

Draft **ETSI EN 301 489-52** V1.2.5 (2024-08)



**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**

ReferenceREN/ERM-EMC-420

KeywordsEMC, GSM, harmonised standard, LTE, MSR, NR,
OFDMA, radio, WCDMA, WMAN**ETSI**650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

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

Siret N° 348 623 562 00017 - APE 7112B
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° w061004871

Important notice

The present document can be downloaded from:

<https://www.etsi.org/standards-search>

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the prevailing version of an ETSI deliverable is the one made publicly available in PDF format at www.etsi.org/deliver.

Users of the present document should be aware that the document may be subject to revision or change of status.

Information on the current status of this and other ETSI documents is available at

<https://portal.etsi.org/TB/ETSIDeliverableStatus.aspx>

If you find errors in the present document, please send your comment to one of the following services:

<https://portal.etsi.org/People/CommitteeSupportStaff.aspx>

If you find a security vulnerability in the present document, please report it through our
Coordinated Vulnerability Disclosure Program:

<https://www.etsi.org/standards/coordinated-vulnerability-disclosure>

Notice of disclaimer & limitation of liability

The information provided in the present deliverable is directed solely to professionals who have the appropriate degree of experience to understand and interpret its content in accordance with generally accepted engineering or other professional standard and applicable regulations.

No recommendation as to products and services or vendors is made or should be implied.

In no event shall ETSI be held liable for loss of profits or any other incidental or consequential damages.

Any software contained in this deliverable is provided "AS IS" with no warranties, express or implied, including but not limited to, the warranties of merchantability, fitness for a particular purpose and non-infringement of intellectual property rights and ETSI shall not be held liable in any event for any damages whatsoever (including, without limitation, damages for loss of profits, business interruption, loss of information, or any other pecuniary loss) arising out of or related to the use of or inability to use the software.

Copyright Notification

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.

The content of the PDF version shall not be modified without the written authorization of ETSI.

The copyright and the foregoing restriction extend to reproduction in all media.

© ETSI 2024.
All rights reserved.

Contents

Intellectual Property Rights	5
Foreword.....	5
Modal verbs terminology.....	6
1 Scope	7
2 References	7
2.1 Normative references	7
2.2 Informative references.....	9
3 Definition of terms, symbols and abbreviations.....	10
3.1 Terms.....	10
3.2 Symbols.....	12
3.3 Abbreviations	12
4 Test conditions	13
4.1 General	13
4.2 Arrangements for test signals	13
4.2.1 General.....	13
4.2.2 Arrangements for test signals for GSM	13
4.2.3 Arrangements for test signals for UTRA and E-UTRA.....	13
4.2.4 Arrangements for test signals for NR	14
4.2.4.1 General for NR.....	14
4.2.4.2 NR FR1 SA	14
4.2.4.3 NR FR1 NSA	15
4.2.4.4 NR FR2 SA	15
4.2.4.5 NR FR2 NSA	16
4.3 Exclusion bands.....	16
4.3.1 General.....	16
4.3.2 GSM exclusion band.....	16
4.3.2.1 GSM Transmitter exclusion band	16
4.3.2.2 GSM Receiver exclusion band.....	16
4.3.3 UTRA and E-UTRA exclusion band	16
4.3.3.1 UTRA and E-UTRA Transmitter exclusion band	16
4.3.3.2 UTRA and E-UTRA Receiver exclusion band	17
4.3.4 NR exclusion band.....	17
4.3.4.1 NR FR1 Transmitter exclusion band.....	17
4.3.4.2 NR FR1 Receiver exclusion band	17
4.3.4.3 NR FR2 Transmitter exclusion band.....	17
4.3.4.4 NR FR2 Receiver exclusion band	17
4.4 Narrow band responses of receivers and receivers of duplex transceivers.....	17
4.4.1 GSM Narrow band responses on receivers	17
4.4.2 UTRA and E-UTRA Narrow band responses on receivers.....	18
4.4.2.1 UTRA.....	18
4.4.2.2 E-UTRA.....	18
4.4.3 NR Narrow band responses on receivers	19
5 Ancillary equipment.....	19
6 Performance criteria	19
6.1 Performance criteria for Continuous phenomena	19
6.1.1 GSM and voice call.....	19
6.1.1.1 Performance criteria for Continuous phenomena applied to Transmitters (CT)	19
6.1.1.2 Performance criteria for Continuous phenomena applied to Receivers (CR)	19
6.1.2 UTRA	20
6.1.3 E-UTRA, E-UTRA with LAA, inband or guard band NB-IoT, Standalone NB-IoT	20
6.1.4 NR.....	20
6.2 Performance criteria for Transient phenomena	20

7	Requirements.....	20
7.1	General	20
7.2	Emission.....	21
7.2.1	General.....	21
7.2.2	Special conditions	21
7.3	Immunity	21
7.3.1	General.....	21
7.3.2	Special conditions.....	22
Annex A (informative): Relationship between the present document and the essential requirements of Directive 2014/53/EU		
		23
Annex B (normative): Performance assessment voice call, Audio breakthrough.....		
		25
B.1	Calibration of audio levels	25
B.2	Measurement of audio levels.....	26
Annex C (normative): Performance assessment of data transfer call, Error Ratios		
		27
C.1	Calibration of data transfer.....	27
C.1.1	UTRA	27
C.1.2	E-UTRA and NR.....	27
C.2	Assessment of data transfer	27
C.2.1	UTRA, Derivation of Error Ratios	27
C.2.2	E-UTRA and NR, Derivation of Throughput Percentages	27
C.3	EUT without data application ancillary.....	28
C.4	EUT with data application ancillary.....	28
Annex D (informative): Change history		
		29
History		30

Intellectual Property Rights

Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The declarations pertaining to these essential IPRs, if any, are publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: "*Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards*", which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (<https://ipr.etsi.org/>).

Pursuant to the ETSI Directives including the ETSI IPR Policy, no investigation regarding the essentiality of IPRs, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

DECT™, **PLUGTESTS™**, **UMTS™** and the ETSI logo are trademarks of ETSI registered for the benefit of its Members. **3GPP™** and **LTE™** are trademarks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners. **oneM2M™** logo is a trademark of ETSI registered for the benefit of its Members and of the oneM2M Partners. **GSM®** and the GSM logo are trademarks registered and owned by the GSM Association.

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 Standardisation Request deliverable 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 Deliverable
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 138 521-2 [19] ETSI TS 138 521-3 [16]

Technical specifications related to the antenna port of radio equipment, 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.

NOTE 1: The relationship between the present document and the 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].

Technical specifications related to conducted emission EMC requirements below 9 kHz on the AC mains port of radio equipment are not included in the present document.

NOTE 3: Such technical specifications are normally found in the relevant product family standards for AC mains powered equipment (e.g. EN 61000-3-2 [i.14] and EN 61000-3-3 [i.15]).

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] Void.
- [4] [ETSI TS 134 109 \(V17.0.0\) \(05-2022\)](#): "Universal Mobile Telecommunications System (UMTS); Terminal logical test interface; Special conformance testing functions (3GPP TS 34.109 version 17.0.0 Release 17)".
- [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 \(07/2022\)](#): "Determination of sensitivity/frequency characteristics of local telephone systems".
- [7] Void.
- [8] Void.
- [9] [ETSI TS 136 101 \(V17.11.0\) \(10-2023\)](#): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception (3GPP TS 36.101 version 17.8.0 Release 17)".
- [10] [ETSI TS 136 508 \(V17.5.0\) \(05-2023\)](#): "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 17.4.0 Release 17)".
- [11] [ETSI TS 136 509 \(V17.4.0\) \(10-2023\)](#): "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 17.2.0 Release 17)".
- [12] [ETSI TS 136 521-1 \(V17.6.1\) \(07-2023\)](#): "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 17.5.0 Release 17)".
- [13] [ETSI TS 138 508-1 \(V17.10.0\) \(10-2023\)](#): "5G; 5GS; User Equipment (UE) conformance specification; Part 1: Common test environment (3GPP TS 38.508-1 version 17.7.0 Release 17)".
- [14] [ETSI TS 138 101-1 \(V17.11.0\) \(01-2023\)](#): "5G; NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone (3GPP TS 38.101-1 version 17.8.0 Release 17)".
- [15] [ETSI TS 138 521-1 \(V17.10.0\) \(10-2023\)](#): "5G; NR; User Equipment (UE) conformance specification; Radio transmission and reception; Part 1: Range 1 standalone (3GPP TS 38.521-1 version 17.7.0 Release 17)".
- [16] [ETSI TS 138 521-3 \(V17.10.0\) \(10-2023\)](#): "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 17.7.0 Release 17)".
- [17] [EN 55035:2017 + A11:2020](#): "Electromagnetic compatibility of multimedia equipment - Immunity requirements" (produced by CENELEC).
- [18] Void.
- [19] [ETSI TS 138 521-2 \(V17.4.0\) \(10-2023\)](#): "5G; NR; User Equipment (UE) conformance specification; Radio transmission and reception; Part 2: Range 2 standalone (3GPP TS 38.521-2 version 17.1.0 Release 17)".
- [20] [ETSI TS 138 101-2 \(V17.11.0\) \(10-2023\)](#): "5G; NR; User Equipment (UE) radio transmission and reception; Part 2: Range 2 Standalone (3GPP TS 38.101-2 version 17.8.0 Release 17)".

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 (V17.1.0) (05-2022): "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); LTE; 5G; Vocabulary for 3GPP Specifications (3GPP TR 21.905 version 17.1.0 Release 17)".
 - [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 4.22.1)".
 - [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 \(V13.1.1\) \(06-2020\)](#): "IMT cellular networks; Harmonised Standard for access to radio spectrum; Part 2: CDMA Direct Spread (UTRA FDD) User Equipment (UE)".
 - [i.12] [ETSI EN 301 908-13 \(V13.2.1\) \(02-2022\)](#): "IMT cellular networks; Harmonised Standard for access to radio spectrum; Part 13: Evolved Universal Terrestrial Radio Access (E-UTRA) User Equipment (UE)".
 - [i.13] ETSI EN 301 489-50 (V2.3.1) (03-2021): "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 for ElectroMagnetic Compatibility".

- [i.14] EN 61000-3-2 (2019) + A1(2021): "ELECTROMAGNETIC COMPATIBILITY (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)".
- [i.15] EN 61000-3-3 (2013) + A2 (2021): "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 ≤ 16 A per phase and not subject to conditional connection".
- [i.16] ETSI TS 100 910 (V8.20.0) (11-2005): "Digital cellular telecommunications system (Phase 2+); Radio Transmission and Reception (3GPP TS 05.05 version 8.20.0 Release 1999)".
- [i.17] [Recommendation ITU-T P.76 \(11/1988\)](#): "Determination of loudness ratings; fundamental principles".

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);
- 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, sends and/or receives 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.

fixed equipment: equipment intended for use in a fixed location and fitted with one or more antennas

NOTE: The equipment may be fitted with either antenna socket(s) or, integral antenna(s) or both.

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.
- For 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, 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

portable equipment: radio equipment intended for portable use and powered by integral batteries or battery

NOTE: Devices will typically be handheld.

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;
- ETSI ETS 300 578 [i.7], clause 8.2 for Phase 2 GSM 900 or Phase 2 GSM 1800 equipment;
- ETSI TS 100 910 [i.16], 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.

vehicular equipment: radio equipment intended for installation and use in a vehicle, and powered by the main battery of the vehicle

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 abbreviations given in ETSI TR 121 905 [i.1], ETSI TR 125 990 [i.3] and the following apply:

3GPP	3 rd Generation Partnership Project
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
EPS	External Power Supply
EUT	Equipment Under Test
E-UTRA	Evolved Universal Terrestrial Radio Access
FDD	Frequency Division Duplex
FR1	Frequency Range 1
FR2	Frequency Range 2
GERAN	GSM EDGE Radio Access Network
GSM	Global System for Mobile communication
IMT-2000	International Mobile Telecommunications 2000
IMT-MC	International Mobile Telecommunication-Multi Carrier
IP	Internet Protocol
ISDN	Integrated Services Digital Network
LAA	License Assisted Access
LTE	3GPP Long Term Evolution (4G)
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
PSTN	Public Switched Telephone 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

The test conditions for user equipment are specified in the present document.

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").

4.2 Arrangements for test signals

4.2.1 General

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

Establish a communication link, then reduce the power until the monitored communication path is no longer stable (for example, additional errors are occurring which are outside the limits defined in clause 6.1). Then, increase the transmit power by 18 dB to establish a stable communication link.

- For radiated immunity tests, the level of the wanted signal at the input of the receiver or the enclosure port of the EUT, shall be 18 dB above the reference sensitivity level for the EUT.
- For all other tests, the level of the wanted signal required to establish a communication link shall be representative of the EUT intended use.

4.2.2 Arrangements for test signals for GSM

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

4.2.3 Arrangements for test signals for UTRA and E-UTRA

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

The test of the transmitter section and receiver section of the EUT may be carried out simultaneously to reduce test time.

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 clause 7.2.3 of ETSI TS 134 108 [2] and annex A of 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 clause 4.5.1 of ETSI TS 136 508 [10] and clause 5.4 of 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.

4.2.4 Arrangements for test signals for NR

4.2.4.1 General for NR

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

The test of the transmitter section and receiver section of the EUT may be carried out simultaneously to reduce test time.

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.

4.2.4.2 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.

4.2.4.3 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 ETSI TS 138 521-1 [15], 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.
- 5) E-UTRA downlink signals are initially set up according to ETSI TS 136 521-1 [12], clauses C0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.
- 6) The UL Reference Measurement channels for NR are 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.
- 7) The UL Reference Measurement channels for E-UTRA are set according to ETSI TS 136 521-1 [12], tables 7.3.4.1-1 and 7.3.4.1-2.
- 8) NR propagation conditions are set according to ETSI TS 138 521-1 [15], clause B.0.
- 9) E-UTRA propagation conditions are set according to ETSI TS 136 521-1 [12], clause B.0.
- 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) Set the UL Reference Measurement channel configurations according to the exceptional cases from ETSI TS 138 521-3 [16], table 7.3B.2.1.4.1-1.

4.2.4.4 NR FR2 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 138 521-2 [19], 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 138 521-2 [19], 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 138 521-2 [19], 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 138 521-2 [19], clause 7.3.2.4.3.

4.2.4.5 NR FR2 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 ETSI TS 138 521-2 [19], 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.
- 5) E-UTRA downlink signals are initially set up according to ETSI TS 136 521-1 [12], clauses C0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.
- 6) The UL Reference Measurement channels for NR are set according to ETSI TS 138 521-2 [19], tables 7.3.2.4.1-1, 7.3.2.4.1-2 and 7.3.2.4.1-3.
- 7) The UL Reference Measurement channels for E-UTRA are set according to ETSI TS 136 521-1 [12], tables 7.3.4.1-1 and 7.3.4.1-2.
- 8) NR propagation conditions are set according to ETSI TS 138 521-2 [19], clause B.0.
- 9) E-UTRA propagation conditions are set according to ETSI TS 136 521-1 [12], clause B.0.
- 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) Set the UL Reference Measurement channel configurations according to the exceptional cases from ETSI TS 138 521-3 [16], table 7.3B.2.1.4.1-1.

4.3 Exclusion bands

4.3.1 General

For EUTs that operate above 6 GHz, there is no exclusion band specified as test ranges stop at 6 GHz.

4.3.2 GSM exclusion band

4.3.2.1 GSM Transmitter exclusion band

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.

4.3.2.2 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 exclusion band

4.3.3.1 UTRA and E-UTRA Transmitter exclusion band

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, 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 clause 5.6 of ETSI TS 136 101 [9].

4.3.3.2 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 the considered Channel Width for calculation of the exclusion band is as follows:

- UTRA Channel Width 5 MHz.
- E-UTRA Channel Width 20 MHz.

4.3.4 NR exclusion band

4.3.4.1 NR FR1 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 clause 5.3 of ETSI TS 138 101-1 [14].

4.3.4.2 NR FR1 Receiver exclusion band

As defined in clause 4.3.3 of ETSI EN 301 489-1 [1] where $n = 1$ and the considered Channel Width for calculation of the exclusion band is as follows:

- NR Channel Width 100 MHz.
- E-UTRA Channel Width 20 MHz.

4.3.4.3 NR FR2 Transmitter exclusion band

For EUTs that operate above 6 GHz there is no exclusion band specified as test ranges stop at 6 GHz.

4.3.4.4 NR FR2 Receiver exclusion band

For EUTs that operate above 6 GHz there is no exclusion band specified as test ranges stop at 6 GHz.

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 are 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 limits, it is necessary to establish whether the measured result 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 measured result is still outside the specified limits, 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 measured result is still outside the specified limits 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 limits, it is necessary to establish whether the measured result 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 clause 5.6 of ETSI TS 136 101 [9].
- If the measured result is still outside the specified limits, the procedure is repeated, and the unwanted signal frequency is increased or decreased by $2 \times$ BW Channel MHz, where BW Channel is the channel bandwidth as defined in clause 5.6 of ETSI TS 136 101 [9].
- If the measured result is still outside the specified limits 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 limits, it is necessary to establish whether the measured result 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 of NR FR1 as defined in clause 5.3 of ETSI TS 138 101-1 [14]. The NR FR2, as defined in clause 5.3 of ETSI TS 138 101-2 [20], shall be applied.
- If the measured result is still outside the specified limits, the procedure is repeated, and the unwanted signal frequency is increased or decreased by $2 \times \text{BW Channel MHz}$, where BW Channel of NR FR1 is the channel bandwidth as defined in clause 5.3 of ETSI TS 138 101-1 [14]. The NR FR2, as defined in clause 5.3 of ETSI TS 138 101-2 [20], shall be applied.
- If the measured result is still outside the specified limits 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

Ancillary equipment shall be tested and assessed in conjunction with the host equipment by applying the provisions of the present document.

6 Performance criteria

6.1 Performance criteria for Continuous phenomena

6.1.1 GSM and voice call

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

With a link established, during the test, the uplink speech output level shall be at least 35 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 may be reduced to a minimum of 40 Hz.

In idle mode, the transmitter shall not operate unintentionally.

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.

6.1.1.2 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.

In the case of narrow-band responses, the procedure in clause 4.4.1 shall be followed.

During the test, the downlink speech output level shall be at least 35 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 may be reduced 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 to 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 to 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.

In the case of narrow-band responses, the procedure in clause 4.4.2.1 shall be followed.

When testing a voice call, the performance criteria in clause 6.1.1 shall apply.

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

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.

In the case of narrow-band responses, the procedure in clause 4.4.2.2 shall be followed.

When testing a voice call, the performance criteria in clause 6.1.1 shall apply.

6.1.4 NR

In the data transfer mode of both FR1 and FR2, the data throughput of the EUT shall not fall below 95 % of the maximum data throughput. Details are specified in annex C.

In the case of narrow-band responses, the procedure in clause 4.4.3 shall be followed.

When testing a voice call, the performance criteria in clause 6.1.1 shall apply.

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

For the radio technologies of the EUT, the immunity tests shall be performed in two modes of operation:

- with a communication link established (traffic mode); and

- in the idle mode.

For an EUT which provides a voice call function, it shall be tested in accordance with annex B.

The type of any charger/ power adaptor (EPS) used in conjunction with the EUT shall be recorded in the test report.

7.2 Emission

7.2.1 General

The following emission requirements set out in table 4 shall apply.

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
conducted emission	wired network port	applicable	not applicable	not applicable	ETSI EN 301 489-1 [1], clause 8.7

NOTE: Radiated emissions from the enclosure port, as well as conducted emissions from the RF port, are out of the scope of the present document, as they are within the scope of the applicable article 3.2 radio standard of the RED [i.2].

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 equipment.

Portable or vehicular equipment, or combinations of equipment, capable of being powered for intended use by AC mains shall additionally be considered as fixed 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 the typical 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.

7.3 Immunity

7.3.1 General

The following immunity requirements set out in table 6 shall apply.

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	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 in the vehicular environment	DC power input	not applicable	applicable	not applicable	ETSI EN 301 489-1 [1], clauses, 9.6.1 and 9.6.2	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	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.

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 equipment.

Portable or vehicular equipment, or combinations of equipment, capable of being powered for intended use by AC mains shall additionally be considered as fixed 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 shall be mounted vertically using non-metallic supports as specified in the last paragraph of clause 4.2.1 of EN 55035 [17].

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 [i.2]

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)	7.2.2	U	
2	Emissions: DC power input/output ports	3.1(b)	7.2.1	C	Only where equipment has DC power input and/or output ports or from a vehicle power supply.
3	Emissions: AC mains power input/output ports	3.1(b)	7.2.1	C	Only applies to fixed equipment where equipment has AC mains power input and/or output ports.
4	Emissions: Wired network ports	3.1(b)	7.2.1	C	Only applies to equipment intended for fixed use.
5	Immunity: Radio frequency electromagnetic field (80 MHz to 6 000 MHz)	3.1(b)	7.3.1	U	
6	Immunity: Electrostatic discharge	3.1(b)	7.3.2	U	
7	Immunity: Fast transients common mode	3.1(b)	7.3.1	C	Only applies to equipment intended for fixed use.
8	Immunity: Radio frequency common mode	3.1(b)	7.3.1	C	Only applies to equipment intended for fixed use and/or vehicle use.
9	Immunity: Transients and surges in the vehicular environment	3.1(b)	7.3.1	C	Only applies to equipment intended for vehicular use.
10	Immunity: Voltage dips and interruptions	3.1(b)	7.3.1	C	Only to fixed equipment where equipment has AC mains power input ports.
11	Immunity: Surges, line to line and line to ground	3.1(b)	7.3.1	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

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. Where the EUT is hand held, it shall be mounted on the artificial head such that the earpiece is centred at the artificial ear.

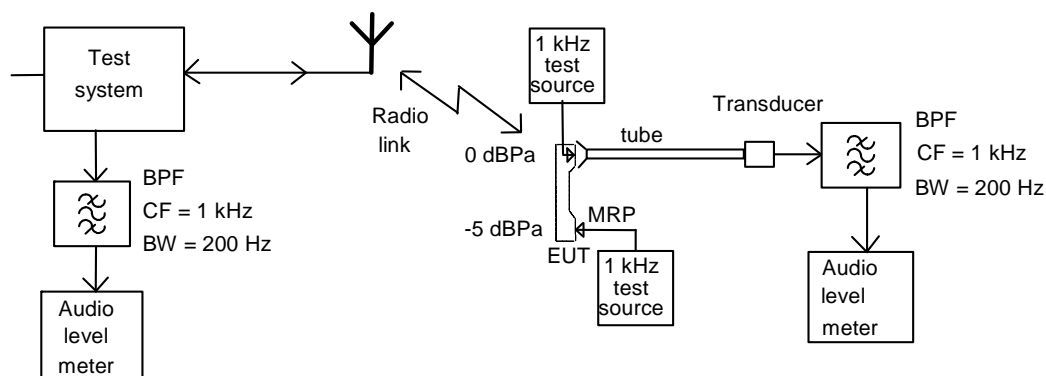
NOTE 1: The MRP is defined with respect to an artificial head defined in Recommendation ITU-T P.76 [i.17].

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 hands-free applications, an external loudspeaker is used. The SPL from the external loudspeaker is normally much higher than from the earpiece of the EUT 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

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 the 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.

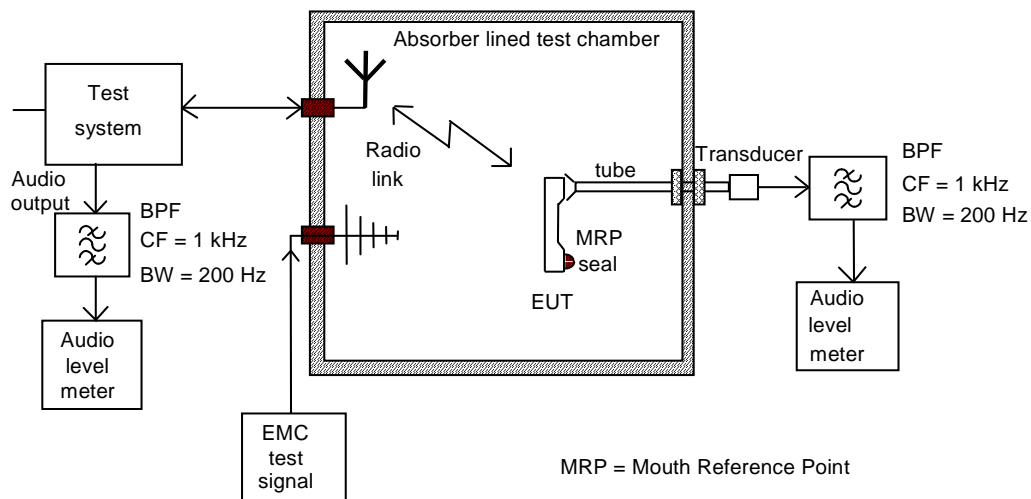


Figure B.2: Audio breakthrough measurement, test set-up

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 descriptions of BER and BLER can be found in ETSI TS 134 109 [4].

End-User Data may be used where BER and BLER measurements are not available (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.

The following formula applies to End-User Data:

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

(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).

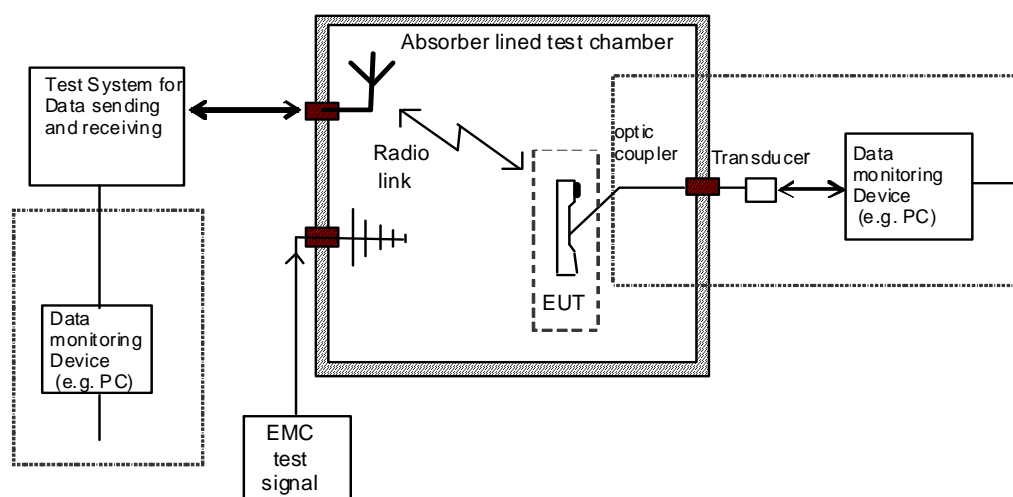


Figure C.1: Error Ratio or throughput assessment, test set-up for EUT without data application ancillary

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 should be included in the EUT configuration.

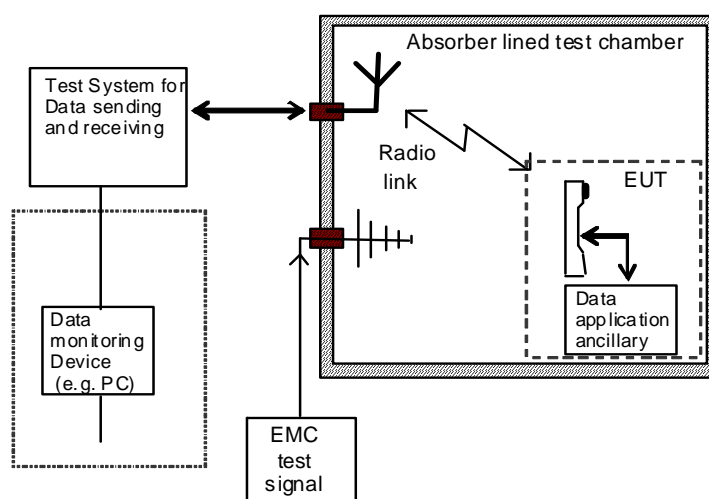


Figure C.2: Error Ratio or throughput assessment, test set-up for EUT with data application ancillary

Annex D (informative): Change history

Version	Information about changes
V1.1.0	The draft standard still in EN Approval Procedure.
V1.1.2	<ul style="list-style-type: none">• 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.
V1.2.0	<ul style="list-style-type: none">• Draft resolving ENAP and HASTAC comments.
V1.2.5	<ul style="list-style-type: none">• Added specification for UE with new radio NR FR2.

History

Document history		
V1.2.1	November 2021	Publication
V1.2.5	August 2024	SRdAP Process EV 20241106: 2024-08-08 to 2024-11-06