IEC 60728-1-2

Edition 2.0 2014-03

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Cable networks for television signals, sound signals and interactive services – Part 1-2: Performance requirements for signals delivered at the system outlet in operation

Réseaux de distribution par câbles pour signaux de télévision, signaux de radiodiffusion sonore et services interactifs – Partie 1-2: Exigences de performance relatives aux signaux délivrés à la prise terminale en fonctionnement

IEC 60728-1-2:2014-03(en-fr)

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

Part 1-2: Performance requirements for signals delivered at the system outlet in operation

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International Standard IEC 60728-1-2 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 2009, and constitutes a technical revision.

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

- update of performance requirements in Clause 7 to include those for DVB-T2 signals.

This International Standard is to be used in conjunction with IEC 60728-1:2014.

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

FDIS	Report on voting
100/2246/FDIS	100/2282/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.

A list of all parts of the IEC 60728 series, published 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 stability 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- withdrawn,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.

INTRODUCTION

Standards and deliverables of the IEC 60728 series deal with cable networks including equipment and associated methods of measurement for headend reception, processing and distribution of television and sound signals, and for processing, interfacing and transmitting all kinds of data signals for interactive services using all applicable transmission media. These signals are typically transmitted in networks by frequency-multiplexing techniques.

This includes for instance

- regional and local broadband cable networks,
- extended satellite and terrestrial television distribution systems,
- individual satellite and terrestrial television receiving systems,

and all kinds of equipment, systems and installations used in such cable networks, distribution and receiving systems.

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

The standardization work will consider coexistence with users of the RF spectrum in wired and wireless transmission systems.

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

The reception of television signals inside a building requires an outdoor antenna and a distribution network to convey the signal to the TV receivers. In a building divided into apartment blocks, the signals received by the antennas are distributed by the MATV/SMATV cable network up to the home network interface (HNI). The television signals are then distributed (inside the home) by home networks (HN) of various types up to the system outlet or terminal input. The cable network can support two way operation, from the system outlet (or terminal input) towards the headend.

The home network can use coaxial cables, balanced pair cables, fibre optic cables (glass or plastic) and also wireless links inside a room (or a small number of adjacent rooms) to replace wired cords.

IEC 60728-1-2 (this standard) deals with the requirements to be fulfilled at the system outlet or terminal input, when the CATV/MATV/SMATV system is in operation.

These performance requirements for signals at the system outlet or terminal input in operation are derived from considerations of the characteristics of the received signals at the input of the headend (see Clause 6 of IEC 60728-1:2014) and the summation of the impairments produced by the headend, the CATV/MATV/SMATV network and the home network, when the requirements given in IEC 60728-1:2014 and IEC 60728-1-1 are fulfilled.

This standard gives the guidelines for calculation of the operational characteristics at system outlet, taking into account the performance requirements of the CATV/MATV/SMATV network, of the home networks and of the received signals, given in the International Standards IEC 60728-1:2014 and 60728-1-1.

Figure 1 shows the main sections of a general CATV/MATV/SMATV system, indicating the parts of the IEC 60728-1 series where the relevant performance requirements are indicated.

- The requirements for the signals received at the headend are given in Clause 6 of IEC 60728-1:2014.
- The requirements for the CATV/MATV/SMATV cable network, assuming an unimpaired input signal at the input of the headend, up to the system outlet are given in IEC 60728-1:2014, Clause 5.
- The requirements for the CATV/MATV/SMATV cable network up to the home network interface (HNI) are given in IEC 60728-1:2014, Clause 7, assuming an unimpaired input signal at the input of the headend.
- The specific requirements from HNI to the system outlet or terminal input are given in IEC 60728-1-1:2014, Clause 5, assuming an unimpaired input signal at the HNI.
- The requirements at the system outlet in operation are given in Clause 7 of this standard.

The expression in operation means that the received signals, with their impairments, are applied to the headend input of the CATV/MATV/SMATV cable network. The requirements at the system outlet in operation are derived, therefore, by summing the impairments of the various cascaded parts of the system and of the input signal.

When a change of signal format from analogue to analogue (e.g. from FM to AM-VSB) or from digital to digital (e.g. from QPSK to QAM) or from digital to analogue (e.g. from DVB-S/S2 to AM-VSB or DVB-T to AM-VSB) is made at the headend, the summation of the impairments that produce a relaxation of requirements at system outlet does not apply. Such a case will be the equivalence of unimpaired signals applied at the headend input. Therefore, the requirements at system outlet given in IEC 60728-1:2014 apply.

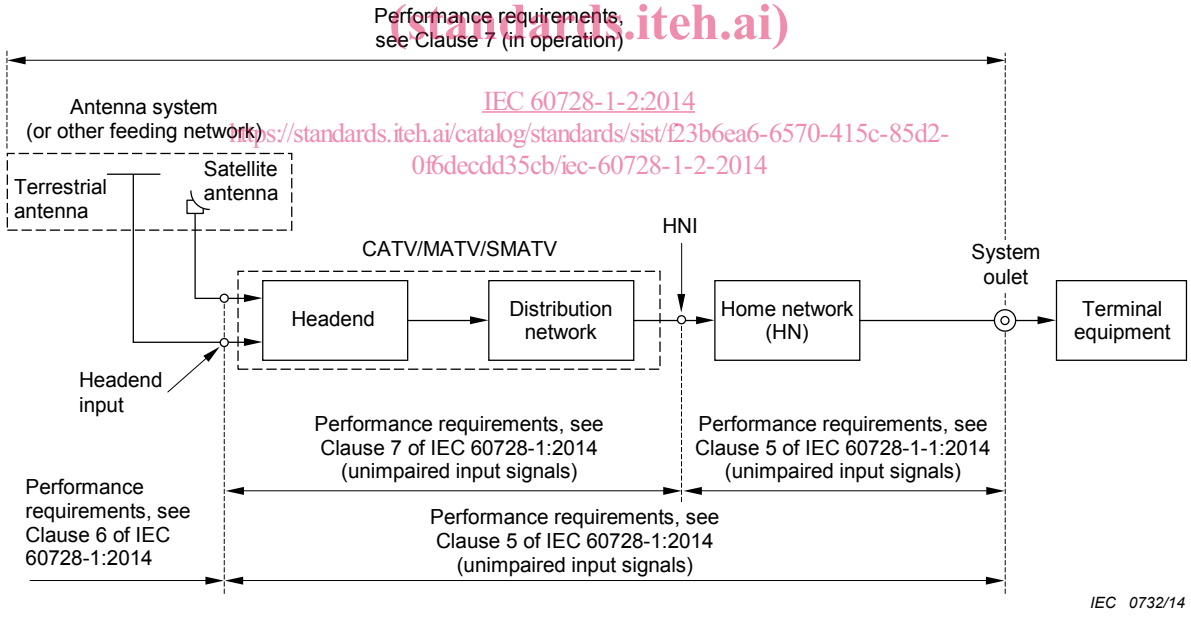

Diagram of the main sections of a CATV/MATV/SMATV cable network and the relevant parts of the IEC 60728-1 series where the requirements are indicated.

Figure 1 – CATV/MATV/SMATV cable network – Performance requirements

This standard also provides references for the basic methods of measurement of the operational characteristics of the downstream cable network in order to assess its performance.

All requirements refer to the performance limits to be achieved in operation at any system outlet when terminated in a resistance equal to the nominal load impedance of the system,

unless otherwise specified. Where system outlets are not used, the above applies to the terminal input.

If the home network is subdivided into a number of parts, using different transmission media (e.g. coaxial cabling, balanced cabling, optical cabling, wireless links) the accumulation of degradations should not exceed the figures given below.

NOTE Performance requirements of return paths as well as special methods of measurement for the use of the return paths in cable networks are described in IEC 60728-10.

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

Part 1-2: Performance requirements for signals delivered at the system outlet in operation

1 Scope

This part of IEC 60728 provides the minimum performance requirements to be fulfilled in operation at the system outlet or terminal input and describes the summation criteria for the impairments present in the received signals and those produced by the CATV/MATV/SMATV cable network, including individual receiving systems.

In a building divided into apartment blocks, the signals received by the antennas are distributed by the MATV/SMATV cable network up to the home network interface (HNI). The television signals are then distributed (inside the home) by home networks (HN) of various types up to the system outlet or terminal input. The cable network can support two way operation, from the system outlet (or terminal input) towards the headend.

The home network can use coaxial cables, balanced pair cables, fibre optic cables (glass or plastic) and also wireless links inside a room (or a small number of adjacent rooms) to replace wired cords.

This part of IEC 60728 is applicable to cable networks intended for television signals, sound signals and interactive services operating between about 5 MHz and 3 000 MHz. The frequency range is extended to 6 000 MHz for home distribution techniques that replace wired cords with a wireless two way communication inside a room (or a small number of adjacent rooms) that uses the 5 GHz to 6 GHz frequency band.

2 Normative references

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

IEC 60050-705, *International Electrotechnical Vocabulary – Chapter 705: Radio wave propagation*

IEC 60050-712, *International Electrotechnical Vocabulary – Chapter 712: Antennas*

IEC 60050-725, *International Electrotechnical Vocabulary – Chapter 725: Space radiocommunications*

IEC 60728-1:2014, *Cable networks for television signals, sound signals and interactive services – Part 1: System performance of forward paths*

IEC 60728-1-1:2014, *Cable networks for television signals, sound signals and interactive services – Part 1-1: RF cabling for two way home networks*

IEC 60728-3:2010, *Cable networks for television signals sound signals and interactive services – Part 3: Active wideband equipment for 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*

ITU-R Recommendation BT.500, *Methodology for the subjective assessment of the quality of television pictures*

ITU-R Recommendation BT.654, *Subjective quality of television pictures in relation to the main impairments of the analogue composite television signal*

ITU-R Recommendation BT.655, *Radio-frequency protection ratios for AM vestigial sideband terrestrial television systems interfered with by unwanted analogue vision signals and their associated sound signals*

ITU-T Recommendation J.61, *Transmission performance of television circuits designed for use in international connections*

ITU-T Recommendation J.63, *Insertion of test signals in the field-blanking interval of monochrome and colour television signals*

ETSI EN 300 421, *Digital Video Broadcasting (DVB); Framing structure, channel coding and modulation for 11/12 GHz satellite services*

ETSI EN 300 429, *Digital Video Broadcasting (DVB); Framing structure, channel coding and modulation for cable systems*

ETSI EN 300 473, *Digital Video Broadcasting (DVB); Satellite Master Antenna Television (SMATV) distribution systems*

ETSI EN 300 744, *Digital Video Broadcasting (DVB); Framing structure, channel coding and modulation for digital terrestrial television*

ETSI EN 302 307, *Digital Video Broadcasting (DVB); Second generation framing structure, channel coding and modulation systems for Broadcasting, Interactive Services, News Gathering and other broadband satellite applications*

ETSI EN 302 755, *Digital Video Broadcasting (DVB) – Frame structure, channel coding and modulation for a second generation digital terrestrial television broadcasting system (DVB-T2)*

3 Terms, definitions, symbols and abbreviations

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-705, IEC 60050-712, IEC 60050-725 and IEC 60728-1, as well as the following, apply.

NOTE The most important definitions are repeated below.

3.1.1
active home network
home network that uses active equipment (for example, amplifiers) in addition to passive equipment such as splitters, taps, system outlets, cables and connectors up to the coaxial RF interface (input and/or output) of the terminal equipment for distributing and combining RF signals

3.1.2
antenna
part of a radio transmitting or receiving system which is designed to provide the required coupling between a transmitter or a receiver and the medium in which the radio wave propagates

Note 1 to entry: In practice, the terminals of the antenna or the points to be considered as the interface between the antenna and the transmitter or receiver should be specified.

Note 2 to entry: If the transmitter or receiver is connected to its antenna by a feeder line, the antenna may be considered to be a transducer between the guided radio waves of the feeder line and the radiated waves in space.

[SOURCE: IEC 60050-712:1992, 712-01-01, modified – The term feeder line instead of feed line has been used.]

3.1.3
attenuation
ratio of the input power to the output power of an equipment or system

Note 1 to entry: The ratio is expressed in decibels.

3.1.4
balun
device for transforming an unbalanced voltage to a balanced voltage or vice-versa

Note 1 to entry: The term is derived from "balanced to unbalanced transformer".

3.1.5
bit error ratio
BER
ratio between erroneous bits and the total number of transmitted bits

3.1.6
carrier-to-intermodulation ratio
C/I
difference between the carrier level at a specified point in a piece of equipment or a system and the level of a specified intermodulation product or combination of products

Note 1 to entry: The difference is expressed in decibels.

3.1.7
carrier-to-noise ratio
C/N
difference between the vision or sound carrier level at a given point in a piece of equipment or a system and the noise level at that point (measured within a bandwidth appropriate to the television or radio system in use)

Note 1 to entry: The difference is expressed in decibels.

3.1.8
CATV network
regional and local broadband cable networks designed to provide sound and television signals as well as signals for interactive services to a regional or local area

Note 1 to entry: Originally defined as community antenna television network.

3.1.9
cross-modulation
undesired modulation of the carrier of a desired signal by the modulation of another signal as a result of equipment or system non-linearities

3.1.10
decibel ratio
ten times the logarithm to base 10 of the ratio of two quantities of power P_1 and P_2, that is

$$10 \lg \frac{P_1}{P_2} \quad \text{in dB}$$

Note 1 to entry: Quantities of power may also be expressed in terms of voltages.

$$20 \lg \frac{U_1}{U_2} \quad \text{in dB}$$

Note 2 to entry: The abbreviation "lg" in equations signifies "$\log_{10}$".

3.1.11
directivity
attenuation between output port and interface or tap port minus the attenuation between input port and interface or tap port, of any equipment or system

3.1.12
distribution amplifier
amplifier designed to feed one or more branch or spur feeders

Note 1 to entry: This is a general term embracing branch amplifier and spur amplifier.

3.1.13
DOCSIS
EuroDOCSIS
standards defining interface specifications for cable modems and cable modem termination systems for high-speed data communication over RF cable networks

3.1.14
dwelling unit
DU
home or office where television and sound signals are distributed and where there is access to interactive services

3.1.15
echo rating
E
result of a system test with a 2*T* sine-squared pulse using the boundary line on a specified graticule within which all parts of the received pulse fall

SEE: Figure Figure 24 of IEC 60728-1:2014.

Note 1 to entry: Determined in ITU-T Recommendation J.61 and ITU-T Recommendation J.63

Note 2 to entry: The object of the graticule design is to ensure that the subjective effect of an echo of rating *E* % is the same as that of a single echo, with displacement greater than 12*T*, of (*E*/2) % relative to the peak amplitude of the test pulse.

3.1.16
extended satellite television distribution network
extended satellite television distribution system
distribution network or system designed to provide sound and television signals received by satellite receiving antenna to households in one or more buildings

Note 1 to entry: This kind of network or system can be combined with terrestrial antennas for the additional reception of TV and/or radio signals via terrestrial networks.

Note 2 to entry: This kind of network or system can also carry control signals for satellite switched systems or other signals for special transmission systems (e.g. MoCA or WiFi) in the return path direction.

3.1.17
extended terrestrial television distribution network
extended terrestrial television distribution system
distribution network or system designed to provide sound and television signals received by terrestrial receiving antenna to households in one or more buildings

Note 1 to entry: This kind of network or system can be combined with a satellite antenna for the additional reception of TV and/or radio signals via satellite networks.

Note 2 to entry: This kind of network or system can also carry other signals for special transmission systems (e.g. MoCA or WiFi) in the return path direction.

3.1.18
feeder
transmission path forming part of a cable network

Note 1 to entry: Such a path may consist of a metallic cable, optical fibre, waveguide, or any combination of them.

Note 2 to entry: By extension, the term is also applied to paths containing one or more radio links.

3.1.19
gain
ratio of the output power to the input power of any equipment or system

Note 1 to entry: The ratio is expressed in decibels.

3.1.20
headend
equipment which is connected between receiving antennas or other signal sources and the remainder of the cable networks, to process the signals to be distributed

Note 1 to entry: The headend may, for example, comprise antenna amplifiers, frequency converters, combiners, separators and generators.

3.1.21
headend input
interface of the headend where the signals received by antennas or individual feeder lines are applied for signal processing

3.1.22
home network
HN
RF cable network inside a single dwelling (one-family house or one unit of a multi-dwelling building) in the SOHO (Small Offices Home Offices) environments or in the rooms of hotels, hospitals

Note 1 to entry: The preferred topology of this network is a star.

Note 2 to entry: This network carries television signals, sound signals and interactive services up to the coaxial RF interface (input and/or output) of the terminal equipment. It may comprise active equipment, passive equipment, cables and connectors.

3.1.23
home network interface
HNI
interface for access to the network for transmission of television signals, sound signals and interactive services inside a home (single dwelling)