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HARMONISED EUROPEAN STANDARD

ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 13: Specific conditions for Citizens' Band (CB) radio and ancillary equipment; Harmonised Standard for ElectroMagnetic Compatibility

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 Standardisation Request deliverable Approval Procedure (SRdAP).

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.1] 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.4].

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.

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

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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1 Scope

The present document concerns the assessment of Citizens' Band (CB) radio equipment intended for the transmission of speech and associated support equipment with regard to ElectroMagnetic Compatibility (EMC).

Requirements relating to the antenna port and emissions from the housing port of CB radio equipment are not included in the present document. Such requirements can be found in the relevant product standards for the effective use of the radio spectrum, see Table 1.

Table 1: Radio Technologies in scope of the present document

Technology	ETSI Standard
Angle-modulated Citizen's Band (CB) radio equipment and associated ancillary equipment operating in the frequency range 26 MHz to 28 MHz.	ETSI EN 300 433 [i.3]
Double Side Band (DSB) and/or Single Side Band (SSB) modulated CB radio equipment operating in the frequency range 26 MHz to 28 MHz	ETSI EN 300 433 [i.3]

NOTE: The relationship between the present document and the essential requirements of article 3.1(b) of Directive 2014/53/EU [i.4] is given in annex A.

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 in the ETSI docbox.

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

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

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

[2] Recommendation ITU-T O.41 (10/94): " Psophometer for use on telephone-type circuits".

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 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] 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.2] ITU Radio Regulations.

[i.3] ETSI EN 300 433 (V2.1.1): "Citizens' Band (CB) radio equipment; Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU".

[i.4] 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.5] EN 61000-6-3: "Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments", (produced by CENELEC).

[i.6] EN 55032: "Electromagnetic compatibility of multimedia equipment - Emission requirements", (produced by CENELEC).

[i.7] EN 61000-4-6: "Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields", (produced by CENELEC).

[i.8] EN 61000-4-4: "Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test", (produced by CENELEC).

[i.9] IEC TR 61000-2-5: "Electromagnetic compatibility (EMC) - Part 2-5: Environment - Description and classification of electromagnetic environments".

3 Definition of terms, symbols and abbreviations

3.1 Terms

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

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

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

- the equipment is intended for use with a receiver or transmitter to provide additional operational and/or control features to the radio equipment, (e.g. to extend control to another position or location); and
- the ancillary equipment cannot be used without being connected to radio equipment to provide user functions independently of a receiver or transmitter; and
- the receiver or transmitter, to which it is connected, is capable of providing some intended operation such as transmitting and/or receiving without the ancillary equipment (i.e. it is not a sub-unit of the main equipment essential to the main equipment basic functions).

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

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

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

integral antenna: antenna designed for permanent connection to the equipment and considered part of the enclosure port

NOTE: An integral antenna may be fitted internally or externally.

mobile equipment: receiver, transmitter or transmitter/receiver (transceiver) intended for installation and use in a vehicle, and powered by a vehicle battery

Pmin: minimum power required to establish a communications link

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

NOTE: Devices will typically be handheld.

switching range: maximum frequency range over which the equipment can be used without reprogramming or rearrangement

vehicle use: radio equipment intended for installation and use in a vehicle, and powered by a vehicle battery

3.2 Symbols

Void.

3.3 Abbreviations

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

AC	Alternating Current
AE	Additional Equipment
AM	Amplitude Modulation
BER	Bit Error Rate
CB	Citizen's Band
CDN	Coupling Decoupling Network
DC	Direct Current
DSB	Double Side Band
EFT	Electrical Fast Transients
EMC	ElectroMagnetic Compatibility
EUT	Equipment Under Test
FM	Frequency Modulation
ME	Monitoring equipment
P.A.	Public Address
RF	Radio Frequency
SINAD	Signal In Noise And Distortion
SSB	Single Side Band

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 CB radio and ancillary equipment are specified in clauses 4.2 to 4.4.

The CB radio equipment shall be operated on the channel closest to the middle of the switching range for each modulation scheme supported by the EUT.

4.2 Arrangements for test signals

4.2.1 Arrangements for test signals at the input of transmitters

The transmitter shall be exercised with a signal, representing the EUT's intended use. Where this signal is provided by an external source, the source may be located outside the test environment.

4.2.2 Arrangements for test signals at the output of transmitters

The Monitoring Equipment (ME) for the wanted RF output signal from the transmitter with an antenna connector shall be located outside the test environment and shall be connected to the transmitter via a shielded transmission line, such as a coaxial cable.

For transmitters with an integral antenna, the wanted RF output signal to establish a communication link shall be delivered from the transmitter to an antenna located within the test environment. This antenna shall be connected to the ME via a shielded transmission line, such as a coaxial cable, so as to not influence the measurement results.

The level of the wanted RF output signal in transmit mode of operation shall be set to the maximum rated RF power for the EUT or at a level not less than 6 dB below that power level in the event of thermal limitations.

4.2.3 Arrangements for test signals at the input of receivers

For receivers with an antenna connector, the wanted RF input signal to establish a communication link shall be located outside of the test environment and connected to the antenna connector of the EUT by a shielded transmission line, such as a coaxial cable.

For receivers with an integral antenna, the wanted RF input signal to establish a communication link shall be presented to the EUT from an antenna located within the test environment. This antenna shall be connected to the external RF signal source by a shielded transmission line, such as a coaxial cable.

For radiated immunity tests, the level of the wanted signal at the input of the receiver or the enclosure port of the EUT, shall be set to 40 dB above the Pmin for the EUT. For all other tests the level of the wanted signal, required to establish a communication link, shall be representative of the EUT intended use.

NOTE: Simple method to establish the required communication link is to establish a link, then reduce the wanted signal power at the EUT to a point of link failure, then increase the wanted signal power by 40 dB.

4.2.4 Arrangements for test signals at the output of receivers

The ME for the output signal from the receiver under test shall be located outside the test environment.

If the receiver has an output connector or port providing the wanted output signal, then this port shall be connected via a cable, consistent with the standard cable used in its intended use, to the ME.

For receivers without an output connector, with an analogue speech output, this output shall be acoustically coupled via an electrically non-conductive means to the ME.

4.3 RF exclusion band of radio equipment

4.3.1 General

The exclusion bands shall be derived using the methodologies detailed in clauses 4.3.2 and 4.3.3.

Whenever an exclusion band is applied, the specific frequency range(s) excluded from assessment shall be detailed in the technical documentation.

NOTE: Exclusion bands are relevant for both conducted and radiated tests.

4.3.2 Exclusion band for transmitters or the transmitter part of transceivers

4.3.2.1 General

Exclusion bands shall not be applied when measuring transmitters in standby mode.

4.3.2.2 Channelized Equipment

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

NOTE: Exclusion band of 250 % is based on the definition from ITU Radio Regulations [i.2], 1 146, 1 146A and 1 146B.

4.3.3 Exclusion band for receivers or the receiver part of transceivers

4.3.3.1 Applicability

Exclusion bands are not applied when testing emissions of receivers or receiver part of transceivers.

4.3.3.2 Channelized Equipment

For channelized equipment the exclusion band shall be calculated by using the following formulae.

For the lower edge for the exclusion band:

$$EXband(lower) = Band_{RX}(lower) - nChW_{RX} \quad (1)$$

and for the upper edge of the exclusion band:

$$EXband(upper) = Band_{RX}(upper) + nChW_{RX} \quad (2)$$

Where n = number of channel widths required for exclusion band.

NOTE: For equipment that support multiple channel widths the Channel Width used is the widest supported by the EUT.

The value of n shall be 1.

4.4 Normal test modulation

4.4.1 Angle-modulated CB radio equipment

The receiver wanted RF input signal shall be set to the channel defined in clause 4.1 and modulated with a sinusoidal audio frequency of 1 000 Hz. The wanted test signal shall have an FM deviation of 1,2 kHz.

The transmitter shall be modulated with a sinusoidal audio frequency signal of 1 000 Hz. The level of this audio signal shall be adjusted to obtain 1,2 kHz FM peak deviation.

4.4.2 DSB or SSB modulated CB radio equipment

The receiver wanted RF input signal shall be set to channel defined in clause B.4.1 and modulated with a sinusoidal audio frequency of 1 000 Hz. In case of DSB (AM) a modulation depth of 60 % shall be used for the wanted test signal. For SSB receivers the wanted signal shall be in the receiver passband at a frequency giving a 1 kHz audio output.

For DSB (AM), the transmitter of the EUT shall be modulated with a sinusoidal audio frequency signal of 1 000 Hz. The level of this audio signal shall be set to obtain 60 % AM modulation depth of the RF output signal.

For SSB, the transmitter of the EUT shall be modulated with a sinusoidal audio frequency signal of 1 000 Hz, the level shall be set to obtain 60 % of the maximum peak envelope RF output power. The level of this audio signal shall be increased by 3 dB and this signal shall be used as normal test modulation signal.

4.5 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 if appropriate, 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.

5 Performance assessment

5.1 General

At the time of submission of the equipment for test, the information required in ETSI EN 301 489-1 [1], annex C and the following should be recorded in the test report:

- the modulation scheme(s) supported by the EUT; and
- the secondary user functions of the CB radio equipment and their related performance criteria; and
- the AC/DC power converter intended to be used with the EUT (if any).

The requirements in the present document apply to all operating modes of the equipment.

5.2 Ancillary equipment

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

6 Performance criteria

6.0 Applicability

Requirements of clauses 6.1, 6.2 and 6.3 in the present document shall take precedence over those in ETSI EN 301 489-1 [1] clause 6 unless otherwise stated.

6.1 General

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.

CB radio equipment may contain user functions which are of primary relevance from the point of view of conveying information or configuring 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 is considered as primary and what as secondary user functions.

EXAMPLE: A CB radio that can also be used as an audio P.A system:

- primary user functions are the reception of CB radio transmissions, or decoding of selective calls, where provided;
- secondary user functions are all functions related to the audio P.A. functionality.

6.2 Performance criteria for primary user function(s)

For assessing the primary user function(s), the EUT shall meet the performance criteria specified in Table 2.

Table 2: Performance criteria for CB equipment (primary user functions)

During test	After test (i.e. as a result of the application of the test)	Criteria
Shall operate as intended (see note) Shall be no loss of primary user function(s) Shall be no unintentional RF transmission.	Shall operate as intended. Shall be no degradation of performance. Shall be no loss of function. Shall be no loss of critical stored data.	A
May be loss of function Shall be no unintentional RF transmission	Functions shall be self-recoverable. Shall operate as intended after recovering. Shall be no loss of critical stored data.	B
May be loss of function Shall be no unintentional RF transmission	Functions shall be recoverable by the operator, either automatically or by operation of user control. Shall operate as intended after recovering. Shall be no loss of critical stored data.	C
NOTE: Operate as intended during the test allows a level of degradation in which the SINAD ratio of the audio signal measured during each individual exposure in the test sequence shall not be lower than 12 dB. The frequency response of the SINAD measurement equipment shall conform to ITU-T Recommendation O.41 [2].		

6.3 Performance criteria for secondary user functions

For secondary user functions, the EUT shall meet the performance criteria defined in Table 2.

Where the CB equipment can be used as a PA system, the note in Table 2 shall apply, as the radio function is disabled during PA operation.

7 Applicability overview

7.1 Emission

7.1.1 General

The following emission requirements set out in Table 3 shall apply.

Table 3: Emission requirements

Phenomenon	Port	Applicability			Reference clause
		Fixed equipment	Vehicular equipment	Portable equipment	
radiated emission	enclosure of ancillary equipment	applicable	applicable	applicable	ETSI EN 301 489-1 [1], clause 8.2
conducted emission	DC power input/output port	applicable	applicable	not applicable	7.1.2
conducted emission	AC mains input/output port	applicable	not applicable	not applicable	7.1.2
conducted emission	wired network port	applicable	applicable	not applicable	ETSI EN 301 489-1 [1], clause 8.7

Portable equipment, or combinations of equipment, capable of being powered for intended use by the 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

The following special conditions set out in Table 4, relate to the emission test methods used in ETSI EN 301 489-1 [1], clause 8.

Table 4: 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
8.3.2 Test method; DC power input/output ports	In Tx mode of operation, for transmitters operating at a frequency below 30 MHz, the transmitter exclusion band shall be taken into account.
8.4.2 Test method; AC mains power input/output ports	In Tx mode of operation, for transmitters operating at a frequency below 30 MHz, the transmitter exclusion band shall be taken into account.

7.2 Immunity

7.2.1 General

The following immunity requirements set out in Table 5 shall apply.

Table 5: 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	applicable	applicable	applicable	ETSI EN 301 489-1 [1], clauses 9.2.1 and 9.2.2	6.2 criteria A and 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 criteria B and 6.3
fast transients common mode	signal, wired network and control	applicable	not applicable	not applicable	7.2.2	6.2 criteria B and 6.3
	DC power	applicable	not applicable (see note 1)	not applicable	7.2.2	6.2 criteria B and 6.3
	AC mains power	applicable	not applicable	not applicable	7.2.2	6.2 criteria B and 6.3
RF common mode 0,15 MHz to 80 MHz	signal, wired network and control	applicable	not applicable	not applicable	7.2.2	6.2 criteria A and 6.3
	DC power	applicable	not applicable	not applicable	7.2.2	6.2 criteria B and 6.3
	AC mains power	applicable	not applicable	not applicable	7.2.2	6.2 criteria B and 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 criteria B and 6.3 (see note 2)
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 criteria C and 6.3
surges, line to line and line to ground	AC mains power input	applicable	not applicable	not applicable	ETSI EN 301 489-1 [1], clauses 9.8.1 and 9.8.2	6.2 criteria B and 6.3
	wired network	applicable	not applicable (see note 1)	not applicable	ETSI EN 301 489-1 [1], clauses 9.8.1 and 9.8.2	6.2 criteria B and 6.3
NOTE 1: This requirement is covered by the transients and surges test on DC power input ports. NOTE 2: For pulses 3a & 3b, performance criteria A shall apply (see clause 6.2).						

Portable equipment, or combinations of equipment, capable of being powered for intended use by the 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 6, relate to the emission test methods 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
9.4.2 Test method; **Fast transients, common mode**	Internal DC input ports: 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**	Internal DC input ports: 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.

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.1] 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.4].

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 301 489-13					
Requirement				Requirement Conditionality	
No	Description	Essential requirements of Directive	Clause(s) of the present document	U/C	Condition
1	Emissions: Enclosure of ancillary equipment measured on a standalone basis	3.1(b)	7.1	U	
2	Emissions: DC power input/output ports	3.1(b)	7.1	C	Only applicable where a DC power input/output port is present.
3	Emissions: AC mains power input/output ports	3.1(b)	7.1	C	Only applies to fixed 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 to fixed equipment with ports capable of supporting a cable length greater than 3 m.
5	Immunity: RF 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 to fixed equipment and/or portable equipment.
7	Immunity: Fast transients common mode	3.1(b)	7.2	C	Only applies to fixed equipment.
8	Immunity: RF common mode 0,15 MHz to 80 MHz	3.1(b)	7.2	C	Only applies to fixed equipment.
9	Immunity: Vehicular transients and surges	3.1(b)	7.2	C	Only applies to vehicular equipment.
10	Immunity: voltage dips and interruptions	3.1(b)	7.2	C	Only applies to fixed equipment.
11	Immunity: surges, line to line and line to ground	3.1(b)	7.2	C	Only applies to fixed equipment.

Key to columns:

Requirement:

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

Description A textual reference to the requirement.

Essential requirements of Directive

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

Clause(s) of the present document

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

Requirement Conditionality:

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

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

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

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

Annex B (informative): Why testing on cables shorter than 3 m in length is not required

B.1 Background

Historically most EMC standards, including European Norms, have exempted short cables (usually less than 3 m in length) from testing on the basis that testing such cables has no discernible impact on the EMC performance of the EUT.

Investigations were performed to support this approach and justifications are in this annex.

B.2 Emission requirements

Technically, the measurement range for conducted emissions is from 150 kHz to 30 MHz and that a quarter wavelength cable makes an effective radiator. From this, it is assumed that a 3 m cable might be an effective radiator at 25 MHz, however, this can only occur in extremely rare situations outside of the test laboratory. The reason it does not occur in the field is because the above assumption is very simplified. Indeed, the typical use of such long cable is not a straight radiator in free space comparable to a rod antenna. In use, cables are typically laid out in a random manner (not in a straight position) and generally terminated, both of which significantly reduces their effectiveness as an antenna. It is also typically positioned mainly horizontally and relatively close to the ground or other conductive parts. When the cable is curved, the effective length is reduced, causing a lower gain.

All EMC assessment and testing specifications are based on experience from around the world which is gathered by the relevant standardisation organisations (IEC). The exemption of testing is in place since the first publication of Generic Emission standards (e.g. EN 61000-6-3 [i.5]) and EMC product standards (e.g. EN 55032 [i.6]).

B.3 Immunity requirements

B.3.1 Common rationale

The coupling path to consider from the source to the potential victim is the capacitive coupling from cables to cables installed longitudinally. In this situation, the length of the cable has a significant impact on the coupling factor: only long cables are able to provide a significant coupling factor allowing the transfer of energy from the source to the victim.

In addition, the immunity testing methods requires a minimum length of the cable for inserting coupling devices considering some standardised distances allowing for reproducibility of the test result.

B.3.2 For EN 61000-4-6 tests

The 3 V test level defined is extremely large and would not appear in the typical installation. These levels will only occur close to radio broadcast transmitters or next to a radio amateur station.

For example, without any obstacle (e.g. walls), 3 V/m occurs at 100 m from a 1,5 kW radio amateur station, for lower power ones this drops to just over 20 m. See IEC TR 61000-2-5 (2017) [i.9], Table 17. Similarly, 3 V/m occurs at 1,5 km from a 500 kW radio transmitter. See IEC TR 61000-2-5 (2017) [i.9], Table 19. Obstacles are likely to reduce the field strength at the victim.

B.3.3 For EN 61000-4-4 tests

For the Electrical Fast Transients (EFT), the threat is noise from the AC mains due to the switching of inductive load. For short cables connected to the EUT, the EFT injection from AC mains cables, being transferred to short signal cable, is covered by the test on the AC main port (see clause B.4.3). There is an additional threat from coupling between the signal cables and an adjacent power cable. This occurs when long cables are very closely coupled, this threat is covered by an additional test on cables longer than 3 m.

B.4 Interactive aspects in EMC Tests

B.4.1 Introduction

EMC tests are interactive, when an Equipment Under Test (EUT) is being tested, so are all the cables and all the Associated Equipment (AE). For example, a Coupling Decoupling Network (CDN) is designed to isolate the AE from the EUT, so when an EFT burst is applied, for example, the voltage should only be applied to EUT, however some of the voltage is always applied to the AE.

B.4.2 For EN 61000-4-6 tests

During conducted RF immunity testing to EN 61000-4-6 [i.7], the EUT, AE and associated cables are within the same test loop (300 Ω), see figure B.1.

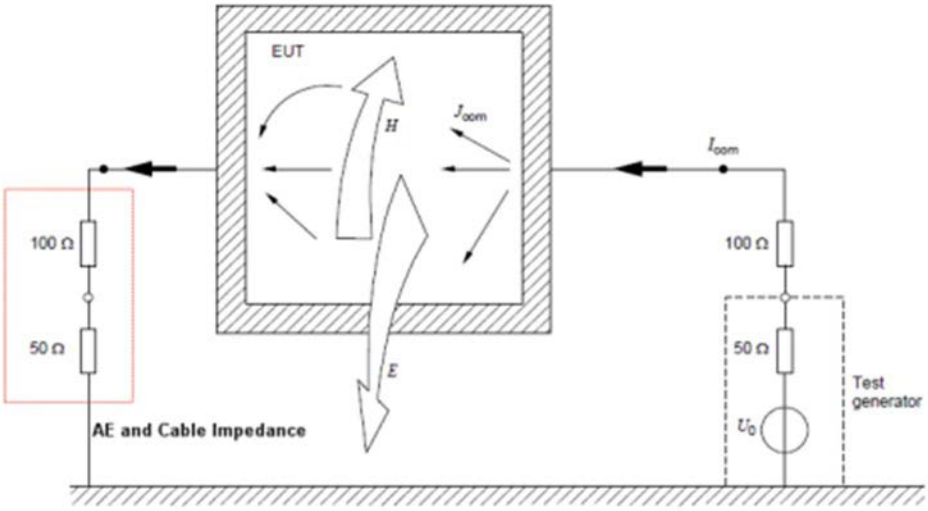

Figure B.1

In all cases cables are terminated using CDNs, this includes any earth cables.

Hence effectively the same voltage/current is applied to the AE and EUT, hence independent of the cable length during the mains testing any associated cabling are also tested. The following are examples of the measured current during a test.

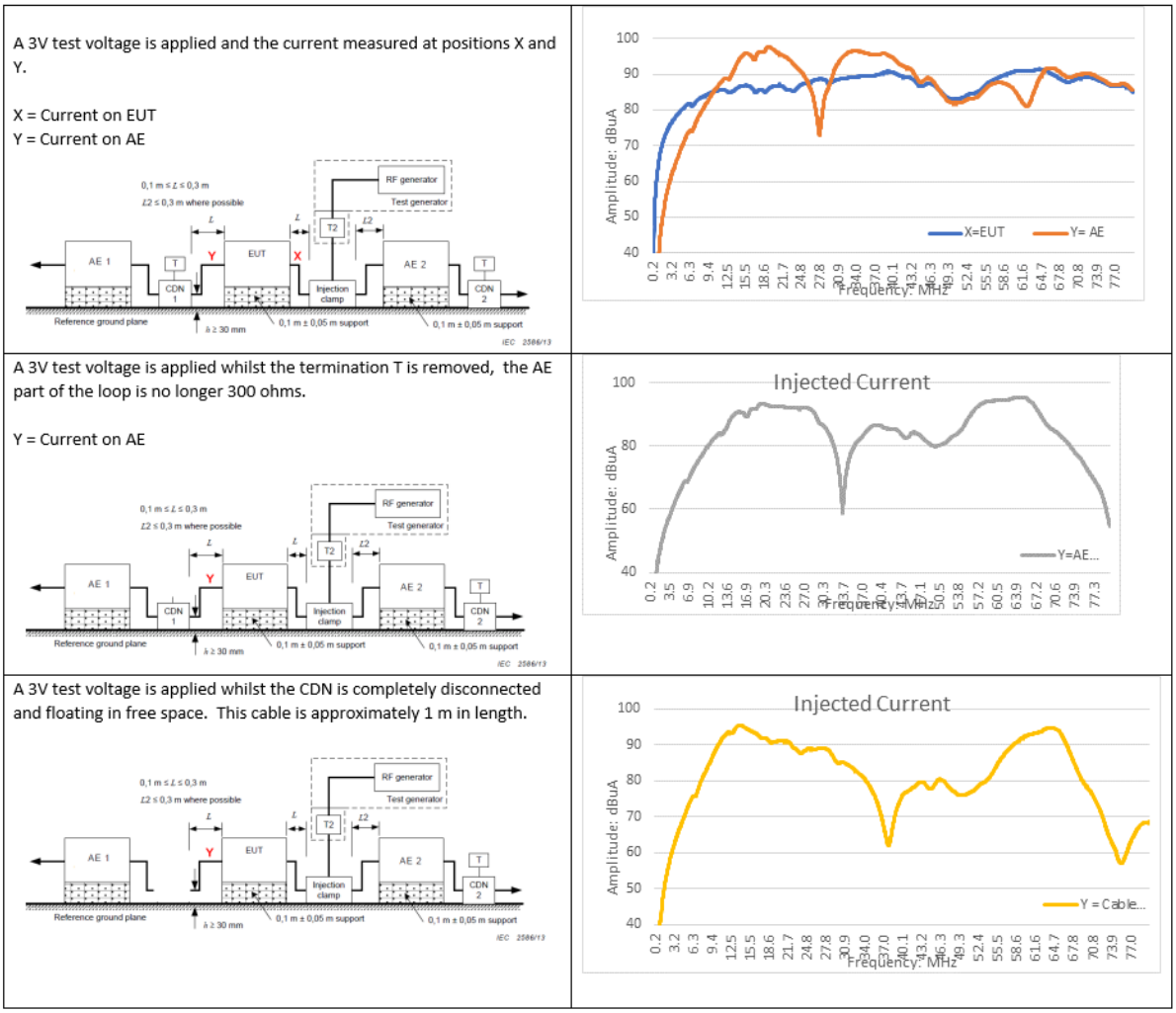

Figure B.2

In addition, close to the EUT a large electric field voltage is created, this voltage will induce signals in any close cable. Using measurement (or calculation) this voltage is significant dependent upon the measurement or calculated voltage. Hence many cables will be exposed to more than the expected 3 V/m.

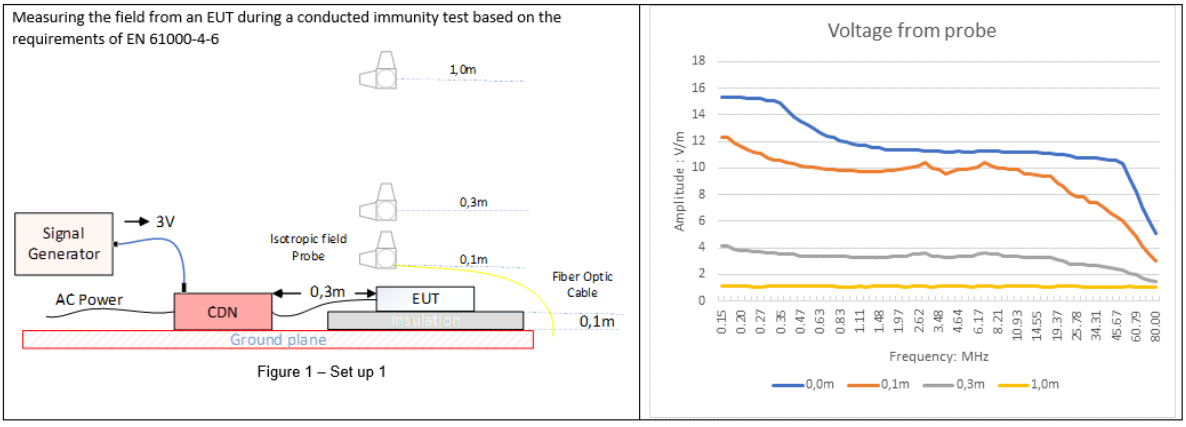

Figure B.3

B.4.3 For EN 61000-4-4 tests

During EFT testing, the voltage is applied to power ports via coupling networks or via a clamp to signal lines. These tests are applied independently. However, because of the close proximity of the power ports with the signal cables and because the signal cables are attached to the same EUT enclosure, the two separate tests become interactive and hence are not independent. When the test is applied to the power port, the signal ports are also tested and vice versa.

The following examples show the voltages which appear on the signal ports when the test is applied to the AC mains port.

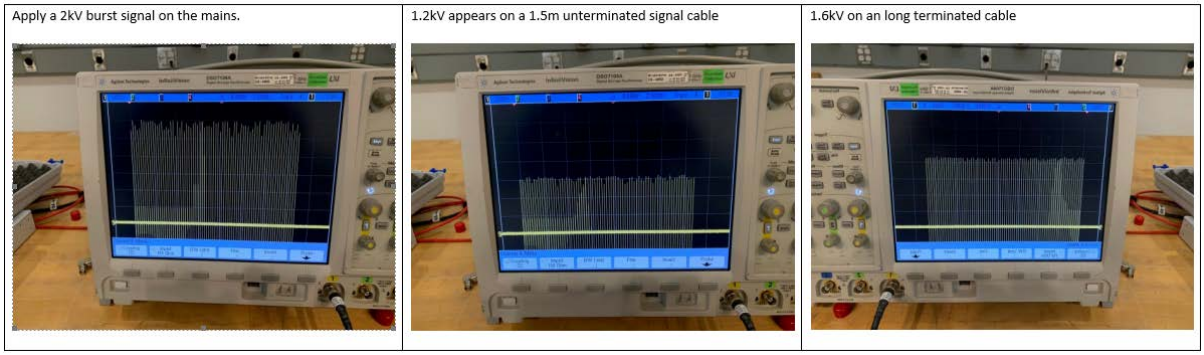

Figure B.3

Typically, the voltage applied is for the mains test is 1 kV and for signal cables 500 V, as defined in the present document. In this context, that would be 600 V and 800 V respectively.

B.5 Conclusion

The examples from testing to EN 61000-4-6 [i.7] and EN 61000-4-4 [i.8] clearly show that during mains testing, significant signals appear on the signal and control lines. Therefore, because of the limited direct threat from the environment on short cables, the test which is applied during testing of the main ports are considered adequate and do not need to be tested separately.

Annex C (informative): Change history

Version	Information about changes
	Radiated immunity testing to a continuous sweep between 80 MHz and 6 000 MHz at 3 V/m, as opposed to the previous frequency range of 80 MHz to 1 000 MHz and 1 400 MHz to 2 700 MHz in earlier editions. New derivations of exclusion bands more closely linked to the operational characteristics of the radio link(s) in the EUT.
2.1.1	CB equipment, whether integral antenna or non-integral antenna are now treated the same in respect of EMC requirements, as no technical justification could be found for maintaining the two sperate categories that were present in the previous (R&TTED) edition. Applicability of minimum cable length for testing clarified in line with latest HAS opinion. Alignment with requirements of RED article 3.1(b).

History

Document history		
V1.1.1	September 2000	Publication
V1.2.1	August 2002	Publication
V2.0.0	July 2025	SRdAP process EV 20251002: 2025-07-04 to 2025-10-02