitted for the combined Public Enquiry and Vote phase of the ETSI standards EN Approval Procedure.

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.4] 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 [i.2].

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 52 of a multi-part deliverable. Full details of the entire series can be found in part 1 [1].

Proposed national transposition dates	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	18 months after doa

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.

1 Scope

The present document specifies the applicable test conditions, performance assessment, and performance criteria for Cellular Communication User Equipment (UE), including Customer Premise Equipment (CPE), Set Top Box (STB) containing cellular communication technologies, and the associated ancillary equipment in respect of ElectroMagnetic Compatibility (EMC) for equipment utilizing the technologies in table 1.

Table 1: Technologies User Equipment (UE) radio and ancillary equipment Cellular Communication

Cellular Mobile Communication Technology	Technology Generation	Standard Set	ETSI Standard
Global System for Mobile communications (GSM)	2G/3G	IMT-2000 SC single carrier	ETSI EN 301 511 [i.9]
CDMA Multi-Carrier (cdma2000)	2G/3G	IS-95/CDMA2000 - IMT-MC multi carrier	ETSI EN 301 908-4 [i.10]
CDMA Direct Spread (UTRA FDD)	3G	IMT-2000 Direct Spread	ETSI EN 301 908-2 [i.11]
Evolved Universal Terrestrial Radio Access (E-UTRA)	4G	IMT-advanced	ETSI EN 301 908-13 [i.12]
New Radio (NR)	5G	IMT-2020	ETSI TS 138 521-1 [15], ETSI TS 138 521-3 [16]

Technical specifications related to the antenna port of radio equipment and radiated emissions from the enclosure port of radio equipment and combinations of radio and associated ancillary equipment are not included in the present document. Such technical specifications are normally found in the relevant product standards for the effective use of the radio spectrum.

The environmental classification and the emission and immunity requirements used in the present document are as stated in ETSI EN 301 489-1 [1], except for any special conditions included in the present document.

NOTE 1: The relationship between the present document and essential requirements of article 3.1(b) of Directive 2014/53/EU [i.2] is given in annex A.

NOTE 2: The present document does not cover the radio base stations as specified in ETSI EN 301 489-50 [i.13].

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 https://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] ETSI EN 301 489-1 (V2.2.3) (11-2019): "ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonised Standard for ElectroMagnetic Compatibility".

[2] ETSI TS 134 108 (V15.2.0) (10-2019): "Universal Mobile Telecommunications System (UMTS); LTE; Common test environments for User Equipment (UE); Conformance testing (3GPP TS 34.108 version 15.2.0 Release 15)".

[3] ETSI TS 125 101 (V15.3.0) (05-2019): "Universal Mobile Telecommunications System (UMTS); User Equipment (UE) radio transmission and reception (FDD) (3GPP TS 25.101 version 15.3.0 Release 15)".

[4] ETSI TS 134 109 (V15.0.0) (07-2018): "Universal Mobile Telecommunications System (UMTS); Terminal logical test interface; Special conformance testing functions (3GPP TS 34.109 version 15.0.0 Release 15)".

[5] ETSI EN 300 296-1 (V1.4.1) (08-2013): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Land Mobile Service; Radio equipment using integral antennas intended primarily for analogue speech; Part 1: Technical characteristics and methods of measurement".

[6] Recommendation ITU-T P.64 (2019): "Determination of sensitivity/frequency characteristics of local telephone systems".

[7] Recommendation ITU-T P.76 (1988): "Determination of loudness ratings; fundamental principles".

[8] ETSI TS 125 102 (V15.0.0) (10-2018): "Universal Mobile Telecommunications System (UMTS); User Equipment (UE) radio transmission and reception (TDD) (3GPP TS 25.102 version 15.0.0 Release 15)".

[9] ETSI TS 136 101 (V15.10.0) (04-2020): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception (3GPP TS 36.101 version 15.10.0 Release 15)".

[10] ETSI TS 136 508 (V15.6.0) (04-2020): "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 15.6.0 Release 15)".

[11] ETSI TS 136 509 (V15.3.0) (01-2020): "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 15.3.0 Release 15)".

[12] ETSI TS 136 521-1 (V15.5.0) (07-2019): "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 15.5.0 Release 15)".

[13] ETSI TS 138 508-1 (V15.4.0) (07-2019): "5G; 5GS; User Equipment (UE) conformance specification; Part 1: Common test environment (3GPP TS 38.508-1 version 15.4.0 Release 15)".

[14] ETSI TS 138 101-1 (V15.9.0) (04-2020): "5G; NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone (3GPP TS 38.101-1 version 15.9.0 Release 15)".

[15] ETSI TS 138 521-1 (V15.3.0) (07-2019): "5G; NR; User Equipment (UE) conformance specification; Radio transmission and reception; Part 1: Range 1 standalone (3GPP TS 38.521-1 version 15.3.0 Release 15)".

[16] ETSI TS 138 521-3 (V15.4.1) (05-2020): "5G; NR; User Equipment (UE) conformance specification; Radio transmission and reception; Part 3: Range 1 and Range 2 Interworking operation with other radios (3GPP TS 38.521-3 version 15.4.1 Release 15)".

[17] CISPR 16-1-4:2019 + AMD1:2020: "Specification for radio disturbance and immunity measuring apparatus and methods -Part 1-4: Radio disturbance and immunity measuring apparatus - Antennas and test sites for radiated disturbance measurements".

[18] CISPR 32:2015 + AMD1:2019: "Electromagnetic compatibility of multimedia equipment - Emission requirements".

[19] EN 55035:2017: "Electromagnetic compatibility of multimedia equipment - Immunity requirements" (produced by CENELEC).

[20] ETSI TS 100 910 (V8.20.0): "Digital cellular telecommunications system (Phase 2+); Radio Transmission and Reception (3GPP TS 05.05 version 8.20.0 Release 1999)".

[21] EN 61000-3-3:2013/A1:2019: "Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current $\leqslant$ 16 A per phase and not subject to conditional connection" (produced by CENELEC).

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 TR 121 905 (V15.1.0): "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); LTE; Vocabulary for 3GPP Specifications (3GPP TR 21.905 version 15.1.0 Release 15)".

[i.2] 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.

[i.3] ETSI TR 125 990 (V3.0.0): "Universal Mobile Telecommunications System (UMTS); Vocabulary (3G TR 25.990 version 3.0.0 Release 1999)".

[i.4] 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.

[i.5] ETSI GTS 05.08 (V3.8.0) (01-1995): "European digital cellular telecommunications system (Phase 1); Radio Subsystem Link Control (GSM 05.08)".

NOTE: The technical content of ETSI I-ETS 300 034-1 has been transferred into ETSI GTS 05.08 (V3.8.0).

[i.6] ETSI GTS 05.08-DCS (V3.0.0) (01-1995): "European digital cellular telecommunications system (Phase 1); Radio Subsystem Link Control; (GSM 05.08 - DCS-1800)".

NOTE: The technical content of ETSI I-ETS 300 034-2 has been transferred into ETSI GTS 05.08-DCS (V3.0.0).

[i.7] ETSI ETS 300 578 (Edition 13) (03-1999): "Digital cellular telecommunications system (Phase 2) (GSM); Radio subsystem link control (GSM 05.08 version 4.22.0)".

[i.8] Void.

[i.9] ETSI EN 301 511 (V12.5.1) (03-2017): "Global System for Mobile communications (GSM); Mobile Stations (MS) equipment; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU".

[i.10] ETSI EN 301 908-4 (V6.2.1) (06-2013): "IMT cellular networks; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive; Part 4: CDMA Multi-Carrier (cdma2000) User Equipment (UE)".

[i.11] ETSI EN 301 908-2 (V11.1.2) (08-2017): "IMT cellular networks; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU; Part 2: CDMA Direct Spread (UTRA FDD) User Equipment (UE)".

[i.12] ETSI EN 301 908-13 (V11.1.2) (07-2017): "IMT cellular networks; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU; Part 13: Evolved Universal Terrestrial Radio Access (E-UTRA) User Equipment (UE)".

[i.13] ETSI EN 301 489-50 (V2.2.1) (04-2019): "ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 50: Specific conditions for Cellular Communication Base Station (BS), repeater and ancillary equipment; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU".

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in ETSI EN 301 489-1 [1] and the following apply:

ancillary equipment: electrical or electronic equipment, that is intended to be used with a receiver or transmitter

NOTE 1: It is considered as an ancillary equipment if:

- the equipment is intended for use with a receiver or transmitter to provide additional operational and/or control features to the radio equipment, (e.g. to extend control to another position or location); and
- the ancillary equipment cannot be used without being connected to radio equipment to provide user functions independently of a receiver or transmitter; and
- the receiver or transmitter, 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).

NOTE 2: An example of ancillary equipment would be a docking station for radio equipment whose interface is dedicated to a particular product or range of products.

bearer: information transmission path of defined characteristics for transfer of user data or predefined test data

camped on a cell: UE is in idle mode and has completed the cell selection/reselection process and has chosen a cell

NOTE 1: The UE monitors system information and (in most cases) paging information.

NOTE 2: The services may be limited, and the PLMN may not be aware of the existence of the UE within the chosen cell.

channel bandwidth: RF bandwidth supporting a single E-UTRA RF carrier with the transmission bandwidth configured in the uplink or downlink of a cell

NOTE: The channel bandwidth is measured in MHz and is used as a reference for transmitter and receiver RF requirements.

critical stored data: data that is essential for an EUT to perform a primary function in accordance with that EUT's specification

NOTE: This may include data previously stored by the user.

data application ancillary: ancillary which provides send and/or receive data access to UMTS services via UE

end-user data: manufacturer defined data patterns for data transfer testing

NOTE: Represents EUT's typical user application data pattern (e.g. photo, video, text file, message) in its characteristics.

idle mode:

- For UTRA/EUTRA equipment: state of User Equipment (UE) when switched on but with no Radio Resource Control (RRC) connection.
- For GSM: mode of operation of a receiver or a transceiver, where the Equipment Under Test (EUT) is powered, available for service and available to respond to a request to set up a call.

- NR equipment: state of User Equipment (UE) when switched on but with no Radio Resource Control (RRC) connection.

International Mobile Telecommunications 2000 (IMT-2000): third generation mobile systems which provide access, by means of one or more radio links, to a wide range of telecommunications services supported by the fixed telecommunication networks (e.g. PSTN, ISDN or IP) and to other services which are specific to mobile users

License Assisted Access (LAA): LTE based base station operating in unlicensed frequency spectrum

maximum average power: average transmitter output power obtained over any specified time interval, including periods with no transmission, when the transmit time slots are at the maximum power setting

maximum throughput: maximum achievable throughput for a reference measurement channel

NB-IoT guard band operation: operation of NB-IOT guard band utilizing the unused resource block(s) within an E-UTRA carrier's guard-band

NB-IoT In-band operation: operation of NB-IOT in-band utilizing the resource block(s) within a normal E-UTRA carrier

NB-IoT standalone operation: operation of NB-IOT standalone utilizing its own spectrum, for example the spectrum currently being used by GERAN systems as a replacement of one or more GSM carriers, as well as scattered spectrum for potential IoT deployment

necessary bandwidth: for a given class of emission, the width of the frequency band which is just sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions

RXQUAL: measure of the received signal quality, which is generated by the mobile or portable equipment, for use as a criterion in the Radio Frequency (RF) power control and handover processes

NOTE: For more information see:

- ETSI GTS 05.08 [i.5], clause 8.2 for Phase 1 GSM 900 equipment;
- ETSI GTS 05.08-DCS [i.6], clause 8.2 for Phase 1 GSM 1800 equipment; or
- ETSI ETS 300 578 [i.7], clause 8.2 for Phase 2 GSM 900 or Phase 2 GSM 1800 equipment;
- ETSI TS 100 910 [20], clause 8.2 for Phase 2+ GSM 900 or Phase 2+ GSM 1800 equipment.

throughput: number of payload bits successfully received per second for a reference measurement channel in a specified reference condition

traffic mode: state of User Equipment (UE) when switched on and with Radio Resource Control (RRC) connection established

Universal Terrestrial Radio Access (UTRA): radio access network of the telecommunications system, incorporating mobile cellular and other functionality, which is the subject of specifications produced by 3GPP

User Equipment (UE): entity capable of accessing a set of cellular services via one or more radio interfaces

NOTE: This entity may be stationary or in motion within the cellular service area while accessing the Cellular services, and may simultaneously serve one or more users.

voice call function: establishment and use of a complete connection for voice communication

3.2 Symbols

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

TR	Transient phenomena applied to Receivers
TT	Transient phenomena applied to Transmitters

3.3 Abbreviations

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

NOTE: Refer to Terminology specifications ETSI TR 121 905 [i.1] and ETSI TR 125 990 [i.3] for further details.

AC	Alternating Current
BER	Bit Error Ratio
BLER	BLock Error Ratio
BS	Base Station
BW	BandWidth
CDMA	Code Division Multiple Access
CPE	Customer Premise Equipment
CR	Continuous phenomena applied to Receivers
CRC	Cyclic Redundancy Check
CT	Continuous phenomena applied to Transmitters
DC	Direct Current
DL	Down Link (from BS to UE)
DRX	Discontinuous Reception
DTX	Discontinuous Transmission
EFTA	European Free Trade Association
EMC	ElectroMagnetic Compatibility
EN-DC	E-UTRA-NR Dual Connectivity
EUT	Equipment Under Test
E-UTRA	Evolved Universal Terrestrial Radio Access
FDD	Frequency Division Duplex
FR1	Frequency Range 1
GSM	Global System for Mobile communication
IMT-2000	International Mobile Telecommunications 2000
IMT-MC	International Mobile Telecommunication-Multi Carrier
LAA	License Assisted Access
LR	Location Registration
MCG	Master Cell Group
Mcps	Megachips per second
MRP	Mouth Reference Point (artificial head)
MS	Mobile Station
NB-IoT	Narrow Band Internet of Things
NR	New Radio
NSA	Non-Standalone
PC	Personal Computer
PLMN	Public Land Mobile Network
RF	Radio Frequency
RRC	Radio Resource Control
RXQUAL	Receiver QUALity
SA	Standalone
SC	Single Carrier
SCG	Secondary Cell Group
SPL	Sound Pressure Level
SS	System Simulator
STB	Set Top Box
TDD	Time Division Duplex
UARFCN	UTRA Appropriate Radio Frequency Channel Number
UE	User Equipment
UL	Up Link (from UE to BS)
UTRA	Universal Terrestrial Radio Access

4 Test conditions

4.1 General

For the purpose of the present document, the test conditions of ETSI EN 301 489-1 [1], clause 4, shall apply as appropriate. Further product related test conditions for user equipment are specified in the present document.

Whenever the EUT is provided with a detachable antenna or a flexible antenna (e.g. an antenna with adjustable length and direction), the EUT shall be tested with the antenna fitted in a manner typical of intended use.

The test configuration and mode of operation shall represent the intended use and shall be recorded in the test report.

A communication link shall be set up with a suitable base station simulator (hereafter called "the test system"). When the EUT is transmitting, set output power to the maximum level.

When the EUT supporting Voice call function, test shall be tested according to the test conditions of the annex B.

4.2 Arrangements for test signals

4.2.0 General

The provisions of ETSI EN 301 489-1 [1], clause 4.2 shall apply.

4.2.1 Arrangements for test signals for GSM

The provisions of ETSI EN 301 489-1 [1], clause 4.2 shall apply.

4.2.2 Arrangements for test signals for UTRA and E-UTRA

The provisions of ETSI EN 301 489-1 [1], clause 4.2 shall apply. The test of the transmitter section and receiver section of the EUT may be carried out simultaneously to reduce test time.

Immunity tests shall be performed in two modes of operation:

- with a communication link established (traffic mode); and
- in the idle mode.

When the EUT is required to be in the traffic mode, a call is set up according to the Generic call set-up procedure and the following conditions shall be met:

- for UTRA see ETSI TS 134 108 [2] and ETSI TS 134 109 [4] Logical Test Interface for details regarding generic call set-up procedure and BER, BLER test loop scenarios;
- for E-UTRA see ETSI TS 136 508 [10] and ETSI TS 136 509 [11] for details regarding generic call set-up procedure and throughput test loop scenarios:
  - set and send continuously Up power control commands to the UE;
  - the DTX shall be disabled;
  - Inner Loop or Up Link Power Control shall be enabled;
- for UTRA the transmitting and/or receiving (UL/DL) bit rate for reference test channel shall be 12,2 kbit/s;
- E-UTRA the transmitting and/or receiving (UL/DL) bit rate for reference test channel shall be the reference measurement channel as specified in annex C in ETSI TS 136 101 [9] with parameters specified in tables 7.3.1-1 and 7.3.1-2 in ETSI TS 136 101 [9].

When the EUT is required to be in the idle mode the following conditions shall be met:

- UE shall be camped on a cell;
- UE shall perform Location Registration (LR) before the test, but not during the test;
- UE's neighbour cell list shall be empty;
- paging repetition period and DRX cycle shall be set to minimum (shortest possible time interval).

Adequate measures shall be taken to avoid the effect of immunity RF test signals on the measuring equipment.

For EUT supporting voice call function the annex B applies.

4.2.3 Arrangements for test signals for NR

4.2.3.1 General for NR

The provisions of ETSI EN 301 489-1 [1], clause 4.2 shall apply. The test of the transmitter section and receiver section of the EUT may be carried out simultaneously to reduce test time.

Immunity tests shall be performed in two modes of operation:

- with a communication link established (traffic mode); and
- in the idle mode.

Where the EUT is to be tested in the idle mode, the following conditions shall be met:

- UE shall be camped on a cell;
- UE shall perform Location Registration (LR) before the test, but not during the test;
- UE's neighbour cell list shall be empty;
- paging repetition period and DRX cycle shall be set to minimum (shortest possible time interval).

Adequate measures shall be taken to avoid the effect of immunity RF test signals on the measuring equipment.

4.2.3.2 NR FR1 SA

When the EUT is required to be in the traffic mode, a call is set up according to the Generic call set-up procedure and the following conditions shall be followed:

1) Connect the SS to the UE conducted or over the air interface.
2) The parameter settings for the cell are set up according to ETSI TS 138 508-1 [13], clause 4.4.3.
3) Downlink signals are initially set up according to ETSI TS 138 521-1 [15], clauses C.0, C.1, C.2 and C.3.1, and uplink signals according to clauses G.0, G.1, G.2 and G.3.1.
4) The UL and Reference Measurement Channel is set according to ETSI TS 138 521-1 [15], tables 7.3.2.4.1-1, 7.3.2.4.1-2 and 7.3.2.4.1-3.
5) Propagation conditions are set according to ETSI TS 138 521-1 [15], clause B.0.
6) Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to ETSI TS 138 508-1 [13], clause 4.5. Message contents are defined in ETSI TS 138 521-1 [15], clause 7.3.2.4.3.

4.2.3.3 NR FR1 NSA

When the EUT is required to be in the traffic mode, a call is set up according to the Generic call set-up procedure and the following conditions shall be followed:

1) Connect the SS to the UE conducted or over the air interface.

2) The parameter settings for NR cell are set up according to ETSI TS 138 508-1 [13], clause 4.4.3.

3) The parameter settings for E-UTRA cell are set up according to ETSI TS 136 508 [10], clause 4.4.3.

4) NR downlink signals are initially set up according to clauses C.0, C.1, C.2, C.3.1 and uplink signals according to clauses G.0, G.1, G.2 and G.3.1 of ETSI TS 138 521-1 [15].

5) E-UTRA downlink signals are initially set up according to clauses C0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0 of ETSI TS 136 521-1 [12].

6) The UL Reference Measurement channels for NR are set according to tables 7.3.2.4.1-1, 7.3.2.4.1-2 and 7.3.2.4.1-3 of ETSI TS 138 521-1 [15].

7) The UL Reference Measurement channels for E-UTRA are set according to tables 7.3.4.1-1 and 7.3.4.1-2 of ETSI TS 136 521-1 [12].

8) NR propagation conditions are set according to clause B.0 of ETSI TS 138 521-1 [15].

9) E-UTRA propagation conditions are set according to clause B.0 of ETSI TS 136 521-1 [12].

10) Ensure the UE is in state RRC_CONNECTED with generic procedure parameters *Connectivity* EN-DC, DC bearer MCG and SCG, Connected without release *On* according to ETSI TS 138 508-1 [13], clause 4.5. Message contents are defined in ETSI TS 138 521-3 [16], clause 7.3B.2.1.4.3.

11) The UL Reference Measurement channels configurations for exceptional cases are set according to ETSI TS 138 521-3 [16], table 7.3B.2.1.4.1-1.

4.2.4 Arrangements for test signals at the output of transmitters

The provisions of ETSI EN 301 489-1 [1], clause 4.2.2 shall apply.

4.2.5 Arrangements for test signals at the input of receivers

4.2.5.1 General

The provisions of ETSI EN 301 489-1 [1], clause 4.2.3 shall apply with the following modifications:

- Where the equipment incorporates an external 50 Ω RF antenna connector that is normally connected via a coaxial cable, then the wanted signal to establish a communication link shall be delivered to that connector by a coaxial cable.

- Where the equipment incorporates an external 50 Ω RF antenna connector, but this port is not normally connected via a coaxial cable, and where the equipment does not incorporate an external 50 Ω RF connector (integral antenna equipment), then the wanted signal, to establish a communication link, shall be presented to the equipment from an antenna located within the test environment.

4.2.5.2 Arrangements for test signals at the input of GSM receivers

The wanted RF input signal level shall be set to 15 dB (±3 dB) above the reference sensitivity level as defined in ETSI TS 100 910 [20], clause 6.2 to provide a stable communication link.

For conducted testing, the wanted RF signal level of the EUT at the input of the receiver on the test shall be set to 15 dB (±3 dB) above the reference sensitivity level, to ensure that it operates within its dynamic range.

4.2.5.3 Arrangements for test signals at the input of UTRA and E-UTRA receivers

For over the air testing, the wanted RF signal level at the input of the EUT shall be set to 15 dB (±3 dB) above the reference sensitivity level to provide a stable communication link. The reference sensitivity level shall be as defined in ETSI TS 125 101 [3], clause 7.3 for FDD UTRA, ETSI TS 125 102 [8], clause 7.3 for TDD UTRA or ETSI TS 136 101 [9], annex C for E-UTRA.

For conducted testing, the wanted RF signal level of the EUT at the input of the receiver on the test shall be set to 15 dB (±3 dB) above the reference sensitivity level, to ensure that it operates within its dynamic range.

4.2.5.4 Arrangements for test signals at the input of E-UTRA with LAA

- The wanted signal shall be set to 1 dB (±3 dB) above the reference sensitivity level as defined in ETSI TS 136 521-1 [12].
- The normal test modulation should be a bearer with the characteristics shown in ETSI TS 136 521-1 [12], annex A.
- For conducted testing, the wanted RF signal level of the EUT at the input of the receiver on the test shall be set to 15 dB (±3 dB) above the reference sensitivity level, to ensure that it operates within its dynamic range.
- Arrangements for test signals at the input of E-UTRA with in band or guard band NB-IoT, Standalone NB-IoT. The wanted signal shall be set to 15 dB (±3 dB) above the reference sensitivity level as defined in ETSI TS 136 521-1 [12], clause 7.3F.1.4.
- The normal test modulation should be a bearer with the characteristics shown in ETSI TS 136 521-1 [12], annex A.
- For conducted testing, the wanted RF signal level of the EUT at the input of the receiver on the test shall be set to 15 dB (±3 dB)above the reference sensitivity level, to ensure that it operates within its dynamic range.

4.2.5.5 Arrangements for test signals at the input of NR receivers

For over the air testing, the wanted RF signal level at the input of the EUT shall be set to 15 dB (±3 dB) above the reference sensitivity level to provide a stable communication link. The reference sensitivity level shall be as defined in ETSI TS 138 521-1 [15].

For conducted testing, the wanted RF signal level of the EUT at the input of the receiver on the test shall be set to 15 dB (±3 dB) above the reference sensitivity level, to ensure that it operates within its dynamic range.

4.3 Exclusion bands

4.3.1 GSM Transmitter exclusion band

The exclusion band for transmitters and transmitter sections of transceivers is the band of frequencies over which no immunity tests with radiated RF are made.

The exclusion band for transmitters is as defined in clause 4.3.2.2 of ETSI EN 301 489-1 [1], 250 % of the channel width either side of the nominal operating frequency of the transmitter.

4.3.2 GSM Receiver exclusion band

The exclusion band for receivers and receiver sections of transceivers is the band of frequencies over which no immunity tests with radiated RF are made as defined in clause 4.3.3 of ETSI EN 301 489-1 [1] where n = 1 and Channel Width is 200 kHz.

4.3.3 UTRA and E-UTRA Transmitter exclusion band

4.3.3.1 UTRA

The frequency bands including in band emissions and out of band emissions are covered by the RF spectral mask specification and need no further consideration.

For the purpose of EMC specifications the transmitter exclusion band this shall be as defined in clause 4.3.2.2 of ETSI EN 301 489-1 [1].

4.3.3.2 E-UTRA

For the purpose of EMC specifications there shall be a transmitter exclusion band as defined in clause 4.3.2.2 of ETSI EN 301 489-1 [1] where BW Channel is the channel bandwidth as defined in ETSI TS 136 101 [9].

4.3.4 UTRA and E-UTRA Receiver exclusion band

As defined in clause 4.3.3 of ETSI EN 301 489-1 [1] where n = 1 and Channel Width is as follows:

- UTRA Channel Width 5 MHz.
- E-UTRA Channel Width 20 MHz (see note).

NOTE: For systems that support multiple channel widths, the Channel Width used should be the widest support by the EUT.

4.3.5 NR SA and NSA Transmitter exclusion band

For the purpose of EMC specifications there shall be a transmitter exclusion band as defined in clause 4.3.2.2 of ETSI EN 301 489-1 [1] where BW Channel is the channel bandwidth as defined in ETSI TS 138 101-1 [14].

4.3.6 NR SA and NSA Receiver exclusion band

As defined in clause 4.3.3 of ETSI EN 301 489-1 [1] where n = 1 and Channel Width is as follows:

- NR Channel Width 100 MHz.
- E-UTRA Channel Width 20 MHz (see note at clause 4.3.4).

4.4 Narrow band responses of receivers and receivers of duplex transceivers

4.4.1 GSM Narrow band responses on receivers

Responses on receivers or duplex transceivers occurring during the immunity test at discrete frequencies that are narrow band responses (spurious responses), are identified by the following method (the procedure below only applies if the separation between test frequencies exceeds 500 kHz):

Narrow band responses are disregarded if the following requirements are satisfied:

- if during an immunity test the RXQUAL or speech output signal level being monitored goes outside the specified figure, it is necessary to establish whether the RXQUAL increase or speech output signal level increase is due to a narrow band response or to a wide band phenomenon. Therefore, the test shall be repeated with the unwanted signal frequency increased, and then decreased by 400 kHz;
- if the RXQUAL increase or speech output signal level increase disappears in either or both of the above 400 kHz offset cases, then the response is considered as a narrow band response;

- if the RXQUAL increase or speech output signal level increase does not disappear, this may be due to the fact that the offset has made the frequency of the unwanted signal correspond to the frequency of another narrow band response. Under these circumstances the procedure is repeated with the increase and decrease of the frequency of the unwanted signal set to 500 kHz;

- if the RXQUAL increase or speech output signal level increase still does not disappear with the increased and/or decreased frequency, the phenomena is considered wide band and therefore an EMC problem and the equipment fails the test.

4.4.2 UTRA and E-UTRA Narrow band responses on receivers

4.4.2.1 UTRA

Responses on receivers or duplex transceivers occurring during the immunity tests at discrete frequencies, which are narrow band responses (spurious responses), are identified by the following method.

Narrow band responses are disregarded if the following requirements are satisfied:

- If during an immunity test the quantity being monitored goes outside the specified tolerances, it is necessary to establish whether the deviation is due to an unwanted effect on the receiver of the UE or on the test system (narrow band response) or to a wideband (EMC) phenomenon. Therefore, the test shall be repeated with the UARFCN increased or decreased by option 1 in table 2.

Table 2: Option 1 of UARFCN

Duplex	UARFCN
FDD bands I, III, VII, VIII and TDD 3,84 Mcps	25 (DL/UL)
TDD option 1,28 Mcps	8 (DL/UL)
TDD option 7,68 Mcps	50 (DL/UL)

- If the deviation does not disappear, the procedure is repeated with the UARFCN increased or decreased from the original value by option 2 in table 3.

Table 3: Option 2 of UARFCN

Duplex	UARFCN
FDD bands I, III, VII, VIII and TDD 3,84 Mcps	50 (DL/UL)
TDD option 1,28 Mcps	16 (DL/UL)
TDD option 7,68 Mcps	100 (DL/UL)

- If the deviation does not disappear with the increased and/or decreased UARFCN, the phenomenon is considered wideband and therefore an EMC problem and the equipment fails the test.

4.4.2.2 E-UTRA

Responses on receivers or duplex transceivers occurring during the immunity test at discrete frequencies, which are narrow band responses (spurious responses), are identified by the following method.

Narrow band responses are disregarded if the following requirements are satisfied:

- If during an immunity test the quantity being monitored goes outside the specified tolerances, it is necessary to establish whether the deviation is due to an unwanted effect on the receiver of the UE or on the test system (narrow band response) or to a wide band (EMC) phenomenon. Therefore, the test shall be repeated with the unwanted signal frequency increased or decreased by BW Channel MHz, where BW Channel is the channel bandwidth as defined in ETSI TS 136 101 [9].

- If the deviation does not disappear, the procedure is repeated the unwanted signal frequency increased or decreased by 2 × BW Channel MHz, where BW Channel is the channel bandwidth as defined in ETSI TS 136 101 [9].

- If the deviation does not disappear with the increased and/or decreased frequency, the phenomenon is considered wide band and therefore an EMC problem and the equipment fails the test.

4.4.3 NR Narrow band responses on receivers

Responses on receivers or duplex transceivers occurring during the immunity test at discrete frequencies, which are narrow band responses (spurious responses), are identified by the following method.

Narrow band responses are disregarded if the following requirements are satisfied:

- If during an immunity test the quantity being monitored goes outside the specified tolerances, it is necessary to establish whether the deviation is due to an unwanted effect on the receiver of the UE or on the test system (narrow band response) or to a wide band (EMC) phenomenon. Therefore, the test shall be repeated with the unwanted signal frequency increased or decreased by the channel bandwidth as defined in ETSI TS 138 101-1 [14].
- If the deviation does not disappear, the procedure is repeated the unwanted signal frequency increased or decreased by 2 × BW Channel MHz, where BW Channel is the channel bandwidth as defined in ETSI TS 138 101-1 [14].
- If the deviation does not disappear with the increased and/or decreased frequency, the phenomenon is considered wide band and therefore an EMC problem and the equipment fails the test.

5 Ancillary equipment

The provisions of ETSI EN 301 489-1 [1], clause 5 shall apply.

6 Performance criteria

6.1 Performance criteria for Continuous phenomena

6.1.1 GSM

6.1.1.1 Performance criteria for Continuous phenomena applied to Transmitters (CT)

During the test, the uplink speech output level shall be at least 35 dB (±3 dB) less than the previously recorded reference levels, when measured through an audio band pass filter of width 200 Hz, centred on 1 kHz (audio breakthrough check).

NOTE: When there is a high-level background noise present, the filter bandwidth can be reduced down to a minimum of 40 Hz.

At the conclusion of the test, the EUT shall operate as intended with no loss of user control functions or critical stored data, and the communication link shall have been maintained. In addition to confirming the above performance during a call, the test shall also be performed in idle mode, and the transmitter shall not unintentionally operate.

6.1.1.2 Performance criteria for Continuous phenomena applied to Receivers (CR)

During the test, the RXQUAL of the downlink shall not exceed the value of three, measured during each individual exposure in the test sequence.

During the test, the downlink speech output level shall be at least 35 dB (±3 dB) less than the previously recorded reference levels, when measured through an audio band pass filter of width 200 Hz, centred on 1 kHz (audio breakthrough check).

NOTE: When there is a high-level background noise present, the filter bandwidth can be reduced down to a minimum of 40 Hz.

At the conclusion of the test, the EUT shall operate as intended with no loss of user control functions or critical stored data, and the communication link shall have been maintained.

6.1.2 UTRA

In the data transfer mode, the performance criteria can be one of the following:

- if the BER (as referred in clause 5.3.1 of ETSI TS 134 109 [4]) is used, it shall not exceed 0,001 during the test sequence;
- if the BLER (as referred in ETSI TS 134 109 [4]) is used, it shall not exceed 0,01 during the test sequence.

The BLER calculation shall be based on evaluating the CRC on each transport block. Details are specified in annex C.

6.1.3 E-UTRA, E-UTRA with LAA, inband or guard band NB-IoT, Standalone NB-IoT

In data transfer mode, the data throughput of the EUT shall not fall below 95 % of the maximum data throughput. Details are specified in annex C.

6.1.4 NR

In data transfer mode, the data throughput of the EUT shall not fall below 95 % of the maximum data throughput. Details are specified in annex C.

6.2 Performance criteria for Transient phenomena

At the conclusion of each exposure of the transient phenomena, the EUT shall operate without loss of the communication link.

At the conclusion of the total test comprising the series of individual exposures, the EUT shall operate as intended without loss of user control functions or critical stored data.

In addition where the EUT supports idle mode it should be verified that the transmitter shall not unintentionally operate when transient phenomena are applied.

7 Requirements

7.1 General

The equipment shall be configured, installed, arranged and operated in a manner that is representative for typical applications. Interface cables/loads/devices shall be connected to at least one port of each type of interface port of the EUT, and where practical, each cable shall be terminated in a device typical of actual usage.

Where possible use coupling/decoupling device applied on cables leaving the test volume to reduce the influence of cables outside the test volume for radiated emission test according to the basic standards of CISPR 16-1-4 [17] and CISPR 32 [18].

7.2 Emission

7.2.1 General

Table 4 contains the EMC emission requirements for the relevant ports of radio equipment.

Table 4: Emission requirements

Phenomenon	Port	Applicability			Reference clause
		Fixed equipment	Vehicular equipment	Portable equipment	
radiated emission	enclosure port of ancillary equipment	applicable	applicable	applicable	7.2.2
conducted emission	DC power input/output port	applicable	applicable	not applicable	ETSI EN 301 489-1 [1], clause 8.3
conducted emission	AC mains input/output port	applicable	not applicable	not applicable	ETSI EN 301 489-1 [1], clause 8.4
harmonic current emissions	AC mains input port	applicable	not applicable	not applicable	ETSI EN 301 489-1 [1], clause 8.5
voltage fluctuations and flicker	AC mains input port	applicable	not applicable	not applicable	7.2.2
conducted emission	wired network port	applicable	not applicable	not applicable	ETSI EN 301 489-1 [1], clause 8.7

Hand portable equipment, or combinations of equipment, capable of being powered for intended use by the main battery of a vehicle shall additionally be considered as vehicular mobile equipment. Hand portable or mobile equipment, or combinations of equipment, capable of being powered for intended use by AC mains shall additionally be considered as fixed station equipment.

7.2.2 Special conditions

The following special conditions set out in table 5, relate to the emission test methods used in ETSI EN 301 489-1 [1], clause 8.

Table 5: Special conditions for EMC emission measurements

Reference to clauses in ETSI EN 301 489-1 [1]	Special product-related conditions, additional to or modifying the test conditions in ETSI EN 301 489-1 [1], clause 8.2
8.2 Enclosure port of ancillary equipment	According to typical of intended use of radio equipment, ancillary equipment can also be measured in combination with the radio equipment under test. When the ancillary equipment is measured in combination with the radio equipment, radiated emissions from the transmitter/transceiver shall be ignored, but recorded in the test report.
8.6: Voltage fluctuations and flicker	The requirements of ETSI EN 301 489-1 [1], clause 8.6 shall be applied with the exception of the first paragraph of clause 6.1 of EN 61000-3-3 [21].

7.3 Immunity

7.3.1 General

Table 6 contains the EMC immunity requirements for the relevant ports of radio equipment.

Table 6: Immunity requirements

Phenomenon	Port	Applicability			Reference clause	Performance criteria clause
		Fixed equipment	Vehicular equipment	Portable equipment		
RF electromagnetic field (80 MHz to 6 000 MHz)	enclosure	applicable	applicable	applicable	ETSI EN 301 489-1 [1], clauses 9.2.1 and 9.2.2	6.1
electrostatic discharge	enclosure	applicable	applicable	applicable	7.3.2	6.2
fast transients common mode	signal, wired network and control	applicable	not applicable	not applicable	ETSI EN 301 489-1 [1], clauses 9.4.1 and 9.4.2	6.2
	DC power	applicable	not applicable (see note)	not applicable		
	AC mains power	applicable	not applicable	not applicable		
RF common mode 0,15 MHz to 80 MHz	signal, wired network and control	applicable	not applicable	not applicable	ETSI EN 301 489-1 [1], clauses 9.5.1 and 9.5.2	6.1
	DC power	applicable	applicable	not applicable		
	AC mains power	applicable	applicable	not applicable		
transients and surges	DC power input	not applicable	applicable	not applicable	7.3.2	6.2
voltage dips and interruptions	AC mains power input	applicable	not applicable	not applicable	ETSI EN 301 489-1 [1], clauses 9.7.1 and 9.7.2	6.2
surges, line to line and line to ground	AC mains power input ports, wired network ports	applicable	not applicable	not applicable	ETSI EN 301 489-1 [1], clauses 9.8.1 and 9.8.2	6.2
	wired network	applicable	not applicable (see note)	not applicable		
NOTE: This requirement is covered by the transients and surges test on DC power input ports.						

Hand portable equipment, or combinations of equipment, capable of being powered for intended use by the main battery of a vehicle shall additionally be considered as vehicular mobile equipment.

Hand portable or mobile equipment, or combinations of equipment, capable of being powered for intended use by AC mains shall additionally be considered as fixed station equipment.

7.3.2 Special conditions

The following special conditions set out in table 7, relate to the immunity test methods and performance criteria used in ETSI EN 301 489-1 [1], clause 9.

Table 7: Special conditions for EMC immunity tests

Reference to clauses in ETSI EN 301 489-1 [1]	Special product-related conditions, additional to or modifying the test conditions in ETSI EN 301 489-1 [1], clause 9
9.3 Electrostatic discharge	When applying direct discharge to a portable or handheld battery-powered EUT with a display screen, it may not be possible to observe the screen for a given EUT orientation. If observation of the screen is necessary during the test, the EUT may be mounted vertically using non-metallic supports as specified in EN 55035 [19].
9.6.3 Performance criteria	During tests with pulses 3a and 3b, the performance criteria TT shall apply, see clause 6.2.

Annex A (informative): 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.4] 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 [i.2].

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.

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

Harmonised Standard ETSI EN 301 489-52					
Requirement				Requirement Conditionality	
No	Description	Essential requirements of Directive	Clause(s) of the present document	U/C	Condition
1	Emissions: Enclosure of ancillary equipment measured on a standalone basis	3.1(b)	7.2	U	
2	Emissions: DC power input/output ports	3.1(b)	7.2	C	Only where equipment has DC power input and/or output ports with a cable length greater than 3 m or from a vehicle power supply.
3	Emissions: AC mains power input/output ports	3.1(b)	7.2	C	Only where equipment has AC mains power input and/or output ports.
4	Emissions: Harmonic current emission (AC mains input port)	3.1(b)	7.2	C	Only where equipment has AC mains power input ports.
5	Emissions: Voltage fluctuations and flicker (AC mains input ports)	3.1(b)	7.2	C	Only where equipment has AC mains power input ports.
6	Emissions: Wired network ports	3.1(b)	7.2	C	Only applies to equipment intended for fixed use.
7	Immunity: Radio frequency electromagnetic field (80 MHz to 6 000 MHz)	3.1(b)	7.3	U	
8	Immunity: Electrostatic discharge	3.1(b)	7.3	U	
9	Immunity: Fast transients common mode	3.1(b)	7.3	C	Only applies to equipment intended for fixed use.
10	Immunity: Radio frequency common mode	3.1(b)	7.3	C	Only applies to equipment intended for fixed use and/or vehicle use.
11	Immunity: Transients and surges in the vehicular environment	3.1(b)	7.3	C	Only applies to equipment intended for vehicular use.
12	Immunity: Voltage dips and interruptions	3.1(b)	7.3	C	Only where equipment has AC mains power input ports.
13	Immunity: Surges, line to line and line to ground	3.1(b)	7.3	C	Only applies to equipment intended for fixed use.

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.

Essential requirements of Directive

Identification of article(s) defining the requirement in the Directive.

Clause(s) of the present document

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 is unconditionally applicable (U) or is conditional upon the manufacturer's claimed functionality of the equipment (C).

Condition Explains the conditions when the requirement is or is not 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 (normative): Performance assessment voice call, Audio breakthrough

B.1 Calibration of audio levels

For the portable, the audio calibration is performed as follows.

Prior to the test sequence, the reference level of the speech output signal on both the downlink and uplink shall be recorded on the test instrumentation, as shown in figure B.1. The reference level shall be equivalent to the SPL of 0 dBPa at 1 kHz at the input of the acoustical coupler described in ETSI EN 300 296-1 [5], clause A.3, for the downlink, and -5 dBPa at 1 kHz at the Mouth Reference Point (MRP) defined in Recommendation ITU-T P.64 [6] for the uplink.

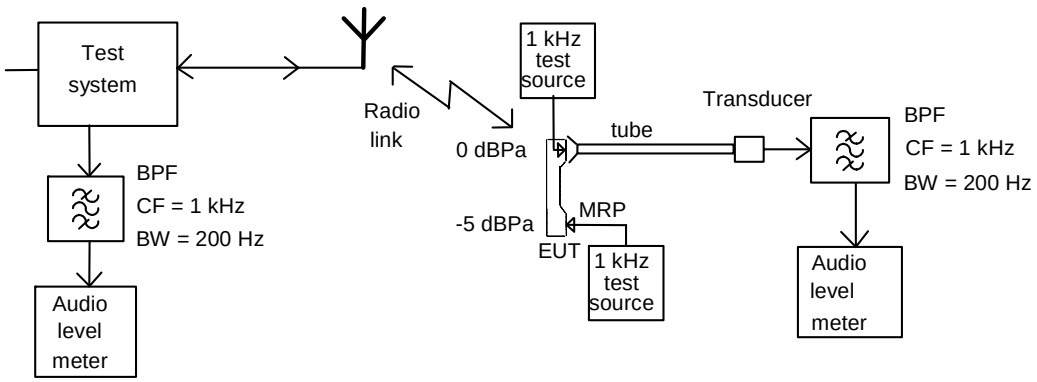
NOTE 1: The MRP is defined with respect to an artificial head defined in Recommendation ITU-T P.76 [7]. The handset should be mounted on the artificial head such that the earpiece is centred at the artificial ear.

NOTE 2: If the equipment does not include acoustical transducers (e.g. a microphone or loudspeaker), the equivalent electrical reference levels should be specified.

The voice processor may often apply noise and echo cancellation algorithms, which attempt to eliminate or reduce steady state audio signals as e.g. the 1 kHz calibration signals. These algorithms may be disabled during the calibration procedure. Specialized test software may be required. If the algorithms cannot be disabled then the reference level shall be measured using a max-hold detection on the audio level meter in order to determine the level before the noise and echo cancellation algorithms become effective.

In handsfree applications, an external loudspeaker is used. The SPL from the external loudspeaker is normally much higher than from the earpiece of the portable in order to overcome a high ambient noise level. The downlink reference level shall be increased in order to compensate for the difference. Alternatively, the distance between the loudspeaker and the measuring microphone shall be adjusted during the measurement procedure. It is important that the dynamic range of the test instrumentation is not exceeded.

Normally no corrections are made to the uplink reference level. If it is not possible to perform the above calibration (e.g. a PC card with headset), the distance between the MRP and the microphone shall be specified in a manner typical use.



NOTE: The EUT is in position during calibration of the uplink, but not during calibration of the downlink where the EUT is replaced by the 1 kHz test audio source. During calibration of the uplink, the mouthpiece shall be placed with respect to the MRP in a way representing intended use.

Figure B.1: Audio breakthrough measurement, calibration set-up for portable equipment

B.2 Measurement of audio levels

When the audio levels are measured during testing the EUT software shall be configured for voice applications. If the algorithms for noise and echo cancellation are not disabled, then the level shall be measured using a max-hold detection on the audio level meter in order to determine the level before the noise and echo cancellation algorithms become effective.

Set the EUT volume to default level. If no such level is specified, the centre volume step shall be used. The volume settings shall be recorded in the test report.

The level of the output signal from the downlink speech channel of the EUT at the mobile and portable's earpiece shall be assessed by measuring the Sound Pressure Level (SPL) as shown in figure B.2. When an external loudspeaker is used, the acoustical coupler shall be fixed to the loudspeaker in the position used during the calibration. The level of the decoded output signal from the uplink speech channel of the EUT at the analogue output of the test system shall be measured. Pick up of extraneous background noise by the microphone of the EUT shall be minimized by sealing the speech input port (microphone) of the EUT (see figure B.2).

NOTE: If the equipment is designed for use with external transducers, they should be included in the test configuration. If the equipment does not include acoustical transducers, the line voltage developed across specified termination impedance may be measured.

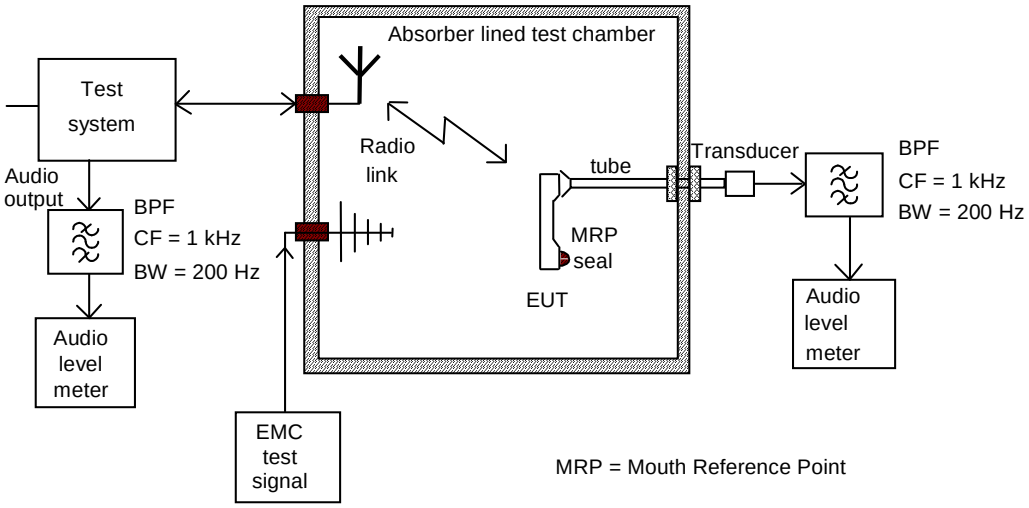


Figure B.2: Audio breakthrough measurement, test set-up for portable equipment

Annex C (normative): Performance assessment of data transfer call, Error Ratios

C.1 Calibration of data transfer

C.1.1 UTRA

For the EUT, calibration of the data transfer may be performed by assessing the Bit Error Ratio (BER), Block Error Ratio (BLER) or End-User data error ratio before applying the RF immunity test signal (defined in ETSI EN 301 489-1 [1], clauses 9.2 and 9.5).

C.1.2 E-UTRA and NR

For the EUT, calibration of the data transfer may be performed by assessing the throughput percentage before applying the RF immunity test signal (defined in ETSI EN 301 489-1 [1], clauses 9.2 and 9.5).

C.2 Assessment of data transfer

C.2.1 UTRA, Derivation of Error Ratios

Known data patterns shall be transferred bi-directionally from end-to-end (the whole of the UL and DL will be exercised). Performance assessment shall be made at each frequency step. Comparison between transmitted known data and received data shall result in the Error Ratio.

The data patterns used should be of sufficient length to give valid results and should be equivalent to the used channel bit rate.

Possible data patterns for assessing the Error Ratio are BER, BLER and User Data. Detailed description of BER and BLER can be found from ETSI TS 134 109 [4].

End-User Data may be used where BER and BLER measurements are not appropriate delete (see below).

EXAMPLE: In the cases when the EUT consists of UE with data application ancillary and the data application ancillary itself does not support a loopback function that can be applied for the assessment of BER or BLER, as specified in ETSI TS 134 109 [4]. This would lead into a situation where the data application ancillary is not exercised, i.e. the data transfer loop is not end-to-end.

The characteristics of the End-User Data used for testing (format, size, typical data throughput rate, additional error corrections, etc.) and the necessary test equipment shall be delivered to enable the assessment of the EUT.

Following formula may apply to End-User Data:

$$\text{ErrorRatio} = \left(\frac{\text{erroneuos (bits, bytes, symbols, etc.)}}{\text{total number of (bits, bytes, symbols, etc.)}} \times 100 \right) = n\,\% \qquad \text{(C.1)}$$

(In case that high Error Ratios exist, ensure that errors are a consequence of EMC stress.)

C.2.2 E-UTRA and NR, Derivation of Throughput Percentages

Known data patterns shall be transferred bi-directionally from end-to-end (the whole of the UL and DL will be exercised). Performance assessment shall be made at each frequency step. Comparison between maximum throughput and achieved throughput shall result in the throughput percentage.

The data patterns used should be of sufficient length to give valid results and should be equivalent to the used channel bit rate.

C.3 EUT without data application ancillary

Data monitoring Devices are here considered as part of the Test System. Arrangements should be made in a manner typical use, if needed, to couple the Data monitoring Device by a method that does not affect the radiated electromagnetic field (e.g. ultrasonic or optical).

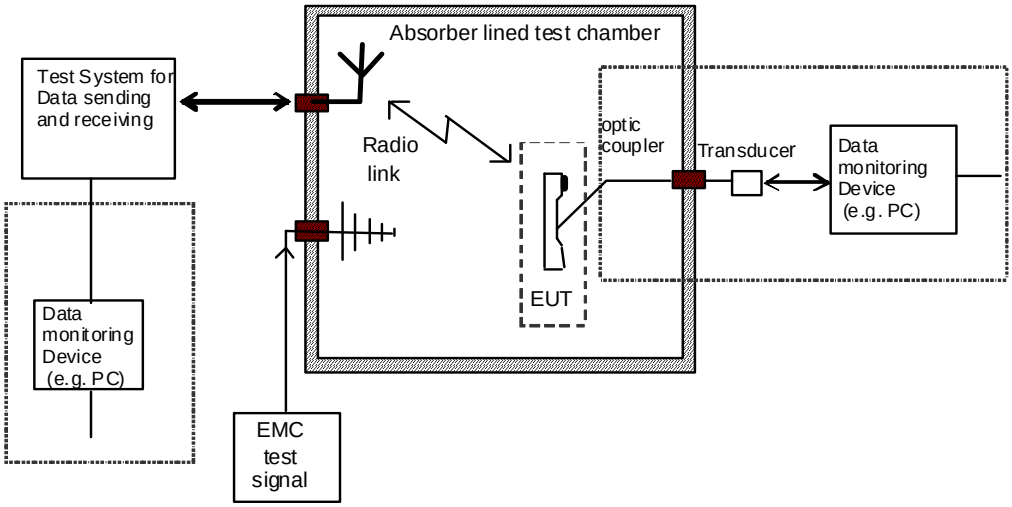


Figure C.1: Error Ratio or throughput assessment, test set-up for EUT without data application ancillary

C.4 EUT with data application ancillary

The Data monitoring Device is here considered as a part of the Test System. The Data application ancillary should be part of the data transfer (UL and DL) loop and is included in the EUT configuration.

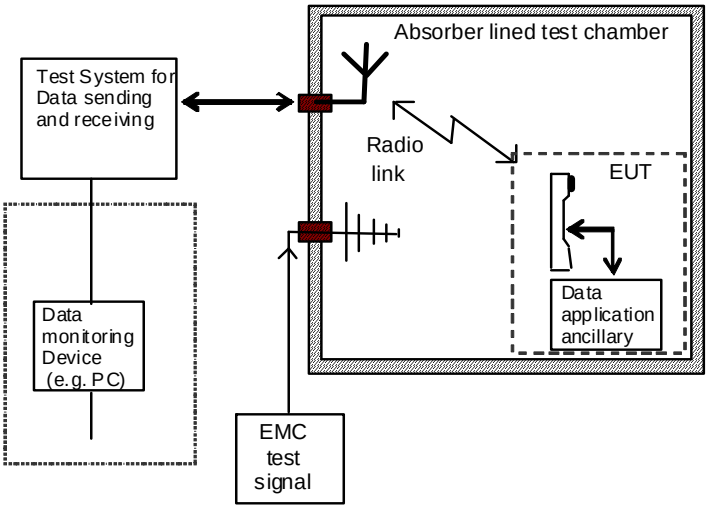


Figure C.2: Error Ratio or throughput assessment, test set-up for EUT with data application ancillary

Annex D (informative): Change history

Version	Information about changes
V1.1.0	The draft standed still in EN Approval Procedure.
V1.1.2	• Specification for UE with New Radio (NR), 5G technology, being included. • Reconstruction of all of clauses and annexes by adding new contents, new references and new specifications.

History

Document history			
V1.1.0	November 2016	EN Approval Procedure	AP 20170221: 2016-11-23 to 2017-02-21
V1.1.2	December 2020	EN Approval Procedure	AP 20210315: 2020-12-15 to 2021-03-15