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Harmonized European Standard (Telecommunications series)

**Electromagnetic compatibility
and Radio spectrum Matters (ERM);
ElectroMagnetic Compatibility (EMC)
standard for radio equipment and services;
Part 34: Specific conditions for External Power Supply (EPS)
for mobile phones**



Reference

DEN/ERM-EMC-270

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Foreword

This Harmonized European Standard (Telecommunications series) 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 under Council Directive 98/34/EC [i.3] (as amended) laying down a procedure for the provision of information in the field of technical standards and regulations.

The present document together with EN 301 489-1 [1], 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 on the approximation of the laws of the Member States relating to electromagnetic compatibility ("the EMC Directive") (2004/108/EC [i.1] as amended) and Directive 1999/5/EC [i.4] of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity ("the R&TTE Directive").

The present document is part 34 of a multi-part deliverable. Full details of the entire series can be found in part 1 [1].

National transposition dates	
Date of adoption of this EN:	17 September 2010
Date of latest announcement of this EN (doa):	31 December 2010
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	30 June 2011
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Introduction

The present document is part of a set of standards developed by ETSI and is designed to fit in a modular structure to cover all radio and telecommunications terminal equipment within the scope of the R&TTE Directive. The modular structure is shown in EG 201 399 [i.2].

1 Scope

The present document contains the Specific conditions for Mobile Phone Common External Power Supply equipment using a USB Micro-B connector as defined in M/455 [2] associated with digital cellular mobile and portable (UE) radio terminal equipment radio communications equipment, in respect of ElectroMagnetic Compatibility (EMC).

Product dependent arrangements necessary to perform the EMC tests on dedicated types of radio communications equipment, and the assessment of test results, are detailed in the appropriate product related parts of EN 301 489 [11].

In case of differences (for instance concerning special conditions, definitions and abbreviations) between the present document and 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 EN 301 489-1 [1], except for any special conditions included in the present document.

2 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 <http://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.

2.1 Normative references

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

- [1] ETSI EN 301 489-1 (V1.8.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements".
 - [2] M/455 EN Annex II Part A of Standardisation mandate to CEN, CENELEC and ETSI on a common Charging Capability for Mobile Telephones 12th, January 2010.
- NOTE: Available [here](#). This reference will be superseded by the specification produced by CENELEC BTTF 135-1.
- [3] CENELEC EN 55022: 2006 / Amendment 1: 2007: "Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement".
 - [4] CENELEC EN 61000-4-2: 2001: "Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test".
 - [5] CENELEC EN 61000-4-3: 2006: "Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test".
 - [6] CENELEC EN 61000-4-4: 2004: "Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test".
 - [7] CENELEC EN 61000-4-5: 2006: "Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test".
 - [8] CENELEC EN 61000-4-6: 2009: "Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields".

- [9] CENELEC EN 61000-4-11: 2004: "Electromagnetic compatibility (EMC) - Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests".
- [10] CENELEC EN 61000-3-3: 2008: "Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection".
- [11] ETSI EN 301 489 (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services".
- [12] CENELEC EN 55016-2-3: 2006: "Specification for radio disturbance and immunity measuring apparatus and methods - Part 2-3: Methods of measurements of disturbances and immunity - Radiated disturbance measurements".
- [13] CENELEC EN 61000-3-2:2006 / Amendment 1: 2009 / Amendment 2: 2009: "Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current up to and including 16 A per phase)".
- [14] CENELEC EN 60950-1: 2006: "Information Technology Equipment - Safety - Part 1: General Requirements".
- [15] CENELEC EN 55016-2-1: 2009: "Specification for radio disturbance and immunity measuring apparatus and methods -- Part 2-1: Methods of measurement of disturbances and immunity - Conducted disturbance measurements".

2.2 Informative references

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] Council Directive 2004/108/EC of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC (EMC Directive).
- [i.2] ETSI EG 201 399: "Electromagnetic compatibility and Radio spectrum Matters (ERM); A guide to the production of candidate Harmonized Standards for application under the R&TTE Directive".
- [i.3] 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.
- [i.4] Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (R&TTE Directive).

3 Definitions and abbreviations

3.1 Definitions

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

adaptor: device with a USB Micro-B receptacle/plug connecting to a specific non USB Micro-B connector

NOTE: An Adaptor can also be a cable.

EPS: Common External Power Supply (EPS) with an AC input which meets the requirements of the specifications given in M/455 EN Annex II part A [2]

NOTE: The specifications include:

- A USB Micro-B Plug attached via a cable which delivers power to the device being charged.

- A voltage supplied of 5,0 V \pm 5 %.
- A maximum output current delivered of between 500 mA and 1 500 mA.
- The EPS must be a Limited Power source in accordance with EN 60950-1 [14].

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

port: particular interface, of the specified equipment (apparatus), with the electromagnetic environment

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).

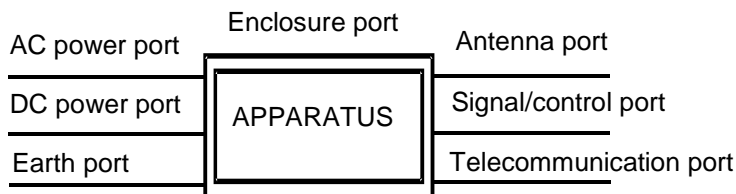


Figure 1: Examples of ports

NOTE: 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.

representative generic test load: EPS load which fully exercise the EPS and is supplied by the EPS manufacturer

NOTE: E.g. as in clause 4.3.

3.2 Abbreviations

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

AC	Alternating Current
AMN	Artificial Mains Network
AN	Artificial Network
CDN	Coupling/Decoupling Network
DC	Direct Current
EM	ElectroMagnetic
EMC	ElectroMagnetic Compatibility
EPS	External Power Supply
ESD	Electro Static Discharge
EUT	Equipment Under Test
HS	Harmonized Standard
RF	Radio Frequency
rms	root mean square
UE	User Equipment (Mobile station)

4 Test conditions

4.1 General

The present document relates to the testing of the EPS, and seeks to ensure that a EPS which is compliant to the provisions of the present document will, when used with a compatible UE which is compliant to the applicable provisions of the EN 301 489 [11], comply with the requirements of EN 301 489-1 [1].

The present document describes testing the EPS with a Representative generic test load, which is intended to emulate a UE for the purpose of testing the EPS.

Because the choice of UE may have some impact on the EMC performance of the EPS certain criteria and/or limits have been tightened beyond those applied in the case of testing intended to determine the compliance of a specific EPS - UE combination. Such specific combinations may be tested as described in other parts of the EN 301 489 [11], but such testing does not demonstrate compliance to the requirements of a EPS.

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

- The EPS shall be connected with a Representative generic test load exercising the DC output port.
- Adequate measures shall be taken to avoid the effect of immunity RF test signals on the measuring equipment.
- Measurements shall be taken with the cable supplied with the EPS at the USB Micro-B port. The type and length of cable used shall be recorded in the test report.

4.2 Arrangements for test signals

Adequate measures shall be taken to avoid the effect of immunity test signals on both the measuring equipment and the signal sources for the wanted signals located outside the test environment.

4.3 Representative generic test load

An EPS Representative generic test load which is representative of a UE shall have the following characteristics:

- A USB Micro-B socket connection.
- An input capacitance of 1µF in parallel with the EPS output.
- An input impedance with switchable range of:
 - 10k Ω (for 0 % rated current).
 - Selection of resistances to obtain the currents and output voltages of the test procedures.
 - A resistance to obtain Maximum rated current.
- A shielded casing/enclosure.

5 Performance assessment

EN 301 489-1 [1], clause 5 shall apply with the following modification stated in clause 6.

6 Performance criteria

For the EPS, the performance criteria are based on a UE intended to be used with the EPS. For some specific test cases a different compliance level and/or performance criteria has been defined in order to ensure the compliance at the UE and EPS.

The performance criteria are used to make a decision on whether an EPS passes or fails immunity tests.

For the purpose of the present document two categories of performance criteria apply:

- performance criteria for continuous phenomena applied to EPS;
- performance criteria for transient phenomena applied to EPS.

6.1 Performance criteria for EPS

For a EPS the performance criteria for continuous phenomena shall meet the requirements whilst tested with the representative generic test load as given below:

- Output Voltage $5\text{ V} \pm 0,25\text{ V}$ from no load to maximum output current measured at the USB Micro-B plug.
- Output Current at $5\text{ V} \pm 0,25\text{ V}$ within 500 mA to 1 500 mA depending on the generic test load and EPS capability.
- Output Voltage Ripple (Under load conditions from idle to full): 80 mVp-p measured at 20 MHz bandwidth using the test method as defined in Addendum II of M/455 EN Annex II Part A [2].

While the parameters above should monitored at the USB Micro-B plug, the reference for the output voltage is the USB Micro-B plug for an EPS with captive cable and the Standard-A plug for an EPS with detachable cable.

The above criteria shall also be met after exposure to transient phenomena.

7 Applicability overview tables

The applicability overview (tables 1 and 2) give a overview about all EMC tests specified in the present document for EPS equipment.

All tests are port-related EMC tests.

7.1 EMC emission

Table 1: EMC emission measurements for EPS equipment specified in the present document, overview

Phenomenon	Application	Equipment test requirement	Reference
		EPS	clause in the present document
radiated emission	enclosure of EPS equipment	applicable	8.2
conducted emission	DC power output port	applicable	8.3
conducted emission	AC mains input port	applicable	8.4
harmonic current emissions	AC mains input port	applicable	8.5
voltage fluctuations and flicker	AC mains input port	applicable	8.6

7.2 Immunity

Table 2: Immunity tests for EPS equipment specified in the present document, overview

Phenomenon	Application	Equipment test requirement	Reference
		EPS	clause in the present document
RF electromagnetic field (80 MHz to 1 000 MHz and 1 400 MHz to 2 700 MHz)	enclosure of EPS equipment	applicable	9.2
electrostatic discharge	enclosure and DC power output port	applicable	9.3
fast transients common mode	DC and AC power ports	applicable	9.4
RF common mode 0,15 MHz to 80 MHz	DC and AC power ports	applicable	9.5
voltage dips and interruptions	AC mains power input ports	applicable	9.6
surges, line to line and line to ground	AC mains power input ports	applicable	9.7

8 Methods of measurement and limits for EMC emissions

8.1 Test configuration

This clause defines the requirements for test configurations:

- measurements shall be made in the operational mode producing the largest emission in the frequency band being investigated consistent with normal applications;
- the equipment shall be configured in a manner which is representative for normal/typical operation, where practical;
- ports, which in normal operation are connected, shall be connected to an EPS equipment and to the Representative generic test load, Input/output ports shall be correctly terminated;
- the configuration and mode of operation during the measurements shall be precisely noted in the test report.

8.2 Enclosure of EPS equipment

The EPS shall be configured in order to ascertain the worst case radiated emissions and this shall be recorded. Tests shall then be carried out at the worst case, 10 % and 100 % of the rated output current and when disconnected from the Representative generic test load (no load condition).

This test assesses the ability of EPS equipment to limit their internal noise from being radiated from the enclosure.

8.2.1 Test method

The test method shall be in accordance with EN 55016-2-3 [12].

8.2.2 Limits

The EPS equipment under no load condition shall meet the class B limits given in EN 55022 [3].

The EPS equipment under worst case, 10 % and 100 % of the rated output current conditions the measured emissions shall meet the class B limits, given in EN 55022 [3].

8.3 DC power output ports

The EPS shall be configured in order to ascertain the worst level of conducted emissions and this shall be recorded. Tests shall then be carried out at the worst case and at 10 % and 100 % of the rated output current and when disconnected from the Representative generic test load (no load condition).

This test is applicable to EPS equipment that may have DC cables longer than 3 m as declared by the manufacturer.

8.3.1 Definition

This test assesses the ability of the EUT to limit its internal noise from being present on the DC power output ports.

8.3.2 Test method

The test method shall be in accordance with EN 55016-2-1 [15]. The Artificial Mains Networks (AMN) as specified in EN 55016-2-1 [15] shall be used and be connected to the Representative generic test load.

The measurement frequency range extends from 150 kHz to 30 MHz.

8.3.3 Limits

The equipment shall meet the limits below including the average limit and the quasi-peak limit when using, respectively, an average detector receiver and a quasi-peak detector receiver and measured in accordance with the method described in clause 8.3.2. If the average limit is met when using a quasi-peak detector, the equipment shall be deemed to meet both limits and measurement with the average detector is unnecessary.

The equipment shall meet the class B limits according to EN 55022 [3].

8.4 AC mains power input ports

This test shall be performed on a representative configuration of the EPS.

8.4.1 Definition

This test assesses the ability of the EUT to limit its internal noise from being present on the AC mains power input port.

8.4.2 Test method

The EPS shall be configured as follows:

The EPS shall be tested across the full range of output currents in order to ascertain the worst mode for internal noise and this shall be recorded. Tests shall then be carried out at the worst case, 10 % and 100 % of the rated output current and when disconnected from the Representative generic test load (no load condition).

The test method shall be in accordance with EN 55016-2-1 [15] and the Artificial Mains Networks (AMNs) shall be connected to the AC mains power source.

The measurement frequency range extends from 150 kHz to 30 MHz.

8.4.3 Limits

The equipment shall meet the limits below including the average limit and the quasi-peak limit when using, respectively, an average detector receiver and a quasi-peak detector receiver and measured in accordance with the method described in clause 8.4.2. If the average limit is met when using a quasi-peak detector, the equipment shall be deemed to meet both limits and measurement with the average detector is unnecessary.

The equipment shall meet the class B limits given in EN 55022 [3].

8.5 Harmonic current emissions (AC mains input port)

The appropriate requirements of EN 61000-3-2/A1 [13] for harmonic current emission apply for equipment covered by the scope of the present document with an input current up to and including 16 A per phase.

8.6 Voltage fluctuations and flicker (AC mains input port)

The appropriate requirements of EN 61000-3-3 [10] for voltage fluctuations and flicker apply for equipment covered by the scope of the present document with an input current up to and including 16 A per phase.

9 Test methods and levels for immunity tests

9.1 Test configuration

The EPS shall have the following configurations:

- The integral USB cable or the Standard detachable cable assembly, supplied for use with the EPS shall be configured for worst case susceptibility during the immunity tests and this shall be recorded in the test report.
- An EPS shall be tested with the defined Representative generic test load.
- The EPS shall be tested at rated nominal voltage at its full rated load and this shall be recorded.

This clause defines the requirements for test configurations:

- the tests shall be carried out at a point within the specified normal operating environmental range and at the rated supply voltage for the equipment;
- ports, which in normal operation are connected, shall be connected to the Representative generic test load;
- the configuration and mode of operation during the tests shall be precisely noted in the test report.

9.2 Radio frequency electromagnetic field (80 MHz to 1 000 MHz and 1 400 MHz to 2 700 MHz)

This test shall be performed on a representative configuration the EPS equipment.

An EPS shall be tested with the defined Representative generic test load.

9.2.1 Definition

This test assesses the ability of the EUT to operate as intended in the presence of a radio frequency electromagnetic field disturbance.

9.2.2 Test method

The test method shall be in accordance with EN 61000-4-3 [5].

The following requirements and evaluation of test results shall apply:

- the test level shall be 10 V/m (measured unmodulated). The test signal shall be amplitude modulated to a depth of 80 % by a sinusoidal audio signal of 1 000 Hz;
- the test shall be performed over the frequency range 80 MHz to 1 000 MHz and 1 400 MHz to 2 700 MHz;
- the stepped frequency increments shall be 1 % frequency increment of the momentary used frequency;
- the frequencies selected and used during the test shall be recorded in the test report.

9.2.3 Performance criteria

For EPS equipment the pass/failure criteria given in clause 6 (see also Annex II part A of M/455 EN [2]) shall apply.

9.3 Electrostatic discharge

An EPS shall be tested with defined Representative generic test load and no load conditions.

This test shall be performed both on a representative configuration of the EPS with the Representative generic test load and to the shield of the USB Micro-B cable whilst disconnected from the Representative generic test load. In both cases the AC shall be connected.

9.3.1 Definition

This test assesses the ability of the EUT to operate as intended in the event of an electrostatic discharge.

9.3.2 Test method

The test method shall be in accordance with EN 61000-4-2 [4].

For EPS equipment the following requirements and evaluation of test results shall apply.

The test severity level for contact discharge shall be 4 kV and for air discharge 8 kV. All other details, including intermediate test levels, are contained within EN 61000-4-2 [4].

Electrostatic discharges shall be applied to all exposed surfaces of the EUT except where the user documentation specifically indicates a requirement for appropriate protective measures (see EN 61000-4-2 [4]).

9.3.3 Performance criteria

Before and after the test the EPS the pass/failure criteria given in clause 6 (see also in Annex II part A of M/455 EN [2]) shall apply.

9.4 Fast transients, common mode

This test shall be performed on a representative configuration of the EPS with the Representative generic test load.

This test shall be performed on the AC mains power port of the EPS equipment.

This test shall be performed on the DC output port of the EPS equipment if intended to be used with cables longer than 3 m as declared by the manufacturer.

9.4.1 Definition

This test assesses the ability of the EUT to operate as intended in the event of fast transients present on one of the input/output ports.

9.4.2 Test method

The test method shall be in accordance with EN 61000-4-4 [6].

The following requirements and evaluation of test results shall apply:

- the test level for DC power output ports shall be 0,5 kV open circuit voltage as given EN 61000-4-4 [6] transients shall be applied using a capacitive clamp;
- the test level for AC mains power input ports shall be 1 kV open circuit voltage as given EN 61000-4-4 [6] with the EPS AC port connected directly to the test generator.

9.4.3 Performance criteria

Before and after the test the EPS the pass/failure criteria given in clause 6 (see also in Annex II part A of M/455 EN [2]) shall apply.

9.5 Radio frequency, common mode

This test shall be performed on the AC mains power port of the EPS equipment.

This test shall be performed on the DC output port of the EPS equipment if intended to be used with cables longer than 3 m as declared by the manufacturer.

9.5.1 Definition

This test assesses the ability of the EUT to operate as intended in the presence of a radio frequency electromagnetic disturbance on the input/output ports.

9.5.2 Test method

The test method shall be in accordance with EN 61000-4-6 [8].

The following requirements and evaluation of test results shall apply:

- the test level shall be severity level 3 as given in EN 61000-4-6 [8] corresponding to 10V rms unmodulated. The test signal shall then be amplitude modulated to a depth of 80 % by a sinusoidal audio signal of 1 000 Hz;
- the test shall be performed over the frequency range 150 kHz to 80 MHz;
- a stepped frequency increments shall be 1 % frequency increment of the momentary frequency in the frequency range 150 kHz to 80 MHz;
- the injection method to be used shall be selected according to the basic standard EN 61000-4-6 [8];
- the frequencies of the immunity test signal selected and used during the test shall be recorded in the test report.

9.5.3 Performance criteria

For EPS equipment the pass/failure criteria given in clause 6 (see also in Annex II Part A of M/455 EN [2]) shall apply.

9.6 Voltage dips and interruptions

This test shall be performed on the AC mains power port of the EPS equipment.

9.6.1 Definition

These tests assess the ability of the EUT to operate as intended in the event of voltage dips and interruptions present on the AC mains power input ports.

9.6.2 Test method

The following requirements and evaluation of test results shall apply.

The test method shall be in accordance with EN 61000-4-11 [9].

The test levels shall be:

- voltage dip: 0 % residual voltage for 0,5 cycle;
- voltage dip: 0 % residual voltage for 1 cycle;
- voltage dip: 70 % residual voltage for 25 cycles (at 50 Hz);
- voltage interruption: 0 % residual voltage for 250 cycles (at 50 Hz).

9.6.3 Performance criteria

For a voltage dips and interruptions the following performance criteria apply:

- For EPS equipment the pass/failure criteria given in clause 6 (see also in Annex II Part A of M/455 EN [2]) shall apply.

9.7 Surges

This test shall be performed on the AC mains power port of the EPS equipment.

9.7.1 Definition

These tests assess the ability of the EUT to operate as intended in the event of surges present on the AC mains power input port.

9.7.2 Test method

For EPS equipment the pass/failure criteria given in clause 6 (see also in Annex II Part A of M/455 EN [2]) shall apply.

9.7.2.1 Test method for mains ports

The test level for ac mains power input ports shall be 2 kV line to ground, and 1 kV line to line, with the output impedance of the surge generator as given in EN 61000-4-5 [7].

The test generator shall provide the 1,2/50 μ s pulse as defined in EN 61000-4-5 [7].

9.7.3 Performance criteria

Before and after the test the EPS the pass/failure criteria given in clause 6 (see also in Annex II part A of M/455 EN [2]) shall apply.

Annex A (informative): Rationales considered in drafting EN 301 489-34

Levels for immunity. The mobile phone industry's experience on EMC RF immunity testing indicates that different combinations of phones and accessories might not be in compliance to 3 V/m when used in different combinations. Based on this experience, the compliance level EPS on RF immunity testing with a Representative generic test load, needs to be higher in order to minimize the risk for non-tested combinations of mobile phones and a EPS for UEs. Also different combinations of phones and accessories might not be in compliance to 3 Vrms when used in different combinations. Based on this experience, the compliance level for a stand alone EPS on RF immunity testing, needs to be higher in order to minimize the risk for non-compliant combinations of UEs and a EPS for mobile phones.

ESD is to ensure a safe and stable performance of the EPS. Different manufacturer have different protection levels for ESD in their design and product and this may cause potential problems for a EPSs that is in compliance with a different product. A ESD testing with a Representative generic test load will provide a reasonable performance level for a EPS since the discharges are likely to affect only the EPS design and not the UE.

Annex B (informative): The EN title in the official languages

The enlargement of the European Union (EU) resulted in a requirement from the EU for a larger number of languages for the translation of the titles of Harmonized Standards and mandated ENs that are to be listed in the Official Journal to support the implementation of this legislation.

For this reason the title translation concerning the present document can be consulted via the [e-approval](#) application.

Annex C (informative): Bibliography

ETSI EN 301 489-7: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 7: Specific conditions for mobile and portable radio and ancillary equipment of digital cellular radio telecommunications systems (GSM and DCS)".

ETSI EN 301 489-24: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 24: Specific conditions for IMT-2000 CDMA Direct Spread (UTRA) for Mobile and portable (UE) radio and ancillary equipment".

History

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