



**ElectroMagnetic Compatibility (EMC)  
standard for combined and/or integrated  
radio and non-radio equipment;  
Part 2: Requirements for equipment  
intended to be used in industrial locations**

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**Reference**

REN/ERM-EMC-399

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**Keywords**

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## Foreword

This draft European Standard (EN) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM), and is now submitted for the combined Public Enquiry and Vote phase of the ETSI standards EN Approval Procedure.

The present document is part 2 of a multi-part deliverable covering ElectroMagnetic Compatibility (EMC) for combined and/or integrated equipment, as identified below:

Part 1: "Requirements for equipment intended to be used in residential, commercial and light industry locations";

**Part 2: "Requirements for equipment intended to be used in industrial locations".**

<b>Proposed national transposition dates</b>	
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):	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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# Introduction

The present document is not intended for citation under any new approach Directive.

The present document is based on the principles given in ETSI EG 203 367 [i.3] "Guide to the application of harmonised standards covering articles 3.1(b) and 3.2 of the Directive 2014/53/EU (RED) to multi-radio and combined radio and non-radio equipment".

The present document contains the measurements, emission limits and performance criteria that are necessary for the assessment of a combination of a non-radio and a radio product (which is called " $\Delta$ " in ETSI EG 203 367 [i.3]).

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# 1 Scope

The present document defines requirements in respect of ElectroMagnetic Compatibility (EMC) for combined and/or integrated equipment intended to be used within industrial locations.

The present document is only applicable to combined and/or integrated equipment where the radio function is within the scope of one or more of the standards listed in clause 2.1.2 (covering references [1] to [8]) and where the non-radio function is within the scope of one or more of the standards listed in clause 2.1.3 (covering references [9] to [50]).

Requirements applicable to the antenna port specifically related to the efficient use of radio spectrum are not included in the present document.

NOTE: These requirements are generally found in the applicable product standard(s) for the effective use of the radio spectrum.

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## 2 References

### 2.1 Normative references

#### 2.1.1 General

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 1: 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.

In addition, within the present document, some references are non-specific. The applicable version listed in the OJEU under the Directives 2014/53/EU [i.1] or 2014/30/EU [i.2] may be used.

NOTE 2: Before the date of withdrawal, a preceding version may be used (see clause 2.4 of the Technical Working Procedures in the ETSI Directives).

#### 2.1.2 Radio EMC standards

- [1] ETSI EN 301 489-1: "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] ETSI EN 301 489-3: "ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 3: Specific conditions for Short-Range Devices (SRD) operating on frequencies between 9 kHz and 246 GHz; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU".
- [3] ETSI EN 301 489-5: "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 covering the essential requirements of article 3.1(b) of Directive 2014/53/EU".
- [4] ETSI EN 301 489-6: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 6: Specific conditions for Digital Enhanced Cordless Telecommunications (DECT) equipment".

- [5] ETSI EN 301 489-17: "ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for Broadband Data Transmission Systems; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU".
- [6] ETSI EN 301 489-19: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 19: Specific conditions for Receive Only Mobile Earth Stations (ROMES) operating in the 1,5 GHz band providing data communications".
- [7] ETSI EN 301 489-33: "ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 33: Specific conditions for Ultra-WideBand (UWB) devices; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU".
- [8] ETSI EN 301 489-51: "ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 51: Specific conditions for Automotive, Ground based Vehicles and Surveillance Radar Devices using 24,05 GHz to 24,25 GHz, 24,05 GHz to 24,5 GHz, 76 GHz to 77 GHz and 77 GHz to 81 GHz; Harmonised Standard covering the essential requirements of article 3.1b of Directive 2014/53/EU".

### 2.1.3 Non-radio EMC standards

- [9] CENELEC EN 50121-3-2: "Railway applications - Electromagnetic compatibility - Part 3-2: Rolling stock - Apparatus".
- [10] CENELEC EN 50121-4: "Railway applications - Electromagnetic compatibility - Part 4: Emission and immunity of the signalling and telecommunications apparatus".
- [11] CENELEC EN 50121-5: "Railway applications - Electromagnetic compatibility - Part 5: Emission and immunity of fixed power supply installations and apparatus".
- [12] CENELEC EN 50270: "Electromagnetic compatibility. Electrical apparatus for the detection and measurement of combustible gases, toxic gases or oxygen".
- [13] CENELEC EN 50293: "Road traffic signal systems - Electromagnetic compatibility".
- [14] CENELEC EN 50370-1: "Electromagnetic compatibility (EMC) - Product family standard for machine tools - Part 1: Emission".
- [15] CENELEC EN 50370-2: "Electromagnetic compatibility (EMC) - Product family standard for machine tools - Part 2: Immunity".
- [16] CENELEC EN 50491-5-1: "General requirements for Home and Building Electronic Systems (HBES) and Building Automation and Control Systems (BACS) - Part 5-1: EMC requirements, conditions and test set-up".
- [17] CENELEC EN 50491-5-3: "General requirements for Home and Building Electronic Systems (HBES) and Building Automation and Control Systems (BACS) - Part 5-3: EMC requirements for HBES/BACS used in industry environment".
- [18] CENELEC EN 55011: "Industrial, scientific and medical equipment. Radio-frequency disturbance characteristics. Limits and methods of measurement".
- [19] CENELEC EN 55015: "Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment".
- [20] CENELEC EN 60730-1: "Automatic electrical controls - Part 1: General requirements".
- [21] CENELEC EN 60947-1: "Low-voltage switchgear and controlgear - Part 1: General rules".
- [22] CENELEC EN 60947-2: "Low-voltage switchgear and controlgear - Part 2: Circuit-breakers".
- [23] CENELEC EN 60947-3: "Low-voltage switchgear and controlgear - Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units".

- [24] CENELEC EN 60947-4-1: "Low-voltage switchgear and controlgear - Part 4-1: Contactors and motor-starters - Electromechanical contactors and motor-starters".
- [25] CENELEC EN 60947-4-2: "Low-voltage switchgear and controlgear - Part 4-2: Contactors and motor-starters - AC semiconductor motor controllers and starters".
- [26] CENELEC EN 60947-4-3: "Low-voltage switchgear and controlgear - Part 4-3: Contactors and motor-starters - AC semiconductor controllers and contactors for non-motor loads".
- [27] CENELEC EN 60947-5-1: "Low-voltage switchgear and controlgear - Part 5-1: Control circuit devices and switching elements - Electromechanical control circuit devices".
- [28] CENELEC EN 60947-5-2: "Low-voltage switchgear and controlgear - Part 5-2: Control circuit devices and switching elements - Proximity switches".
- [29] CENELEC EN 60947-5-6: "Low-voltage switchgear and controlgear - Part 5-6: Control circuit devices and switching elements - DC interface for proximity sensors and switching amplifiers (NAMUR)".
- [30] CENELEC EN 60947-5-7: "Low-voltage switchgear and controlgear - Part 5-7: Control circuit devices and switching elements - Requirements for proximity devices with analogue output".
- [31] CENELEC EN 60947-5-9: "Low-voltage switchgear and controlgear - Part 5-9: Control circuit devices and switching elements - Flow rate switches".
- [32] CENELEC EN 60947-6-1: "Low-voltage switchgear and controlgear - Part 6-1: Multiple function equipment - Transfer switching equipment".
- [33] CENELEC EN 60947-6-2: "Low-voltage switchgear and controlgear - Part 6-2: Multiple function equipment - Control and protective switching devices (or equipment) (CPS)".
- [34] CENELEC EN 60947-8: "Low-voltage switchgear and controlgear - Part 8: Control units for built-in thermal protection (PTC) for rotating electrical machines".
- [35] CENELEC EN 60974-10: "Arc welding equipment - Part 10: Electromagnetic compatibility (EMC) requirements".
- [36] CENELEC EN 61000-6-2: "Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity standard for industrial environments".
- [37] CENELEC EN 61000-6-4: "Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments".
- [38] CENELEC EN 61131-2: "Programmable controllers - Part 2: Equipment requirements and tests".
- [39] CENELEC EN 61204-3: "Low voltage power supplies, d.c. output - Part 3: Electromagnetic compatibility (EMC)".
- [40] CENELEC EN 61326-1: "Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements".
- [41] CENELEC EN 61326-2-2: "Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 2-2: Particular requirements - Test configurations, operational conditions and performance criteria for portable test, measuring and monitoring equipment used in low-voltage distribution systems".
- [42] CENELEC EN 61326-2-3: "Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 2-3: Particular requirements - Test configuration, operational conditions and performance criteria for transducers with integrated or remote signal conditioning".
- [43] CENELEC EN 61326-2-4: "Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 2-4: Particular requirements - Test configurations, operational conditions and performance criteria for insulation monitoring devices according to IEC 61557-8 and for equipment for insulation fault location according to IEC 61557-9".

- [44] CENELEC EN 61326-2-5: "Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 2-5: Particular requirements - Test configurations, operational conditions and performance criteria for devices with field bus interfaces according to IEC 61784-1".
- [45] CENELEC EN 61439-2: "Low-voltage switchgear and controlgear assemblies - Part 2: Power switchgear and controlgear assemblies".
- [46] CENELEC EN 61439-3: "Low-voltage switchgear and controlgear assemblies - Part 3: Distribution boards intended to be operated by ordinary persons (DBO)".
- [47] CENELEC EN 61557-12: "Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V d.c. - Equipment for testing, measuring or monitoring of protective measures - Part 12: Performance measuring and monitoring devices (PMD)".
- [48] CENELEC EN 61800-3: "Adjustable speed electrical power drive systems - Part 3: EMC requirements and specific test methods".
- [49] CENELEC EN 62135-2: "Resistance welding equipment - Part 2: Electromagnetic compatibility (EMC) requirements".
- [50] ETSI EN 300 386: "Telecommunication network equipment; ElectroMagnetic Compatibility (EMC) requirements; Harmonised Standard covering the essential requirements of the Directive 2014/30/EU".

#### 2.1.4 Other EMC standards

- [51] CENELEC EN 55032 (2015) and AC (2016): "Electromagnetic compatibility of multimedia equipment - Emission requirements".
- [52] CENELEC EN 50561-1 (2013) and AC (2015): "Power line communication apparatus used in low-voltage installations - Radio disturbance characteristics - Limits and methods of measurement - Part 1: Apparatus for in-home use".
- [53] CENELEC EN 50561-3 (2016): "Power line communication apparatus used in low-voltage installations - Radio disturbance characteristics - Limits and methods of measurement - Part 3: Apparatus operating above 30 MHz".
- [54] CENELEC EN 61000-6-4 (2007) and A1 (2011): "Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments".

NOTE: The standards referenced in clause 2.1.4 do not directly fall into the scope of the present document. They are only referenced in the sense of a basic standard for a specific measurement.

## 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.

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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] 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] Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to electromagnetic compatibility (recast).

- [i.3] ETSI EG 203 367: "Guide to the application of harmonised standards covering articles 3.1b and 3.2 of the Directive 2014/53/EU (RED) to multi-radio and combined radio and non-radio equipment".
- [i.4] ETSI EN 303 446-1: "ElectroMagnetic Compatibility (EMC) standard for combined and/or integrated radio and non-radio equipment; Part 1: Requirements for equipment intended to be used in residential, commercial and light industry locations".
- [i.5] CENELEC EN 61000-6-3: "Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments".
- [i.6] Recommendation ITU-R SM.329: "Unwanted emissions in the spurious domain".

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## 3 Definition of terms, symbols and abbreviations

### 3.1 Terms

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

**AC mains power port:** port that connects to the low voltage AC mains power network for the sole purpose of supplying electrical energy to the EUT

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

**auxiliary equipment:** equipment needed to exercise and/or monitor the operation of the EUT

NOTE 1: Auxiliary equipment may be either local (within the measurement or test area) or remote.

NOTE 2: This is also known as associated equipment in other standards (e.g. CENELEC EN 55032 [51]).

**combined equipment:** equipment consisting of two or more products where at least one of which is radio communication or radio determination equipment and at least one of which is non-radio equipment

EXAMPLE: A radio enabled pressure sensor, where the radio functionality is embedded by incorporating a radio module, which may be assessed separated from the host.

**configuration:** operational conditions of the EUT and AE, consisting of the set of hardware elements selected to comprise the EUT and AE, mode of operation used to exercise the EUT and arrangement of the EUT and AE

**DC distribution network:** local supply network in the infrastructure of a site or building intended for use by one or more different types of equipment and providing power independent of the public mains network

NOTE: Connection to a remote local battery is not regarded as a DC distribution network, if such a link comprises only power supply for a single piece of equipment.

**DC power port:** port used to connect to a low voltage DC power generating system, energy storage or DC distribution network to power the equipment

**exclusion band(s):** frequency range(s) where during immunity test, the radio functionality is not required to meet the performance criteria defined for the specific test and where the emissions are not assessed

NOTE: Further information on exclusion bands can be found in Annex C.

**function:** operation carried out by an equipment

NOTE: Functions are related to basic technologies incorporated in the equipment such as radio reception, radio transmission, emitting light, conversion of physical dimensions to electrical signals.

**industrial location:** location characterized by a separate power network, supplied from a high- or medium-voltage transformer, dedicated for the supply of the installation

EXAMPLE: Metalworking, pulp and paper, chemical plants, car production, farm building, HV areas of airports.

NOTE 1: Industrial locations can generally be described by the existence of an installation with one or more of the following characteristics:

- items of equipment installed and connected together and working simultaneously;
- significant amount of electrical power is generated, transmitted and/or consumed;
- frequent switching of heavy inductive or capacitive loads;
- high currents and associated magnetic fields;
- presence of industrial, high power scientific and medical (ISM) equipment (for example, welding machines).

The electromagnetic environment at an industrial location is predominantly produced by the equipment and installation present at the location. There are types of industrial locations where some of the electromagnetic phenomena appear in a more severe degree than in other installations.

NOTE 2: See CENELEC EN 61000-6-2 [36].

**integrated equipment:** equipment which cannot be physically separated into radio and non-radio constituent products that can be assessed individually

EXAMPLE: A radio enabled programmable logic control, where the radio functionality is completely incorporated on the printed circuit board (PCB) of the programmable logic control in the host appliance, and cannot be assessed separately from the host.

**manufacturer:** any natural or legal person who manufactures equipment or has equipment designed or manufactured, and markets that equipment under his name or trade mark

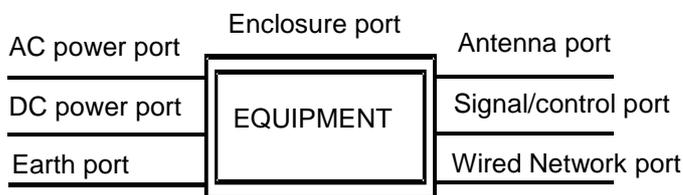
**PLC port:** port for the purpose of data transfer and communications that may also carry electrical energy to or from the EUT

NOTE 1: PLC ports are also called PLT ports.

NOTE 2: A PLC port is not considered a wired network port in the sense of this definition.

**port:** particular interface, of the specified equipment, with the electromagnetic environment

NOTE 1: For example, any connection point on an equipment intended for connection of cables to or from that equipment is considered as a port (see figure 1).



**Figure 1: Examples of ports**

NOTE 2: An interface, which uses optical fibre, is not a port for the purposes of testing because it does not interact with the electromagnetic environment within the frequency range, which is applicable for the present document. An optical fibre interface may still be used in the assessment of performance.

NOTE 3: In the case of integral antenna equipment the antenna port is the same as the enclosure port.

**product:** constituent part of a combined equipment (i.e. radio product or non-radio product)

**radio equipment:** *"An electrical or electronic product, which intentionally emits and/or receives radio waves for the purpose of radio communication and/or radio determination, or an electrical or electronic product which must be completed with an accessory, such as antenna, so as to intentionally emit and/or receive radio waves for the purpose of radio communication and/or radio determination"*, definition from Directive 2014/53/EU [i.1].

**radio module:** piece of a radio equipment providing the radio function

**service or configuration link:** radio link that is only temporarily used by authorized personnel during installation, configuration and/or servicing and not intended to be operated unattended

**wired network port:** point of connection for voice, data and signalling transfers intended to interconnect widely dispersed systems by direct connection to a single-user or multi-user communication network (for example PSTN, ISDN, xDSL, LAN and similar networks)

NOTE: These ports may support screened or unshielded cables and may also carry AC or DC power where this is an integral part of the telecommunication specification.

## 3.2 Symbols

Void.

## 3.3 Abbreviations

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

AC	Alternating Current
AE	Auxiliary Equipment
DC	Direct Current
EM	ElectroMagnetic
EMC	ElectroMagnetic Compatibility
EUT	Equipment Under Test

NOTE: The complete combined and/or integrated equipment.

LAN	Local Area Network
OJEU	Official Journal of the European Union
PLC	Power Line Communication

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# 4 EMC requirements

## 4.1 Introduction

The configuration(s) of the EUT in typical intended use shall be assessed according to the requirements in clauses 4.2 and 4.3. The configuration(s) of the EUT should be established in order to:

- maximize the emissions of the EUT;
- ensure the EUT is most susceptible to the effects of external electromagnetic interference.

Further guidance on the choice of test configuration(s) can be found in Annex A.

For the non-radio function, this configuration can be achieved by satisfying the requirements of the applicable non-radio EMC standard listed in clause 2.1.3. The configuration of the radio function shall be in accordance with the applicable radio EMC standard listed in clause 2.1.2. The configuration(s) used shall be recorded in the test report together with the rationale for these choices.

Where the applicable non-radio EMC standard and the applicable radio EMC standard refer to different editions of a basic test standard, for conducted tests the edition referred to in the applicable non-radio EMC standard shall be used, whereas for radiated tests the edition referred to in the applicable radio EMC standard shall be used.

Where there are alternative test methods and test configurations in the present document, those selected shall be detailed in the test report according to the applied standard, so that it is possible to use it for re-testing to ensure consistency of the results.

Where it has been shown from the electrical characteristics and intended usage of the EUT that one or more measurements are unnecessary, the decision and justification not to perform these measurements shall be recorded.

## 4.2 Emissions requirements

### 4.2.1 Radiated Emissions

For radiated emissions, the EUT with the radio function in standby or receive mode shall be assessed against the applicable non-radio EMC standard(s) as listed in clause 2.1.3.

Alternatively, the EUT may be assessed with the radio function in transmit mode. In this case, the EUT shall comply with the applicable non-radio EMC standard(s) as listed in clause 2.1.3 except within the exclusion band(s) defined in the applicable radio EMC standard(s) listed in clause 2.1.2.

NOTE 1: The transmit mode of the radio function is part of the assessment under article 3.2 of the Directive 2014/53/EU [i.1] applicable to the radio technology used.

NOTE 2: To prevent saturation of the measuring receiver, the good practice is to include filter(s) rejecting the transmitter frequency in the measurement chain.

If the upper frequency of this assessment is below 6 GHz, then the test requirements (while keeping the EUT configuration from the non-radio EMC standard as listed in clause 2.1.3) of CENELEC EN 61000-6-4 [37] shall apply from this upper frequency to the maximum derived from CENELEC EN 61000-6-4 [37], table 1 footnote c.

NOTE 3: While applying table 1 footnote c of CENELEC EN 61000-6-4 [37] the EUT is considered to be the combined and/or integrated equipment as defined in the present document. Therefore the highest internal frequency of the EUT includes the radio module.

NOTE 4: During the assessment, it may be beneficial to utilize results from the spurious emission testing under the requirements of article 3.2 of Directive 2014/53/EU [i.1]. To convert between effective radiated power and field strength Recommendation ITU-R SM.329 [i.6] may be used.

### 4.2.2 Conducted Emissions

#### 4.2.2.1 Special provisions

Where the wired network port provides AC or DC power as an integral part of a telecommunication function, they shall only be tested as wired network ports.

#### 4.2.2.2 AC Power port

For conducted emissions on the AC power port(s), the EUT shall be assessed against the applicable non-radio EMC standard(s) as listed in clause 2.1.3.

The exclusion band(s) defined in the applicable radio EMC standard(s) listed in clause 2.1.2 shall be applied.

#### 4.2.2.3 PLC port

Where the A.C power port of the equipment is also used for PLC communication up to 30 MHz, the EUT shall comply with the requirements of CENELEC EN 50561-1 [52], clause 6.

Where the A.C power port of the equipment is also used for PLC communication above 30 MHz, the EUT shall comply with the requirements of CENELEC EN 50561-3 [53], clause 6.

The exclusion band(s) defined in the applicable radio EMC standard(s) listed in clause 2.1.2 shall be applied.

#### 4.2.2.4 DC power port

For conducted emissions on the DC power port(s), the EUT shall be assessed against the applicable non-radio EMC standard(s) as listed in clause 2.1.3.

Where the applicable non-radio EMC standard(s) listed in clause 2.1.3 do not contain test methods and limits no measurement is required.

The exclusion band(s) defined in the applicable radio EMC standard(s) listed in clause 2.1.2 shall be applied.

#### 4.2.2.5 Wired network port

For conducted emissions on the wired network port(s), the EUT shall be assessed against the applicable non-radio EMC standard(s) as listed in clause 2.1.3.

Where the applicable non-radio EMC standard(s) listed in clause 2.1.3 do not contain test methods and limits, the EUT shall meet the requirements given in CENELEC EN 61000-6-4 [37], table 3.

The exclusion band(s) defined in the applicable radio EMC standard(s) listed in clause 2.1.2 shall be applied.

#### 4.2.2.6 Antenna Port

Where the EUT has a port intended for the connection of an external antenna via coaxial cable longer than 3 m, the Class A requirements of CENELEC EN 55032 [51] clause A.3 for antenna ports shall apply. In the case where non-compliance can be attributed to the transmission of the wanted signal from the EUT, these shall be disregarded.

The exclusion band(s) defined in the applicable radio EMC standard(s) listed in clause 2.1.2 shall be applied.

### 4.3 Immunity requirements

#### 4.3.1 General

The radio function of the EUT shall be tested against the requirements of the applicable radio EMC standard(s) listed in clause 2.1.2 and the non-radio function of the EUT shall be tested against the applicable non-radio EMC standard(s) listed in clause 2.1.3. To reduce the amount of testing, it is recommended that one or more configuration(s) are selected that exercise these functions simultaneously during the application of each test.

Where the radio and the non-radio functions have been tested separately, an additional assessment of the EUT shall be performed.

NOTE 1: As an example, the evaluation of the measurement and radio function of the EUT may be performed by transmitting measurement data over wireless LAN port. This allows the functions to be exercised in parallel during a single test, thus reducing test time.

Where immunity requirements are in conflict between those defined in the applicable radio EMC standard(s) listed in clause 2.1.2 and those defined in the applicable non-radio EMC standard(s) listed in clause 2.1.3, the more stringent requirements shall apply, unless otherwise defined in clauses 4.3.4 to 4.3.10.

NOTE 2: The selection of immunity requirements reflects the environment where the combined equipment is intended to be used. The immunity requirements for radio technologies were aligned with the less stringent requirements intended for the residential environment. In the industrial environment more stringent requirements apply, which will ensure that the product continues to operate satisfactorily in the presence of disturbances encountered in real life use.

#### 4.3.2 Configuration of the equipment during immunity tests

The configuration(s) of the EUT as defined in the applicable non-radio EMC standard(s) listed in clause 2.1.3 shall be used.

The radio function shall be set into the operating mode(s) as defined in the applicable radio EMC standard(s) listed in clause 2.1.2.

In order to minimize the number of tests, when possible and when this is representative of a normal use, different operating modes may be tested simultaneously (e.g. measurement with simultaneous transmission of data over wireless LAN).

Configuration(s) used during the tests shall be detailed in the test report.

### 4.3.3 Performance criteria

The performance of the radio communications function(s) shall comply with the performance criteria of the applicable radio EMC standard(s) listed in clause 2.1.2.

The other functions shall comply with the performance criteria defined in the applicable non-radio EMC standard(s) listed in clause 2.1.3.

Performance criteria applied during the tests shall be detailed in the test report.

### 4.3.4 Radiated Immunity

The radio and non-radio functions of the EUT shall meet the immunity requirements of the applicable non-radio EMC standard(s) listed in clause 2.1.3. Where the frequency range in these standards does not fully cover 80 MHz to 6 GHz, or where only spot frequencies in this range are specified, the radio function shall meet the requirements of the applicable radio EMC standard(s) listed in clause 2.1.2 for the frequency range(s) not covered within the 80 MHz to 6 GHz range.

Where the radio link is defined in the product specification as a service or configuration link only and not intended for permanent use, the radio link may be disturbed temporarily at test levels higher than those defined in the applicable radio EMC standard(s) listed in clause 2.1.2. In this case, the "performance criteria for transient phenomena applied to transmitters and receivers" according ETSI EN 301 489-1 [1], clause 6.2 shall be applied to the radio function at those increased test levels.

Where the radio function is operational during the test, the exclusion band(s) defined in the applicable radio EMC standard(s) listed in clause 2.1.2 shall only be applied when assessing the radio function.

NOTE: Additional measures might be necessary to avoid damaging of the radio when performing tests within the frequency range of the exclusion band(s) (e.g. adding an attenuator to the antenna port or removal/shielding of the antenna).

### 4.3.5 Electrostatic discharge

The EUT shall be assessed against the requirements defined in the applicable non-radio EMC standard(s) listed in clause 2.1.3.

### 4.3.6 Fast transients, common mode

The EUT shall be assessed against the requirements defined in the applicable non-radio EMC standard(s) listed in clause 2.1.3.

### 4.3.7 Radio frequency, common mode

The EUT shall be assessed against the requirements defined in the applicable non-radio EMC standard(s) listed in clause 2.1.3 up to 80 MHz.

Where the radio link is defined in the product specification as a service or configuration link only and not intended for permanent use, the radio link may be disturbed temporarily at test levels higher than those defined in the applicable radio EMC standard(s) listed in clause 2.1.2. In this case, the "performance criteria for transient phenomena applied to transmitters and receivers" according clause 6.2 of ETSI EN 301 489-1 [1] shall be applied to the radio function at those increased test levels.

The exclusion band(s) defined in the applicable radio EMC standard(s) listed in clause 2.1.2 shall only be applied when assessing the radio function.

NOTE: Additional measures might be necessary to avoid damaging of the radio when performing tests within the frequency range of the exclusion band(s) (e.g. adding an attenuator to the antenna port or removal/shielding of the antenna).

### 4.3.8 Voltage dips and interruptions

The EUT shall be assessed against the requirements defined in the applicable non-radio EMC standard(s) listed in clause 2.1.3.

### 4.3.9 Surges

The EUT shall be assessed against the requirements defined in the applicable non-radio EMC standard(s) listed in clause 2.1.3.

### 4.3.10 Other immunity tests

If the applicable non-radio EMC standard(s) listed in clause 2.1.3 contain(s) further immunity test requirements than those defined in the previous clauses, then these requirements also apply to the EUT.

Where these immunity tests are of a continuous nature like the tests covered by clauses 4.3.4 or 4.3.7, then the exclusion band(s) defined in the applicable radio EMC standard(s) listed in clause 2.1.2 shall only be applied when assessing the radio function.

NOTE: Additional measures might be necessary to avoid damaging of the radio when performing tests within the frequency range of the exclusion band(s) (e.g. adding an attenuator to the antenna port or removal/shielding of the antenna).

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## Annex A (informative): Guidance for the choice of configurations for the measurements on combined equipment

Clause 4.1 of the present document requires the test of at least one configuration of typical intended use according to the requirements in clauses 4.2 and 4.3 with both non-radio and radio functions operating at the same time.

These simultaneous test(s) have been introduced so that possible interactions, for example; intermodulation between the radio part and the non-radio part of the combined equipment are taken into account when determining compliance with the EMC requirements. Manufacturers should choose a configuration, which is stable enough to carry out the measurements without the use of special test modes. The configuration chosen should be able to maintain operation for the duration of the required test. Should special evaluation procedures be required, these will usually exist in the EMC product standard.

The test configuration includes:

- set of connected hardware elements (EUT and AE);
- arrangement of the EUT, AE and the cables;
- operating modes of the EUT.

To find a suitable configuration for testing, the manufacturer needs to follow the principles set out above and evaluate if different modes of operation of the EUT have an impact on the performance of the radio and thereby an impact on the EMC behaviour of the EUT. As a result of that evaluation a range of configurations or a simplified test may be chosen.

**NOTE:** If e.g. discontinuous disturbances caused by the switching of large loads in specific configurations do not influence the radio performance of the EUT, they may be disregarded for particular tests.

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## Annex B (informative): Use of industrial equipment in residential locations

If equipment can be used also in residential environments, then the instructions for use accompanying the product should contain the following text:

***Caution:** This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.*

Alternatively, the equipment should comply with the emission requirements of ETSI EN 303 446-1 [i.4] with CENELEC EN 61000-6-3 [i.5] used as non-radio EMC standard.

## Annex C (informative): Exclusion bands

Where required by clauses in the present document exclusion bands are derived from the standard(s) referenced in table C.1 applicable to the radio technology deployed within the combined and/or integrated equipment under assessment. Where multiple radio technologies are deployed within the same equipment all of the relevant exclusion bands are applied.

It should be noted that the exclusion bands applied during immunity testing may differ from those applied during emission testing.

**Table C.1: Exclusion band references**

Radio technology	Exclusion bands defined in
Bluetooth® (Bluetooth® LE included), ZigBee®, Wi-Fi®	ETSI EN 301 489-17 [5], clause 4.3
Non-Specific SRD	ETSI EN 301 489-3 [2], clause 4.3
WiGig®	No exclusion bands applied
DECT®	ETSI EN 301 489-6 [4], clause 4.3
NOTE 1: Other technologies have their exclusion band(s) according to the applicable radio EMC standard(s) listed in clause 2.1.2 of the present document or ETSI EN 301 489-1 [1], clause 4.3 if a specific radio technology part does not exist.	
NOTE 2: The Bluetooth® word mark is a registered trademark owned by Bluetooth SIG, Incorporation. This information is given for the convenience of the user of the present document and does not constitute an endorsement by ETSI. Equivalent technology may be used if it can be shown to lead to the same results.	
NOTE 3: The ZigBee® word mark is a registered trademark owned by the ZigBee Alliance. This information is given for the convenience of the user of the present document and does not constitute an endorsement by ETSI. Equivalent technology may be used if it can be shown to lead to the same results.	
NOTE 4: The Wi-Fi® and WiGig® word marks are registered trademarks owned by the Wi-Fi Alliance. This information is given for the convenience of the user of the present document and does not constitute an endorsement by ETSI. Equivalent technology may be used if it can be shown to lead to the same results.	

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## Annex D (informative): Change History

Version	Information about changes
1.1.0	First draft version as a European harmonised standard developed under the Commission's standardisation request C(2015) 5376. NOTE: This version was never released.
1.2.0	First draft version as a European standard.

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## History

<b>Document history</b>			
V1.1.0	March 2017	EN Approval Procedure	AP 20170615: 2017-03-17 to 2017-06-15
V1.2.0	March 2019	EN Approval Procedure	AP 20190611: 2019-03-13 to 2019-06-11