Telecommunication network equipment;
ElectroMagnetic Compatibility (EMC) requirements;
Harmonised Standard covering the essential requirements
of the Directive 2014/30/EU
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Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for ETSI members and non-members, and can be found in ETSI SR 000 314: "Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards", which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (https://ipr.etsi.org/).

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Foreword

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

The present document has been prepared to provide one voluntary means of conforming to the essential requirements of Directive 2014/30/EU [i.31] 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).

NOTE: The corresponding Commission’s standardisation request to provide one voluntary means of conforming to the essential requirements Directive 2014/30/EU on the harmonisation of the laws of the Member States relating to electromagnetic compatibility (recast) [i.31] is expected shortly.

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.

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Modal verbs terminology

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

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

The present document covers the EMC requirements for non-radio equipment intended to be used within a public telecommunications network, which provides telecommunications between Network Termination Points (NTPs) (i.e. excluding terminal equipment beyond the NTPs). Examples of such equipment are:

- **Switching equipment.** Such equipment includes:
  - local telephone exchanges;
  - remote switching concentrators;
  - international switches;
  - telex switches;
  - network packet switches;
  - base station controllers, radio network controllers;
  - network servers and gateways.

- **Non-radio transmission equipment and ancillary equipment.** Such equipment includes:
  - multiplexers;
  - line equipment and repeaters, e.g. equipment for:
    - Synchronous Digital Hierarchy (SDH);
    - Plesiochronous Digital Hierarchy (PDH);
    - Asynchronous Transfer Mode (ATM);
  - Digital Cross Connect systems;
  - network terminations;
  - transmission equipment used in the access network like xDSL.

- **Power supply equipment.** Such equipment includes:
  - central power plant;
  - end of suite power supplies;
  - uninterruptible power supplies;
  - stabilized AC power supplies; and
  - other dedicated telecommunication network power supplies;
  but excludes equipment which is uniquely associated with or integrated in other equipment.

- **Supervisory equipment.** Such equipment includes:
  - network management equipment;
  - operator access maintenance equipment;
  - traffic measurement systems;
  - line test units;
  - functional test units.
NOTE: The function of supervision may either be performed by independent equipment or form part of other telecommunication network equipment. If the function of supervision forms part of a telecommunication network equipment, the performance may be evaluated simultaneously with other functions (such as switching and transmission) during EMC testing.

- Data centre equipment which is intended to be used within telecommunication network infrastructure:
  - Storage.
  - Processor.
  - Server.

The environmental classification locations used in the present document refers to ETSI TR 101 651 [i.22].

The requirements of the present document have been selected to ensure an adequate level of immunity for the apparatus covered by the scope of the present document. The levels do not, however, cover extreme cases which may occur at any location but with a low probability of occurrence. In special cases, situations may arise where the levels of disturbance may exceed the immunity test levels specified in the present document. In these instances, special mitigation measures may have to be employed.

General purpose equipment, which is used as a part of a telecommunication network, may be covered by the scope of other standards. For such equipment, if those other standards fully cover the requirements of the present document, no further assessment is necessary. Equipment which also fall within the scope of CENELEC EN 50083-2 [3] may require additional testing on the relevant RF ports. See clause 9.2 and annex D.

Equipment may provide different functions, i.e. switching equipment may also provide transmission functions and transmission equipment may provide storage capabilities etc. All available functions of the EUT are to be tested.

## 2 References

### 2.1 Normative references

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

Referenced documents which are not found to be publicly available in the expected location might be found at [http://docbox.etsi.org/Reference](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.

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


NOTE: The use of CENELEC EN 55022 is controlled by the dates defined in the Official Journal.
CENELEC EN 61000-3-2 (2014): "Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current <= 16 A per phase)".

CENELEC EN 61000-3-3 (2013): "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".

CENELEC EN 61000-3-11 (2000): "Electromagnetic compatibility (EMC) - Part 3-11: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems - Equipment with rated current <= 75 A and subject to conditional connection".

CENELEC EN 61000-3-12 (2011): "Electromagnetic compatibility (EMC) - Part 3-12: Limits - Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current > 16 A and <= 75 A per phase".

CENELEC EN 61000-4-2 (2009): "Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test".


CENELEC EN 61000-4-4 (2012): "Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test".


NOTE: The dated reference of CENELEC EN 61000-4-5 has not been updated to the latest version because of the significant technical changes in comparison with the referenced revision. For some test laboratories, updating equipment will be a significant additional cost hence more time is required for implementation.

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".

NOTE: The dated reference of CENELEC EN 61000-4-6 has not been updated to the latest version because of the significant technical changes in comparison with the referenced revision. For some test laboratories, updating equipment will be a significant additional cost hence more time is required for implementation.

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".

ETSI ETS 300 132-1 (edition 1) (09-1996): "Equipment Engineering (EE); Power supply interface at the input to telecommunications equipment; Part 1: Operated by alternating current (ac) derived from direct current (dc) sources".

ETSI EN 300 132-2 (V2.4.6) (12-2011): "Environmental Engineering (EE); Power supply interface at the input to telecommunications and datacom (ICT) equipment; Part 2: Operated by -48 V direct current (dc)".


Void.

Void.

Void.
2.2 Informative references

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

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

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] ETSI EN 300 011-1 (V1.2.2): "Integrated Services Digital Network (ISDN); Primary rate User Network Interface (UNI); Part 1: Layer 1 specification".

[i.2] ETSI EN 300 012-1 (V1.2.2): "Integrated Services Digital Network (ISDN); Basic User-Network Interface (UNI); Part 1: Layer 1 specification".

[i.3] ETSI EN 300 166 (V1.2.1): "Transmission and Multiplexing (TM); Physical and electrical characteristics of hierarchical digital interfaces for equipment using the 2 048 kbit/s - based plesiochronous or synchronous digital hierarchies".


[i.5] ISO/IEC/IEEE 8802-3 (2014): "Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements - Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications".

[i.6] Void.

[i.7] Void.


Void.

Recommendation ITU-T G.961 (1993 + Erratum 1: 2000): "Digital transmission system on metallic local lines for ISDN basic rate access".


Recommendation ITU-T V.10 (1993): "Electrical characteristics for unbalanced double-current interchange circuits operating at data signalling rates nominally up to 100 kbit/s".

Recommendation ITU-T V.11 (1996): "Electrical characteristics for balanced double-current interchange circuits operating at data signalling rates up to 10 Mbit/s".

Recommendation ITU-T V.24 (2000): "List of definitions for interchange circuits between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE)".


Recommendation ITU-T X.24 (1988): "List of definitions for interchange circuits between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE) on public data networks".

Recommendation ITU-T X.25 (1996 + Corrigendum 1: 1998): "Interface between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE) for terminals operating in the packet mode and connected to public data networks by dedicated circuit".

ETSI TR 101 651 (V2.1.1): "Electromagnetic compatibility and radio spectrum matters (ERM); Classification of the electromagnetic environment conditions for equipment in telecommunication networks".


3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in IEC 60050-161 [17] and the following apply:

NOTE: The definitions taken from IEC 60050-161 [17] have reference in parentheses.

AC secondary interface: output port of an AC power supply
AC secondary voltage: output of the AC power supply at the AC secondary interface

NOTE: The AC secondary voltage may be either:
- a stabilized AC supply derived from a DC primary supply (e.g. where the power supply is an inverter); or
- derived from the AC primary supply (e.g. a stabilized power supply used where the quality of the primary supply is not sufficient to feed telecommunications equipment).

burst (161-02-07): sequence of a limited number of distinct pulses or an oscillation of limited duration

collection: temporary association of transmission channels or telecommunication circuits, switching or other functional units set up to provide for the transfer of information between two or more points in a telecommunication network (IEC 60050-714 [18])

continuous disturbance (161-02-11): electromagnetic disturbance the effects of which on a particular device or equipment cannot be resolved into a succession of distinct effects

data centre: structure, or group of structures, dedicated to the centralized accommodation, interconnection and operation of information technology and network telecommunications equipment providing data storage, processing and transport services together with all the facilities and infrastructures for power distribution and environmental control together with the necessary levels of resilience and security required to provide the desired service availability

DC secondary interface: output port of a DC power supply

DC secondary voltage: output of the DC power supply at the DC secondary interface

NOTE: The DC secondary voltage may be derived from the AC primary supply with or without a buffer battery.

duration (of a voltage change) (161-08-03): interval of time for the voltage to increase or decrease from the initial value to the final value

duration (of a pulse): interval of time between the instants at which the instantaneous value of a pulse reaches 50 % of the pulse magnitude for the first and last time

enclosure port: physical boundary of the Equipment Under Test (EUT) through which electromagnetic fields may emanate or on which they may impinge

environment, environmental conditions: electromagnetic conditions external to the equipment, to which it is subjected at a certain time

NOTE: The environmental conditions comprise a combination of single environmental parameters and their severity.

environmental parameters: present one or more properties of the electromagnetic environment

immunity (to a disturbance) (161-01-20): ability of a device, equipment or system to perform without degradation in the presence of an electromagnetic disturbance

impulsive disturbance (161-02-09): electromagnetic disturbance which, when incident on a particular device or equipment, manifests itself as a succession of distinct pulses or transients

interface "A": terminals at which a power supply is connected to the telecommunications equipment

interface A3: interface, physical point, at which power supply is connected in order to operate the telecommunications and datacom (ICT) equipment with input DC voltage between 260 V and 400 V

multimedia network equipment: multimedia network equipment containing broadcast and telecommunication functions

Network Termination Point (NTP): physical point at the boundary of the Public Switched Telecommunications Networks (PSTN) intended to accept the connection of a Terminal Equipment (TE)

nominal voltage: nominal value of voltage that designates the type of supply

normal service: service mode where telecommunications equipment operates within its specification
**performance criterion:** limits of acceptable behaviour of the equipment during and after the application of the electromagnetic phenomenon

NOTE: Performance criteria A apply for continuous phenomena; performance criteria B and C apply for transient phenomena; and performance criteria R apply for resistibility phenomena.

**port:** particular interface of the EUT with the external electromagnetic environment

**power supply:** power source (within the scope of the present document) to which telecommunications equipment is intended to be connected

**primary supply:** public mains or a locally generated AC or DC supply

**pulse** *(161-02-02):* abrupt variation of short duration of a physical quantity followed by a rapid return to the initial value

**Radio Frequencies (RF):** frequency range above 150 kHz

**rise time (of a pulse)** *(161-02-05):* interval of time between the instants at which the instantaneous value of a pulse first reaches a specified lower value and then a specified upper value

NOTE: Unless otherwise specified, the lower and upper values are fixed at 10 % and 90 % of the pulse magnitude.

**secondary supply:** supply to the telecommunications equipment (e.g. racks or system blocks), derived from the primary supply

**signal line port:** these include telecommunication ports, wired network ports, RF ports or ports intended for the interconnection of components of an EUT, or between an EUT and AE and used in accordance with relevant functional specifications (for example for the maximum length of cable connected to it)

**surge (voltage)** *(161-08-11):* transient voltage wave propagating along a line or a circuit and characterized by a rapid increase followed by a slower decrease of the voltage

**system block:** functional group of equipment depending for its operation and performance upon the secondary power supply

**telecommunications network:** network operated under a licence granted by a national telecommunications authority, which provides telecommunications between Network Termination Points (NTPs) (i.e. excluding terminal equipment beyond the NTPs)

**telecommunication network ports:** telecommunications/network port point of connection for voice, data and signalling transfers intended to interconnect widely dispersed systems via such means as direct connection to multi-user telecommunications networks (e.g. public switched telecommunications networks (PSTN) integrated services digital networks (ISDN), x-type digital subscriber lines (xDSL), etc.), local area networks (e.g. Ethernet, Token Ring, etc.) and similar networks

NOTE 1: A port generally intended for interconnection of components of the EUT (e.g. RS-232, IEEE 1284™ [i.28] (parallel printer), Universal Serial Bus (USB), IEEE 1394™ [i.29] ("Fire Wire"). etc.) and used in accordance with its functional specifications (e.g. for the maximum length of cable connected to it), is not considered to be a telecommunications/network port under this definition.

NOTE 2: See CENELEC EN 55022 [4].

**tertiary supply:** supply to the telecommunications equipment derived from the secondary supply

**transient (adjective or noun)** *(161-02-01):* pertaining to or designating a phenomenon or a quantity which varies between two consecutive steady states during a time interval which is short compared with the timescale of interest
**wired network ports**: 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 1: A port generally intended for interconnection of components of the EUT (e.g. RS-232, IEEE 1284™ [1.28] (parallel printer), Universal Serial Bus (USB), IEEE 1394™ [1.29] ("Fire Wire"), etc.) and used in accordance with its functional specifications (e.g. for the maximum length of cable connected to it), is not considered to be a wired network port under this definition.

NOTE 2: See CENELEC EN 55032 [31].

NOTE 3: These ports may support screened or unscreened cables and may also carry AC or DC power where this is an integral part of the communication specification.

### 3.2 Abbreviations

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

- **AC**: Alternated Current
- **ADSL**: Asymmetric Digital Subscriber Line
- **AM**: Amplitude Modulation
- **ATM**: Asynchronous Transfer Mode
- **BSC**: Base Station Controller
- **CATV**: CAble TeleVision
- **CD**: Collision Detection
- **CDN**: Coupling Decoupling Network
- **CPU**: Central Processing Unit
- **CSMA**: Carrier Sense Multiple Access
- **DBS**: Digit Broadcast Satellite
- **DC**: Direct Current
- **DCE**: Data Circuit-terminating Equipment
- **DLU**: Digital Line Unit
- **DSL**: Digital Subscriber Line
- **DTE**: Data Terminal Equipment
- **EC**: European Commission
- **EE**: Environmental Engineering
- **EMC**: ElectroMagnetic Compatibility
- **EN**: European Norm
- **ESD**: ElectroStatic Discharge
- **ETSI**: European Telecommunications Standards Institute
- **EUT**: Equipment Under Test
- **HDSL**: High bit-rate Digital Subscriber Line
- **ICT**: Information and Communications Technology
- **IEC**: International Electrotechnical Commission
- **IEEE**: Institute of Electrical and Electronics Engineers
- **ISDN**: Integrated Services Digital Network
- **ISO**: International Organization for Standardization
- **ITU-T**: International Telecommunication Union - Telecommunication Sector
- **LAN**: Local Area Network
- **LTE**: Long Term Evolution
- **LTG**: Line Trunk Group
- **MATV**: Master Antenna Television (system)
- **NTPs**: Network Termination Points
- **PDH**: Plesiochronous Digital Hierarchy
- **POTS**: Plain Old Telephone Service
- **PRBS**: Pseudo Random Bit Sequence
- **PS**: Power Supply
- **PSTN**: Public Switched Telecommunication Network
- **RF**: Radio Frequency
- **rms**: root-mean-square
- **RNC**: Radio Network Controller
- **SAT-IF**: Satellite-Intermediate Frequency
4 Installation environment

The installation environments for the equipment covered by the present document are defined in ETSI TR 101 651 [i.22]. The environments defined are either:

- the telecommunication centre (major and minor);
- locations other than telecommunication centre e.g. within offices, customers’ premises, outdoor locations, etc.

If no restrictions are specified in the product documentation for the installation environment, the equipment shall comply with the requirements of all environments, implying that the more severe test level shall be used when the test is performed.

5 Immunity: test methods

5.0 General requirements

Where reference is made in the present document to specific "test levels" to be used for the tests, it is implicitly required that the EUT shall also fulfil the compliance criteria when tested at "test levels" lower than those specified. This requirement does not apply, however, to tests for immunity to continuous phenomena.

Conducted immunity tests shall be applied to one port at a time.

Based upon actual installation practices, for a single EUT with multiple power ports intended to be connected to the same power source, conducted immunity tests can be applied to all these ports at the same time.

Conducted immunity test shall not be applied to the signal ports that, according to the product documentation, are not permanently connected.

One signal port of each type found on the equipment shall be tested. If in normal installation practice multi-pair cables (e.g. 64 x balanced pairs) and composite cables (e.g. a combination of fibre and copper) are used, they may be tested as one single cable. Cables bundled for aesthetic or routing purposes are to be tested individually.

It may be determined from consideration of the electrical characteristics and usage of a particular equipment that some of the tests are inappropriate and therefore unnecessary. In such a case, it is required that both the decision and the justification not to apply any particular test to any particular port be recorded in the test report.

The test levels specified in tables of clause 7.2 shall apply.
5.1 Electrostatic discharge

The immunity test method and laboratory conditions shall be in accordance to CENELEC EN 61000-4-2 [9].

ESD shall be applied only to those points and surfaces of the EUT that are expected to be touched during normal operation including users access as specified in the user manual.

The application of discharges to any point of the equipment other than the electrostatic protection point, which is accessible only for maintenance purposes, is not required. The application of ESD to the contacts of open connectors is not required.

5.2 Electrical fast transients/burst

The immunity test method and laboratory conditions shall be in accordance to CENELEC EN 61000-4-4 [11].

5.3 Surges

5.3.1 Signal line ports

This requirement shall apply to both indoor and outdoor signal line ports.

The immunity test method to be used for signal line ports shall be in accordance to CENELEC EN 61000-4-5 [12].

Annex B specifies an appropriate test method, dedicated to unshielded 4-wire balanced interface types with phantom DC power feeding and operating at bit rates up to and including 2 Mbit/s. This test method shall apply when the coupling/decoupling network specified in the CENELEC EN 61000-4-5 [12] is not suitable for the bit rate of the signal port under test.

The test set up for shielded interface cables is specified in CENELEC EN 61000-4-5 [12].

For ports connected to multi-conductor lines, for which the network according to annex B is not applicable, the networks according to CENELEC EN 61000-4-5 [12] shall be used.

Where normal functioning cannot be achieved because of the impact of the CDN on the EUT, no immunity test shall be required.

5.3.2 AC power ports

The immunity test method for AC power line ports shall be in accordance to CENELEC EN 61000-4-5 [12].

5.4 Immunity to continuous conducted signals

5.4.1 Low frequency (≤ 150 kHz)

No requirements.

5.4.2 Radio frequency (> 150 kHz)

5.4.2.1 AC power port

The test method shall be in accordance to CENELEC EN 61000-4-6 [13].

Power ports, which according to the manufacturers specification are not intended to be connected to power supply equipment with a cable longer than 3 m, shall not be subjected to these tests.
5.4.2.2 DC power port

The test method shall be in accordance to CENELEC EN 61000-4-6 [13].

Power ports, which according to the manufacturers specification are not intended to be connected to power supply equipment with a cable longer than 3 m, shall not be subjected to these tests. The coupling/decoupling network type M1 as given in CENELEC EN 61000-4-6 [13] shall be used when the DC return lead at the EUT side is to be connected to the equipment protective earth. If the DC return lead is not connected to the equipment protective earth then the coupling/decoupling network M2 as given in CENELEC EN 61000-4-6 [13] shall be used.

5.4.2.3 Signal line port

The test method shall be in accordance to CENELEC EN 61000-4-6 [13].

It only applies when the overall cable length between the EUT and another item of active equipment may be greater than 3 m.

5.5 Immunity to radiated electromagnetic fields

The test method shall be in accordance to CENELEC EN 61000-4-3 [10].

5.6 Immunity to power supply disturbances: AC and DC power ports

5.6.1 Test of immunity to low frequency disturbances: AC power ports

Immunity to low frequency disturbances on the AC power ports, test methods are defined below.

**Telecommunication equipment in telecommunication centres**

- No requirements.

**Telecommunication equipment, locations other than telecommunication centres**

- The test method shall be in accordance to CENELEC EN 61000-4-11 [14].

5.6.2 Test of immunity to low frequency disturbances: DC power ports

No requirements.

6 Emission: test methods

6.0 General

Where not specified here, the EUT shall be configured, installed, arranged and operated in a manner consistent with normal operation.

6.1 AC power port

For conducted emission on AC power port in the frequency range 0,15 MHz to 30 MHz, the test method specified in CENELEC EN 55022 [4] or CENELEC EN 55032 [31] shall apply.

For current harmonics emission the test methods of either CENELEC EN 61000-3-2 [5] or CENELEC EN 61000-3-12 [8] shall apply.
For voltage fluctuations (Flickers) the test methods of either CENELEC EN 61000-3-3 [6] or CENELEC EN 61000-3-11 [7] shall apply.

6.2 DC power port

The measuring methods shall be those specified for the mains interface in CENELEC EN 55022 [4] or AC mains interface in CENELEC EN 55032 [31].

Power ports, which according to the manufacturer's specification are not intended to be connected to the power supply equipment with a cable longer than 3 m, shall not be subjected to these tests.

The EUT shall be connected to the DC power supply through an artificial network to provide a defined impedance across EUT at the point of measurement and to provide isolation from the noise on the DC power supply lines.

For an EUT that has several modules, each with its own power cable (however terminated) and for which the manufacturer provides a power strip (multi-socket mains splitter) with a single power cable for connection to the external power source, a single measurement shall be performed at the mains input to that power cable.

The artificial network shall be the one described in CENELEC EN 55016-1-2 [1], clause 4:

- 0,15 MHz to 30 MHz: (50 Ω // 50 μH).

The DC return lead at the EUT side shall be connected to the protective earth if this is required by the equipment installation specification.

When the use of the artificial network is not suitable (e.g. when the artificial mains network with the current capacity of the EUT is not commercially available) the method described in CENELEC EN 55016-1-2 [1] for the voltage probe (1 500 Ω) shall be used.

6.3 Wired network and telecommunication Ports

For conducted emissions on telecommunications ports in the frequency range 0,15 MHz to 30 MHz, the test method specified in CENELEC EN 55022 [4] shall apply. Alternatively, conducted emissions on wired network ports in the frequency range 0,15 MHz to 30 MHz, the test method specified in CENELEC EN 55032 [31] shall apply.

Where measurement devices specified in CENELEC EN 55016-1-2 [1] are not commercially available another suitable technique shall be used and detailed within the test report.

6.4 Radiated emission

For radiated emission in the frequency range 30 MHz to 6 000 MHz the test method specified in the CENELEC EN 55022 [4] or CENELEC EN 55032 [31] shall apply.

Physically large equipment that are tested in situ, the test method defined in clause 7.7 of CENELEC EN 55016-2-3 [2] shall apply.

7 Test levels and limits

7.0 General requirements

The following emission requirements shall apply.
7.1 Emission

7.1.1 Enclosure port, Radiated electromagnetic field emissions
The limits defined in the CENELEC EN 55022 [4] or CENELEC EN 55032 [31] shall apply.

7.1.2 AC ports

7.1.2.1 Conducted emissions
The limits defined in the CENELEC EN 55022 [4] or CENELEC EN 55032 [31] shall apply.

7.1.2.2 Current harmonics
Current harmonics emission shall meet the requirements of either CENELEC EN 61000-3-2 [5] or CENELEC EN 61000-3-12 [8].

7.1.2.3 Voltage fluctuations
Voltage fluctuations (Flickers) shall meet the requirements of either CENELEC EN 61000-3-3 [6] or CENELEC EN 61000-3-11 [7].

7.1.3 DC ports, Conducted emissions
The class A limits for the mains interface defined in the CENELEC EN 55022 [4] or for the AC mains interface defined in CENELEC EN 55032 [31] shall apply.

7.1.4 Wired network or Telecommunication ports, Conducted emissions
The limits defined in the CENELEC EN 55022 [4] for telecommunication ports or CENELEC EN 55032 [31] for wired network ports shall apply.
### 7.2 Immunity

#### 7.2.1 Equipment operating in telecommunication centres

#### 7.2.1.1 Telecommunication centres, enclosure port

**Table 1**

<table>
<thead>
<tr>
<th>Environmental phenomenon</th>
<th>Unit</th>
<th>Test level and characteristic</th>
<th>Reference</th>
<th>Performance criterion</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immunity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.2.1.1.1 Electrostatic discharge</td>
<td>kV</td>
<td>4 Contact Discharge 4 Air Discharge</td>
<td>CENELEC EN 61000-4-2 [9]</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>7.2.1.1.2 Radio frequency electromagnetic field amplitude modulated</td>
<td>MHz V/m % AM (1 kHz)</td>
<td>80 to 690 3 80</td>
<td>CENELEC EN 61000-4-3 [10]</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MHz V/m % AM (1 kHz)</td>
<td>690 to 6 000 10 80</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
7.2.1.2 Telecommunication centres, ports for outdoor signal lines

Table 2

<table>
<thead>
<tr>
<th>Immunity</th>
<th>Environmental phenomenon</th>
<th>Unit</th>
<th>Test level and characteristic</th>
<th>Reference</th>
<th>Performance criterion</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.2.1.2.1</td>
<td>Fast transients</td>
<td>kV</td>
<td>0.5</td>
<td>CENELEC EN 61000-4-4 [11]</td>
<td>B</td>
<td>For xDSL ports, repetition frequency is 100 kHz.</td>
</tr>
<tr>
<td>7.2.1.2</td>
<td>Surges</td>
<td>Line to Ground</td>
<td>T&lt;sub&gt;r&lt;/sub&gt;/T&lt;sub&gt;h&lt;/sub&gt; μs kV</td>
<td>10/700 (5/320)</td>
<td>CENELEC EN 61000-4-5 [12] and clause 5.3.1 of the present document</td>
<td>B (see notes 2 and 3)</td>
</tr>
<tr>
<td>7.2.1.3</td>
<td>Surges</td>
<td>Line to Ground</td>
<td>T&lt;sub&gt;r&lt;/sub&gt;/T&lt;sub&gt;h&lt;/sub&gt; kV</td>
<td>1,2/50 (8/20)</td>
<td>CENELEC EN 61000-4-5 [12] and clause 5.3.1 of the present document</td>
<td>B</td>
</tr>
<tr>
<td>7.2.1.2.4</td>
<td>Radio frequency, conducted continuous</td>
<td>MHz</td>
<td>0.15 to 80</td>
<td>CENELEC EN 61000-4-6 [13]</td>
<td>A</td>
<td></td>
</tr>
</tbody>
</table>

NOTE 1: Outdoor lines carrying DC power with superimposed signals shall be treated as outdoor signal lines.
NOTE 2: As a result of the surge, loss of function of the port under test is allowed. The function of the port under test shall be self recoverable or restored by the intervention of the user. For the whole system, performance degradations are allowed during the application of surge and self-recovery to normal condition is required after the cessation of the test. System SW reboot is not allowed.
NOTE 3: Primary protections shall not be in place for this test.
7.2.1.3 Telecommunication centres, ports for indoor signal lines

Only ports connected to inter-system cables are to be tested. Testing of ports for intra-system cabling, e.g. local alarm and control, (provided in all cases both ends are controlled by the same manufacturer) is left to the discretion of the manufacturer which is responsible for the correct installation of the cables.

Table 3

<table>
<thead>
<tr>
<th>Environmental phenomenon</th>
<th>Unit</th>
<th>Test level and characteristic</th>
<th>Reference</th>
<th>Performance criterion</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.2.1.3.1 Fast transients</td>
<td>kV</td>
<td>0.5, 5/50, 5</td>
<td>CENELEC EN 61000-4-4 [11]</td>
<td>B</td>
<td>Only applies when the overall cable length between the EUT and another item of active equipment may be greater than 3 m. For xDSL ports repetition frequency is 100 kHz.</td>
</tr>
<tr>
<td>7.2.1.3.2 Surges Line to Ground</td>
<td>kV, μs, kHz</td>
<td>1.2/50 (8/20), 0.5</td>
<td>CENELEC EN 61000-4-5 [12] and clause 5.3.1 of the present document</td>
<td>B</td>
<td>Only applies when the overall cable length between the EUT and another item of active equipment may be greater than 30 m.</td>
</tr>
<tr>
<td>7.2.1.3.3 Radio frequency, conducted continuous</td>
<td>MHz</td>
<td>0.15 to 80, 3, 80, 150</td>
<td>CENELEC EN 61000-4-6 [13]</td>
<td>A</td>
<td>Only applies when the overall cable length between the EUT and another item of active equipment may be greater than 3 m.</td>
</tr>
</tbody>
</table>

NOTE: Indoor lines carrying DC power with superimposed signals shall be treated as indoor signal lines.
### 7.2.1.4 Telecommunication centres, AC power ports

#### Table 4

<table>
<thead>
<tr>
<th>Environmental phenomenon</th>
<th>Unit</th>
<th>Test level and characteristic</th>
<th>Reference</th>
<th>Performance criterion</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Immunity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.2.1.4.1</td>
<td>Fast transients</td>
<td>kV</td>
<td>5/50</td>
<td>CENELEC EN 61000-4-4 [11]</td>
<td>B</td>
</tr>
<tr>
<td>7.2.1.4.2</td>
<td>Surges (line to line) (line to ground)</td>
<td>T\textsubscript{r}/T\textsubscript{h} ns</td>
<td>0,5</td>
<td>CENELEC EN 61000-4-5 [12]</td>
<td>B</td>
</tr>
<tr>
<td>7.2.1.4.3</td>
<td>Radio frequency, conducted continuous</td>
<td>MHz</td>
<td>0,15 to 80</td>
<td>CENELEC EN 61000-4-6 [13]</td>
<td>A</td>
</tr>
</tbody>
</table>

### 7.2.1.5 Telecommunication centres, DC power ports

#### Table 5

<table>
<thead>
<tr>
<th>Environmental phenomenon</th>
<th>Unit</th>
<th>Test level and characteristic</th>
<th>Reference</th>
<th>Performance criterion</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Immunity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.2.1.5.1</td>
<td>Fast transients</td>
<td>kV</td>
<td>5/50</td>
<td>CENELEC EN 61000-4-4 [11]</td>
<td>B</td>
</tr>
<tr>
<td>7.2.1.5.2</td>
<td>Radio frequency, conducted continuous</td>
<td>MHz</td>
<td>0,15 to 80</td>
<td>CENELEC EN 61000-4-6 [13]</td>
<td>A</td>
</tr>
</tbody>
</table>
7.2.2 Equipment operating in locations other than telecommunication centres

7.2.2.1 Other than telecommunication centres, enclosure port

<table>
<thead>
<tr>
<th>Environmental phenomenon</th>
<th>Unit</th>
<th>Test level and characteristic</th>
<th>Reference</th>
<th>Performance criterion</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.2.2.1.1 Electrostatic discharge</td>
<td>kV</td>
<td>6 contact discharge</td>
<td>CENELEC EN 61000-4-2 [9]</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td></td>
<td>kV</td>
<td>8 air discharge</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.2.2.1.2 Radio frequency electromagnetic field amplitude modulated</td>
<td>MHz</td>
<td>80 to 690</td>
<td>CENELEC EN 61000-4-3 [10]</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>V/m</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>% AM (1 kHz)</td>
<td>80</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MHz</td>
<td>690 to 6 000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>V/m</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>% AM (1 kHz)</td>
<td>80</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 7.2.2.2 Other than telecommunication centres, ports for outdoor signal lines

#### Table 7

<table>
<thead>
<tr>
<th>Environmental phenomenon</th>
<th>Unit</th>
<th>Test level and characteristic</th>
<th>Reference</th>
<th>Performance criterion</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.2.2.2.1 Fast transients</td>
<td>kV, ( T_r/T_H ) ns, Rep. frequency kHz</td>
<td>0.5, 5/50, 5</td>
<td>CENELEC EN 61000-4-4 [11]</td>
<td>B</td>
<td>For xDSL ports repetition frequency is 100 kHz.</td>
</tr>
<tr>
<td>7.2.2.2.2 Surges Line to Ground</td>
<td>( T_r/T_H ) μs, kV</td>
<td>10/700 (5/320), 1</td>
<td>CENELEC EN 61000-4-5 [12] and clause 5.3.1 of the present document</td>
<td>B (see notes 2 and 3)</td>
<td>This test applies to symmetrical and unsymmetrical unscreened cables.</td>
</tr>
<tr>
<td>7.2.2.2.3 Surges Line to Ground Line to Line</td>
<td>( T_r/T_H ) μs, kV</td>
<td>1,2/50 (8/20), 1, 0.5</td>
<td>CENELEC EN 61000-4-5 [12] and clause 5.3.1 of the present document</td>
<td>B</td>
<td>This test applies to symmetrical/unsymmetrical screened cables and to coax cables.</td>
</tr>
<tr>
<td>7.2.2.2.4 Radio frequency, conducted continuous</td>
<td>MHz, V, % AM (1 kHz), Source impedance Ω</td>
<td>0.15 to 80, 3, 80, 150</td>
<td>CENELEC EN 61000-4-6 [13]</td>
<td>A</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE 1:** Outdoor lines carrying DC power with superimposed signals shall be treated as outdoor signal lines.

**NOTE 2:** As a result of the surge, loss of function of the port under test is allowed. The function of the port under test shall be self recoverable or restored by the intervention of the user. For the whole system, performance degradations are allowed during the application of surge and self-recovery to normal condition is required after the cessation of the test. System SW reboot is not allowed.

**NOTE 3:** Primary protections shall not be in place for this test.
7.2.2.3 Other than telecommunication centres, ports for indoor signal lines

Only ports connected to inter-system cables are to be tested. Testing of ports for intra-system cabling, e.g. local alarm and control, (provided in all cases both ends are controlled by the same manufacturer) is left to the discretion of the manufacturer which is responsible for the correct installation of the cables.

<table>
<thead>
<tr>
<th>Environmental phenomenon</th>
<th>Test level and characteristic</th>
<th>Reference</th>
<th>Performance criterion</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.2.2.3.1 Fast transients</td>
<td>kV Tr/Th ns Rep. frequency kHz</td>
<td>0.5 5/50 5</td>
<td>CENELEC EN 61000-4-4 [11]</td>
<td>B Only applies when the overall cable length between the EUT and another item of active equipment may be greater than 3 m. For xDSL ports repetition frequency is 100 kHz.</td>
</tr>
<tr>
<td>7.2.2.3.2 Surges Line to Ground</td>
<td>Tp/Th μs kV</td>
<td>1.2/50 (8/20) 0.5</td>
<td>CENELEC EN 61000-4-5 [12], and clause 5.3.1 of the present document</td>
<td>B Only applies when the overall cable length between the EUT and another item of active equipment may be greater than 30 m.</td>
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<tr>
<td>7.2.2.3.3 Radio frequency, conducted continuous</td>
<td>MHz V % AM (1 kHz) Source impedance Ω</td>
<td>0.15 to 80 3 80 150</td>
<td>CENELEC EN 61000-4-6 [13]</td>
<td>A Only applies when the overall cable length between the EUT and another item of active equipment may be greater than 3 m.</td>
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### 7.2.2.4 Other than telecommunication centres, AC power ports

#### Table 9

<table>
<thead>
<tr>
<th>Environmental phenomenon</th>
<th>Unit</th>
<th>Test level and characteristic</th>
<th>Reference</th>
<th>Performance criterion</th>
<th>Remarks</th>
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<td></td>
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<td></td>
<td>Tr/Th ns</td>
<td>5/50</td>
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<td></td>
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<td>Rep. frequency kHz</td>
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<td>CENELEC EN 61000-4-5 [12]</td>
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<td>7.2.2.4.3 Radio frequency, conducted continuous</td>
<td>MHz</td>
<td></td>
<td>0.15 to 80</td>
<td>CENELEC EN 61000-4-6 [13]</td>
<td>A</td>
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<tr>
<td></td>
<td>V</td>
<td></td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>% AM (1 kHz)</td>
<td>80</td>
<td></td>
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<td></td>
<td></td>
<td>Source impedance Ω</td>
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<td>7.2.2.4.4 Voltage dips and short interruptions</td>
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<td>C (see note)</td>
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<td></td>
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<td>C</td>
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</tbody>
</table>

**NOTE:** Performance criterion B may apply to equipment without redundant power supplies ports/sources.
### 7.2.2.5.1 Fast transients

<table>
<thead>
<tr>
<th>Environmental phenomenon</th>
<th>Unit</th>
<th>Test level and characteristic</th>
<th>Reference</th>
<th>Performance criterion</th>
<th>Remarks</th>
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<td></td>
<td>Tr/Tn ns</td>
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<td></td>
<td>Rep. frequency kHz</td>
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<td></td>
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<td></td>
<td>5/50</td>
<td>5</td>
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<td>Only applies when the overall cable length between the EUT and another item of active equipment may be greater than 3 m.</td>
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### 7.2.2.5.2 Radio frequency, conducted continuous

<table>
<thead>
<tr>
<th>Environmental phenomenon</th>
<th>Unit</th>
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<th>Reference</th>
<th>Performance criterion</th>
<th>Remarks</th>
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<tbody>
<tr>
<td>Radio frequency, conducted</td>
<td>MHz</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>continuous</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% AM (1 kHz)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source impedance Ω</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0,15 to 80</td>
<td>3</td>
<td>80</td>
<td>CENELEC EN 61000-4-6 [13]</td>
<td>A</td>
<td>Only applies when the overall cable length between the EUT and another item of active equipment may be greater than 3 m.</td>
</tr>
</tbody>
</table>
8 General test configuration

The EUT shall be configured and operated in accordance with the basic EMC standards.

The signal or control ports shall be correctly terminated either by auxiliary equipment necessary to exercise the ports or by their nominal impedance.

Adequate measures shall be taken to avoid any effects of unwanted signals on the measuring equipment used to monitor the performance of the EUT.

The test conditions shall be within operating ranges voltage and frequency as specified for the EUT by manufacturer, having regard to the supply voltage and frequency for the intended market of the EUT.

The equipment test conditions shall be as close as possible to the installed conditions, as defined by the manufacturer. Wiring shall be consistent with the manufacturer's recommended procedures, and the equipment shall be in its housing with all covers and access panels in place as in normal operation, unless otherwise stated. If the equipment is designed to be mounted in a rack or cabinet, it should be tested in this configuration.

Signal ports are divided into two categories:

- main signal ports which provide the telecommunications service (third party traffic);
- auxiliary signal ports, i.e. ports for alarms, maintenance, etc., which are only used by the operator or the service provider.

A sufficient number of ports shall be correctly terminated to ensure that the test is representative of normal operating conditions and the selection of ports shall be specified in the test report.

The earth connections of the EUT shall be connected to a reference earth according to the manufacturer's specifications.

The types of the cables connected to the EUT shall be indicated in the test report.

The test configurations shall be recorded in the test report.

9 General operational conditions during testing

9.0 General requirements

The general operational conditions shall allow for appropriate measuring of the emission and for testing of immunity. Special exercising equipment and/or software may be used with the object of reducing the test time and to simulate traffic conditions.

The tests described shall be performed with the Equipment Under Test (EUT) powered up (i.e. connected to an appropriate power supply), and operating in a manner which is as representative of normal operation as possible.

Details on the evaluation of test results are given in annex B.

9.1 Equipment configuration

Power and signal distribution, grounding, interconnecting cabling and physical placement of equipment of a test system shall simulate the typical application and usage in so far as is practicable, and shall be in accordance with the relevant product specifications of the manufacturer.

The configuration that tends to maximize the EUT's emission or minimize its immunity is not usually intuitively obvious and in most instances selection will involve some trial and error testing.
Where equipment may be connected with cables routed either overhead or from beneath (i.e. equipment mounted on a raised floor) the equipment shall be tested in a manner representative of an installation using overhead cable routing.

**EXAMPLE:** Interface cables may be moved or equipment re-orientated during initial stages of testing and the effects on the results observed.

Only configurations within the range of positions likely to occur in normal use need to be considered.

The configuration selected shall be fully detailed and documented in the test report, together with the justification for selecting that particular configuration.

### 9.2 Operation of multimedia network equipment

Multimedia network equipment which is subjected simultaneously to different clauses of the present document and/or other standards shall be tested with each function operating in isolation, if this can be achieved without modifying the equipment internally. The equipment thus tested shall be deemed to have complied with the requirements of all clauses/standards when each function has satisfied the requirements of the relevant clause/standard.

For equipment for which it is not practical to test with each function operating in isolation, or where the isolation of a particular function would result in the equipment being unable to fulfil its primary function, the equipment shall be deemed to have complied if the relevant provisions of each clause/standard are taken into account, with the necessary functions operative.

In case of emission requirements, if the limits for the different functions are not identical, the highest limits for the functions in operation apply, taking into account the specific measurement conditions related to those (highest) limits.

**EXAMPLE 1:** For telecommunication equipment provided with an RF port for CATV distribution, this would mean that the emission requirements at the RF port shall be according to CENELEC EN 50083-2 [3].

In case of immunity requirements, if the test levels for the different functions are not identical, the level for the function under test applies, taking into account the performance criteria for this function.

**EXAMPLE 2:** For telecommunication equipment provided with an RF port for CATV distribution, this would mean that the RF port shall be measured according to CENELEC EN 50083-2 [3].

Field immunity of telecommunication functions shall be measured according to the present document. Field immunity of the distribution of television and sound signal functions shall be measured according to CENELEC EN 50083-2 [3].

### 10 General immunity conditions

#### 10.0 General

If the minimum performance level or permissible performance loss is not specified in the following clauses or by the manufacturer, then either of these may be deduced from the product description and documentation, and what the user may reasonably expect from the apparatus if used as intended.

#### 10.1 General performance criteria

The general performance criteria apply for those ports for which no specific performance criteria are defined (e.g. auxiliary ports) in the present document.

Where the specific immunity criteria are not relevant or in appropriate, relevant justification shall be included in the test report highlighting how the EUT was fully exercised and met the general immunity criteria defined in this clause.
Performance criterion A:

The apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer when the apparatus is used as intended. In some cases the performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be deduced from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.

Performance criterion B:

The apparatus shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. In some cases the performance level may be replaced by a permissible loss of performance. During the exposure to an electromagnetic phenomenon, degradation of performance is, however, allowed. No change of actual operating state or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be deduced from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.

Performance criterion C:

Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls, or, in the case of switching equipment, by normal subsequent use.

11 Switching equipment specific requirements

11.1 Test configuration

For network switching equipment, two separate processes are monitored simultaneously, see figure 1. The first is the continuous process of establishing and clearing connections and the second is the stable situation of monitoring signal quality during testing. It is to be considered that at least a part of the set-up for both processes covers the full signal path from subscriber to the network. The signal loop at the network end can either be established by test equipment or by a simple cable loop. In the latter case the simulation of normal grounding and connection practice is required.

The test equipment may be digital or analogue signal analyser as required. The test equipment may also loop back the test signal.
If possible, cable harnesses shall be separated and the cables tested individually.

For Base Station Controller (BSC) and Radio Network Controller (RNC) equipment it is not necessary to exercise the continuous process of establishing and clearing connections; the manufacturer may test a representative configuration with End to End system functionality employing either core network and base station or core network and base station simulators.

11.2 Operational conditions

11.2.0 General

The general conditions of clause 9 apply.

For switching equipment with less than 32 subscriber lines (analogue or digital), all the lines shall be driven. For switching equipment with more than 32 subscriber lines (analogue or digital) a choice of at least 32 lines shall be made among the available lines. In this case, as it is impossible to do tests at all ports, single ports of each type shall be selected for the testing. At least one port of each type shall be tested.

The ports shall be configured with their nominal impedance for a connection to another port. Auxiliary equipment or loopback may be used to simulate the functional termination of the ports.

Connections have to be provided which shall be established before the start of the tests and then maintained.
11.2.1 Emission

The general requirements for test methods are described in clause 6 of the present document.

11.2.2 Immunity

The general requirements for test methods are described in clause 5 of the present document.

11.3 Specific immunity performance criteria

11.3.0 General

For the switching equipment the following main signal ports are recognized:

- analogue ports (e.g. analogue subscribers' lines, analogue interfaces to transmission equipment);
- digital ports (e.g. digital subscribers' lines (ISDN), digital connections to transmission equipment).

The interfaces shall operate as described in the clauses 11.3.1 and 11.3.2.

11.3.1 Digital port performance criteria

11.3.1.1 Performance criterion A (continuous phenomena)

During the sweep:

- the established connections shall be maintained throughout testing and the transfer of information shall be within the limits of the manufacturer's specification;
- loss of frame alignment or loss of synchronization is not allowed during each individual exposure (if applicable).

For selected frequencies (see clause 11.2.2):

- it shall be possible to establish a connection between two ports;
- it shall be possible to clear a connection in a controlled manner.

11.3.1.2 Performance criterion B (transient phenomena)

The established connections shall be maintained throughout testing except in the case of surge immunity testing at 1 kV where disconnection is allowed on the port being tested:

- it shall be possible to establish a connection between two ports after the end of the transient disturbances;
- it shall be possible to clear a connection in a controlled manner after the end of the transient disturbances.

11.3.1.3 Performance criterion C (interruptions)

The general performance criterion C applies.

11.3.2 Analogue port performance criteria

11.3.2.1 Performance criterion A (continuous phenomena)

During the sweep:

- the established connections shall be maintained throughout testing;
- the noise level at a two wire analogue interface shall be less than \(-40\ \text{dBm}\) at 600\,\Omega (ignoring the nominal impedance of the port for practical reasons) if not otherwise stated by the manufacturer. The measurement shall be done selectively with a bandwidth \(\leq 100\ \text{Hz}\) at 1\,kHz;
- dialling tones shall be available (if applicable).

For selected frequencies (see clause 11.2.2):
- it shall be possible to establish a connection between two ports;
- it shall be possible to clear a connection in a controlled manner.

11.3.2.2 Performance criterion B (transient phenomena)

Established connections shall be maintained throughout testing except in the case of surge immunity testing at 1\,kV where disconnection is allowed on the port being tested:
- it shall be possible to establish a connection between two ports after the end of the transient disturbances;
- it shall be possible to clear a connection in a controlled manner after the end of the transient disturbances.

11.3.2.3 Performance criterion C (interruptions)

The general performance criterion C applies.

12 Transmission equipment specific requirements

12.1 Test configuration

Typically the EUT will be configured as shown in figure 2. The EMC test equipment is not shown.

The test configuration shall cover a representative set up of tributary signals within the aggregate interface signals.

In figure 2 a test signal is derived from a signal generator and looped through EUT. If the EUT supports several identical channels, these may be connected in series and the test signal may be looped through all the channels.

The test equipment may be digital or analogue signal analyser as required. The test equipment may also loop-back the test signal.

![Figure 2: Schematic test configuration](image-url)
12.2 Operational conditions

12.2.0 General

The general conditions of clause 9 apply.

An appropriate test signal shall be used. The test signal shall be stated in the test report. The preferred test signal is the Pseudo Random Bit Sequence (PRBS) appropriate for the bit rate of the channel (Recommendation ITU-T O.150 [i.13]).

The modes of operation during testing shall be recorded in the test report.

12.2.1 Emission

The measurements shall be made in the operating mode, with the EUT producing the maximum emission, consistent with normal applications. The EUT load shall be adjusted within the range specified by manufacturer in order to maximize the emission.

Conducted emission shall be measured on the power input and output ports.

12.2.2 Immunity

Immunity tests shall be performed at nominal values of all signal conditions and with a typical value of line attenuation as declared by the manufacturer.

Conducted immunity testing shall be performed on power input and output ports and on signal ports.

For surge testing the conducted immunity tests shall be performed on auxiliary (signal) ports that are permanently connected in the normal installation.

12.3 Specific immunity performance criteria

12.3.1 Digital signal ports

12.3.1.0 General

The performance of the equipment shall be verified for digital signal ports:

- by measuring the number of induced bit errors on the main signal port during all exposures;
- by testing the functionality of the main signal port and the other signal ports after the exposure;
- by verifying that corruption of software and data held in memory has not occurred.

12.3.1.1 Performance criterion A (continuous phenomena)

The performance of the equipment shall be verified by measuring the additional errors induced due to the application of any electromagnetic phenomena. During the test sweep the established connection shall be maintained throughout the testing and the transfer of information shall be without any additional reproducible bit errors or loss of synchronization.

If a degradation in performance is observed and the system is adaptive i.e. has the capability to automatically re-train in the presence of an interfering signal, then for Conducted Immunity tests only the following procedure shall be followed:

1) For each range of interfering frequencies where a degradation in performance is observed, three frequencies (beginning, middle and end) shall be identified.

2) At each of the frequencies identified in step 1, the interfering signal shall be turned on and the system allowed to re-train. If the system is able to re-train and then function without any additional reproducible bit errors or loss of synchronization then the system's performance is considered acceptable.
3) The frequencies identified in 1 and the data rates achieved in 2 shall be recorded in the test report.

12.3.1.2 Performance criterion B (transient phenomena)

Loss of frame alignment is not allowed during each individual exposure. No alarms shall be generated as a result of the electromagnetic stress.

The above does not apply to surge testing where some loss of frame alignment may be expected. For this test, the EUT shall operate as intended following the cessation of the exposure.

12.3.1.3 Performance criterion C (interruptions)

The general performance criterion C applies.

12.3.2 Analogue voice frequency signal ports

12.3.2.0 General

The performance of the equipment shall be verified for analogue voice frequency signal ports:

- by measuring the audio signal break-through (demodulated 1 kHz) on the signal port during continuous exposures in both signal path directions covering both analogue to digital conversion and digital to analogue conversion;
- by testing the functionality of the main signal port and the other signal ports after the transient exposures;
- by verifying that corruption of software and data held in memory has not occurred.

12.3.2.1 Performance criterion A (continuous phenomena)

The noise signal level received from the EUT measured in an impedance of 600 $\Omega$ shall not be greater than -40 dBm. The measurement shall be done selectively with a bandwidth $\leq$ 100 Hz at 1 kHz.

Connections shall be maintained throughout the test.

12.3.2.2 Performance criterion B (transient phenomena)

The established connections shall be maintained throughout testing except in the case of surge immunity testing at 1 kV where disconnection is allowed on the port being tested.

The EUT shall return automatically to normal performance after the cessation of the exposure.

12.3.3 SDH and PDH interfaces

12.3.3.1 Tributary and aggregate interfaces

The criteria specified in clause 12.3.1 apply to the interfaces specified in ETSI EN 300 166 [i.3] (electrical interface) and ETSI ETS 300 232 [i.4], Recommendations ITU-T G.783 [i.25] and G.798 [i.26] (optical interfaces).

12.3.4 ISDN interfaces

12.3.4.1 Primary rate access ISDN interfaces

The criteria specified in clause 12.3.1 apply to the interfaces specified in ETSI EN 300 011-1 [i.1].

12.3.4.2 Network termination NT1 for ISDN "U" interfaces

The criteria specified in clause 12.3.1 apply to the interfaces specified in Recommendation ITU-T G.961 [i.12].
12.3.4.3 Basic access ISDN interfaces
The criteria specified in clause 12.3.1 apply to the interfaces specified in ETSI EN 300 012-1 [i.2].

12.3.5 Analogue interfaces

12.3.5.1 Trunk interfaces and leased line interfaces
The criteria specified in clause 12.3.2 apply to the interfaces specified in Recommendation ITU-T G.712 [i.8].

12.3.5.2 Subscriber interfaces
The criteria specified in clause 12.3.2 apply to the interfaces specified in Recommendation ITU-T Q.552 [i.14].

12.3.6 V.10, V.11, V.24, V.28, V.36, X.24 and similar V.- and X.- series interfaces
The criteria specified in clause 12.3.1 apply to the interfaces specified in Recommendations ITU-T V.10 [i.15],
V.11 [i.16], V.24 [i.17], V.28 [i.18], V.36 [i.19] and X.24 [i.20].

12.3.7 Ethernet and packet-data interfaces

12.3.7.0 General
To the interfaces specified in ISO/IEC/IEEE 8802-3 [i.5] and Recommendation ITU-T X.25 [i.21], the criteria below apply.

12.3.7.1 Performance criterion A (continuous phenomena)
For interfaces which are intended for the transmission of third party data traffic, a selected port shall be connected to
test equipment (e.g. a data communications analyser) as a single point-to-point data link. This will avoid excessive
failed transmission attempts caused by data collisions and bus contention problems.
The interface shall be suitably exercised and monitored throughout the test period for errored frames.
No more than 5 % additional errored frames above the quiescent level shall be permitted during the exposure.

12.3.7.2 Performance criterion B (transient phenomena)
The established connections shall be maintained throughout testing except in the case of surge immunity testing at 1 kV
where disconnection is allowed on the port being tested.

12.3.8 Service and maintenance interfaces
The functional performance of ports of this type not intended to be permanently connected and therefore not subjected
to immunity testing shall be verified according to the manufacturer's specification following cessation of the
electromagnetic exposure on other ports.

12.3.9 Synchronization interfaces

12.3.9.0 General
The performance of slave clocks specified in Recommendations ITU-T G.812 [i.9] and G.813 [i.10] shall be checked
with the equipment synchronized with an external source.
12.3.9.1 Performance criterion A (continuous phenomena)
During the exposure, synchronization shall not be lost.

12.3.9.2 Performance criterion B (transient phenomena)
No alarm indications shall persist after the exposure.
The functional performance according to the manufacturer's specification shall be verified following cessation of the exposure.

12.3.10 Remote alarm interfaces

12.3.10.0 General
These interfaces are defined by the manufacturer.

12.3.10.1 Performance criterion A (continuous phenomena)
No false alarms shall occur during continuous exposures.

12.3.10.2 Performance criterion B (transient phenomena)
No false alarm indications shall persist after the exposure.

12.4 Digital Subscriber Line (DSL) Access Systems

12.4.1 Test configuration
Typically the equipment shall be configured as shown in figure 3. The EMC test Equipment is not shown.

![Figure 3: DSL Access System Configuration](image)

For passband systems such ADSL and VDSL both ends of the equipment under test typically comprise a DSL modem and splitter/filter via which the POTS/ISDN port is presented. The modem and splitter may be separate units or combined into one unit.

For baseband systems such as HDSL and SDSL or passband systems where the DSL modem does not include the splitter then the equipment under test as shown in figure 3 will not include the parts denoted with a dotted line and hence measurements at the analogue port do not apply.

For the test setup, test loops shall be configured using a line simulator or real cable lengths.
12.4.2 Operational conditions

The general conditions of clause 9 shall apply.

The measurements shall be made with the digital transmission system trained up and operating at its nominal transmission rate such that the full frequency spectrum used by the system is utilized. If the system can be operated in asymmetric and symmetric modes then the testing shall be carried out for each of these modes of operation.

Immunity testing shall be performed at nominal values of all signal conditions and with a value of the line attenuation (i.e. using real cable or line simulator) such that the system will be operating at its minimum acceptable noise margin. (E.g. 6 dB noise margin relative to the system's nominal bit error ratio of 1E-7).

Further details on the noise margin can be found in the following documents:

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<th>Protocol</th>
<th>Reference</th>
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<tr>
<td>ADSL</td>
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<td>Recommendation ITU-T G.992.1 [i.36]</td>
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<td>Recommendation ITU-T G.991.2 [i.42]</td>
</tr>
<tr>
<td>VDSL</td>
<td>ETSI TS 101 270-1 [i.35]</td>
</tr>
<tr>
<td></td>
<td>Recommendation ITU-T G.993.1 [i.39]</td>
</tr>
<tr>
<td></td>
<td>Recommendation ITU-T G.993.2 [i.40]</td>
</tr>
</tbody>
</table>

Ports should be either terminated in their nominal impedance or connected to auxiliary equipment that simulates the functional termination of the port.

12.4.3 Immunity

The test methods are given in clause 5 of the present document. Conducted immunity testing shall be performed on all power input ports, DSL port and POTS/ISDN port. Testing on the digital port of the equipment shall only be performed if the length of cable that can be attached to the port may exceed 3 m (30 m for surge tests).

12.4.4 Specific Immunity performance criteria

12.4.4.0 General

The performance of the equipment shall be verified by:

- Measuring the additional errors induced due to the application of any electromagnetic phenomena.
- Measuring the audio signal break-through (demodulated 1 kHz) at any POTS port whilst continuous interference phenomena are applied.
- Testing the functionality of the system at the cessation of test.
- Ensuring that any software or stored data corruption has not occurred.
- For ISDN ports the performance requirements of clause 12.3.4 shall apply.

12.4.4.1 Performance Criteria A (continuous phenomena)

- During the test sweep the established connection shall be maintained throughout the testing and the transfer of information shall be without any additional reproducible bit errors or loss of synchronization. If a degradation in performance is observed and the system is adaptive i.e. has the capability to automatically re-train in the presence of an interfering signal, then for Conducted Immunity tests only the following procedure shall be followed:
  1) For each range of interfering frequencies where a degradation in performance is observed, three frequencies (beginning, middle and end) shall be identified.
2) At each of the frequencies identified in step 1, the interfering signal shall be turned on and the system is allowed to re-train. If the system is able to re-train and then function without any additional reproducible bit errors or loss of synchronization then the system's performance is considered acceptable.

3) The frequencies identified in 1 and the data rates achieved in 2 shall be recorded in the test report.

- During the test sweep the demodulated noise level at the POTS port shall be less than -40 dBm at 600 Ω (ignoring the nominal port impedance for practical reasons) if not otherwise stated by the manufacturer. The measurement shall be done selectively with a bandwidth \( \leq 100 \) Hz at 1 kHz. As an alternative method the acoustic Sound Pressure Level (SPL) at the receiver of a telephone connected to the two-wire analogue interface shall not exceed 55 dB (SPL) when measured in a bandwidth \( \leq 100 \) Hz at 1 kHz.

12.4.4.2 Performance Criteria B (transient phenomena)

The general performance criteria B shall apply in that errors are acceptable during the application of the test. However the application of the test shall not cause the system to lose the established connection or delay function (e.g. by re-train). At the cessation of the test the system shall continue to function in the state established prior to the application of the test, without user intervention.

The above performance criteria do not apply to surge testing. For this test, the EUT shall not lose the established connection and shall operate as intended following the cessation of the exposure.

12.4.4.3 Performance Criteria C (interruptions)

The general performance criteria C shall apply.

13 Power supply equipment specific conditions

13.0 General

This clause is not applicable to power supplies i.e. DC/DC converters, AC/DC adapters and supplies incorporated within network equipment. It is intended for power supplies aimed at the generation of power for distribution within telecomm centres.

13.1 Test configuration

Typically the EUT will be configured as shown in figures 4 and 5. The EMC test equipment is not shown.

The earth connections of the EUT shall be connected to a reference earth according to the manufacturer specifications.

The EUT load shall be resistive unless otherwise specified by the manufacturer.

For EUT with DC output and battery back-up, EMC tests shall be performed without the battery unless otherwise specified.

Uninterruptible power supplies shall also be tested whilst feeding from the battery only (AC mains off).
13.2 Operational conditions

13.2.1 Emission

The measurements shall be made in the operating mode, with the EUT producing the maximum emission, consistent with normal applications. The EUT load shall be adjusted within the range specified by manufacturer in order to maximize the emission.

Conducted emission shall be measured on the power input and output ports.

The conducted emission tests shall only be performed on ports that are permanently connected in the normal installation.

13.2.2 Immunity

Immunity tests may be performed with the EUT operating at reduced output power: 50 % is recommended. The actual output power level for each test shall be stated in the test report.

Conducted immunity tests shall be performed on the power input and output ports, and on one signal/control interface of each type found on the equipment.

The conducted immunity tests need only be performed on ports that are permanently connected in the normal installation.

Power and control cables, which according to the manufacturer's specification are not intended to be longer than 3 m in installed systems, shall not be subjected to conducted immunity testing. However, cables that may be connected to an extensive network shall be subjected to the conducted immunity test.
13.3 Specific immunity performance criteria

13.3.0 General

The ports of the power supply equipment (figure 6) that shall be monitored during the tests can be categorized as one of:

- DC secondary interface;
- AC secondary interface; or
- control/signal interface.

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

- the primary functions of the power supply equipment to be tested;
- the intended functions of the power supply equipment, which shall be in accordance with the documentation accompanying the equipment and sales literature as appropriate;
- the auxiliary equipment to be combined with the power supply equipment;
- a list of ports, classified as AC/DC power port or control/signal port;
- the operating conditions.

13.3.1 Alternating current secondary interface

13.3.1.1 Performance criterion A (continuous phenomena)

During the exposure, the AC secondary range shall be in accordance with the normal service condition defined in ETSI ETS 300 132-1 [15].

The long-term voltage fluctuations at the AC secondary interface shall be within ±10 % of the nominal voltage.

During and after the exposure, the EUT shall operate without alarms, false alarm indications (power supply failure, protection failure, etc.) and false display indications.

13.3.1.2 Performance criterion B (transient phenomena)

Voltage interruptions at the AC secondary interface shall last no longer than 20 ms. The time between two voltage interruptions shall be no less than 10 s.

The voltage fluctuations at the AC secondary interface shall be in accordance with the requirements of ETSI ETS 300 132-1 [15]:

- for < 500 ms with respect to rms value: no worse than ±15 % of nominal value;
- for < 2 ms with respect to actual value: no worse than ±40 % of nominal value.

The frequency at the AC secondary interface shall not vary by more than ±3 Hz and shall return to the nominal value within 5 s.

Peaks with a duration shorter than 0,25 of one period (5 ms for a 50 Hz system), which appear during the exposure, are permissible.

After the exposure, the EUT shall operate without alarms or false alarm indications (power supply failure, protection failure, etc.) or false display indications.

Self-recovery to normal performance shall occur at the cessation of the exposure.
13.3.2 Direct current secondary interface

13.3.2.1 Performance criterion A (continuous phenomena)

During the exposure, the DC secondary voltage range shall be in accordance with the normal service conditions defined in ETSI EN 300 132-2 [16] for 48 V DC or ETSI EN 300 132-3-1 [28] for 260 V DC to 400 V DC.

The maximum level of wide band noise at the DC secondary interface shall not exceed the limits specified in table 11 of the present document (this requirement is taken from the ETSI EN 300 132-2 [16]).

Table 11: Level of wide band noise

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Voltages</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 Hz to 5 kHz</td>
<td>10 mV Upso rms (measured over a 50 Ω impedance)</td>
</tr>
</tbody>
</table>

The reference method of measurement is with a psophometer that shall conform to Recommendation ITU-T O.41 [20].

During and after the exposure, the EUT shall operate without alarms or false alarm indications (power supply failure, protection failure, etc.) and false display indications.

13.3.2.2 Performance criterion B (transient phenomena)

After the exposure, the EUT shall operate without alarms or false alarm indications (power supply failure, protection failure, etc.) and false display indications:

- the DC secondary voltage during the exposure shall not exceed the following value:
  - for -48 V DC nominal value: -60 V;
  - for -60 V DC nominal value: -75 V;
  - for 365 V DC ±15 V nominal value: 410 V;
- short peaks, which appear during the application of the tests, shall be ignored.

13.3.3 Control/signal interface

The control and signal ports need not be monitoring during the tests, because they are not considered to be primary functions.

13.3.4 Tertiary supply interface

To be considered only for special cases. Performance criteria should be derived from the product specifications.

14 Supervisory equipment specific conditions

14.1 Test configuration

Exercising equipment e.g. a traffic simulator used for testing of other functions and equipment e.g. switching equipment can also be used as exercising equipment for supervisory equipment. Figure 6 shows two examples for a possible test configuration. The EMC test equipment is not shown.

Parts of the supervisory equipment (e.g. terminals) may be connected together but installed at locations other than the supervised equipment. For the purpose of EMC testing, these parts may be tested simultaneously and at the same location as the supervised equipment.
Example A shows a configuration with an external traffic simulator. In example B a test load simulator software is used. The use of either or both configurations is possible. The EMC tests shall be carried out during normal operation of supervisory equipment.

![Diagram of configuration examples](image_url)

Legend: CPU = Central Processing Unit  
DLU = Digital Line Unit  
LTG = Line Trunk Group  
SN = Switching Network  
TLS = Test Load Simulator  
TS = Traffic Simulator

**Figure 6: Two examples for the configuration of the EUT and exercising equipment**

### 14.2 Operational conditions

The general conditions of clause 9 apply.

### 14.3 Specific immunity performance criteria

#### 14.3.1 Performance criterion A (continuous phenomena)

The connection between the supervising and supervised equipment shall be maintained.

No supervisory functions shall be affected by EMC testing.

No false alarms, such as signal lamps or printer misprints shall occur.
14.3.2 Performance criterion B (transient phenomena)

The supervisory equipment shall not affect the normal operation of the equipment being supervised.

The operating speed of the supervising equipment may be reduced.

Any minor priority supervisory function may be affected during EMC testing. These functions shall resume normal performance at cessation of the exposure. For example, false alarms shall reset.
Annex A (normative):
Relationship between the present document and the essential requirements of Directive 2014/30/EU

The present document has been prepared to provide one voluntary means of conforming to the essential requirements of Directive 2014/30/EU [i.31] 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).

NOTE: The corresponding Commission's standardisation request to provide one voluntary means of conforming to the essential requirements Directive 2014/30/EU on the harmonisation of the laws of the Member States relating to electromagnetic compatibility (recast) [i.31] is expected shortly.

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 2014/30/EU

<table>
<thead>
<tr>
<th>Harmonised Standard</th>
<th>Requirement</th>
<th>Requirement Conditionality</th>
</tr>
</thead>
<tbody>
<tr>
<td>ETSI EN 300 386</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The following requirements are relevant to the presumption of conformity under the Directive 2014/30/EU [i.31]

<table>
<thead>
<tr>
<th>No</th>
<th>Description</th>
<th>Reference: Clause No</th>
<th>U/C</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Emissions (Annex I, 1a of Directive 2014/30/EU [i.31])</td>
<td>7.1</td>
<td>U</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Immunity (Annex I, 1b of Directive 2014/30/EU [i.31])</td>
<td>7.2</td>
<td>U</td>
<td></td>
</tr>
</tbody>
</table>

Key to columns:

Requirement:

- **No**: A unique identifier for one row of the table which may be used to identify a requirement.
- **Description**: A textual reference to the requirement.
- **Clause Number**: Identification of clause(s) defining the requirement in the present document unless another document is referenced explicitly.

Requirement Conditionality:

- **U/C**: Indicates whether the requirement shall be unconditionally applicable (U) or is conditional upon the manufacturers claimed functionality of the equipment (C).
- **Condition**: Explains the conditions when the requirement shall or shall not be applicable for a requirement which is classified “conditional”.

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

Other Union legislation may be applicable to the product(s) falling within the scope of the present document.
Annex B (normative):
Surges: test method for ports of signal lines remaining within the building

B.0    General

Ports of signal lines remaining within the building, e.g. of ISDN-equipment with interfaces at basic and primary rate shall be tested with the surge test set-up as described in figure B.1.

The test generator to produce the test pulses 1,2/50 μs shall conform to CENELEC EN 61000-4-5 [12]. The total source impedance (2 Ω of the generator plus external resistor) shall be 42 Ω.

At least 5 positive and 5 negative pulses with alternating polarity shall be applied to the EUT. The time interval between two pulses shall be according to CENELEC EN 61000-4-5 [12].

B.1    Test set-up for signal ports

Figures B.1 and B.2 show the test set-up for ports with ISDN interface.

NOTE 1: The impedance matching network is used to decouple the mains and to provide low impedance to reference plane at EUT side. The impedance matching network is described in figure A.2.

NOTE 2: The coupling/decoupling network is described in CENELEC EN 61000-4-5 [12].

NOTE 3: Insulation thickness: 0,1 m for floor standing EUT; 0,5 mm for table top EUT.

NOTE 4: Interface wiring shall be placed 0,1 m above reference plane.

Figure B.1: Surge test set-up for basic rate and primary rate interface ports (using unshielded four wires interface cable)
NOTE: The impedance matching network is required to protect the mains supply and the power source for remote power feeding from test overvoltages and to establish standard termination conditions for the test. It is used:
- to couple the EUT either to the ac mains or to the dc feeding source PS;
- to terminate the mains input with the low impedance port L2/N2, to standardize the presentation of the mains source;
- to feed the EUT from a high impedance port L1/N1 to allow for effective surge application at the feeding interface of the TE.

In conjunction with a coupling capacitance of 1 µF (two capacitors C = 500 nF) as incorporated in the coupling network figure B.1, a nominal pulse form of 1,2/50 µs shall be influenced by the high impedance port L1/N1 of the impedance matching networks; figure B.2, to a reduced time to half value of about 40 µs. For the nominal pulse form 10/700 µs the time to half value may be reduced to approximately 100 µs. This reduction is envisaged and in line with the statistics of overvoltages at mains socket-outlets.

Figure B.2: Example of impedance matching network
Annex C (informative):
Evaluation of test results

The test report will comprise:

a) a detailed description of the EUT, the physical aspects of the set-up and of the earthing conditions;
b) a list (and description) of the auxiliary equipment;
c) a detailed description of the operation modes and operational status of the EUT during emission testing;
d) the response of the EUT to the immunity test levels should be expressed in terms of the compliance criteria detailed in the present document;
e) a description of the test conditions (including temperature and relative humidity) and test results together with the method of test. If the method used differs from the preferred method, then the deviations should be recorded and justification made in the test report;
f) a statement of measurement uncertainty;
g) the calibration status of all test equipment used;
h) if an unrepeatable response occurs, this should be noted in the test report, but the response should not be taken into account in the assessment of the EUT.

Test reports

The work carried out by the testing laboratory will be covered by a report which accurately, clearly and unambiguously presents the test results and all other relevant information.

Each test report should include at least the following information:

a) name and address of testing laboratory and location where the test was carried out when different from the address of the testing laboratory;
b) unique identification of report (such as serial number) and of each page, and total number of pages of the report;
c) name and address of client;
d) description and identification of the test item;
e) date of receipt of test item and date(s) of performance of test;
f) identification of the test specification or description of the method or procedure;
g) description of sampling procedure, where relevant;
h) any deviations, additions to or exclusions from the test specification, and any other information relevant to a specific test;
i) identification of any non-standard test method or procedure utilized;
j) measurements, examinations and derived results, supported by tables, graphs, sketches and photographs as appropriate, and any failures identified;
k) a statement on measurement uncertainty (where relevant);
l) a signature and title or an equivalent marking of person(s) accepting technical responsibility for the test report and date of issue;
m) a statement to the effect that the test results relate only to the items tested;
n) a statement that the report cannot be reproduced except in full without the written approval of the testing laboratory.
Particular care and attention need to be paid to the arrangement of the test report, especially with regard to presentation of the test data and ease of assimilation by the reader. The format should be carefully and specifically designed for each type of test carried out, but the headings should be standardized as far as possible.

Corrections or additions to a test report after issue can be made only by a further document suitably marked, e.g. "Amendment/Addendum to test report serial number XXX (or as otherwise identified)", and should meet the relevant requirements of the preceding clauses.

A test report should not include any advice or Recommendation arising from the test results.

Test results should be presented accurately, clearly, completely and unambiguously in accordance with instructions that may be part of the test methods.

Quantitative results should be given together with calculated or estimated uncertainty.

Test results obtained on items, which have been statistically selected from a larger lot, batch or production quantity, are frequently used to infer the properties of the lot, batch or production quantity. Any extrapolation of the test results to the properties of the lot, batch or production quantity should be contained in a separate document.

NOTE: Test results could be measured values, findings from the visual examination or practical use of the test item, derived results or any other type of observation from the testing activities. Test results may be supported by tables, photographs or graphical information of any kind appropriately identified.
Annex D (informative):
Guidance on EMC performance requirements and methods of measurement for RF ports (also covered by CENELEC EN 50083-2) of multimedia network equipment

This annex provides guidance on additional testing to be performed on network equipment, that is intended to be included in cable distribution systems. This type of equipment is known as “multimedia network equipment”.

The rationale behind this annex is that cable distribution systems for television and sound signals are being used for many more interactive services, some network equipment can include both RF ports as defined in the CENELEC EN 50083 series [32] and RF ports, network ports as defined in the present document (including CENELEC EN 55032 [31] and CENELEC EN 55022 [4]). Hence these additional requirements will provide a single standard for the EMC assessment of “multimedia network equipment”.

RF ports of multimedia network should comply with the requirements of the following clauses of CENELEC EN 50083-2 [3] presented in table D.1.

Table D.1: Additional RF Port test requirements defined in CENELEC EN 50083-2 [3]

<table>
<thead>
<tr>
<th>Clause</th>
<th>Test</th>
<th>Specifics</th>
<th>Limits/Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.2.3</td>
<td>Measurement of input terminal disturbance voltage 30 MHz to 3 GHz</td>
<td>This measurement is relevant for equipment directly connected to receiving antennas or to satellite outdoor units (e.g. channel converter, DBS tuner, etc.).</td>
<td>5.2.2</td>
</tr>
<tr>
<td>4.4.3.2</td>
<td>External immunity to ambient fields: In-band immunity 790 MHz to 862 MHz</td>
<td>This is included to state that within the LTE band the test level is 1 V/m.</td>
<td></td>
</tr>
<tr>
<td>4.4.4.2</td>
<td>Internal immunity in the frequency range: 47 MHz to 862 MHz</td>
<td>Only applicable to equipment directly connected to receiving antennas (from CENELEC EN 50083-2 [3], clause 4.4.4) and is an RF amplifier and converter (from CENELEC EN 50083-2 [3], table 16).</td>
<td>5.4.2</td>
</tr>
<tr>
<td>4.4.4.3</td>
<td>Internal immunity in the frequency range: 10.95 GHz to 12.75 GHz</td>
<td>Applicable to satellite receiving outdoor units for CATV and MATV headend application.</td>
<td>5.4.2</td>
</tr>
<tr>
<td>4.4.4.4</td>
<td>Immunity of outdoor units to image frequency signals</td>
<td>The immunity to image frequency signals is given by the image frequency rejection ratio. It shall be measured for outdoor units used for the reception and conversion of TV-signals with output frequencies in the SAT-IF range.</td>
<td>5.4.3</td>
</tr>
</tbody>
</table>

Table D.2 defines which equipment falls within the scope of this annex.

Table D.2: Port structure of different network equipment

<table>
<thead>
<tr>
<th>Port</th>
<th>Cable network equipment</th>
<th>Telecommunication network equipment</th>
<th>Multimedia network equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enclosure</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Power</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Signal and Control</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Earth</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>RF</td>
<td>X</td>
<td>See note</td>
<td>X</td>
</tr>
<tr>
<td>Telecommunication / Wired Network</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

NOTE: Telecommunication Network Equipment may have RF ports which are not covered by CENELEC EN 50083-2 [3].

In table D.2, cable network equipment and telecommunication network equipment have four common ports and one individual port each. Multimedia network equipment has an addition RF port as well as a telecom port.

The EMC requirements for these systems should be common, since they operate in similar environments.
Annex E (informative):
Bibliography


CENELEC EN 61000-6-1 (2007): "Electromagnetic compatibility (EMC) - Part 6-1: Generic standards - Immunity for residential, commercial and light-industrial environments".


## History

### Document history

<table>
<thead>
<tr>
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<th>Date</th>
<th>Description</th>
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<td>December 1994</td>
<td>Publication as ETSI ETS 300 386-1</td>
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<td>Corrigendum 1</td>
<td>April 1997</td>
<td>Corrigendum 1 to 1st Edition of ETSI ETS 300 386-1</td>
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<td>V1.2.1</td>
<td>March 2000</td>
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<td>V2.1.1</td>
<td>July 2016</td>
<td>Publication</td>
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