

INTERNATIONAL STANDARD



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

<https://standards.iec.ch/catalogue/standards/sis/e4625d03-f5b7-4b11-b4cd-0a887bf02ef2/iec-60728-1-1-2010>



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INTERNATIONAL STANDARD



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

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE **XA**

ICS 33.060.30; 33.160.01

ISBN 978-2-88910-260-0

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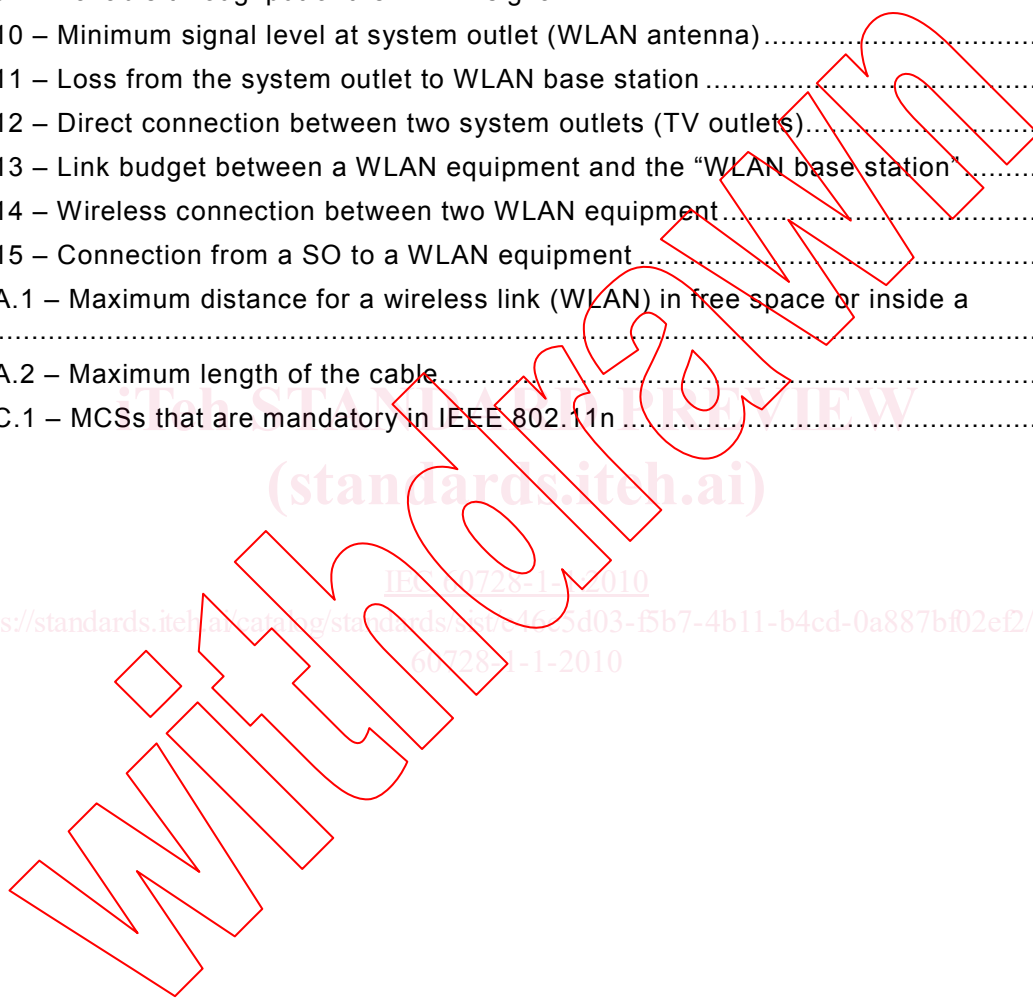
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**CABLE NETWORKS FOR TELEVISION SIGNALS,
SOUND SIGNALS AND INTERACTIVE SERVICES –****Part 1-1: RF cabling for two way home networks**

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International Standard IEC 60728-1-1 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.

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

FDIS	Report on voting
100/1622/FDIS	100/1645/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, 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- withdrawn,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.

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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 and their associated data signals, and for processing, interfacing and transmitting all kinds of signals for interactive services using all applicable transmission media.

This includes

- CATV¹-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 standardisation 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, 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.

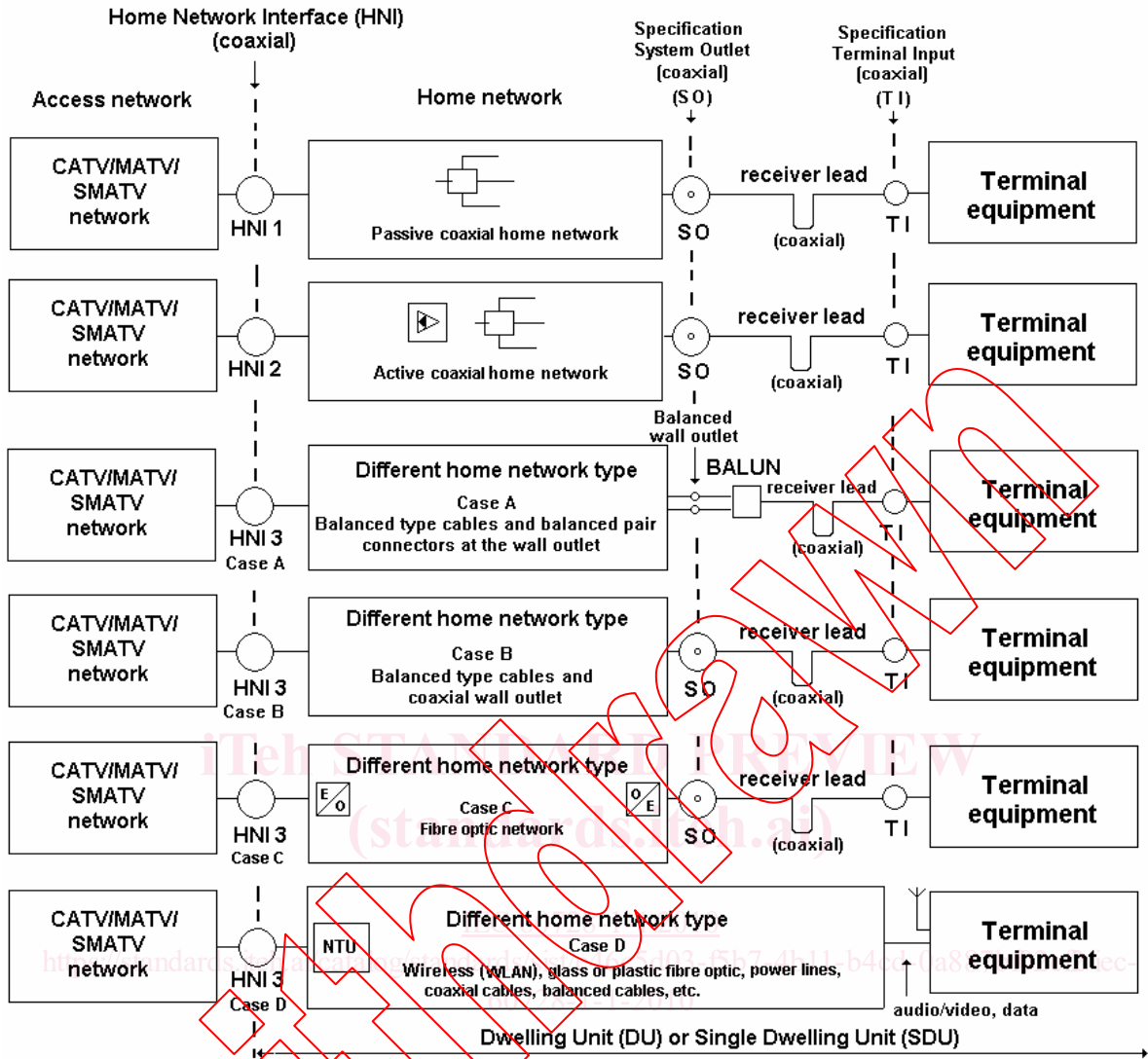
This part of the IEC 60728 deals with the requirements and implementation guidelines for a home network that can be realised with different techniques. The following types of home networks (HN) are possible:

- passive coaxial home network;
- active coaxial home network;
- different home network types.

Figure 1 shows typical situations that are possible when considering RF home networks.

The RF home network can be realised using coaxial cables, balanced cables, optical cables or radio links.

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



IEC 2523/09

Figure 1 – Examples of RF home network types

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

Part 1-1: RF cabling for two way home networks

1 Scope

This part of IEC 60728 provides the requirements and describes the implementation guidelines of RF cabling for two-way home networks; it is applicable to any home network that distributes signals provided by CATV/MATV/SMATV cable networks (including individual receiving systems) having a coaxial cable output. It is also applicable to home networks where some part of the distribution network uses wireless links, for example in place of the receiver cord.

This part of IEC 60728 is therefore applicable to RF cabling for two-way home networks with wired cords or wireless links inside a room and primarily intended for television and sound signals operating between about 5 MHz and 3 000 MHz. The frequency range is extended to 6 000 MHz for 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 band.

In a building divided into apartment blocks, the distribution of the signals inside the home starts from the home network interface (HNI) up to the system outlet or terminal input. The requirements at the system outlet are given in IEC 60728-1, Clause 5 and the requirements at the HNI are given in IEC 60728-1, Clause 7. In Clause 5 of this standard additional requirements are given.

This standard deals with various possibilities to distribute signals in a home network, using 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 standard gives references to basic methods of measurement of the operational characteristics of the home cable network in order to assess its performance.

All requirements refer to the performance limits, which are obtained between the input(s) at the home network interface (HNI) and the output 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.

NOTE 1 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 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.

Clause 5 defines the performance limits measured at system outlet or terminal input for an unimpaired (ideal) test signal applied at the HNI. Under normal operating conditions for any analogue channel and meeting these limits, the cumulative effect of the impairment of any single parameter at the HNI and that due to the home network will produce picture and sound signals not worse than Grade four on the five-grade impairment scale contained in ITU-R BT.500. These requirements are given in IEC 60728-1-2. For digitally modulated signals the quality requirement is a QEF (Quasi Error Free) reception.

This standard describes the physical layer connection for home networks. Description of protocols required for Layer 2 and higher layers is out of the scope of this standard. Logical connections between devices within the home network are therefore not always guaranteed.

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.

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 60617, *Graphical symbols for diagrams*

IEC 60728-1:2007, *Cable networks for television signals sound signals and interactive services – Part 1: System performance of forward paths*

IEC 60728-1-2, *Cable networks for television signals sound signals and interactive services – Part 1-2: Performance requirements for signals delivered at system outlet in operation*

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

IEC 60728-10, *Cable networks for television signals, sound signals and interactive services – Part 10: System performance of return paths*

IEC 60966 (all parts), *Radio frequency and coaxial cable assemblies*

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*

IEEE 802.11, 1999 *IEEE Standards for Information Technology – Telecommunications and Information Exchange between Systems – Local and Metropolitan Area Network – Specific Requirements – Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications*²

² Parts of IEEE 802.11 are reproduced in ISO/IEC 8802-11:2005, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specification*

IEEE 802.11a-1999, *IEEE Standard for Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications – Amendment 1: High-speed Physical Layer in the 5 GHz band*

IEEE 802.11b-1999 Supplement to 802.11-1999, *Wireless LAN MAC and PHY specifications: Higher speed Physical Layer (PHY) extension in the 2.4 GHz band*

IEEE 802.11e-2005, *IEEE Standard for Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications: Amendment 8: Medium Access Control (MAC) Quality of Service Enhancements*

IEEE 802.11g-2003 *IEEE Standard for Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications – Amendment 4: Further Higher-Speed Physical Layer Extension in the 2.4 GHz Band*

IEEE 802.11h-2003 *IEEE Standard for Information technology – Telecommunications and Information Exchange Between Systems – LAN/MAN Specific Requirements – Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications: Spectrum and Transmit Power Management Extensions in the 5GHz band in Europe*

IEEE 802.11n/D4.0, *March 2008 Active Unapproved Draft – IEEE Draft STANDARD for Information Technology-Telecommunications and information exchange between systems-Local and metropolitan area networks-Specific requirements-Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications: Amendment 4: Enhancements for Higher Throughput*

IEEE 802.16-2004 *IEEE Standard for Local and metropolitan area networks – Part 16: Air Interface for Fixed Broadband Wireless Access Systems (WiMax)*

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

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*

EN 50117-2-4, *Coaxial cables – Part 2-4: Sectional specification for cables used in cabled distribution networks - Indoor drop cables for systems operating at 5 MHz to 3000 MHz*

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

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

ETSI EN 300 473, *Digital Video Broadcasting (DVB): 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*

3 Terms, definitions, symbols and abbreviations

3.1 Terms and definitions

For the purpose of this document, the terms and definitions given in IEC 60050-705, IEC 60050-712 and IEC 60050-725, 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 like 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

that 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 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 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.

[IEV 712-01-01]

3.1.3

attenuation

ratio of the input power to the output power of an equipment or system, expressed in decibels

3.1.4

balun

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

broadcast and communication technologies

BCT

group of applications including RF distribution of sound signals and video signals

NOTE For this standard, this is a group of applications using the HF band (3 MHz to 30 MHz), the VHF band (30 MHz to 300 MHz) and the UHF band (300 MHz to 3 000 MHz) for transmission of television signals, sound signals and interactive services, as well as for in-home inter-networking.

3.1.7**carrier-to-intermodulation ratio****C/I**

difference in decibels 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

3.1.8**carrier-to-noise ratio****C/N**

difference in decibels 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)

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 the base 10 of the ratio of two quantities of power P_1 and P_2 , i.e.

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

NOTE May also be expressed in terms of voltages for a common impedance (e.g. 75 Ω).

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

3.1.11**designed receiving antenna**

antenna that has the gain, the directivity and the polarization for receiving the wanted signal at the headend site with the required performance

3.1.12**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

3.1.13**DOCSIS****Euro-DOCSIS**

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 is access to interactive services

3.1.15**echo rating****E**

result of a system test with a 2T sine-squared pulse (as determined in ITU-T Recommendation J.61 and ITU-T Recommendation J.63) using the boundary line on a specified graticule (for example, Figure 29 of IEC 60728-1) within which all parts of the received pulse fall