



**~~Electromagnetic compatibility  
and Radio spectrum Matters (ERM);  
ElectroMagnetic Compatibility (EMC)~~  
standard for radio equipment and services;  
Part 15: Specific conditions for commercially available  
amateur radio equipment;  
Harmonised Standard covering the essential requirements of  
article 3.1(b) of the Directive 2014/53/EU**

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Reference

REN/ERM-EMC-344

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## Foreword

This ~~Candidate Harmonized~~ Harmonised European Standard (~~Telecommunications series~~ EN) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM).

The present document has been ~~produced by ETSI in response to a mandate from the European Commission issued prepared under Council Directive 98/34/EC~~ the Commission's standardisation request C(2015) 5376 final [i.4] (as amended) laying down a procedure for the provision to provide one voluntary means of information in the field conforming to the essential requirements of technical standards and regulations.

~~The present document is intended to become a Harmonized Standard, the reference of which will be published in the Official Journal of the European Communities referencing the Council Directive~~ Directive 2014/53/EU on the approximation harmonisation of the laws of the Member States relating to electromagnetic compatibility ("the EMC Directive") (89/336/EEC [3] as amended) and Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 the making available on the market of radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity ("the R&TTE Directive" [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 15 of a multi-part deliverable. Full details of the entire series can be found in part 1 [41].

### National transposition dates

Date of adoption of this EN:	21 July 2016
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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).

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

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# 1 Scope

The present document, together with [ETSI EN 301 489-1 \[1\]](#), covers the assessment of commercially available amateur radio equipment, and associated ancillary equipment, in respect of ElectroMagnetic Compatibility (EMC).

Technical specifications related to the antenna port and emissions from the enclosure port of commercially available amateur radio equipment are not included in the present document. Such technical specifications are found in the relevant product standard [ETSI EN 301 783 \[i.2\]](#) for the effective use of the radio spectrum.

The present document specifies the applicable EMC tests, the methods of measurement, the limits and the performance criteria for radio equipment intended for use by radio amateurs within the meaning of article 1, definition 53 of the Radio Regulations [i.3] and associated ancillary equipment, which is commercially available.

Examples of amateur radio equipment covered by the present document are given in annex [A](#).

The provisions of the present document apply to amateur radio equipment manufactured commercially either as ready-to-use equipment, modules, or components having an intrinsic functionality for the customer.

The expression "amateur radio equipment" in the context of the present document is taken to mean "commercially available amateur radio equipment" only.

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.

The environment 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. The applicable environments referred to in [ETSI EN 301 489-1 \[1\]](#) where equipment covered by the scope of the present document may be used, ~~shall~~ are to be declared by the manufacturer.

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## 2 References

### 2.1 Normative references

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

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

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

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

- [1] [ETSI EN 301 489-1 \(V2.1.1\) \(11-2016\): "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 Directive 2014/53/EU and the essential requirements of article 6 of Directive 2014/30/EU"](#).

### 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 EN 301 489-1: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements".~~
- [2] ~~Directive 1999/5/EC2014/53/EU of the European Parliament and of the Council of 9 March 199916 April 2014 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (R&TTE Directive).~~
- [3] ~~Council Directive 89/336/EEC of 3 May 1989 on the approximationthe harmonisation of the laws of the Member States relating to electromagnetic compatibility (EMC Directive);the making available on the market of radio equipment and repealing Directive 1999/5/EC.~~
- [i.2] ~~Directive 98/34/EC of the European Parliament and of the Council of 22 June 1998 laying down a procedure for the provision of information in the field of technical standards and regulations.~~
- [1] ETSI EN 301 783: "Commercially available amateur radio equipment; Harmonised standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU".
- [i.3] ITU Radio Regulations.
- [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, symbols and abbreviations and symbols

### 3.1 Definitions

For the purposes of the present document, the terms and definitions given in ETSI EN 301 489-1 [1], clause 3 and the following apply:

**maximum usable sensitivity:** minimum receiver Radio Frequency (RF) input signal level or field strength able to produce a specified analogue SINAD ratio or Bit Error Ratio (BER), or other specified output performance which depends on this input signal level

**multimode equipment:** amateur radio equipment capable of being used in several modes of operation, such as AM, FM, SSB

### 3.2 AbbreviationsSymbols

For the purposes of the present document, the symbols given in ETSI EN 301 489-1 [1], clause 3 and the following apply:

<u>F<sub>b</sub></u>	<u>skirt bandwidth</u>
<u>F<sub>c</sub></u>	<u>centre frequency of the transmitter necessary bandwidth</u>
<u>F<sub>n</sub></u>	<u>necessary bandwidth</u>

### 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI EN 301 489-1 [1], clause 3 and the following apply:

AM	Amplitude Modulation
BER	Bit Error Ratio
DSB-SC	Double SideBand Suppressed Carrier



EMC	ElectroMagnetic Compatibility
ESD	ElectroStatic Discharge
EUT	Equipment Under Test
FM	Frequency Modulation
HF	High Frequency
PEP	Peak Envelope Power
<del>RF</del>	<del>Radio Frequency</del>
SINAD	Ratio of (Signal + Noise + Distortion) to (Noise + Distortion)
<del>RF</del>	<del>Radio Frequency</del>
SSB	Single SideBand
UHF	Ultra High Frequency
VHF	Very High Frequency

### 3.3 Symbols

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

<del><math>F_b</math></del>	<del>skirt bandwidth</del>
<del><math>F_c</math></del>	<del>centre frequency of the transmitter necessary bandwidth</del>
<del><math>F_n</math></del>	<del>necessary bandwidth</del>

## 4 Test conditions

### 4.0 Introduction

For the purposes 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 amateur radio and ancillary equipment are specified in the present document.

### 4.1 General

For emission and immunity tests, the test modulation, test arrangements, etc., as specified in the present document, clauses 4.1 to 4.5, shall apply.

The general test conditions for amateur radio equipment are as follows:

- transmitters and amplifiers shall be tested in stand-by (if applicable) and in transmit mode of operation;
- transceivers and transverters shall be tested in receive, stand-by, and transmit mode of operation;
- if integral antenna equipment provides an internal antenna connector for testing purposes, then the tests can be made via that connector.

The manufacturer shall recommend a power supply (e.g. an AC/DC power adapter) for use in conjunction with the equipment under test (EUT), to ensure satisfactory operation of the combination during the EMC tests. When a range of different types of power supply units can be used with several types of that manufacturer's radio equipment, then each type of power supply unit shall be tested with the radio providing the highest RF output Peak Envelope Power (PEP). These power supply units shall then be listed as preferred items for future generations of that manufacturer's radio equipment.

The EMC tests shall be performed with the EUT set to the following operation frequencies:

single-band equipment:

- test with the operation frequency set to the centre of the operation frequency band;

double-band equipment:

- test with the operation frequency set in sequence to the centre of each operation frequency band;

HF multiband equipment or VHF/UHF multiband equipment:

- test with the operation frequency set in sequence to the centre of the lowest, middle, and highest HF operation frequency band;

HF/VHF, HF/UHF, or HF/VHF/UHF combined equipment:

- test with the operation frequency set in sequence to the centre of the lowest HF band, the middle HF band, the highest HF band, the lowest VHF/UHF band, the middle VHF/UHF band, and the centre of the highest VHF/UHF band.

## 4.2 Arrangements for test signals

### 4.2.0 Introduction

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

### 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 with the following modifications.

If possible, the transmitter should be modulated with a suitable signal, from an internal or external signal source. If it is not appropriate to get a modulated RF signal from the transmitter, then the tests may be performed using its unmodulated carrier.

It shall be possible to verify that a communications link is established and maintained.

### 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 modifications.

The transmitter under test shall be modulated such that the maximum PEP output is achieved, either by single or multiple tones, or by a suitable bit stream, or in case of transmitters for other than analogue voice or data transmission, by a test modulation representative of normal use (see also clause 4.5). The manufacturer shall declare the normal test modulation.

Where thermal limitations prevent continuous transmission under such conditions, the tests may be performed using gated methods. Under these circumstances, the test method used shall be recorded in the test report.

### 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 modifications.

The receiver shall be provided with a wanted RF input signal chosen according to clause 4.1.1 set to its operation frequency, and modulated with a suitable modulation signal fitting the communication system characteristics (see clause 4.5.2). If it is not appropriate to provide the receiver with a modulated wanted RF input signal, the test may be performed using an unmodulated wanted RF input signal.

If possible, the wanted RF input signal to establish a communications link shall be presented to the antenna connector by a coaxial cable. The wanted RF input signal shall be set to a nominal value of 60 dB (or a lower value as declared by the manufacturer) above the maximum usable sensitivity of the EUT, as declared by the manufacturer in the product documentation.

It shall be possible to verify that a communications link is established and maintained.

### 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.

These arrangements are only applicable for duplex transceivers. The wanted RF input signal, coupled to the receiver, shall be modulated with a suitable test signal (see clause 4.5.3). The transmitter shall be operated at its maximum PEP RF output, modulated with the test signal, coupled to the transmitter from the output of the receiver (repeater mode).

## ~~4.3 Exclusion bands~~

### 4.3 RF exclusion band of radio communications equipment

#### 4.3.0 General

The provisions of ETSI EN 301-489-1 [1], clause 4.3 shall apply.

#### ~~4.3.1 Receiver and~~ Exclusion band for receivers or the receiver part of transceivers ~~exclusion band~~

The exclusion band for a receiver and the receiver part of a transceiver is determined by the characteristics of the equipment.

For receivers operating on a fixed single frequency, the exclusion band extends from -5 % to +5 % of that fixed single operation frequency.

For receivers operating, or capable of operating, on a number of spot frequencies in a narrow operating frequency band which is less than 20 % of the centre frequency of the operating band, the exclusion band extends from -5 % of the lowest frequency of the narrow operating frequency band to +5 % of the highest frequency of that band.

For receivers operating, or capable of operating on a number of spot frequencies over a wide frequency band, the exclusion band for each of the wanted RF signal test frequencies shall extend from -5 % to +5 % of each wanted RF signal test frequency.

#### ~~4.3.2 Transmitter exclusion band~~

NOTE: The exclusion bands are derived using different methodologies from those described in clause 4.3.3 of ETSI EN 301 489-1 [1]. However, the used methodologies lead to narrow exclusion bands for every amateur radio frequency band. The parameter n in the formulas derived in ETSI EN 301 489-1 [1] calculates in any case smaller than 1.

### 4.3.2 Exclusion band for transmitters or the transmitter part of transceivers

#### 4.3.2.1 Exclusion band for EMC emission measurements

For EMC emission measurements, the exclusion band for transmitters shall be determined considering the class of emission characteristics of the EUT. For EMC emission measurement purposes, the bandwidth of the exclusion band shall additionally allow for the skirt bandwidth ( $F_b$ ) of the measuring instrumentation, as shown in table 1.

**Table 1: Transmitter exclusion band for emissions**

Necessary bandwidth of emission	Exclusion band	Centre of the exclusion band
$F_n < 0,05 F_c$	$3 F_n + F_b$	$F_c$
$F_n > 0,05 F_c$	$1,1 F_n + F_b$	$F_c$

Where:

- $F_n$  = necessary bandwidth of the wanted class of emission as defined in ITU Radio Regulations [i.3], clause 146;
- $F_b$  = 200 kHz in the frequency range below 30 MHz;
- $F_b$  = 2 MHz in the frequency range above 30 MHz;
- $F_c$  = centre frequency of the transmitter necessary bandwidth.

#### 4.3.2.2 Exclusion band for immunity tests

For immunity tests, the exclusion band for transmitters extends plus and minus twice the maximum occupied bandwidth allowed for the type of service for which the equipment is intended to operate, centred around the occupied bandwidth.

NOTE: The exclusion bands are derived using different methodologies from those described in clause 4.3.2 of ETSI EN 301 489-1 [1]. However, the used methodologies lead to narrower exclusion bands for every amateur radio frequency band.

## 4.4 Narrowband responses of receivers or receivers which are part of transceivers

The provision of ETSI EN 301 489-1 [1], clause 4.4 shall apply.

## 4.5 Normal test modulation

### 4.5.1 Transmitters

For the transmitter under test, the manufacturer shall declare the normal test modulation taking due account of the following requirements:

AM transmitters:

- the normal modulation signal shall consist of a single sinusoidal modulation signal, causing a modulation depth to the rated value;

AM-SSB or AM-DSB-SC transmitters with analogue voice modulation:

- the normal modulation signal shall consist of two sinusoidal, non-harmonically related frequencies in the audio passband such as to produce signals of equal output power;

FM transmitters (narrowband FM):

- the normal modulation signal shall consist of a single audio frequency of such a level causing a deviation to the rated value, as declared by the manufacturer;

Transmitters for data transmission:

- the manufacturer shall declare a Test Data Sequence for the modulation of the transmitter. The Test Data Sequence shall be such that:
  - the generated RF signal is the same for each transmission;
  - the transmissions occur regularly in time;
  - sequences of transmissions can be repeated accurately;
  - the format of the signal is such that the transmitted data (as opposed to any preamble or synchronization sequences) is essentially random in nature;

- the modulation depth (or deviation) attained is representative of the normal intended use of the equipment;
- the same Test Data Sequence shall be used for all emissions measurements on the same equipment.

Transmitters with special modulation (including FM TV in F3F mode):

- if the transmitters are intended for modulation by signals other than those specified above, the modulation shall be representative of that in normal use. In all cases, the details of the modulation shall be documented in the test report.

## 4.5.2 Receivers

For the receiver under test, the manufacturer shall declare the normal test modulation, taking due account of the following requirements.

If it is not appropriate to provide the receiver with a modulated wanted RF input signal, then an unmodulated wanted RF input signal may be used.

The level of the wanted RF input signal shall be as specified clause 4.2.3. The modulation signal shall correspond to the related requirements in clause 4.5.1 and shall be provided by a suitable test signal source. The wanted RF input signal, modulated with normal test modulation, shall have the characteristics set out in table 2.

**Table 2: Normal test modulation, characteristics of the wanted RF input signal for receivers**

Modulation scheme	Modulation
AM	60 % AM (1 kHz modulation)
FM	60 % of the maximum permissible frequency deviation (1 kHz modulation)
SSB	1 kHz offset from the carrier frequency
Other modes	as declared by the manufacturer

For receivers intended for the reception of wanted RF signals modulated by signals other than those explicitly specified in table 2, the modulation shall be representative of that in normal use. In all cases, the details of the modulation shall be recorded in the test report.

## 4.5.3 RF amplifiers and transverters

RF amplifiers and transverters shall be stimulated with wanted RF signals in accordance with the manufacturer's specifications.

---

# 5 Performance assessment

## 5.1 General

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

In addition, the manufacturer shall declare, or properly document the following information which shall be in accordance with the information contained in the (user) instructions accompanying the equipment:

- the maximum duty cycle and the maximum transmit time for each mode of transmission where the EUT is incapable of continuous transmission;
- the rated value of the modulation depth (AM transmitters), or frequency deviation (FM transmitters), or the Test Data Sequence (transmitters for data transmission);
- the operating mode which produces the maximum emission, for multimode equipment;
- the nominal antenna load impedance for transmitters and the applicable tolerance;

- the nominal antenna source impedance for receivers and the applicable tolerance;
- the dedicated AC/DC power adapter to be used with the EUT, if any.

## 5.2 Equipment which can provide a continuous communications link

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

## 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

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

It is up to the manufacturer to declare, for example, his power supply unit as an integral part of his radio equipment or as a stand-alone item which would be declared compliant separately.

Typical examples of ancillary equipment include, e.g. microphones, loudspeakers, Morse keys (manual or automatic/electronic), and desktop 'drop-in' battery chargers for hand-held portables. Remote front-panels may be considered as ancillary equipment only if the radio has an integral, permanent front panel as well.

Otherwise, de-mountable front-panels should be considered as an integral part of the EUT. Embedded PCB assemblies sold as options, which increase or change the EUT functionality, are regarded as integral to the EUT and not as ancillary equipment. Snap-On battery packs are also integral parts of the EUT and not ancillary equipment.

Plug-in or screw-on whip antennas are regarded as integral parts of the EUT and not ancillary equipment, even if the interface is a 50  $\Omega$  connector.

## 5.5 Equipment classification

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

Amateur radio equipment and/or combinations of equipment shall be considered as either base station, and/or mobile equipment, and/or portable equipment, as declared by the manufacturer.

---

# 6 Performance criteria

## 6.0 Introduction

Commercially available amateur radio equipment may comprise such items as transmitters, receivers, transceivers, RF amplifiers, and transverters. For all these different items of radio equipment the performance criteria for radio equipment shall apply.

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 primary and secondary functions of the equipment during and after the test.

The performance criteria A, B and C set out in ~~table~~ tables 3 and 4 shall be used in the following manner:

- performance criteria A for immunity tests with phenomena of a continuous nature;
- performance criteria B for immunity tests with phenomena of a transient nature and **short voltage dips**;
- performance criteria C for immunity tests with power interruptions and voltage dips exceeding a certain period of time (**long voltage dips**).

Amateur radio equipment may contain user functions which are of primary relevance from the point of view of conveying information or configure the equipment to allow the exchange of information.

In addition, other user functions may be included in the equipment which do not have a functional relationship with the primary function.

From the perspective of developing intrinsic immunity specifications (minimum performance criteria), the example below illustrates what are considered as primary or secondary functions.

EXAMPLE: A paging receiver also containing an alarm clock:

- primary functions are the reception of a call, the call alert and the storage of a call, if provided;
- secondary functions are all functions related to the alarm clock.

## 6.1 Performance criteria for primary user functions

### 6.1.0 Introduction

The EUT shall meet the general performance criteria specified in table 3, as detailed in the special performance criteria in ~~clause~~ clauses 6.1.2, ~~or~~ 6.1.3, or 6.1.4, as appropriate.

### 6.1.1 General performance criteria (primary user functions)

**Table 3: General performance criteria (primary user functions)**

During test	After test	Criteria
Degradation of performance (see note 1); No loss of function; Operate as intended (no loss of link); No unintended RF transmission; No loss of user control functions or stored configuration data.	Operate as intended; No degradation of performance (see note 2); No loss of function; No loss of stored data.	A
Loss of function (one or more); No unintended RF transmission; No loss of user control functions or stored configuration data.	Operate as intended; No degradation of performance (see note 2); Functions self-recoverable; No loss of link after test; No loss of stored data.	B
Loss of function (one or more) (and/or) user data No unintended RF transmission	Operate as intended; No degradation of performance (see note 2); Functions recoverable by the operator; (i.e. can be reset to normal).	C
<p>NOTE 1: Degradation of performance during the test is understood as a degradation to a level not below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases, the specified minimum performance level may be replaced by a permissible degradation of performance.</p> <p>If the minimum performance level or the permissible degradation of performance is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising), and what the user may reasonably expect from the apparatus if used as intended.</p> <p>NOTE 2: No degradation of performance after the test is understood as no degradation below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. After the test no change of actual operating data or user retrievable data is allowed. If the minimum performance level or the permissible degradation of performance is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising), and what the user may reasonably expect from the apparatus if used as intended.</p>		

### 6.1.2 Performance criteria A for continuous phenomena (primary user functions)

The performance criteria for continuous phenomena detail the general performance criteria in table 3 (performance criteria A) as follows:

during and after the EMC exposure:

- there shall be no unintended transmission;

during the EMC exposure:

- for analogue (speech) communication, the SINAD of the audio output measured during each individual exposure in the test sequence shall not deteriorate below a level of 12 dB;
- for data or digital communication, the digital throughput shall not drop below 80 % of the nominal throughput;

after the EMC exposure:

- the audio output shall not deteriorate below a level specified by the manufacturer;
- the digital throughput shall return to its nominal value, respectively;
- the EUT shall operate as intended with no loss of user functions or stored data, and the communication link shall have been maintained during the test.



### 6.1.3 Performance criteria B for transient phenomena and short voltage dips (primary user functions)

Performance criteria B shall apply to transient phenomena and **short voltage dips** corresponding to a **reduction of the supply voltage of 30 % for 10 ms**.

The performance criteria for transient phenomena detail the general performance criteria in table 3 (performance criteria B) as follows:

during and after the EMC exposure:

- there shall be no unintended transmission;

after the EMC exposure:

- at the conclusion of each EMC exposure the amateur radio equipment shall operate with no user noticeable loss of the communication link, except from individual ElectroStatic Discharge (ESD) events where it shall be permissible to re-key the transmitter;
- at the conclusion of the total test comprising the series of individual exposures the speech quality level of the EUT shall return to a level not below that specified by the manufacturer and the digital throughput shall return to its nominal value respectively;
- at the conclusion of the total test comprising the series of individual exposures the EUT shall operate as intended with no loss of user functions or stored data, as declared by the manufacturer, and the communication link shall have been maintained.

**NOTE:**—In case of data systems utilizing "Acknowledgement" transmissions, it is recognized that during or after immunity tests with transient phenomena there may be a transmission which although not externally commanded, is a result of performance according to criteria B or C in table 3. If such a transmission occurs, this fact shall be noted in the test report, but the equipment shall not be deemed to have failed the test as a result of this transmission.

### 6.1.4 Performance criteria C for long voltage dips and interruptions (primary user functions)

Performance criteria C shall apply to **voltage interruptions** and **long voltage dips** corresponding to a **reduction of the supply voltage of 60 % for 100 ms**.

The performance criteria for voltage interruptions and dips exceeding a certain period of time detail the general performance criteria in table 3 (performance criteria C) as follows:

during the EMC exposure:

- during the test the communications link may be lost and one or more functions and/or stored user data may be lost;
- for equipment tested in receive or stand-by mode of operation, there shall be no unintended switch-over to the transmit mode of operation;

after the EMC exposure:

- the communications link shall be recoverable either automatically or by the operation of user controls as declared by the manufacturer;
- the speech quality level shall return to a level not below that specified by the manufacturer;
- the digital throughput shall return to its nominal value;
- there shall be no unintended transmission.

**NOTE:**—In case of data systems utilizing "Acknowledgement" transmissions, it is recognized that during or after immunity tests with transient phenomena there may be a transmission which although not externally commanded, is a result of performance according to criteria B or C in table 3. If such a transmission occurs, this fact shall be noted in the test report, but the equipment shall not be deemed to have failed the test as a result of this transmission.

## 6.2 Performance criteria for secondary user functions

For secondary user functions, the EUT shall meet the performance criteria specified in table 4.

**Table 4: Performance criteria (secondary user functions)**

During test	After test	Criteria
Operate as intended; Degradation of performance (see note 1); No loss of function.	Operate as intended; No degradation of performance (see note 2); No loss of function.	A
Loss of function (one or more).	Operate as intended; No degradation of performance (see note 2); Functions self-recoverable;	B
Loss of function (one or more).	Operate as intended; No degradation of performance (see note 2); Functions recoverable by the operator.	C
<p>NOTE 1: Degradation of performance during the test is understood as a degradation to a level not below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. If the minimum performance level or the permissible degradation of performance is not specified by the manufacturer, then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.</p> <p>NOTE 2: No degradation of performance after the test is understood as no degradation below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. After the test no change of actual operating data or user retrievable data is allowed. If the minimum performance level or the permissible degradation of performance is not specified by the manufacturer, then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.</p>		

## 6.3 Performance criteria for equipment which does not provide a continuous communication link

The provision of ETSI EN 301 489-1 [1], clause 6.3 shall apply.

## 6.4 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.

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## 7 Applicability overview tables

### 7.1 EMC Emission

#### 7.1.1 General

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

#### 7.1.2 Special conditions

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

Table 5: Special conditions for EMC emission measurements

Reference to clauses in ETSI EN 301 489-1 [1]	Special product-related conditions, additional to or modifying the test conditions in ETSI EN 301 489-1 [1], clause 8
8.1 Test configuration; Methods of measurement and limits for EMC emissions	For receivers operating, or capable of operating on a number of frequencies over a wide frequency band, measurements shall be made over a selected number of wanted signal frequencies. For the selected wanted signal frequencies, see clause 4.1 of the present document. For measurements in transmit mode of operation, transmitters designed to transmit with a non-constant envelope only, the power setting may be reduced by 6 dB in relation to the maximum PEP RF output. Transmitters designed to transmit with a constant envelope, the EUT may be operated at its maximum PEP RF output, or at a level up to 6 dB lower than this, in the event of declared thermal limitations.

## 7.2 Immunity

### 7.2.1 General

ETSI EN 301 489-1 [1], table 32, contains the applicability of EMC immunity measurements to the relevant ports of radio and/or associated ancillary equipment.

### 7.2.2 Special conditions

The following special conditions set out in table 6, relate to the immunity test methods and performance criteria used in ETSI EN 301 489-1 [1], clause 9.

Table 6: 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
9.1 Test configuration; Test methods and levels for immunity tests	For receivers operating, or capable of operating on a number of frequencies over a wide frequency band, immunity tests shall be made over a selected number of wanted signal frequencies. For the selected wanted signal frequencies, see clause 4.1. For tests in transmit mode of operation, transmitters designed to transmit with a non-constant envelope only, the power setting may be reduced by 6 dB in relation to the maximum PEP RF output. Transmitters designed to transmit with a constant envelope, the EUT may be operated at its maximum PEP RF output, or at a level up to 6 dB lower than this, in the event of declared thermal limitations.
9.3.3 Performance criteria; Electrostatic discharge	It shall be permissible to re-key the transmitter after individual ElectroStatic Discharge (ESD) events to recover the communications link, see clause 6.1.3.
9.4.2 Test method; Fast transients, common mode	<b>Internal DC input ports:</b> This test does not apply to internal battery compartment DC input ports which do not serve the purpose of connection to any remote AC/DC power adapter.
9.5.2 Test method; Radio frequency, common mode	<b>Internal DC input ports:</b> This test does not apply to internal battery compartment DC input ports which do not serve the purpose of connection to any remote AC/DC power adapter.
9.7.3 Performance criteria; Voltage dips and interruptions	Different special performance criteria (B or C) apply for different types of voltage dips (short or long dips), for details see clauses 6.1.3 and 6.1.4.

Annex A (informative):

Examples of amateur radio equipment within the scope of the present document

The present document covers types of amateur radio equipment as set out below.

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

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

<b>Harmonised Standard ETSI EN 301 489-15</b>				
The following requirements are relevant to the presumption of conformity under the article 3.1(b) of Directive 2014/53/EU [i.1]				
<b>Requirement</b>			<b>Requirement Conditionality</b>	
<b>No</b>	<b>Description</b>	<b>Reference: Clause No</b>	<b>U/C</b>	<b>Condition</b>
1	Enclosure of ancillary equipment measured on a stand-alone basis	8.2 of ETSI EN 301 489-1 [1]	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 3m or from a vehicle power supply
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	
5	Voltage fluctuations and flicker (AC mains input ports)	8.6 of ETSI EN 301 489-1 [1]	C	
6	Wired network ports	8.7 of ETSI EN 301 489-1 [1]	C	Only where equipment has wired network ports
7	Radio frequency electromagnetic field (80 MHz to 6 000 MHz)	9.2 of ETSI EN 301 489-1 [1]	U	Refer also to 7.2.2 Table 6
8	Electrostatic discharge	7.2.2	U	
9	Fast transients, common mode	7.2.2	U	
10	Radio frequency, common mode	7.2.2	U	
11	Transients and surges in the vehicular environment	9.6 of ETSI EN 301 489-1 [1]	C	Only where equipment is fitted to a vehicle power supply
12	Voltage dips and interruptions	7.2.2	C	Only where equipment has AC mains power input ports
13	Surges, line to line and line to ground	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 shall be unconditionally applicable (U) or is conditional upon the manufacturers claimed functionality of the equipment (C).

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

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

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

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## Annex B (informative): Examples of amateur radio equipment within the scope of the present document

### B.1 Amateur radio equipment which is commercially available

The present document applies to radio equipment intended for use by radio amateurs in accordance with the definition contained in article 1.56 of the Radio Regulations [5<sub>1.3</sub>], and associated ancillary equipment, which are commercially available.



## History

<b>Document history</b>		
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