



**ElectroMagnetic Compatibility (EMC)  
standard for radio equipment and services;  
Part 5: Specific conditions for  
Private land Mobile Radio (PMR) and  
ancillary equipment (speech and non-speech) and  
Terrestrial Trunked Radio (TETRA);  
Harmonised Standard for ElectroMagnetic Compatibility**

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**Reference**

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REN/ERM-EMC-419

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**Keywords**

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regulation, TETRA

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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 Standardisation Request deliverable Approval Procedure (SRdAP).

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.3] 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.1].

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

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
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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 the applicable test conditions, performance assessment and performance criteria technical characteristics, test methods and methods of measurement for the assessment of Private land Mobile Radio (PMR) and associated ancillary equipment, in respect of ElectroMagnetic Compatibility (EMC).

The present document covers both analogue and digital Private land Mobile Radio (PMR) equipment as well as Terrestrial Trunked Radio (TETRA).

Technical specifications related to the antenna port and emissions from the enclosure port of the equipment are outside of the scope of the present document. Such technical specifications are found in the relevant product standards for the effective use of the radio spectrum, see Table 1.

Emissions requirements in the present document are specified for frequencies above 9 kHz.

**Table 1: Radio Technologies in scope of the present document**

Technology	ETSI Standard
Land Mobile Service; Radio equipment using constant or non-constant envelope modulation operating in a channel bandwidth of 25 kHz, 50 kHz, 100 kHz or 150 kHz; Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU	ETSI EN 302 561 [i.2]
Land Mobile Service; Radio equipment with an internal or external RF connector intended primarily for analogue speech; Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU	ETSI EN 300 086 [i.4]
Land Mobile Service; Radio equipment transmitting signals to initiate a specific response in the receiver; Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU	ETSI EN 300 219 [i.5]
Land Mobile Service; Radio equipment intended for the transmission of data (and/or speech) using constant or non-constant envelope modulation and having an antenna connector; Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU	ETSI EN 300 113 [i.6]
Land Mobile Service; Radio equipment using integral antennas intended primarily for analogue speech; Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU	ETSI EN 300 296 [i.7]
Land Mobile Service; Radio equipment using an integral antenna transmitting signals to initiate a specific response in the receiver; Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU	ETSI EN 300 341 [i.8]
Land Mobile Service; Radio equipment intended for the transmission of data (and speech) and using an integral antenna; Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU	ETSI EN 300 390 [i.9]
Land Mobile Service; Radio equipment for analogue and/or digital communication (speech and/or data) and operating on narrow band channels and having an antenna connector; Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU	ETSI EN 301 166 [i.10]
TETRA radio equipment using non-constant envelope modulation operating in a channel bandwidth of 25 kHz, 50 kHz, 100 kHz or 150 kHz; Harmonised Standard for access to radio spectrum	ETSI EN 303 758 [i.11]

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

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 2: Such technical specifications are normally found in the relevant product family standards for AC mains powered equipment (e.g. EN 61000-3-2 [i.12] and EN 61000-3-3 [i.13]).

The environmental classification as per ETSI EN 301 489-1 [1] applies.

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## 2 References

### 2.1 Normative references

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

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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 EN 300 394-1 \(V3.3.1\) \(04-2015\)](#): "Terrestrial Trunked Radio (TETRA); Conformance testing specification; Part 1: Radio".
- [3] [ETSI EN 300 395-2 \(V1.3.1\) \(01-2005\)](#): "Terrestrial Trunked Radio (TETRA); Speech codec for full-rate traffic channel; Part 2: TETRA codec".
- [4] Void.
- [5] Void.

### 2.2 Informative references

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The following referenced documents may be useful in implementing an ETSI deliverable or add to the reader's understanding but are not required for conformance to the present document.

- [i.1] [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.2] ETSI EN 302 561: "Land Mobile Service; Radio equipment using constant or non-constant envelope modulation operating in a channel bandwidth of 25 kHz, 50 kHz, 100 kHz or 150 kHz; Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU".
- [i.3] [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.4] ETSI EN 300 086: "Land Mobile Service; Radio equipment with an internal or external RF connector intended primarily for analogue speech; Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU".



- [i.5] ETSI EN 300 219: "Land Mobile Service; Radio equipment transmitting signals to initiate a specific response in the receiver; Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU".
- [i.6] ETSI EN 300 113: "Land Mobile Service; Radio equipment intended for the transmission of data (and/or speech) using constant or non-constant envelope modulation and having an antenna connector; Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU".
- [i.7] ETSI EN 300 296: "Land Mobile Service; Radio equipment using integral antennas intended primarily for analogue speech; Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU".
- [i.8] ETSI EN 300 341: "Land Mobile Service; Radio equipment using an integral antenna transmitting signals to initiate a specific response in the receiver; Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU".
- [i.9] ETSI EN 300 390: "Land Mobile Service; Radio equipment intended for the transmission of data (and speech) and using an integral antenna; Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU".
- [i.10] ETSI EN 301 166: "Land Mobile Service; Radio equipment for analogue and/or digital communication (speech and/or data) and operating on narrow band channels and having an antenna connector; Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU".
- [i.11] ETSI EN 303 758: "TETRA radio equipment using non-constant envelope modulation operating in a channel bandwidth of 25 kHz, 50 kHz, 100 kHz or 150 kHz; Harmonised Standard for access to radio spectrum".
- [i.12] EN 61000-3-2: "Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current  $\leq 16$  A per phase)", (produced by CEN).
- [i.13] EN 61000-3-3: "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  $\leq 16$  A per phase and not subject to conditional connection", (produced by CEN).

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## 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.

**antenna port:** port, for connection of an antenna used for intentional transmission and/or reception of radiated RF energy

**base station:** radio equipment intended for operation at a fixed location which is not defined as portable equipment

**continuous phenomena (continuous disturbance):** electromagnetic disturbance, the effects of which on a particular device or equipment cannot be resolved into a succession of distinct effects

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

**enclosure port:** physical boundary of the equipment through which electromagnetic fields may radiate or impinge

**hand portable station:** equipment either fitted with an antenna connector or integral antenna, or both, normally used a stand-alone basis, to be carried on a person or held in the hand

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

## 3.2 Symbols

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

$P_{min}$  minimum power required to establish a communication link

## 3.3 Abbreviations

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

BER	Bit Error Ratio
CR	Continuous phenomena applied to Receivers
CT	Continuous phenomena applied to Transmitters
EUT	Equipment Under Test
PMR	Private land Mobile Radio
TETRA	TErrestrial TRunked RAdio
TR	Transient phenomena applied to Receivers
TT	Transient phenomena applied to Transmitters

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# 4 Test conditions

## 4.1 General

For the purposes of the present document, the test conditions of ETSI EN 301 489-1 [1], clause 4 shall apply with the following additions. Further product related test conditions for PMR and TETRA equipment are specified in the present document.

## 4.2 Arrangements for test signals

### 4.2.1 Arrangements for test signals at the input of transmitters

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

### 4.2.2 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 modification.

The transmitter shall be operated at its maximum rated RF output power, modulated with normal test modulation (see clause 4.5).

### 4.2.3 Arrangements for test signals at the input of receivers

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

A communication link shall be established at the start of the test and maintained during the test.

The level of the wanted RF input signal shall be 40 dB above the  $P_{min}$  for the EUT. For radiated immunity testing this input level is measured while the power amplifiers generating the EM disturbance are switched on, but without excitation.

NOTE: A simple method to establish the required communication link is establish link, reduce power to point of link failure then increase by 40 dB.

### 4.2.4 Arrangements for test signals at the output of receivers

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

### 4.2.5 Arrangements for testing transmitter and receiver together (as a system)

The provisions of ETSI EN 301 489-1 [1], clause 4.2.5 shall apply with the following modification.

For the immunity tests of duplex transceivers, the EUT may be configured in the repeater mode, consistent with the conditions given above.

## 4.3 Exclusion bands

### 4.3.1 Transmitter exclusion band

The exclusion band shall extend 250 % of the channel width either side of the transmitter centre frequency.

### 4.3.2 Receiver and receivers of transceivers exclusion band

The exclusion band for receivers and receivers of transceivers is the frequency range determined by the switching range extended as follows:

- the lower frequency of the exclusion band is the lower frequency of the switching range, minus 5 % of the centre frequency of the switching range, or minus 10 MHz, whichever will result in the lowest frequency;
- the upper frequency of the exclusion band is the upper frequency of the switching range, plus 5 % of the centre frequency of the switching range, or plus 10 MHz, which ever will result in the highest frequency.

The switching range is the maximum frequency range over which the receiver can be operated without reprogramming or realignment.

NOTE: The receiver exclusion band range aligns with the blocking test range.

## 4.4 Narrow band responses of receivers

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

If during the test the immunity RF test signal causes non-compliance of the receiver with the specified performance criteria (see clause 6), it is necessary to evaluate whether this non-compliance is due to a narrow band response or a wideband phenomenon. Therefore, the frequency of the test signal is increased by an amount equal to twice the nominal 6 dB bandwidth of the IF filter immediately preceding the demodulator of the receiver, or the bandwidth over which the equipment is intended to operate. The test is repeated with the frequency of the test signal decreased by the same amount. If the receiver is then in either or both frequency offset cases in compliance with the specified performance criteria, the response is considered as a narrow band response. If the receiver still does not comply with the specified performance criteria, this can 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 an increase and decrease of the frequency of the test signal adjusted two and a half times the bandwidth referred to above. If the receiver still does not comply with the specified performance criteria in either or both frequency offset cases, the phenomena is considered wide band and therefore an EMC problem and the equipment fails the test.

For immunity tests, narrow band responses shall be disregarded.

## 4.5 Normal test modulation

### 4.5.1 General

The test signal generator (modulation) shall be able to produce a continuous stream of data or a repetitive message.

The test signal receiver (de-modulator) shall be, able to produce a readout of Bit Error Ratio (BER) of a continuous data stream or a repetitive readout of message acceptance.

### 4.5.2 Analogue speech equipment

#### 4.5.2.1 Angle modulated equipment

- The receiver wanted input signal shall be set to the nominal frequency of the receiver modulated with a sinusoidal audio frequency of 1 000 Hz to a deviation of 60 % peak system.
- The transmitter of the EUT shall be modulated with a sinusoidal audio frequency of 1 000 Hz at a deviation of 60 % peak system deviation.

#### 4.5.2.2 Non-angle modulated equipment

- The receiver wanted input signal shall be set to the nominal frequency of the receiver suitably modulated with a sinusoidal audio frequency of 1 000 Hz, which represents normal operation.
- The transmitter of the EUT shall be modulated with a sinusoidal audio frequency of 1 000 Hz, which represents normal operation.
- Details concerning the modulation used shall be recorded in the test report.

### 4.5.3 Digital speech equipment

- The receiver wanted input signal shall be set to the nominal frequency of the receiver modulated with a test signal which represents normal operation.
- The transmitter shall be modulated with a test signal which represents normal operation.
- Details concerning the modulation used shall be recorded in the test report.

### 4.5.4 Non-speech equipment (data, specific response, etc.)

- The receiver wanted input signal shall be set to the nominal frequency of the receiver modulated with a test signal which represents normal operation.
- The transmitter shall be modulated with a test signal which represents normal operation.

- Details concerning the modulation used shall be recorded in the test report.

#### 4.5.5 TETRA equipment

The receiver wanted input signal shall be set to a frequency in the middle of the operating band of the receiver modulated with one of the test signals listed below, the transmitter shall be set to a frequency in the middle of the operating band of the transmitter modulated with one of the test signals listed below:

- for equipment capable of speech operation, a speech traffic channel (TETRA TCH/S) in accordance with all clauses of ETSI EN 300 395-2 [3] representing a 1 020 Hz tone at a level of 17 dB below peak level;
- for non-speech V+D or DMO equipment, a T1 TCH/7.2 test signal in accordance with clause 5.3 of ETSI EN 300 394-1 [2];
- for non-speech V+D or DMO equipment, a T1 SCH/F test signal in accordance with clause 5.3 of ETSI EN 300 394-1 [2];
- for equipment capable of speech operation speech traffic channel (TETRA TCH/S) in accordance with all clauses of ETSI EN 300 395-2 [3] representing silence;
- for speech and/or data equipment connected to ancillary equipment intended for data operation, or connected to ancillary equipment which can be directly connected to a data application, the method of BER or MER measurement shall be agreed between the test house and the manufacturer.

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## 5 Performance assessment

### 5.1 Ancillary equipment

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

### 5.2 Performance assessment of equipment providing an audio path

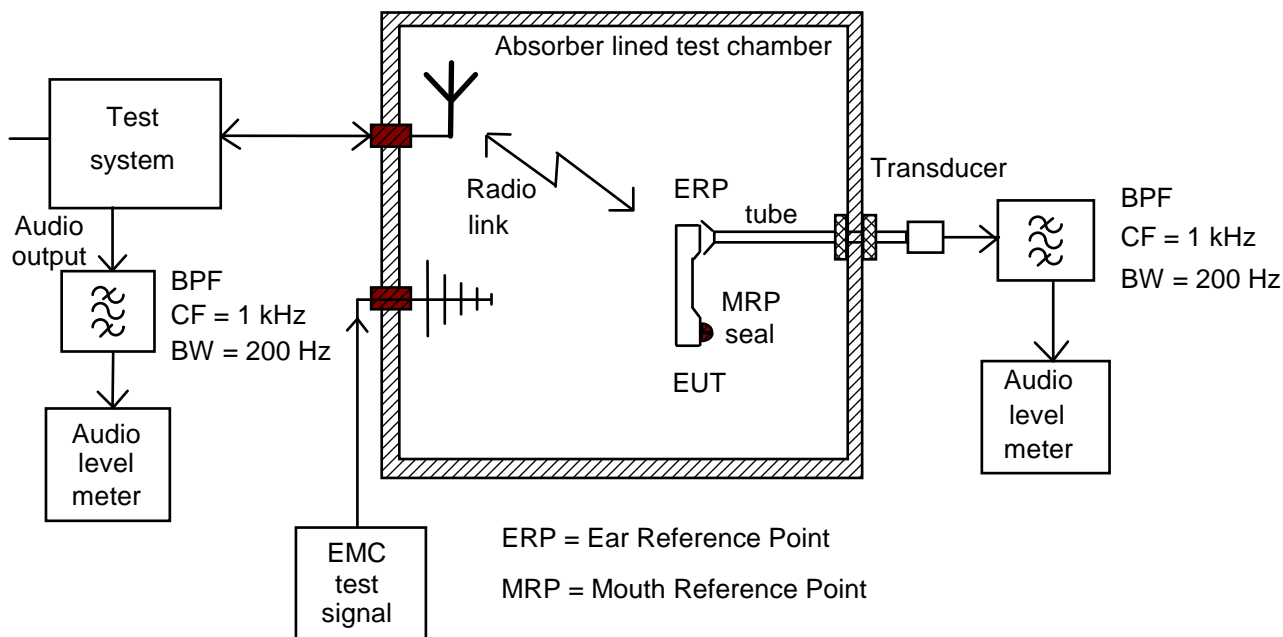
#### 5.2.1 Assessment of audio path using the audio breakthrough method

This test only applies to equipment with audio capability. The audio paths shall be enabled.

A communication link shall be set up with a suitable PMR/TETRA transceiver system simulator, or test set (hereafter called "the test system").

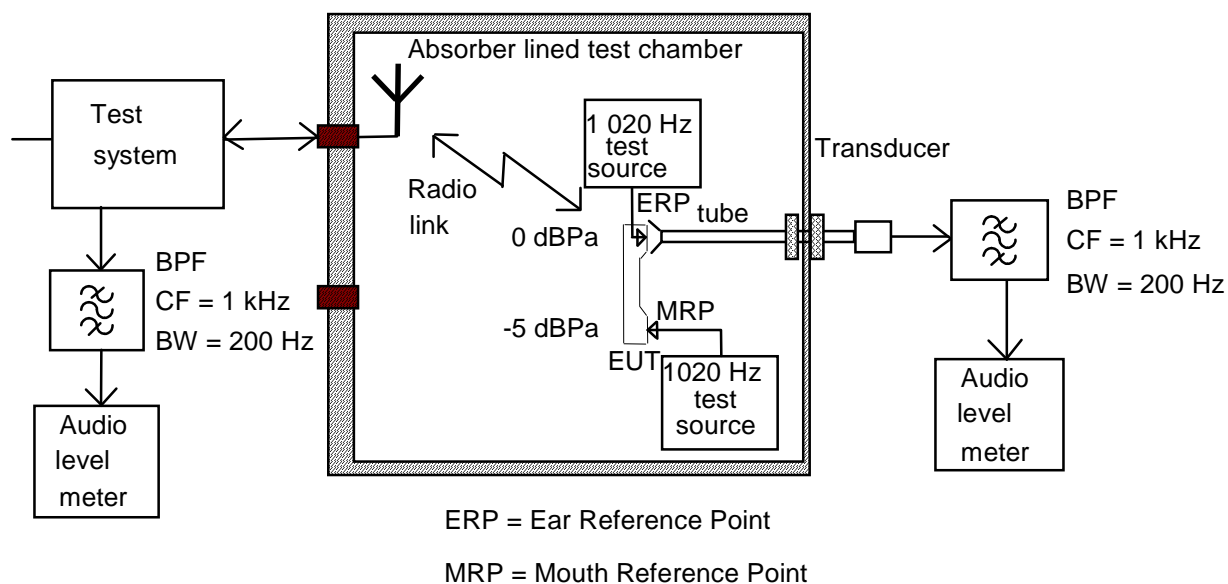
When the EUT is required to be in the transmit/receive mode, the following conditions shall be met:

- The EUT shall be set to operate at maximum transmit power.
- 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 2. The reference level shall be equivalent to 0 dBPa at 1 020 Hz at the Ear Reference Point (ERP), or +5,0 dBPa at the loudspeaker for the downlink and -5 dBPa at 1 020 Hz at the Mouth Reference Point (MRP), or the microphone for the uplink.
- The level of the output signal from the EUT's downlink speech channel at the mobile or portable's earpiece shall be assessed by measuring the Sound Pressure Level (SPL) as shown in Figure 1.
- The level of the recovered audio output signal of the test system from the EUT's uplink speech channel shall be measured. Pick up of extraneous background noise by the EUT's microphone shall be minimized.



NOTE: In the case of a mobile equipment the ERP can be the loudspeaker, and the MRP the microphone.

**Figure 1: Audio breakthrough measurement, test set-up**



NOTE 1: The EUT is in position during calibration of the uplink, but not during calibration of the downlink.

NOTE 2: Where the EUT has a loudspeaker the reference level shall be equivalent to +5,0 dBPa at 1 020 Hz.

**Figure 2: Audio breakthrough measurement, calibration set-up**

## 6 Performance criteria

### 6.0 General

The equipment shall meet the minimum performance criteria as specified in clauses 6.1, 6.2, 6.3 and 6.4.

The establishment of the communication link at the start of the test, its maintenance and the assessment of the recovered signal are used as the performance criteria for the evaluation of the essential functions of the equipment during and after the test.

The performance specification shall be included in the test report and the product description and documentation.

## 6.1 Performance criteria for Continuous phenomena applied to Transmitters (CT)

### 6.1.0 Introduction

For speech equipment the EUT shall comply with the audio breakthrough and audio link requirement (see clause 6.1.1.1).

Non-speech equipment shall comply with the non-audio test criteria (see clause 6.1.2).

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 during the test.

Where the EUT is a transmitter only and can be operated in standby mode, tests shall be repeated with the EUT in this mode to ensure that unintentional transmission does not occur.

### 6.1.1 Audio test criteria

#### 6.1.1.0 General

EUT functionality with the exception of analogue speech (where implemented) shall comply with the audio breakthrough, and audio link requirement (see clause 6.1.1.1). Analogue speech functionality shall comply with the audio signal distortion requirement (see clause 6.1.1.2)

#### 6.1.1.1 Audio breakthrough requirement

For details see clause 5.2.1. During the immunity tests, the observed uplink and downlink speech output levels shall be at least 35 dB less than the previously recorded reference level, when measured through an audio band pass filter of 200 Hz width, centred on 1 kHz.

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

Audio link test:

- During the audio breakthrough test the speech channel shall maintain its functionality and shall not be accidentally muted because of exposure to EMC phenomena. The test may be made either as a separate test or integrated in the audio breakthrough test by adding at each testpoint an extra measurement of the transfer function of an imposed audio signal. The precise implementation method is to be documented by the laboratory.

#### 6.1.1.2 Audio signal distortion requirement

For speech equipment, the distortion of the audio signal shall be measured during each individual exposure in the test sequence and shall not exceed 25 % measured in a post detection bandwidth determined by a first order band pass filter with a 3 dB bandwidth of 300 Hz to 3 kHz, without the use of psophometric weighting filter.

For equipment which can be measured using continuous bit streams, a bit error shall not exceed  $1 \times 10^{-2}$ .

For other non-speech equipment four messages out of five or 90 % of the transmitted symbols shall be received correctly.

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 during the test.

Where the EUT is a transmitter only and can be operated in standby mode, tests shall be repeated with the EUT in this mode to ensure that unintentional transmission does not occur.

### 6.1.2 Non-audio test criteria

For equipment which can be measured using continuous bit streams, a bit error shall not exceed  $1 \times 10^{-2}$ .

For other non-speech equipment four messages out of five or 90 % of the transmitted symbols shall be received correctly.

## 6.2 Performance criteria for Transient phenomena applied to Transmitters (TT)

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 critical stored data and the communication link shall have been maintained during the test.

Where the EUT is a transmitter only and can be operated in standby mode, tests shall be repeated with the EUT in this mode to ensure that unintentional transmission does not occur.

## 6.3 Performance criteria for Continuous phenomena applied to Receivers (CR)

### 6.3.0 Introduction

For speech equipment the EUT shall comply with audio test criteria (see clause 6.3.1).

Non-speech equipment shall comply with the non-audio test criteria (see clause 6.3.2).

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 during the test.

Where the EUT is a transmitter only and can be operated in standby mode, tests shall be repeated with the EUT in this mode to ensure that unintentional transmission does not occur.

### 6.3.1 Audio test criteria

#### 6.3.1.0 General

EUT functionality with the exception of analogue speech (where implemented) shall comply with the audio breakthrough, and audio link requirement (see clause 6.3.1.1). Analogue speech functionality shall comply with the audio signal distortion requirement (see clause 6.3.1.2)

#### 6.3.1.1 Audio breakthrough test

For details see clause 5.2.1. During the immunity tests, the observed uplink and downlink speech output levels shall be at least 35 dB less than the previously recorded reference level, when measured through an audio band pass filter of 200 Hz width, centred on 1 kHz.

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

Audio link test:

- During the audio breakthrough test the speech channel shall maintain its functionality and shall not be accidentally muted because of exposure to EMC phenomena. The test may be made either as a separate test or integrated in the audio breakthrough test by adding at each testpoint an extra measurement of the transfer function of an imposed audio signal. The precise implementation method is left to the test laboratory.



### 6.3.1.2 Audio signal distortion requirement

For speech equipment, the distortion of the audio signal shall be measured during each individual exposure in the test sequence and shall not exceed 25 % measured in a post detection bandwidth determined by a first order band pass filter with a 3 dB bandwidth of 300 Hz to 3 kHz, without the use of psophometric weighting filter.

For equipment which can be measured using continuous bit streams, the bit error rate shall not exceed  $10^{-2}$ .

For other non-speech equipment four messages out of five or 90 % of the transmitted symbols shall be received correctly.

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 during the test.

Where the EUT is a transceiver, under no circumstances shall the transmitter operate unintentionally during the test.

### 6.3.2 Non-audio test criteria

For equipment which can be measured using continuous bit streams, the bit error rate shall not exceed  $10^{-2}$ .

For other non-speech equipment four messages out of five or 90 % of the transmitted symbols shall be received correctly.

## 6.4 Performance criteria for Transient phenomena applied to Receivers (TR)

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 critical stored data and the communication link shall have been maintained during the test.

Where the EUT is a transceiver, under no circumstances shall the transmitter operate unintentionally during the test.

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## 7 Applicability overview

### 7.1 Emission

#### 7.1.1 General

Table 2 contains the applicability of EMC emission requirements to the relevant ports of radio and/or associated ancillary equipment.

**Table 2: Emission requirements**

Phenomenon	Port	Applicability			Reference clause
		Fixed-Use	Vehicle Use	Portable Use	
Radiated emission	Enclosure port of ancillary equipment	applicable	applicable	applicable	ETSI EN 301 489-1 [1], clause 8.2
Conducted emission	DC power input/output port	applicable (see note)	applicable (see note)	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 (see note)	not applicable	not applicable	ETSI EN 301 489-1 [1], clause 8.7
NOTE: The cable supported is considered shorter than 3 meters when, the port type does not support cables longer than 3 meters or the installation guide clearly forbids connecting cables longer than 3 meters.					

NOTE: Radiated emissions from the enclosure port as well as conducted emissions from the RF port are out of scope of the present document, as they are within the scope of the applicable article 3.2 radio standard of the RED [i.1].

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.

## 7.1.2 Special conditions

No special conditions for emissions shall apply to equipment in the scope of the present document.

## 7.2 Immunity

### 7.2.1 General

Table 3 contains the applicability of EMC immunity requirements to the relevant ports of radio and/or associated ancillary equipment.

**Table 3: Immunity requirements**

Phenomenon	Port	Applicability			Reference clause	Performance criteria clause
		Fixed-Use	Vehicle Use	Portable Use		
RF electromagnetic field (80 MHz to 6 000 MHz)	Enclosure port (TETRA)	applicable	applicable	applicable	7.2.2	6.1, 6.3
RF electromagnetic field (80 MHz to 6 000 MHz)	Enclosure port (PMR)	applicable	applicable	applicable	ETSI EN 301 489-1 [1], clauses 9.2.1 and 9.2.2	6.1, 6.3
Electrostatic discharge	Enclosure	applicable	not applicable	applicable	ETSI EN 301 489-1 [1], clauses 9.3.1 and 9.3.2	6.2, 6.4
Fast transients common mode	Signal, wired network and control ports, DC and AC power ports	applicable (see note)	not applicable	not applicable	ETSI EN 301 489-1 [1], clauses 9.4.1 and 9.4.2	6.2, 6.4
RF common mode 0,15 MHz to 80 MHz	Signal, wired network and control ports, DC and AC power ports (TETRA)	applicable (see note)	not applicable	not applicable	7.2.2	6.1, 6.3
RF common mode 0,15 MHz to 80 MHz	Signal, wired network and control ports, DC and AC power ports (PMR)	applicable (see note)	not applicable	not applicable	ETSI EN 301 489-1 [1], clauses 9.5.1 and 9.5.2	6.1, 6.3
Vehicular transients and surges	DC power input Ports	not applicable	applicable	not applicable	ETSI EN 301 489-1 [1], clauses 9.6.1 and 9.6.2	6.2, 6.4

Phenomenon	Port	Applicability			Reference clause	Performance criteria clause
		Fixed-Use	Vehicle Use	Portable Use		
Voltage dips and interruptions	AC mains power input ports	applicable	not applicable	not applicable	ETSI EN 301 489-1 [1], clauses 9.7.1 and 9.7.2	6.2, 6.4
Surges, line to line and line to ground	AC mains power input ports, wired network ports	applicable	not applicable	not applicable	ETSI EN 301 489-1 [1], clauses 9.8.1 and 9.8.2	6.2, 6.4
NOTE: The cable supported is considered shorter than 3 meters when, the port type does not support cables longer than 3 meters or the installation guide clearly forbids connecting cables longer than 3 meters.						

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 4, relate to the immunity test methods and performance criteria used in ETSI EN 301 489-1 [1], clause 9 shall apply to TETRA equipment only.

**Table 4: Special conditions for EMC immunity tests for TETRA equipment**

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
<b>9.2.2: Test method; Radio frequency electromagnetic field</b>	<ul style="list-style-type: none"> <li>the test signal shall be amplitude modulated to a depth of 80 % by a sinusoidal audio signal of 1 020 Hz;</li> <li>the test shall be carried out on one surface. The surface selected to face the source of the interference signal shall be the one anticipated by the test house to be the most susceptible. The selected surface shall be recorded in the test report.</li> </ul>
<b>9.5.2: Test method; Radio frequency, common mode</b>	<ul style="list-style-type: none"> <li>the test signal shall be amplitude modulated to a depth of 80 % by a sinusoidal audio signal of 1 020 Hz.</li> </ul>

## 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.3] 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.1].

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

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

Harmonised Standard ETSI EN 301 489-5					
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 stand alone basis	3.1(b)	7.1	U	
2	Emissions: DC power input/output ports	3.1(b)	7.1	C	Only applies for fixed-use and vehicular-use equipment where the equipment has DC power input and/or output ports with a cable length greater than 3 meters or from a vehicle power supply.
3	Emissions: AC mains power input/output ports	3.1(b)	7.1	C	Only applies for fixed-use equipment where the equipment has AC mains power input and/or output ports.
4	Emissions: Wired network ports	3.1(b)	7.1	C	Only applies for fixed-use equipment where the equipment has wired network ports supporting cables longer than 3 meters.
5	Immunity: Radio frequency electromagnetic field (80 MHz to 6 000 MHz)	3.1(b)	7.2	U	
6	Immunity: Electrostatic discharge	3.1(b)	7.2	C	Only applies for fixed-use and portable-use equipment.
7	Immunity: Fast transients common mode	3.1(b)	7.2	C	Only applies for fixed-use equipment.
8	Immunity: Radio frequency common mode	3.1(b)	7.2	C	Only applies for fixed-use equipment with DC power ports supporting cables longer than 3 meters and with any AC power ports.
9	Immunity: Transients and surges in the vehicular environment	3.1(b)	7.2	C	Only applies where the equipment is fitted to a vehicle power supply.
10	Immunity: Voltage dips and interruptions	3.1(b)	7.2	C	Only applies for fixed-use equipment where the equipment has AC mains power input ports.
11	Immunity: Surges, line to line and line to ground	3.1(b)	7.2	C	Only applies for fixed-use equipment where the equipment has AC mains power input ports and/or wired network ports.
NOTE: The cable supported is considered shorter than 3 meters when, the port type does not support cables longer than 3 meters or the installation guide clearly forbids connecting cables longer than 3 meters.					

**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.

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Annex B:  
Void

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## Annex C (informative): Information supplied to the test laboratory

### C.1 Information to be supplied

The manufacturer should, at the time of submission of the equipment for test, supply the following information to be recorded in the test report:

- the intended use and performance of the radio equipment which should be in accordance with the user documentation;
- the user control functions and stored data that are required for intended use and the method to be used to assess whether these have been lost after the EMC exposure;
- the type of modulation (also known as "normal test modulation"), the characteristics of the transmission used for testing (random bit stream, message format, etc.) and the necessary test equipment delivered to enable the assessment of the EUT;
- the ancillary equipment to be combined with the radio equipment for testing (where applicable);
- an exhaustive list of ports, with the maximum cable lengths allowed, classified as either power or telecommunication/signal/control. Power ports should further be classified as AC or DC power;
- the operating frequency band(s) over which the equipment is intended to operate;
- any equipment thermal limitation which prevents continuous testing of the EUT;
- the climatic environment(s) in which the equipment is intended to be used;
- the occupied bandwidth of the corresponding transmitter signal for non-channelized equipment.

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Annex D:  
Void



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## Annex E (informative): Change history

Version	Information about changes
2.2.1	Addition of TETRA requirements to the DMR EMC standard Extension of radiated immunity test range from 80 MHz - 2 700 MHz to 80 MHz - 6 000 MHz Alignment of text with requirements of the standardisation request for article 3.1(b) of the RED.
2.2.7	Alignment with EN 301 489-1 V2.2.3 and other parts of EN 301 489 series that have been cited under RED.

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## History

Document history		
V1.2.1	August 2000	Publication
V1.3.1	August 2002	Publication
V2.1.1	November 2016	Publication
V2.2.1	April 2019	Publication
V2.2.8	September 2024	SRdAP process EV 20241212: 2024-09-13 to 2024-12-12
V2.2.9	May 2025	SRdAP process VA 20250715: 2025-05-16 to 2025-07-15