



NSAI
Standards

Irish Standard
I.S. EN 60728-13:2010

Cable networks for television signals,
sound signals and interactive services
-- Part 13: Optical systems for
broadcast signal transmissions (IEC
60728-13:2010 (EQV))

I.S. EN 60728-13:2010

Incorporating amendments/corrigenda issued since publication:

<i>This document replaces:</i>	<i>This document is based on:</i> EN 60728-13:2010	<i>Published:</i> 26 February, 2010
This document was published under the authority of the NSAI and comes into effect on: 10 March, 2010		ICS number: 33.160.01; 33.160.01
NSAI 1 Swift Square, Northwood, Santry Dublin 9	T +353 1 807 3800 F +353 1 807 3838 E standards@nsai.ie W NSAI.ie	Sales: T +353 1 857 6730 F +353 1 857 6729 W standards.ie
Údarás um Chaighdeáin Náisiúnta na hÉireann		

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 60728-13

February 2010

ICS 33.160.01; 33.180.01

English version

**Cable networks for television signals, sound signals
and interactive services -
Part 13: Optical systems for broadcast signal transmissions
(IEC 60728-13:2010)**

Réseaux de distribution par câbles
destinés aux signaux de télévision,
de radiodiffusion sonore
et aux services interactifs -
Partie 13 : Systèmes optiques
pour transmission de signaux
de radiodiffusions
(CEI 60728-13:2010)

Kabelnetze für Fernsehsignale,
Tonsignale und interaktive Dienste -
Teil 13: Optische Anlagen
zur Übertragung
von Rundfunksignalen
(IEC 60728-13:2010)

This European Standard was approved by CENELEC on 2010-02-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: Avenue Marnix 17, B - 1000 Brussels

Foreword

The text of document 100/1623/FDIS, future edition 1 of IEC 60728-13, prepared by IEC TC 100, Audio, video and multimedia systems and equipment, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60728-13 on 2010-02-01.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN and CENELEC shall not be held responsible for identifying any or all such patent rights.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 2010-11-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2013-02-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60728-13:2010 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60068	NOTE Harmonized in EN 60068 series (not modified).
IEC 60728-1-2	NOTE Harmonized as EN 60728-1-2:2009 (not modified).
IEC 60728-3	NOTE Harmonized as EN 60728-3.
IEC 60728-5	NOTE Harmonized as EN 60728-5.
IEC 60728-10	NOTE Harmonized as EN 60728-10.
IEC 60728-11	NOTE Harmonized as EN 60728-11.
IEC 60875-1	NOTE Harmonized as EN 60875-1.
IEC 61280-1-1	NOTE Harmonized as EN 61280-1-1.
IEC 61280-1-3	NOTE Harmonized as EN 61280-1-3.
IEC 61280-2-9	NOTE Harmonized as EN 61280-2-9.
IEC 61281-1	NOTE Harmonized as EN 61281-1.
IEC 61290-1-2	NOTE Harmonized as EN 61290-1-2.
IEC 61290-1-3	NOTE Harmonized as EN 61290-1-3.

I.S. EN 60728-13:2010

- 3 -

EN 60728-13:2010

IEC 61300-3-2 NOTE Harmonized as EN 61300-3-2.

IEC 61754-13 NOTE Harmonized as EN 61754-13.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60068-1	1988	Environmental testing - Part 1: General and guidance	EN 60068-1 ¹⁾	1994
IEC 60728-1	2007	Cable networks for television signals, sound signals and interactive services - Part 1: System performance of forward paths	EN 60728-1	2008
IEC 60728-6	2003	Cable networks for television signals, sound signals and interactive services - Part 6: Optical equipment	EN 60728-6	2003
IEC/TR 60728-6-1	2006	Cable networks for television signals, sound signals and interactive services - Part 6-1: System guidelines for analogue optical transmission systems	-	-
IEC 60825-1	-	Safety of laser products - Part 1: Equipment classification and requirements	EN 60825-1	-
IEC 60825-2	-	Safety of laser products - Part 2: Safety of optical fibre communication systems (OFCS)	EN 60825-2	-
IEC 60825-12	-	Safety of laser products - Part 12: Safety of free space optical communication systems used for transmission of information	EN 60825-12	-
IEC 61291-1	2006	Optical amplifiers - Part 1: Generic specification	EN 61291-1	2006
IEC 61755-1	2005	Fibre optic connector optical interfaces - Part 1: Optical interfaces for single mode non-dispersion shifted fibres - General and guidance	EN 61755-1 + corr. December	2006 2006
IEC/TR 61930	1998	Fibre optic graphical symbology	-	-
IEC/TR 61931	1998	Fibre optic - Terminology	-	-
ITU-T Recommendation G.692	-	Optical interfaces for multichannel systems with optical amplifiers	-	-
ITU-T Recommendation G.694.2	-	Spectral grids for WDM applications: CWDM wavelength grid	-	-

¹⁾ EN 60068-1 includes A1 to IEC 60068-1
+ corr. October .

CONTENTS

FOREWORD.....	5
INTRODUCTION.....	7
1 Scope.....	8
2 Normative references	8
3 Terms, definitions, symbols and abbreviations.....	9
3.1 Terms and definitions	9
3.2 Symbols	15
3.3 Abbreviations	16
4 Optical system reference model.....	17
5 Preparation of measurement	19
5.1 Environmental conditions	19
5.1.1 Standard measurement conditions.....	19
5.1.2 Temperature and humidity.....	20
5.1.3 Setting up the measuring setup and system under test.....	20
5.1.4 AGC operation.....	20
5.1.5 Impedance matching between pieces of equipment	20
5.1.6 Standard operating condition.....	20
5.1.7 Standard signal and measuring equipment	20
5.2 Accuracy of measuring equipment.....	21
5.3 Source power	21
6 Methods of measurement	21
6.1 Measuring points and items.....	21
6.1.1 General	21
6.1.2 Measuring points	21
6.1.3 Measured parameters.....	21
6.2 Optical power	22
6.2.1 General	22
6.2.2 Measuring setup	22
6.2.3 Measuring method	23
6.2.4 Precaution for measurement.....	23
6.2.5 Presentation of the results.....	24
6.3 Carrier level and carrier-to-noise ratio	24
6.3.1 General	24
6.3.2 Measuring setup	24
6.3.3 Measuring conditions.....	24
6.3.4 Measuring method for analogue signals (AM-VSB)	24
6.3.5 Measuring method for digitally modulated signals (64 QAM, OFDM).....	25
6.3.6 Precautions for measurement.....	25
6.3.7 Presentation of the results.....	25
6.4 Carrier-to-noise ratio defined by optical signal.....	25
6.4.1 General	25
6.4.2 Measuring setup	26
6.4.3 Measuring conditions.....	27
6.4.4 System <i>R/N</i> measuring method.....	27
6.4.5 <i>C/N</i> calculation based on <i>R/N</i> value.....	29
6.4.6 Component <i>R/N</i> calculation	29

6.5	Optical modulation index	31
6.6	Carrier-to-crosstalk ratio (CCR).....	31
6.6.1	General	31
6.6.2	Equipment	31
6.6.3	General measurements	32
6.6.4	Procedure.....	32
6.6.5	Potential sources of error	33
6.6.6	Presentation of the results.....	33
7	Specification of optical system for broadcast signal transmission	33
7.1	Analogue and digital broadcast system over optical network	33
7.2	International TV systems	34
7.3	Relationship between R/N and C/N	35
7.4	Optical wavelength	36
7.5	Frequency of source signal	36
7.6	Optical system specification for broadcast signal transmission	36
7.7	C/N ratio specification for in-house and in-building wirings	37
7.8	Crosstalk due to optical fibre non-linearity	39
7.9	Single frequency interference level due to fibre non-linearity	40
7.10	Environmental conditions	40
Annex A (informative)	Actual service systems and design considerations	41
Annex B (informative)	Optical system overview	56
Annex C (informative)	Optical system degradations	60
Annex D (normative)	Measurement of parameters (R , I_{d0} , I_{eq} and G) required for R/N calculation	66
Bibliography	68
Figure 1	– Optical system reference model for one-fibre solution	18
Figure 2	– Optical system reference model for two-fibres solution.....	18
Figure 3	– Example of PON triplexer.....	19
Figure 4	– Performance specified points of the optical system	19
Figure 5	– Typical optical video distribution system.....	21
Figure 6	– Measurement of optical power using a WDM coupler	23
Figure 7	– Measurement of optical power using a wavelength filter	23
Figure 8	– Arrangement of test equipment for carrier-to-noise ratio measurement.....	24
Figure 9	– Measuring points in the optical cable TV network	26
Figure 10	– R/N measurement setup.....	27
Figure 11	– Arrangement of test equipment for measuring other services crosstalk.....	32
Figure 12	– Performance allocation and measuring points	33
Figure 13	– Section of C/N ratio specification (45 dB) for in-house wiring (specified for electrical signals).....	38
Figure 14	– Section of C/N ratio specification for in-house wiring (specified for optical signals).....	39
Figure A.1	– Example of a multi-channel service system of one million terminals	41
Figure A.2	– Example of a multi-channel service system of 2 000 terminals	42
Figure A.3	– Example of re-transmission service system of 72 terminals.....	43
Figure A.4	– Example of re-transmission service system of 144 terminals.....	43

Figure A.5 – Model No.1 of a system performance calculation	47
Figure A.6 – Model No.2 of a system performance calculation	48
Figure A.7 – Model No.3 a of system performance calculation	49
Figure A.8 – Model No.4 of a system performance calculation	50
Figure A.9 – Model No.5 of a system performance calculation	51
Figure A.10 – Model No.6 of a system performance calculation	52
Figure A.11 – Model No.7 of system performance calculation	53
Figure B.1 – Topology of optical system	56
Figure B.2 – Network composition.....	57
Figure B.3 – Example of SS system	58
Figure B.4 – Example of ADS system.....	58
Figure B.5 – Example of PON system	59
Figure C.1 – Reflection model.....	60
Figure C.2 – Degradation factors of optical transmission system.....	61
Figure C.3 – SBS generation image	61
Figure C.4 – Interference between two wavelengths	63
Figure C.5 – Simulation of SRS(OLT transmission power versus D/U)	63
Figure C.6 – Simulation of SRS (D/U in arbitrary unit versus fibre length).....	64
Figure C.7 – Fibre length of the first peak of SRS D/U versus frequency.....	64
Figure C.8 – GE-PON idle pattern spectrum (IEEE 802.3ah 1000Base-PX) (62,5 MHz = 1 250 Mbps/20 bit)	65
Figure D.1 – Measurement of gain (G)	67
Table 1 – Level of RF signals.....	12
Table 2 – Measuring instruments	20
Table 3 – Measuring points and measured parameters	22
Table 4 – Parameters used for the calculation of carrier-to-noise ratio (C/N).....	30
Table 5 – Minimum C/N requirements in operation	34
Table 6 – Minimum RF signal-to-noise ratio requirements in operation.....	34
Table 7 – Types of broadcast services	36
Table 8 – Type of service and minimum operational R/N values	36
Table 9 – Optical system specification	37
Table 10 – Section of C/N ratio specification for in-house/in-building wiring	38
Table 11 – Interference level due to fibre non-linearity.....	40
Table 12 – Environmental conditions	40
Table A.1 – Operating conditions of a multi-channel service system	42
Table A.2 – Operating conditions of re-transmission service system	43
Table A.3 – Basic system parameters for multi-channel and re-transmission service systems	45
Table A.4 – Verified optimum operation	54
Table B.1 – PON systems and main parameters	59
Table C.1 – Disturbance parameter of Raman crosstalk.....	62

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**CABLE NETWORKS FOR TELEVISION SIGNALS,
SOUND SIGNALS AND INTERACTIVE SERVICES –****Part 13: Optical systems for broadcast signal transmissions**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60728-13 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
100/1623/FDIS	100/1646/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 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.

A bilingual version of this publication may be issued at a later date.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

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.

¹ This word encompasses the HFC (Hybrid Fibre Cable) 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 13: Optical systems for broadcast signal transmissions

1 Scope

This part of IEC 60728 is applicable to optical transmission system for broadcast signal transmission that consists of a head-end equipment, optical transmission lines, in-house wirings and a system outlet. The system is primarily intended for television and sound signals using analogue and/or digital transmission technology. This standard specifies the basic system parameters and methods of measurement for optical distribution system having a system outlet in order to assess the system performance and its performance limits.

The purpose of this part of IEC 60728 is to describe the system specification of FTTH (fibre to the home) network for broadcast signal transmission. This standard is also applicable to the broadcast signal transmission using telecommunication network if it satisfies the optical portion of this standard. This standard describes RF transmission for broadcast and narrowcast (limited area distribution of broadcast) signals over FTTH, and introduces xPON system as a physical layer media. The detailed description of physical layer is out of the scope of this standard. The scope is limited to RF signal transmission over FTTH, thus, it does not include IP transport technologies, such as IP Multicast and associate protocols. Some interference descriptions between telecommunication system and broadcast system addressed in Clause 7 and Annex D should be referred to for detailed explanations. Annex A describes actual service systems with design consideration based on this standard. Annex B gives an overview of the optical transmission systems applicable for broadcast signal transmission.

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 60068-1:1988, *Environmental testing – Part 1: General and guidance*

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

IEC 60728-6:2003, *Cable networks for television signals, sound signals and interactive services – Part 6: Optical equipment*

IEC/TR 60728-6-1:2006, *Cable networks for television signals, sound signals and interactive services – Part 6-1: System guidelines for analogue optical transmission systems*

IEC 60825-1, *Safety of laser products – Part 1: Equipment classification and requirements*

IEC 60825-2, *Safety of laser products – Part 2: Safety of optical fibre communication systems (OFCS)*

IEC 60825-12, *Safety of laser products – Part 12: Safety of free space optical communication systems used for transmission of information*

This is a free preview. Purchase the entire publication at the link below:

[Product Page](#)

-
- Looking for additional Standards? Visit Intertek Inform Infostore
 - Learn about LexConnect, All Jurisdictions, Standards referenced in Australian legislation
-