



HARMONISED EUROPEAN STANDARD

**Electromagnetic Compatibility (EMC)
standard for radio equipment and services;
Part 52: Specific conditions for Cellular Communication
Mobile and portable (UE) radio and ancillary equipment;
Harmonised Standard covering the essential requirements
of article 3.1(b) of Directive 2014/53/EU**

Reference

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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 |
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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).

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1 Scope

The present document specifies technical characteristics and methods of measurements for equipment the following equipment types:

- 1) digital cellular User Equipment (UE);
- 2) associated ancillary equipment.

Including individually and combinations of:

- UTRA, WCDMA (IMT-2000 Direct Spread, W-CDMA, UMTS)
- E-UTRA, LTE (IMT-2000 and IMT advanced) (see annex D)
- GSM (IMT-2000 SC, Technology GSM/EDGE) (see annex D)

In case of differences (for instance concerning special conditions, definitions, abbreviations) between the present document and ETSI EN 301 489-1 [1], the provisions of the present document take precedence.

Technical specifications related to the antenna port and emissions from the enclosure port of radio equipment are not included in the present document. Such technical specifications are 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.

Base station (BS) equipment operating within network infrastructure is outside the scope of the present document. However, the present document does cover mobile and portable equipment that is intended to be operated in a fixed location while connected to the AC mains (see clause 5.5).

The present document covers the essential requirements of article 3.1(b) of Directive 2014/53/EU under the conditions identified in annex A.

2 References

2.1 Normative references

References are specific, identified by date of publication and/or edition number or version number. Only the cited version applies.

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

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

- [1] ETSI EN 301 489-1 (V2.1.1) (11-2016): "ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements: Harmonised Standard covering the essential requirements of article 3.1(b) of the Directive 2014/53/EU and Harmonised Standard covering the essential requirements of article 6 of the Directive 2014/30/EU".
- [2] ETSI TS 134 108 (V6.4.0) (10-2006): "Universal Mobile Telecommunications System (UMTS); Common test environments for User Equipment (UE); Conformance testing (3GPP TS 34.108 version 6.4.0 Release 6)".
- [3] ETSI TS 125 101(V7.5.0) (10-2006): "Universal Mobile Telecommunications System (UMTS); User Equipment (UE) radio transmission and reception (FDD) (3GPP TS 25.101 version 7.5.0 Release 7)".

- [4] ETSI TS 134 109 (V6.2.0) (09-2006): "Universal Mobile Telecommunications System (UMTS); Terminal logical test interface; Special conformance testing functions (3GPP TS 34.109 version 6.2.0 Release 6)".
- [5] ETSI EN 300 296-1 (V1.4.1) (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 (1999): "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 (V7.4.0) (10-2006): "Universal Mobile Telecommunications System (UMTS); User Equipment (UE) radio transmission and reception (TDD) (3GPP TS 25.102 version 7.4.0 Release 7)".
- [9] ETSI TS 136 101 (V8.4.0) (01-2009): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception (3GPP TS 36.101 version 8.4.0 Release 8)".
- [10] ETSI TS 136 508 (V8.1.0) (04-2009): "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 8.1.0 Release 8)".
- [11] ETSI TS 136 509 (V8.0.1) (01-2009): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Special conformance testing function for User Equipment (UE) (3GPP TS 36.509 version 8.0.1 Release 8)".
- [12] ETSI I-ETS 300 034-1 (Edition 1) (10-1993): "European digital cellular telecommunications system (Phase 1); Radio subsystem link control (GSM 05.08)".
- [13] ETSI I-ETS 300 034-2 (Edition 1) (09-1993): "European digital cellular telecommunications system (Phase 1); Radio subsystem link control; Part 2: DCS extension (GSM 05.08-DCS)".
- [14] ETSI ETS 300 578 (Edition 13) (03-1999): "Digital cellular telecommunications system (Phase 2) (GSM); Radio subsystem link control (GSM 05.08 V4.22.0)".
- [15] ETSI TS 100 911 (V8.23.0) (11-2005): "Digital cellular telecommunications system (Phase 2+); Radio subsystem link control (3GPP TS 05.08 version 8.23.0 Release 1999)".

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 (V8.7.0): "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Vocabulary for 3GPP Specifications (3GPP TR 21.905 version 8.7.0 Release 8)".
- [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.

3 Definitions and abbreviations

3.1 Definitions

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

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.

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.

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

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

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 I-ETSI ETS 300 034-1 [12] clause 8.2 for Phase 1 GSM 900 equipment;
- ETSI I-ETSI ETS 300 034-2 [13] clause 8.2 for Phase 1 DCS 1800 equipment; or

- ETSI ETS 300 578 [14] clause 8.2 for Phase 2 GSM 900 or Phase 2 DCS 1800 equipment;
- ETSI TS 100 911 [15] clause 8.2 for Phase 2+ GSM 900 or Phase 2+ DCS 1800 equipment.

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

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

Universal Terrestrial Radio Access (UTRA): radio access network of the telecommunications system, incorporating mobile cellular and other functionality, that 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.

3.2 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 |
| ARFCN | Absolute Radio Frequency CHannel Number (see note) |
| BCCH | Broadcast Control Channel (see note) |
| BER | Bit Error Ratio |
| BLER | BLock Error Ratio |
| BPF | Band Pass Filter |
| BTS | Base Transceiver Station |
| BS | Base Station |
| BSS | Base Station System |
| BW | BandWidth |
| CCCH | Common Control CHannel (see note) |
| CDMA | Code Division Multiple Access |
| CF | Centre Frequency |
| CR | Continuous phenomena applied to Receivers (see clause 6.1.3) |
| CRC | Cyclic Redundancy Check |
| CT | Continuous phenomena applied to Transmitters (see clause 6.1.1) |
| DL | Down Link (from BS to UE) |
| DRX | Discontinuous Reception |
| DTX | Discontinuous Transmission (see note) |
| EARFCN | E-UTRA Absolute Radio Frequency Channel Number |
| EMC | ElectroMagnetic Compatibility |
| EUT | Equipment Under Test |
| E-UTRA | Evolved Universal Terrestrial Radio Access |
| FDD | Frequency Division Duplex |
| IMT-2000 | International Mobile Telecommunications 2000 |
| LR | Location Registration |
| MRP | Mouth Reference Point (artificial head) |
| MS | Mobile Station |
| PC | Personal Computer |
| PLMN | Public Land Mobile Network |
| RF | Radio Frequency |
| RRC | Radio Resource Control |
| RXQUAL | Receiver QUALity (see note) |
| SPL | Sound Pressure Level |
| TDD | Time Division Duplex |
| TR | Transient phenomena applied to Receivers |
| TT | Transient phenomena applied to Transmitters |
| UARFCN | UTRA Absolute 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 digital cellular mobile and portable radio equipment are specified in the present document.

Whenever the EUT is provided with a detachable antenna, the EUT shall be tested with the antenna fitted in a manner typical of normal intended use, unless specified otherwise.

4.2 Arrangements for test signals

4.2.1 Arrangements for test signals for GSM and DCS

4.2.1.1 General for GSM and DCS

The provisions of ETSI EN 301 489-1 [1], clause 4.2 shall apply with the following modifications given in clauses 4.2.1.2 to 4.2.1.4.

4.2.1.2 GSM and DCS Arrangements for establishing a communications link

The nominal frequency of the wanted RF input signal (for the receivers) shall be selected by setting the Absolute Radio Frequency Channel Number (ARFCN) to an appropriate number (e.g. in case of GSM 900 MHz this is 60 to 65, and in case of GSM 1 800 MHz this is 690 to 706).

A communication link shall be set up with a suitable base station simulator (hereafter called "the test system").

When the EUT is required to be in the transmit/receive mode, the following conditions shall be met:

- the EUT shall be commanded to operate at maximum transmit power;
- the downlink RXQUAL shall be monitored.

4.2.1.3 GSM and DCS Calibration of the overall audio link performance

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 1.

If the equipment does not include acoustical transducers (e.g. a microphone or loudspeaker) the equivalent electrical reference levels shall be specified by the manufacturer.

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.

The calibration should be carried out with the noise and echo cancellation algorithms disabled. (Specific test software may be required).

If the noise and echo cancellation algorithms cannot be disabled then the reference level of the speech output signal should 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.

Calibration of the downlink:

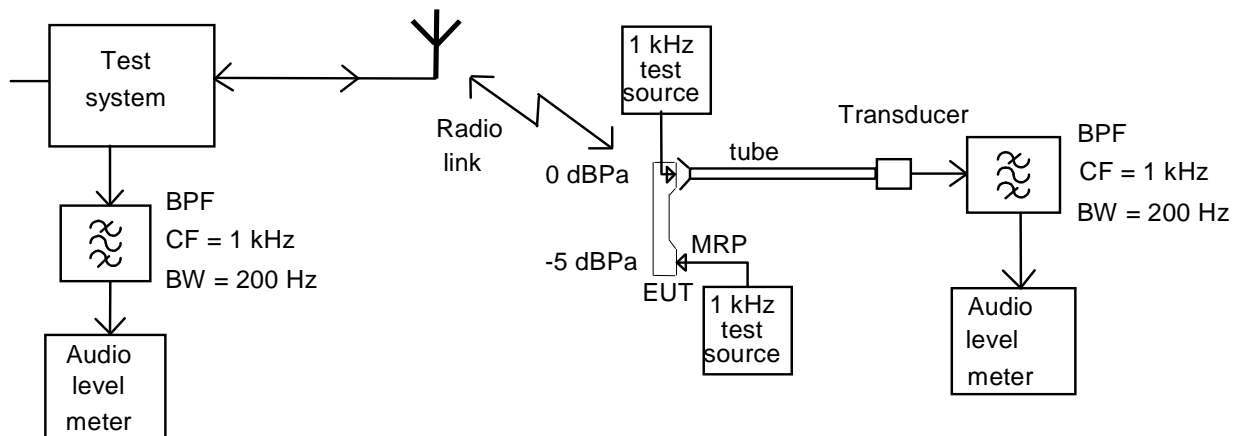
- The EUT is not used for the calibration of the downlink. Adjust the output of the audio test source to achieve a reference level equivalent to a SPL of 0 dBPa at 1 kHz at the input of the acoustic coupler (tube in figure 1) for the downlink. Record the reading of the audio level meter as the reference level.
- If in handsfree applications an external loudspeaker is used, the SPL from the external loudspeaker is higher than that from the earpiece of the portable by a certain amount in order overcome a high ambient noise level. Two methods can be used to achieve the required SPL:
 - the downlink reference level shall be increased by the same amount in order to compensate for the difference in SPL; or
 - the distance between the loudspeaker and the measuring microphone shall be adjusted during the measurement procedure resulting in the required SPL.

It is important that the dynamic range of the test instrumentation is not exceeded.

Calibration of the uplink:

- For the calibration of the uplink the EUT is used. Adjust the output of the audio test source to achieve a reference level equivalent to a SPL of -5 dBPa at 1 kHz at the Mouth Reference Point (MRP) defined in Recommendation ITU-T P.64 [6]. Record the reading of the audio level meter, which is connected to the output of the test system, as the reference level.
- For handsfree applications, 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 manufacturer shall specify the distance between the MRP and the microphone.
- It is important that the dynamic range of the test instrumentation is not exceeded.
- The MRP is defined with respect to an artificial head defined in Recommendation ITU-T P.64 [6]. The handset shall be mounted on the artificial head such that the ear piece is centred at the artificial ear.

Both recorded levels (downlink and uplink) are used as reference levels for the performance assessment (see clauses 6.1.1 and 6.1.3).



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

4.2.1.4 GSM and DCS Measurement of the audio level at the speech output of the EUT

The voice processor may apply noise and echo cancellation algorithms which attempt to eliminate or reduce steady state audio signals as e.g. the 1 kHz calibration signals.

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 provide the nominal audio level if specified by the manufacturer. 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 or portable's earpiece shall be assessed by measuring the Sound Pressure Level (SPL) as shown in figure 2. When an external loudspeaker is used the acoustic 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 2).

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

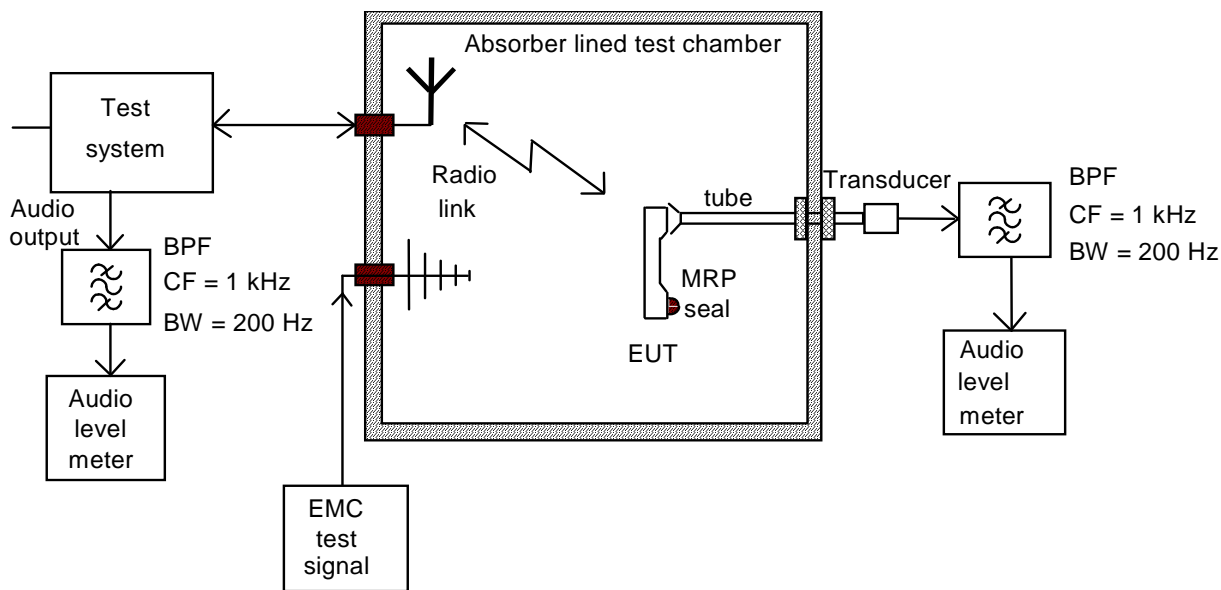


Figure 2: Audio breakthrough measurement, test set-up for portable equipment

4.2.2 Arrangements for test signals for CDMA Direct Spread (UTRA and E-UTRA)

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

- The wanted RF signal nominal frequency shall be selected by setting the UTRA or E-UTRA Absolute Radio Frequency Channel Number (UARFCN or EARFCN) to an appropriate number.
- A communication link shall be set up with a suitable base station simulator (hereafter called "the test system"). The test system shall be located outside of the test environment.

Where possible 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; or
- 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.

4.2.3 Arrangements for test signals at the input of transmitters

The provisions of ETSI EN 301 489-1 [1], clause 4.2.1 shall apply.

For GSM and DCS the provisions of ETSI EN 301 489-1 [1], clause 4.2.1 shall apply with the following modifications:

- The test system shall command the EUT to disable Discontinuous Transmission (DTX).
- A communication link shall be set up between the EUT and the test system.

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 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 from 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 delivered from the equipment to an antenna located within the test environment.

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 and DCS receivers

The wanted RF input signal level shall be set to 40 dB above the reference sensitivity level as defined in ETSI TS 100 911 [15], clause 6.2 to provide a stable communication link.

4.2.5.3 Arrangements for test signals at the input of CDMA Direct Spread (UTRA and E-UTRA) receivers

For immunity testing the wanted RF signal level at the input of the EUT shall be at least 40 dB above the reference sensitivity level to provide a stable communication link. The reference sensitivity level is defined in ETSI TS 125 101 [3] and ETSI TS 125 102 [8] or ETSI TS 136 101 [9].

For emission testing the wanted RF signal level at the input of the measuring receiver shall be no more than 15 dB above the reference sensitivity level, to ensure that it operates within its dynamic range.

4.2.6 Arrangements for test signals at the output of receivers

4.2.6.1 Arrangements for test signals at the output of GSM and DCS receivers

The provisions of ETSI EN 301 489-1 [1], clause 4.2.4 shall apply.

When the EUT is required to be in the idle mode, the test system shall simulate a Base Station (BS) with Broadcast Control Channel/Common Control Channel (BCCH/CCCH) on one carrier. The EUT shall be synchronized to the BCCH, listening to the CCCH and able to respond to paging messages. Periodic Location Updating shall be disabled.

4.2.6.2 Arrangements for test signals at the output of CDMA Direct Spread (UTRA and E-UTRA) receivers

The provisions of ETSI EN 301 489-1 [1], clause 4.2.4 shall apply with the following modification.

The specific arrangements for test signals at the output of receivers are in annexes B and C.

4.3 Exclusion bands

4.3.1 GSM and DCS Receiver and receivers of duplex transceivers 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.

4.3.2 GSM and DCS 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.

4.3.3 CDMA Direct Spread (UTRA and E-UTRA) Transmitter exclusion band

4.3.3.1 UTRA

In 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 BWChannel is the channel bandwidth as defined in ETSI TS 136 101 [9].

4.3.4 CDMA Direct Spread (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.

4.4 Narrow band responses of receivers and receivers of duplex transceivers

4.4.1 GSM and DCS Narrow band responses of receivers and receivers of duplex transceivers

Responses on receivers or duplex transceivers occurring during the test at discrete frequencies which 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):

- 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.

Narrow band responses are disregarded.

4.4.2 CDMA Direct Spread (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:

- 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:
 - FDD bands I, III, VII, VIII and TDD option 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:
 - FDD bands I, III, VII, VIII and TDD option 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.

Narrow band responses are disregarded.

4.4.2.2 E-UTRA

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

- 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 BWChannel MHz, where BWChannel 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 $2 \times \text{BWChannel}$ MHz, where BWChannel 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.

Narrow band responses are disregarded.

4.5 Normal test modulation

4.5.1 GSM and DCS Normal test modulation

The immunity tests in voice call mode shall be performed without the application of any external modulation input signal.

For immunity tests in voice call mode, the overall audio uplink and downlink performance of the radio equipment shall be calibrated before the start of the tests. The calibration procedure is explained in clause 4.2.1.3.

The immunity tests in data mode shall be performed with the application of an appropriate external modulation input signal such that the performance of the data call can be monitored.

4.5.2 CDMA Direct Spread (UTRA and E-UTRA) Normal test modulation

For transmission of analogue speech or audio signals (voice call mode), immunity tests shall be performed without the application of any external modulation input signal.

The overall audio Up Link (UL) and Down Link (DL) performance of the radio equipment shall be calibrated before the start of the tests. The calibration procedure is explained in clause B.1.

The immunity tests in the data transfer mode shall be performed with the application of an appropriate external modulation input signal such that the performance of the data call can be monitored. For assessment of the data transfer mode, refer to annex C.

5 Performance assessment

5.1 General

The provision of ETSI EN 301 489-1 [1], clause 5.1 shall apply with the following modification.

The information about the bandwidth of the IF filter immediately preceding the demodulator as set out in ETSI EN 301 489-1 [1], clause 5.1 is not applicable to radio equipment in the scope of the present document.

5.2 Equipment which can provide a continuous communications link

5.2.1 GSM and DCS Equipment with analogue speech circuits

The provision of ETSI EN 301 489-1 [1], clause 5.2 shall apply.

The performance of equipment which supports voice and data calls is assessed based on the voice call.

5.2.2 GSM and DCS Equipment without analogue speech circuits

The provision of ETSI EN 301 489-1 [1], clause 5.2 shall apply.

The assessment of the equipment performance shall be specified by the manufacturer.

5.3 Equipment which does not provide a continuous communications link

The provision of ETSI EN 301 489-1 [1], clause 5.3 shall apply.

5.4 Ancillary equipment

5.4.1 GSM and DCS Ancillary equipment

The provision of ETSI EN 301 489-1 [1], clause 5.4 shall apply with the following modification.

For emission measurements on transmitters performed in conjunction with associated ancillary equipment, the radiated emissions (spurious and wanted components) from the transmitter shall be ignored.

5.4.2 CDMA Direct Spread (UTRA and E-UTRA) Ancillary equipment

The provision of ETSI EN 301 489-1 [1], clause 5.4 shall apply with the following modification.

Ancillary equipment shall be tested with it connected to a UE in which case compliance shall be demonstrated to the appropriate clauses of the present document.

5.5 Equipment classification

The provision of ETSI EN 301 489-1 [1], clause 5.5 shall apply.

For GSM and DCS the provision of ETSI EN 301 489-1 [1], clause 5.5 shall apply with the following modification.

Portable or mobile equipment or combinations of equipment, when used in conjunction with a charger powered from the AC mains, shall in addition fulfil the requirements of radio and ancillary equipment for fixed use (see tables 2 and 3 of ETSI EN 301 489-1 [1]).

6 Performance criteria

6.1 GSM and DCS Performance Criteria

6.1.1 General

The equipment shall meet the performance criteria specified in this clause and clauses 6.1.1 to 6.1.4, as appropriate.

Portable equipment intended for use whilst powered by the main battery of a vehicle shall additionally fulfil the applicable requirements set out in ETSI EN 301 489-1 [1], clauses 7.1 and 7.2 for mobile equipment.

Portable or mobile equipment powered by the AC mains shall additionally fulfil the applicable requirements of ETSI EN 301 489-1 [1], clauses 7.1 and 7.2 for radio and ancillary equipment for fixed use.

The establishment and maintenance of a communications link, the assessment of RXQUAL, and the assessment of the audio breakthrough by monitoring the speech output signal level, are used as performance criteria to ensure that all primary functions of the transmitter and receiver are evaluated during the immunity tests. In addition, the test shall also be performed in idle mode to ensure the transmitter does not unintentionally operate.

The maintenance of a communications link shall be assessed using an indicator which may be part of the test system or the EUT.

If an equipment is of a specialized nature, such that the performance criteria described in the following clauses are not appropriate, then the manufacturer shall declare, for inclusion in the test report, his own specification for an acceptable level of performance or degradation of performance during and/or after the immunity tests. The performance specification shall be included in the product description and documentation.

The performance criteria specified by the manufacturer shall give the same degree of immunity protection as called for in the following clauses.

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

A communication link shall be established at the start of the test, and maintained during the test, see clauses 4.2.3 and 4.2.4.

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 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 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.

6.1.3 Performance criteria for Transient phenomena applied to Transmitters (TT)

A communications link shall be established at the start of the test, see appropriate clauses 4.2 to 4.2.4.

At the conclusion of each exposure the EUT shall operate with no user noticeable loss of the communication link.

At the conclusion of the total test comprising the series of individual exposures, the EUT shall operate as intended with no loss of user control functions or stored data, as declared by the manufacturer, 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.

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

A communications link shall be established at the start of the test, see appropriate clauses 4.2 to 4.2.6.

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 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 stored data, and the communication link shall have been maintained.

6.1.5 Performance criteria for Transient phenomena applied to Receivers (TR)

A communications link shall be established at the start of the test, see appropriate clauses 4.2. to 4.2.6.

At the conclusion of each exposure the EUT shall operate with no user noticeable loss of the communication link.

At the conclusion of the total test comprising the series of individual exposures, the EUT shall operate as intended with no loss of user control functions or stored data, as declared by the manufacturer, and the communication link shall have been maintained.

6.1.6 Performance criteria for ancillary equipment tested on a stand alone basis

The provision of ETSI EN 301 489-1 [1], clause 6.4 shall apply.

6.2 CDMA Direct Spread (UTRA and E-UTRA) Performance Criteria

6.2.1 General

The equipment shall meet the performance criteria specified in this clause and clauses 6.2.2 and 6.2.3 as appropriate.

The maintenance of a communications link shall be assessed by using an indicator, which may be part of the test system or the equipment under test.

If an equipment is of a specialized nature, that the performance criteria described in the following clauses are not appropriate, then the manufacturer shall declare, for inclusion in the test report, his own specification for an acceptable level of performance or degradation of performance during and/or after testing, as required by the present document.

The performance criteria specified by the manufacturer shall give the same degree of immunity protection as called for in the following clauses.

In addition, the test shall also be performed in idle mode to ensure the transmitter does not unintentionally operate.

The requirements apply to all types of UTRA and E-UTRA (FDD or TDD) for the UE.

6.2.2 Performance criteria for continuous phenomena

6.2.2.1 General

A communication link shall be established at the start of the test, and maintained during the test, clauses 4.1 and 4.2.

In the speech mode, the performance criteria shall be that the Up Link and Down Link speech output levels shall be at least 35 dB less than the recorded reference levels, when measured through an audio band pass filter of width 200 Hz, centred on 1 kHz (annex B).

NOTE: When there is a high level of background audio 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 stored data, and the communication link shall have been maintained.

In addition to confirming the above performance in traffic mode, the test shall be performed in idle mode, and the transmitter shall not unintentionally operate.

6.2.2.2 UTRA

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

- if the BER (as referred in 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.

6.2.2.3 E-UTRA

In the data transfer mode, the performance criteria shall be that the throughput shall be ≥ 95 % of the maximum throughput of 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] during the test sequence.

6.2.3 Performance criteria for Transient phenomena

A communications link shall be established at the start of the test, clauses 4.1 and 4.2.

At the conclusion of each exposure the EUT shall operate with no user noticeable loss of the communication link.

At the conclusion of the total test comprising the series of individual exposures, the EUT shall operate as intended with no loss of user control functions or stored data, as declared by the manufacturer, and the communication link shall have been maintained.

In addition to confirming the above performance in traffic mode, the test shall also be performed in idle mode, and the transmitter shall not unintentionally operate.

7 Applicability overview

7.1 GSM and DCS Applicability overview

7.1.1 Emission

7.1.1.1 General

ETSI EN 301 489-1 [1], table 1 contains the applicability of EMC emission measurements to the relevant ports of radio and/or associated ancillary equipment.

7.1.1.2 Special conditions

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

Table 1: 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 |
|---|---|
| 8.2 Enclosure of ancillary equipment measured on a stand alone basis | At the manufacturer's discretion, 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. |

7.1.2 Immunity

7.1.2.1 General

ETSI EN 301 489-1 [1], table 2 contains the applicability of EMC immunity measurements to the relevant ports of radio and/or associated ancillary equipment.

7.1.2.2 Special conditions

The following special conditions set out in table 2, relate to the immunity test methods and performance criteria used in ETSI EN 301 489-1 [1], clause 9.

Table 2: 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 |
|--|--|
| 9.2 Radio frequency electromagnetic field 9.2.2 Test method | When using the max hold detector method (see annex B) at each test frequency step initially an unmodulated test signal shall be applied. Then the test modulation shall be applied. The test shall be repeated with the equipment in the idle mode of operation and the exclusion band shall not be used during this test. |
| 9.5 Radio frequency, common mode | When using the max hold detector method (see annex B) at each test frequency step initially an unmodulated test signal shall be applied. Then the test modulation shall be applied. |
| 9.5.2 Test method | The stepped frequency increments may be 50 kHz increment of the momentary frequency in the frequency range 150 kHz to 5 MHz. When using the max hold detector method, initially at each test frequency step an unmodulated immunity test signal shall be applied. Then the modulation of the immunity RF test signal (1 kHz tone) shall be applied as specified in the ETSI EN 301 489-1 [1]. |
| 9.6.3 Performance criteria | During tests with pulses 3a and 3b, the performance criteria TT shall apply, see clause 6.2. |
| 9.7.3 Performance criteria; Voltage dips and interruptions | For a voltage dip corresponding to a reduction of the supply voltage of 30 % for 10 ms the performance criteria TT or CR specified in clauses 6.2 or 6.3 shall apply as appropriate. |

7.2 CDMA Direct Spread (UTRA and E-UTRA) Applicability overview tables

7.2.1 Emission

7.2.1.1 General

ETSI EN 301 489-1 [1], table 1 contains the applicability of EMC emission measurements to the relevant ports of radio and/or associated ancillary equipment.

7.2.1.2 Special conditions

No special conditions shall apply to UE in the scope of the present document.

7.2.2 Immunity

7.2.2.1 General

ETSI EN 301 489-1 [1], table 2 contains the applicability of EMC immunity measurements to the relevant ports of radio and/or associated ancillary equipment.

7.2.2.2 Special conditions

The following special conditions set out in table 3, relate to the immunity test methods used in the ETSI EN 301 489-1 [1], clause 9.

Table 3: Special conditions for EMC immunity 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 9 |
|--|--|
| 9.2 Radio frequency electromagnetic field 9.2.2 Test method | When using the max hold detector method (see annex B) at each test frequency step initially an unmodulated test signal shall be applied. Then the test modulation shall be applied. |
| 9.5 Radio frequency, common mode 9.5.2 Test method | There is no exclusion band for the equipment in the scope of the present document. When using the max hold detector method (see annex B) at each test frequency step initially an unmodulated test signal shall be applied. Then the test modulation shall be applied. The procedure used for identifying narrowband responses does not apply to conducted immunity tests in the frequency range 150 kHz to 80 MHz (see clause 4.4). |
| 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 [i.2]

| Harmonised Standard ETSI EN 301 489-52 | | | | |
|--|---|------------------------------|----------------------------|--|
| Requirement | | | Requirement Conditionality | |
| No | Description | Reference: Clause No | U/C | Condition |
| 1 | Enclosure of ancillary equipment measured on a stand alone basis | 7.1.1.2 and 7.2.2.2 | U | |
| 2 | DC power input/output ports | 8.3 of ETSI EN 301 489-1 [1] | C | Only where equipment has DC power input and/or output ports with a cable length greater than 3 m |
| 3 | AC mains power input/output ports | 8.4 of ETSI EN 301 489-1 [1] | C | Only where equipment has AC mains power input and/or output ports |
| 4 | Harmonic current emission (AC mains input port) | 8.5 of ETSI EN 301 489-1 [1] | C | Only where equipment has AC mains power input and/or output ports |
| 5 | Voltage fluctuations and flicker (AC mains input ports) | 8.6 of ETSI EN 301 489-1 [1] | C | Only where equipment has AC mains power input and/or output ports |
| 6 | Wired network ports | 8.7 of ETSI EN 301 489-1 [1] | C | Only where equipment has wired network ports |
| 7a | Radio frequency electromagnetic field (80 MHz to 6 000 MHz) GSM and DCS | 7.1.2 | U | For GSM and DCS |
| 7b | Radio frequency electromagnetic field (80 MHz to 6 000 MHz) UTRA and E-UTRA | 7.2.2 | U | For GSM and DCS |
| 8 | Electrostatic discharge | 9.3 of ETSI EN 301 489-1 [1] | U | |
| 9 | Fast transients common mode | 9.4 of ETSI EN 301 489-1 [1] | U | |
| 10a | Radio frequency common mode GSM and DCS | 7.1.2 | U | |
| 10b | Radio frequency common mode UTRA and E-UTRA | 7.2.2 | U | |
| 11a | Transients and Surges in a vehicular environment GSM and DCS | 7.1.2 | U | |
| 11b | Transients and Surges in a vehicular environment UTRA and E-UTRA | 7.2.2 | U | |
| 12a | Voltage dips and interruptions GSM and DCS | 7.1.2 | U | |
| 12b | Voltage dips and interruptions UTRA and E-UTRA | 9.7 of ETSI EN 301 489-1 [1] | C | Only where equipment has AC mains power input ports |
| 13 | Surges, | 9.8 of ETSI EN 301 489-1 [1] | C | Only where equipment has AC mains power input ports and/or wired network ports |

Key to columns:**Requirement:**

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

Description A textual reference to the requirement.

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

Requirement Conditionality:

U/C Indicates whether the requirement 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): CDMA Direct Spread Performance assessment voice call. Audio breakthrough

B.1 Calibration of audio levels

For the portable the audio calibration is performed as follows.

Set the EUT volume to provide the nominal audio level if specified by the manufacturer. If no such level is specified, the centre volume step shall be used.

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 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.

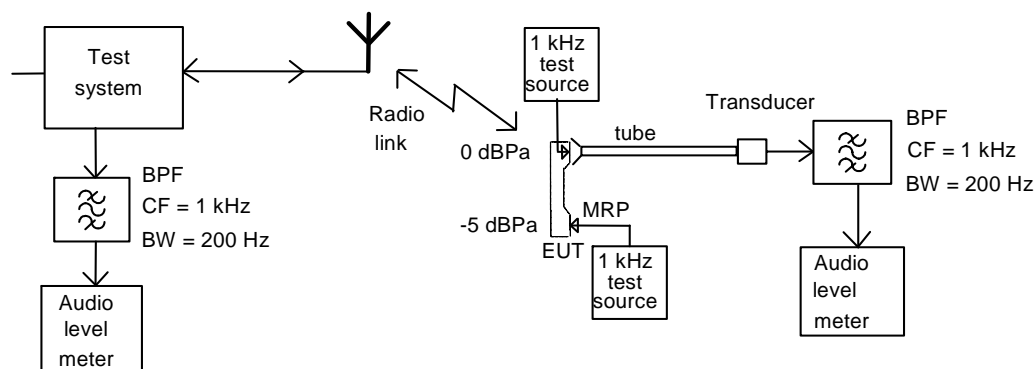
NOTE 1: The MRP is defined with respect to an artificial head defined in Recommendation ITU-T P.76 [7]. The handset should be mounted on the artificial head such that the ear piece is centred at the artificial ear.

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

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 in accordance with the manufacturer's specification. It is important that the dynamic range of the test instrumentation is not exceeded.

Normally no corrections are made to the uplink reference level. In case it is not possible to perform the above calibration (e.g. a PC card with headset) the manufacturer shall specify the distance between the MRP and the microphone.



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.

The level of the output signal from the downlink speech channel of the EUT at the mobile or portable's ear piece 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.

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.

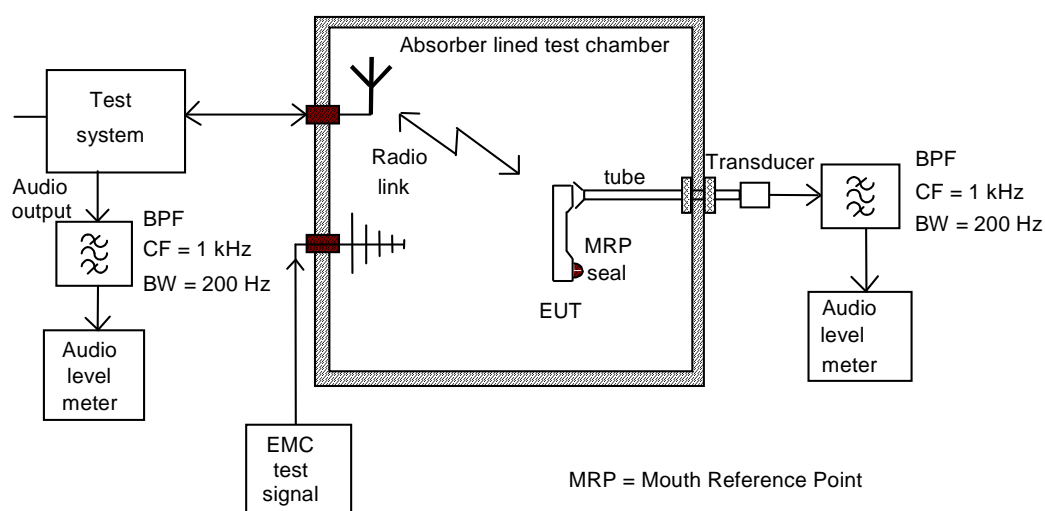


Figure B.2: Audio breakthrough measurement, test set-up for portable equipment

Annex C (normative): CDMA Direct Spread 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

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

The manufacturer shall provide the method for calculating the Error Ratio. 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 and is a manufacturer's decision (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:

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

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

C.2.2 E-UTRA. 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 by the manufacturer, if needed, to couple the Data monitoring Device by a method which does not affect the radiated electromagnetic field (e.g. ultrasonic or optical).

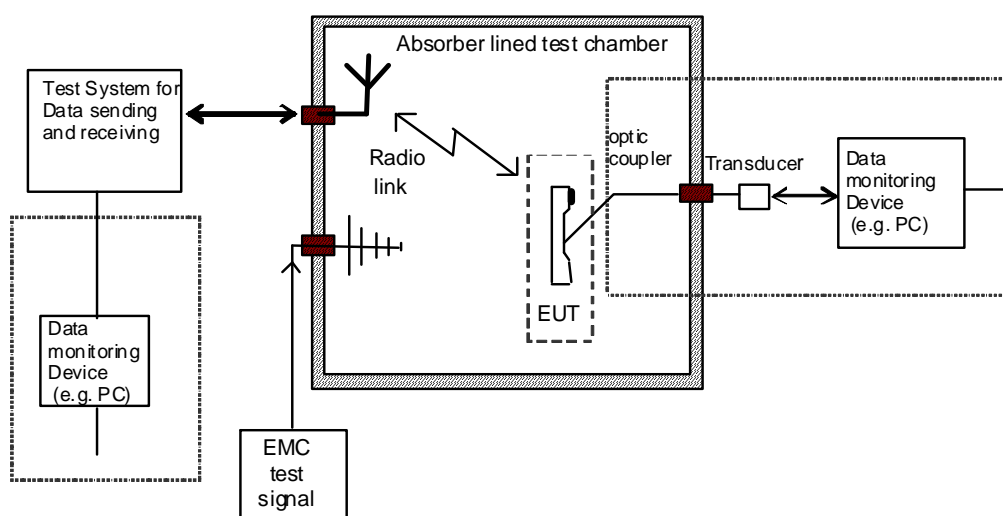


Figure C.1: Error Ratio or throughput assessment, test set-up for EUT without data application ancillary

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.

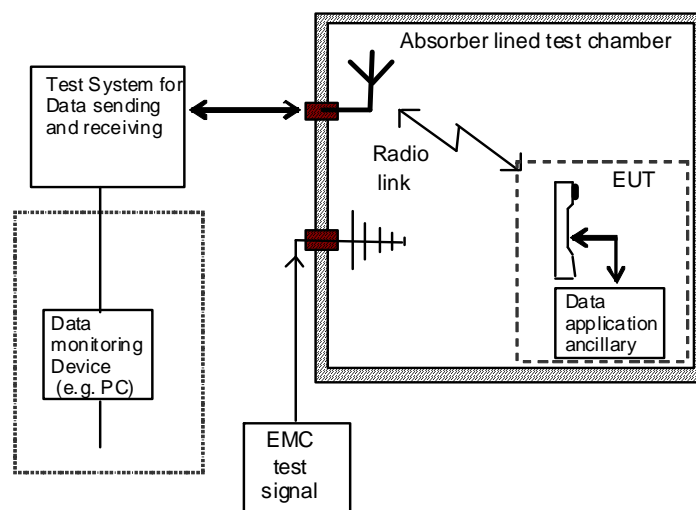


Figure C.2: Error Ratio or throughput assessment, test set-up for EUT with data application ancillary

Annex D (informative):

Examples of cellular mobile and portable radio and ancillary equipment for digital cellular radio telecommunications systems within the scope of the present document

D.1 Mobile and portable radio equipment, and ancillary equipment meeting Phase 1, Phase 2, and Phase 2+ requirements of GSM 450 MHz, 900 MHz or DCS 1 800 MHz digital cellular telecommunications system

This annex applies to Phase 1, Phase 2, and Phase 2+ GSM 900 MHz and DCS 1 800 MHz digital cellular mobile and portable radio equipment, transmitting and receiving speech and/or data, and the associated ancillary equipment. Definitions for mobile and portable radio and associated ancillary equipment within the scope of Phase 1, Phase 2, and Phase 2+ GSM 900 MHz and DCS 1 800 MHz are found in the following GSM functional radio standards:

- ETSI I-ETS 300 034-1 [12] for Phase 1 GSM 900 equipment;
- ETSI I-ETS 300 034-2 [13] for Phase 1 DCS 1800 equipment; or
- ETSI ETS 300 578 [14] for Phase 2 GSM 900 or Phase 2 DCS 1800 equipment;
- ETSI TS 100 911 [15] for Phase 2+ GSM 900 or Phase 2+ DCS 1800 equipment.

D.2 Mobile and portable radio equipment, and ancillary equipment for the IMT-2000 CDMA Direct Spread (UTRA)

This annex applies to the 3rd Generation Partnership Project (UTRA) digital cellular mobile and portable radio equipment. Definitions for mobile and portable radio and associated ancillary equipment within the scope of the 3rd Generation Partnership Project (UTRA) are found in the following functional radio specifications:

- ETSI TS 125 101 [3]: "Universal Mobile Telecommunications System (UMTS); UE Radio Transmission and Reception (FDD) (3GPP TS 25.101)".
- ETSI TS 125 102 [8] "Universal Mobile Telecommunications System (UMTS); UTRA (UE) TDD; Radio Transmission and Reception (3GPP TS 25.102)".

D.3 Mobile and portable radio equipment, and ancillary equipment for the Evolved Universal Terrestrial Radio Access (E-UTRA)

This Clause applies to the 3rd Generation Partnership Project (E-UTRA) digital cellular mobile and portable radio equipment. Definitions for mobile and portable radio and associated ancillary equipment within the scope of the 3rd Generation Partnership Project (E-UTRA) are found in the following functional radio specification:

- ETSI TS 136 101 [9]: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception (FDD)".

Annex E (informative): Change History

| Version | Information about changes |
|---------|---------------------------|
| V1.1.1 | First published version. |

History

| Document history | | | |
|-------------------------|---------------|-----------------------|---------------------------------------|
| V1.1.0 | November 2016 | EN Approval Procedure | AP 20170221: 2016-11-23 to 2017-02-21 |
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