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INTERNATIONAL STANDARD

Cable networks for television signals, sound signals and interactive services – Part 2: Electromagnetic compatibility for equipment

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

CABLE NETWORKS FOR TELEVISION SIGNALS, SOUND SIGNALS AND INTERACTIVE SERVICES –

Part 2: Electromagnetic compatibility for equipment

FOREWORD

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International Standard IEC 60728-2 has been prepared by technical area 5: Cable networks for television signals, sound signals and interactive services, of IEC technical committee 100: Audio, video and multimedia systems and equipment.

This second edition cancels and replaces the first edition published in 2002, of which it constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

– updated scope, added some new terms and definitions;
– added methods of measurement and performance requirements for telecom signal ports of multimedia network equipment;
– updated methods of measurement for immunity and emissions;

– applicability of EMC performance requirements and methods of measurement to different types of equipment.

The text of this standard is based on the following documents:

FDIS	Report on voting
100/1620/FDIS	100/1640/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The list of all the parts of the IEC 60728 series, under the general title *Cable networks for television signals, sound signals and interactive services*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

INTRODUCTION

Standards of the IEC 60728 series deal with cable networks including equipment and associated methods of measurement for headend reception, processing and distribution of television signals, sound signals, interactive services signals, interfaces and their associated data signals, using all applicable transmission media.

This includes

- CATV[1]-networks,
- MATV-networks and SMATV-networks,
- individual receiving networks,

and all kinds of equipment, systems and installations installed in such networks.

The extent of this standardization work is from the antennas, special signal source inputs to the headend or other interface points to the network up to the terminal input.

The standardization of any user terminals (i.e. tuners, receivers, decoders, terminals, etc.) as well as of any coaxial, balanced and optical cables and accessories thereof is excluded.

1 This word encompasses the HFC networks used nowadays to provide telecommunications services, voice, data, audio and video both broadcast and narrowcast.

CABLE NETWORKS FOR TELEVISION SIGNALS, SOUND SIGNALS AND INTERACTIVE SERVICES –

Part 2: Electromagnetic compatibility for equipment

1 Scope

This part of IEC 60728 applies to the radiation characteristics and immunity to electromagnetic disturbance of EM-active equipment (active and passive equipment) for the reception, processing and distribution of television, sound and interactive multimedia signals as dealt with in the following parts of the IEC 60728 series:

– IEC 60728-3 Active wideband equipment for coaxial cable networks
– IEC 60728-4 Passive wideband equipment for coaxial cable networks
– IEC 60728-5 Headend equipment
– IEC 60728-6 Optical equipment

It covers the following frequency ranges:

– Disturbance voltage injected into the mains 9 kHz to 30 MHz
– Radiation from active equipment 5 MHz to 25 GHz
– Immunity of active equipment 150 kHz to 25 GHz
– Screening effectiveness of passive equipment 5 MHz to 3 GHz (25 GHz)[2]

This standard specifies requirements for maximum allowed radiation, minimum immunity and minimum screening effectiveness and describes test methods for conformance testing.

Due to the fact that cable networks, the former cabled distribution systems for television and sound signals, are more and more used for interactive services, these networks may incorporate also equipment, which carry besides the cable network equipment ports also one or more telecom signal port(s) as well as one Ethernet (IP) port. This equipment should be named as multimedia network equipment.

The EMC behaviour of cable network equipment, telecommunication network equipment and multimedia network equipment may be described by the following port structure (see Table 1).

2 For screening effectiveness of passive equipment no requirements apply at present for the frequency range 3 GHz to 25 GHz. Methods of measurement and limits are investigated for inclusion in a future amendment or revised edition.

Table 1 – Port structure of different network equipment

Port name	Cable network equipment	Telecommunication network equipment	Multimedia network equipment
Enclosure	X	X	X
Earth	X	X	X
AC/DC power supply	X	X	X
Control (e.g. alarm)	X	X	X
Antenna input port	X		X
RF network port	X		X
Telecom signal port		X	X
Ethernet (IP) port			X

Table 1 shows that cable network equipment and telecommunication network equipment have four common ports and one respectively two individual port each. Multimedia network equipment carries besides the common ports an antenna input port and/or a RF network port as well as a telecom signal port.

The electromagnetic compatibility requirements for telecommunication network equipment only are standardized in EN 300 386 (mainly) and in EN 301 489-4, those for cable network equipment only are given in this IEC 60728-2.

Equipment for multimedia networks of the above mentioned type has to work under the same EMC conditions as equipment, which is falling under the cable network and the telecommunication network EMC-standards. Due to the fact, that this equipment has to work in close proximity, e.g. in the same operating room, the EMC environmental conditions for all three types of equipment are the same.

This means that multimedia network equipment has to fulfil the EMC requirements of one of the above mentioned standards and in addition the EMC requirements, laid down in the other EMC standard, for the additional port, by which it is connected to the other network.

By this procedure it is ensured that multimedia network equipment fulfils the EMC conditions of one of the above mentioned networks and will neither disturb the respective other system nor will be disturbed by the respective other system via the connecting port.

Coaxial cables for cable networks do not fall under the scope of this standard. Reference is made to the European Standard series EN 50117.

This standard also covers active indoor antennas for which the requirements and the applicable methods of measurement are limited to the radiation and the electrostatic discharge phenomena.

Standardisation in the field of electromagnetic compatibility for any broadcast terminals (e.g. tuners, receivers, decoders, etc.) is covered by the International Standards CISPR 13 and CISPR 20 and for multimedia terminals by CISPR 22 and CISPR 24.

Requirements for the electromagnetic compatibility of receiver leads are laid down in IEC 60966-2-4, IEC 60966-2-5 and IEC 60966-2-6.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

CISPR 13, *Sound and television broadcast receivers and associated equipment – Radio disturbance characteristics – Limits and methods of measurement*

CISPR 16-1-1, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-1: Radio disturbance and immunity measuring apparatus – Measuring apparatus*

CISPR 20, *Sound and television broadcast receivers and associated equipment – Immunity characteristics – Limits and methods of measurement*

CISPR 22, *Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement*

CISPR 24, *Information technology equipment – Immunity characteristics – Limits and methods of measurement*

IEC 60050-161, *International Electrotechnical Vocabulary – Chapter 161: Electromagnetic compatibility*

IEC 60617, *Graphical symbols for diagrams*

IEC 60728 (all parts), *Cable networks for television signals, sound signals and interactive services*

IEC 60728-3:2005, *Cable networks for television signals, sound signals and interactive services – Part 3: Active wideband equipment for coaxial cable networks*

IEC 60966-2-4, *Radio frequency and coaxial cable assemblies – Part 2-4: Detail specification for cable assemblies for radio and TV receivers – Frequency range 0 MHz to 3 000 MHz, IEC 61169-2 connectors*

IEC 60966-2-5, *Radio frequency and coaxial cable assemblies – Part 2-5: Detail specification for cable assemblies for radio and TV receivers – Frequency range 0 MHz to 1 000 MHz, IEC 61169-2 connectors*

IEC 60966-2-6, *Radio frequency and coaxial cable assemblies – Part 2-6: Detail specification for cable assemblies for radio and TV receivers – Frequency range 0 MHz to 3 000 MHz, IEC 61169-24 connectors*

IEC 61000-3-2, *Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current ≤16 A per phase)*

IEC 61000-4-3, E*lectromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*

IEC 61000-4-4, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-6, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-6-1:2005, *Electromagnetic compatibility (EMC) – Part 6-1: Generic standards – Immunity for residential, commercial and light-industrial environments*

IEC 61079-1:1992, *Methods of measurement on receivers for satellite broadcast transmissions in the 12 GHz band – Part 1: Radio-frequency measurements on outdoor units*

EN 300 386 V1.3.3 (2005), *Electromagnetic compatibility and Radio spectrum Matters (ERM); Telecommunication network equipment; ElectroMagnetic Compatibility (EMC) requirements*

EN 301 489-4 V1.3.1 (2002) *Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 4: Specific conditions for fixed radio links and ancillary equipment and services*

EN 50117 (all parts), *Coaxial cables used in cabled distribution networks*

3 Terms, definitions, symbols and abbreviations

3.1 Terms and definitions

For the purposes of this document, the definitions contained in IEC 60050(161) apply. The most important definitions of IEC 60050(161) are repeated hereafter with the IEC-numbering given in brackets. In addition, some more specific definitions, used in this standard, are listed.

3.1.1
AC power port
point at which a cable for the AC power supply is connected to the equipment

3.1.2
active equipment
equipment (e.g. amplifiers, converters, etc.), performing signal processing by means of external or internal power supply in a certain frequency range

3.1.3
antenna input port
point at which the equipment under test is directly connected to the receiving antenna(s)

3.1.4
band
nominal operating frequency range of the equipment

3.1.5
burst
sequence of a limited number of distinct pulses or an oscillation of limited duration

[IEV 161-02-07]

3.1.6
cable network equipment
equipment from which cable networks for television signals, sound signals and interactive services are built

NOTE Examples of typical cable network equipment could be found in Part 3, Part 4, Part 5, Part 6 and Part 10 of the IEC 60728 series.

3.1.7
carrier-to-interference ratio
minimum level difference measured at the output of an active equipment between the wanted signal and

– intermodulation products of the wanted signal and/or unwanted signals generated due to non-linearities,

– harmonics generated by an unwanted signal,

– unwanted signals that have penetrated into the operating frequency range,

– unwanted signals that have been converted to the frequency range to be protected (operating frequency range).

3.1.8
control port
point at which a cable for the control signal is connected to the equipment

3.1.9
DC power port
point at which a cable for the DC power supply is connected to the equipment

3.1.10
electromagnetic disturbance
any electromagnetic phenomenon which may degrade the performance of a device, equipment or system, or adversely affect living or inert matter

[IEV 161-01-05]

NOTE An electromagnetic disturbance may be an electromagnetic noise, an unwanted signal or a change in the propagation medium itself.

3.1.11
electromagnetic interference
EMI
degradation of the performance of an equipment, transmission channel or system caused by an electromagnetic disturbance

[IEV 161-01-06]

NOTE In English, the terms electromagnetic disturbance and electromagnetic interference designate respectively the cause and the effect, but they are often used indiscriminately.

3.1.12
electromagnetic-active equipment
all passive and active equipment carrying RF signals are considered as electromagnetic-active equipment because they are liable to cause electromagnetic disturbances or the performance of them is liable to be affected by such disturbances

3.1.13
electrostatic discharge
ESD
transfer of electric charge between bodies of different electrostatic potential in proximity or through direct contact

[IEV 161-01-22]

3.1.14
enclosure port
physical boundary of the equipment through which electromagnetic fields may be transmitted

3.1.15
ethernet (IP) port
point at which a cable for the wanted IP signal is connected to the equipment

3.1.16
Euro-DOCSIS
the European Data Over Cable Service Interface Specification Standard (Euro-DOCSIS) defines interface specifications for cable modems and cable modem termination systems for high-speed data communication over cable networks

3.1.17
external immunity
ability of a device, equipment or system to perform without degradation in the presence of electromagnetic disturbances entering other than via its normal input terminals or antennas

[IEV 161-03-07]

3.1.18
first satellite intermediate frequency range
output frequency range of the outdoor unit which is comprised of the frequency band between 950 MHz and at least 3 GHz or parts thereof

3.1.19
immunity (to a disturbance)
ability of a device, equipment or system to perform without degradation in the presence of an electromagnetic disturbance

[IEV 161-01-20

3.1.20
immunity level
maximum level of a given electromagnetic disturbance incident on a particular device, equipment or system for which it remains capable of operating at a required degree of performance

[IEV 161-03-14]

3.1.21
immunity limit
specified minimum immunity level

[IEV 161-03-15]

3.1.22
immunity margin
ratio of the immunity limit to the electromagnetic compatibility level

[IEV 161-03-16, modified]

3.1.23
in-band immunity
immunity against disturbance at any frequency of the wanted signals carried at the interfaces and used internally within the equipment under test (e.g. input/output frequencies, IF, video band, etc.)

3.1.24
individual receiving system
system designed to provide television and sound signals to an individual household

3.1.25
indoor signal lines
lines which do not leave the building and which are protected by other equipment against outdoor interference (e.g. connections from switching to transmission equipment in the same building)