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CONSOLIDATED VERSION

INTERNATIONAL STANDARD

colour inside

Cable networks for television signals, sound signals and interactive services – Part 7-1: Hybrid Fibre Coax Outside Plant status monitoring – Physical (PHY) Layer Specification

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

Part 7-1: Hybrid Fibre Coax Outside Plant status monitoring – Physical (PHY) layer specification

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This consolidated version of the official IEC Standard and its amendment has been prepared for user convenience.

IEC 60728-7-1 edition 1.1 contains the first edition (2003-10) [documents 100/576/CDV and 100/683/RVC] and its amendment 1 (2015-04) [documents 100/2417/FDIS and 100/2481/RVD].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions and deletions are displayed in red, with deletions being struck through. A separate Final version with all changes accepted is available in this publication.

International Standard IEC 60728-7-1 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.

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

The committee has decided that the contents of the base publication and its amendment 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

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- withdrawn,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

The following differences exist in some countries:

The Japanese *de facto* standard (NCTEA S-006) concerning requirements for the HFC outside plant management, which was published in 1995, has already been available in Japan. The purpose of this standard is to support the design and implementation of interoperable management systems for HFC cable networks used in Japan. (see Table 4)

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 for television signals, sound signals and interactive services including equipment, systems and installations for~~

- ~~head-end reception, processing and distribution of television and sound signals and their associated data signals, and~~
- ~~processing, interfacing and transmitting all kinds of signals for interactive services~~

~~using all applicable transmission media.~~

~~All kinds of networks like~~

- ~~CATV-networks,~~
- ~~MATV networks and SMATV networks,~~
- ~~individual receiving networks~~

~~and all kinds of equipment, systems and installations installed in such networks, are within this scope.~~

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 is from the antennas~~,~~ and/or special signal source inputs to the headend or other interface points to the network up to ~~the system outlet or~~ the terminal input~~, where no system outlet exists~~ 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 and optical cables and accessories ~~therefore~~ thereof is excluded.

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

Part 7-1: Hybrid Fibre Coax Outside Plant status monitoring – Physical (PHY) layer specification

1 Scope

This part of IEC 60728 specifies requirements for The Hybrid Fibre Coax (HFC) Outside Plant (OSP) Physical (PHY) Layer Specification and is part of the series of specifications developed by the Hybrid Management Sub-Layer (HMS) subcommittee under the SCTE. The purpose of the HMS specification is to support the design and implementation of interoperable management systems for evolving HFC cable networks. The HMS Physical (PHY) Layer Specification describes the physical layer portion of the protocol stack used for communication between HMS-compliant transponders interfacing to managed outside plant network elements (NE) and a centralized head-end element (HE).

This standard describes the PHY layer requirements that must be implemented by all *Type 2* and *Type 3* compliant OSP HMS transponders on the HFC plant and the controlling equipment in the head-end. Any exceptions to compliance with this standard will be specifically noted herein as necessary. Refer to Table 1 for a full definition of the type classifications.

Electromagnetic Compatibility (EMC) is not specified in this standard and is left to the vendor to ensure compliance with local EMC regulatory requirements. Other than operating temperature, physical parameters such as shock, vibration, humidity, etc., are also not specified and left to the vendor's discretion.

Transponder type classifications referenced within the HMS series of standards are defined in Table 1.

Table 1 – Transponder type classifications

Type	Description	Application
Type 0	Refers to legacy transponder equipment, which is incapable of supporting the HMS specifications	This transponder interfaces with legacy network equipment through proprietary means. This transponder could be managed through the same management applications as the other types through proxies or other means at the head-end
Type 1	Refers to stand-alone transponder equipment (legacy or new) which can be upgraded to support the HMS specifications	This transponder interfaces with legacy network equipment through proprietary means. Type 1 is a standards-compliant transponder (either manufactured to the standard or upgraded) that connects to legacy network equipment via a proprietary interface
Type 2	Refers to a stand-alone, HMS-compliant transponder	This transponder interfaces with network equipment designed to support the electrical and physical specifications defined in the HMS standards. It can be factory or field-installed. Its RF connection is independent of the monitored NE
Type 3	Refers to a stand-alone or embedded, HMS-compliant transponder	This transponder interfaces with network equipment designed to support the electrical specifications defined in the HMS standards. It may or may not support the physical specifications defined in the HMS standards. It can be factory-installed. It may or may not be field-installed. Its RF connection is through the monitored NE

2 Normative references

None.

3 Terms, definitions and abbreviations

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

3.1
forward ~~spectrum~~ path band
~~the pass-band~~ continuous set of frequencies in HFC cable systems with a lower edge of between 48 MHz and 87,5 MHz, depending on the particular geographical area, and an upper edge that is typically in the range of 300 MHz to ~~860~~ 1 000 MHz depending on implementation

Note 1 to entry: Due to different channel spacing plans in use, this upper frequency limit may not be exactly 1 000 MHz, but some megahertz higher, e.g. 1 002 MHz or 1 006 MHz. The notation 1 000 MHz in this standard is intended to include such small deviations.

3.2
full ~~spectrum~~ path band
~~combined~~ combination of forward ~~and return spectrums~~ path band and return path band in HFC cable systems ~~and excludes~~ excluding any guard band

3.3
guard band
unused frequency band between the upper edge of the usable return ~~spectrum~~ path band and the lower edge of the usable forward ~~spectrum~~ path band in HFC cable systems

3.4
network element (NE)
active element in the outside plant that is capable of receiving commands from a head-end element (HE) in the head-end and, as necessary, providing status information and alarms back to the HE

3.5
open system interconnection (OSI)
framework of International Organization for Standardization (ISO) standards for communication between multi-vendor systems that organizes the communication process into seven different categories that are placed in a layered sequence based on the relationship to the user. Each layer uses the layer immediately below it and provides services to the layer above. Layers 7 through 4 deal with end-to-end communication between the message source and destination, and layers 3 through 1 deal with network functions

3.6
physical (PHY) layer
layer 1 in the Open System Interconnection (OSI) architecture; the layer that provides services to transmit bits or groups of bits over a transmission link between open systems and which entails electrical, mechanical and handshaking procedures

3.7
return ~~spectrum~~ path band
~~pass-band~~ continuous set of frequencies in HFC cable systems with a lower edge of 5 MHz and an upper edge that is typically in the range of 42 MHz to 65 MHz depending on the particular geographical area

3.8
transponder
device in the outside plant that interfaces to outside plant NEs and relays status and alarm information to the HE. It can interface with an active NE via an arrangement of parallel analogue, parallel digital and serial ports

3.9
un-modulated carrier
carrier resting on the 'mark' frequency rather than on the channel's centre frequency

3.10 Abbreviated terms

ANSI	American National Standards Institute
BER	Bit Error Rate
C/R	Carrier-to-Noise Ratio
C/(N+I)	Carrier to Noise-plus-Interference Ratio
CW	Continuous Wave
EMC	Electromagnetic Compatibility
FSK	Frequency Shift Keying
HE	Head-end Element
HFC	Hybrid Fibre Coax
HMS	Hybrid Management Sub-Layer
LSB	Least Significant Bit
MSB	Most Significant Bit
NE	Network Element
MAC	Media Access Control
OSP	Outside Plant
PHY	Physical
RF	Radio Frequency
SCTE	Society of Cable Telecommunications Engineers

4 HMS reference architecture forward and return channel specifications

The reference architecture for the HMS series of specifications is illustrated in Figure 1.

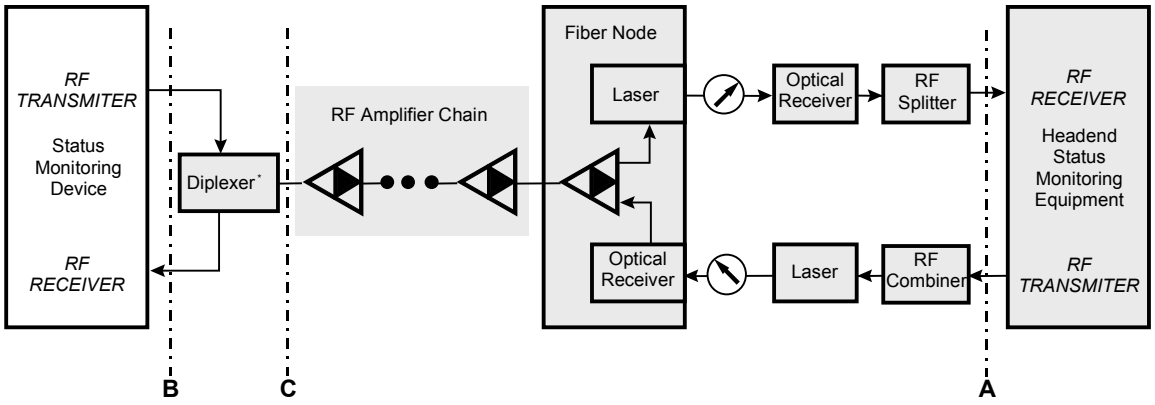

Figure 1 – HMS reference architecture diagram