

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Cable networks for television signals, sound signals and interactive services –
Part 4: Passive wideband equipment for coaxial cable networks**

**Réseaux de distribution par câbles pour signaux de télévision, signaux de
radiodiffusion sonore et services interactifs –
Partie 4: Equipement à large bande passif pour les réseaux de distribution par
câbles coaxiaux**





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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**CABLE NETWORKS FOR TELEVISION SIGNALS,
SOUND SIGNALS AND INTERACTIVE SERVICES –**
**Part 4: Passive wideband equipment
for coaxial cable networks**

FOREWORD

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International Standard IEC 60728-4 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 third edition cancels and replaces the second edition published in 2000, of which it constitutes a technical revision.

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

- Subclause 3.1 includes several new or modified definitions.
- Clause 4 includes added test methods for attenuation, isolation, through-loss, group delay variation, amplitude frequency response and two carrier intermodulation measurements for second- and third-order products.
- Clause 5 includes updated and new performance requirements.

This bilingual version (2012-11) corresponds to the monolingual English version, published in 2007-08.

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

FDIS	Report on voting
100/1243/FDIS	100/1275/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.

The French version of this standard has not been voted upon.

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

For the differences existing in some countries, see Annex B

The 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 [IEC 60728-4:2007](http://standards.iteh.ai/catalog/standards/sist/8abadbf2-f4c3-43d6-9715-e45f5e914c68/iec-60728-4-2007)
- amended. <https://standards.iteh.ai/catalog/standards/sist/8abadbf2-f4c3-43d6-9715-e45f5e914c68/iec-60728-4-2007>

ITEH STANDARD PREVIEW
(standards.iteh.ai)

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 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.

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.

iTeh STANDARD PREVIEW (standards.iteh.ai)

[IEC 60728-4:2007](https://standards.iteh.ai/catalog/standards/sist/8abadbf2-f4c3-43d6-9715-e45f5e914c68/iec-60728-4-2007)

<https://standards.iteh.ai/catalog/standards/sist/8abadbf2-f4c3-43d6-9715-e45f5e914c68/iec-60728-4-2007>

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 4: Passive wideband equipment for coaxial cable networks

1 Scope

This part of IEC 60728 applies to system outlets, splitters and taps, passive single or multiple port equipment comprising filters, attenuators, equalizers, galvanic isolators, power injectors, cable splices, terminating resistors and transfer points, but excluding coaxial cables and receiver leads (see 5.2).

This standard

- covers the frequency range 5 MHz to 3 000 MHz;
- identifies performance requirements for certain parameters;
- lays down data publication requirements for certain parameters;
- stipulates methods of measurements;
- introduces minimum requirements defining quality grades.

There are three grades for all passive equipment except system outlets where there is only one.

[IEC 60728-4:2007](https://standards.iteh.ai/catalog/standards/sist/8abadb2-f4c3-43d6-9715-e451be914c68/iec-60728-4-2007)

Different networks require the same performance and, when integrating networks, upgrading will be avoided.

Practical experience has shown that these three grades meet most of the technical requirements necessary for supplying a minimum signal quality to the subscribers. This classification should not be considered as a requirement but as information for users and manufacturers on the minimum quality criteria of the material required to install networks of different sizes. The system operator should select appropriate material to meet the minimum signal quality at the subscriber's outlet and to optimize cost/performance, taking into account the size of the network and local circumstances.

All requirements and published data should be understood as guaranteed values within the specified frequency range and in well-matched conditions.

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 60068 (all parts), *Environmental testing*

IEC 60417, *Graphical symbols for use on equipment*

NOTE IEC 60417 can be consulted on the IEC website.

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 60617, *Graphical symbols for diagrams*

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

NOTE The title of some of the parts of the IEC 60728 series will be changed when a new edition is published.

IEC 60966-1, *Radio frequency and coaxial cable assemblies – Part 1: Generic specification – General requirements and test methods*

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 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 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 to 3 000 MHz, IEC 61169-24 connectors*

IEC 61000-4-5, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

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

IEC 61169-1, *Radio-frequency connectors – Part 1: Generic specification – General requirements and measuring methods*

IEC 61169-2, *Radio-frequency connectors – Part 2: Sectional specification – Radio-frequency coaxial connectors of type 9,52*

IEC 61169-24, *Radio-frequency connectors – Part 24: Sectional specification – Radio-frequency coaxial connectors with screw coupling, typically for use in 75 ohm cable distribution systems (type F)*

3 Terms, definitions, symbols and abbreviations

3.1 Terms and definitions

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

NOTE Some terms have been taken from IEC 60050-723.

3.1.1

active equipment

equipment (for example, amplifiers, converters, etc), performing signal processing by means of external or internal power supply in a certain frequency range

3.1.2

amplitude frequency response

gain or loss of an equipment or system plotted against frequency

3.1.3

attenuation

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

3.1.4

decibel ratio

ten times the logarithm of the ratio of two quantities of power, P_1 and P_2 , i.e.

$$10 \lg \frac{P_1}{P_2} \text{ dB} \quad (1)$$

3.1.5

directional coupler

tap

passive signal splitting equipment, with minimum signal loss between the input port and the output port (through-loss), a specified coupling loss between the input port and the tap port (tap loss), and very high loss between the output port and tap port (isolation)

[IEV 723-09-25, modified]

3.1.6

directivity

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

3.1.7

EM-active equipment

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

3.1.8

equalizer

equipment designed to compensate over a certain frequency range for the amplitude/frequency distortion or phase/frequency distortion introduced by feeders or equipment

NOTE This equipment is for the compensation of linear distortions only.

3.1.9

feeder

transmission path forming part of a cable network. Such a path may consist of a metallic cable, optical fibre, wave guide or any combination of them. By extension, the term is also applied to paths containing one or more radio links

[IEV 723-09-12, modified]

3.1.10

grade

classification of performance for equipment for use in cable networks. The choice of the appropriate grade depends on, for example,

- size of network;
- structure of network;
- lengths of cable between equipment;
- kind of services;

- kind of signals

NOTE In any case, the system performance requirement should be fulfilled by the design of the network and the choice of the grade of equipment used.

3.1.11 group delay variation

indicates the deviation from a linear phase-frequency response; the group delay is

$$\tau = \frac{d\varphi}{df} \quad (2)$$

where

φ is the phase;

f is the frequency.

Group delay variation (typically in ns) is the difference of the values of τ between the given frequency and the reference frequency

3.1.12 isolation

attenuation between two output, tap or interface ports of any equipment or system

3.1.13 level

level of any power P_1 is the decibel ratio of that power to the standard reference power P_0 , i.e.

$$10 \lg \frac{P_1}{P_0} \quad (3)$$

level of any voltage U_1 is the decibel ratio of that voltage to the standard reference voltage U_0 , i.e.

$$20 \lg \frac{U_1}{U_0} \quad (4)$$

NOTE This may be expressed in decibels (relative to 1 μV in 75 Ω) or more simply in dB(μV) if there is no risk of ambiguity.

3.1.14 looped system outlet

device through which the spur feeder passes and to which is connected a receiver lead, without the use of a subscriber's feeder

[IEV 723-09-21]

3.1.15 nominal value

reference value around which a certain tolerance field (plus/minus) is permitted or specified

3.1.16 passive equipment

equipment (for example, splitters, tap-offs, system outlets, etc.) not requiring a power supply in order to operate and/or not carrying out signal processing in a certain frequency range

3.1.17**receiver lead**

lead which connects the system outlet to the subscriber equipment

[IEV 723-09-23, modified]

NOTE 1 The meaning of receiver lead may not describe the function of this device if it is used for interactive subscriber equipment; the definition already gives the more general explanation and allows bi-directional services.

NOTE 2 A receiver lead may include filters and balun transformers in addition to the cable.

3.1.18**r.f. data port**

r.f. interface port to connect an interactive data equipment (for example, a modem) and passes return band (upstream), as well as distribution (downstream) frequency band

3.1.19**splice**

connecting device with barrel(s) accommodating electrical conductor(s) with or without additional provision to accommodate and secure the insulation

[IEV 581-05-11]

3.1.20**splitter**

equipment in which the signal power at the (input) port is divided equally or unequally between two or more (output) ports

NOTE This equipment may be used in the reverse direction for combining signal energy.

3.1.21**spur feeder**

feeder to which splitters, subscriber taps or looped system outlets are connected

[IEV 723-09-16, modified]

3.1.22**standard reference power and voltage**

in cable networks the standard reference power, P_0 , is 1/75 pW

NOTE This is the power dissipated in a 75 Ω resistor with an r.m.s voltage drop of 1 μ V across it.

The standard reference voltage, U_0 , is 1 μ V.

3.1.23**subscriber feeder**

feeder connecting a subscriber tap to a system outlet or, where the latter is not used, direct to the subscriber equipment

[IEV 723-09-17, modified]

NOTE A subscriber feeder may include filters and balun transformers.

3.1.24**subscriber tap**

equipment with one or more ports for connecting a subscriber feeder to a spur feeder

3.1.25**system outlet**

equipment for interconnecting a cable network and a receiver lead

**3.1.26
transfer point**

interface between the cable network and the internal network of the building, each of which may be separately owned. The transfer point may contain a voltage-dependent device and/or a galvanic isolator

**3.1.27
well-matched**


















matching condition when the return loss of the equipment is sufficient that the expected error can be neglected

NOTE Through mismatching of measurement instruments and the measurement object, measurement errors are possible. Comments on the estimation of such errors are given in Annex A.

3.2 Symbols

The following graphical symbols are used in the figures of this standard. These symbols are either listed in IEC 60617 or based on symbols defined in IEC 60617.

NOTE Numbers in brackets ([]) refer to symbols in IEC 60617 database.

Symbol	Terms	Symbol	Terms
	voltmeter [IEC 60617-S00059(2001:07)] [IEC 60617-S00913(2001:07)]		oscilloscope [IEC 60617-S00059(2001:07)], [IEC 60617-S00922(2001:07)]
	ampere meter [IEC 60617-S00059(2001:07)] [IEC 60617-S00910(2001:07)]		spectrum analyser [IEC 60617-S00059(2001:07)] [IEC 60617-S00910(2001:07)]
	variable generator [IEC 60617-S00081(2001:07)] [IEC 60617-S01225(2001:07)] [IEC 60617-S01403(2001:09)]		detector with LF-amplifier [IEC 60617-S00118] [IEC 60617-S01239]
	equipment under test [IEC 60617-S00059(2001:07)]		adjustable a.c. voltage source
	system outlet		low pass filter [IEC 60617-S01248(2001:07)]
	looped through system outlet		high pass filter [IEC 60617-S01247(2001:07)]
	variable attenuator [IEC 60617-S01245(2001:07)]		r.f. choke [IEC 60617-S00583(2001:07)]
	ground [IEC 60617-S00200(2001:07)]		variable resistor [IEC 60617-S00557(2001:07)]
	capacitor [IEC 60617-S00567(2001:07)]		

3.3 Abbreviations

AC	alternating current
AM	amplitude modulation
CATV	community antenna television (system)
dBc	dBc means dB in relation to carrier level
DC	direct current
EM	electromagnetic
EMC	electromagnetic compatibility
EUT	equipment under test
FM	frequency modulation
HP	high pass
IP Class	international protection class
LF	low frequency
LP	low pass
MATV	master antenna television (system)
Q grade(s)	quality grade(s)
RF	radio frequency
RMS	root mean square
SMATV	satellite master antenna television (system)
TV	television

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4 Methods of measurement

[IEC 60728-4:2007](#)

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4.1 Attenuation

4.1.1 Test equipment

The following test equipment is required:

- tuneable r.f. signal generator;
- variable calibrated attenuator;
- r.f. switch;
- spectrum analyser or selective voltmeter.

NOTE This test set is used as the basic method of measurement; normally, a network analyser is used.

4.1.2 Measurement procedure

The equipment shall be connected as shown in Figure 1. Both r.f. switches shall be set to position A. The variable attenuator shall be adjusted until a reference line on the spectrum analyser or a reference value on the selective voltmeter is met. The value a_1 in dB of the variable attenuator shall be read. Both r.f. switches shall be set to position B. The variable attenuator shall be adjusted until the reference (line) is met again. The value a_2 in dB of the variable attenuator shall be read.