IEC 60728-101-2

Edition 1.0 2023-06

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Cable networks for television signals, sound signals and interactive services – Part 101-2: Performance requirements for signals delivered at the system outlet in operation with all-digital channels load

Réseaux de distribution par câbles pour signaux de télévision, signaux de radiodiffusion sonore et services interactifs – Partie 101-2: Exigences de performance relatives aux signaux délivrés à la prise d'abonné en fonctionnement sous une charge de porteuses exclusivement numériques

IEC 60728-101-2:2023-06(en-fr)

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

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This International Standard is to be used in conjunction with IEC 60728-101:2016.

The text of this International Standard is based on the following documents:

Draft	Report on voting
100/3903/FDIS	100/3944/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all 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 document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document 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- withdrawn,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.

This part of IEC 60728 deals with the requirements that are 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 IEC 60728-101:2016, Clause 6) 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 60728-101 and IEC 60728-101-1 are fulfilled.

This document 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 IEC 60728-101 and IEC 60728-101-1.

This document considers digital signals only and is based on IEC 60728-101 dealing with system performance of forward paths loaded with digital channels only. For performance requirements for analogue signals delivered at the system outlet in operation, refer to IEC 60728-1-2.

Although the upper frequency range of terrestrial broadcast signals depends on the allocation frequency plan of each region (e.g. in Europe it is 694 MHz, the 700 MHz and 800 MHz bands being assigned to telecommunication services), the upper frequency range into the cable networks can be maintained at 862 MHz in order to maximise the number of channels distributed in the cable networks, assuming that sufficient immunity (screening efficiency) to signals radiated in the 700 MHz and 800 MHz bands is provided.

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

Part 101-2: Performance requirements for signals delivered at the system outlet in operation with all-digital channels load

1 Scope

This part of IEC 60728-101 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.

NOTE 1 When a change of signal format is made at the headend, the summation of the impairments does not apply (see also Clause 6).

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 limited to downstream TV broadcast signals received from antennas and is applicable to cable networks intended for television signals, sound signals and interactive services operating between about 5 MHz and 3 300 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.

Figure 1 shows the main sections of a general CATV/MATV/SMATV system, indicating the parts of the IEC 60728-101 series documents where the relevant performance requirements are indicated.

- The requirements for the signals received at the headend are given in IEC 60728-101:2016, Clause 6.
- 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 60728-101:2016, Clause 5.
- The requirements for the CATV/MATV/SMATV cable network up to the home network interface (HNI) are given in IEC 60728-101:2016, 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 60728-101-1:2023, Clause 5, assuming an unimpaired input signal at the HNI.
- The requirements at the system outlet in operation are given in Clause 6 of this document.

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 digital to digital (e.g. from QPSK to QAM) (e.g. as in ETSI EN 300 473) or from digital to analogue (e.g. from DVB-S/S2 to AM-VSB or DVB-T/T2 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 apply.

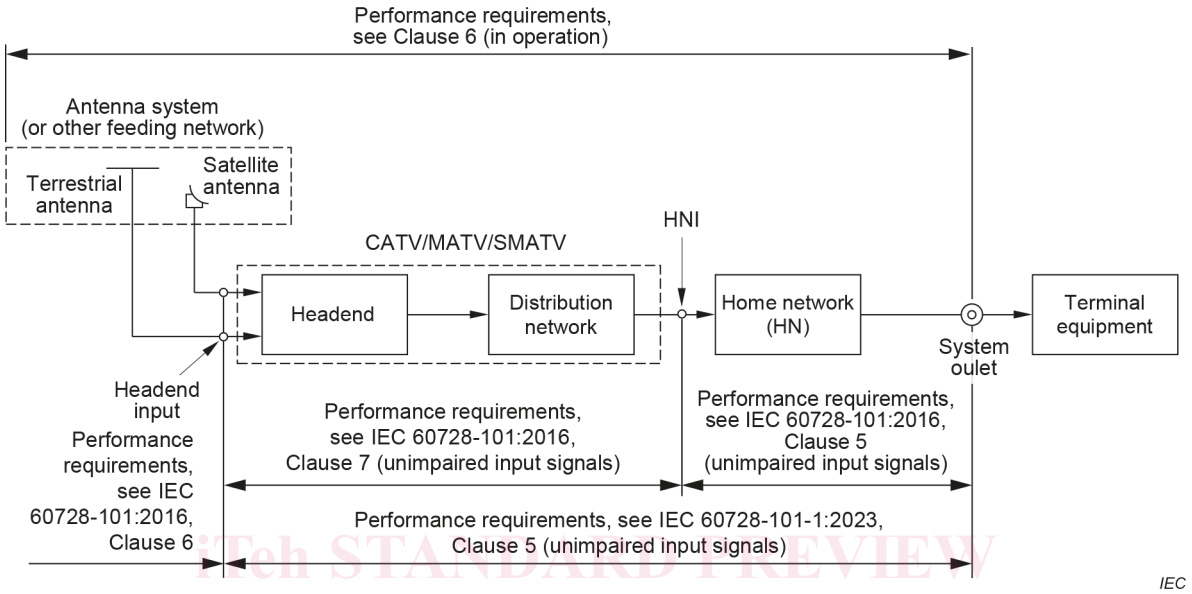

Diagram of the main sections of a CATV/MATV/SMATV cable network and the relevant parts of the IEC 60728-101 series where the requirements are indicated.

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

This document 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.

The present document also provides limits for the accumulation of degradations 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).

NOTE 2 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.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

IEC 60728-101:2016, *Cable networks for television signals, sound signals and interactive services – Part 101: System performance of forward paths loaded with digital channels only*

IEC 60728-101-1:2023, *Cable networks for television signals, sound signals and interactive services – Part 101-1: RF cabling for two-way home networks with all-digital channels load*

IEC 60728-3:2017, *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*

3 Terms, definitions, symbols and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

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

[SOURCE: IEC 60728-1:2014, 3.1.2]

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 are specified.

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

Note 3 to entry: See also IEC 60728-1:2014, 3.1.3, IEC 60728-1-1:2014, 3.1.2 and IEC 60728-1-2:2014, 3.1.2.

[SOURCE: IEC 60050-712:1992, 712-01-01, modified – The deprecated term "aerial" has been deleted, in Note 1 to entry "should be specified" has been replaced by "are specified", Note 2 to entry has been clarified and a Note 3 to entry giving additional references has been added.]

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

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

[SOURCE: IEC 60728-1:2014, 3.1.5]

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".

[SOURCE: IEC 60728-101-1:2023, 3.1.4]

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

[SOURCE: IEC 60728-1:2014, 3.1.9]

3.1.6
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.

[SOURCE: IEC 60728-1-1:2014, 3.1.9]

3.1.7
decibel ratio
ten times the logarithm to the 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: This ratio may also be expressed in terms of voltages, on the condition that impedance of U_1 and U_2 is the same (e.g. 75 Ω).

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

[SOURCE: IEC 60728-1:2014, 3.1.24, modified – Note 1 to entry clarified.]

3.1.8
distribution amplifier
amplifier designed to feed one or more branch feeders or spur feeders

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

3.1.9
dwelling unit
DU
home or office where television and sound signals are distributed and where there is access to interactive services

[SOURCE: IEC 60728-1:2014, 3.1.31]

3.1.10
extended satellite television distribution network or 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 Wi-Fi) in the return path direction.

[SOURCE: IEC 60728-1:2014, 3.1.35]

3.1.11
extended terrestrial television distribution network or 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 Wi-Fi) in the return path direction.

[SOURCE: IEC 60728-1:2014, 3.1.36]

3.1.12
feeder
transmission path forming part of a cable network

Note 1 to entry: Such a path can 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.

[SOURCE: IEC 60728-1:2014, 3.1.38]

3.1.13
gain
ratio of the output power to the input power of any equipment or system

Note 1 to entry: Gain is expressed in decibels.

[SOURCE: IEC 60728-1:2014, 3.1.42]

3.1.14
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 can, for example, comprise antenna amplifiers, frequency converters, combiners, separators and generators.

[SOURCE: IEC 60728-1:2014, 3.1.43]

3.1.15
headend input
interface of the headend where the signals received by antennas or individual feeder lines are applied for signal processing

[SOURCE: IEC 60728-1:2014, 3.1.45]

3.1.16
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 can comprise active equipment, passive equipment, cables and connectors.

[SOURCE: IEC 60728-1:2014, 3.1.48]

3.1.17
home network interface
HNI
interface for access to the network for transmission of television signal, sound signals and interactive services inside a home (single dwelling)

Note 1 to entry: It is the first accessible point after the entrance of the network into an individual home (see Figure 2).

Note 2 to entry: In some cases, the home network interface can coincide with the system outlet. In this case, the performance requirements for a system outlet apply.

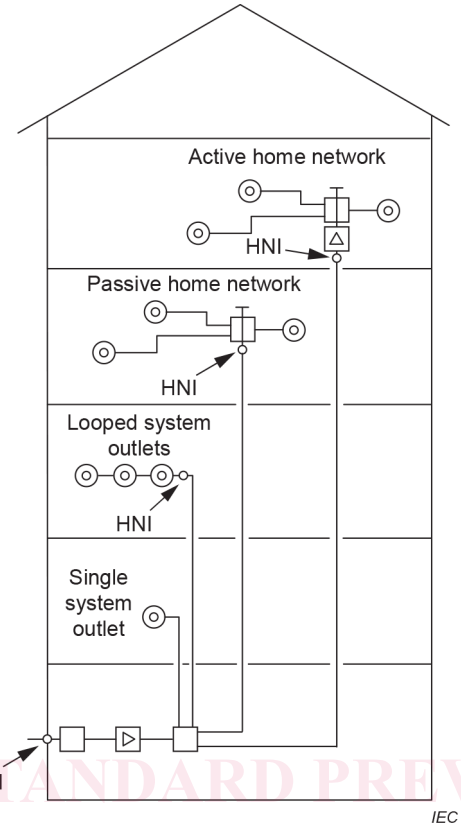

Figure 2 – Examples of location of HNI for various home network types

[SOURCE: IEC 60728-1:2014, 3.1.49, modified – Notes to entry and Figure 2 added.]

3.1.18
individual satellite television receiving system
system designed to provide sound and television signals received from satellite(s) to an individual household

Note 1 to entry: This kind of system could also carry control signals for satellite switched systems or other signals for special transmission systems (e.g. MoCA or Wi-Fi) in the return path direction.

[SOURCE: IEC 60728-1:2014, 3.1.51]

3.1.19
individual terrestrial television receiving system
system designed to provide sound and television signals received via terrestrial broadcast networks to an individual household

Note 1 to entry: This kind of system could also carry other signals for special transmission systems (e.g. MoCA or Wi-Fi) in the return path direction.

[SOURCE: IEC 60728-1:2014, 3.1.52]

3.1.20
intermodulation
process whereby non-linearity of equipment in a system produces output signals (called intermodulation products) at frequencies which are linear combinations of those of the input signals

[SOURCE: IEC 60728-1:2014, 3.1.53]