IEC 60728-4

Edition 3.0 2007-08

INTERNATIONAL STANDARD

Cable networks for television signals, sound signals and interactive services – Part 4: Passive wideband equipment for coaxial cable networks

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE V

ICS 33.060.40; 33.170

ISBN 2-8318-9265-1

CONTENTS

FOREWORD 4
INTRODUCTION 6

1 Scope 7
2 Normative references 7
3 Terms, definitions, symbols and abbreviations 8
3.1 Terms and definitions 8
3.2 Symbols 12
3.3 Abbreviations 13
4 Methods of measurement 13
4.1 Attenuation 13
4.1.1 Test equipment 13
4.1.2 Measurement procedure 13
4.1.3 Presentation of the results 14
4.2 Isolation 14
4.2.1 Definition 14
4.2.2 Test equipment 14
4.2.3 Measurement procedure 14
4.2.4 Presentation of the results 15
4.3 Through-loss 15
4.3.1 Definition 15
4.3.2 Test equipment 15
4.3.3 Measurement procedure 15
4.3.4 Presentation of the results 15
4.4 Group delay variation 15
4.4.1 Definition 15
4.4.2 Test equipment 15
4.4.3 Method of measurement 16
4.4.4 Presentation of the result 16
4.5 Amplitude frequency response 16
4.6 Return loss 16
4.7 Hum modulation of carrier 16
4.7.1 Definition 16
4.7.2 Description of the method of measurement 17
4.7.3 Measuring procedure 18
4.7.4 Calculating the hum-modulation ratio 19
4.7.5 Presentation of the results 20
4.8 Two-carrier intermodulation measurements for second- and third-order products 20
5 Performance requirements and recommendations 21
5.1 General performance requirements and recommendations 21
5.1.1 Safety 21
5.1.2 Electromagnetic compatibility (EMC) 21
5.1.3 Environmental 21
5.1.4 Marking 22
5.1.5 Impedance 22

5.1.6 Degradation of performance caused by overvoltages 22
5.2 Performance requirements and recommendations for receiver lead 22
5.3 Performance requirements and recommendations for system outlets 22
5.3.1 Safety 22
5.3.2 Quality grading 22
5.3.3 Mechanical requirements 23
5.3.4 Electrical parameters and requirements 23
5.4 Performance requirements and recommendations for splitters and taps 26
5.4.1 Description 26
5.4.2 Mechanical requirements for connectors 26
5.4.3 Electrical parameters and requirements 26
5.5 Performance requirements and recommendations for all other passive equipment 28
5.5.1 Description 28
5.5.2 Mechanical requirements for connectors 28
5.5.3 Electrical parameters and requirements 28

Bibliography 32

Annex A (informative) Measurement errors which occur due to mismatched equipment 30
Annex B (informative) Differences in some countries 31

Figure 1 – Test set-up for the measurement of attenuation 14
Figure 2 – Test set-up for the measurement of isolation 14
Figure 3 – Measurement of through-loss 15
Figure 4 – Carrier/hum ratio 16
Figure 5 – Test set-up for power injectors 17
Figure 6 – Test set-up for passive equipment, excluding power injectors 18
Figure 7 – Oscilloscope display 18
Figure 8 – Harmonic/Intermodulation test circuit 20
Figure 9 – Types of losses of system outlets 25
Figure A.1 – Error concerning return loss measurement 30
Figure A.2 – Maximum ripple 30

Table 1 – Return loss of system outlets 23
Table 2 – Return loss of looped-through system outlets 24
Table 3 – Maximum return path signal level derived from maximum allowed intermodulation distortion level in the downstream frequency band 26
Table 4 – Return loss of splitters and taps 26
Table 5 – Isolation of splitters 27
Table 6 – Return loss for all other passive equipment 28

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

Part 4: Passive wideband equipment for coaxial cable networks

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardisation comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardisation in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). 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. IEC collaborates closely with the International Organization for Standardisation (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60728-4 has been prepared by technical area 5: Cable networks for television signals, sound signals and interactive services, of IEC technical committee 100: Audio, video and multimedia systems and equipment.

This third edition cancels and replaces the second edition published in 2000, of which it constitutes a technical revision.

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

- Subclause 3.1 includes several new or modified definitions.
- Clause 4 includes added test methods for attenuation, isolation, through-loss, group delay variation, amplitude frequency response and two carrier intermodulation measurements for second- and third-order products.
- Clause 5 includes updated and new performance requirements.

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

FDIS	Report on voting
100/1243/FDIS	100/1275/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 2.

For the differences existing in some countries, see Annex B.

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

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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

A bilingual version of this publication may be issued at a later date.

INTRODUCTION

Standards of the IEC 60728 series deal with cable networks including equipment and associated methods of measurement for headend reception, processing and distribution of television signals, sound signals and their associated data signals and for processing, interfacing and transmitting all kinds of signals for interactive services using all applicable transmission media.

This includes

- CATV[1]-networks;
- MATV-networks and SMATV-networks;
- individual receiving networks;

and all kinds of equipment, systems and installations installed in such networks.

The extent of this standardization work is from the antennas and/or special signal source inputs to the headend or other interface points to the network up to the terminal input.

The standardization of any user terminals (i.e., tuners, receivers, decoders, multimedia terminals, etc.) as well as of any coaxial, balanced and optical cables and accessories thereof is excluded.

---

1 This word encompasses the HFC networks used nowadays to provide telecommunications services, voice, data, audio and video both broadcast and narrowcast.

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

Part 4: Passive wideband equipment for coaxial cable networks

1 Scope

This part of IEC 60728 applies to system outlets, splitters and taps, passive single or multiple port equipment comprising filters, attenuators, equalizers, galvanic isolators, power injectors, cable splices, terminating resistors and transfer points, but excluding coaxial cables and receiver leads (see 5.2).

This standard

- covers the frequency range 5 MHz to 3 000 MHz;
- identifies performance requirements for certain parameters;
- lays down data publication requirements for certain parameters;
- stipulates methods of measurements;
- introduces minimum requirements defining quality grades.

There are three grades for all passive equipment except system outlets where there is only one.

Different networks require the same performance and, when integrating networks, upgrading will be avoided.

Practical experience has shown that these three grades meet most of the technical requirements necessary for supplying a minimum signal quality to the subscribers. This classification should not be considered as a requirement but as information for users and manufacturers on the minimum quality criteria of the material required to install networks of different sizes. The system operator should select appropriate material to meet the minimum signal quality at the subscriber's outlet and to optimize cost/performance, taking into account the size of the network and local circumstances.

All requirements and published data should be understood as guaranteed values within the specified frequency range and in well-matched conditions.

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 60068 (all parts), *Environmental testing*

IEC 60417, *Graphical symbols for use on equipment*

NOTE IEC 60417 can be consulted on the IEC website.

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 60617, *Graphical symbols for diagrams*

IEC 60728 (all parts), *Cable networks for television signals, sound signals and interactive services*

NOTE The title of some of the parts of the IEC 60728 series will be changed when a new edition is published.

IEC 60966-1, *Radio frequency and coaxial cable assemblies – Part 1: Generic specification – General requirements and test methods*

IEC 60966-2-4, *Radio frequency and coaxial cable assemblies – Part 2-4: Detail specification for cable assemblies for radio and TV receivers – Frequency range 0 to 3 000 MHz, IEC 61169-2 connectors*

IEC 60966-2-5, *Radio frequency and coaxial cable assemblies – Part 2-5: Detail specification for cable assemblies for radio and TV receivers – Frequency range 0 to 1 000 MHz, IEC 61169-2 connectors*

IEC 60966-2-6, *Radio frequency and coaxial cable assemblies – Part 2-6: Detail specification for cable assemblies for radio and TV receivers – Frequency range 0 to 3 000 MHz, IEC 61169-24 connectors*

IEC 61000-4-5, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

IEC 61000-6-1, *Electromagnetic compatibility (EMC) – Part 6-1: Generic standards – Immunity for residential, commercial and light-industrial environments*

IEC 61169-1, *Radio-frequency connectors – Part 1: Generic specification – General requirements and measuring methods*

IEC 61169-2, *Radio-frequency connectors – Part 2: Sectional specification – Radio-frequency coaxial connectors of type 9,52*

IEC 61169-24, *Radio-frequency connectors – Part 24: Sectional specification – Radio-frequency coaxial connectors with screw coupling, typically for use in 75 ohm cable distribution systems (type F)*