

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

**Réseaux de distribution par câbles pour signaux de télévision, signaux de
radiodiffusion sonore et services interactifs –
Partie 10: Performances des systèmes de voie de retour**



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CONTENTS

FOREWORD.....	6
INTRODUCTION.....	8
1 Scope.....	9
2 Normative references	9
3 Terms, definitions, symbols and abbreviations.....	10
3.1 Terms and definitions.....	10
3.2 Symbols.....	13
3.3 Abbreviations.....	14
4 Methods of measurement	14
4.1 General.....	14
4.2 Set-up of the network.....	15
4.3 Measurement of channel level.....	15
4.3.1 General	15
4.3.2 Equipment required	15
4.3.3 Connection of the equipment	16
4.3.4 Measurement procedure for digitally modulated carriers	16
4.3.5 Measurement procedure for intermittent digitally modulated carriers	17
4.3.6 Presentation of the results	18
4.4 Measurement of amplitude response variation	18
4.4.1 Background	18
4.4.2 Equipment required	18
4.4.3 Connection of the equipment	18
4.4.4 Calibration of equipment.....	18
4.4.5 Method of measurement	19
4.4.6 Presentation of the results	19
4.5 Measurement of signal to noise ratio ($S_{D,RF}/N$)	19
4.5.1 General	19
4.5.2 Equipment required	19
4.5.3 Connection of the equipment	19
4.5.4 Measurement procedure	19
4.5.5 Presentation of the results	20
4.6 Measurement of multiple interference	20
4.6.1 General	20
4.6.2 Equipment required	21
4.6.3 Connection of the equipment	21
4.6.4 Measurement procedure	21
4.6.5 Processing of the data	21
4.6.6 Presentation of the results	21
4.7 Measurement of impulse noise.....	22
4.7.1 General	22
4.7.2 Equipment required	22
4.7.3 Connection of the equipment	22
4.7.4 Measurement procedure	22
4.7.5 Processing of the data and presentation of the results	23

4.8	Measurement of echo ratio.....	23
4.8.1	General	23
4.8.2	Equipment required	24
4.8.3	Connection of the equipment	25
4.8.4	Measurement procedure	25
4.8.5	Presentation of the results	25
4.9	Measurement of group delay variation.....	25
4.10	Measurement of frequency error	26
4.10.1	General	26
4.10.2	Equipment required	26
4.10.3	Connection of the equipment	26
4.10.4	Measurement procedure	26
4.10.5	Presentation of the result.....	27
4.11	Measurement of bit error ratio (BER)	27
4.11.1	General	27
4.11.2	Equipment required	27
4.11.3	Connection of the equipment	28
4.11.4	Measurement procedure	28
4.11.5	Presentation of the results	28
4.12	Noise power ratio (<i>NPR</i>) measurement on return path	28
4.12.1	General	28
4.12.2	Equipment required	29
4.12.3	Connection of the equipment	29
4.12.4	Measurement procedure	30
4.12.5	Presentation of the results	31
4.12.6	Recommended correction factors	31
4.12.7	Precautions during measurement.....	32
4.12.8	<i>NPR</i> dynamic range	32
4.13	10-Tone measurement	33
4.13.1	General	33
4.13.2	Measurement principle.....	34
4.13.3	Measurement procedure	34
4.14	Modulation error ratio (<i>MER</i>) measurement on return path	35
4.14.1	General	35
4.14.2	Equipment required	36
4.14.3	Connection of the equipment	36
4.14.4	Measurement procedure	36
4.14.5	Presentation of the results	37
5	System performance requirements	37
5.1	General.....	37
5.2	Analogue parameters that influence the system performance	40
5.3	General requirements	42
5.3.1	Impedance	42
5.3.2	Maximum signal level	42
5.4	Specific system performance requirements	42
6	System performance recommendations – Return path bandwidth	45
6.1	Frequency allocation	45
6.2	Transmission quality in the return path frequency ranges	45
Annex A	(normative) Correction factors for noise	47

A.1	Signal level measurement	47
A.2	Noise level measurement	47
Annex B (normative)	Correction factor for a spectrum analyser	49
Annex C (normative)	Null packet and PRBS definitions	50
C.1	Null packet definition	50
C.2	PRBS definition	51
Bibliography	52
Figure 1	– Reference points of an active return path system (example)	15
Figure 2	– Time domain representation of an upstream burst with marker on the preamble of the DOCSIS signal	17
Figure 3	– Arrangement of test equipment for measurement of amplitude response variation	18
Figure 4	– Echo rating graticule	24
Figure 5	– Arrangement of test equipment for measurement of echo ratio	25
Figure 6	– Test set-up for frequency stability measurement	26
Figure 7	– Principle of BER measurement	27
Figure 8	– Band-pass and band-stop filters response	29
Figure 9	– <i>NPR</i> test set up	30
Figure 10	– <i>NPR</i> versus RF power density applied at input of optical transmitter and determination of <i>OMI</i> 100 %	31
Figure 11	– Example of the frequency response of the optional band-pass filter	31
Figure 12	– Example of <i>NPR</i> dynamic range	33
Figure 13	– Dynamic range plotted versus <i>NPR</i>	33
Figure 14	– Alternative <i>NPR</i> measurement principle	34
Figure 15	– Relationship between classical <i>NPR</i> method and multi-tone method	35
Figure 16	– Test set-up for modulation error ratio (<i>MER</i>) measurement	36
Figure 17	– Example of constellation diagram for a 64QAM modulation format	37
Figure 18	– Return path signals affecting forward path signals	38
Figure 19	– Forward path signals affecting return path signals	39
Figure 20	– Return path signals of service 1 affecting return path signals of a different service (e.g. service 2)	39
Figure 21	– Return path signals of a specific service (e.g. service 2) affecting return path signals of the same service	39
Figure 22	– Identification of the most common sub-bands within the return path band with limited transmission quality	46
Figure A.1	– Noise correction factor <i>CF</i> versus measured level difference <i>D</i>	48
Table 1	– Examples of the Nyquist bandwidth of digitally modulated carriers	16
Table 2	– Band-stop filter notch frequencies	29
Table 3	– Summary of the requirements for <i>MER</i> according to ETSI EN 302 878-2, V.1.1.1 (2011-11), (clause 6.2.22.3.2)	41
Table 4	– System performance requirements for different modulation techniques for <i>BER</i> = 10 ⁻⁴	43
Table 5	– Comparison of system performance parameters given in Table 4 with those given in ETSI EN 302 878-2, V.1.1.1 (2011-11), specifications	44

Table 6 – Return path frequency ranges	45
Table 7 – Reasons for quality reduction in sub-bands of the return path	45
Table A.1 – Noise correction factor	47
Table C.1 – Null transport stream packet definition	51

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International Standard IEC 60728-10 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 2005 and constitutes a technical revision.

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

- update on the state-of-the-art of return path transmission in cable networks;
- provisions for DOCSIS 3.0 and EuroDOCSIS 3.0 transmission standards;
- revision of subclause 4.3 on measurement of channel level;
- new subclause 4.12 for method of measurement of noise power ratio (NPR) on return paths;

- new subclause 4.13 for 10-tone measurements;
- new subclause 4.14 for method of measurement of modulation error ratio (*MER*);
- revision of subclause 5.2 on analogue parameters influencing system performance.

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

FDIS	Report on voting
100/2247/FDIS	100/2283/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 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

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INTRODUCTION

Standards and deliverables of 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.

IEC 60728-10:2014

Specific equipment installed in cable networks for the operation of such return paths is standardised in the relevant equipment standards. See IEC 60728-3, IEC 60728-4, IEC 60728-5, IEC 60728-6.

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

Part 10: System performance for return paths

1 Scope

This part of IEC 60728 specifies the transparent return path of cable networks operated in the frequency range between 5 MHz and 85 MHz or parts thereof. The upper frequency limit of the return path is reduced to 65 MHz where FM radio signals are transmitted in a cable network. Higher frequencies may be used in fibre based networks.

NOTE In addition, it is possible to use the frequency range from 0 MHz to 5 MHz for return path transmissions, for example for NMS or other control, monitoring and signalling purposes. Applications below 5 MHz are not covered by this standard.

Specifications of transmission systems (e.g. DOCSIS) are not within the scope of this standard.

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 60728-10:2014](https://standards.iteh.ai/catalog/standards/sist/5956d90f-2558-4afe-a105-100000000000/iec-60728-10-2014)

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

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

IEC 60728-2, *Cable networks for television signals, sound signals and interactive services – Part 2: Electromagnetic compatibility for equipment*

IEC 60728-5, *Cable networks for television signals, sound signals and interactive services – Part 5: Headend equipment*

IEC 60728-12, *Cabled distribution systems for television and sound signals – Part 12: Electromagnetic compatibility of systems*

ISO/IEC 13818-1:2007, *Information technology – Generic coding of moving pictures and associated audio information – Part 1: Systems*

ITU-R BT.470, *Conventional analogue television systems*

CLC/TR 50083-10-1:2009, *Guidelines for the implementation of return paths in cable networks*

ETSI ES 200 800, *Digital Video Broadcasting (DVB); DVB interaction channel for Cable TV distribution systems (CATV)*

ETSI EN 302 878-2, V.1.1.1 (2011-11), *Access, Terminals, Transmission and Multiplexing (ATTM); Third Generation Transmission Systems for Interactive Cable Television Services – IP Cable Modems; Part 2: Physical Layer; DOCSIS 3.0*

3 Terms, definitions, symbols and abbreviations

3.1 Terms and definitions

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

3.1.1

amplitude response variation

peak-to-peak variation in frequency amplitude response of a specified signal path over a specified frequency band

Note 1 to entry: The amplitude response variation is expressed in dB.

3.1.2

broadcast signal

signal comprising video and/or audio and/or data content distributed to several receivers simultaneously

3.1.3

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.

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3.1.4

channel availability

percentage of the time during which the channel fulfils all performance requirements

Note 1 to entry: The duration of the observation time shall be published.

3.1.5

extended satellite television distribution network or system

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

Note 1 to entry: This kind of network or system can possibly 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.

3.1.6

extended terrestrial television distribution network or system

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

Note 1 to entry: This kind of network or system can possibly 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.

3.1.7

forward path direction

direction of signal flow in a cable network from the headend or any other central point (node) of a cable network to the subscribers' area

3.1.8**forward path**

part of a cable network by which signals are distributed in the forward path direction from the headend or any other central point (node) of a cable network to the subscribers' area

Note 1 to entry: The forward path was formerly referred to as downstream.

3.1.9**frequency error**

quality of supply evaluated on the basis of the actual frequency of an electrical system compared to its nominal value

Note 1 to entry: Frequency error consists of initial error, and short term and long term frequency stability.

3.1.10**headend**

equipment connected between receiving antennas or other signal sources and the remainder of the cable network, 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.

3.1.11**hybrid fibre coaxial network****HFC**

cable network which is comprised of optical equipment and cables and coaxial equipment and cables in different parts

3.1.12**impulse noise**

noise caused by electromagnetic interference into cable networks

Note 1 to entry: Impulse noise is characterised by pulses with a duration of typically $<10 \mu\text{s}$.

3.1.13**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 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.

3.1.14**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 WiFi) in the return path direction.

3.1.15**ingress noise**

noise caused by electromagnetic interference into cable networks

Note 1 to entry: The power of the ingress noise decreases with increasing frequency. It is permanently present but it varies slowly in its intensity as a function of time.

3.1.16**interaction path**

part of a cable network by which interactive signals are transmitted in the forward path direction (from the headend or node to the subscriber) and in the return path direction (from the subscriber to the headend or node)

3.1.17

local broadband cable network

network designed to provide sound and television signals as well as signals for interactive services to a local area (e.g. one town or one village)

3.1.18

location specific noise

noise which occurs at a specific area of a cable network or which occurs in a cable network located in a specific environment

3.1.19

MATV network

extended terrestrial television distribution networks or systems designed to provide sound and television signals received by terrestrial receiving antennas to households in one or more buildings

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

Note 2 to entry: This kind of network or system can possibly be combined with a satellite antenna for the additional reception of TV and/or radio signals via satellite networks.

Note 3 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.

3.1.20

multiple interference

interfering signal which consists of at least two signals that originated from at least two different sources

Note 1 to entry: On return path the multiple interference consists of ingress noise and intermodulation distortion products.

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3.1.21

multimedia signal

signal comprising two or more different media contents, for example, video, audio, text, data, etc.

3.1.22

network management system

NMS

software based system for controlling and supervising cable networks

3.1.23

network segment

part of a cable network comprising a set of functions and/or a specific extent of the complete cable network

3.1.24

network termination

electrical termination of a cable network at any outlet on subscribers' side and headend or node side

3.1.25

node

central point of a network segment at which signals can be fed into the forward path or can be gathered from a number of subscribers out of the return path

3.1.26

regional broadband cable network

network designed to provide sound and television signals as well as signals for interactive services to a regional area covering several towns and/or villages

3.1.27**return path**

part of a cable network by which signals are transmitted in the return path direction from any subscriber, connected to the network, to the headend or any other central point (node) of a cable network

Note 1 to entry: The return path was referred to as upstream before.

3.1.28**return path direction**

direction of signal flow in a cable network from a subscriber to the headend or any other central point (node) of a cable network

3.1.29**SMATV network**

extended distribution networks or systems designed to provide sound and television signals received by satellite receiving antennas to households in one or more buildings

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

Note 2 to entry: This kind of network or system can possibly be combined with terrestrial antennas for the additional reception of TV and/or radio signals via terrestrial networks.

Note 3 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.

3.2 Symbols**iTeh STANDARD PREVIEW**

The following graphical symbols are used in the figures of this standard. These symbols are either listed in IEC 60617, IEC 60417 or based on symbols defined in IEC 60617.

Symbols	Terms	Symbols	Terms
	Optical receiver [IEC 60617-S00213 (2001-07)]		Electrical spectrum analyzer [IEC 60617-S00910 (2001-07)]
	Test waveform generator [IEC 60617-S01225 (2001-07)]		Passive distribution network [IEC 60617-S00910 (2001-07)]
	Variable signal generator [IEC 60617-S00899 (2001-07), IEC 60617-S01403 (2001-09), IEC 60617-S00081 (2001-07)]		Oscilloscope [IEC 60617-S00059, IEC 60617-S00922 (2001-07)]
	Variable attenuator [IEC 60617-S01245 (2001-07)]		Low pass filter [IEC 60617-S01248 (2001-07)]
	High pass filter [IEC 60617-S01247 (2001-07)]		System under test/ Network under test [IEC 60617-S00060 (2007-07)]
	Demodulator [IEC 60417-5260 (2002-10)]		Modulator [IEC 60417-5261 (2002-10)]
	Amplifier with return path amplifier [IEC 60617-S00433 (2001-07)]		Bit error rate detector [IEC 60617-S00059, IEC 60617-S00910 (2001-07)]