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BSI Standards Publication

Video surveillance systems for use in security applications

Part 3: Analog and digital video interfaces

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National foreword

This British Standard is the UK implementation of EN 62676-3:2015. It is identical to IEC 62676-3:2013.

The UK participation in its preparation was entrusted by Technical Committee GW/1, Electronic security systems, to Subcommittee GW/1/10, Closed circuit television (CCTV).

A list of organizations represented on this committee can be obtained on request to its secretary.

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Video surveillance systems for use in security applications - Part 3: Analog and digital video interfaces (IEC 62676-3:2013)

Systèmes de vidéosurveillance destinés à être utilisés dans les applications de sécurité - Partie 3: Interfaces vidéo analogiques et vidéo numériques (IEC 62676-3:2013)

Videoüberwachungsanlagen für Sicherungsanwendungen - Teil 3: Analoge und digitale Videoschnittstellen (IEC 62676-3:2013)

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Foreword

This document (EN 62676-3:2015) consists of the text of IEC 62676-3:2013 prepared by IEC/TC 79 "Alarm and electronic security systems".

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2016-01-05
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2018-01-05

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Endorsement notice

The text of the International Standard IEC 62676-3:2013 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 60874-1:2011	NOTE	Harmonized as EN 60874-1:2012 (not modified).
IEC 61169-8	NOTE	Harmonized as EN 61169-8.
IEC 62676-1-2	NOTE	Harmonized as EN 62676-1-2.
IEC 62676-2-1	NOTE	Harmonized as EN 62676-2-1.
IEC 62676-2-2	NOTE	Harmonized as EN 62676-2-2.
IEC 62676-2-3	NOTE	Harmonized as EN 62676-2-3.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu

Publication	Year	Title	EN/HD	Year
IEC 60068-1	1988	Environmental testing - Part 1: General and guidance	EN 60068-1	1994 [1)]
IEC 62315-1	2003	DTV profiles for uncompressed digital video interfaces - Part 1: General	EN 62315-1	2003

VESA Industry Standards & Guidelines for Computer Display Monitor Timing (DMT) Version 1 Revision 11

VESA Video Signal Standard (VSIS) Version 1, Rev. 2

[1)] Superseded by EN 60068-1:2014 (IEC 60068-1:2013): DOW = 2016-11-11.

CONTENTS

INTRODUCTION

The IEC Technical Committee 79 in charge of alarm and electronic security systems together with many governmental organizations, test houses and equipment manufacturers has defined a common framework for video surveillance transmission in order to achieve interoperability between products.

The IEC 62676 series of standards on video surveillance systems is divided into four independent parts:

Part 1: System requirements

Part 2: Video transmission protocols

Part 3: Analog and digital video interfaces

Part 4: Application guidelines

Each part offers its own clauses on scope, references, definitions and requirements.

This IEC Standard Part 3 of IEC 62676 specifies physical, electrical interface and software specifications of analog and digital video interfaces in Video Surveillance Systems (VSS), so far called Closed Circuit Television (CCTV).

For analog video interfaces, analog video signal such as Composite Video is still the most commonly used interface among Video Surveillance Systems equipment. Though broadcast television industry has adopted composite video standards (e.g. NTSC, PAL), they have not been consistently applied for Video Surveillance Systems applications and it is important to standardize the interface to ensure interoperability between Video Surveillance Systems.

Also, as broadcast is moving towards digital, there are many possibilities to improve the performance with these new Video Interfaces compared to conventional Analog Video Interface, and thus it is important to standardize those new Analog Video interface and also Digital Video Interface to ensure interoperability among Video Surveillance Systems using these new interfaces.

For digital video interface, IEC 62676-1-2, IEC 62676-2-1, IEC 62676-2-2 and IEC 62676-2-3 focus on video transmission and compressed IP video transmissions by specifying internet (IP) and higher layers. IEC 62676-3 completes the communication layer specification by describing uncompressed digital video and two lowest layer protocols such as physical and network access.

VIDEO SURVEILLANCE SYSTEMS FOR USE IN SECURITY APPLICATIONS –

Part 3: Analog and digital video interfaces

1 Scope

This Part of IEC 62676 specifies physical, electrical and software interface (non-IP) specifications of analog and digital video interface in video surveillance systems (so far called CCTV) applications. Video interfaces are used both for connection and transmission of surveillance video, audio and control signals. Through video interfaces, video surveillance systems can be put together by connecting various components such as image capturing devices, image handling devices, etc. This International Standard ensures interoperability among various video surveillance components.

This International Standard applies strictly to Video Surveillance Systems. This standard is based on broadcast television standards and other standards, and it defines the minimum requirements for analog and digital video interfaces to meet VSS's requirements, interoperability and de facto practice.

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

IEC 62315-1:2003, *DTV profiles for uncompressed digital video interfaces – Part 1: General*

VESA Industry Standards & Guidelines for Computer Display Monitor Timing (DMT) Version 1 Revision 11

VESA Video Signal Standard (VSIS) Version 1, Rev. 2

3 Terms, definitions and abbreviations

3.1 Terms and definitions

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

3.1.1
analog
a form of information that is represented by a continuous and smoothly varying amplitude or frequency changes over a certain range

3.1.2
analog bandwidth
the difference between the upper and lower frequencies in a contiguous set of frequencies

Note 1 to entry: It is expressed in cycles per second, or Hertz (Hz).

3.1.3
analog video
video signal made of a continuous electrical signal which contains the luminance (brightness) and chrominance (color) of the image

Note 1 to entry: This video signal may be carried in separate channels, as in component video (YPbPr) and S-Video, or combined in one channel, as in composite video and RF connector.

3.1.4
BNC jack
a type of connector used to input/output analog video signals, component video signals and serial digital video signals, with the female electrical contact or socket, and is the "more fixed" connector of a connector pair

Note 1 to entry: Relevant specifications can refer to IEC 61169-8.

3.1.5
channel
one or more streams of video, audio and/or metadata that together constitute a unique entity for the purpose of surveillance

3.1.6
color depth
pixel depth
the number of bits used to represent the color of a single pixel in a bitmapped image or video frame buffer

3.1.7
component
a software or hardware object, meant to interact with other components, encapsulating certain functionality or a set of functionalities with clearly defined interfaces and conforming to a prescribed behaviour common to all components within a standard

3.1.8
component video
a type of analog video information which is transmitted or stored as three separate signals

3.1.9
composite video
one format of analog video which contains all required video information in a single line-level signal, including three source signals called Y, U and V with sync pulses

Note 1 to entry: It is usually in standard formats such as NTSC, PAL and SECAM.

3.1.10
composite video broadcast signal
one type of composite video signal which transfers data with analog waveform

3.1.11
DB9 connector
a common type of electrical connector used particularly in computers

3.1.12
DC voltage
the unidirectional flow of electric charge

3.1.13
differential gain
one kind of linearity distortion which affects the color saturation in TV broadcasting

3.1.14
differential phase
one kind of linearity distortion which affects the color hue in TV broadcasting

3.1.15
digital
information coded in discrete, separate pulses or signal levels

3.1.16
digital video
video is presented as a sequence of digital data in binary format, rather than in a continuous signal as analog information

3.1.17
displayPort
a digital display interface standard put forth by VESA which defines a digital audio/video interconnect used primarily between a computer and its display, or a computer and a home-theater system

3.1.18
equipment set-up
configuration and calibration of the equipment and operating software (if applicable)

3.1.19
fiber distributed data interface
one type of interface which provides a 100 Mbps optical standard for data transmission in a local area network

3.1.20
frame
full frame of video as combination of two image fields interlaced together

3.1.21
interoperability
the ability of systems and units to provide services and to accept services from other systems and units, in order to use the services for efficient operation.

Note 1 to entry: This term also refers to ability for information or services to be exchanged directly and smoothly between providers and consumers.

3.1.22
internet protocol
basic connectionless network-layer protocol

3.1.23
NTSC
national television standards committee
standardized video signal format used in North America and other parts of the world, delivering 29,97 frames per second and 525 scanlines

3.1.24
network interface
point of communication between a device and the network

3.1.25
open system interconnection
complete suite of network routing protocols developed by ISO including routing protocols between the different layers of the system

3.1.26
PAL
phase alternating line
analog color encoding system used in television systems in Europe and in many other parts of the world, defining the video signal, using 625 TV lines per frame, at a refresh rate equal to 25 frames per second

3.1.27
physical transmission path
combination of the transmission medium, necessary amplifiers and other equipment to form a transmission path with one or more transmission channels

3.1.28
picture aspect ratio
the aspect ratio of a picture is the ratio of the width of the image to its height

3.1.29
principle
fundamental rule applicable to a large number of situations and variations

3.1.30
RCA jack
a type of connector used to input/output analog audio/video signals, with the female electrical contact or socket, and is the “more fixed” connector of a connector pair

3.1.31
RJ45 jack
one type of registered jack which specifies the physical male and female connectors as well as the pin assignments of the wires in a network cable

3.1.32
serial digital interface
a family of video interfaces standardized by the Society of Motion Picture and Television Engineers (SMPTE)

Note 1 to entry: For example, ITU-R.BT.656 and SMPTE 259M define digital video interfaces used for broadcast-grade video.

3.1.33
transition of minimized differential signaling
one technology for transmitting high-speed serial data and is used by the DVI and HDMI video interfaces, as well as other digital communication interfaces

3.1.34
transmission channel
combination of the transmission medium and necessary amplifiers and other equipment to form a connection between video equipment in a VSS system

3.1.35
transmission system
combination of equipment and media that provide the transmission of video signals between various VSS equipment

3.1.36
video graphic array
a video interface standard used for computer monitors, where ability to transmit a sharp, detailed image is essential

3.1.37
video matrix
a unit for connecting several input video signals to several outputs

3.1.38
video surveillance system
a system consisting of camera equipment, storage, monitoring and associated equipment for transmission and controlling purposes

3.1.39
Y/C video
a type of analog video transmission scheme in which video information is encoded on two channels: luma (luminance, "Y") and chroma (color, "C")

3.2 Abbreviations

For the purposes of this document, the following abbreviations apply.

3G-SDI	3-Gbps Serial digital interface
APL	Average Peaks Level
BNC	Bayonet Neill-Concelman
CAT5	Category 5 cable
CCIR	Consultative Committee of International Radio (International Consultative Committee for Radio)
CCTV	Closed Circuit Television – In the rest of the series called VSS (Video Surveillance Systems)
CRT	Cathode Ray Tube
CVBS	Composite Video Broadcast Signal
DC	Direct Current
DCE	Data Communications Equipment
DDC	Display Data Channel
DDWG	Digital Display Working Group
DIN	Deutsche Industrie für Normen
DP	DisplayPort
DMT	Display Monitor Timing
DTE	Data Terminal Equipment
DTV	Digital TeleVision
DVI	Digital Visual Interface
EDID	Extended Display Identification Data
FCC	Federal Communications Commission
FDDI	Fiber Distributed Data Interface
HDcctv	High Definition Closed Circuit Television
HD-SDI	High Definition Serial Digital Interface
HDMI	High-Definition Multimedia Interface
IP	Internet Protocol
LCD	Liquid Crystal Display
LED	Light Emitting Diode
NTSC	National Television Systems Committee
OSI	Open Systems Interconnection

PAL	Phase Alternating Line
PC	Personal Computer
PPP	Point-to-Point Protocol
PTZ	Pan/Tilt/Zoom
RCA	Radio Corporation of America
RF	Radio Frequency
RGB	Red, Green, Blue
SDI	Serial Digital Interface
SECAM	Sequential Couleur A Memoire
SMPTE	Society of Motion Picture and Television Engineers
S-Video	Separate Video
TCP	Transmission Control Protocol
TMDS	Transition of Minimized Differential Signaling
VESA	Video Electronics Standard Association
VGA	Video Graphic Array
VSIS	Video Signal Standard
VSS	Video Surveillance System
VTD	Video Transmission Device
Y/C	Luma (luminance, "Y") / Chroma (color, "C")

4 General information

4.1 General principles

This clause consists of informative general information about analog and digital video interfaces.

To achieve interoperability between analog and digital video devices connected to each other as well as the necessary auxiliary devices in video surveillance system, it is necessary to develop a basic standard of the analog/digital video interfaces based on existing correlative standards. Thus this standard prescribes the physical interface, electric interface, as well as the software/protocol interface among different devices. The scheme of interface hierarchy is shown in Figure 1 below.

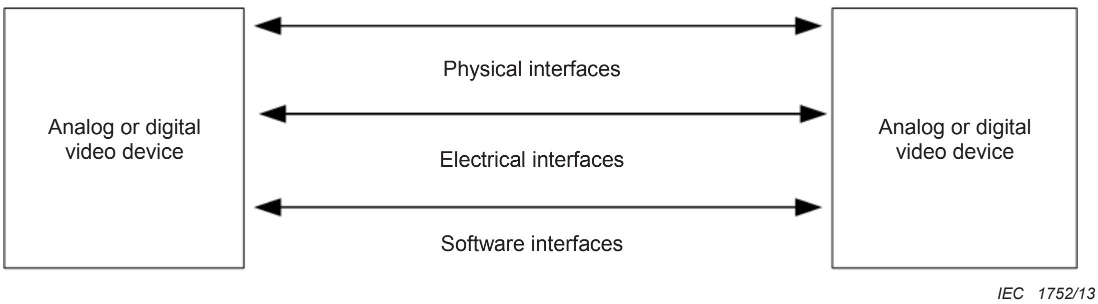

Figure 1 – Interface hierarchy of analog and digital video device

Manufacturers of both hardware and software system in video surveillance field should ensure that their products conform to the requirements specified in this standard.

Communication standards/protocols can be conceptually modelled by the ISO OSI reference model of seven layers: physical, data link, network, transport, session, presentation, and application. They can also be more realistically modelled (as done by IEC 62676-2-1) by the TCP/IP architecture model of five layers: physical, network access, internet, transport and applications. IEC 62676-2-1 described communication standards concerning internet and transport, especially at the IP level. IEC 62676-3 will describe physical and network access layers. Physical and network access layers include physical, electrical and software interfaces.

Physical and electrical interfaces specify requirements on physical media (e.g. connectors and cables) and electrical signals (e.g. composite, component). The interfaces address the physical layer.

Moreover, video surveillance system is moving towards digital, networked and intelligence based. So digital video interface in this standard addresses those digital video signals as well.

Finally, IEC 62676-1-2 describes the interfaces which are used to exchange data between the VSS system and other systems. The interfaces between the systems can manage data communication, mutual system control, common databases, common user interfaces or other type of system integration. IEC 62676-3 describes those system level (analog and digital) interfaces in detail.

4.2 Physical interfaces

4.2.1 General

The physical interfaces of video surveillance devices are used to connect devices through fiber optic or video cables etc., as shown in Figure 2. It is the elementary interface to ensure reliable transmission of the analog and digital signals as well as the related control signals. This physical interface is usually one part in physical layer of the ISO OSI model. The physical interface can include connectors (e.g. BNC, RCA, FC, ST, SC, LC, DIN, dB9) or cables (e.g. coaxial, twisted-pair, fiber-optic) for wired transmission or air with a certain electromagnetic spectrum (e.g. RF, microwave, infrared) for wireless transmission.

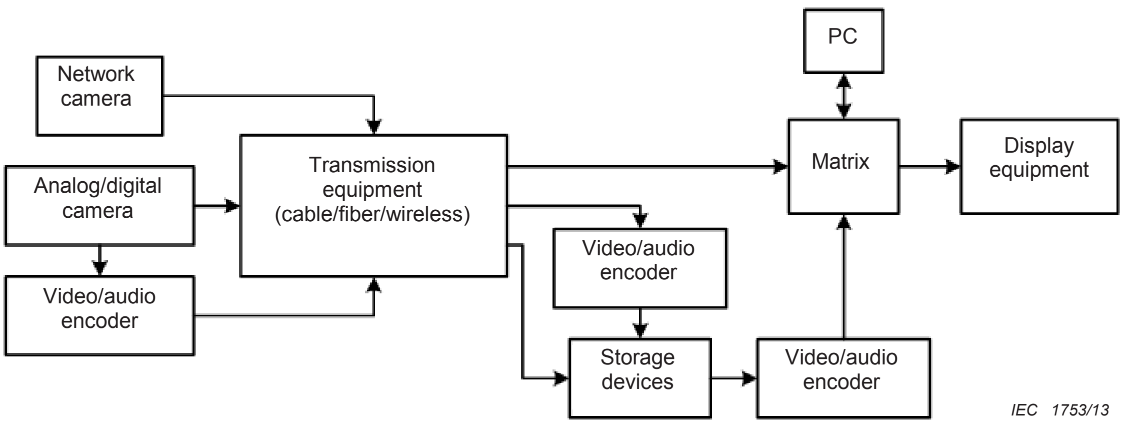

Figure 2 – Connection scheme of VSS devices

4.2.2 Camera signal interface

4.2.2.1 Analog video camera signal interface

Analog video camera with composite video output should have the 75 Ω BNC jack connector which also connects to 75 Ω coaxial cable (such as RG/59, RG/6, and RG/11) for transmission.

Analog video camera may have an S-video min-DIN jack connector for outputting Y/C video signal. The min-DIN jacks also connect to 75 Ω coaxial cable for transmission. Specifications of Y/C video signal is described in 5.2.2.

Analog video camera may have YPbPr analog component video RCA or BNC jacks for outputting component video signals. The RCA or BNC jacks are connected to 75 Ω coaxial cable for transmission.

If the camera has an embedded microphone, it may have the RCA jack or female 0,35 mm jack for outputting audio signal.

4.2.2.2 Digital video camera signal interface

In the video surveillance field, digital video cameras should mainly include SDI, HD-SDI, 3G-SDI camera and network camera, separately prescribed as below:

4.2.2.3 Serial camera signal interface

This kind of digital video camera should have the 75 Ω BNC jack for outputting the video signals of serial digital interface (SDI, HD-SDI, 3G-SDI, HDcctv).

If the camera has an embedded microphone, it may have the female RCA or female 0,35 mm jack for outputting audio signal.

In order to conveniently watching the live image via a portable monitor at the camera site during the system installation, the digital camera may have another 75 Ω BNC jack for outputting auxiliary composite video signal.

4.2.2.4 Parallel camera signal interface

This kind of digital video camera should have dB25 connectors for outputting video signals of ITU-BT.601, ITU-BT.656, ITU-BT.1120 or SMPTE 125M.

4.2.2.5 Network camera interface

Network camera should have network interface for digital video transmission via network. The physical interface of network camera should be the RJ45 jack which is connected to twisted pair cables such as CAT3, CAT5, CAT5e or CAT6 cables.

In order to conveniently watch the video image over a portable monitor at the camera site during the system installation, network camera may have a 75 Ω BNC jack for outputting composite video signal.

If the camera has an embedded microphone, it may have the female RCA or female 0,35 mm jack for outputting audio signal.

4.2.3 Display equipment video interface

4.2.3.1 General

Video display units (monitor) receive video from cameras or video processing/control equipment. There are analog monitors such as CRT and digital monitors such as LCD, plasma and organic LEDs. Regardless of monitor type, each monitor should have an analog video interface and/or a digital video interface.

4.2.3.2 Analog video input interface

Composite (CVBS) video interface should use the same connectors and cables as cameras with composite video output (see 4.2.2.1). The connector in the monitor should have female type.

S-video interface should use the same connectors and cables as cameras with S-video output (see 4.2.2.1). The connector in the monitor should have female type.

YPbPr analog component video interface should use the same connectors and cables as cameras with component video output (see 4.2.2.1). The connectors in the monitor should have female type.

RGB analog component video interface should use VESA VGA DE-15 connector (female). The DE-15 connector should connect to a VGA cable. The RGB analog component video interface may also use a VESA DVI-I 29-pin connector (female) in the monitor. A cable with a DVI-I (analog and digital) or a DVI-A connector (male) should be used to connect to the monitor.

4.2.3.3 Digital video input interface

A display monitor may use a number of digital video interfaces such as Digital Visual Interface (DVI), High-Definition Multimedia Interface (HDMI), Displayport and SDI. Those standards shall be based on the requirements of IEC 62315-1, which defines the requirements on video outputs for uncompressed digital video interfaces and is applicable to a variety of standard digital video-related high-speed physical interfaces.

DVI video interface should use DVI-D or DVI-I connectors. The connectors should be connected to DVI-D or DVI-I cables.

HDMI video interface should use connectors defined in the HDMI1.0, HDMI1.3 and HDMI1.4 specifications. The interface should use cables defined in the HDMI1.4 specification.

DisplayPort video interface should use connectors and cables compliant with DisplayPort version 1.0, 1.1 and 1.2.

SDI (SDI, HD-SDI/3G-SDI, HDcctv) interface should use the same connectors and cables as cameras with SDI output (see 4.2.2.3).

4.2.3.4 Display wall video input interface

Multiple instances of interfaces described in analog video input interface (4.2.3.2) and digital video input interface (4.2.3.3) are used. No special new interface is specified.

4.2.3.5 Daisy chain display video output interface

Sometimes a monitor also outputs received video signal to another monitor or video recording device. The output interface should be one of the analog or digital video interfaces described in camera signal interface 4.2.2 or display video input interface in 4.2.3.

4.2.4 Video processing and control equipment interface

Video processing and control equipment includes video matrix/ switch/ quad/ multiplexer, etc. Matrix in VSS system can transmit analog and digital video signals from multiple inputs to multiple outputs. The connector should be consistent with specifications in 4.2.2 and 4.2.3.

If an equipment needs to communicate with a PC or other devices, it may have a female dB9, RJ45 connector that supports RS-232 or RS-485 communication protocol or a RJ45 connector that supports network communication.

4.2.5 Video/audio encoder/decoder interface

Video/audio encoder in VSS system is the equipment that compresses video/audio signal with corresponding standard; then packages them in accordance with the TCP/IP protocol and transmits them in the form of network stream. Whereas video/audio decoder is the equipment that unpacks and decodes the network stream to restore the analog video/audio signal for displaying on termination equipment such as monitor, etc.

Video/audio encoder may have female BNC connector for inputting analog video signal and female RCA or female JACK3.5 connector (optional) for analog audio signal. It may have female RJ45 connector for outputting network stream. It may also have the connector to output PTZ instructions to the PTZ control unit.

Video/audio decoder may have female RJ45 connector for inputting network stream. It may have female BNC connector for outputting analog video signal and female RCA or female JACK3.5 connector (optional) for analog audio signal.

4.2.6 Fiber optical transmission equipment interface

Fiber optical transmission equipment in VSS system should have one of the FC, ST, SC or LC interfaces according to IEC 60874-1.

Fiber optical equipment may have female BNC connector for inputting/outputting analog video signal and female RCA connector (optional) for analog audio signal.

Fiber optical equipment may have female dB9 or RJ45 connector that supports RS 232 or RS 485 communication protocol for auxiliary data transmission.

4.2.7 Wireless transmission equipment interface

Wireless transmission equipment in VSS system is the equipment that transmits video/audio and control signals via radio frequency. The wireless transmission system can be structured in the topology of point-to-point, point-to-multipoint or multipoint-to-multipoint. Wireless transmission equipment may have female BNC connector for inputting/outputting composite video signal; it may also have female RCA or female JACK3.5 connector for audio signal. In addition, it may have female dB9 or RJ45 connector that supports RS-232 communication protocol for unidirectional or bidirectional auxiliary data transmission.

4.2.8 Alarm equipment interface

Video surveillance system may have alarm interface which can input or output control signal from or to alarm equipment. The connectors should adopt the corresponding form or wiring terminator.

4.3 Software interfaces for network access layer

This subclause specifies software interfaces regarding network access layer.

A number of layer-2 (datalink layer) technologies such as Ethernet (802.3), PPP, FDDI, IEEE 802.11, IEEE 802.16 may be used for the software and protocol interface. The software interfaces need to be compatible with network layer specified in IEC 62676-2-1.

5 Electrical interfaces

5.1 General

The electrical interface specifies electrical signals (e.g. composite, HDMI) used to connect various surveillance equipments such as cameras, display equipments, video processing and control equipments.

5.2 Analog video signal interface

5.2.1 Composite video

Composite video signals such as NTSC or PAL signals are defined in SMPTE 170M or ITU-R.BT.470. However, VSS industry has different requirements, and detailed requirements are specified in Clause 6.

5.2.2 Y/C video

Y/C video (also called S-Video) is composed of a Y signal for luminance and a C signal which is obtained after orthogonally modulating the two color difference signals onto a subcarrier for chrominance. The chrominance subcarrier frequency is 4,43 MHz for PAL video or 3,58 MHz for NTSC video.

Signal level of Y/C video is 1 V for Y signal, C signal is 0,3 V for PAL and 0,286 V for NTSC, and the matching impedance of the interface is 75 Ω.

5.2.3 YPbPr analog component video

Specifications of YPbPr video signal are described in the standards of SMPTE 240M, SMPTE 274M, SMPTE 293M, SMPTE 296M and ITU-R.BT.1358.

5.2.4 RGB analog component video

5.2.4.1 General

Specifications of RGB analog component video signal are described in the standards of VESA.

5.2.4.2 Requirements on video waveform timings

Every video output of a transmission device corresponding to this standard shall either support the format defined in IEC 62315-1:2003, 6.2.1, 640 × 480p in 60 Hz, or support 720 × 576p defined in IEC 62315-1:2003, 6.2.9.

The timing of the video signal shall be according to Table 2 and the time charts in 6.2 of IEC 62315-1:2003. The video output of the transmission device shall be able to represent the formats of Table 1 of IEC 62315-1:2003, either with 59,94 Hz or 60 Hz (picture change frequency in consecutive scanning and half picture change frequency in line leap scanning). Therefore the 59,94 Hz and 60 Hz versions of a format shall be regarded as the same format with negligibly different pixel clock. The video output of a transmission device shall generate video signals, whose pixel frequencies deviate less than 0,5 % from the clock speed specified in Table 2 of IEC 62315-1:2003.

5.2.4.3 VGA and derived video display interface standards

VGA is a video interface standard used for computer monitors, where ability to transmit a sharp, detailed image is essential. VGA uses separate wires to transmit the three color component signals and vertical and horizontal synchronization signals.

The VGA display standards or modes are a combination of display resolution (specified as the width and height in pixels), color depth (measured in bits), and refresh rate (expressed in hertz).

Most computer monitors have a 4:3 aspect ratio and some have 5:4. Monitors with 16:10 aspect ratios have become commonly available.

A number of common resolutions have been used with video devices and video transmission devices and the VESA group has coordinated the efforts to a video standard, which is referred here.

5.2.4.4 VESA DMT interface standards and guidelines reference

Table 1 contains a summary of display monitor timings (DMT) that are compliant to this standard. This clause refers to all current VESA Industry Standards & Guidelines for Computer Display Monitor Timing (DMT) Version 1 Revision 11 or later.

The video output signal of a video transmission device, media or combination of both shall fully meet the requirements of VESA DMT, where that standard refers to display monitors having screen resolutions between 640 × 350 and 1 280 × 1 024 and refresh rates between 60 Hz and 85 Hz and 1 600 × 1 200 with a refresh rate of 60 Hz.

Any video transmission device with RGB video outputs shall specify the DMTs supported. The product specification shall list items compliance to the VESA DMT standard in following way:

VESA [PIXEL FORMAT] @ [REFRSH RATE] & [REFRSH RATE2] & [...

Example:

VESA 640 × 480 @ 56 Hz & 72 Hz

VESA VGA @ 56 Hz & 72 Hz

Alternatively the Pixel Format may be listed as mnemonic.

5.2.4.5 VESA DMT video timing parameter compliance

The video timing parameters for all DMTs declared to be supported by the video transmission device shall be according to the VESA Monitor Timing Standards & Guidelines for Computer Display Monitor Timing (DMT) Version 1.0 Revision 11 or later.

If a video transmission device does not comply with this standard at the minimum pixel clock period, then alternatively a longer pixel clock period may be specified.

Table 1 – Summary of display monitor timings – Standards and guidelines

Pixel format	Refresh rate
640 × 350	85 Hz
640 × 400	85 Hz
720 × 400	85 Hz
640 × 480	50 Hz, 60 Hz, 72 Hz, 75 Hz, 85 Hz
720 × 576	50 Hz, 60 Hz, 72 Hz, 75 Hz
800 × 600	50 Hz, 56 Hz, 60 Hz, 72 Hz, 75 Hz, 85 Hz, 120 Hz (RB)
848 × 480	60 Hz
1 024 × 768	50 Hz, 120 Hz (RB), 43 Hz (Int.), 60 Hz, 70 Hz, 75 Hz, 85 Hz
1 152 × 864	75 Hz
1 280 × 768	50 Hz, 60 Hz, 75 Hz, 85 Hz, 120 Hz (RB)
1 280 × 800	50 Hz, 60 Hz, 75 Hz, 85 Hz, 120 Hz (RB)
1 280 × 960	50 Hz, 60 Hz, 85 Hz, 120 Hz (RB)
1 280 × 1 024	50 Hz, 60 Hz, 75 Hz, 85 Hz, 120 Hz (RB)
1 360 × 768	50 Hz, 60 Hz ,120 Hz (RB)
1 400 × 1 050	50 Hz, 60 Hz, 75 Hz, 85 Hz, 120 Hz (RB)
1 440 × 900	50 Hz, 60 Hz, 75 Hz, 85 Hz, 120 Hz (RB)
1 600 × 1 200	50 Hz, 60 Hz, 65 Hz, 75 Hz, 85 Hz, 120 Hz (RB)
1 680 × 1 050	50 Hz, 60 Hz, 75 Hz, 85 Hz, 120 Hz (RB)
1 792 × 1 344	50 Hz, 60 Hz, 75 Hz, 120 Hz (RB)
1 856 × 1 392	50 Hz, 60 Hz, 75 Hz, 120 Hz (RB)
1 920 × 1 200	50 Hz, 60 Hz, 75 Hz, 85 Hz, 120 Hz (RB)

Pixel format	Refresh rate
1 920 × 1 440	50 Hz, 60 Hz, 75 Hz, 120 Hz (RB)
1 920 × 1 080	Full HD
2 560 × 1 600	60 Hz, 75 Hz, 85 Hz, 120 Hz (RB)

5.2.4.6 VESA VSIS video signal characteristics standard compliance

The analog video signal of the video transmission device, media or combination of both shall be compliant to the VESA Video Signal Standard (VSIS) Version 1, Rev. 2, December 12, 2002 or later. This standard establishes the analog video signal characteristics for today's video display interfaces.

5.3 Digital video signal interface

5.3.1 HDMI

High-Definition Multimedia Interface (HDMI) is used to transmit high definition lossless digital television audiovisual signals from various audiovisual sources to various video displays via a single cable. Every HDMI video output corresponding to this standard shall offer a picture aspect ratio of 16:9 and, as defined in 6.2.2, 6.2.3, 6.2.6, 6.2.7 and 6.2.8 of IEC 62315-1:2003, either support 1 920 × 1 080i or 1 280 × 720p, or support 1 920 × 1 080p as defined in ITU-R BT.1120-7. The formats determined in 6.2.10, 6.2.4 and 6.2.5 of IEC 62315-1:2003, 720 × 576i, 720 × 480p and 720 × 480i are optional according to this standard.

Specifications of HDMI signal are described in the standards of HDMI.

5.3.2 DVI

DVI stands for Digital Video Interface that is designed for digital display devices such as flat panel display and digital projector, and compatible with analog VGA interface. Thus the interface sort of DVI is detailedly divided into DVI-D for digital only, DVI-A for analog only, and DVI-I for integrated that implies both digital and analog.

The Digital Visual Interface (DVI) was developed by an industry consortium, the Digital Display Working Group (DDWG). It is designed for carrying uncompressed digital video data to display. It is partially compatible with the High-Definition Multimedia Interface (HDMI) standard in digital mode (DVI-D).

Specifications of DVI signal are described in the standards of TMDS.

5.3.3 DisplayPort (DP)

The DisplayPort standard defines a royalty-free digital interface between sources e.g. workstations and computer displays. If a video transmission device is specifying the DisplayPort as the video interface standard supported, it shall follow DisplayPort Standard – Version 1.1a, published by VESA as document VESA_2008_1 in January 2008. DisplayPort provides a connection to external (and, what is not in focus here, internal) high resolution displays without the need for signal conversion. The video transmission device shall specify the supported resolutions and color depth. The interface is scalable to support future resolution requirements and can be extended to support multiple video and/or audio streams on one link.

5.3.4 SDI video

Serial digital interface (SDI) is a family of video interfaces standardized by SMPTE. These standards are used for transmission of uncompressed digital video signals. Specifications of SDI, HD-SDI, 3G-SDI video signal are described in the standards of SMPTE 259M, SMPTE

292M, SMPTE 424M and EBU Tech 3267. HDcctv 1.0 which is based on SMPTE 292M, is a high definition uncompressed video transmission standard specifically defined for VSS industry.

5.4 Control signal interface

5.4.1 RS-232

RS-232 is a widely used serial binary communication interface between DTE device (Data Terminal Equipment) and DCE device (Data Circuit-terminating Equipment). In VSS system, RS-232 is used for transmitting device setting data or control instructions. Its electrical specifications should be in accordance with the ITU-T.V.28.

5.4.2 RS-485

RS-485 is a standard defining the electrical characteristics of drivers and receivers for use in balanced digital multipoint systems. In VSS system, RS-485 is used effectively for transmitting control instructions over long distances and in electrically noisy environments using a single twisted-pair, shielded cable, forming a communication network. Multiple receivers may be connected to such network in a linear, multi-drop configuration.

6 Detailed analog (composite) video signal transmission requirements

6.1 General

The properties of the transmission system shall be provided in a specification sheet covering the items in this clause.

The specifications stated by the manufacturer shall be those determined under the standard operating conditions, indicating the type and requirements for the transmission media and additional information that enables the system designer to achieve the requirements of this standard.

The common requirements of a video transmission system are given in 6.2 to 6.10.

6.2 Video input and output

6.2.1 Source and load impedance

The source and load impedance of a transmission system shall be 75 Ω unbalanced coaxial input and output.

6.2.2 Return loss

The return loss in the inputs and outputs shall be better than 20 dB from 0,1 MHz to 5 MHz.

6.2.3 Input and output signal levels

6.2.3.1 PAL

The nominal input and output signal levels shall be 1 V_{p-p} in accordance with ITU-R.BT.470 for 625 lines, 50 fields per second and, in case of color, PAL color coding.

The signal level of the synchronization components in the composite video signal shall be (0,3 ± 0,05) V_{p-p}. For color signals, the amplitude of the burst component in the composite video signal shall be (0,3 ± 0,05) V_{p-p}.

6.2.3.2 NTSC

The nominal input and output signal levels shall be 1 V_{p-p} in accordance with SMPTE 170M for 525 lines, 60 fields per second and, in case of color, NTSC color coding.

The signal level of the synchronization components in the composite video signal shall be (0,286 ± 0,05) V_{p-p}. For color signals, the amplitude of the burst component in the composite video signal shall be (0,286 ± 0,05) V_{p-p}.

6.2.4 Input signal frequency

6.2.4.1 General

The equipment shall be capable of operating at an input signal with a nominal bandwidth of 5 MHz.

6.2.4.2 PAL

The equipment shall be capable of operating at an input signal with a horizontal frequency (f_h) of 15 625 Hz, with a relative tolerance of ± 1 % and a vertical frequency of $^2/_{625} \times f_h$ and a subcarrier frequency of 4,433 618 75 MHz, with a relative tolerance of $\pm 10^{-4}$.

6.2.4.3 NTSC

The equipment shall be capable of operating at an input signal with a horizontal frequency (f_h) of 15 734 Hz, with a relative tolerance of ± 1 % and a vertical frequency of $^2/_{525} \times f_h$ and a subcarrier frequency of 3,579 545 MHz, with a relative tolerance of $\pm 10^{-4}$.

6.2.5 Input and output DC voltage

The equipment shall be capable of operating correctly when presented with a video input signal having a DC component of (0 ± 2) V.

The DC voltage in the terminated output signal shall not exceed (0 ± 2) V.

6.3 Insertion gain

The insertion gain of the transmission system shall be (0 ± 1) dB on the nominal 1 V_{p-p} input signal.

6.4 Signal to noise ratio

The signal to noise ratio of the transmission channel, which includes the accumulated noise in cascaded amplifiers and cable loss correction, shall be ≥ 46 dB.

6.5 Interference

Interference from e.g. data channels, other video channels, audio channels, shall not cause visible disturbance to the picture.

6.6 Luminance non-linearity

The luminance non linearity shall be ≤ 10 %.

6.7 Chrominance to luminance gain inequality

The gain error shall be ≤ 20 %.

6.8 Chrominance to luminance delay inequality

The delay error shall be ≤ 100 ns.

6.9 Differential gain

The differential gain error shall be ≤ 10 %.

6.10 Differential phase

The differential phase error shall be ≤ 10°.

7 Analog video signal transmission test conditions

7.1 General

The test requirements described in this clause have been devised to measure the performance of video surveillance transmission equipment in a manner corresponding to their normal operation. The tests cover the most important transmission properties and enable comparisons between measurements taken at different laboratories.

To guarantee sufficient accuracy and reproducibility in the measurements, the test shall be conducted in certain specified conditions.

7.2 Test equipment

7.2.1 General

Test equipment shall be calibrated to meet the required accuracy of the respective measurements.

7.2.2 Test equipment

The test equipment normally required is as follows:

a) a video wave form monitor or oscilloscope. Preferably with facilities for triggering of the sweep from field or line pulses of the CVS signal;
b) monochrome or color video monitor;
c) video noise meter, capable of PAL and NTSC weighted noise measurements;
d) video signal generator providing appropriate test signals;
e) a video vectorscope.

NOTE Video analysis equipment combining some of the above mentioned functions can be used.

7.2.3 Test signals

List of signals (also refer to CCIR Recommendation 567-3:1990, Annex 1, part C for PAL, FCC for NTSC).

Signal A:	half frame white and black bar signal (see Figure A.1).
Signal B:	pulse and bar signal (see Figure A.2) for PAL.
	FCC composite signal for NTSC
Signal C:	frequency burst (see Figure A.3) for PAL.
	FCC multi burst signal for NTSC
Signal D1 and D2:	grey scale signal (see Figures A.4 and A.5).
Signal E:	20T pulse (see Figure A.6) for PAL.

FCC composite signal for NTSC.

7.2.4 Equipment set-up

The transmission equipment shall be connected and adjusted in accordance with the manufacturer’s recommendations, for the recommended cables and up to their maximum specified length. Unless otherwise specified in the tests, the system shall be operated at nominal input and output levels and terminated in a standard load impedance of 75 Ω.

7.3 Laboratory conditions

Unless otherwise specified, the atmospheric conditions in the laboratory shall be the standard atmospheric conditions for measurements and tests, specified in IEC 60068-1:1988, 5.3.1, as follows:

Temperature:	15 °C to 35 °C
Relative humidity:	25 % to 75 %
Air pressure:	86 kPa to 106 kPa

8 Analog video signal transmission performance tests

8.1 Input and output signal levels

8.1.1 Principle

The objective is to verify the minimum and maximum signal amplitude at the transmission equipment input and output terminals.

8.1.2 Preparation of the test

A TV-signal generator providing grey scale signal D2, Figure A.5, shall be connected to the terminated equipment input. The amplitude and the blanking reference voltage of the input and output signals shall be monitored on a dc-coupled waveform monitor.

8.1.3 Test procedure

The composite video test signal applied at the input shall be (0,7 ± 0,05) $V_{p\text{-}p}$ for PAL or (0,714 ± 0,05) $V_{p\text{-}p}$ for NTSC (luminance part), of which the amplitude of the synchronization signal shall be (0,3 ± 0,05) $V_{p\text{-}p}$ for PAL or (0,286 ± 0,05) $V_{p\text{-}p}$ for NTSC. Superimpose a positive and negative dc-voltage on the video test signal such that the blanking level of the test signal reaches + 2 V and – 2 V. Allow some time for the equipment to stabilise to the new input condition.

8.1.4 Criterion for compliance

The transmission equipment shall be capable of operating over the full test without noticeable distortion of video signal at the output. Clipping or crushing of the video and synchronization signals at the equipment output is not allowed.

8.2 Insertion gain

8.2.1 Principle

Verify ratio of the output signal to the input signal of the transmission equipment.

8.2.2 Preparation of the test

A TV-signal generator providing signal element B3, Figure A.2, shall be connected to the equipment input. The amplitude and the blanking reference voltage of the input and output signals shall be monitored on a dc-coupled waveform monitor. The input source impedance and output termination impedance shall be 75 Ω, with a relative tolerance of ± 0,5 %.

8.2.3 Test procedure

Measure the peak to peak voltage of test signal B3, Figure A.2 at the input and at the output of the transmission equipment. The amplitude and timing of the test signal are measured between the centre point of the bar signal and the blanking level.

8.2.4 Criterion for compliance

The transfer gain of the transmission equipment shall be (0 ± 1) dB after initial adjustment.

8.3 Input and output impedance

8.3.1 Principle

Define the termination impedance at the input and source impedance at the output termination of the transmission equipment by the reflection damping.

8.3.2 Preparation of the test

A TV-signal generator providing a grey scale signal shall be connected to the terminated equipment input. The amplitude and the blanking reference voltage of the input and output signals shall be monitored on a dc-coupled waveform monitor.

8.3.3 Test procedure

The input and output impedance and return loss shall be determined by measuring the return factor, using dedicated reflector devices or by using a Wheatstone bridge in accordance with Figure 3. The signal generator shall be able to provide a frequency sweep from 0,1 MHz to 5 MHz. The differential capacitor is adjusted to achieve proper high frequency balancing of the source. R_n is the reference resistor (75 Ω) with a tolerance of less than 0,5 %, R_x is input or output impedance of the transmission equipment for measurement of the input and output impedance, respectively. The oscilloscope is used to measure the unbalance voltage U_2 as a function of the applied input voltage U_1.

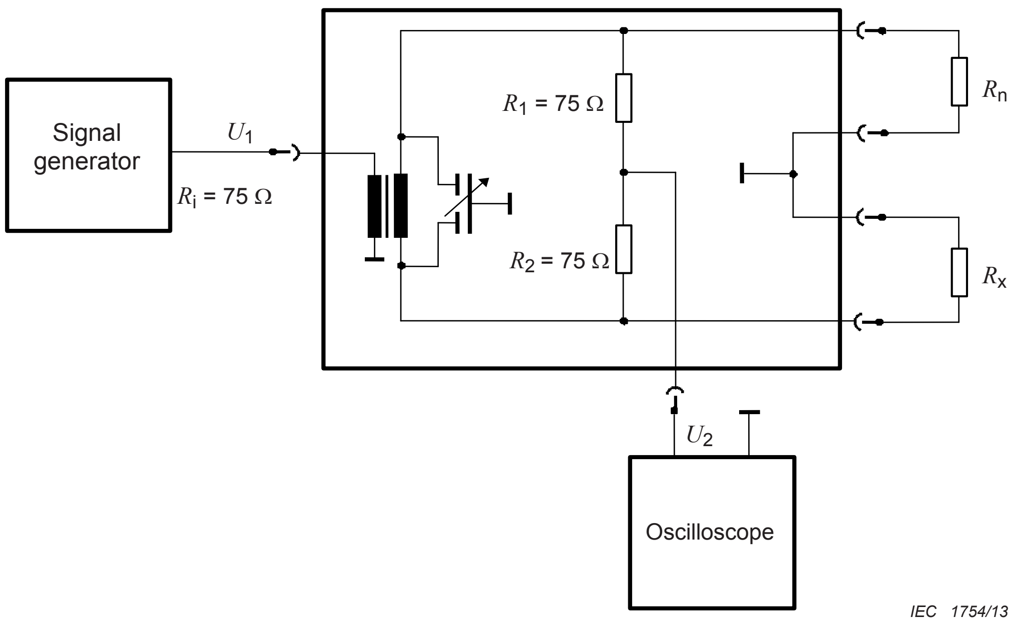

Figure 3 – Impedance measuring circuit

The relation between return factor and input and output impedance is:

$$r = \frac{R_x - R_n}{R_x + R_n} \tag{1}$$

By measuring the unbalance voltage of the Wheatstone bridge, the relation between the unbalance voltage and the return factor is defined by Equation (2):

$$r = 4 \; \frac{U_2}{U_1} \tag{2}$$

The return loss is given in Equation (3):

$$b_r = 20 \log \frac{1}{r} \left(\text{dB}\right) \tag{3}$$

8.3.4 Criterion for compliance

The input and output impedance for the transmission equipment shall be 75 Ω and the return loss of ≥ 20 dB in the frequency range between 0,1 MHz and 5 MHz.

8.4 DC voltage at the output

8.4.1 Principle

Define the dc voltage level of the black part of the video signal in the output of the transmission equipment.

8.4.2 Preparation of the test

A TV-signal generator providing a grey scale signal shall be connected to the terminated equipment input. The amplitude and the blanking reference voltage of the input and output signals shall be monitored on a dc-coupled waveform monitor.

The transmission equipment output shall be terminated in 75 Ω, with a relative tolerance of ± 0,5 %.

8.4.3 Test procedure

The DC voltage level in the output shall be determined by measuring the voltage level of the reference black level in the test signal using a DC coupled wave form monitor.

8.4.4 Criterion for compliance

The DC voltage level of the reference black level in the video signal at the output shall be (0 ± 2) V.

8.5 Chrominance to luminance gain and delay inequality

8.5.1 Principle

Verify the change in amplitude and phase of the chrominance components relative to the luminance component of the video signal between the input and the output of the equipment.

8.5.2 Preparation of the test

Apply an input signal with E, Figure A.6. Measure the output signal of the system with an oscilloscope.

8.5.3 Test procedure

Measure the amplitude and phase relationship of the chrominance component with regard to the luminance component in the output signal. For an illustration of the different types of relationship, refer to Figure B.1.

Measure y_{max}, y_1 and y_2, calculate the values $\frac{y_1}{y_{max}}$ and $\frac{y_2}{y_{max}}$, and read the delay and gain inequality values from the Rosman nomogram of Figure B.2.

8.5.4 Criterion for compliance

The delay inequality shall be ≤ 100 ns and the gain inequality shall be ≤ 20 %.

8.6 Signal to noise ratio

8.6.1 Principle

Verify the continuous random noise as the ratio, expressed in decibels, of the nominal amplitude of the luminance signal to the root mean square amplitude of the noise measured after band limiting and weighting with a special network.

8.6.2 Preparation of the test

Apply a black signal to the input of the system. Connect a video noise meter with the band limiting and unified weighting filter as specified (for PAL with 200 kHz high pass and 5 MHz low pass filters, for NTSC with 100 kHz high pass and 4,2 MHz low pass filters) to the terminated output.

8.6.3 Test procedure

Measure the signal to noise ratio if the video noise meter is calibrated to do a direct measurement. If the video noise meter is calibrated to measure the root mean square noise voltage, calculate the signal to noise ratio from:

$$\text{S/N ratio} = 20 \log \frac{0{,}7}{V_{\text{noise}}} \, (\text{dB}) \qquad (4)$$

8.6.4 Criterion for compliance

The signal to noise ratio shall be ≥ 46 dB.

8.7 Interference

8.7.1 Principle

Verify the operation of the video transmission system without interference from other signals, e.g. audio channels, data channels, other video channels, sharing the same physical transmission path or the same transmission system.

8.7.2 Preparation of the test

Apply grey scale signal D1, Figure A.4, to the input of a representative video channel under test. Connect a video monitor to the terminated output.

8.7.3 Test procedure

One at a time applies test signals to the additional channels as follows:

a) video channels: a multiburst video signal (signal C, Figure A.3) to any of the other video channels;
b) audio channels: make a slow frequency sweep (approximately 10 s per decade) within the specified audio frequency range at the specified maximum amplitude;
c) data channels: the data signals for which the equipment has been designed.

8.7.4 Criterion for compliance

Interference from these signals shall not be visible on the monitor screen at normal viewing distance and nominal monitor contrast.

8.8 Luminance non-linearity

8.8.1 Principle

Verify the ability of the transmission system to reproduce an output signal that is proportional to the applied input signal.

8.8.2 Preparation of the test

Apply a 5-riser staircase, test signal element D1 of Figure A.4, to the input. At the receiving end, the test signal is passed through a differentiating and shaping network whose effect is to transform the staircase into a train of 5 pulses. An example of such a filter is given in Annex II to Part C of CCIR recommendation 567-3:1990.

8.8.3 Test procedure

Measure the difference between the largest V_{max} and smallest V_{min} pulses. The value of the distortion is calculated from:

$$\frac{V_{\text{max}} - V_{\text{min}}}{V_{\text{max}}} \times 100\ \% \qquad (5)$$

8.8.4 Criterion for compliance

The luminance non linearity shall be ≤ 10 %.

8.9 Differential gain

8.9.1 Principle

Verify the ability of the transmission equipment to reproduce the superimposed sub-carrier in the output signal at equal amplitudes as the luminance varies from blanking level the white level.

8.9.2 Preparation of the test

Apply a 5-riser staircase with superimposed sub-carrier, test signal element D2 of Figure A.5, to the input. At the receiving end, the sub-carrier is filtered from the rest of the test signal and its six sections are compared in amplitude using a waveform monitor.

8.9.3 Test procedure

Measure the difference between the largest A_{max} and smallest A_{min} pulses. The amplitude of the sub-carrier at the blanking level is A_0.The value of the distortion is calculated from:

$$\frac{A_{max} - A_{min}}{A_0} \times 100\ \% \qquad (6)$$

8.9.4 Criterion for compliance

The differential gain error shall be ≤ 10 %.

8.10 Differential phase

8.10.1 Principle

Verify the ability of the transmission equipment to reproduce the superimposed sub-carrier in the output signal at equal phase as the luminance varies from blanking level to the white level.

8.10.2 Preparation of the test

Apply a 5-riser staircase with superimposed sub-carrier, test signal element D2 of Figure A.5, to the input. At the receiving end test signal is fed to a vectorscope.

8.10.3 Test procedure

Measure the maximum phase difference of the sub-carrier on the all treads of the staircase.

8.10.4 Criterion for compliance

The differential phase error shall be less than 10°.

8.11 Documentation

The documentation to be provided with the equipment shall comprise the following:

a) the properties of the equipment shall be provided in a specification sheet covering at least the items in this clause. The specifications stated by the manufacturer shall be those determined under the specified operating conditions;

b) voltage rating, frequency and maximum power consumption of the power supplies.

Annex A
(normative)

Test patterns

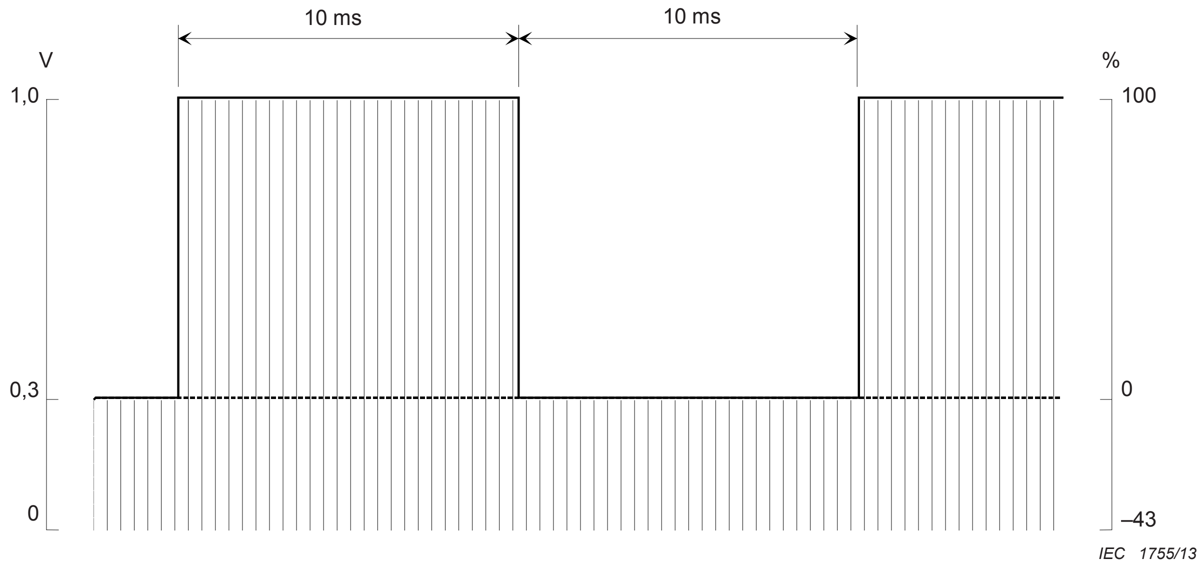

Figure A.1 – Signal A

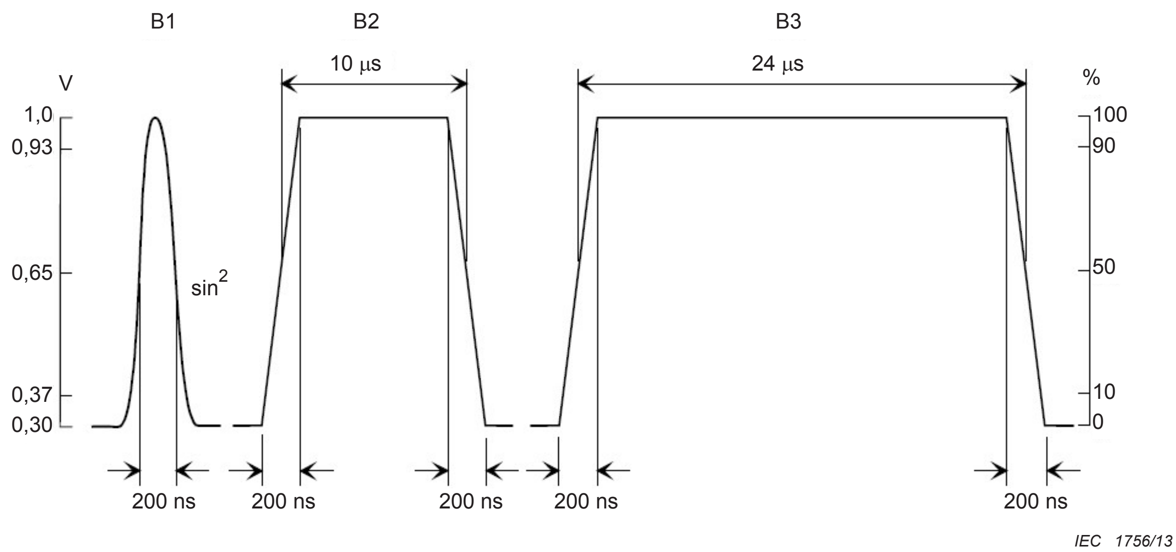

Figure A.2 – Signal B

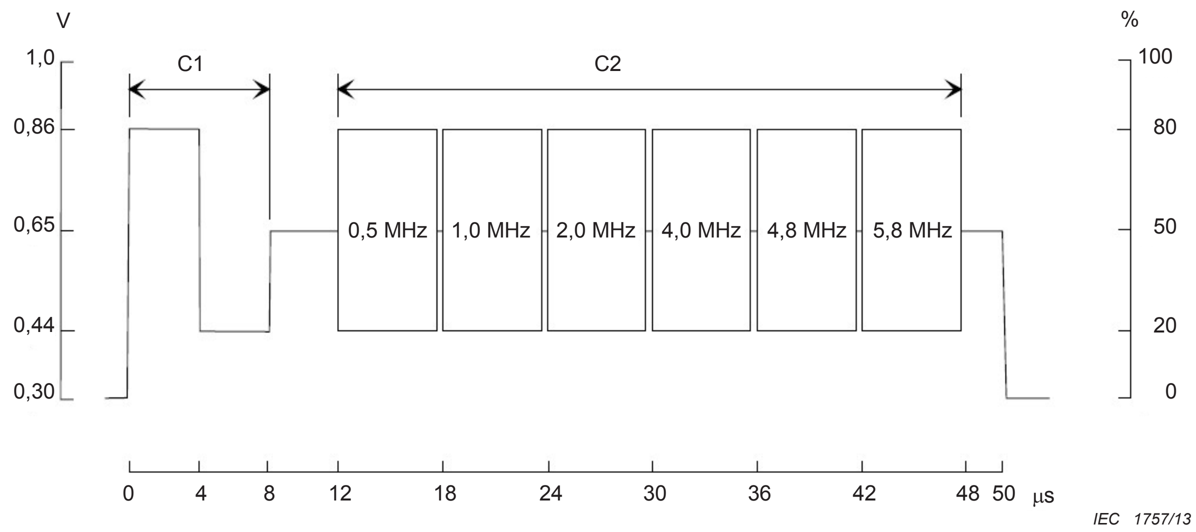

Figure A.3 – Signal C

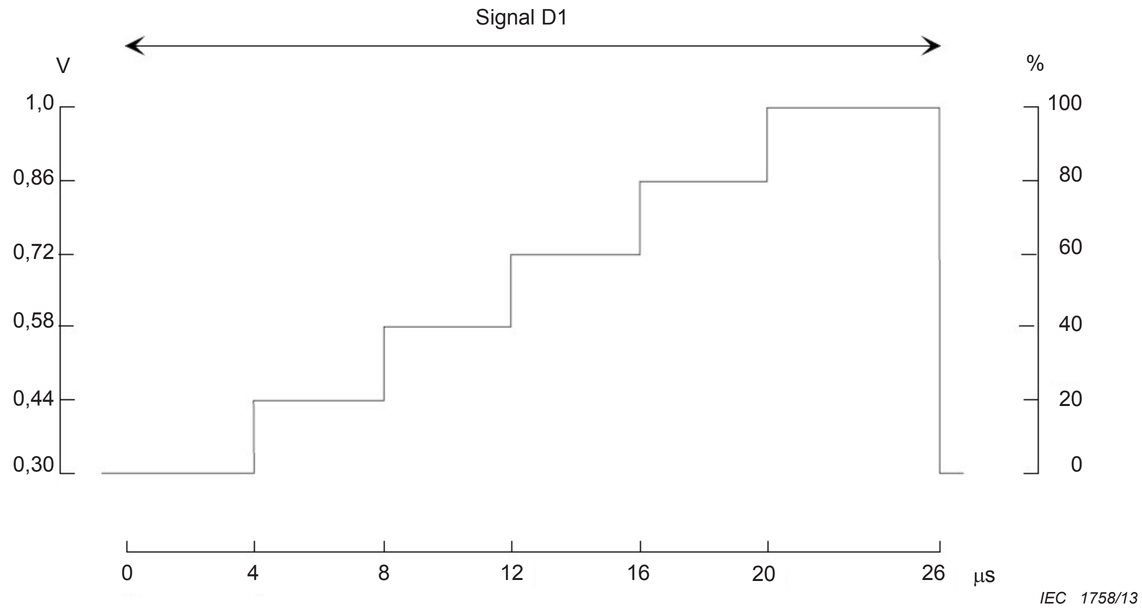

Figure A.4 – Signal D1

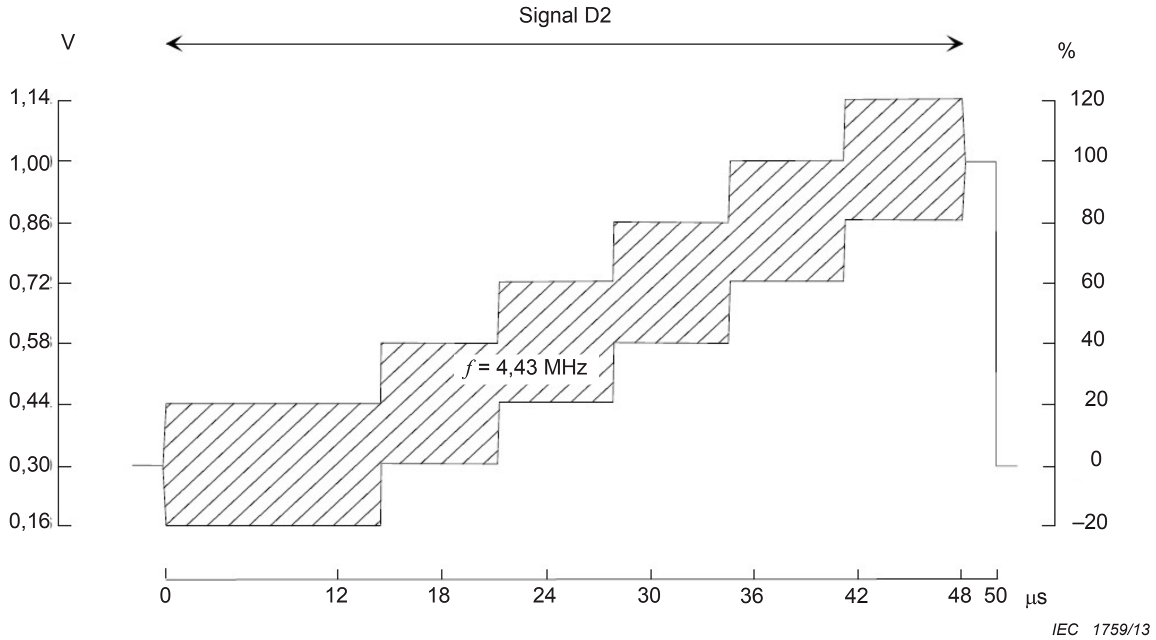

Figure A.5 – Signal D2

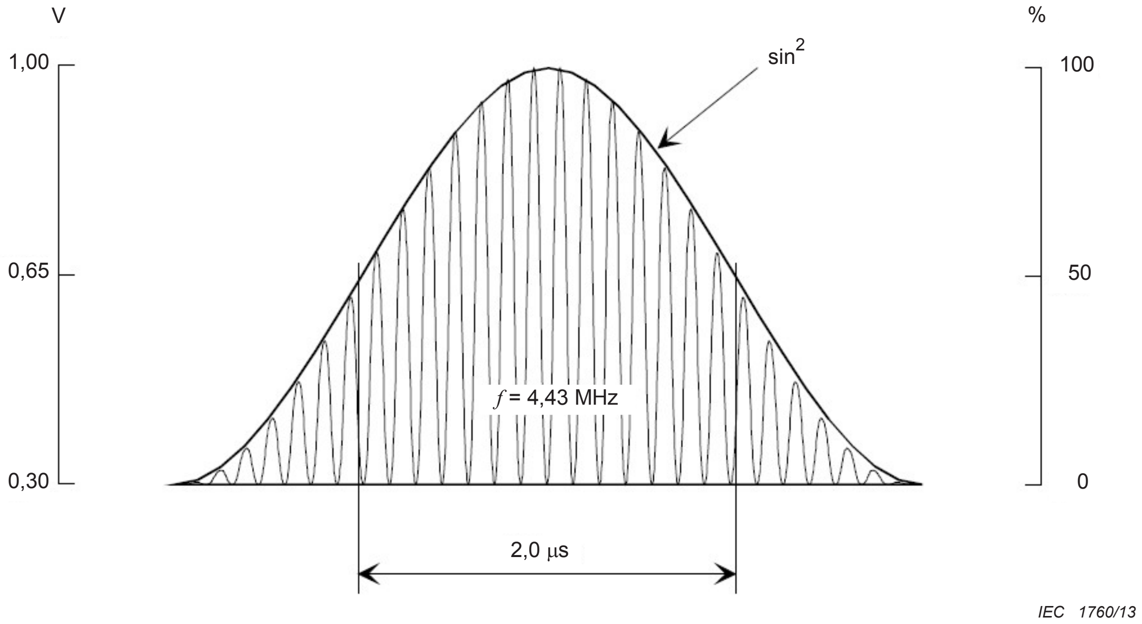

Figure A.6 – Signal E

Annex B
(normative)

Chrominance to luminance gain and delay charts

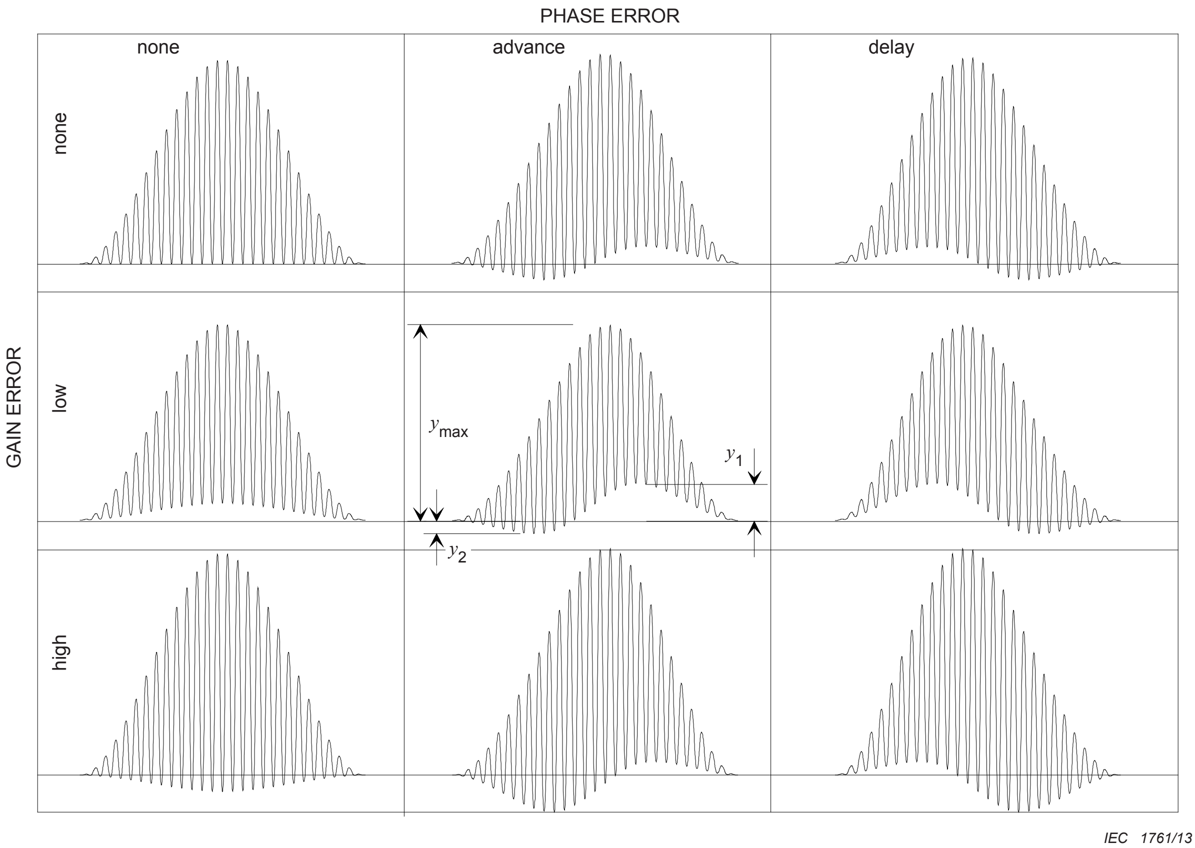

Figure B.1 – Chrominance to luminance amplitude and delay errors

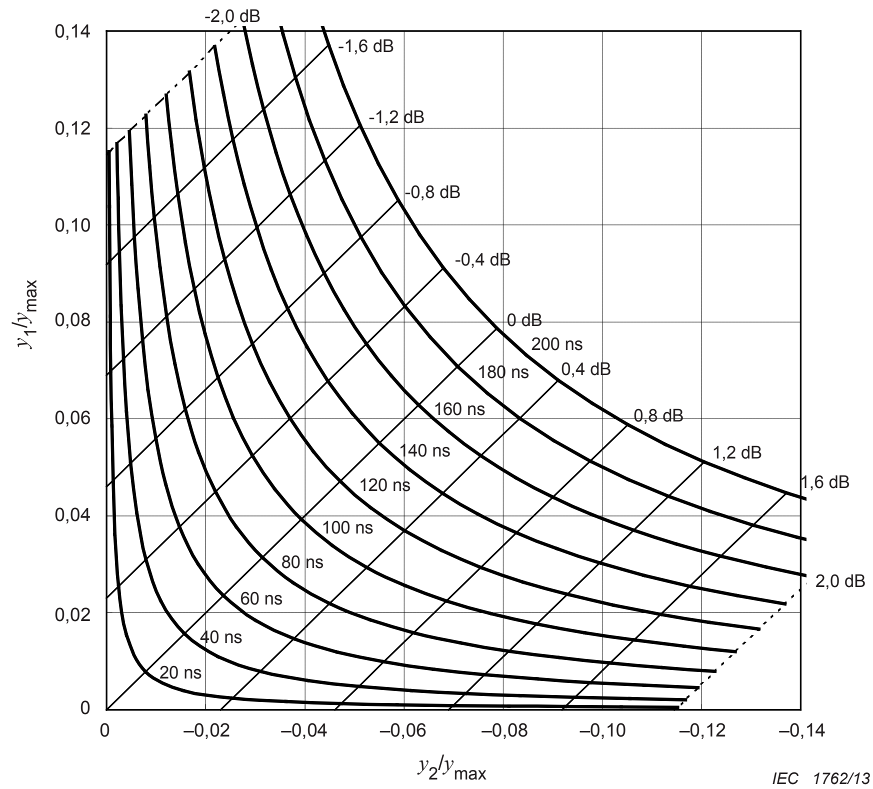

Figure B.2 – The Rosman nomogram

Bibliography

IEC 60874-1:2011, *Fibre optic interconnecting devices and passive components – Connectors for optical fibres and cables – Part 1: Generic specification*

IEC 61169-8, *Radio-frequency connectors – Part 8: Sectional specification – RF coaxial connectors with inner diameter of outer conductor 6,5 mm (0,256 in) with bayonet lock – Characteristic impedance 50 Ω (type BNC)*

IEC 62676-1-2, *Video surveillance systems for use in security applications – Part 1-2: System requirements – Performance requirements for video transmission* [1]

IEC 62676-2-1, *Video surveillance systems for use in security applications – Part 2-1: Video transmission protocols – General requirements* [2]

IEC 62676-2-2, *Video surveillance systems for use in security applications – Part 2-2: Video transmission protocols – IP interoperability implementation based on HTTP and REST services* [3]

IEC 62676-2-3, *Video surveillance systems for use in security applications – Part 2-3: Video transmission protocols – IP interoperability implementation based on Web services* [4]

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

ITU-R.BT.601, *Studio encoding parameters of digital television for standard 4:3 and wide screen 16:9 aspect ratios*

ITU-R.BT.656, *Interface for digital component video signals in 525-line and 625-line television systems operating at the 4:2:2 level of Recommendation ITU-R BT.601*

ITU-R.BT.1120-7, *Digital interfaces for HDTV studio signals*

ITU-R BT.1358, *Studio Parameters of 625 and 525 line progressive television systems*

ITU-T.V28: *Electrical characteristics for unbalanced double-current interchange circuits*

CCIR recommendation 567-3:1990, *Transmission performance of television circuits designed for use in international connections*

DDWG Specifications, Digital Display Working Group, URL www.ddwg.org

DVI-Digital Visual Interface, Revision 1.0, April 2, 1999, Digital Display Working Group, www.ddwg.org.

HDMI – High-Definition Multimedia, HDMI Licensing, LLC,

HDMI – High-Definition Multimedia Interface Specification Version 1.3a, HDMI Licensing LLC

HDMI – High-Definition Multimedia Interface Specification Version 1.4, HDMI Licensing LLC

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1 To be published.

2 To be published.

3 To be published.

4 To be published.

IEEE 802.11, *Telecommunications and information exchange between systems – Local and metropolitan area networks – specific requirements – Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY)*

IEEE 802.16, *Telecommunications and information exchange between systems – Local and metropolitan area networks – specific requirements – Part 16: Broadband Wireless MAN Standard – WiMAX*

SMPTE 125M-1995: *Television – Component Video Signal 4:2:2 – Bit-Parallel Digital Interfaces*

SMPTE 170M-2004: *Television – Composite Analog Video Signal – NTSC for Studio Applications*

SMPTE 240M-1999: *Television – 1125-Line High-Definition Production Systems – Signal Parameters*

SMPTE 259M-2006: *Television – Digital Signal/Data – Serial Digital Interface*

SMPTE 274M-1998: *Televison – 1920 × 1080 Scanning and Analog and Parallel Digital Interfaces for Multiple Picture Rates*

SMPTE 292M-1998: *Bit-Serial Digital Interface for High-Definition Television Systems*

SMPTE 293M-2003: *Television – 720 × 483 Active Line at 59.94-Hz Progressive Scan Production – Digital Representation*

SMPTE 296M-1997: *Television – 1280 × 720 Scanning Analog and Digital Representation and Analog Interfaces*

SMPTE 424M-2012: *3 Gb/s Signal/Data Serial Interface*

VESA Display Data Channel Command Interface (DDC/CI) Standard, Version 1.1

VESA Enhanced Extended Display Identification Data. Implementation Guide, Version 1.0

VESA DisplayPort Interoperability Guideline, Version 1.1a

VESA DisplayPort Standard, Version 1, Revision 1a

VESA Generalized Timing Formula Standard, Version 1.1

EBU Tech 3267-1992, *EBU interfaces for 625-line digital video signals at the 4:2:2 level of CCIR Recommendations 601*

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