

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE



**Cable networks for television signals, sound signals and interactive services –  
Part 113: Optical systems for broadcast signal transmissions loaded with digital  
channels only**

**Réseaux de distribution par câbles pour signaux de télévision, signaux de  
radiodiffusion sonore et services interactifs –  
Partie 113: Systèmes optiques pour la transmission de signaux de radiodiffusion  
soumis à une charge de porteuses exclusivement numériques**



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## CONTENTS

|   |    |
|---|----|
| FOREWORD.....   | 8  |
| INTRODUCTION.....   | 10 |
| 1 Scope.....  | 11 |
| 2 Normative references .....  | 11 |
| 3 Terms, definitions, graphical symbols and abbreviated terms.....                    | 12 |
| 3.1 Terms and definitions.....  | 12 |
| 3.2 Graphical symbols .....   | 19 |
| 3.3 Abbreviated terms.....  | 20 |
| 4 Optical system reference model.....   | 21 |
| 4.1 Overview.....   | 21 |
| 4.2 Over-all FTTH system reference model.....   | 21 |
| 4.3 Reference models for the optical systems for broadcast signal transmissions ..... | 24 |
| 4.3.1 Optical wavelength for FTTH system .....  | 24 |
| 4.3.2 Reference models.....   | 24 |
| 4.4 Specified performance points of the optical system.....                           | 25 |
| 5 Preparation of measurement.....   | 25 |
| 5.1 Environmental conditions .....  | 25 |
| 5.1.1 Standard measurement conditions.....  | 25 |
| 5.1.2 Temperature and humidity .....  | 26 |
| 5.1.3 Setting up the measuring setup and system under test .....                      | 26 |
| 5.1.4 AGC/ALC operation .....   | 26 |
| 5.1.5 Impedance matching between pieces of equipment .....                            | 26 |
| 5.1.6 Standard operating condition .....  | 26 |
| 5.1.7 Standard signal and measuring equipment .....                                   | 26 |
| 5.2 Accuracy of measuring equipment .....   | 27 |
| 5.3 Source power.....   | 27 |
| 6 Methods of measurement .....  | 27 |
| 6.1 Measuring points and items .....  | 27 |
| 6.1.1 General .....   | 27 |
| 6.1.2 Measuring points .....  | 28 |
| 6.1.3 Measured parameters.....  | 28 |
| 6.2 General measurement requirement.....  | 29 |
| 6.2.1 General .....   | 29 |
| 6.2.2 Input specification.....  | 29 |
| 6.2.3 Standard measurement conditions.....  | 29 |
| 6.2.4 Precautions for measurements .....  | 30 |
| 6.3 Optical power.....  | 30 |
| 6.3.1 General .....   | 30 |
| 6.3.2 Measuring setup .....   | 30 |
| 6.3.3 Measuring method .....  | 31 |
| 6.3.4 Precautions for measurement.....  | 31 |
| 6.3.5 Presentation of the results .....   | 31 |
| 6.4 Optical wavelength.....   | 32 |
| 6.4.1 Introduction .....  | 32 |
| 6.4.2 Method of measurement .....   | 32 |
| 6.4.3 Presentation of the results .....   | 32 |

|        |  |    |
|--------|--|----|
| 6.5    | SINR (signal-to-intermodulation and noise ratio) below 1GHz .....                        | 32 |
| 6.5.1  | General .....  | 32 |
| 6.5.2  | Measuring setup .....  | 33 |
| 6.5.3  | Measuring conditions .....   | 33 |
| 6.5.4  | Precautions for measurement .....  | 33 |
| 6.5.5  | Presentation of the results .....  | 34 |
| 6.6    | Relative intensity noise (RIN) of optical signal .....                                   | 34 |
| 6.6.1  | General .....  | 34 |
| 6.6.2  | Measuring setup .....  | 34 |
| 6.6.3  | Measurement conditions .....   | 35 |
| 6.6.4  | System RIN measuring method .....  | 35 |
| 6.6.5  | SINR calculation based on RIN value .....  | 37 |
| 6.6.6  | Component RIN calculation .....  | 37 |
| 6.6.7  | Example for calculating of SINR .....  | 39 |
| 6.7    | Optical modulation index .....   | 41 |
| 6.8    | Signal-to-crosstalk ratio (SCR) .....  | 41 |
| 6.8.1  | General .....  | 41 |
| 6.8.2  | Equipment required .....   | 41 |
| 6.8.3  | General measurement requirements .....   | 41 |
| 6.8.4  | Procedure .....  | 41 |
| 6.8.5  | Potential sources of error .....   | 42 |
| 6.8.6  | Presentation of the results .....  | 42 |
| 6.9    | RF signal-to-intermodulation and noise ratio (SINR) of satellite broadcast signals ..... | 42 |
| 6.9.1  | General .....  | 42 |
| 6.9.2  | Measuring setup .....  | 43 |
| 6.9.3  | Equipment required .....   | 43 |
| 6.9.4  | Measurement procedure .....  | 43 |
| 6.9.5  | Presentation of the results .....  | 44 |
| 6.10   | System BER (bit error ratio) .....   | 44 |
| 6.10.1 | Overview .....   | 44 |
| 6.10.2 | Connection of the equipment .....  | 44 |
| 6.10.3 | Measurement procedure .....  | 45 |
| 6.10.4 | Presentation of the results .....  | 45 |
| 6.11   | SINR versus BER measurement .....  | 45 |
| 6.11.1 | General .....  | 45 |
| 6.11.2 | Connection of the equipment .....  | 45 |
| 6.11.3 | Presentation of the results .....  | 46 |
| 6.12   | System noise margins .....   | 47 |
| 6.12.1 | General .....  | 47 |
| 6.12.2 | Connection of the equipment .....  | 47 |
| 6.12.3 | Measurement procedure .....  | 48 |
| 6.12.4 | Presentation of the results .....  | 48 |
| 6.13   | Modulation error ratio (MER) .....   | 49 |
| 6.13.1 | General .....  | 49 |
| 6.13.2 | Connection of the equipment .....  | 49 |
| 6.13.3 | Measurement procedure .....  | 50 |
| 6.13.4 | Presentation of the results .....  | 50 |
| 6.14   | In-band frequency characteristics between optical transmitter and V-ONU .....            | 50 |

|                       |   |    |
|-----------------------|---|----|
| 6.14.1                | Overview .....  | 50 |
| 6.14.2                | Measurement setup .....   | 50 |
| 6.14.3                | Measuring method .....  | 51 |
| 6.14.4                | Presentation of the results .....   | 51 |
| 7                     | Specification of the optical system for broadcast signal transmission.....    | 52 |
| 7.1                   | Digital broadcast system over optical network.....                            | 52 |
| 7.2                   | RF signal levels at system outlet.....  | 52 |
| 7.3                   | RF signal-to-intermodulation and noise ratio and performance allocation ..... | 53 |
| 7.4                   | Relationship between RIN and SINR.....  | 58 |
| 7.4.1                 | Type of broadcast services .....  | 58 |
| 7.4.2                 | Types of broadcast services and relative signal level.....                    | 59 |
| 7.4.3                 | RIN performance requirements .....  | 60 |
| 7.5                   | Optical wavelength.....   | 62 |
| 7.6                   | Frequency of source signal .....  | 63 |
| 7.7                   | Level difference between adjacent channels .....                              | 63 |
| 7.8                   | BER at headend input .....  | 65 |
| 7.9                   | MER .....   | 65 |
| 7.10                  | SINR specification for in-house and in-building wirings .....                 | 66 |
| 7.11                  | In-band frequency characteristics .....                                       | 68 |
| 7.12                  | Electrical signal interference .....  | 69 |
| 7.13                  | Crosstalk due to optical fibre non-linearity .....                            | 71 |
| 7.14                  | Interference due to intermodulation noise caused by fibre non-linearity.....  | 72 |
| 7.15                  | Environmental conditions .....  | 72 |
| Annex A (informative) | Actual service systems and design considerations .....                        | 73 |
| A.1                   | General.....  | 73 |
| A.2                   | Multi-channel service system .....  | 73 |
| A.2.1                 | General .....   | 73 |
| A.2.2                 | Operating conditions.....   | 74 |
| A.2.3                 | Operating environment .....   | 74 |
| A.3                   | Re-transmission service system.....   | 75 |
| A.3.1                 | General .....   | 75 |
| A.3.2                 | Operating conditions.....   | 75 |
| A.3.3                 | Operating environment .....   | 76 |
| A.4                   | SINR calculation of optical network.....                                      | 76 |
| A.5                   | System reference model .....  | 77 |
| A.6                   | Hints for actual operation .....  | 81 |
| A.6.1                 | Optimum operation .....   | 81 |
| A.6.2                 | Key issues to be specified .....  | 81 |
| Annex B (informative) | BER extrapolation method.....   | 82 |
| Annex C (informative) | Optical system degradations .....   | 84 |
| C.1                   | System degradation factors.....   | 84 |
| C.2                   | Non-linear degradation .....  | 85 |
| C.2.1                 | Degradation factors .....   | 85 |
| C.2.2                 | Stimulated Brillouin scattering (SBS) .....                                   | 85 |
| C.2.3                 | Stimulated Raman scattering (SRS).....  | 86 |
| C.2.4                 | Self-phase modulation (SPM) .....   | 89 |
| C.2.5                 | Cross-phase modulation (XPM) .....  | 89 |

|   |     |
|---|-----|
| Annex D (informative) Measurement of parameters ( $R$ , $I_{d0}$ , $I_{eq}$ and $G$ ) required for RIN calculation .....  | 90  |
| D.1 Measurement of the responsivity ( $R$ ) .....   | 90  |
| D.2 Measurement of dark current ( $I_{d0}$ ) .....  | 90  |
| D.3 Measurement of equivalent noise current density ( $I_{eq}$ ) .....  | 90  |
| D.4 Measurement of gain ( $G$ ) .....   | 91  |
| Annex E (informative) Measurement of peak and average signal levels of digitally modulated signals .....  | 92  |
| E.1 General .....   | 92  |
| E.2 Peak and average power measurement using CCDF .....   | 92  |
| E.3 Measurement method of CCDF .....  | 94  |
| E.3.1 General .....   | 94  |
| E.3.2 Measurement procedure .....   | 94  |
| E.3.3 Estimation of BER from the CCDF measurement result .....  | 95  |
| E.3.4 Examples of CCDF measurements .....   | 96  |
| E.4 Performance evaluation of the FTTH system .....   | 97  |
| E.4.1 General .....   | 97  |
| E.4.2 Evaluation procedure .....  | 97  |
| E.5 Potential sources of error .....  | 98  |
| Annex F (informative) Clipping noise .....  | 99  |
| Annex G (informative) Relation between SINR degradation and rain attenuation .....  | 100 |
| G.1 Relation between SINR and G/T .....   | 100 |
| G.2 SINR degradation of satellite receiving system due to rain attenuation .....  | 101 |
| Bibliography .....  | 102 |
| <a href="https://standards.iteh.ai/catalog/standards/sist/b88a72a0-2a63-4093-97f0-5be33d7c844d/iec-60728-113-2023">https://standards.iteh.ai/catalog/standards/sist/b88a72a0-2a63-4093-97f0-5be33d7c844d/iec-60728-113-2023</a> |     |
| Figure 1 – Example of FTTH system for television and sound signal .....   | 23  |
| Figure 2 – FTTH Cable TV system using one wavelength .....  | 25  |
| Figure 3 – FTTH Cable TV system using two wavelengths .....   | 25  |
| Figure 4 – Specified performance points of the optical system .....   | 25  |
| Figure 5 – Typical optical video distribution system .....  | 28  |
| Figure 6 – Test setup for optical power measurement using a wavelength filter .....   | 30  |
| Figure 7 – Test setup for optical power measuring using a WDM coupler .....   | 31  |
| Figure 8 – Measurement of optical wavelength without a WDM coupler .....  | 32  |
| Figure 9 – Measurement of optical wavelength using a WDM coupler .....  | 32  |
| Figure 10 – Test setup for RF signal to intermodulation and noise ratio measurement .....   | 33  |
| Figure 11 – Test setup for RIN measurement .....  | 35  |
| Figure 12 – Test setup for signal to crosstalk measurement .....  | 41  |
| Figure 13 – Setup for the measurement of SINR for satellite broadcast signals .....   | 43  |
| Figure 14 – Test setup for BER measurement .....  | 44  |
| Figure 15 – Test setup for SINR versus BER measurement procedure .....  | 45  |
| Figure 16 – Extrapolation method of BER measurement .....   | 46  |
| Figure 17 – Example of SINR versus BER characteristics .....  | 47  |
| Figure 18 – Test setup for system noise margin measurement .....  | 48  |
| Figure 19 – Example of system noise margin characteristics .....  | 49  |
| Figure 20 – Test setup for MER measurement .....  | 49  |



|  |    |
|--|----|
| Figure 21 – Example of result of MER measurement (64-QAM modulation format).....                                       | 50 |
| Figure 22 – Setup for the measurement of in-band frequency characteristics .....                                       | 51 |
| Figure 23 – Measurement example of in-band frequency characteristics .....   | 51 |
| Figure 24 – Performance specified points .....   | 52 |
| Figure 25 – Permissible signal level of adjacent channels (ISDB-T, ISDB-C and ISDB-C2) .....                           | 64 |
| Figure 26 – Section SINR for SDU wiring (specified by electrical signal) .....   | 67 |
| Figure 27 – Section SINR for MDU wiring (specified by electrical signal) .....   | 68 |
| Figure 28 – Section SINR for MDU wiring (specified by optical signal) .....  | 68 |
| Figure 29 – Signal level difference with 3rd order interference signal (ISDB-T) .....                                  | 69 |
| Figure 30 – Signal level difference with 3rd order interference signal (ISDB-C 64QAM) .....                            | 70 |
| Figure 31 – Signal level difference with 3rd order interference signal (ISDB-C 256QAM) .....                           | 70 |
| Figure 32 – Level difference between signal and reflected (echo) signal (ISDB-T) .....                                 | 70 |
| Figure 33 – Level difference between signal and reflected (echo) signal (ISDB-C 64QAM) .....                           | 71 |
| Figure 34 – Level difference between signal and reflected (echo) signal (ISDB-C 256QAM) .....                          | 71 |
| Figure A.1 – Example of a multi-channel service system of one million terminals .....                                  | 73 |
| Figure A.2 – Example of a multi-channel service system of 2 000 terminals .....  | 74 |
| Figure A.3 – Example of re-transmission service system of 72 terminals.....  | 75 |
| Figure A.4 – Example of re-transmission service system of 144 terminals.....   | 75 |
| Figure A.5 – Model 1 system performance calculation.....   | 79 |
| Figure A.6 – Model 4 system performance calculation.....   | 80 |
| Figure B.1 – Extrapolation method of BER measurement.....  | 82 |
| Figure B.2 – BER characteristics for 256-QAM, 1 024-QAM and 4 096-QAM (extrapolation method) .....                     | 83 |
| Figure C.1 – Reflection model.....   | 84 |
| Figure C.2 – Degradation factors of optical transmission system.....   | 85 |
| Figure C.3 – SBS generation image .....  | 85 |
| Figure C.4 – Interference between two wavelengths .....  | 87 |
| Figure C.5 – Simulation of SRS (OLT transmission power versus D/U) .....   | 87 |
| Figure C.6 – Simulation of SRS (D/U in arbitrary unit versus fibre length) .....                                       | 88 |
| Figure C.7 – Fibre length of the first peak of SRS D/U versus frequency.....   | 88 |
| Figure C.8 – GE-PON idle pattern spectrum (ISO/IEC/IEEE 8802-3:2017 1 000 Base-PX) (62,5 MHz = 1 250 Mbps/20 bit)..... | 89 |
| Figure D.1 – Measurement of gain ( $G$ ) .....   | 91 |
| Figure E.1 – Typical CCDF curves for OFDM and M-QAM signals.....   | 93 |
| Figure E.2 – CCDF measurement setup .....  | 94 |
| Figure E.3 – CCDF measurement example .....  | 95 |
| Figure E.4 – SER vs SINR performance in an AWGN channel .....  | 96 |
| Figure E.5 – Example of CCDF measurements .....  | 96 |
| Figure E.6 – Performance evaluation of digital optical signals in the FTTH system.....                                 | 97 |
| Figure E.7 – CCDF measurement bandwidth.....   | 97 |
| Figure F.1 – Clipping effects in laser diode static curve (IL curve).....  | 99 |
| Figure F.2 – Clipping noise, zero span, sweep time 100 $\mu$ s.....  | 99 |



|  |    |
|--|----|
| Table 1 – Level of RF signals.....   | 16 |
| Table 2 – Optical wavelength for FTTH system .....   | 24 |
| Table 3 – Frequency range .....  | 24 |
| Table 4 – Measuring equipment .....  | 27 |
| Table 5 – Measuring points and measured parameters .....   | 29 |
| Table 6 – Parameters used for the calculation of SINR .....  | 39 |
| Table 7 – RF signal noise bandwidth .....  | 40 |
| Table 8 – Digital signal levels at the system outlet.....  | 53 |
| Table 9 – Minimum SINR (SDU case) .....  | 54 |
| Table 10 – Minimum SINR (MDU case).....  | 55 |
| Table 11 – Minimum RF SINR requirements in operation .....   | 56 |
| Table 12 – Types of broadcast services .....   | 58 |
| Table 13 – Types of broadcast services and relative signal level .....   | 60 |
| Table 14 – Minimum operational RIN values for digital broadcast services using the<br>frequency band below 1 000 MHz ..... | 60 |
| Table 15 – Type of service and minimum operational RIN values for satellite services.....                                  | 61 |
| Table 16 – Performance of optical wavelength and power.....  | 62 |
| Table 17 – Minimum MER Performance <sup>a</sup> for FTTH systems.....  | 66 |
| Table 18– Section SINR for in-house/in-building wiring.....  | 67 |
| Table 19 – In-band frequency characteristics specification.....  | 68 |
| Table 20 – Limits for in-channel electrical signal interference .....  | 69 |
| Table 21 – Interference level due to fibre non-linearity.....  | 72 |
| Table 22 – Environmental conditions .....  | 72 |
| Table A.1 – Operating conditions of a multi-channel service system .....   | 74 |
| Table A.2 – Operating conditions of re-transmission service system .....   | 76 |
| Table A.3 – Basic system parameters for multi-channel and re-transmission service<br>systems .....                         | 78 |
| Table C.1 – Disturbance parameter of Raman crosstalk.....  | 86 |

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**CABLE NETWORKS FOR TELEVISION SIGNALS,  
SOUND SIGNALS AND INTERACTIVE SERVICES –****Part 113: Optical systems for broadcast signal  
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This second edition cancels and replaces the first edition published in 2018 and IEC 60728-13-1:2017. This edition constitutes a technical revision.

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

- a) IEC 60728-13-1, which deals with the bandwidth expansion for broadcast signal over FTTH systems, has been merged with this document;
- b) a table containing the digital signal level at the system outlet (Table 8) has been added.

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

| Draft         | Report on voting |
|---------------|------------------|
| 100/3900/FDIS | 100/3920/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.

The list of all the parts of the IEC 60728 series, published under the general title *Cable networks for television signals, sound signals and interactive services*, can be found on the IEC website.

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](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are described in greater detail at [www.iec.ch/publications](http://www.iec.ch/publications).

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- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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**IMPORTANT – The "colour inside" logo on the cover page of this document 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

International Standards and other 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 ranges from antennas and/or special interfaces to headends, or other interface points on the network up to any terminal interface of the equipment on the customer's premises.

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) as well as of any coaxial, balanced and optical cables and accessories thereof is excluded.

[IEC 60728-113:2023](https://standards.iteh.ai/catalog/standards/sist/b88a72a0-2a63-4093-97f0-5be33d7c844d/iec-60728-113-2023)

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

## **Part 113: Optical systems for broadcast signal transmissions loaded with digital channels only**

### **1 Scope**

This part of IEC 60728 is applicable to optical transmission systems for broadcast signal transmission that consist of headend equipment, optical transmission lines, in-house wirings and system outlets. These systems are primarily intended for television and sound signals using digital transmission technology. This document specifies the basic system parameters and methods of measurement for optical distribution systems between headend equipment and system outlets in order to assess the system performance and its performance limits.

In this document, the upper signal frequency is limited to about 3 300 MHz.

The purpose of this part of IEC 60728 is to describe the system specifications of FTTH (fibre to the home) networks for digitally modulated broadcast signal transmission. This document is also applicable to broadcast signal transmission using a telecommunication network if it satisfies the performance of the optical portion of the system defined in this document. This document describes RF transmission for fully digitalized broadcast and narrowcast (limited area distribution of broadcast) signals over FTTH, and introduces the xPON system as a physical layer media. The detailed description of the physical layer is out of scope of this document. The scope is limited to downstream RF video signal transmission over FTTH; IP transport technologies, such as IP Multicast and associate protocols, which require a two-way optical transmission system, are out of scope of this document.

Some interference effects occurring between the telecommunication system and the broadcast system are addressed in Clause 7.

### **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 60068-1:2013, *Environmental testing – Part 1: General and guidance*

IEC 60728-1:2014, *Cable networks for television signals, sound signals and interactive services – Part 1: System performance of forward paths*

IEC 60728-6:2011, *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 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 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 (OFCSs)*

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

IEC 61280-1-1:2013, *Fibre optic communication subsystem basic test procedures – Part 1-1: Test procedures for general communication subsystems – Transmitter output optical power measurement for single-mode optical fibre cable*

IEC 61280-1-3, *Fibre optic communication subsystem test procedures – Part 1-3: General communication subsystems – Measurement of central wavelength, spectral width and additional spectral characteristics*

IEC 61755-1:2005, *Fibre optic connector optical interfaces – Part 1: Optical interfaces for single mode non-dispersion shifted fibres – General and guidance*

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*

ITU-T Recommendation J.83, *Digital multi-programme systems for television, sound and data services for cable distribution*

ITU-T Recommendation J.183, *Time-division multiplexing of multiple MPEG-2 transport streams and generic formats of transport streams over cable television systems*

ITU-T Recommendation J.382, *Advanced digital downstream transmission systems for television, sound and data services for cable distribution*

### **3 Terms, definitions, graphical 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**

##### **BER**

##### **bit error ratio**

ratio between erroneous bits and the total number of transmitted bits

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

**3.1.2****central wavelength**

average of those wavelengths at which the amplitude of a light source reaches or last falls to half of the maximum amplitude

[SOURCE: IEC 60728-6:2011, 3.1.23, modified – The term "centre wavelength" has been replaced by "central wavelength".]

**3.1.3****D/U ratio**

single or multiple frequency interference ratio of desired signal level to undesired signal level

Note 1 to entry: The ratio of desired signal level,  $D(\text{dB}(\mu\text{V}))$ , to undesired signal level,  $U(\text{dB}(\mu\text{V}))$  is given by

$$D/U \text{ (dB)} = D - U$$

Note 2 to entry: Both the desired and the undesired signals can also be expressed in dB(mW).

Note 3 to entry: The D/U ratio is generally used for multiple frequency interference as CSO and CTB, for single frequency interference as SCR.

Note 4 to entry: Note the similarity of the definition to the definition of SINR (3.1.20).

**3.1.4****MER****modulation error ratio**

sum of the sequence of the squares of the magnitudes of the ideal symbol vectors divided by the sum of the squares of magnitudes of the symbol error vectors of a sequence of symbols, the result being expressed as a power ratio in dB

[SOURCE: IEC 60728-1:2014, 3.1.61, modified – Note 1 to entry has been deleted, and "the result being expressed as a power ratio in dB" has been added to the end of the definition.]

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**3.1.5****OFDM signal****orthogonal frequency division multiplexing**

multiplexing scheme used for the transportation of terrestrial digital broadcasting SDTV and HDTV signals based on the idea of frequency-division multiplexing

Note 1 to entry: OFDM is based on the idea of frequency-division multiplexing, where each frequency subcarrier is modulated with a simpler modulation, and the frequencies and modulation of FDM are arranged to be orthogonal with each other, which almost eliminates the interference between subcarriers.

**3.1.6****optical amplifier**

optical waveguide device containing a suitably pumped, active medium which is able to amplify an optical signal

Note 1 to entry: There are several methods based on wavelength to be used for amplification. The term "Erbium Doped Fibre Amplifier (EDFA)" is the synonym of optical amplifier in this document.

[SOURCE: IEC TR 61931:1998, 2.7.75, modified – Note 1 to entry has been added.]

**3.1.7****optical modulation index**

optical modulation index of  $k$ -th RF signal,  $m_k$  is defined as

$$m_k = \frac{\phi_h - \phi_l}{\phi_h + \phi_l}$$