

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

General methods of measurement for digital television receivers

Méthodes de mesure générales pour récepteurs de télévision numériques

IEC 62028:2002

<https://standards.iteh.ai/catalog/standards/sist/3c9e9c0d-53b3-46bd-b873-52e116dfc7b9/iec-62028-2002>



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# INTERNATIONAL ELECTROTECHNICAL COMMISSION

## GENERAL METHODS OF MEASUREMENT FOR DIGITAL TELEVISION RECEIVERS

### FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 62028 has been prepared by IEC technical committee 100: Audio, video and multimedia systems and equipment.

This bilingual version (2011-12) corresponds to the monolingual English version, published in 2002-02.

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

CDV	Report on voting
100/232/CDV	100/427/RVC

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

The French version of this standard has not been voted upon.

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

Annexes A, B, and C form an integral part of this standard.

The committee has decided that the contents of this publication will remain unchanged until 2004. At this date, the publication will be

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- withdrawn;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



# GENERAL METHODS OF MEASUREMENT FOR DIGITAL TELEVISION RECEIVERS

## 1 Scope

IEC 62028 deals with the standard conditions and methods of measurement on digital television receivers which receive digital television broadcast transmissions.

IEC 62028 deals with the determination of performance and allows the comparison of equipment by listing the characteristics which are useful for specifications and by laying down uniform measuring methods of these characteristics. Performance requirements are not specified, since they are specified by other international, regional or domestic standards for the systems.

It does not include the measurements specific to the transmission system, such as;

- measurements on receivers for satellite transmission systems,
- measurements on receivers for terrestrial transmission systems,
- measurements on receivers for cable transmission systems,
- measurements specific to sound channels, and
- measurements specific to data channels.

IEC 62028 does not include methods of measurement on outdoor units and antennas for satellite reception, for which reference is required to other appropriate IEC standards.

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IEC 62028 does not deal with general safety matters, for which reference is required to IEC 60065, or other appropriate IEC safety standards, nor with radiation and immunity, which will be dealt with by CISPR.

## 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60107-1:1997, *Methods of measurement on receivers for television broadcast transmissions – Part 1: General considerations – Measurements at radio and video frequencies*

ISO/IEC 13818-1:2000, *Information technology – Generic coding of moving pictures and associated audio: Systems*

ISO/IEC 13818-4:1998, *Information technology – Generic coding of moving pictures and associated audio information – Part 4: Conformance testing*

ISO/IEC 13818-9:1996, *Information technology – Generic coding of moving pictures and associated audio information – Part 9: Extension for real time interface for systems decoders*

ITU-R BT.500-10:2000, *Methodology for the subjective assessment of quality of television pictures*

EN 300 421 *Digital video broadcasting (DVB) – Framing structure, channel coding and modulation for 11/12 GHz satellite services*

EN 300 429 *Digital video broadcasting (DVB) – Framing structure, channel coding and modulation for cable systems*

EN 300 744 *Digital video broadcasting (DVB) – Framing structure, channel coding and modulation for digital terrestrial television”*

ETR 211:1997, *Digital video broadcasting (DVB) – Guidelines on implementation and usage of Service Information (SI)*

ETS 300 468:2000, *Digital video broadcasting (DVB) – Specification for Service Information (SI) in DVB systems*

### 3 Terms, definitions and abbreviations

#### 3.1 Terms and definitions

For the purposes of this publication, the following terms and definitions apply:

##### 3.1.1

##### **MPEG-2**

refers to the ISO/IEC 13818 series. System coding is defined in part 1, video coding is defined in part 2, audio coding is defined in part 3

##### 3.1.2

##### **multiplex**

stream of all the digital data carrying one or more services within a single physical channel

##### 3.1.3

##### **service information (SI)**

digital data describing the delivery system, content and scheduling/timing of broadcast data streams etc. It includes MPEG-2 program specific information (PSI) together with independently defined extensions.

##### 3.1.4

##### **transport stream (TS)**

a data structure defined in ISO/IEC 13818-1

#### 3.2 Abbreviations

<b>AGC</b>	Automatic Gain Controller
<b>ARIB</b>	Association of Radio Industries and Business
<b>ASCII</b>	American Standard Code for Information Interchange
<b>ATM</b>	Asynchronous Transfer Mode
<b>ATSC</b>	Advanced Television Systems Committee
<b>BAT</b>	Bouquet Association Table
<b>BEP</b>	Bit Error Probability
<b>BER</b>	Bit Error Rate
<b>BPSK</b>	Biphase Shift Keying
<b>bslbf</b>	bit string, left bit first
<b>CA</b>	Conditional Access
<b>CAT</b>	Conditional Access Table

<b>CATV</b>	Community Antenna TeleVision
<b>COFDM</b>	Coded Orthogonal Frequency Division Multiplexing
<b>CPE</b>	Common Phase Error
<b>CRC</b>	Cyclic Redundancy Check
<b>D/A</b>	Digital-to-Analogue converter
<b>DBS</b>	Direct Broadcast Satellite
<b>DFT</b>	Discrete Fourier Transform
<b>DIRD</b>	Digital Integrated Receiver Decoder
<b>DIT</b>	Discontinuity Information Table
<b>DTS</b>	Display Time-Stamp
<b>DQPSK</b>	Differential Quadrature Phase Shift Keying
<b>DVB</b>	Digital Video Broadcasting
<b>DVB-C</b>	DVB-Cable
<b>DVB-S</b>	DVB-Satellite
<b>DVB-SI</b>	DVB-Service Information
<b>DVB-T</b>	DVB-Terrestrial
<b>EB</b>	Error Block
<b>ECM</b>	Entitlement Control Message
<b>EIT</b>	Event Information Table
<b>EMM</b>	Entitlement Management Message
<b>EN</b>	European Standard
<b>EPG</b>	Electronic Programme Guide
<b>ETR</b>	ETSI Technical Report
<b>ETS</b>	European Telecommunication Standard
<b>ETSI</b>	European Telecommunications Standards Institute
<b>FEC</b>	Forward Error Correction
<b>FFT</b>	Fast Fourier Transform
<b>FIFO</b>	First-in, First-out shift register
<b>FS</b>	Full Scale
<b>HDTV</b>	High Definition TeleVision
<b>HEX</b>	Hexadecimal notation
<b>HP</b>	High Priority bit stream
<b>ICI</b>	Inter-Carrier Interference
<b>IF</b>	Intermediate Frequency
<b>IFFT</b>	Inverse Fast Fourier Transform
<b>IRD</b>	Integrated Receiver Decoder
<b>ISDN</b>	Integrated Services Digital Network
<b>JTC</b>	Joint Technical Committee
<b>LP</b>	Low Priority bit stream
<b>LSB</b>	Least Significant Bit
<b>MER</b>	Modulation Error Ratio
<b>MP@ML</b>	Main Profile at Main Level
<b>MPEG</b>	Moving Picture Experts Group

<b>MSB</b>	Most Significant Bit
<b>MUX</b>	Multiplex
<b>NIT</b>	Network Information Table
<b>NVOD</b>	Near Video On Demand
<b>OCT</b>	Octal notation
<b>OFDM</b>	Orthogonal Frequency Division Multiplex
<b>PAT</b>	Program Association Table
<b>PCR</b>	Program Clock Reference
<b>PES</b>	Packetized Elementary Stream
<b>PID</b>	Packet Identifier
<b>PMT</b>	Program Map Table
<b>PRBS</b>	Pseudo-Random Binary Sequence
<b>PSK</b>	Phase Shift Keying
<b>PSI</b>	Program System Information
<b>PTS</b>	Presentation Time-Stamp
<b>PSTN</b>	Public Switched Telephone Network
<b>QAM</b>	Quadrature Amplitude Modulation
<b>QEF</b>	Quasi Error Free
<b>QPSK</b>	Quaternary Phase Shift Keying
<b>RF</b>	Radio Frequency
<b>rpchof</b>	remainder polynomial coefficients, highest order first
<b>RS</b>	Reed-Solomon
<b>RST</b>	Running Status Table
<b>SHF</b>	Super High Frequency
<b>SDT</b>	Service Description Table
<b>SDTV</b>	Standard Definition TeleVision
<b>SI</b>	Service Information
<b>SIT</b>	Selection Information Table
<b>SMATV</b>	Satellite Master Antenna TeleVision
<b>SMD</b>	System Management Descriptor
<b>Smid</b>	System Management identifier
<b>ST</b>	Stuffing Table
<b>STB</b>	Set Top Box
<b>TC-8PSK</b>	Trellis Code 8-level Phase Shift Keying
<b>TDT</b>	Time and Date Table
<b>TEI</b>	Transport Error Indicator
<b>TOT</b>	Time Offset Table
<b>TPS</b>	Transmission Parameter Signalling
<b>TS</b>	Transport Stream
<b>TV</b>	Television
<b>uimsbf</b>	unsigned integer most significant bit first
<b>UTC</b>	Universal Time, Co-ordinated
<b>VSB</b>	Vestigial Side Band


  
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<b>8VSB</b>	8-level Vestigial Side Band
<b>16VSB</b>	16-level Vestigial Side Band
<b>64QAM</b>	64-level Quadrature Amplitude Modulation

## 4 Conceptual block diagram of digital television receivers

### 4.1 General

#### 4.1.1 Types of receivers

Digital television receivers are usually designed to be capable of receiving digital television signals in a variety of ways. Examples are direct off-air reception or reception via cabled network in the VHF/UHF bands, and from satellite broadcasts in conjunction with an outdoor unit and a dBs tuner. Further digital signals can be delivered by the PSTN or ISDN. The signal will usually include information on the service supplied.

A return path can be present for interactive TV applications.

For non-broadcast signals, the receiver may be used as a monitor to display pre-recorded video or home movies.

The methods of measurement described in this standard take into account various options.

#### 4.1.2 Peripheral connectors

Most receivers are provided with connectors for the interface with audio and video signals. Examples are the 21-pin connector described in IEC 60933-1 and IEC 60933-2 and the Y/C connector described in IEC 60933-5. An example for a digital interface is described in the IEC 61883 series and an example for an analogue interface is described in IEC 61880.

### 4.2 Basic common block diagram

#### 4.2.1 General

The basic common conceptual block diagram of digital television broadcasting system is shown in figure 1.

After audio and video signals are converted from analogue to digital, they are compressed. Data signals, which might include EPG (Electronic Program Guide), SI (Service Information), teletext program, etc., are multiplexed with compressed audio and video signals. After channel coding, the TS is modulated and transmitted via satellite, terrestrial, or cable.

In digital television receivers, the transmitted signal is demodulated and sent to the error correction block. After error correction, audio, video, and data signals are demultiplexed, and audio and video signals are decompressed respectively. Audio and video signals are sent to a conventional (analogue) TV receiver (through the peritelevision socket) or to a display and loud speakers, and the data signal is sent to a conventional (analogue) TV receiver (through the peritelevision socket) or to data equipment.

#### 4.2.2 Satellite broadcasting system

When the digital television signal is transmitted via satellite, BPSK, QPSK and TC-8PSK modulation formats are used.

#### 4.2.3 Terrestrial broadcasting system

COFDM, band-segmented OFDM and 8VSB modulation formats are used in the terrestrial broadcasting system.

#### 4.2.4 CATV system

64QAM and 16VSB modulation formats are used for the CATV system.

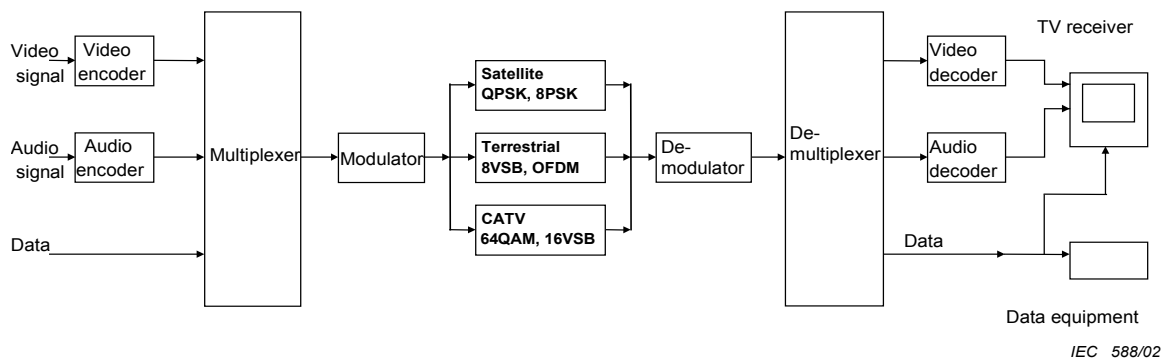


Figure 1 – Conceptual configuration of a digital broadcasting system

### 5 General notes on measurements

#### 5.1 General conditions

General measuring conditions are according to 3.1 of IEC 60107-1.

#### 5.2 Test signals

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Test signals are common to all the transmission systems.

##### 5.2.1 Video test signals

[IEC 62028:2002](#)

[https://standards.iteh.ai/catalog/standards/sist/3c9e9c0d-53b3-46bd-b873-](https://standards.iteh.ai/catalog/standards/sist/3c9e9c0d-53b3-46bd-b873-116dfc7b9/iec-62028-2002)

##### 5.2.1.1 Still image video signal

[116dfc7b9/iec-62028-2002](#)

The still image video signal shall be electronically generated.

- a) Colour bar signal;
- b) Ramp signal;
- c) Modulated ramp signal;
- d) Multiburst signal;
- e) 5-steps signal.

##### 5.2.1.2 Moving picture video signal

*Under consideration.*

##### 5.2.2 Audio test signals

1 kHz sine-wave signal is used.

Frequency variable sine-wave signal is used for measuring frequency characteristics.

##### 5.2.3 Data test signals

*Under consideration.*

### 5.3 RF (radio frequency) television signal

#### 5.3.1 General

The RF signal is usually digitally modulated by a MPEG transport stream containing audio, video and service information data.

Subclauses 3.3 and 3.4 of IEC 60107-1 as far as relevant shall apply.

#### 5.3.2 Reference modulation

The modulation shall be in accordance with the system for which the receiver under test is designed.

(1) Cable systems:

64QAM, 16VSB modulation formats are used on cable systems.

(2) Satellite broadcast:

QPSK, TC-8PSK, BPSK modulation formats are used for satellite broadcast.

(3) Terrestrial broadcast:

COFDM, band-segmented OFDM, 8VSB modulation formats are used for terrestrial broadcasting.

QPSK, DQPSK, 16QAM and 64QAM are used for modulating carriers when using OFDM (COFDM or band-segmented OFDM) modulation format for transmission.

In the following sections, the typical notation “QAM, PSK, OFDM and VSB” are used instead of 16QAM, 64QAM, 256QAM, QPSK, COFDM, band-segmented OFDM and 8VSB.

#### 5.3.3 Signal level

IEC 62028:2002

<https://standards.iteh.ai/catalog/standards/sist/3c9e9c0d-53b3-46bd-b873-665d5716c603-30>

The RF signal level shall be expressed by the r.m.s. voltage of the modulated carrier on a terminating resistor. The definition of the RF signal level is according to 3.4 of IEC 60107-1.

### 5.4 Measuring systems and test instruments

#### 5.4.1 Measuring system

A notional block diagram for the measuring system is shown in figure 2.

#### 5.4.2 Base band test signal generators

The video signal generator can be used for still picture image, and VCR and DVD can be used for moving picture image.

#### 5.4.3 Service data generator

*Under consideration.*

#### 5.4.4 Encoders

The video encoder shall be capable of encoding video signals in accordance with MPEG2 format.

The audio encoder shall be capable of encoding audio signals in accordance with MPEG2 or AC-3 or MPEG2-AAC format.