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Additional ElectroMagnetic Compatibility (EMC) requirements and resistibility requirements for telecommunications equipment for enhanced availability of service in specific applications

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Foreword

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

The present document defines the EMC requirements of telecommunication network equipment for an increased reliability and the resistibility requirements.

Modal verbs terminology

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

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Introduction

The present document defines EMC requirements for telecommunications equipment to guarantee enhanced availability of service in specific applications. Resistibility requirements are also defined with reference to ITU-T K series recommendations.

1 Scope

The present document covers the emission, immunity and resistibility requirements for telecommunications equipment where higher performance is required by operators to guarantee enhanced availability of service in specific applications.

The environments considered in the present document are defined in ETSI TR 101 651 [i.5] and are:

- telecommunication centres (classes 1 and 2 of ETSI TR 101 651 [i.5]);
- locations other than telecommunication centres (classes 3 and 4 of ETSI TR 101 651 [i.5]).

Data centres and similar facilities are also considered telecommunication centres, where they are within a dedicated room with servers, storage devices and associated telecommunication equipment.

Considering that all kinds of equipment are not equally important, two equipment categories and associated EMC requirements are introduced and are designated as:

- level 1 (see tables in clauses 9.1.1.1 to 9.1.1.5 and 9.2.1.1 to 9.2.1.5);
- level 2 (see tables in clauses 9.1.2.1 to 9.1.2.5 and 9.2.2.1 to 9.2.2.5);

the latter containing the more demanding requirements.

The appropriate level should be chosen by the operator considering the consequences of failure of the equipment which may lead to impaired function, loss of service, failure to meet contractual obligations or bad publicity and loss of reputation.

The present document is applicable to all equipment types, examples of which are listed below:

- switching equipment which includes trunk and local telephone exchanges, remote switching concentrators, international switches, telex switches and network packet switches, base station controllers, radio network controllers, network servers and gateways;
- non-radio transmission equipment which includes multiplexers, line equipment and repeaters, Synchronous Digital Hierarchy (SDH), Digital Cross Connect (DXC), Asynchronous Transfer Mode (ATM) and network terminations, transmission equipment used in the access network like xDSL;
- power supply equipment which includes central power plant, end of suite power supplies, power management systems and other dedicated telecommunications network power supplies;
- supervisory equipment and dedicated Operation And Maintenance (OAM) equipment;
- tariff and billing equipment;
- data centre equipment which includes: Storage, Processor, Server intended to be used within telecommunication network infrastructure.

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>.

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

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

- [1] ETSI EN 300 386 (V2.2.1): "Telecommunication network equipment; Harmonised Standard for ElectroMagnetic Compatibility (EMC) requirements".
- [2] EN 61000-4-2 (2009): "Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test" (produced by CENELEC).
- [3] EN 61000-4-3 (2020): "Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test" (produced by CENELEC).
- [4] EN 61000-4-4 (2012): "Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test" (produced by CENELEC).
- [5] EN 61000-4-5 (2014 + Amendment 1: 2017): "Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test" (produced by CENELEC).
- [6] EN 61000-4-6 (2014): "Electromagnetic compatibility (EMC); Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields" (produced by CENELEC).
- [7] EN 61000-4-8 (2010): "Electromagnetic compatibility (EMC); Part 4-8: Testing and measurement techniques - Power frequency magnetic field immunity test" (produced by CENELEC).
- [8] EN 61000-4-11 (2020): "Electromagnetic compatibility (EMC); Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests for equipment with input current up to 16 A per phase" (produced by CENELEC).
- [9] Recommendation ITU-T K.54 (12/2004): "Conducted immunity test method and level at fundamental power frequencies".
- [10] Recommendation ITU-T K.20 (06/2021): "Resistibility of telecommunication equipment installed in a telecommunications centre to overvoltages and overcurrents".
- [11] Recommendation ITU-T K.21 (08/2022): "Resistibility of telecommunication equipment installed in customer premises to overvoltages and overcurrents".
- [12] Recommendation ITU-T K.45 (10/2019): "Resistibility of telecommunication equipment installed in the access and trunk networks to overvoltages and overcurrents".
- [13] EN 61000-4-34 (2007 + Amendment A1: 2009): "Electromagnetic compatibility (EMC) - Part 4-34: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests for equipment with mains current more than 16 A per phase" (produced by CENELEC).
- [14] IEC 60050-714 (1992): "International Electrotechnical Vocabulary (IEV) - Part 714: Switching and signalling in telecommunications".

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] Recommendation ITU-T K.44 (10-2019): "Resistibility tests for telecommunication equipment exposed to overvoltages and overcurrents - Basic Recommendation".

- [i.2] ETSI EN 300 132-1 (V.2.1.1) (03-2019): "Environmental Engineering (EE); Power supply interface at the input to Information and Communication Technology (ICT) equipment; Part 1: Alternating Current (AC)".
- [i.3] ETSI EN 300 132-2 (V2.7.1) (09-2022): "Environmental Engineering (EE); Power supply interface at the input of Information and Communication Technology (ICT) equipment; Part 2: -48 V Direct Current (DC)".
- [i.4] IEC 60050-161 (1990): "International Electrotechnical Vocabulary (IEV); Part 161: Electromagnetic compatibility".
- [i.5] ETSI TR 101 651 (V2.1.1): "Classification of the electromagnetic environment conditions for equipment in telecommunication networks".
- [i.6] ETSI EN 300 132-3 (V2.2.1): "Environmental Engineering (EE); Power supply interface at the input of Information and Communication Technology (ICT) equipment; Part 3: Up to 400 V Direct Current (DC)".
- [i.7] IEEE 1284™ (2000): "IEEE Standard Signalling Method for a Bidirectional Parallel Peripheral Interface for Personal Computers".
- [i.8] IEEE 1394™ (2008): "IEEE Standard for High Performance Serial Bus Bridges".
- [i.9] Void.
- [i.10] EN 55032 (2015 + Amendment A11: 2020 + Amendment A1: 2020): "Electromagnetic compatibility of multimedia equipment - Emission requirements" (produced by CENELEC).

iTEh STANDARD PREVIEW

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in IEC 60050-161 [i.4] and the following apply:

NOTE: Where applicable, the clause number of IEC 60050-161 [i.4] is in parenthesis.

Audio (low) Frequency (AF): frequency interval from 0 Hz to 20 kHz

NOTE: It may sometimes be convenient to extend the use of this term to include the range of frequencies up to 150 kHz.

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

characteristic severity: characteristic severity for a certain detail parameter in an environmental class states a severity which has only a low probability (generally less than 1 %) of being exceeded

NOTE: The term relates to duration, rate of occurrence or location. It applies to requirements on the environment and to immunity requirements.

connection: 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 [14])

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

discontinuous interference (161-02-13): electromagnetic interference occurring during certain time intervals separated by interference-free intervals

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

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

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 severities.

environmental class: representation of the environment on locations with similar properties

NOTE: They are specified and standardized to provide an operational frame of reference for:

- requirements on the environment;
- immunity requirements.

The class is described using an envelope of environmental conditions expressed in terms of a number of environmental parameters and their characteristic severities or other characteristics. The environmental parameters specified for the class are limited to those which may affect equipment performance.

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

level: measures on a relative scale how important it is that the equipment operates as specified

NOTE: Two levels are defined for the purpose of the present document and are designated as level 1 and level 2.

Level 1 should be selected if the equipment has moderate failure consequences. An equipment has moderate failure consequences when:

- a failure causes limited inconvenience;
- repairs may be made without compromising the responsibilities of the network operator.

Level 2 should be selected if the equipment has severe failure consequences. An equipment has severe failure consequences when:

- failure compromises the function of vital, centralized systems, or services of commercially sensitive or security related nature;
- repair or restoration costs are high, or the time the equipment is out of service is unacceptably long;
- corruption of charging or billing information occurs.

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

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

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

quiescent level: steady state performance of the equipment operating as intended when configured for EMC immunity testing prior to the application of any disturbance signal

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.

shielding effectiveness: for a given external source, the ratio of electric or magnetic field strength at a point before and after the placement of the shield in question

signal line ports: these include 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

NOTE: E.g. 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

telecommunications network: network operated under a licence granted by a national telecommunications authority, which provides telecommunications between Network Termination Points (NTPs)

NOTE: I.e. excluding terminal equipment beyond the NTPs.

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

NOTE 1: E.g. PSTN, ISDN, xDSL, LAN and similar networks.

NOTE 2: A port generally intended for interconnection of components of the EUT (e.g. RS-232, IEEE 1284™ [i.7] (parallel printer), Universal Serial Bus (USB), IEEE 1394™ [i.8] ("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 3: See EN 55032 [i.10].

NOTE 4: These ports may support screened or unshielded cables and may also carry AC or DC power where this is an integral part of the communication specification.

3.2 Symbols

Void.

3.3 Abbreviations

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

| | |
|------|------------------------------------|
| AC | Alternating Current |
| ADSL | Asymmetric Digital Subscriber Line |
| AE | Auxiliary Equipment |
| AM | Amplitude Modulation |
| ATM | Asynchronous Transfer Mode |
| CDN | Coupling Decoupling Network |

| | |
|------|---|
| CRC | Cyclic Redundancy Check |
| CRT | Cathode Ray Tube |
| DC | Direct Current |
| DXC | Digital Cross Connect |
| EE | Environmental Engineering |
| EMC | ElectroMagnetic Compatibility |
| EN | European Norm |
| ESD | ElectroStatic Discharge |
| ETS | European Telecommunications Standard |
| ETSI | European Telecommunications Standards Institute |
| EUT | Equipment Under Test |
| HDSL | High bit-rate Digital Subscriber Line |
| IEC | International Electrotechnical Commission |
| IEEE | Institute of Electrical and Electronics Engineers |
| ISDN | Integrated Services Digital Network |
| LAN | Local Area Network |
| NTP | Network Termination Point |
| OAM | Operation And Maintenance |
| PSTN | Public Switched Telecommunication Network |
| RF | Radio Frequency |
| SDH | Synchronous Digital Hierarchy |
| SDSL | Symmetrical single pair high bit rate Digital Subscriber Line |
| USB | Universal Serial Bus |
| VDSL | Very high speed Digital Subscriber Line |

4 General operational conditions

4.0 General requirements

This clause gives the general operational conditions. The product-specific operating conditions will be derived from the product description and documentation and stated in the test report.

The general operational conditions shall allow for appropriate measuring of the emission and for testing of immunity.

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 A.

4.1 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.

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.

4.2 Exercising equipment

The exercising equipment and other auxiliary equipment shall be sufficiently decoupled from the EUT so that the performance of such equipment does not significantly influence the test results.

4.3 Laboratory environment

For all the tests, the test laboratory environment shall be the one defined in the corresponding basic standards.

The electromagnetic environment of the test laboratory shall not influence the results.

The laboratory environment shall not exceed the limits specified by the manufacturer for normal operation of the EUT.

5 General performance criteria for immunity tests

5.0 General requirements

In this clause, general performance criteria are defined and equipment shall meet these criteria when tested according to the requirements of clause 8.

The manufacturer has the obligation to express the specific performance criteria in terms which relate to the normal performance of his specific product when used as intended according to the product description and documentation.

Interpretation of compliance

The equipment is deemed to comply with the EMC requirements if:

- it meets the test levels given in tables in clauses 9.1.1.1 to 9.2.2.5;
- it meets the performance criteria according to tables in clauses 9.1.1.1 to 9.2.2.5;
- it is operated according to the general and product specific operating conditions, given in clause 4 and in the product documentation;
- the performance items, as derived from the product documentation, being monitored.

5.1 Performance criterion A

The EUT shall continue to operate as intended. No change of operational state is allowed. No loss or unintentional change in critical stored data shall occur and no more than 5 % degradation in transmission performance or 5 % additional errored frames above the quiescent level is allowed during the test.

For instance, it is not allowed to have more than 500 additional errored frames in any 10 000 transmitted frames.

5.2 Performance criterion B

Degradation of the performance below the level described in criterion A is permitted, provided the EUT self-recovers to the condition established prior to the application of the test. The EUT shall operate as intended after the test. No change of actual operating state or critical stored data is allowed.

5.3 Performance criterion C

Degradation of performance as described in criteria A and B is permitted provided that the EUT self-recovers to the condition established prior to the application of the test, or can be restored after the test by the operator.