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Third edition
2001-11

Cabled distribution systems for television and sound signals –

Part 1: Methods of measurement and system performance

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

CABLED DISTRIBUTION SYSTEMS FOR TELEVISION AND SOUND SIGNALS –

Part 1: Methods of measurement and system performance

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 60728-1 has been prepared by TA 5: Cable networks for television signals, sound signals and interactive services, of IEC technical committee 100: Audio, video and multimedia systems and equipment

This third edition cancels and replaces the second edition published in 1986, its amendment 1 (1992) and amendment 2 (1995) of which it constitutes a technical revision.

The text of this standard is based on

| FDIS | Report on voting |
|--------------|------------------|
| 100/404/FDIS | 100/436/RVD |

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 3.

Annexes A, B, C, D, E, F, G, H and I form an integral part of this standard.

The committee has decided that the contents of this publication will remain unchanged until 2005. At this date, the publication will be

- reconfirmed;
- withdrawn;

- replaced by a revised edition, or
- amended.

The following differences exist in some countries:

– 5.2.1: Replace by the following “Minimum and maximum carrier levels” regulation (France):

| | |
|---------------------------------|--|
| AM-VSB television: | |
| between 47 MHz and 68 MHz: | 57,5 dB(μ V) _{min} 74,0 dB(μ V) _{max} |
| between 118,75 MHz and 862 MHz: | 57,0 dB(μ V) _{min} 74,0 dB(μ V) _{max} |
| FM sound mono or stereo: | 50 dB(μ V) _{min} 66 dB(μ V) _{max} |

Replace by/add the following “Minimum and maximum carrier levels” regulation (Japan):

| | |
|--|--|
| AM-VSB television | 60 dB(μ V) _{min} 85 dB(μ V) _{max} |
| FM sound mono or stereo | 50 dB(μ V) _{min} 75 dB(μ V) _{max} |
| FM NTSC television | 57 dB(μ V) _{min} |
| FM HDTV (1 035 MHz~1 335 MHz) | 57 dB(μ V) _{min} |
| AM HDTV | 65 dB(μ V) _{min} 85 dB(μ V) _{max} |
| 64QAM digital TV | 53 dB(μ V) _{min} 85 dB(μ V) _{max} |
| Upper CH adjacent to AM-VSB television | 53 dB(μ V) _{min} 81 dB(μ V) _{max} |
| Lower CH adjacent to AM-VSB television | 53 dB(μ V) _{min} 79 dB(μ V) _{max} |

Replace by/add the following “Minimum and maximum carrier levels” regulation (Netherlands):

| | |
|----------------|--------------------------------|
| FM sound mono: | 80 dB(μ V) _{max} |
| DSR: | 39 dB(μ V) _{max} |

(measured in accordance with CISPR 16-1 (quasi peak measurement within 120 kHz bandwidth))

Replace by the following “Minimum and maximum carrier levels” regulation (Norway):

| | |
|--------------------------|--|
| AM-VSB television: | 60,0 dB(μ V) _{min} 84,0 dB(μ V) _{max} |
| FM sound mono or stereo: | 52 dB(μ V) _{min} 80,0 dB(μ V) _{max} |

- 5.2.2: Replace by/add the following “Carrier level differences” regulation (France):

| | | |
|------------------------|--------|---|
| TV channels in AM-VSB: | ≤12 dB | Between 47 MHz and 862 MHz |
| TV channels in FM: | ≤12 dB | Between 950 MHz and 2 050 MHz |
| | ≤4 dB | Between adjacent channels spaced less than 40 MHz |

– 5.2.2: Replace by/add the following “Carrier level differences” regulation (Japan):

| | |
|---------------------------------|---|
| AM-VSB television | Not more than 10 dB (not more than 3 dB between adjacent CH) |
| Sound carrier to vision carrier | –3 to –14 dB (–9 dB to –14 dB between adjacent CH) |
| FM | Not more than 10 dB |
| FM carrier to AM-VSB | Not more than –10 dB |
| FM NTSC | Not more than 6 dB |
| FM HDTV | Not more than 6 dB |
| AM HDTV | Not more than 3 dB between adjacent CH |
| 64 QAM carrier to AM-VSB | |
| Upper CH adjacent to AM-VSB | –4 dB to –18 dB |
| Lower CH adjacent to AM-VSB | –6 dB to –20 dB |

Replace by/add the following “Carrier level differences” regulation (Norway):

| | |
|--------------------|------------------------------|
| AM-VSB television: | |
| | ≤2 dB within a TV channel |
| | ≤6 dB within band I, II, III |
| | ≤10 dB within band IV |
| | ≤12 dB within band V |

– 5.3.1: Replace by/add the following “Isolation between two subscribers” regulation (France):

| | |
|---------------------|--|
| TV/TV: ≥30 dB | Between 10 MHz and 2 050 MHz |
| TV/FM sound: ≥50 dB | Between the TV outlet of any subscriber and the FM sound outlet of an other subscriber |

Replace by /add the following “Isolation between two subscribers” regulation (Japan):

| | |
|--|---------------------|
| TV/TV (mutual isolation of a subscriber tap) | Not less than 25 dB |
| TV/FM (in case of FM filter use) | Not less than 35 dB |

Replace by/add the following “Isolation between two subscribers” regulation (Norway):

| | | |
|-------------|--------|---------------------------|
| TV/TV | ≥36 dB | Between 47 MHz – 470 MHz |
| | ≥30 dB | Between 470 MHz – 790 MHz |
| FM sound/TV | ≥46 dB | |

– 5.4.1: Replace by/add the following “Amplitude response” regulation (France):

| | |
|--------------------------------------|-----------------------|
| For an RF outlet and SECAM channels: | |
| $\leq \pm 1,2$ dB | Between 0 and 4 MHz |
| $\leq \pm 2$ dB | For the 4,8 MHz burst |

– 5.4.1: Replace by/add the following “Amplitude response” regulation (Japan):

| | |
|---|----------------|
| For an RF outlet and NTSC channels (–0,5 MHz~4 MHz) | –3 dB to +4 dB |
| 64QAM digital channels (bandwidth 5,274 MHz) | ± 3 dB |

– 5.4.2: Add the group delay response curve valid for PAL with FM-FM sound (figure 39) (Netherlands).

– 5.5: Replace by/add the following “Frequency stability” regulation (France):

NOTE The stability values, given hereinafter, are referenced to the specified value of the carrier.

| | |
|---------------------------------|--------------|
| AM-VSB-TV and L-SECAM channels: | ± 50 kHz |
|---------------------------------|--------------|

NOTE Regulation makes provision for precision offset tuning between adjacent channels.

| | | |
|--------|---------------|-----------------------------------|
| FM-TV: | ± 3 MHz | for satellite originated channels |
| | ± 175 kHz | for locally modulated channels |

Replace by/add the following “Frequency stability” regulation (Japan):

| | |
|---|------------------------------|
| AM-VSB television | ± 20 kHz |
| Between vision carrier and sound carrier | ± 2 kHz |
| FM | ± 20 kHz |
| 64QAM digital (DVB-C) QPSK digital (DVB-S) OFDM (Japan) | ± 20 kHz u.c. u.c. |

– 5.6: Replace by/add the following “Random noise” regulation (France):

| | | |
|------------|--------------------|---|
| AM-VSB-TV: | $C/N \geq 45,5$ dB | in a 5 MHz bandwidth (measured according to 4.5 of IEC 60728-1) |
|------------|--------------------|---|

Replace by/add the following “Random noise” regulation (Japan):

| | |
|--------------------------------------|--------------------------|
| AM-VSB television (bandwidth 4 MHz) | C/N: not less than 38 dB |
| FM (bandwidth 200 kHz) | C/N: not less than 28 dB |
| FM-NTSC (bandwidth 27MHz) | C/N: not less than 15 dB |
| FM-HDTV (bandwidth 27MHz) | C/N: not less than 16 dB |
| AM-HDTV (bandwidth 4 MHz equivalent) | C/N: not less than 41 dB |
| 64QAM digital (bandwidth 5,274 MHz) | C/N: not less than 31 dB |

Replace by the following “Random noise” regulation (Norway):

| | |
|---------------------------|------------------|
| AM-VSB-TV: | $C/N \geq 43$ dB |
| FM sound mono and stereo: | $C/N \geq 45$ dB |

– 5.7.1: Replace by the following “Single frequency interference” regulation (France):

Single frequency interference for AM-VSB-TV-channels according to the templates given in figure 40.

Replace by/add the following “Single frequency interference” regulation (Japan):

| | |
|----------------|----------------------------------|
| VSB-AM NTSC | Not less than 50 dB (figure 41) |
| VSB-AM HDTV | Not more than –60 dB (figure 42) |
| 64 QAM digital | Not more than –30 dB (figure 43) |

– 5.7.1: Replace by/add the following “Single frequency interference” regulation (Netherlands):

| | |
|---|--------------------------------------|
| AM-VSB-PAL-signals: C/I ≥ 60 dB | (measured in a bandwidth of 300 kHz) |
| For signals outside used TV channels: C/I ≥ 40 dB | |

Replace by the following “Single frequency interference” regulation (Norway):

| | |
|------------------|-------------|
| AM-VSB-channels: | C/I ≥ 60 dB |
|------------------|-------------|

– 5.7.2: Replace by/add the following “Single channel intermodulation” regulation (Japan):

| | |
|---------|----------------------|
| FM-NTSC | Not more than –36 dB |
| FM HDTV | Not more than –36 dB |

– 5.7.3: Replace by the following “Multiple frequency intermodulation interference” regulation (France):

Third order: weighted summation of the clusters of composite triple beats, with the frequency channel allocation anticipated for the cable system:

$$\frac{C}{CTB} \geq 52 \text{ dB}$$

Otherwise, with the test carriers listed in table 15 (30 carriers):

$$\frac{C}{CTB} \geq 52 \text{ dB} + 20 \lg n/30$$

(n is the number of anticipated channels)

Second order: no specification

– 5.7.4: Replace by/add the following “Cross modulation” regulation (Japan):

| | |
|--|----------------------|
| Cross modulation ($20 \lg\{(a-b)/a\}$) | Not more than –40 dB |
|--|----------------------|

– 5.8.1 Replace by the following “Differential gain and phase” regulation (France):

| | |
|---------------|------------------------------------|
| PAL or SECAM: | Differential gain $\leq 15\%$ |
| | Differential phase $\leq 10^\circ$ |

– 5.8.2: Replace the requirements for “Echoes in television channels, PAL-SECAM standards” by the “Requirement for echo loss in relation to the time delay of the reflected signal for AM-PAL-TV and FM-radio” (figure 44) (Netherlands).

– 5.8.2 Replace by/add the following “Echoes” regulation (Japan):

| | |
|----------------|-------------|
| VSB-AM NTSC | (figure 45) |
| FM NTSC | (figure 46) |
| FM HDTV | (figure 47) |
| VSB-AM HDTV | (figure 48) |
| 64 QAM Digital | (figure 49) |

– 5.9: Replace the requirement for “Hum modulation” by ≥ 52 dB (Norway).

– 5.9: Replace by /add the following “Hum modulation” regulation (Japan):

| | |
|-------------------------------|--|
| AM-VSB $(20 \lg\{(a-b)/a\})$ | Not more than -50 dB (50 Hz) Not more than -40 dB (60 Hz) |
| AM-HDTV $(20 \lg\{(a-b)/a\})$ | Not more than -50 dB (50 Hz) Not more than -40 dB (60 Hz) |

– 5.10.1: Add the requirement for “Decoding margin” being “The decoding margin must be 40 %, when the margin is minimum 70 % at the receiving antenna” (Denmark).

– 5.11.1.5: Replace by/add the following “Phase noise” regulation (Japan):

| | |
|------------------------|------|
| 64 QAM digital (DVB-C) | u.c. |
|------------------------|------|

– 5.12.1: Add the requirement for “Amplitude response within the entire FM-band” being ≤ 6 dB (Norway).

– 5.12.3: Add the requirement for “Adjacent channel spacing” by ≥ 400 kHz (Netherlands).

Add the requirement for “Adjacent channel spacing” by ≥ 500 kHz (Norway).

– 5.12.4: Replace the requirement for “AM hum modulation on FM sound carriers” by 52 dB (Norway).

INTRODUCTION

The reception of television signals inside a building requires an outdoor antenna and a distribution network to convey the signal to the TV receivers.

The installation of an outdoor antenna for each TV receiver must be avoided for several obvious technical, economical and practical reasons.

In apartment blocks, the installation of a master antenna television system for terrestrial (MATV) and/or satellite (SMATV) reception as shown in figure 1 is usual.

When signals to be conveyed to the TV receivers are picked-up far away due to geographical reasons and the number of users (subscribers) is very high, the installation of a cabled distribution system using coaxial cables and/or fibre optic cables is used as indicated in figure 2.

A system model of a cabled distribution system is shown in figure 3, where the main parts of the systems are indicated, as defined in clause 3.

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CABLED DISTRIBUTION SYSTEMS FOR TELEVISION AND SOUND SIGNALS –

Part 1: Methods of measurement and system performance

1 Scope

This part of IEC 60728 is applicable to any cabled distribution system (including individual receiving systems) having a coaxial cable output and primarily intended for television and sound signals operating between about 30 MHz and 2 150 MHz.

This standard specifies the basic methods of measurement of the operational characteristics of cabled distribution systems having coaxial cable outputs in order to assess the performance of these systems and their performance limits.

All requirements refer to the performance limits which are obtained between the input(s) to the headend or headends and any system outlet when terminated in a resistance equal to the nominal load impedance of the system, unless otherwise specified. Where system outlets are not used, the above applies at the subscriber's end of the subscriber's feeder.

NOTE 1 Basic methods of measurement are described in this standard. However, any equivalent method that ensures at least the same accuracy may be used.

NOTE 2 If the system operator wishes to subdivide the system into a number of parts, the accumulation of degradations should not exceed the figures given below.

NOTE 3 An extension of the frequency range to that from 5 MHz to 3 000 MHz will be considered for future work.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 60728. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of IEC 60728 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60050-713, *International Electrotechnical Vocabulary – Part 713: Radiocommunications: transmitters, receivers, networks and operation*

IEC 60728-3, *Cabled distribution systems for television and sound signals – Part 3: Active coaxial wideband distribution equipment*

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

ISO/IEC 13818-2, *Information technology – Generic coding of moving pictures and associated audio information: Video*

ISO/IEC 13818-3, *Information technology – Generic coding of moving picture and associated audio information – Part 3: Audio*

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

ITU-T Recommendation J.61, *Transmission performance of television circuits designed for use in international connections*

ITU-T Recommendation J.63, *Insertion of test signals in the field-blanking interval of monochrome and colour television signals*

ITU-R Recommendation BT.470-6, *Conventional television systems*

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

EN 300421, *Digital Video Broadcasting (DVB); DVB framing structure, channel coding and modulation for 11/12 GHz satellite services*

EN 300429, *Digital Video Broadcasting (DVB); DVB framing structure, channel coding and modulation for cable systems*

EN 300468, *Digital Video Broadcasting (DVB); Specification for Service Information (SI) in DVB systems*

EN 300473, *Digital Video Broadcasting (DVB); DVB Satellite Master Antenna Television (SMATV) distribution systems*

EN 300744, *Digital Video Broadcasting (DVB); Framing structure, channel coding and modulation for digital terrestrial television*

ETR 211, *Digital Video Broadcasting (DVB); DVB guidelines on implementation and usage of Service Information (SI)*

3 Terms, definitions, symbols and abbreviations

3.1 Terms and definitions

For the purpose of this part of IEC 60728, the following terms and definitions apply.

3.1.1 headend

equipment which is connected between receiving antennas or other signal sources and the remainder of the cabled distribution system, to process the signals to be distributed

NOTE The headend may, for example, comprise antenna amplifiers, frequency converters, combiners, separators and generators.

3.1.2 local headend

a headend which is directly connected to the system trunk feeders or to a short haul trunk feeder replacement link

3.1.3 hub headend

a headend used to feed the entire operating network in the service area

3.1.4 remote headend

a headend from which signals are delivered to a local headend via a long-distance terrestrial link

**3.1.5
distribution point**

a point where signals are taken from the trunk feeder to energize branch and/or spur feeders

NOTE In some cases, a distribution point may be directly connected to the headend.

**3.1.6
feeder**

a transmission path forming part of a cabled distribution system. Such a path may consist of a metallic cable, optical fibre, waveguide, or any combination of them. By extension, the term is also applied to paths containing one or more radio links.

**3.1.7
supertrunk feeder**

a feeder which connects only between headends or between a headend and the first distribution point

**3.1.8
trunk feeder**

a feeder used for the transmission of signals between a headend and a distribution point or between distribution points

**3.1.9
branch feeder**

a feeder used for connecting a distribution point to spur feeders

**3.1.10
spur feeder**

a feeder to which splitters, subscriber taps, or looped system outlets are connected

**3.1.11
subscriber feeder**

a feeder connecting a subscriber tap to a system outlet or, where the latter is not used, directly to the subscriber's equipment

NOTE A subscriber feeder may include filters and balun transformers.

**3.1.12
antenna amplifier**

an amplifier (often a low-noise type) associated with an antenna

**3.1.13
trunk amplifier**

an amplifier to compensate for the attenuation in a trunk feeder

**3.1.14
bridger amplifier**

a) an amplifier for connection in a trunk feeder to energize a distribution point

b) an amplifier for connection in a branch feeder, to energize one or more branch or spur feeders

**3.1.15
trunk-bridger amplifier**

an amplifier to compensate for the attenuation in a trunk feeder and also to energize a distribution point