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# Final Committee Draft ISO/IEC 15018:

# Information technology - Generic cabling for homes

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# Final Committee Draft ISO/IEC 15018: Information technology - Generic cabling for homes

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# Final Committee Draft ISO/IEC 15018: Information technology - Generic cabling for homes

## Foreword

1) ISO (the International Organisation for Standardisation) and IEC (the International Electrotechnical Commission) form the specialised system for world-wide standardisation. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by these organisations to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organisations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

2) In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75% of the national bodies casting a vote.

3) International Standard ISO/IEC 15018, Information Technology – Generic cabling system for homes, was prepared by the Joint Technical Committee ISO/IEC JTC 1/SC 25, Interconnection of Information Technology Equipment.

4) This International Standard has taken into account requirements specified in application. It refers to International Standards for components and test methods whenever an appropriate International Standard is available.

# Introduction

This standard specifies a generic cabling infrastructure for three groups of applications in homes:

- Information and Communications Technologies (ICT);
- Broadcast and Communications Technologies (BCT);
- Commands, Control and Communications in Buildings (CCCB);

as shown in Figure 1 and is intended to guide new installations.

This standard also applies where cabling is installed to support one or two of the above application groups.

These groups of applications may also be supported by different types of cabling, which may be subject to other standards. For example, ISO/IEC 11801 specifies generic cabling for ICT applications in general for the office environment. While the cabling structure and reference implementations are matched to the home environment, the channel performances specified in this standard for ICT are identical to those specified in ISO/IEC 11801.

This standard specifies a generic cabling for a home that may support ICT, BCT and CCCB application groups. Because it is designed to cover the three major groups the cabling system may be installed prior to the selection of specific applications. The home may contain one or more buildings (e.g. farm) or may be within a building which contains more than one home (e.g. one home in a multi-dwelling building).

The campus or backbone cabling connecting individual homes is built according to the relevant standard (for instance ISO/IEC 11801, IEC 60728).

Appropriate use of this standard:

a) allows deployment of a wide range of applications without changes to the fixed cabling infrastructure;

b) provides a platform to support moves, adds and changes of connectivity.

This standard specifies a generic cabling infrastructure based upon balanced cabling, coaxial cabling and / or optical fibre cabling.

This standard provides:

- users with an application-independent generic cabling for applications run in homes;
- users with a flexible cabling scheme such that changes are both easy and economical;
- building professionals (for example, architects) with guidance for accommodating cabling before specific requirements are known i.e. in the initial planning either for construction or refurbishment;
- industry and applications standardisation bodies (e.g. ITU-T, ISO/IEC JTC 1/SC 6, ISO/IEC JTC 1/SC 25/WG1, IEC TC 100) with a cabling system that supports current products and provides a basis for future product development;
- users, designers, and manufacturers of application-specific cabling systems with advice on interfacing to this generic cabling;
- suppliers of cabling components and installers of cabling with relevant requirements.

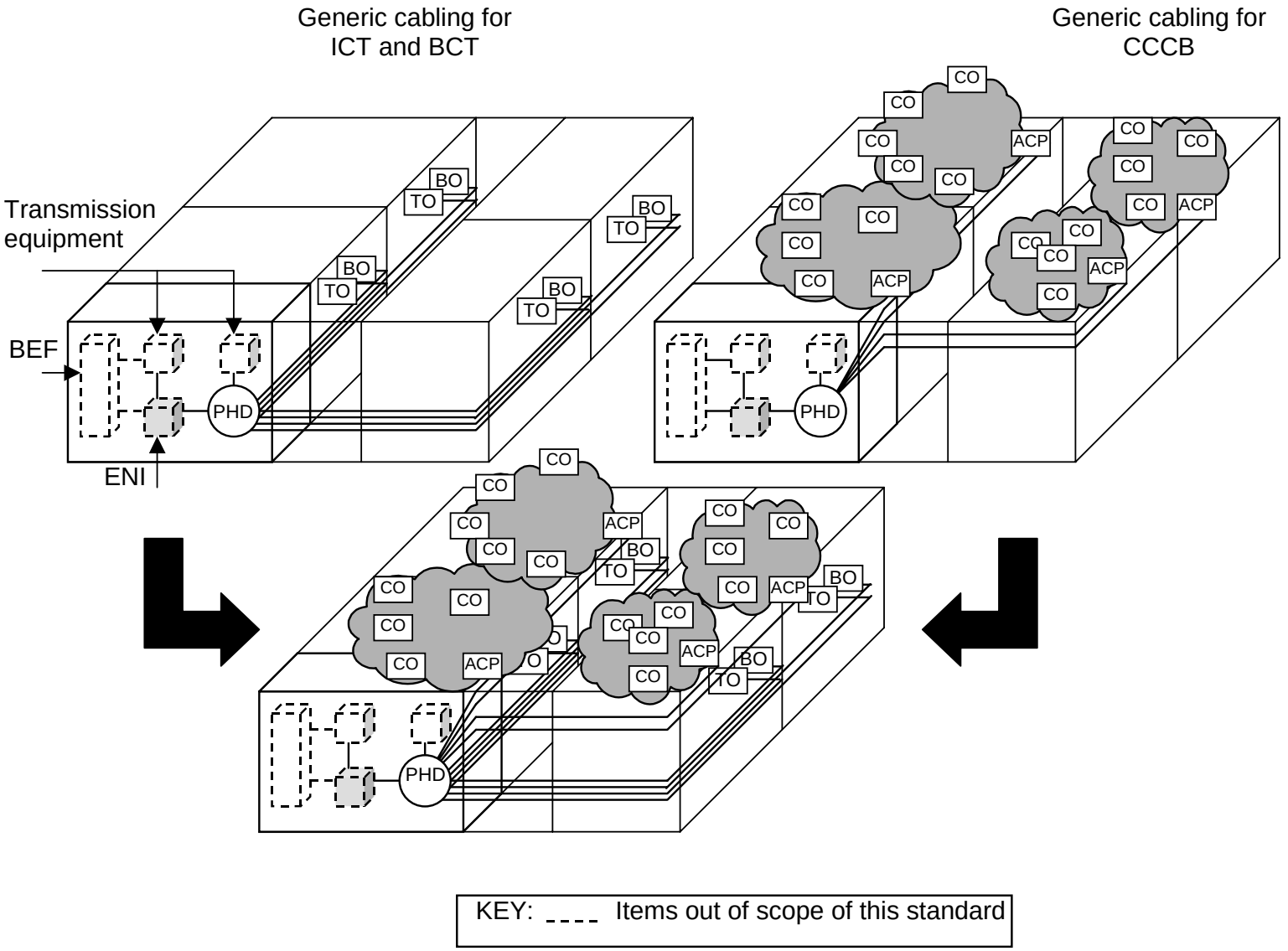


**Figure 1 – Overview of a generic cabling for home**

A number of ICT, BCT and CCCB applications have been analysed to determine the requirements for a generic cabling (see Table D. 2 in Annex D) and to specify the minimum performance of channels given in clause 7. These requirements, together with the logical and physical models described in clause 5 and 6, have been used to develop the requirements for cabling components and to stipulate their arrangement into generic cablings.

Wireless and (unguided) infrared as well as Power Line Communication may also be used for applications mentioned above. Media used for these technologies are not covered in this standard.

NOTE Specific codes and regulations may preclude carrying certain services on the cabling specified in this standard.

# Final Committee Draft ISO/IEC 15018: Information technology - Generic cabling for homes

## 1 Scope

This standard specifies generic cabling for the home. A home may contain one or more buildings or may be within a building which contains more than one home.

This standard specifies a generic cabling infrastructure for three groups of applications:

- Information and Communications Technologies (ICT);
- Broadcast and Communications Technologies (BCT);
- Commands, Controls and Communications in Buildings (CCCB).

It specifies cabling that comprises one or more of the following :

- balanced cabling;
- coaxial cabling;
- optical fibre cabling.

The standard specifies the requirements for the design and configuration of the generic cabling with respect to:

a) structure and topology;
b) minimum configuration;
c) performance requirements for permanent links and channels;
d) density and location of connection points;
e) interfaces to application-specific equipment and external networks;
f) coexistence with other building services.

Although safety (electrical, fire, etc.) and electromagnetic compatibility (EMC) requirements are outside the scope of this International Standard and are covered by other standards and regulations, information given in this International Standard may be of assistance in meeting these requirements.

NOTE Test requirements in this standard are only for system designers. The installation tests should be decided between supplier and customer.

## 2 Normative References

The following standards contain provisions that, through references in this text, constitute part of ISO/IEC 15018. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on ISO/IEC 15018 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

| | |
|---|---|
| IEC 60189-1 | *Low-frequency cables and wires with p.v.c. insulation and p.v.c. sheath – Part 1: General test and measuring methods* |
| IEC 60352-3 | *Solderless connections – Part 3: Solderless accessible insulation displacement connections – General requirements, test methods and practical guidance* |
| IEC 60352-4 | *Solderless connections – Part 4: Solderless non-accessible insulation displacement connections – General requirements, test methods and practical guidance* |

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|---|---|
| IEC 60352-6 | *Solderless connections – Part 6: Insulation piercing connections – General requirements, test methods and practical guidance* |
| IEC 60364-4-41 | *Electrical installations of buildings – Part 4: Protection for safety – Chapter 41: Protection against electric shock* |
| IEC 60512-2 | *Electromechanical components for electronic equipment; basic testing procedures and measuring methods – Part 2: General examination, electrical continuity and contact resistance tests, insulation tests and voltage stress tests* |
| IEC 60512-25-1 | *Connectors for electronic equipment – Tests and measurements - Part 25-1: Test 25a - Crosstalk ratio* |
| IEC 60512-25-2 | *Connectors for electronic equipment – Tests and measurements - Part 25-2: Test 25b - Attenuation* |
| IEC 60512-25-4 | *Connectors for electronic equipment - Tests and measurements - Part 25-4: Test 25d - Propagation delay* |
| IEC 60512-25-5: (under consideration) | *Connectors for electronic equipment- Basic tests and measurements-Part 25-5: Test 25e - Return loss* |
| IEC 60512-3 | *Electromechanical components for electronic equipment; basic testing procedures and measuring methods. Part 3: Current-carrying capacity tests* |
| IEC 60603-7 | *Connectors for frequencies below 3 MHz for use with printed boards - Part 7: Detail specification for connectors, 8-way, including fixed and free connectors with common mating features, with assessed quality* |
| IEC 60603-7-1:2002 | *Connectors for electronic equipment – Part 7-1: Detail specification for 8-way, shielded free and fixed connectors, with common mating features, with assessed quality* |
| IEC 60603-7-2:(under consideration) | *Connectors for electronic equipment – Part 7-2: Detail specification for 8-way unshielded free and fixed connectors, for data transmission with frequencies up to 100 MHz* |
| IEC 60603-7-3: (under consideration) | *Connectors for electronic equipment – Part 7-3: Detail specification for 8-way shielded connectors for frequencies up to 100 MHz* |
| IEC 60603-7-4 | *Connectors for electronic equipment – Part 7-4: Detail specification for 8-way, unshielded, free and fixed connectors, for data transmissions with frequencies up to 250 MHz (CAT 6, unshielded)* |
| IEC 60603-7-5 | *Connectors for electronic equipment – Part 7-5: Detail specification for 8-way, shielded, free and fixed connectors, for data transmissions with frequencies up to 250 MHz (CAT 6, shielded)* |
| IEC 60603-7-7:2002 | *Connectors for electronic equipment – Part 7-7: Detail specification for 8-way, shielded, free and fixed connectors, for data transmission with frequencies up to 600 MHz (category 7, shielded)* |
| IEC 60728 series | *Cabled distribution systems for television and sound signals* |
| 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 3000 MHz, IEC 60169-2 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 60169-2 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 60169-24 connectors* |
| IEC 61024 series | *Protection of structures against lightning* |

| | |
|---|---|
| IEC 61076-3-104 | *Connectors for electronic equipment - Part 3-104:Rectangular connectors – Detail specification for 8 way, shielded free and fixed connectors for data transmissions with frequencies up to 600 MHz minimum* |
| IEC 61140 | *Protection against electric shock - Common aspects for installation and equipment* |
| IEC 61156 series | *Multicore and symmetrical pair/quad cables for digital communications* |
| IEC 61156-1 | *Multicore and symmetrical pair/quad cables for digital communications – Part 1 : Generic specification* |
| IEC 61156-2 | *Multicore and symmetrical pair/quad cables for digital communications – Part 2 : Horizontal floor wiring – Sectional specification* |
| IEC 61156-3 | *Multicore and symmetrical pair/quad cables for digital communications – Part 3 : Work area wiring – Sectional specification* |
| IEC 61156-5 | *Multicore and symmetrical pair/quad cables for digital communications - Part 5: Symmetrical pair/quad cables with transmission characteristics up to 600 MHz - Horizontal floor wiring - Sectional specification* |
| IEC 61156-6 | *Multicore and symmetrical pair/quad cables for digital communications - Part 6: Symmetrical pair/quad cables with transmission characteristics up to 600 MHz - Work area wiring - Sectional specification* |
| IEC 61156-7 | *Multicore and symmetrical pair/quad cables for digital communications - Part 7: Symmetrical pair cables with transmission characteristics up to 1200 MHz -Sectional specification for digital and analog communications* |
| IEC 61169-1 | *Radio-frequency connectors - Part 1: Generic specification - General requirements and measuring methods* |
| IEC 61169-1-2 | *Radio-frequency connectors - Part 1-2:* |
| IEC 61169-2 | *Radio-frequency connectors - Part 2: Sectional specification - Radio frequency coaxial connectors of type 9,52* |
| IEC 61169-2-2 | *Radio-frequency connectors - Part 2-2:* |
| IEC 61169-2-3 | *Radio-frequency connectors - Part 2-3:* |
| IEC 61169-2-4 | *Radio-frequency connectors - Part 3-4:* |
| 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)* |
| IEC 61935-1 | *Generic cabling systems - Specification for the testing of balanced communication cabling in accordance with ISO/IEC 11801 - Part 1: Installed cabling* |
| ISO/IEC 11801 Ed.2:2002 | *Information Technology – Generic cabling for customer premises* |
| ISO/IEC 14763-1 | *Information Technology – Implementation and operation of customer premises cabling – Part 1: Administration* |
| ISO/IEC TR 14763-2 | *Information technology - Implementation and operation of customer premises cabling – Part 2: Planning and installation* |
| ITU-T K.31 | *Bonding configurations and earthing of telecommunication installations inside a subscriber's building* |

# 3 Definitions and abbreviations

## 3.1 Definitions

For the purposes of this International Standard, the following definitions apply.

**3.1.1**
**application**
a system, with its associated transmission method, that is supported by cabling

**3.1.2**
**application outlet**
a point at which application-specific equipment may be connected to the generic cabling in support of ICT and/or BCT application

**3.1.3**
**area connection point (ACP)**
a point at which coverage area cabling is connected to area feeder cabling

**3.1.4**
**balanced cable**
a cable consisting of one or more metallic symmetrical cable elements (twisted pairs or quads) [ISO/IEC 11801]

**3.1.5**
**broadcast and communications technologies (BCT)**
a group of applications including sound radio and TV

NOTE These applications are also called HES class 3 in ISO/IEC TR 15044.

**3.1.6**
**building entrance facility (BEF)**
a facility that provides all necessary mechanical and electrical services, that complies with all relevant requirements, for the entry of telecommunications cables into a building.

**3.1.7**
**cable element**
the smallest construction unit (for example balanced pair, balanced quad, coaxial pair or single optical fibre) in a cable; a cable element may have a screen [ISO/IEC 11801]

**3.1.8**
**cable unit**
a single assembly of one or more cable elements of the same type or category; the cable unit may have a screen [ISO/IEC 11801]

**3.1.9**
**cabling**
a system of telecommunications cables, cords, and connecting hardware that can support the connection of information technology and other equipment

**3.1.10**
**channel**
the end-to-end transmission path connecting any two pieces of application-specific equipment

NOTE 1 Channels specified in this standard are within the boundaries of generic cabling and may only comprise passive components.

NOTE 2 A channel may use one or more pairs, may share a pair with another channel, e.g. power feeding and information may run over the same pair.

**3.1.11**
**coaxial pair**
a uniform transmission line consisting of two cylindrical conductors with the same axis [IEV]

**3.1.12**
**commands / controls and communications in buildings (CCCB)**
a group of applications such as appliance control and building control

NOTE These applications are also called HES class 1 in ISO/IEC TR 15044.

**3.1.13**
**connection**
mated device or combination of devices including terminations connecting two cables or cable elements.

**3.1.14**
**connector sharing**
the ability of a connector to accept multiple plugs in one socket such as 4 one-pair plugs in one 4 pair socket while maintaining the required performance; this may also be achieved by means of an external adapter

**3.1.15**
**coverage area**
area within a home covered by any application

**3.1.16**
**cross-connect**
apparatus enabling the termination of cable elements and their cross-connection, primarily by means of patch cords or jumpers [ISO/IEC 11801]

NOTE incoming and outgoing cables are terminated at fixed points [ISO/IEC 11801]; they are connected with the help of a third cable, a patch cord or a jumper cable.

**3.1.17**
**distributor**
term used for a collection of components (such as patch panels, patch cords) used to connect cables [ISO/IEC 11801]

**3.1.18**
**equipment interface (EI)**
interface at which application specific equipment is connected to the cabling

NOTE An application outlet is an example of an EI.

**3.1.19**
**home**
a physical structure used as a dwelling place, such as a house or an apartment

NOTE This may be an individual building, part of a larger building or more than one building.

**3.1.20**
**home electronic system (HES)**
electronic systems within homes that are interconnected in accordance with ISO/IEC TR 14543

**3.1.21**
**information and communications technologies (ICT)**
a group of applications using information and communications (telecommunications) technologies

NOTE These applications are also called HES class 2 in ISO/IEC TR 15044.

**3.1.22**
**insert**
device attached to an application outlet that provides a modified presentation and/or performance of the cable elements at the interface to the generic cabling

**3.1.23**
**intercom**
a communication system for voice and optionally video, internal to the premises often including door opening functions

**3.1.24**
**interconnect**
technique enabling equipment cords (or cabling subsystems) to be terminated and connected to the cabling subsystems without using a patch cord or jumper [ISO/IEC 11801]

NOTE Incoming or outgoing cables are terminated at a fixed point. [ISO/IEC 11801]

**3.1.25**
**link**
the transmission path between an outlet or distributor to another outlet or distributor of a generic cabling; it excludes equipment cords

**3.1.26**
**network access cabling**
cabling that brings services to the home from a source outside the home

**3.1.27**
**optical fibre cable (or optical cable)**
cable comprising one or more optical fibre cable elements [ISO/IEC 11801]

**3.1.28**
**pathway**
facility dedicated to or area reserved for the placement of cable

**3.1.29**
**permanent link**
the transmission path between two mated interfaces of generic cabling, excluding equipment cords, work area cords and cross-connections, but including the connecting hardware at each end [ISO/IEC 11801]

**3.1.30**
**primary home distributor (PHD)**
the primary distributor within a home where cables terminate

**3.1.31**
**remote power feeding**
the supply of power different from mains power to application-specific equipment via cabling specified by this standard

**3.1.32**
**requirement to be met by design**
a requirement which may be met by calculation and selection of appropriate materials and installation techniques, where either there is no test method specified that allows verification or there is no requirement for verification by testing

**3.1.33**
**screened balanced cable**
a balanced cable with an overall screen and / or screens for the individual elements [ISO/IEC 11801]

**3.1.34**
**secondary home distributor (SHD)**
an optional distributor used to provide additional infrastructure flexibility and / or transmission equipment between the primary home distributor and coverage areas (e. g. for homes with multiple floors)

**3.1.35**
**space**
area or volume defined by markings or fittings intended for the containment of connecting hardware

**3.1.36**
**terminal equipment**
equipment (e.g. telephone handset) that provides user access to an application / service at an outlet

**3.1.37**
**transmission equipment**
active equipment used to distribute applications from distributors to other distributors and to outlets

**3.1.38**
**twisted pair**
a cable element consisting of two insulated conductors twisted together in a regular fashion to form a balanced transmission line [ISO/IEC 11801]

**3.1.39**
**unscreened balanced cable**
an electrically conducting balanced cable without any screen

## 3.2 Abbreviations

| | |
|---|---|
| a.c. | alternating current |
| ACP | Area Connection Point |
| ACR | Attenuation to Cross-talk Ratio |
| BCT | Broadcast and Communications Technologies |
| BCT B | BCT supported by balanced cabling |
| BCT C | BCT supported by coaxial cabling |
| BCT-H | BCT high (signal level) |
| BCT-L | BCT low (signal level) |
| BCT-M | BCT medium (signal level) |
| BEF | Building Entrance Facility |
| BO | Broadcast Outlet |
| CATV | Community Antenna TV |
| CC | Cross-Connect |
| CCCB | Commands, Controls and Communications in Buildings |
| CCTV | Closed Circuit TV |
| CO | Control Outlet |

| | | |
|---|---|---|
| 466 | d.c. | direct current |
| 467 | EI | Equipment Interface |
| 468 | ELFEXT | Equal Level Far End Cross-talk attenuation (loss) |
| 469 | EMC | Electromagnetic Compatibility |
| 470 | ENI | External Network Interface |
| 471 | EQP | Transmission Equipment |
| 472 | FEXT | Far End Cross-talk |
| 473 | ffs | for further study |
| 474 | HES | Home Electronic System |
| 475 | HVAC | Heating, Ventilating, and Air-Conditioning |
| 476 | ICT | Information and Communications Technology |
| 477 | IEV | International Electrotechnical Vocabulary |
| 478 | ISDN | Integrated Services Digital Network |
| 479 | IL | Insertion Loss |
| 480 | N/A | Not Applicable |
| 481 | NEXT | Near-End cross-talk attenuation (loss) |
| 482 | OF | Optical Fibre |
| 483 | PELV | Protective Extra Low Voltage |
| 484 | PHD | Primary Home Distributor |
| 485 | PS | Power Source |
| 486 | PS ACR | Power sum ACR |
| 487 | PS ELFEXT | Power Sum ELFEXT |
| 488 | r.m.s. | root mean square |
| 489 | SELV | Safety Extra Low Voltage |
| 490 | SHD | Secondary Home Distributor |
| 491 | TE | Terminal Equipment |
| 492 | TI | Test Interface |
| 493 | TO | Telecommunications Outlet |
| 494 | TV | Television |

# 4 Conformance

For a cabling installation to conform to this International Standard the following shall apply.

c) The configuration of cabling in support of ICT and BCT applications shall conform to the requirements in clause 5.

d) The configuration of cabling in support of CCCB applications shall conform to the requirements in clause 6.

e) The interfaces to the cabling at the TO or the BO shall conform to the requirements of clause 10 with respect to mating interfaces and performance.

f) Connecting hardware at other places in the cabling structure shall meet the performance requirements specified in clause 10.

g) All channels and links shall meet the necessary level of performance specified in clause 7 and Annex B respectively. This shall be achieved by one of the following:

   1) a channel design and implementation ensuring that the prescribed channel is met;

   2) attachment of appropriate components to a permanent link design meeting the prescribed performance class of Annex B. Channel performance shall be assured where a channel is created by adding more than one cord to either end of a link meeting the requirements of Annex B;

   3) using the reference implementations of clause 8 and compatible cabling components conforming to the requirements of clauses 9 and 10, based upon a statistical approach of performance modelling.

h) System administration shall meet the requirements of ISO/IEC 14763-1.

i) Regulations concerning safety and EMC shall be met as applicable to the location of the installation.

# 5 Structure of the generic cabling system to support ICT and/or BCT applications

## 5.1 General

This clause identifies the functional elements of a generic cabling system to support ICT and/or BCT applications, describes how they are connected together to form subsystems and identifies the interfaces at which application-specific components are connected to the generic cabling infrastructure.

## 5.2 Functional elements

The functional elements of generic cabling are as follows:

- primary home distributor (PHD);
- primary home cable;
- secondary home distributor (SHD);
- secondary home cable;
- application outlet (TO or BO).

NOTE The SHD and secondary home cable are optional functional elements.

The type and number of functional elements used depends upon the type of premises and the application group(s) served. It is possible for the functions of multiple elements to be combined into a single element.

The functional elements used within a given implementation of a generic cabling system are connected together to form cabling subsystems. The connection of equipment at the application outlets and distributors supports applications.

Equipment is not included within the functional elements. The accommodation of functional elements and the facilities for co-location of equipment and functional elements is discussed in 5.7.

## 5.3 Cabling subsystems for ICT and BCT

### 5.3.1 General

Generic cabling schemes to support ICT and/or BCT applications contain a maximum of two cabling subsystems: the primary home cabling subsystem and the secondary home cabling subsystem as shown in Figure 2.

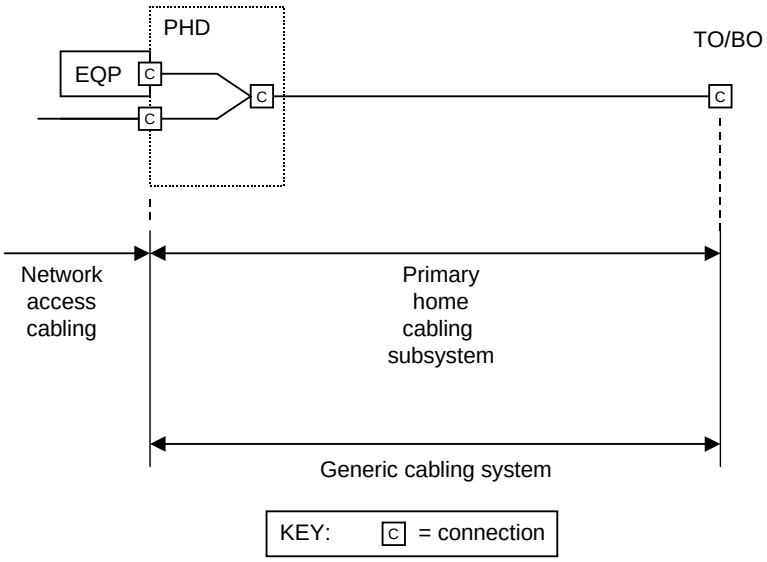
The composition of the subsystems is described in 5.3.2 and 5.3.3. Conformance to this standard does not require the presence of the secondary home cabling subsystem.

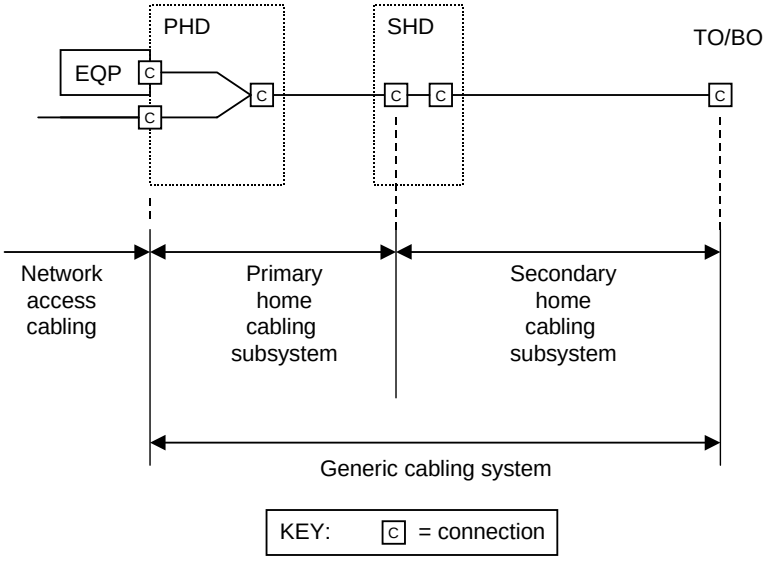
The distributors and the application outlets provide the means to configure the cabling to support topologies in addition to those implemented by the installed cables.

Connections between the cabling subsystems at the SHD are either active, requiring application-specific equipment, or passive using cross-connections by way of either patch cords or jumpers (see Figure 3).

Connection to application-specific equipment at the distributors adopts an interconnect approach (see Figure 3).

Passive connections between the primary home cabling subsystem and the network access cabling at the PHD are generally achieved using cross-connections.



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560 NOTE The dotted elements represent the boundaries of functional elements and not the enclosure that contains
561 the functional elements.

562 **Figure 2 – Structure of the generic cabling system**

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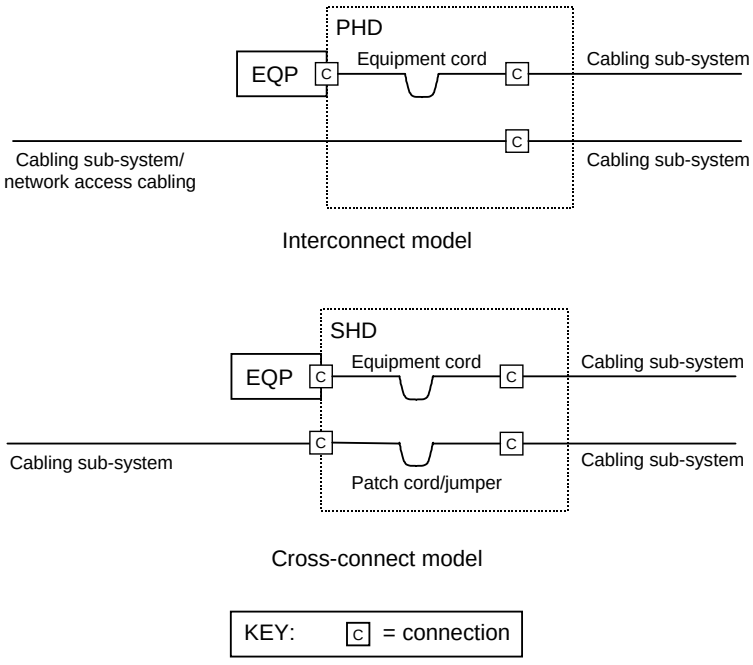


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569 NOTE The dotted elements represent the boundaries of functional elements and not the enclosure that contains
570 the functional elements.

571 **Figure 3 – Interconnect and cross-connect models**

572 **5.3.2 Primary home cabling subsystem**

573 The primary home cabling subsystem extends from the PHD to the application outlet.

574 When an SHD is used, the primary home cabling subsystem extends from the PHD to the
575 secondary home cabling subsystem.

The subsystem includes:

- the primary home cables;
- the mechanical termination of the primary home cables at the SHD or application outlet as appropriate;
- the mechanical termination of the home cables at the PHD including the connecting hardware, e.g. of the interconnect or cross-connect (see Figure 3);
- any interconnection to application-specific equipment at the PHD;
- any cross-connection to network access cabling at the PHD;
- the TO or BO (where a SHD is not used).

Although equipment cords are used to connect the transmission equipment to the cabling subsystem, they are not considered part of the cabling subsystem because they are application-specific.

The primary home cabling subsystem does not include the interface to the network access cabling at the PHD.

### 5.3.3 Secondary home cabling subsystem

The secondary home cabling subsystem extends from a SHD to the application outlet.

The subsystem includes:

- the secondary home cables;
- the mechanical termination of the secondary home cables at the TO or BO;
- the mechanical termination of the secondary home cables at the SHD;
- any interconnection to application-specific equipment at the SHD;
- any cross-connection at the SHD;
- the TO or BO.

Although equipment cords are used to connect the transmission equipment to the cabling subsystem, they are not considered part of the cabling subsystem because they are application-specific.

## 5.4 Cabling structure for ICT and BCT applications

For generic cabling to support ICT and/or BCT applications, the functional elements of the cabling subsystems are connected to form a hierarchical structure as in Figure 4.

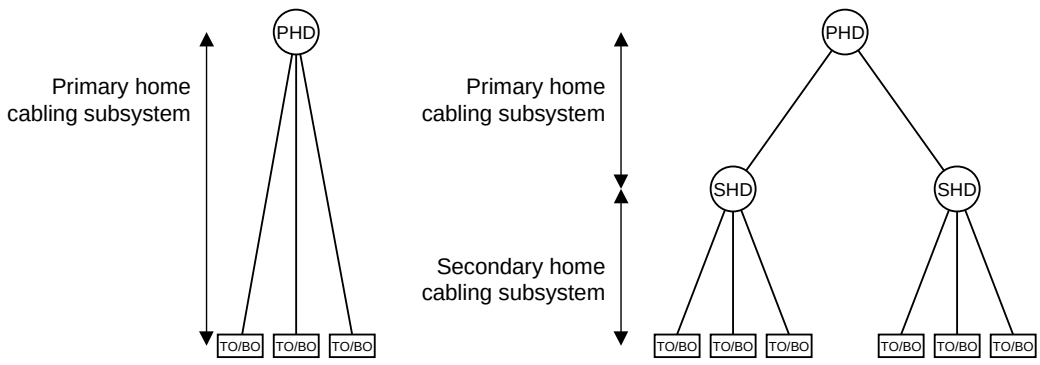



**Figure 4 – Hierarchical structure of a generic cabling system**

For ICT and BCT applications, the cabling shall have a star topology from the distributors to the application outlet (see Figure 4).

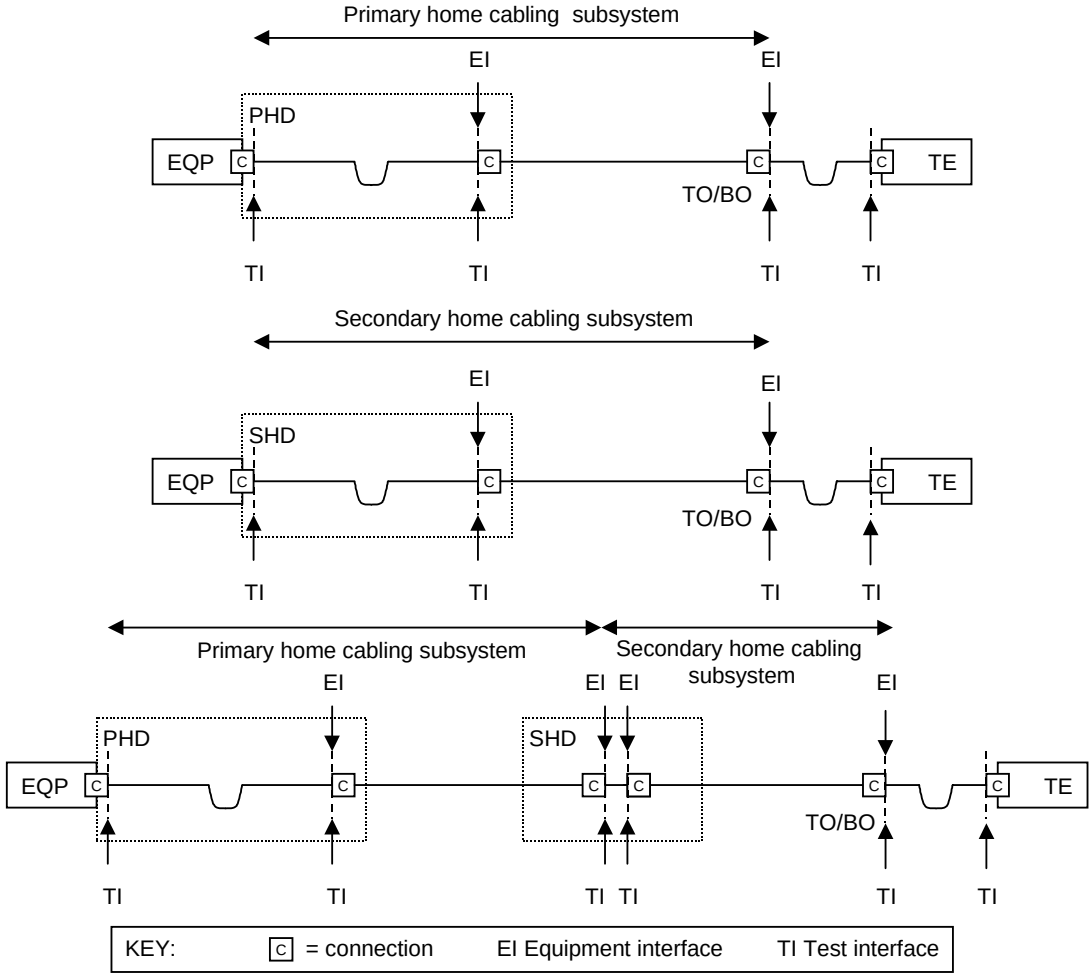
## 5.5 Interfaces

### 5.5.1 Equipment interfaces and test interfaces

Equipment interfaces to generic cabling are located at distributors and application outlets. Test interfaces to cabling are located at the ends of each subsystem.

Figure 4 shows the potential equipment interfaces and potential test interfaces within the generic cabling system.

Transmission and terminal equipment are generally connected to the equipment interface using an equipment cord.




NOTE 1 The dotted elements represent the boundaries of functional elements and not the enclosure that contains the functional elements.

NOTE 2 For BCT-C applications (see clause 7) the test interface is defined as the reference plane of the connector.

*Editors note Note 2 agreed in Helsinki may create unacceptable complexity and this topic is for further review by experts.*

**Figure 5 – Equipment and test interfaces**

### 5.5.2 Channel and permanent link

#### 5.5.2.1 Channel

The channel is any signal transmission path or power feeding path comprising passive cabling components between:

- connections to the network access cabling and application-specific equipment;
- sender(s) and receiver(s) or between power source and associated load of application-specific equipment.

For cabling to support ICT and/or BCT applications, the channel consists of the home cabling subsystem(s) together with the equipment cord(s) as shown in Figure 6.

It is important that the cabling channel is designed to meet the required class of performance for the applications that are to be run. The performance of the channel excludes the connections at the application-specific equipment.

The transmission performance of channels is detailed in clause 7.

The creation of a channel between two application outlets via a passive cross-connection at the distributors is allowed provided that the relevant channel performance of clause 7 is met.

The maximum channel lengths for each application group are dependent upon the performance of the cable and connecting hardware used (see Table 1 and Table 7 for maximum channel lengths using the reference implementations of clause 8).

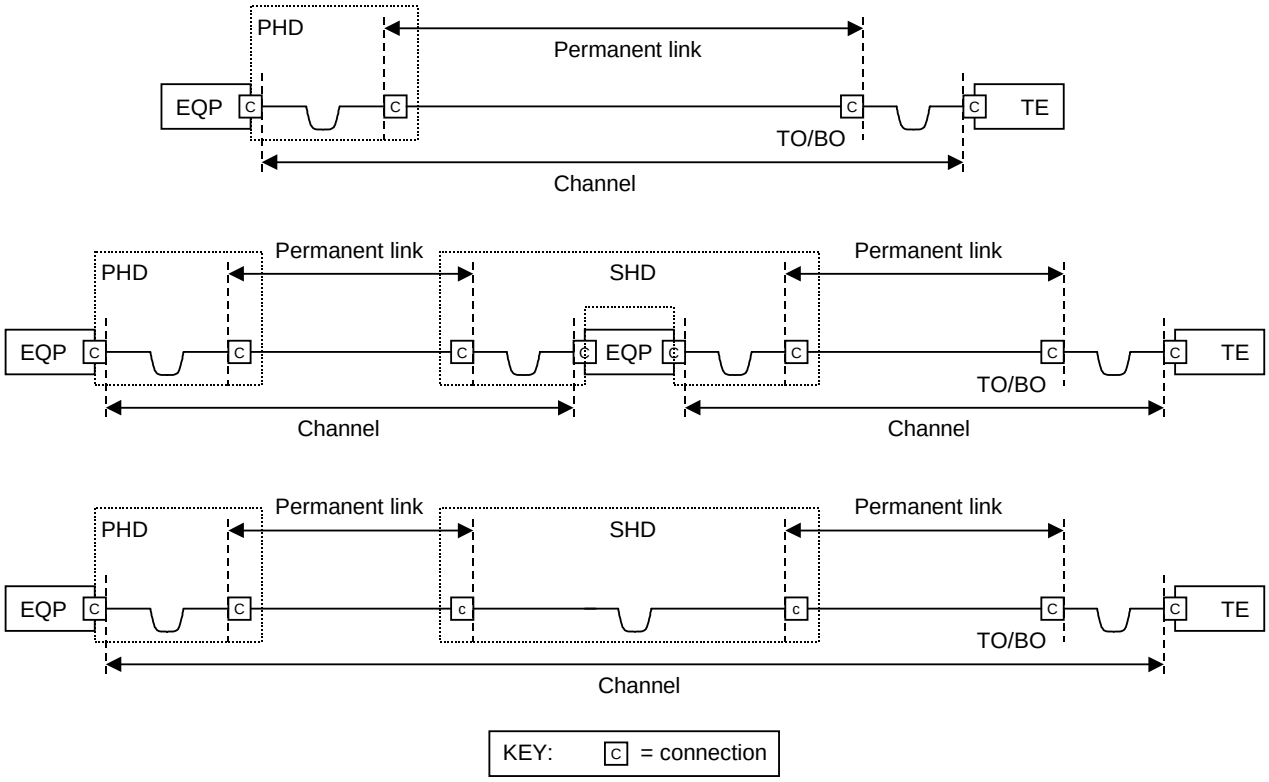
Where the performance requirements of an application allow, longer channels may be formed by the passive connection of cabling subsystems together with equipment cords where appropriate.

#### 5.5.2.2 Permanent link

The permanent link consists of the primary or secondary home cable and the termination of that cable at the application outlet and the PHD or SHD respectively as shown in Figure 6.

The permanent link includes the connections at the ends of the installed cabling.

The transmission performance of permanent links is detailed in Annex B.




NOTE The dotted elements represent the boundaries of functional elements and not the enclosure that contains the functional elements.

**Figure 6 – Channels and permanent links within the home**

### 5.5.3 Network access cabling

Network access cabling is presented at the PHD as shown in Figure 7.

In premises containing a single home the network access cabling provides the connection between the external network interfaces (public or private) and the PHD.

In premises containing multiple homes the network access cabling may also provide the connection between:

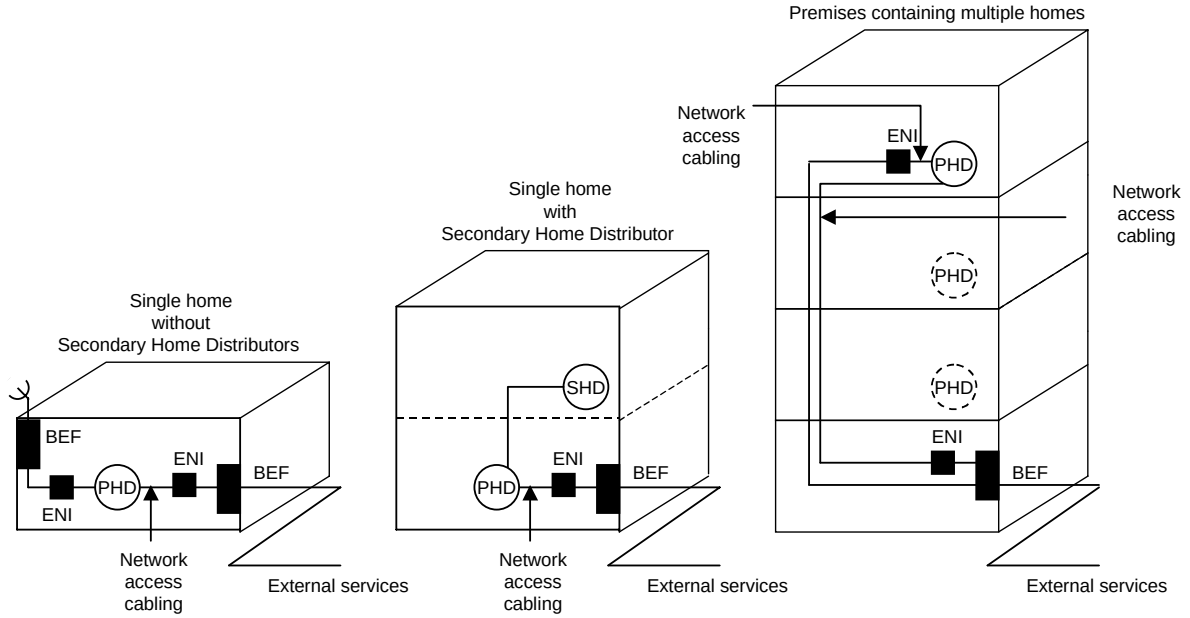
- the individual homes in the same premises;
- the premises external network interfaces (public or private) and the PHD in each home.

When used to provide a direct connection between the generic cabling system and an external network interface in the home, the performance of the network access cabling should be considered as part of the initial design and implementation of customer applications.

When used to provide a direct connection between the generic cabling system and an external network interface in the same premises (but not within the home served by the home distributor), the network access cabling shall be in accordance with:

- ISO/IEC 11801 for ICT applications;
- IEC 60728 for BCT applications;

The only interfaces to network access cabling within a home shall be those serving that home.




NOTE Some network access cabling uses bus structure

**Figure 7 - Interconnection of home and network access cabling**

### 5.5.4 External network interface

Connections to external networks for the provision of external telecommunications services are made at external network interfaces. The location of external network interfaces, if present, and the facilities required may be specified by national, regional, and local regulations. The service provider(s) shall be contacted to locate the external network interface(s).

## 5.6 Accommodation of functional elements

### 5.6.1 Distributors

#### 5.6.1.1 PHD

Each home shall be served by one PHD. The physical volume of the PHD depends upon the complexity of the infrastructure being served.

The PHD shall be located in a designated area with adequate access and space to house the cabling, the transmission equipment and to enable management of the cabling connections. The PHD shall be provided with access to the mains power required for application-specific equipment.

Other requirements for the accommodation of PHDs should be based upon the general recommendations of ISO/IEC TR 14763-2 for other distributors.

#### 5.6.1.2 SHD

Where used, SHDs shall be located in a designated area with adequate access and space to house the cabling, the transmission equipment and to enable management of the cabling connections. SHDs shall be provided with access to the mains power required for the application-specific equipment.

Other requirements for the accommodation of SHDs should be based upon the general recommendations of ISO/IEC TR 14763-2 for other distributors.

### 5.6.2 Application outlets

The number and distribution of application outlets shall correspond to the size and function of the coverage area.

For ICT and/or BCT applications the coverage area corresponds to a room or to 10 $m^2$ within a larger room. Each coverage area should be provided with a minimum of one TO for ICT applications and one BO for BCT applications.

It should be noted that in certain cases the terminal equipment connected to an application outlet within a coverage area may be located on the external surface of the building or in a separate building within the premises (see Figure 8).

The cabling provided to a coverage area for ICT and/or BCT channels as specified in clause 7 shall be:

- at least 4 balanced pairs within at least one balanced cable capable of supporting ICT channels in accordance with 7.2. For channels exploiting the maximum length specified in Table 1, the cable shall be either an ICT cable in accordance with 9.2 or a balanced BCT cable in accordance with 9.3.1;

and, in support of BCT channels, either

- at least 2 balanced pairs within at least one balanced BCT cable capable of supporting BCT channels in accordance with 7.3. For channels exploiting the maximum length specified in Table 1 this cable shall be a balanced cable in accordance with 9.3.1

or

- a coaxial BCT cable capable of supporting BCT channels in accordance with 7.3. For channels exploiting the maximum length specified in Table 1 this cable shall be a coaxial cable in accordance with 9.3.2.

NOTE 1 Requirements for optical fibre cabling are for further study.

All cable elements within a coverage area shall be terminated at application outlets. A cable element shall not be terminated at more than one application outlet.

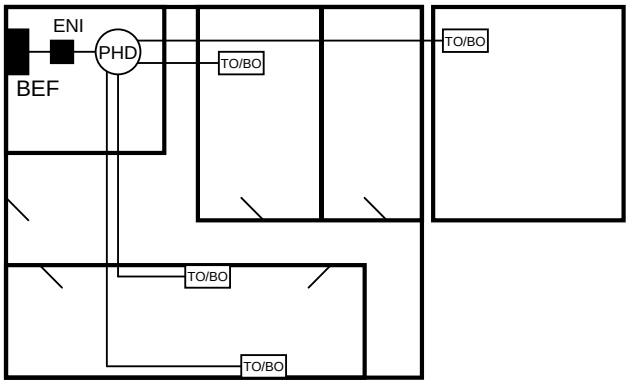
NOTE 2 Cabling configurations beyond the application outlet that provide such connections (e.g. physical bus) are application-specific and lie outside the scope of this standard.

NOTE 3 Where the pairs are provided to an application outlet by more than one cable, care shall be exercised to ensure the channel requirements of clause 7 are met.

Additional balanced cables (for ICT and/or BCT applications) or coaxial cables (for BCT applications) should be provided as defined by the:

- number and mix of applications (e.g. satellite feed, multi-cable feed of CATV, in-house generated video);
- number of application outlets to be served.

NOTE 4 Some applications, such as direct satellite feeds, use frequencies above 1 000 MHz that are only supported by the higher bandwidth BCT-C channels.




Single home
comprising two buildings

**Figure 8 – Interconnection of home cabling subsystems**

### 5.6.3 Cable pathways

Cables are routed using pathways. A variety of cable management systems can be used to support the cables within the pathways including trunking and ducting (see IEC 61084), conduit (IEC 61386) and tray (IEC 61537). Information concerning pathways serving ICT cabling is provided by ISO/IEC 18010.

Pathways shall accommodate the minimum bend radii of the cables to be installed. Where the pathways are to contain more than one cable type, then the largest minimum bend radius shall apply.

Where space available to pathways is limited, the sharing of cables for multiple applications may be considered (see 5.7.2.4).

The pathways used shall match the cabling topology. If not all of the cabling specified in this standard is pre-installed, pathways allowing future installation of cables should be provided for all cabling subsystems (ffs). In this case the pathways shall be sufficient in cross section and shall provide access to ease the installation of additional cables.

*Editors note: It is assumed that the design of pathways within premises containing multiple homes shall be in accordance with the ISO/IEC NWIP on pathways and spaces in multi-tenant premises.*

A generic cabling may be located adjacent to mains cabling subject to the requirements of national or local regulations and clause 11.

Where ICT and/or BCT cables are to be installed in the same pathways as mains power cables the requirements of 11.2 shall be observed.

## 5.7 Dimensioning and configuring

### 5.7.1 Distributors

The design of distributors should ensure that the lengths of patch cords, jumpers and equipment cords are minimised and administration should ensure that the design lengths are maintained during operation.

Distributors shall be located such that the resulting cable lengths are consistent with the channel performance requirements of clause 7. For the reference implementations described in clause 8, the maximum channel lengths in Table 1 shall be observed subject to the following restrictions:

- not all applications are supported over the maximum lengths shown in Table 1 using a single cable type and the support of specific applications over installed channels may require a mix of cabling media and types;
- national, regional, and local regulations or service provider instructions may restrict the maximum channel length between the application outlet and the external network interface.

**Table 1 - Maximum channel lengths for reference implementations of ICT/BCT channels**

| Cabling type | | | |
|---|---|---|---|
| **ICT** | **BCT B** | **BCT C** | **Optical fibre** |
| 100 | 50 [a] | 100 [a] | 100 |
| [a] - See Annex C for performance considerations for BCT channels | | | |

NOTE BCT channel length is restricted to 50 meters when using BCT-B cabling since the BCT-B cable has higher attenuation than that of BCT-C.

### 5.7.2 Application outlets

#### 5.7.2.1 Hierarchy

For cabling supporting ICT applications only, the application outlet is termed the TO in accordance with the ISO/IEC 11801. A TO may also be used to support BCT and CCCB applications where appropriate.

For cabling supporting BCT applications, the application outlet is termed the BO and uses connecting hardware specified in 10.2.3. A BO may also be used to support ICT and CCCB applications where appropriate.

#### 5.7.2.2 TO

The TO shall be located in readily accessible locations in the room, depending on the design of the building and subject to the requirements of national and local regulations.

Each TO should be terminated in accordance with 10.2.2 using 4-pairs. 2 pairs per TO may be used as an alternative to 4 pairs, however this may require pair reassignment and will not support some applications. Care should be taken that the initial pair assignment, and all subsequent changes, are recorded (see ISO/IEC 14763-1 for details of administration requirements). Pair reassignment by means of inserts is allowed.

NOTE Requirements for optical fibre cabling are for further study.

#### 5.7.2.3 BO

The BO shall be located in readily accessible locations in the room, depending on the design of the building and subject to the requirements of national and local regulations.

Each BO using balanced BCT cable should be terminated in accordance with clause 10.2.3. Less than 4 pairs per BO may be terminated, however this may require pair reassignment. Care should be taken that the initial pair assignment, and all subsequent changes, are recorded (see ISO/IEC 14763-1 for details of administration requirements). Pair reassignment by means of inserts is allowed.

Each BO using coaxial BCT cable shall be terminated in accordance with 10.2.3.

Where balanced cable is used and the BO is intended to also support ICT applications then the number of pairs to be terminated shall take into account the recommendations of 5.7.2.2.

NOTE Requirements for optical fibre cabling are for further study.

#### 5.7.2.4 Cable sharing

In order to maximise the capacity of cable management systems it is possible for ICT, BCT and CCCB applications to share cables. However, the sharing of cables by applications with other application groups may require additional performance requirements to be applied. Sharing of cable by ICT and BCT applications is for further study.

### 5.7.3 Equipment cords

The performance contribution of the equipment cords, used to connect application-specific equipment to the cabling at distributors and at application outlets, shall be taken into account in the design of the channel. Assumptions have been made concerning the length and the transmission performance of these cords; the assumptions are identified when relevant. The performance contribution of these cords shall be taken into account in the design of the channel. Clause 7 provides guidance on cord length for reference implementations of cabling in accordance with this clause.

### 5.7.4 Building entrance facilities

Building entrance facilities are required whenever network access cables (including cables from antennae) enter buildings and a transition is made to internal cables.

National or local regulations should be consulted to determine any additional requirements where external cables are terminated within the building entrance facility.

## 6 Cabling to support CCCB applications

### 6.1 General

This clause identifies functional elements of the generic cabling system to support CCCB applications. Where the functional elements differ from those of clause 5, this clause describes how the functional elements are connected together to form subsystems and identifies the interfaces at which application-specific components are connected to the generic cabling system infrastructure.

### 6.2 Functional elements

In order to support CCCB applications the following set of functional elements are specified:

- primary home distributor (PHD) (see clause 5);
- primary home cable (see clause 5);
- secondary home distributor (SHD) (see clause 5);
- area feeder cable;
- area connection point (ACP);
- coverage area cable;
- CO.

The type and number of functional elements used depends upon the type of premises. It is possible for the functions of multiple elements to be combined into a single element.

The functional elements used within a given implementation of a generic cabling system are connected together to form cabling subsystems. The connection of equipment at the COs and distributors supports applications.

The CO may be connecting hardware or may be a termination on the application-specific equipment.

## 6.3 Cabling subsystems for CCCB

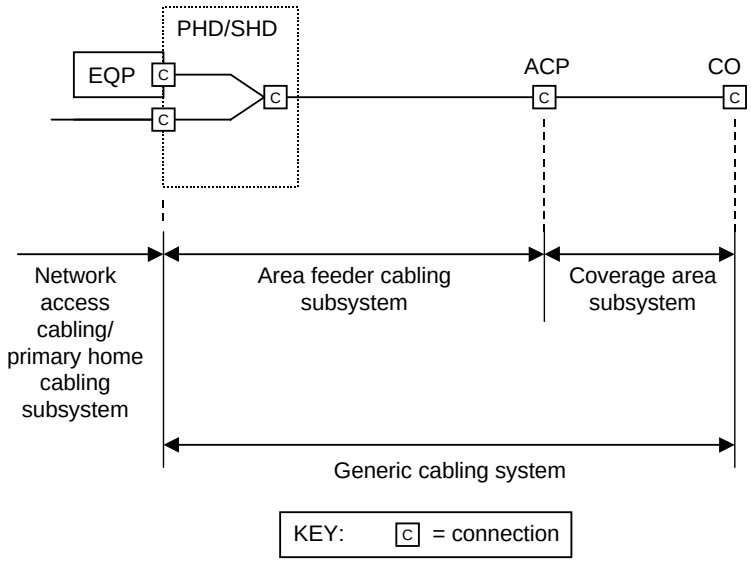
### 6.3.1 General

Generic cabling systems to support CCCB applications contain a maximum of three cabling subsystems: the primary home cabling subsystem (where a SHD is used) as specified in clause 5, the area feeder cabling subsystem and the coverage area cabling subsystem as shown in Figure 9.

The composition of the subsystems is described in 6.3.2 and 6.3.3.

The distributors and the COs provide the means to configure the cabling to support topologies in addition to those implemented by the installed cables.

Connections between the cabling subsystems at the ACPs adopts an interconnect approach (see Figure 3).




NOTE The dotted elements represent the boundaries of functional elements and not the enclosure that contains the functional elements.

**Figure 9 – Structure of the generic cabling system**

### 6.3.2 Area feeder cabling subsystem

The area feeder cabling subsystem extends from the PHD (or SHD as appropriate) to the ACP. The subsystem includes:

- the area feeder cables;
- the mechanical termination of the area feeder cables at the ACP;
- the mechanical termination of the area feeder cables at the PHD or SHD;
- any interconnection to application-specific equipment at the PHD or SHD;
- any cross-connection at the PHD or SHD;
- the ACP.

Although equipment cords are included in a channel they are not part of the cabling subsystem because they are application-specific.

### 6.3.3 Coverage area cabling subsystem

The coverage area cabling subsystem extends from the ACP to the COs. The subsystem includes:

- the coverage area cables;
- the mechanical termination of the coverage area cables at the ACP;
- the mechanical termination of the coverage area cables at the COs;
- the mechanical termination of the coverage area cables to each other at other places within the subsystem;
- the COs.

Although equipment cords are included in a channel they are not part of the cabling subsystem because they are application-specific.

## 6.4 Cabling structure for CCCB applications

For generic cabling to support CCCB applications, the functional elements of the cabling subsystems are connected to form a hierarchical structure as in Figure 10.

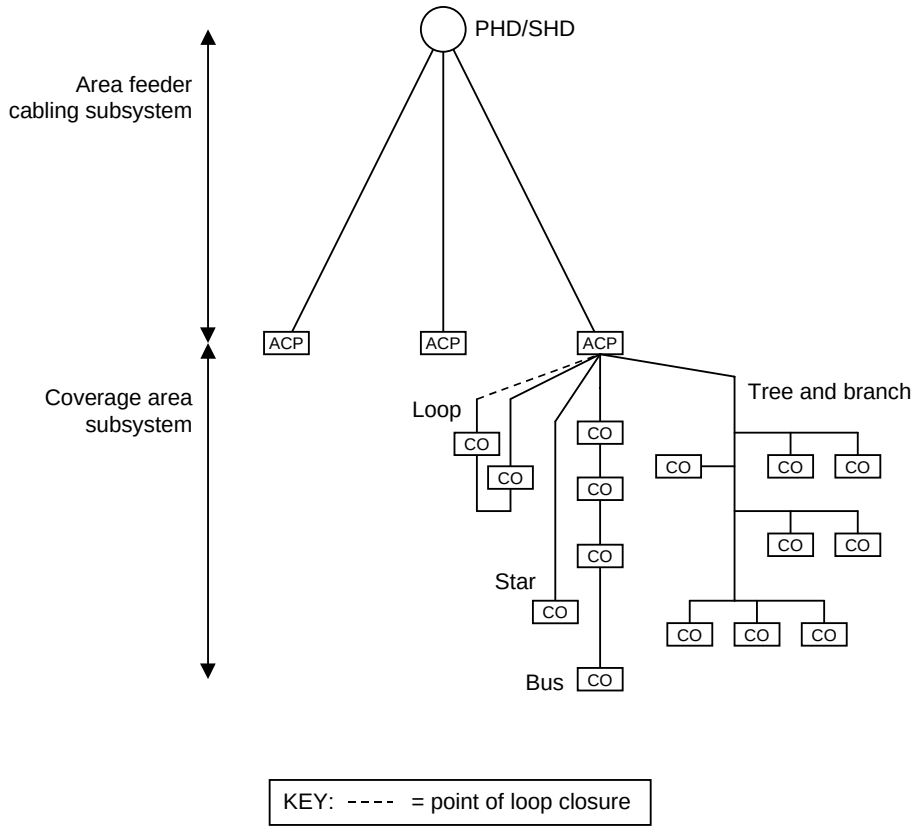



**Figure 10 – Hierarchical structure of a generic cabling system**

For CCCB applications, the area feeder cabling shall have a star topology from the distributor to the ACP.

The coverage area cabling may be installed in any of the topologies shown in Figure 10. Where permitted by the application, loops shall be closed by a connection only at easily accessible points (e.g. the ACP or at distributors).

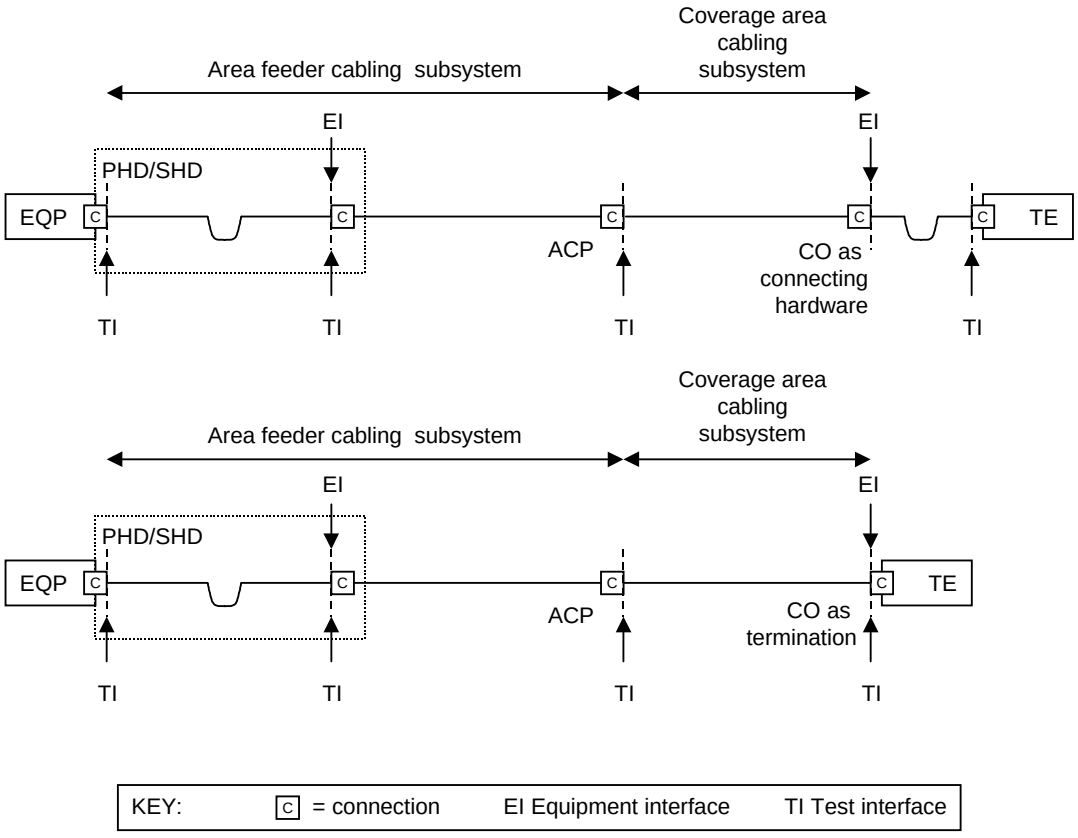
## 6.5 Interfaces

### 6.5.1 Equipment interfaces and test interfaces

Equipment interfaces to generic cabling are located at distributors and the COs. Test interfaces to cabling are located at the ends of each subsystem.

Figure 11 shows the potential equipment interfaces and potential test interfaces within the generic cabling system.

Transmission equipment at the distributor is generally connected to the equipment interface using an equipment cord. At the CO the equipment interface may be connecting hardware or may be a termination on the application-specific equipment.




NOTE The dotted elements represent the boundaries of functional elements and not the enclosure that contains the functional elements.

**Figure 11 – Equipment and test interfaces**

### 6.5.2 Channel and permanent link

#### 6.5.2.1 Channel

The channel is any signal transmission path or power feeding path comprising passive cabling components between:

- connections to the network access cabling and application-specific equipment;
- sender(s) and receiver(s) or between power source and associated load of application-specific equipment.

For cabling to support CCCB applications, the channel consists of the area feeder cabling subsystem and/or coverage area cabling with the equipment cord(s) as shown in Figure 12.

It is important that the cabling channel is designed to meet the required class of performance for the applications that are to be run. The performance of the channel excludes the connections at the application-specific equipment.

The transmission performance of channels is detailed in clause 7.

The creation of a channel between two COs in different coverage areas via a passive cross-connection at the distributors is allowed provided that the relevant channel performance of clause 7 is met.

Maximum channel lengths are dependent upon the performance of the cable and connecting hardware used. See 6.7.1 for the maximum cabling lengths using the reference implementations of clause 8.

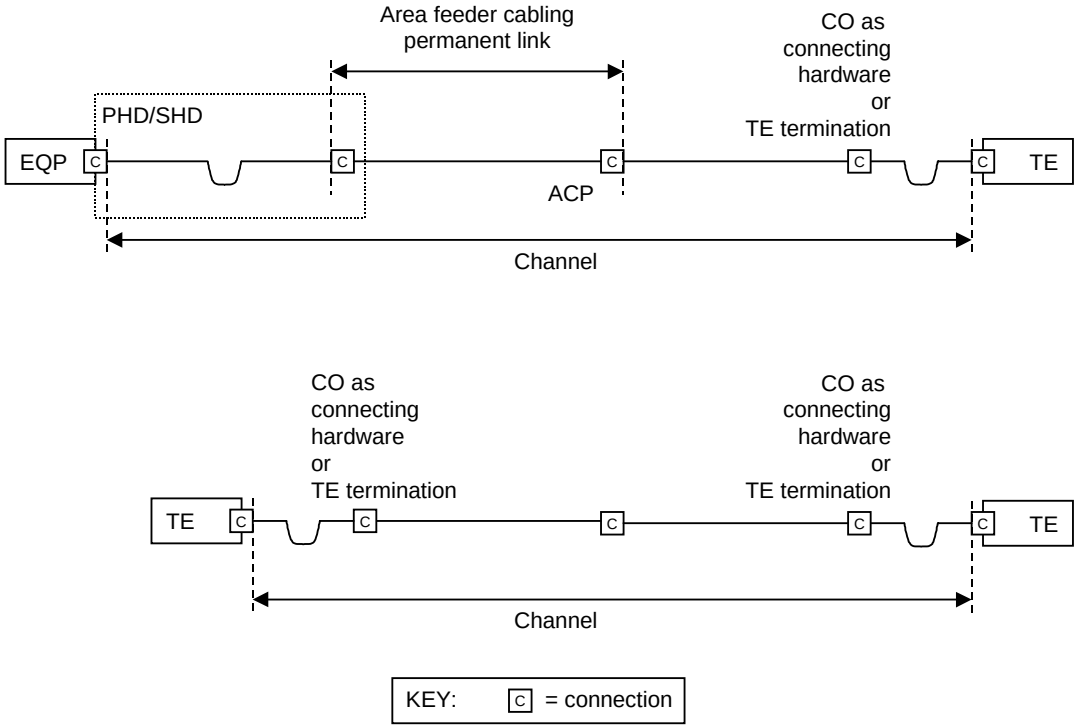
Where the performance requirements of an application allow, longer channels may be formed by the passive connection of cabling subsystems together with equipment cords where appropriate.

#### 6.5.2.2 Permanent link (area feeder cabling)

The area feeder permanent link consists of the area feeder cable and the termination of that cable at the ACP and the PHD or SHD respectively as shown in Figure 12.

The permanent link includes the connections at the ends of the installed cabling.

The transmission performance of permanent links is detailed in Annex B.




NOTE The dotted elements represent the boundaries of functional elements and not the enclosure that contains the functional elements.

**Figure 12 – Channels and permanent links for CCCB cabling**

#### 6.5.3 Network access cabling

See 5.5.3.

### 6.5.4 External network interface

See 5.5.4.

## 6.6 Accommodation of functional elements

### 6.6.1 ACPs

For CCCB applications the coverage area corresponds to an area of 25 $m^2$. Each coverage area should be provided with a minimum of one ACP.

CCCB cabling is intended to carry signal and, in many cases, power to the COs. The ACP may provide pair reassignment to allow the conductors within the area feeder cabling to be used in parallel in order to increase current carrying capacity (see clause 7).

Relevant application standards and manufacturers‘ instructions shall be consulted with reference to safety aspects of power feeding. Care shall be taken when using multi-unit or bundled cables due to the possible rise of temperature within the cabling components that may degrade channel performance.

The area feeder cabling to each ACP shall be a 4-pair balanced cable capable of meeting the permanent link performance requirements of clause 7, enabling the delivery of ICT applications if appropriate connecting hardware is used at the distributor and the ACP.

### 6.6.2 COs

The number and distribution of COs shall correspond to the size and function of the coverage area.

A CO should be located at, for direct termination of CCCB terminal equipment, or near all potential locations of CCCB terminal equipment.

It should be noted that in certain cases the terminal equipment connected within a coverage area may be located on the external surface of the building or in a separate building within the premises.

### 6.6.3 Cable pathways

Where CCCB, ICT and/or BCT cables are to be installed in the same pathways as mains power cables the requirements of 11.2 shall be observed.

NOTE Based on local regulations or practical considerations, it may be necessary or advisable to have two parallel pathways (one for mains, one for information; or one for mains and CCCB, one for ICT and BCT) even though this standard specifies one.

## 6.7 Dimensioning and configuring

### 6.7.1 Distributors

Distributors shall be located such that the resulting cable lengths are consistent with the channel performance requirements of clause 7.

For the reference implementations described in clause 8, the maximum length of the area feeder cabling permanent link shall not exceed 90 metres and the total length of coverage cabling shall not exceed 50 metres.

National, regional, and local regulations or service provider instructions may restrict the maximum channel length between the COs and the ENI.

### 6.7.2 CO

Where the coverage area cabling is not directly terminated to the CCCB terminal equipment, the CO uses connecting hardware specified in clause 10.2.4.

A TO or a BO (see clause 5) may be used to support CCCB applications where appropriate.

A minimum of 1-pair shall be terminated at each CO. The same pair may be terminated at multiple COs within a coverage area.

NOTE Requirements for optical fibre cabling are for further study.

### 6.7.3 Cable sharing

CCCB applications may share ICT and BCT cables. However, the sharing of cables by applications with other application groups may require additional performance requirements to be applied and additionally may be subject to national or local regulations. This topic is for further study.

### 6.7.4 Equipment cords

See 5.7.3.

### 6.7.5 Building entrance facilities

See 5.7.4.

## 7 Performance

### 7.1 General

This clause specifies the minimum performance of a cabling system with channels for three groups of applications: ICT, BCT and CCCB. The minimum channel performances specified in this clause are independent of the length of the channels, are determined by application requirements and shall be met at all intended channel operating temperatures.

Specification of channel performances is based on the minimum performance of the most demanding application of an application group for each transmission characteristic. In general a channel specified for an application group with higher requirements supports applications with lower requirements. Less demanding applications of a higher group may also use channels aimed at a lower group as shown in Table 2.

NOTE 1 The minimum channel performance specified in this clause, is the maximum performance an application may expect from the worst channel that meets this standard, if the design is intended to use any channel that conforms to this standard.

NOTE 2 In case an application exploits a number of channel characteristics that are interrelated, it may not be possible to reach all limits concurrently, as each value is a separate limit. For example, with a current carrying capacity of 175 mA, operating voltage of 72 V and power capacity of 10 W, an application that exploits the full 72 V may not use more than 138 mA, an application that goes to the limit of 175 mA may not use more than 57 V.

1013 **Table 2 – Different channels and their potential use**

| Channel | Upper frequency of specification MHz | ICT Applications supported | BCT Applications supported | CCCB Applications supported |
|---|---|---|---|---|
| Balanced CCCB channel | $f$ = 0,1 | ICT applications supported by CCCB channels | BCT applications supported by CCCB channels | all CCCB applications |
| Balanced ICT channel | $f$ = 100 | all ICT applications supported by Class D channels as specified in ISO/IEC 11801 [a] up to 100 MHz | BCT applications supported by Class D channel performance as specified in ISO/IEC 11801 [a] | CCCB applications supported by the ICT channel performance [b] |
| Balanced BCT channel | $f$ = 1 000 | ICT applications supported by the BCT channel performance | all BCT applications supported by balanced cabling | CCCB applications supported by the BCT channel performance [b] |
| Coaxial BCT channel | $f$ = 3 000 | N/A | all BCT applications supported by coaxial cabling that require up to 3 GHz | N/A |
| | $f$ = 1 000 | N/A | all BCT applications supported by coaxial cabling that require up to 1 GHz | N/A |
| Optical channels | N/A | see ISO/IEC 11801 | ffs | ffs |

[a] When Class E or F channels are installed to meet the minimum requirements for ICT channels, ICT and BCT applications accommodated by the performance of the respective channels are supported.

[b] The power carrying capacity may limit the applications or the number of COs supported.

1014 Clauses 9 and 10 provide the minimum performance that components need to provide when
1015 used to implement channels following the channel models shown in clause 5 and 6 for the
1016 reference implementations of clause 8.

1017 The component performance for other lengths and operating temperatures may be calculated
1018 based on the channel performance specified in this clause and the channel models from
1019 clause 5 and 6.

1020 While cabling channels for ICT and CCCB within the home presently are provided via
1021 balanced cables only, channels for BCT may be provided via balanced cable or coaxial cable.
1022 The CCCB channel specified in this clause assumes power feeding and information transfer
1023 on the same pair(s). The CCCB channel is specified with a current carrying capacity of 0,7 A.
1024 This requirement may be met with one pair of CCCB cable or 4 pairs of ICT cable connected
1025 together. All channels specified in this clause assume bi-directional transmission.

1026 The majority of BCT channels use one balanced pair or one coaxial cable, ICT applications
1027 use one, two or four pairs. The requirements for pair to pair characteristics are specified in
1028 this standard to also cover the case that a channel contains multiple transmission paths
1029 (pairs). The power feeding, where applicable, is covered in the specification of the channel.
1030 The channel for power feeding may start at other points than that for information transfer.

1031 NOTE Multiple pair requirements are only applicable to cables having more than one pair.

1032 Cables and connecting hardware may support multiple channels, provided safety and
1033 electrical characteristics of channels are not degraded.

1034 This standard includes the option where the same resource, e.g. cable or connecting
1035 hardware, may serve more than one channel. If this option is exploited, the additional
1036 requirements for sharing of such resources specified in this clause shall be met. Where only a
1037 cable is shared, the additional requirements for the cable are specified in clause 9.

The minimum performance specified in this clause shall be met by appropriate design of the channels, selection of adequate material and their proper installation.

The term “attenuation” is widely used in the cable industry to characterise cables. However, due to impedance mismatches in cabling systems, especially at higher frequencies, the behaviour of a cable that constitutes part of a system is better described as “insertion loss”. In this standard, the term “insertion loss” is adopted throughout, to describe the signal attenuation over the length of channels, links and short components. However it should be clearly understood, that insertion loss is not a length specific characteristic. The term “attenuation” is used for cables and for the following parameters:

- attenuation to crosstalk ratio (*ACR*),
- unbalance attenuation,
- coupling attenuation,
- screening attenuation.

For *ACR*, *PS ACR*, *ELFEXT* and *PS ELFEXT* it is implied that for their calculation the corresponding insertion loss is used.

### 7.2 ICT channel performance

The cabling channels from PHD and SHD respectively to TOs as shown in Figure 6, shall meet the minimum transmission performances as specified up to 100 MHz in clause 6 of ISO/IEC 11801 Ed.2 for Class D channels over the whole temperature range the cabling is intended to work. Installation of Class E channels is strongly recommended.

In case more than one Class D channel uses the same cabling components (cables and connecting hardware), each channel shall meet the requirements as specified in ISO/IEC 11801 Ed.2 for Class E channels.

The cables installed as part of such channels shall provide the transmission characteristics needed to meet the minimum channel performance chosen (class D, class E, or even class F) and in addition they shall meet the mechanical characteristics specified in Table 8. The minimum performance of cables used to implement channels exploiting the maximum distance specified in Table 1 shall meet the minimum performance specified in clause 9.

### 7.3 BCT channel performance

*Editors note: IEC TC 100 is asked explicitly to comment this clause.*

Cabling channels for BCT may be provided via balanced or coaxial cables, OF are ffs.

Cabling channels for BCT implemented on balanced cable shall meet the minimum transmission performances as specified in Table 3 together with those specified for Class F channels in ISO/IEC 11801 Ed.2 over the whole temperature range the cabling is intended to operate at. In addition the cables used for such channels shall meet the mechanical requirements specified in Table 8.

Cabling channels for BCT implemented on coaxial cable shall meet the minimum transmission performances specified in Table 4 over the whole temperature range the cabling is intended to operate at. In addition the cables used shall meet the mechanical requirements specified in Table 11.

In order to avoid unnecessary amplification and attenuation of BCT applications at the distributors and BOs respectively, the BCT channels have been subdivided into 3 insertion loss levels as shown in Annex A.

1081 In order to maintain the channel performance equipment cords that meet IEC 60966-2-4,
1082 IEC 60966-2-5 and IEC 60966-2-6 respectively shall be used.

1083 **Table 3 – Minimum performance of BCT channel via balanced cable**

| Channel Characteristics | | | | Cabling Channel performance | Test Method |
|---|---|---|---|---|---|
| **No** | **Electrical Characteristics** | **Units** | **Frequency** MHz | **Balanced channel** | |
| 1 | Nominal impedance | Ω | | 100 | to be met by design |
| 2 | Minimum return loss (*RL*) at each cabling Interface [a] | dB | $4 \le f < 40$ | $24 - 5\lg(f)$, 19 dB max | 4.9 of IEC 61935-1 |
| | | | $40 \le f \le 1\,000$ | $32 - 10\lg(f)$, 8 dB min | |
| | Informative value | | $f = 100$ | 12 | |
| | | | $f = 1\,000$ | 8 | |
| 3 | Maximum insertion loss (*IL*) | dB | $1 \le f \le 1\,000$ | $(LPL + x \times LEC) \times \left(1{,}645\sqrt{f} + 0{,}01 \times f + 0{,}25/\sqrt{f}\right) / 100 + 2 \times 0{,}02\sqrt{f}$ 2 dB min [b] | |
| | Informative values for a length factor of 49,5 m | | $f = 1$ | 2 | 4.4 of IEC 61935-1 |
| | | | $f = 4$ | 2 | |
| | | | $f = 10$ | 2,8 | |
| | | | $f = 100$ | 9,1 | |
| | | | $f = 200$ | 13,1 | |
| | | | $f = 600$ | 23,9 | |
| | | | $f = 1\,000$ | 32 | |
| 4 | Minimum coupling attenuation | dB | | | to be met by design |
| | Connected to CATV | | $30 \le f < 300$ | 85 | |
| | | | $300 \le f < 450$ | 80 | |
| | | | $450 \le f \le 1\,000$ | 75 | |
| | Individual antenna | | $30 \le f \le 1\,000$ | 75 | |
| 5 | Transfer impedance | mΩ | | Local regulations shall be met. | |

[a] The return loss requirements shall be met at both ends of the cabling. Return loss (*RL*) values at frequencies where the insertion loss (*IL*) is below 3,0 dB are for information only.

[b] $L_{PL}$ = permanent link length, and $L_{EC}$ = total equipment cord length *x* is the insertion loss (*IL*) premium for the cords.

1084 **Table 4 – Minimum performance of BCT channel via coaxial cable**

| Channel Characteristics | | | | Cabling Channel performance | | Test Method |
|---|---|---|---|---|---|---|
| **No** | **Electrical Characteristics** | **Units** | **Frequency** MHz | **Coaxial channel** | | |
| | | | | **1 GHz channel** | **3 GHz channel** | |
| 1 | Nominal impedance | Ω | | 75 | | to be met by design |
| 2 | Minimum return loss (*RL*) at each cabling interface | dB | $5 \le f < 470$ | 18 | | IEC 61196-1 |
| | | | $470 \le f < 1\,000$ | 16 | | |
| | | | $1\,000 \le f \le 3\,000$ | N/A | 10 | |
| 3 | Maximum insertion loss (*IL*) (attenuation) | dB | $1 \le f \le 3\,000$ | $\left(LPL + x \times LEC\right) \times \left(0{,}835\sqrt{f} + 0{,}002\,5\,f\right) / 100 + 2 \times 0{,}02\sqrt{f}$ 2 dB min [a] | | ffs |
| | Informative values for a length factor of 103,5 m | | $f = 5$ | 2 | | |
| | | | $f = 10$ | 2,9 | | |
| | | | $f = 100$ | 9,3 | | |
| | | | $f = 200$ | 13,3 | | |
| | | | $f = 600$ | 23,7 | | |
| | | | $f = 1\,000$ | 31,2 | | |
| | | | $f = 2\,400$ | N/A | 50,5 | |
| | | | $f = 3\,000$ | N/A | 57,3 | |
| 5 | Maximum (d.c.) loop resistance | Ω | d.c. | 10 | | IEC 61196-1 |
| 6 | Current carrying capacity | mA | d.c. | 500 | | to be met by design |
| 7 | Operating voltage | V | d.c. | 72 [b, c] | | |
| 8 | Power capacity | W | d.c. | ffs | | |
| 9 | Maximum propagation delay | ns | $f = 100$ | 548 | | to be met by design |
| 10 | Minimum screening attenuation – Connected to CATV | dB | $30 \le f < 300$ | 85 | | to be met by design |
| | | | $300 \le f < 470$ | 80 | | |
| | | | $470 \le f \le 1\,000$ | 75 | | |
| | Minimum screening attenuation – Individual antenna | | $30 \le f \le 1\,000$ | 75 | | |

[a] $L_{PL}$ = permanent link length and $L_{EC}$ = total equipment cord length *x* is the attenuation premium for the cords

[b] TV networks presently use 24 V a.c. and 34 V d.c.

[c] In countries that limit applications to a lower voltage, the minimum operating voltage for the cabling may be lowered to the highest voltage allowed.

NOTE Where requirement for transmission of more than 1 GHz are specifically excluded for the lifetime of an installation the column for 1 GHz applies.

1085 NOTE The performance of network access cabling channels for BCT are for further study by relevant bodies.

## 7.4 CCCB channel performance

Specifications for HES, like ISO/IEC TR 14543, support the connection of a number of addressable devices to a shared channel. Such devices are often powered via the same conductors that are also used for information transfer. Therefore the performance of CCCB channels that may be installed prior to the selection of a specific application is determined by:

- the maximum number of devices supported on a single channel by the majority of HES specifications,
- the maximum feeding distance of the most power-demanding devices,
- the minimum transmission characteristics of the most bandwidth-demanding device.

Based on these considerations cabling channels for information transfer and for power feeding may start at different locations even when they share the same pair. The nature of the CCCB cabling within the coverage area (shown as a cloud in Figure 14 and Figure 15 and in more details in Figure 10) requires that transmission performance is specified in two ways. The first specifies the individual transmission paths between any two connection points for application specific equipment. The second specifies the characteristics of all the cabling within the coverage area together with its area feeder cabling. The electrical characteristics of the latter may be measured.

CCCB channels shall meet the minimum performance for transmission characteristics and for power feeding specified in Table 5 and Table 6 respectively, over the whole temperature range at which the cabling is intended to work.

The area feeder cables shall meet the mechanical characteristics specified in Table 8. The area feeder cabling shall be capable of class D link performance as specified in ISO/IEC 11801 Ed.2. Verification of this requirement would require termination with connecting hardware specified for the TO.

The cables installed in the coverage area as part of such channels shall provide the transmission characteristics needed to meet, together with the area feeder cable, the channel performances as specified in Table 5 and Table 6. In addition they shall meet the mechanical characteristics specified in Table 13.

The minimum transmission performance of cables used to implement channels exploiting the maximum distance specified in Table 1 are specified in 9.2 and in Table 12 respectively.

Connection points where CCCB applications may be connected shall provide a minimum of one channel for information transfer and for power feeding consisting of and sharing one balanced pair.

**Table 5 – Minimum performance of CCCB copper channels for information transfer**

| | Channel Characteristics | | Channel performance | | Test Method |
|---|---|---|---|---|---|
| | **Electrical Characteristics** | **Units** | **Frequency** kHz | | |
| 1a | Minimum mutual capacitance of pair [a] | nF | $f = 1$ | 2 ffs | 3.2.5 of IEC 61156-1 |
| 1b | Maximum mutual capacitance of pair [a] | nF | $f = 1$ | 20 | 3.2.5 of IEC 61156-1 |
| 2 | Max d.c. loop resistance | Ω | d.c. | 8 | 3.2.1 of IEC 61156-1 |
| 3 | Maximum (d.c.) resistance unbalance | % of loop resistance | d.c. | 3 | 3.2.2 of IEC 61156-1 |
| 4 | Maximum attenuation | dB | $f = 100$ | 4 | 3.2.2 of IEC 61156-1 |
| 5 | Capacitance unbalance between pairs [a, b] | pF | $f = 1$ | 75 | 3.2.6 of IEC 61156-1 |
| 6 | Maximum propagation delay | ns | $f = 100$ | 1 000 | to be met by design |
| 7 | Maximum unbalance attenuation | dB | $f = 100$ | 20 | to be met by design |
| 8 | Capacitance unbalance to earth [a] | pF | $f = 1$ | 450 | 3.2.6 of IEC 61156-1 |
| NOTE As the same pair may be used for power feeding and information transfer the requirements specified in Table 6 shall also be met. | | | | | |
| [a] This characterises the behaviour of the area access cable plus the complete area cabling.<br>[b] Multiple pair requirements are only applicable to cables having more than one pair | | | | | |

**Table 6 – Minimum performance of CCCB channels for d.c. power feeding**

| | Channel Characteristics | | | Channel performance with current capacity | Test Method |
|---|---|---|---|---|---|
| | **Electrical Characteristics at all operating temperatures** | **Units** | **Frequency** kHz | | |
| 1 | Maximum d.c. loop resistance from distributor housing the power source to any CO | Ω | d.c. | 10 | 5.1 of IEC 60189-1 |
| 2 | Maximum d.c. resistance unbalance | % of loop resistance | d.c. | 1,5 | 3.2.2 of IEC 61156-1 |
| 3 | Current carrying capacity | A | d.c. | 0,7 | to be met by design |
| 4 | Operating voltage | V | d.c. | 72 | |
| 5 | Power capacity | W | d.c. | 15 | |
| 6 | Fault current carrying capacity | A | d.c. | 1 [a] | |
| NOTE As the same pair may be used for power feeding and information transfer the requirements specified in Table 5 shall also be met. | | | | | |
| [a] In case the power is fed by parallel conductors or thicker conductors, the fault current carrying capacity may be 3 A. | | | | | |

The CCCB channel model specified in clause 6 supports the implementation of CCCB and/or of Class D channels with utilisation of appropriate coverage area cabling.

# 8 Reference Implementation

## 8.1 General

This clause describes implementations of a generic cabling infrastructure that utilises components that meet the minimum requirements specified in clauses 9 and 10. These reference implementations meet the requirements of clause 7 when installed in accordance with the applicable installation procedures and in compliance with the maximum channel lengths specified in Table 1.

## 8.2 Cabling Assumptions

### 8.2.1 Introduction

In the reference implementation of this clause, the components used in each cabling channel shall meet the following requirements:

- a specific balanced copper cabling channel shall use components all of the same nominal impedance;
- optical fibre channels for ICT in the primary home subsystem shall be in compliance with ISO/IEC 11801, optical fibre for BCT and CCCB is ffs;
- coaxial cabling channels shall use components that meet the requirements as specified in clauses 9.3.2 and 10.2.

The reference implementations will meet the channel performance specified in clause 7 over the maximum distances specified in Table 1 with components meeting the performance requirements at 20 °C. When the channels are intended to operate at a higher temperature they shall meet the minimum performance at that temperature, either by shortening the channel taking into account the effect of temperature on the performance of cables as shown in Table 7, or by using cables which provide the performance needed at the higher temperature.

### 8.2.2 General

The generic cabling provides the transmission paths from the PHD to TOs, BOs, and COs. With cables and connecting hardware meeting the minimum performance specified in clauses 9 and 10 respectively, it is possible to create channels of lengths up to 100 m for all ICT and coaxial BCT channels. For balanced BCT channels using these components it is also possible to create channels of lengths of up to 50 m. For CCCB the combined length of the area feeder permanent link and the total cable length installed in the coverage area shall not exceed 140 m.

In order to avoid unnecessary amplification and attenuation of BCT applications at the distributors and BOs respectively, the BCT channels have been subdivided as shown in Annex A.

Table 7 gives an overview of the maximum length achievable for the different channels when the components used just meet the minimum performance specified in clauses 9 and 10.

1161

**Table 7 – Link length equations**

| | | | Implementation equation for lengths using | | |
|---|---|---|---|---|---|
| **Model** | **Figure** | **Max. length** m | **BCT balanced components** | **BCT coaxial components** | **CCCB components** |
| CCCB area feeder cabling | Figure 14<br>Figure 15 | 90 | 90 | N/A | N/A |
| CCCB coverage area cabling | Figure 14<br>Figure 15 | 50 | 50 | N/A | 50 |
| ICT (2 connectors) | Figure 13 a | 100 | $H$ = 135-$FX$ | N/A | N/A |
| ICT (4 connectors) | Figure 13 b | 100 | $H$ = 133-$FX$ | N/A | N/A |
| BCT (2 connectors) | Figure 13 a | 100 coaxial<br>50 balanced | $H$ = 50-$FX$ | $H$ = 104-$FX$ | N/A |

Legend for equations

$H$ the maximum length of the fixed cable (m)

$F$ combined length of patch cords, jumpers and equipment cords

$X$ the ratio of flexible cable attenuation (dB/m) to fixed cable attenuation (dB/m)
for ICT cable (balanced), 1,5 is used as default value
for BCT cable (coaxial and balanced), 1,35 is used as default value

NOTE

For operating temperatures above 20 °C, H should be reduced by:

a) 0,2 % per °C for balanced screened cables,

b) 0,4 % per °C for unscreened balanced cables up to 40 °C,

c) 0,6 % per °C for unscreened balanced cables between 40 °C and 60 °C,

d) 0,2 % for coaxial cables.

These are default values and should be used where the actual characteristic of the cable is not known.

If the cable is specified to meet the attenuation requirements of clause 8 at a “base” temperature above 20 °C then the calculation shall only apply to planned temperatures above the “base” temperature.

### 8.2.3 Dimensions for ICT and BCT channels

Figure 13 shows the models used to correlate home cabling dimensions specified in this clause with the ICT and BCT channel specifications in clause 7.

Figure 13 shows the channel configurations from the distributors to the TOs and BOs. The channels shown contain a maximum of four connections.

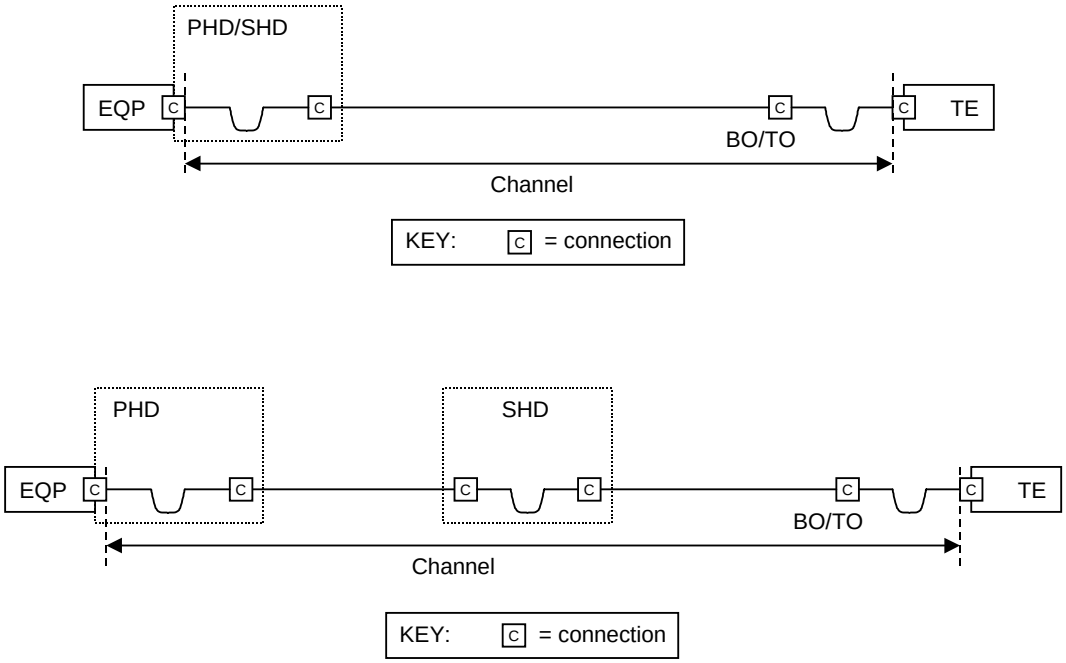



**Figure 13 – Reference implementations for ICT and BCT channels (PHD/SHD - TO/BO)**

### 8.2.4 Dimensions for CCCB channels

There is considerable design freedom for CCCB channels. Figure 14 and Figure 15 show some of the most common designs.

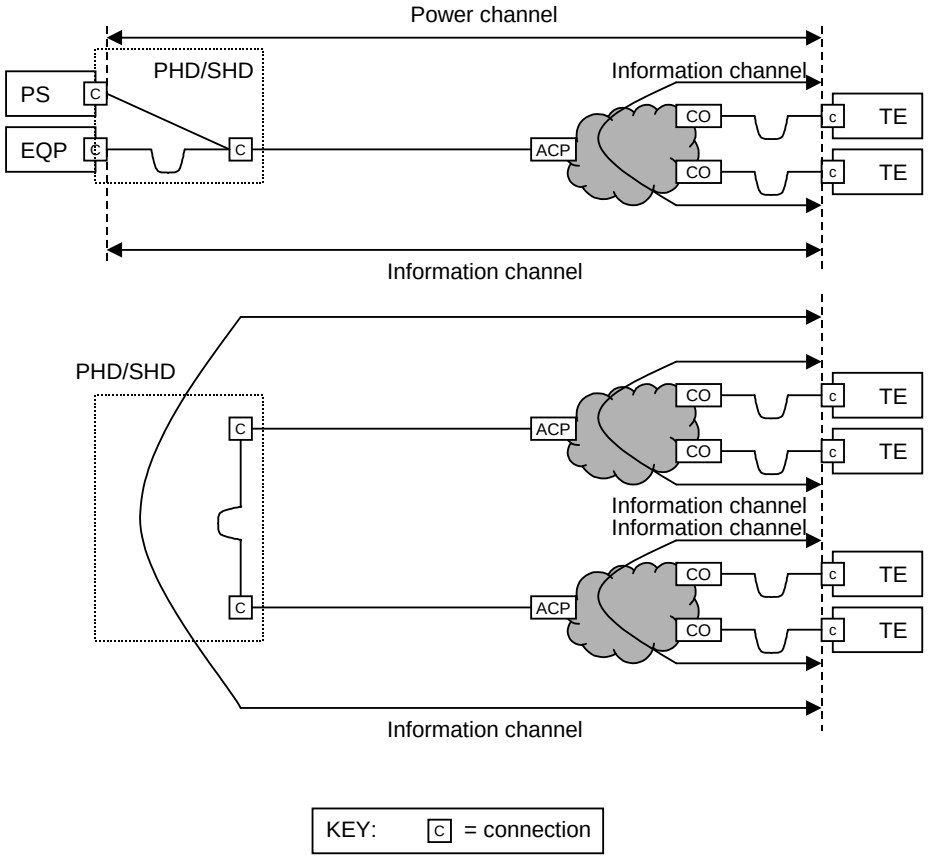
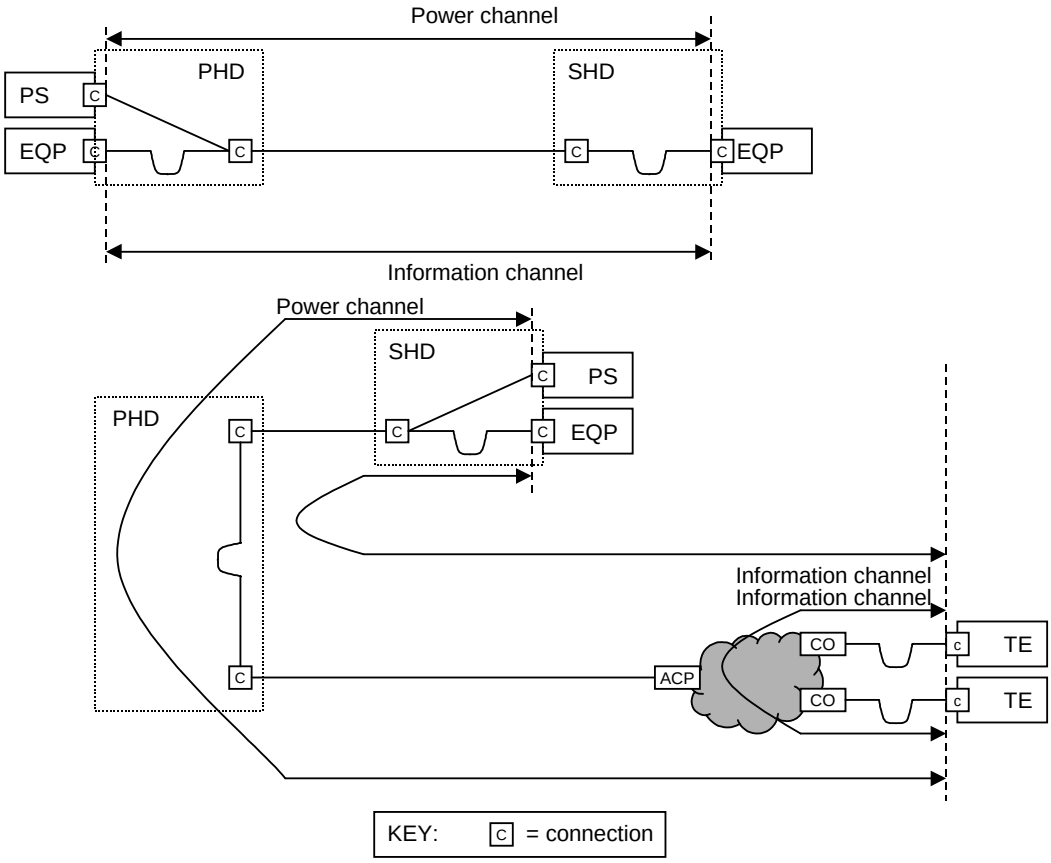



**Figure 14 – Reference implementations for CCCB channels with PHD or SHD**




1174

1175 **Figure 15 – Reference implementations for CCCB channels with PHD and SHD**

1176 # 9 Cable requirements

1177 ## 9.1 General

1178 This clause specifies the minimum requirements for cables as parts of links and channels of
1179 the reference implementation of clause 8.

1180 In addition it specifies those cable requirements that provide compatibility with connecting
1181 hardware of clause 10, where required, as well as other cable requirements important for the
1182 implementation of generic cabling systems.

1183 This clause does not provide the full set of cable characteristics, which is provided in cable
1184 specifications such as IEC 61156 series.

1185 ## 9.2 Cable performance for ICT

1186 The minimum requirements are met with cables as specified in IEC 61156-2 and meeting the
1187 Category 5 requirements in ISO/IEC 11801 Ed.2. If a cable is shared by two or more ICT
1188 applications additional requirements should be taken into account, which may be fulfilled by
1189 Category 6 and Category 7 cables as specified in IEC 61156-5 and IEC 61156-6 respectively,
1190 as well as meeting the requirements in ISO/IEC 11801 Ed.2.

1191 Cables used to implement ICT channels shall meet the minimum requirements for mechanical
1192 characteristics specified in Table 8 .

1193 **Table 8 – Mechanical performance requirements for ICT and balanced BCT cables**

| Cable characteristics | | Units | Value |
|---|---|---|---|
| 1 | Diameter of conductor | mm | 0,4 to 0,8 [a] |
| 2 | Diameter over insulated conductor | mm | ≤ 1,6 [b] |
| 3 | Number of conductors in a cable element | per pair / per quad | 2 / 4 |
| 4 | Screen around cable element [c] | | Optional |
| 5 | Number of cable | pairs | ≥ 4 |
| | elements in a unit | quads | ≥ 2 |
| 6 | Screen around cable unit [c] | | Optional |
| 7 | Screen around cable [c] | | Optional |
| 8 | Outer diameter of cable [d] | mm | ≤ 90 |
| 9 | Temperature range [e] | °C | installation: 0 to +50<br>operation: -20 to +60 |
| 10 | Minimum bending radius for pulling during installation | | 8 times outer cable diameter |
| 11 | Minimum bending radius installed | | 6 (ffs) times outer cable diameter |
| 12 | Pulling strength [f] | N/mm² | ≥ ffs |
| 13 | Fire rating | | According to 3.5.9 of IEC 61156-1 unless otherwise in accordance with national or local regulation |
| 14 | Colour coding | | as required by local regulations or customer, preferred IEC 60708-1 |
| 15 | Cable marking | | as required by customer |

[a] Conductor diameters below 0,5 mm and above 0,65 mm may not be compatible with all connecting hardware.

[b] Diameters over the insulated conductor up to 1,7 mm may be used if they meet all other performance requirements. These cables may not be compatible with all connecting hardware.

[c] See 11.4.

[d] Should be minimised to make best use of duct and cross-connect capacity.
In case of under carpet cable the value is not applicable.

[e] For certain applications (e.g. precabling buildings in cold climate) a cable with a lower temperature bending performance of –30 °C may be required.

[f] This is an indication for cable performance, installation needs are for further study.

## 9.3 Cable performance for BCT

### 9.3.1 Requirements for balanced pairs for BCT

Balanced cables used to implement BCT channels exploiting the maximum distances specified in Table 1 shall meet the minimum requirements specified in Table 9 together with the category 7 requirements in ISO/IEC 11801 Ed.2.

See IEC 61156-7 for specifications of cables that meet the requirements of table 10.

**Table 9 – Minimum transmission performance requirements BCT balanced pairs**

| No | Electrical Characteristics | | Units | Frequency MHz | Requirement |
|---|---|---|---|---|---|
| 1 | Mean characteristic impedance | | Ω | | 100 ± 5 |
| 2 | Minimum return loss (*RL*) on 100 m cable [a] | | dB | $4 \le f < 10$ | $20 + 5\lg(f)$ |
| | | | | $10 \le f < 20$ | 25 |
| | | | | $20 \le f < 600$ | $25 - 6\lg\frac{f}{20}$, 17,3 dB min |
| | | | | $600 \le f \le 1000$ | $17{,}3 - 10\lg\frac{f}{600}$ |
| | Informative values at key frequencies | | | $f = 10$ | 25 |
| | | | | $f = 100$ | 20,8 |
| | | | | $f = 1\,000$ | 15,1 |
| 3 | Maximum attenuation | | dB/ 100 m | $1 \le f \le 1\,000$ | $1{,}645 \times \sqrt{f} + 0{,}01f + 0{,}25\sqrt{f}$ 4 dB min |
| | Informative values at key frequencies | | | $f = 4$ | 4 |
| | | | | $f = 10$ | 5,4 |
| | | | | $f = 100$ | 17,5 |
| | | | | $f = 200$ | 25,3 |
| | | | | $f = 600$ | 46,3 |
| | | | | $f = 1\,000$ | 62,0 |
| 4 | Minimum coupling attenuation | Connected to cable TV | dB | $30 \le f < 300$ | 85 |
| | | | | $300 \le f < 450$ | 80 |
| | | | | $450 \le f \le 1\,000$ | 75 |
| | | Individual antenna | | $30 \le f \le 1\,000$ | 75 |

Any cable used to implement BCT channels shall meet the minimum mechanical requirements specified in Table 8.

### 9.3.2 Requirements for coaxial cables for BCT

Coaxial cables used to implement BCT channels exploiting the maximum distances specified in Table 1 shall meet the minimum requirements of Table 10. See IEC 61196 series for specifications of cables that meet such requirements.

**Table 10 – Minimum electrical performance requirements for BCT coaxial cable**

| No | Electrical Characteristics | Units | Frequency MHz | Requirement |
|---|---|---|---|---|
| 1 | Mean Characteristic impedance | Ω | | 75 ± 3 |
| 2 | Minimum return loss (*RL*) on 100 m cable | dB | $5 \leq f < 470$ | 20 |
| | | | $470 \leq f < 1\,000$ | 18 |
| | | | $1\,000 \leq f \leq 3\,000$ | 12 ffs |
| 3 | Maximum attenuation | dB/100 m | $1 \leq f \leq 3\,000$ | $0{,}835 \times \sqrt{f} + 0{,}0025\ f$ |
| | Informative values at key frequencies | | $f = 5$ | 4 |
| | | | $f = 10$ | 4 |
| | | | $f = 100$ | 8,6 |
| | | | $f = 200$ | 12,3 |
| | | | $f = 600$ | 22,0 |
| | | | $f = 1\,000$ | 28,9 |
| | | | $f = 2\,400$ | 46,9 |
| | | | $f = 3\,000$ | 53,2 |
| 4 | Maximum (d.c.) loop resistance | Ω/100 m | d.c. | 9 |
| 5 | d.c. current carrying capacity | A | d.c. | 0,5 |
| 6 | Operating voltage | V | d.c. | 72 |
| 7 | Power capacity | W | d.c. | Ffs |
| 8 | Velocity ratio | % | | >66 |
| 9 | Minimum screening attenuation | dB | $30 \leq f \leq 1\,000$ | 85 |
| | Connected to cable TV | | $1\,000 < f \leq 3\,000$ | ffs |
| | Individual antenna | | $30 \leq f \leq 1\,000$ | 75 |
| | | | $1\,000 < f \leq 3\,000$ | ffs |
| 10 | Maximum transfer impedance | mΩ/m | $f = 5$ | 7 |
| | | | $f = 30$ | 1,2 |

1208 Any coaxial cable used to implement BCT channels shall meet the minimum requirements for
1209 mechanical characteristics specified in Table 11 for connector compatibility of clause 10.

1210 **Table 11 – Mechanical performance requirements for coaxial BCT cables**

| | Cable characteristics | Units | Value |
|---|---|---|---|
| 1 | Diameter of inner conductor [a] | mm | 0,6 to 1,2 |
| 2 | Diameter over dielectric [a] | mm | 3 to 6 |
| 3 | Outer diameter of outer conductor | mm | 3,5 to 6,5 |
| 4 | Number of coaxial cable elements in a cable | pairs | ≥ 1 |
| 5 | Outer diameter of cable [b] | mm | ≤ 11 |
| 6 | Temperature range [c] | °C | installation: 0 to +50<br>operation: -20 to +60 |
| 7 | Minimum bending radius for pulling during installation | | 10 times outer cable diameter |
| 8 | Minimum bending radius installed | | 6 times outer cable diameter |
| 9 | Pulling strength [d] | N/mm² | ffs |
| 10 | Cable marking | | as required |

[a] Conductor diameters below 0,6 mm and above 1,2 mm may not be compatible with all connecting hardware.
The two measured values using the IEC method must be averaged and then compared to the limit for compliance verification.

[b] Should be minimised to make best use of duct and cross-connect capacity. In case of under carpet cable the value is not applicable.

[c] For certain applications (e.g. precabling buildings in cold climate) a cable with a lower temperature bending performance of –30 °C may be required.

[d] This is to indicate cable performance, installation needs are for further study.

## 9.4 Cable performance for CCCB coverage area

Cables used to implement CCCB coverage area, assuming a maximum length of 50 m of installed cable including all spurs, shall meet the minimum requirements for installed cables specified in Table 12.

**Table 12 – Minimum transmission performance requirements for CCCB coverage area cables**

| | Cable Characteristics | | | Cable performance | | Test Method |
|---|---|---|---|---|---|---|
| | **Electrical Characteristics at all operating temperatures** | **Units** | **Frequency** kHz | **Power feeding** | **Information transfer including cable sharing** | |
| 1 | Mutual capacitance | nF/km max | $f = 1$ | N/A | 90 | 3.2.5 of IEC 61156-1 |
| 2 | Maximum d.c. loop resistance | Ω/km | d.c. | 75 | 150 | 3.2.1 of IEC 61156-1 |
| 3 | Maximum d.c. resistance unbalance | % | d.c. | 1,5 | 1,5 | 3.2.2 of IEC 61156-1 |
| 4 | Current carrying capacity per conductor | A | d.c. | 0,75 | N/A | To be met by design |
| 5 | Operating voltage | V | d.c. | 72 | 72 | |
| 6 | Maximum attenuation | dB/100 m | $f = 100$ | N/A | 2 | 3.3.2 of IEC 61156-1 |
| 7 | Capacitance unbalance between pairs | pF/km | $f = 1$ | N/A | 500 | 3.2.6 of IEC 61156-1, |
| 8 | Capacitance unbalance to earth | pF/km | $f = 1$ | N/A | 3 000 | 3.2.6 of IEC 61156-1 |
| 9 | Maximum group delay | µs/km | $f = 100$ | N/A | 5,5 | 3.3.1 of IEC 61156-1 |
| 10 | Minimum near end unbalance attenuation | dB | $f = 100$ | N/A | 40 | 3.3.3 of IEC 61156-1 |

NOTE 1 the same pair may be used for power feeding and information transfer.

NOTE 2 operating temperatures normally are in the range of –20 °C to +60 °C.

1217 Any cable used to implement CCCB channels shall meet the minimum requirements for
1218 mechanical characteristics specified in Table 13.

1219 **Table 13 – Mechanical performance requirements for balanced CCCB coverage area**
1220 **cables**

| Cable characteristics | | Units | Cable performance | Test method |
|---|---|---|---|---|
| 1 | Mechanical characteristics | | | Subclause |
| 1.1 | Diameter of conductor | mm | 0,65 to 1,0 [a] | 3.4.1 of IEC 61156-1 |
| 1.2 | Diameter over insulated conductor [b] | mm | ≤1,6 | 3.4.1 of IEC 61156-1 |
| 1.3 | Number of conductors in a cable element | per pair / per quad | 2/4 | Visual |
| 1.4 | Screen around cable element [c] | | Optional | Visual |
| 1.5 | Number of cable elements in a unit | Pairs | ≥1 | Visual |
| | | Quads | ≥1 | Visual |
| 1.6 | Screen around cable unit [c] | | Optional | Visual |
| 1.7 | Number of cable units in a cable | | ≥1 | Visual |
| 1.8 | Screen around cable core [c] | | Optional | Visual |
| 1.9 | Outer diameter of cable [d, e] | mm | ≤20 | 3.4.1 of IEC 61156-1 |
| 1.10 | Temperature range [f] | °C | Installation: 0 to +50<br>Operation: –20 to +60 | ffs |
| 1.11 | Minimum bending radius for pulling during installation | | 8 times outer cable diameter | 3.4.8 of IEC 61156-1 |
| 1.12 | Minimum bending radius fixed Fr172 | | 4 times outer cable diameter | To be met by design |
| 1.13 | Pulling strength [g] | $N/mm^2$ | ffs | 3.4.9 of IEC 61156-1 |
| 1.14 | Fire rating | | According to 3.5.9 of IEC 61156-1 unless otherwise in accordance with national or local regulation | As applicable |
| 1.15 | Colour coding [h] | | As required by local regulations or customer preferably IEC 60708-1 | To be met by design |
| 1.16 | Cable marking | | As required by local regulations or national specifications | To be met by design |

[a] Conductor diameters above 0,8 mm may not be compatible with all connecting hardware.

[b] Diameters of the insulated conductor up to 1,6 mm may be used if they meet all other performance requirements. These cables may not be compatible with all connecting hardware.

[c] If it is intended to use cables with screening, care shall be taken that the connecting hardware is properly designed to terminate the screen.

[d] Should be minimised to make best use of duct and cross-connect capacity.

[e] In case of under carpet cable the value is not applicable.

[f] For certain applications (e.g. precabling buildings in cold climate) a cable with a lower temperature bending performance of –30 °C may be required.

[g] This is to indicate cable performance, installation needs are for further study.

[h] For cables with fewer cable elements than those specified by IEC 60708, pair colours should be consistent with all pairs or quads specified starting from 1 up to the number of elements in the cable.

# 10 Connecting hardware

## 10.1 General requirements

### 10.1.1 Applicability

This clause provides guidelines and requirements for connecting hardware used in a generic cabling. For the purpose of this clause, a connector is a component normally attached to a cable or mounted on a piece of apparatus (excluding an adapter) for electrically or optically joining separable parts of a cabling system. Unless otherwise specified, only the performance of connections is specified. For connectors used at TOs, BOs, Cos, mating interfaces and minimum performance are specified. For connectors at all other places only the minimum performance is specified.

These requirements apply to individual connectors, which include TOs, BOs, COs, patch panels, splices and cross-connects. All requirements for these components are applicable for the temperature range of –10 ºC to +60 ºC. At other operating temperatures the performance may be different. Performance requirements do not include the effects of cross-connect jumpers or patch cords. Requirements for cords for ICT cabling are provided in clause 13 of ISO/IEC 11801 Ed.2.

In the following tables, requirements are provided for a range of frequencies. Performance values at discrete frequencies are provided for reference only. The requirements listed for ICT are an excerpt from ISO/IEC 11801.

NOTE This clause does not address requirements for devices with passive or active electronic circuitry, including those whose main purpose is to serve a specific application or to provide compliance with other rules and regulations. Examples include media adapters, impedance matching transformers, terminating resistors, LAN equipment, filters and protection apparatus. Such devices are considered to be outside the scope of a generic cabling and may have significant detrimental effects on network performance. Therefore, it is important that their compatibility with the cabling system and equipment be considered before use.

### 10.1.2 Location

Connecting hardware is installed:

a) in a home distributor (PHD/SHD) providing the cross-connections between cabling subsystems and interconnections to application-specific equipment;

b) at the ACPs;

c) at the TOs, BOs and COs.

### 10.1.3 Design

In addition to its primary purpose, connecting hardware should be designed to provide:

a) a means to identify cabling for installation and administration as described in ISO/IEC 14763-1;

b) a means to permit orderly cable management;

c) a means of access to monitor or test cabling and equipment;

d) protection against physical damage and ingress of contaminants;

e) a termination density that is space efficient, but that also provides ease of cable management and ongoing administration of the cabling system;

f) a means to accommodate screening and bonding requirements, when applicable.

Any connections used at distributors shall meet the same performance requirements as those specified in this clause.

### 10.1.4 Operating environment

Performance of the connecting hardware shall be maintained over temperatures ranging from –10 °C to +60 °C. Connecting hardware should be protected from physical damage and from direct exposure to moisture and other corrosive effects. This protection may be accomplished by installation in an appropriate enclosure for the environment according to the relevant IEC standard.

### 10.1.5 Mounting

Connecting hardware should be designed to provide flexibility for mounting, either directly or by means of an adapter plate or enclosure (e.g. on walls, in walls, in racks, or on other types of distribution frames and mounting fixtures).

### 10.1.6 Installation practices

The manner and care with which the cabling is implemented are significant factors in the performance and ease of administration of installed cabling systems. Installation and cable management precautions should include the elimination of cable stress as caused by tension, sharp bends, and tightly bunched cables.

The connecting hardware shall be installed to permit:

a) minimal signal impairment and maximum screen effectiveness (where screened cabling is used) by proper cable preparation, termination practices (in accordance with manufacturer's guidelines) and well organised cable management;

b) room for mounting equipment associated with the cabling system. Racks should have adequate clearances for access and cable dressing space.

In cabling pathways and in areas occupied by connecting hardware, cable bend radius requirements in clause 9 shall be observed.

The connecting hardware shall be identified according to the requirements of ISO/IEC 14763-1. Planning and installation of connecting hardware for ICT cabling should be carried out in accordance with ISO/IEC TR 14763-2.

NOTE 1 Some connections are used to perform a crossover function between two elements to properly configure cabling channels for transmit and receive connections.

NOTE 2 Besides signal degradation, improper termination practices of balanced cable elements, screens or both also may create loop antenna effects resulting in levels of signal emissions that may exceed regulatory requirements.

### 10.1.7 Marking and colour coding

In order to maintain consistent and correct point-to-point connections, provision shall be made to ensure that terminations are properly located with respect to connector positions and their corresponding cable elements. Such provisions may include the use of colours, alphanumeric identifiers or other means designed to ensure that cables are connected in a consistent manner throughout the system.

When two physically similar cable types are used in the same subsystem, they shall be marked in such a way as to allow each cable type to be clearly identified. For example, different performance categories, different nominal impedance and different optical fibre core diameters should carry unique markings or colours to facilitate visual identification.

## 10.2 Mating interfaces at TO, BO and CO

### 10.2.1 General

Mating interfaces used for ICT channels shall comply with ISO/IEC 11801 Ed.2.

Any connecting hardware used shall ensure that the channel requirements specified in clause 7 are met.

When connectors are used at TOs, BOs, and COs the mating interfaces shall meet the following specifications.

### 10.2.2 Mating interface for TO

TOs for ICT: ICT connector: IEC 60603-7 series (including IEC 60603-7-1 for screened/unscreened connectors, IEC 60603-7-2 for unscreened connectors, IEC 60603-7-3 for screened connectors, IEC 60603-7-4, IEC 60603-7-5 and IEC 60603-7-7 for screened connectors.)

NOTE Some local codes or regulation may require a specific connector for a telephone outlet, especially for homes.

Pin and Pair Assignments for the IEC 60603-7 series connectors for ICT applications are specified in Figure 16.

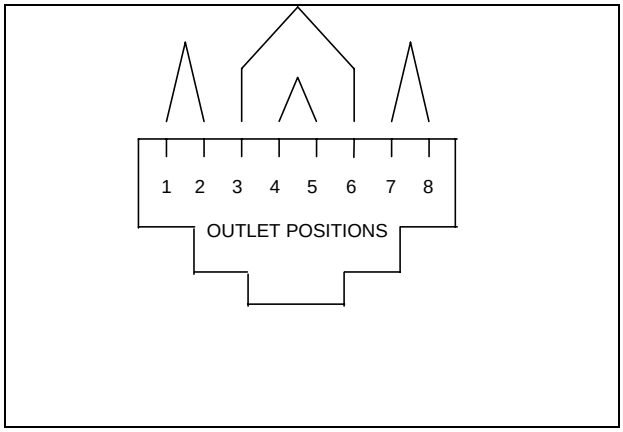



**Figure 16 – Pin grouping assignments for IEC 60603-7 series outlet (front view)**

### 10.2.3 Mating interface for BO

BOs for BCT are either of the balanced or the coaxial type. At BOs for balanced channels the balanced BCT connector: IEC 61076-3-104 for balanced cables and BOs for coaxial channels the coaxial BCT connectors: IEC 61169-2, IEC 61169-24 (Type F) for coaxial cables shall be used.

Pin and Pair Assignments for IEC 61076-3-104 and IEC 60603-7-7 style connectors for ICT and BCT applications using a balanced BO are specified in Figure 17 and Figure 18.

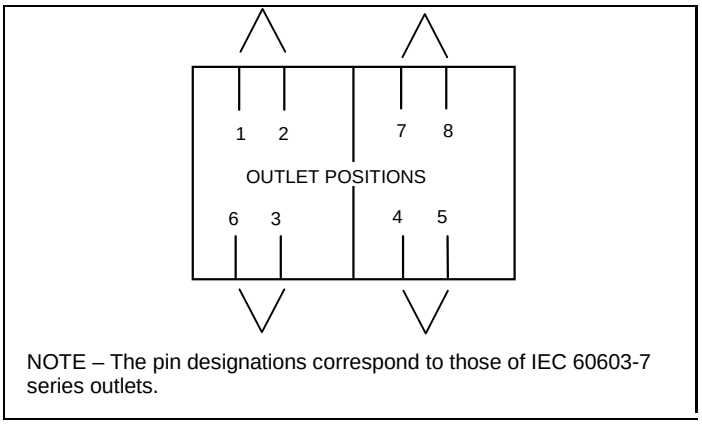



**Figure 17 – Pin grouping assignments for 61076-3-104 outlet (front view)**

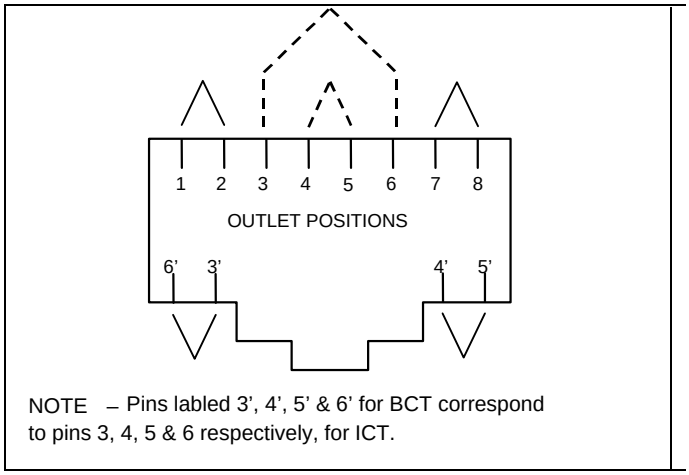



**Figure 18 – Pin grouping assignments for IEC 60603-7-7 outlet (front view)**

Figure 19 and Figure 20 show the mating interfaces for coaxial BOs.

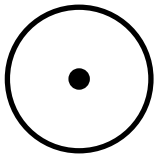


**Figure 19 – IEC 61169-2 connector**

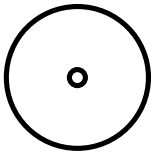


**Figure 20 – IEC 61169-24 (Type F) connector**

### 10.2.4 Mating interface for CO

COs for CCCB: CCCB connector interface is not specified in this standard.

### 10.2.5 Minimum performance requirements

#### 10.2.5.1 General

Connecting hardware for use in distributors, TOs, BOs and COs shall meet the corresponding performance requirements specified in the following tables.

For connecting devices that provide cross-connections without patch cords or jumpers, electrical performance shall not be worse than the equivalent of two connectors and 5 m of patch cord of the same application group. Applicable parameters include insertion loss, input to output resistance, input to output resistance unbalance, propagation delay, delay skew and transfer impedance. In addition, crosstalk loss, return loss and unbalance insertion loss of such devices are permitted to be worse than the minimum values specified in the following tables but not more than 6 dB.

#### 10.2.5.2 Mechanical characteristics

Connecting hardware intended for use with balanced cabling shall meet the requirements specified in Table 14.

1355 **Table 14 – Mechanical characteristics of connecting hardware for use with balanced**
1356 **cabling**

| Mechanical characteristics | | | Requirement | Component or test standard |
|---|---|---|---|---|
| a) | Physical dimensions **(only at TO, BO or CO)** | ICT | Mating dimensions and gauging IEC 60603-7-2, -3 [a] | IEC 60603-7-2, -3 [a] |
| | | BCT-B | Mating dimensions and gauging IEC 61076-3-104 [b] | IEC 61076-3-104 [b] |
| | | BCT-C | Mating dimensions and gauging IEC 61169-24, IEC 61169-2 | IEC 61169-2-2, -2-3, -2-4 |
| | | CCCB | Mating dimensions and gauging ffs | ffs |
| b) | Termination compatibility for balanced cables | | | |
| | Nominal conductor diameter - mm | ICT and BCT | 0,5 to 0,65 [c] | - |
| | | CCCB | 0,65 to 1,0 | |
| | Cable type | Patching [d] | Stranded conductors | - |
| | | Jumpers | Stranded or solid conductors | - |
| | | Other | Solid conductors | - |
| | Nominal diameter of insulated conductor mm | ICT and BCT | 0,7 to 1,4 [e, f] | - |
| | | CCCB | 0,7 to 1,6 | |
| | Number of conductors | TO | 8 | Visual inspection |
| | | Other | ≥ 2*n (n = 1,2,3, ...) | |
| | Cable outer diameter mm | Outlet | ≤ 20 | - |
| | | Plug | ≤ 9 [g] | |
| | Means to connect screen [h] | | - | Annex B and clause 11.4 |
| c) | Mechanical operation (durability) | | | |
| | Cable termination (cycles) | Non-reusable IDC | 1 | IEC 60352-4 |
| | | Reusable IDC | ≥ 20 | IEC 60352-3 |
| | | Non-reusable IPC (plug) | ≥ 1 | IEC 60352-6 |
| | Jumper termination (cycles) | | ≥ 200 [i] | IEC 60352-3 |
| | Two pieces interface (cycles) (e.g. modular plug and socket) | | ≥ 750 | IEC 60603-7, IEC 61076-3-104, level P1 |

[a] For higher frequency performance the applicable IEC 60603-7 detail specification applies.

[b] In installations where other factors, such as interoperability with 60603-7 series take preference over the connector sharing offered with IEC 61076-3-104, also the interface specified in IEC 60603-7-7 may be used.

[c] It is not required that connecting hardware be compatible with cables outside of this range. However, when cables with conductor diameters as low as 0,4 mm or as high as 0,8 mm are used, special care shall be taken to ensure compatibility with connecting hardware to which they connect.

[d] Connectors used in work area cords and equipment cords shall also be compatible with stranded conductors.

[e] Use of the modular plug connector specified in IEC 60603-7 is typically limited to cables having insulated conductor diameters in the range of 0,8 mm to 1,6 mm.

[f] It is not required that connecting hardware be compatible with cables outside of this range. However, when cables with insulated conductor diameters as high as 1,6 mm are used, special care shall be taken to ensure compatibility with connecting hardware to which they connect.

[g] Applicable only to individual units.

[h] If it is intended to use screened cabling, care should be taken that the connector is designed to terminate the screen. Note that there may be a difference between connectors designed to terminate balanced cables with overall screens only, as opposed to cables having both individually screened elements and an overall screen.

[I] This durability requirement is only applicable to connections designed to administer cabling system changes (i.e., at a distributor)

### 10.2.5.3 Electrical characteristics

Connecting hardware intended for use with balanced cabling shall meet the following performance requirements. Connecting hardware shall be tested with terminations and test leads that match the nominal characteristic impedance of the type of cables (i.e. 100 Ω or 120 Ω) they are intended to support.

Connectors used for ICT applications shall comply with category 5 requirements defined in ISO/IEC 11801 Ed.2. Connectors used for BCT applications shall comply with the requirements listed in Table 15, Table 16 and table 17 together with the category 7 requirements defined in ISO/IEC 11801 Ed.2.

**Table 15 – Return loss (*RL*)**

| Electrical characteristics | Frequency MHz | Requirement | | | Test standard |
|---|---|---|---|---|---|
| | | BCT B | BCT C | CCCB | |
| Minimum return loss (*RL*) [a] dB | $f = 0{,}1$ | N/A | N/A | 30,0 | IEC 60512-25-5 (balanced, draft) |
| | $1 \leq f \leq 100$ | - | - | 30,N/A | IEC 61169-2 |
| | $1 \leq f \leq 1\,000$ | 68 – 20lg(*f*) | - | N/A | IEC 61169-24 |
| | $1 \leq f \leq 3\,000$ | N/A | 79 – 20lg(*f*) | N/A | |
| Minimum return loss (*RL*) values at selected frequencies (reference only) [b] dB | $f = 0{,}1$ | 30 | N/A | 0 | |
| | $f = 1$ | 30,0 | 23,0 | N/A | |
| | $f = 100$ | 28,0 | 23,0 | N/A | |
| | $f = 1\,000$ | 10,0 | 23,0 | N/A | |
| | $f = 3\,000$ | N/A | 9,5 | N/A | |

[a] Return loss (*RL*) for BCT-C from 1 to 2,0 GHz is 23 dB.

[b] Return loss (*RL*) at frequencies that correspond to calculated values of greater than 30,0 dB shall revert to a minimum requirement of 30,0 dB.

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**Table 16 – Insertion loss**

| Electrical characteristics | Frequency MHz | Requirement | | | Test standard |
|---|---|---|---|---|---|
| | | BCT B | BCT C | CCCB | |
| Maximum insertion loss (*IL*) [a] dB | $f = 0{,}1$ | 0,10 | N/A | 0,10 | IEC 60512-25-2<br>IEC 61169-1 (coax) |
| | $1 \leq f \leq 100$ | N/A | 0,1 | N/A | |
| | $1 \leq f \leq 1\,000$ | $0{,}02\sqrt{f}$ | 0,1 | N/A | |
| | $1 \leq f \leq 3\,000$ | N/A | $0{,}02\sqrt{f}$ | N/A | |
| Maximum insertion loss (*IL*) values at selected frequencies (informative) dB | $f = 0{,}1$ | 0,10 | 0,10 | 0,10 | |
| | $f = 1$ | 0,10 | 0,10 | N/A | |
| | $f = 100$ | 0,20 | 0,20 | N/A | |
| | $f = 600$ | 0,49 | 0,49 | N/A | |
| | $f = 1\,000$ | 0,63 | 0,63 | N/A | |
| | $f = 2\,400$ | N/A | 0,98 | N/A | |
| | $f = 3\,000$ | N/A | 1,10 | N/A | |
| [a] Insertion loss at frequencies that correspond to calculated values of less than 0,1 dB shall revert to a requirement of 0,1 dB maximum. | | | | | |

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**Table 17 – Near end crosstalk (*NEXT*)**

| Electrical characteristics | Frequency | Requirement | Test standard |
|---|---|---|---|
| | MHz | CCCB | |
| Minimum *NEXT* dB | $f = 0{,}1$ | 80,0 | IEC 60512-25-1 (balance) |
| Minimum *NEXT* values at selected frequencies (informative) dB | $f = 0{,}1$ | 80,0 | |

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**Table 18 – Far end crosstalk (*FEXT*)**

| Electrical characteristics | Frequency | Requirement | Test standard |
|---|---|---|---|
| | MHz | CCCB | |
| Minimum *FEXT* dB | $f = 0{,}1$ | 65,0 | IEC 60512-25-1 |
| Minimum *FEXT* loss values at selected frequencies (informative) dB | $f = 0{,}1$ | 65,0 | |

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**Table 19 – Input to output resistance**

| Electrical characteristics | Frequency MHz | Requirements | Test standard |
|---|---|---|---|
| | | CCCB | |
| Maximum Input to Output Resistance [a] mΩ | d.c. | 100 | IEC 60512-2 Test 2a |
| [a] Input to output resistance is a separate measurement from the contact resistance measurements required in IEC 60603-7. Input to output resistance is measured to determine the connector's ability to transmit direct current and low frequency signals. Contact resistance measurements are used to determine the reliability and stability of individual electrical connections. These requirements are applicable to each conductor and to the screen, when present. | | | |

1371 **Table 20 – Current carrying capacity**

| Electrical characteristics | Frequency | Requirement | Test standard |
|---|---|---|---|
| | MHz | **CCCB** | |
| Minimum current carrying capacity [a, b, c] A | d.c. | 0,7 | IEC 60512-3 Test 5b (balanced)<br>61169-1-2 (coax) |
| [a] Applicable for an ambient temperature of 60 ºC.<br>[b] Applicable to each conductor.<br>[c] Sample preparation shall be as specified in the applicable document. | | | |

1372 **Table 21 – Propagation delay**

| Electrical characteristics | Frequency | Requirement | Test standard |
|---|---|---|---|
| | MHz | **CCCB** | |
| Maximum Propagation Delay ns | $f = 0{,}1$ | 1,0 | IEC 60512-25-4 |

1373 **Table 22 – Coupling Attenuation**

| Electrical characteristics | | Frequency | Requirement | | | Test standard |
|---|---|---|---|---|---|---|
| | | MHz | **BCT B** | **BCT C** | **CCCB** | |
| Minimum Coupling Attenuation dB | | $f = 0{,}1$ | N/A | N/A | ffs | EN 50289-1-14 |
| | | $1 \leq f \leq 100$ | N/A | N/A | N/A | |
| | Individual antenna | $1 \leq f < 1\,000$ | 75 | N/A | N/A | |
| | Connected to CATV | $30 \leq f < 300$ | 85 | N/A | N/A | |
| | | $300 \leq f < 470$ | 80 | N/A | N/A | |
| | | $470 \leq f \leq 1\,000$ | 75 | N/A | N/A | |
| | | $1 \leq f \leq 3\,000$ | N/A | 85 | N/A | |
| Minimum Coupling Attenuation at selected frequencies dB | | $f = 0{,}1$ | N/A | N/A | ffs | |
| | | $f = 1$ | 85 | N/A | N/A | |
| | | $f = 100$ | 85 | N/A | N/A | |
| | | $f = 1\,000$ | 75 | N/A | N/A | |
| | | $f = 3\,000$ | N/A | 85 | N/A | |

1374 **Table 23 – Insulation resistance**

| Electrical characteristics | Frequency | Requirement | Test standard |
|---|---|---|---|
| | MHz | **CCCB** | |
| Minimum insulation resistance MΩ | d.c. | 100 | IEC 60512-2 Test 3a, Method C – 500 V d.c. |

**Table 24 – Voltage proof**

| Electrical characteristics | | Frequency MHz | Requirement CCCB | Test standard |
|---|---|---|---|---|
| Minimum voltage proof | | d.c. | | IEC 60512-2 Test 4a |
| V | Conductor to conductor | | 1 000 | |
| | Conductor to test panel | | 1 500 | |

# 11 Safety requirements and screening practices

## 11.1 General

In order to achieve most reliable safety and EM performance the international standards referenced in this clause shall be considered. However, applicable national and local regulations shall take precedence.

## 11.2 Coexistence with mains

Where CCCB, ICT or BCT cable share the same pathways as mains power cables:

- Special measures regarding dielectric strength between cables and cable elements have to be taken into account.
- a barrier, a partition or physical separation in accordance with applicable regulations and performance requirements may be required.

## 11.3 Operational safety

The cabling system specified in this standard and the equipment connected to it, shall ensure safe operation and protection against electric shock during normal operation as well as under specified fault conditions such as short circuits in the cabling or the attached equipment.

Care shall be taken that no part of the cabling system comes into contact with higher voltages than SELV during or after the installation. This implies that the cabling system complies with the following electrical safety requirements.

To achieve the required protection against electric shock, SELV or PELV as defined in IEC 60364-4-41 shall be used as the protective measure for the HES cabling.

NOTE 1 Some countries do not accept the use of PELV according to IEC 60364-4-41.

If for functional reasons a connection between SELV circuits and earth is required, this connection shall comply with the requirements for protective impedance as described in IEC 61140.

NOTE 2 Some countries do not accept connections via protective impedance.

Where a lightning protection is required, IEC 61024 applies.

If a lightning protection system exists, the cabling system shall be integrated into this protection system.

## 11.4 Screening practices

### 11.4.1 General

This clause applies when screened cables or cables with screened elements or units are used. Only basic guidance is provided. The procedures necessary to provide adequate earthing for both electrical safety and electromagnetic performance are subject to national and local regulations, are dependent on proper workmanship, and are at times only

accomplished with installation-specific engineering. Note that a proper handling of screens in accordance with suppliers instructions will increase performance and safety.

### 11.4.2 Earthing

All screens of the cables shall be terminated at each distributor. Normally, the screens are connected to the equipment racks, which are, in turn, bonded to building earth.

NOTE 1 High working frequencies are served with a meshed system.

The bond shall be designed to ensure that:

a) The path to earth shall be permanent and of low impedance. It is recommended that each equipment rack is individually bonded, in order to assure the continuity of the earth path.

b) The cable screens provide a continuous earth path to all parts of a cabling system that are interconnected by it.

c) This bonding directs currents induced within the generic cabling to earth for the purpose of reducing interference from power lines and other sources of disturbances. All earthing electrodes of different systems in the building shall be bonded together in accordance with local regulations to reduce effects of differences in earth potential.

NOTE 2 ITU-T K.31 shall be taken into account.

The building earthing system should not exceed the earth potential difference limits of 1 V r.m.s. between any two earths on the network.

# Annex A
(normative)

# BCT channel levels

*Editors note: IEC TC 100 is asked explicitly to comment this annex.*

Cabling channels for BCT may be provided via balanced or coaxial cables, OF are ffs.

In order to economically support homes of different sizes, that may be subject to different signal levels arriving at the PHD, depending on e. g. the distance to an antenna or an ENI of a cable TV system, the BCT channels have been subdivided in three levels of insertion loss as shown in Table A. 1.

**Table A. 1 – BCT channels division**

| Name | Units | BCT-H | BCT-M | BCT-L |
|---|---|---|---|---|
| Input signal level | | high | medium | low |
| Insertion loss level | | high | medium | low |
| Insertion loss value at 1 GHz | dB | 32 | 16,5 | 9 |
| Max. reference length with coaxialcable | m | 100 | 50 | 25 |
| Max. reference length with balanced cable | m | 50 | 25 | 12,5 |

This takes into account that a number of BCT applications supported by the generic cabling specified in this standard use analogue technology, where signals are amplified rather than regenerated and therefore can handle less of a difference in channel insertion loss than digital transmission.

# Annex B
(normative)

# Link performance

## B.1 General

This Annex contains performance requirements for installed cabling between test interfaces for permanent links which do not constitute the entire channel.

This Annex specifies the minimum performance requirements for three permanent links: ICT, BCT and CCCB (only the part served by the area feeder cable). For channel models see clause 5.

The possible test interfaces are specified Figure 5 and Figure 11.

NOTE For the division of BCT links in BCT-H, BCT-M and BCT-L see Annex C.

## B.2 Performance requirements for ICT permanent links

Permanent links for ICT shall meet the transmission performances specified in ISO/IEC 11801 Ed.2 for Class D permanent links over the whole temperature range the cabling is intended to work. In case more than one Class D channel uses the same cabling components (cables and connecting hardware), each channel shall meet the requirements as specified in ISO/IEC 11801 Ed.2 for Class E links. For cable sharing also see 9.3 of ISO/IEC 11801 Ed.2.

The cables installed as part of such links shall provide the transmission characteristics needed to meet this performance requirement. In addition they shall meet the mechanical characteristics specified in Table 8.

## B.3 Performance requirements for BCT permanent links

Permanent links for BCT may be provided via balanced or coaxial cables.

Permanent links for BCT implemented on balanced cable shall meet the minimum transmission performances as specified in Table B. 1 together with those specified for Class F links in ISO/IEC 11801 Ed.2 over the whole temperature range the cabling is intended to work. In addition the cables used shall meet the mechanical requirements as specified in Table 8.

1471 **Table B. 1 – Minimum performance of BCT permanent links via balanced cable**

| Permanent link characteristics | | | | Permanent link performance | Test Method |
|---|---|---|---|---|---|
| **No** | **Electrical Characteristics** | **Units** | **Frequency** MHz | | |
| 1 | Nominal impedance | Ω | | 100 [a] | to be met by design |
| 2 | Minimum return loss (*RL*) at each cabling Interface [b] | dB | $4 \le f < 40$ | $25 - 5\lg(f)$, 19 dB max | 4.9 of IEC 61935-1 |
| | | | $40 \le f \le 250$ | $33 - 10\lg(f)$, 8 dB min | |
| 3 | Maximum insertion loss (*IL*) (attenuation) | dB | $1 \le f \le 1\,000$ | $(L/100)\times\left(1{,}8\sqrt{f} + 0{,}01\times f + 0{,}2/\sqrt{f}\right) + n\times 0{,}02\times\sqrt{f}$ 2 dB min | |
| | | | $f = 1$ | 2,0 | 4.4 of IEC 61935-1 |
| | | | $f = 4$ | 2,0 | |
| | | | $f = 10$ | 2,5 | |
| | | | $f = 100$ | 8,1 | |
| | | | $f = 200$ | 11,7 | |
| | | | $f = 600$ | 21,4 | |
| | | | $f = 1\,000$ | 28,6 | |
| 10 | Minimum coupling - | dB | | | to be met by design |
| | atten-uation Connected to CATV | | $30 \le f < 300$ | 85 | |
| | | | $300 \le f < 450$ | 80 | |
| | | | $450 \le f \le 1\,000$ | 75 | |
| | atten-uation Individual antenna | | $30 \le f \le 1\,000$ | 75 | |

[a] This value is achieved by suitable design, and appropriate choice of cabling components (irrespective of their nominal impedance), see ISO/IEC 11801.

[b] The return loss requirements shall be met at both ends of the cabling. Return loss (*RL*) values at frequencies where the insertion loss (*IL*) is below 3,0 dB are for information only.

Permanent links for BCT implemented on coaxial cable shall meet the minimum transmission performances as specified in Table B. 2 over the whole temperature range the cabling is intended to work. In addition the cables used shall meet the mechanical requirements as specified in Table 11.

**Table B. 2 – Minimum performance of BCT permanent links via coaxial cable**

| Permanent link characteristics | | | | Permanent link performance | | Test Method |
|---|---|---|---|---|---|---|
| **No** | **Electrical Characteristics** | **Units** | **Frequency** MHz | **Coaxial link** | | |
| | | | | **1 GHz link** | **3 GHz link** | |
| 1 | Nominal impedance | Ω | | 75 | | to be met by design |
| 2 | Minimum return loss (*RL*) at each cabling interface | dB | $5 \le f < 470$ | 18 | | |
| | | | $470 \le f < 1\,000$ | 16 | | |
| | | | $1\,000 \le f \le 3\,000$ | N/A | 10 | |
| 3 | Maximum insertion loss (*IL*) (attenuation) [a] | dB | $1 \le f \le 3\,000$ | $LPL \times \left(0{,}835\sqrt{f} + 0{,}0025 f\right)/100 + 2 \times 0{,}02\sqrt{f}$ 2 dB min. | | |
| | | | $f = 5$ | 2,0 | | |
| | | | $f = 10$ | 2,5 | | |
| | | | $f = 100$ | 8,1 | | |
| | | | $f = 200$ | 11,6 | | |
| | | | $f = 600$ | 20,7 | | |
| | | | $f = 1\,000$ | 27,3 | | |
| | | | $f = 2\,400$ | N/A | 44,2 | |
| | | | $f = 3\,000$ | N/A | 50,1 | |
| 4 | Minimum *NEXT* coaxial to coaxial | dB | $f = 100$ | 100 | | to be met by design |
| 5 | Maximum (d.c.) loop resistance | Ω | d.c. | 9 | | 5.1 of IEC 60189-1 |
| 6 | (d.c.) current carrying capacity | mA | d.c. | 500 | | to be met by design |
| 7 | Operating voltage | V | d.c. | 72 | | |
| 8 | Power capacity | W | d.c. | ffs | | |
| 9 | Maximum propagation delay | ns | $f = 100$ | 490 | | to be met by design |
| 10 | Minimum screening - attenuation | dB | | | | to be met by design |
| | Connected to CATV | | $30 \le f < 300$ | 85 | | |
| | | | $300 \le f < 450$ | 80 | | |
| | | | $450 \le f \le 1\,000$ | 75 | | |
| | Individual antenna | | $30 \le f \le 1\,000$ | 75 | | |

## B.4 Performance requirements for CCCB permanent links

The permanent link construed by the area feeder cable shall meet the minimum performance specified for Class D links in ISO/IEC 11801 Ed.2. The permanent link construed by area feeder cable and coverage area cabling used for CCCB information transfer shall meet the performance requirements for transmission characteristics specified in Table 5 over the whole temperature range the cabling is intended to work. The permanent links used for power feeding shall meet the minimum performance specified in Table 6 over the whole temperature range the cabling is intended to work.

The cables installed as part of permanent links shall provide the transmission characteristics needed to meet these performance requirements. In addition they shall meet the mechanical characteristics specified in Table 8 for the area feeder cable and in Table 13 for the coverage area cable.

# Annex C
(informative )

# BCT levels: channel and link performance and implementation

## C.1 General

All three BCT channel levels support the same applications. They provide the means to exploit the actual distances in a specific installation in order to minimise the need for amplification and attenuation of the signal at distributors and BOs.

In cases were the BCT channels in a specific premises belong to different performance levels, the level of performance should be identified for each channel installed. Channels that have a higher attenuation than the maximum attenuation specified for BCT-M should be marked as BCT-H, channels that have a higher attenuation than the maximum attenuation specified for BCT-L but a lower than the maximum attenuation for BCT-M should be marked as BCT-M, and channels below the maximum attenuation for BCT-L should be marked as BCT-L.

## C.2 BCT-H, BCT-M and BCT-L channels

Cabling channels for BCT-H, BCT-M and BCT-L implemented on balanced cable shall meet the minimum transmission performance for Class F channels as specified in ISO/IEC 11801 Ed.2 together with the return loss (*RL*), coupling attenuation and transfer impedance specified in Table 3, in addition they should meet the insertion loss (*IL*) specified in Table C. 1 over the whole temperature range the cabling is intended to operate at. The cables used shall also meet the mechanical requirements specified in Table 8.

NOTE The performance of network access cabling channels for BCT are for further study by relevant bodies.

**Table C. 1 – Minimum insertion loss of BCT-H, BCT-M and BCT-L channels via balanced cable**

| Channel Characteristics | | | Cabling Channel performance | | | Test Method |
|---|---|---|---|---|---|---|
| **Electrical Characteristics** | **Units** | **Frequency** MHz | **Balanced channel** | | | |
| Nominal impedance | Ω | | 100 | | | to be met by design |
| Maximum insertion loss (*IL*) | dB | | ***BCT-H*** | **BCT-M** | **BCT-L** | |
| | | $1 \le f \le 1\,000$ | $\left(LPL + x \times LEC\right) \times \left(1{,}645\sqrt{f} + 0{,}01 \times f + 0{,}25/\sqrt{f}\right) / 100 + 2 \times 0{,}02\sqrt{f}$ 2 dB min [a] | | | |
| Informative values for length factor in m | | | 49,5 | 24,5 | 12,5 | 4.4 of IEC 61935-1 |
| | | $f$ = 1 | *2* | 2 | 2 | |
| | | $f$ = 4 | *2* | 2 | 2 | |
| | | $f$ = 10 | *2,8* | 2 | 2 | |
| | | $f$ = 100 | *9,1* | 4,7 | 2 | |
| | | $f$ = 200 | *13,1* | 6,8 | 3,7 | |
| | | $f$ = 600 | *23,9* | 12,3 | 6,8 | |
| | | $f$ = 1 000 | *32,0* | 16,5 | 9,0 | |
| NOTE *For ease of use the BCT values from* Table 3 *are copied in italics as BCT-H.* | | | | | | |
| [b] $L_{PL}$ = permanent link length, and $L_{EC}$ = total equipment cord length x is the insertion loss (*IL*) premium for the cords. | | | | | | |

Cabling channels for BCT implemented on coaxial cable shall meet the minimum transmission performances specified in Table 4, in addition they should meet the insertion loss (*IL*) specified in Table C. 2 over the whole temperature range the cabling is intended to operate at. The cables used shall also meet the mechanical requirements specified in Table 11.

1517 **Table C. 2 – Minimum insertion loss of BCT-H, BCT-M and BCT-L channels via coaxial**
1518 **cable**

| **Channel Characteristics** | | | **Cabling Channel performance** | | | **Test Method** |
|---|---|---|---|---|---|---|
| **Electrical Characteristics** | **Units** | **Frequency** MHz | **Coaxial channel** | | | |
| Nominal impedance | Ω | | 75 | | | to be met by design |
| | | | ***BCT-H*** | **BCT-M** | **BCT-L** | |
| Maximum insertion loss (*IL*) (attenuation) | dB | $1 \leq f \leq 3\ 000$ | $(LPL + x \times LEC) \times (0{,}835\sqrt{f} + 0{,}025 f) / 100 + 2 \times 0{,}02\sqrt{f}$ 2 dB min [a] | | | ffs |
| Informative values for a length factor in m | | | 103,5 | 51,4 | 26,4 | |
| | | $f$ = 5 | *2* | 2 | 2 | |
| | | $f$ = 10 | *2,9* | 2 | 2 | |
| | | $f$ = 100 | *9,3* | 4,8 | 2,7 | |
| | | $f$ = 200 | *13,3* | 6,9 | 3,8 | |
| | | $f$ = 600 | *23,7* | 12,3 | 6,8 | |
| | | $f$ = 1 000 | *31,2* | 16,1 | 8,9 | |
| | | $f$ = 2 400 | *50,5* | 26,1 | 14,3 | |
| | | $f$ = 3 000 | *57,3* | 29,6 | 16,2 | |
| NOTE *For ease of use the BCT values from* Table 4 *are copied in italics as BCT-H.* | | | | | | |
| [a] $L_{PL}$ = permanent link length, and $L_{EC}$ = total equipment cord length x is the insertion loss (*IL*) premium for the cords. | | | | | | |

1519 ## C.3 BCT-H, BCT-M and BCT-L links

1520 Permanent links for BCT implemented on balanced cable should meet the minimum
1521 transmission performances for links as specified in Table B. 1 together with those specified
1522 for class F links in ISO/IEC 11801 Ed.2 over the whole temperature range the cabling is
1523 intended to work, together with the insertion loss specified in Table C. 3. In addition the
1524 cables used shall meet the mechanical requirements as specified in Table 8.

1525 **Table C. 3 – Insertion loss for BCT permanent links via balanced cable**

| Permanent link characteristics | | | Permanent link performance | | | Test Method |
|---|---|---|---|---|---|---|
| **Electrical Characteristics** | **Units** | **Frequency** MHz | **balanced BCT-H** | **balanced BCT-M** | **balanced BCT-L** | |
| Maximum insertion loss (*IL*) (attenuation) | dB | $1 \leq f \leq 1\,000$ | $(L/100) \times (1{,}645\sqrt{f} + 0{,}01 \times f + 0{,}25/\sqrt{f}) + 2 \times 0{,}02 \times \sqrt{f}$ 2 dB min | | | |
| Informative values for length factor in m | | | 46 | 21 | 8,5 | |
| | | $f$ = 1 | 2,0 | 2,0 | 2,0 | 4.4 of IEC 61935-1 |
| | | $f$ = 4 | 2,0 | 2,0 | 2,0 | |
| | | $f$ = 10 | 2,6 | 2,0 | 2,0 | |
| | | $f$ = 100 | 8,4 | 4,1 | 2,0 | |
| | | $f$ = 200 | 12,2 | 5,9 | 2,7 | |
| | | $f$ = 600 | 22,3 | 10,7 | 4,9 | |
| | | $f$ = 1 000 | 29,8 | 14,3 | 6,5 | |

[a] This value is achieved by suitable design, and appropriate choice of cabling components (irrespective of their nominal impedance), see ISO/IEC 11801.

1526 Permanent links for BCT implemented on coaxial cable should meet the minimum
1527 transmission performances for channels as specified in Table B. 2 over the whole temperature
1528 range the cabling is intended to work, together with the insertion loss specified in Table C. 4.
1529 In addition the cables used should meet the mechanical requirements as specified in Table
1530 11.

1531 **Table C. 4 – Insertion loss for BCT permanent links via coaxial cable**

| Permanent link characteristics | | | Permanent link performance | | | Test Method |
|---|---|---|---|---|---|---|
| **Electrical Characteristics** | **Units** | **Frequency** MHz | **Coax link BCT-L** | **Coax link BCT-M** | **Coax link BCT-H** | |
| Maximum insertion loss (*IL*) (attenuation) [a] | dB | $1 \leq f \leq 3\,000$ | $LPL \times (0{,}835\sqrt{f} + 0{,}0025 f)/100 + 2 \times 0{,}02\sqrt{f}$ 2 dB min. | | | |
| Informative values for length factor in m | | | 91 | 46 | 21 | |
| | | $f$ = 5 | 2,0 | 2,0 | 2,0 | |
| | | $f$ = 10 | 2,5 | 2,0 | 2,0 | |
| | | $f$ = 100 | 8,1 | 4,4 | 2,2 | |
| | | $f$ = 200 | 11,6 | 6,2 | 3,2 | |
| | | $f$ = 600 | 20,7 | 11,1 | 5,6 | |
| | | $f$ = 1 000 | 27,3 | 14,6 | 7,3 | |
| | | $f$ = 2 400 [a] | 44,2 | 23,5 | 11,8 | |
| | | $f$ = 3 000 [a] | 50,1 | 26,7 | 13,4 | |

[a] not applicable when the link is not intended to support 3 GHz channels.

## C.4 BCT levels' implementation

### C.4.1 General

This subclause provides details of the methodology used to develop the requirements for the BCT insertion loss levels introduced in Annex A and their interrelation with the cabling components of clauses 9 and 10 that produces the maximum reference implementation channel lengths of clause 8.

### C.4.2 Cable specifications

Two coaxial cable specifications have been developed by IEC (and Cenelec). These have equation based attenuation requirements as follows (in dB/100m):

- $ATTENUATION_{\text{cable A}} = 0{,}6 \times \sqrt{f} + 0{,}0025 \times f$ (E.1)
- $ATTENUATION_{\text{cable B}} = 0{,}835 \times \sqrt{f} + 0{,}0025 \times f$ (E.2)

A balanced cable with performance requirements at frequencies up to and including 1 GHz is being developed by IEC 61156-7. This cable has a formula based attenuation requirement as follows (in dB/100m):

$$1{,}645 \times \sqrt{f} + 0{,}01 \times f + \frac{0{,}25}{\sqrt{f}} \quad \text{(E.3)}$$

This cable will meet the requirements as specified for BCT B cables in 9.3.1.

### C.4.3 Connecting hardware specifications

In this international standard both the balanced and coaxial connecting hardware have an attenuation requirement of 0,02*$\sqrt{f}$ (in dB).

For this reason the insertion loss levels are characterised in terms of their channel attenuation requirements. Requirements for channel attenuation at 1 GHz of 32, dB, 16,5 dB and 9 dB were allocated to BCT-H, BCT-M and BCT-L respectively.

### C.4.4 Maximum channel lengths for reference implementations

The maximum channel lengths in the reference implementations are based upon a channel attenuation at 1 000 MHz of 32 dB (BCT-H), 16,5 dB (BCT-M), and 9 dB (BCT-L) corresponding to an approx. channel attenuation at 400 MHz of 19 dB, 10 dB and 6 dB. This relates to coaxial channel lengths of 100 m, 50 m and 25 m and balanced channel lengths of 48 m, 23 m and 11 m for application classes BCT-H, BCT-M and BCT-L respectively.

A common model is used for both balanced and coaxial channels. The assumptions are listed below:

- a two connections model;
- for channels in excess of 50 m (indicating a large home), it is assumed that the total equipment cordage will be 10 m;
- for channels of 50 m and below it is assumed that the total cordage will be 4 m.

The BCT-C cable used, is the cable B discussed above. The equipment cords have a stranded construction having 35 % attenuation premium (X = 1,35).

The balanced cable mentioned in C.4.2 will meet the requirements for BCT-B cables. The equipment cords are assumed to be of a stranded construction with a 35 % attenuation premium (X = 1,35).

The equations for channel insertion loss/attenuation are therefore:

- coaxial: $\left(L_{PT} + 1{,}35 \times L_{EC}\right) \times \frac{0{,}835\sqrt{f} + 0{,}0025 f}{100} + 0{,}04\sqrt{f}$ (E.4)

- balanced: $\left(L_{PT} + 1{,}35 \times L_{EC}\right) \times \frac{1{,}645\sqrt{f} + 0{,}01 f + \frac{0{,}25}{\sqrt{f}}}{100} + 0{,}04\sqrt{f}$ (E.5)

where $L_{PL}$ = permanent link length and $L_{EC}$ = total equipment cord length.

Table C. 5 shows the resulting channel lengths and their associated insertion loss/attenuation values.

**Table C. 5 – BCT-L, BCT-M and BCT-H channel implementations**

| Channel class | Cable type | Permanent link length m | Equipment cord length m | Channel length m | Attenuation dB | |
|---|---|---|---|---|---|---|
| | | | | | at 400 MHz | at 1 000 MHz |
| BCT-L | BCT B | 44 | 4 | 48 | 19,1 | 31,2 |
| BCT-L | BCT C | 90 | 10 | 100 | 19,1 | 32 |
| BCT-M | BCT B | 19 | 4 | 23 | 10 | 16,1 |
| BCT-M | BCT C | 46 | 4 | 50 | 10 | 16,5 |
| BCT-H | BCT B | 7 | 4 | 11 | 5,4 | 9 |
| BCT-H | BCT C | 21 | 4 | 25 | 5,5 | 9 |

### C.4.5 Channel lengths using other coaxial cable specifications

Installing cable A within the permanent link and using cable B as equipment cords creates a channel insertion loss/attenuation equation

- coaxial: $\left(L_{PT} + 1{,}35 \times L_{EC}\right) \times \frac{0{,}6\sqrt{f} + 0{,}002\,5 f}{100} + 0{,}04\sqrt{f}$ (E.6)

The channel lengths achieved will significantly exceed those defined for cable B and may be necessary for larger homes.

### C.4.6 Channel lengths using other balanced cable specifications

Installing cables that meet the requirements of Category 7 as specified in ISO/IEC 11801 creates a channel insertion loss/attenuation equation

- balanced: $\left(L_{PT} + 1{,}5 \times L_{EC}\right) \times \frac{1{,}8\sqrt{f} + 0{,}01 f + \frac{0{,}2}{\sqrt{f}}}{100} + 0{,}04\sqrt{f}$ (E.7)

The channel lengths achieved will be lower than for the BCT-B cables specified in this standard. However, the reduced cable diameter may be advantageous and such cables may be applicable to smaller homes.

# Annex D
(informative)

## Applications and Associated Cabling

Cabling is an infrastructure for applications. The requirements of applications on the media used are, above all, related to the bandwidth needed, and the topology (logical and physical implementation) used. Presently at least six kinds of cabling may be found in residential and commercial buildings that support groups of applications as listed in Table D. 1. In addition, cabling specific to a single application may be used, for example, between a PC and a printer, and between a hi-fi amplifier and speakers.

**Table D. 1 – Grouping of applications and cabling**

| Application field | | Present Cabling topology / cable type | | | | | | | Application Group |
|---|---|---|---|---|---|---|---|---|---|
| **Line No** | **Name** | **Mains** | **Phone** | **TV** | **Intercom** | **Security** | **Control** | **Other** | |
| 1 | Mains supply | O/p | | | | | | | mains supply |
| 2 | Lighting control | O/p | | | | | O/h, p, t | | CCCB |
| 3 | Building control | O/p | | | | | O/h, p, t | | CCCB |
| 4 | Appliance control | O/p | | | | | O/h, p, t | | CCCB |
| 5 | Demand management via circuit breakers | O/p | | | | | | | |
| 6 | Burglar alarm | | | | | B/t | | | CCCB |
| 7 | Fire alarm | | | | | B/t | | | CCCB |
| 8 | Intercom | | | | B/t | | O/h, t | | ICT |
| 9 | Telephone | | E/t | | | | | | ICT |
| 10 | ISDN | | E/t | | | | | | ICT |
| 11 | HiFi | | | | | | | S/l | BCT |
| 12 | Computing | | B/d, S/t | | B/d, S/t | B/d, S/t | B/d, S/t, d | O/d | ICT |
| 13 | CCTV | | | B/c,S/c | B, S | | | B/c | BCT |
| 14 | Radio and TV | | | B, S/c | | | | B/c | BCT |
| **Column No** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |

B: Bus, loop through
c: coaxial cable
d: data cable
E: extended star
h: home control system cable
l: loudspeaker cable
O: open topology. For mains distribution based on local regulations, this may include loops.
p: power distribution cable
S: star
t: simple “telephone” cable

The difference in cabling is caused by electrical codes, requirements concerning the electrical characteristics of the channel, the topology required or permitted by the applications, and traditions in installation profession. Variations may be found in the number of outlets supported by a specific transmission technology used for / by the application, e. g., point to point or bus. In some commercial buildings, separate networks for security and/or telephone may be required for administrative purposes or to meet contractual requirements e. g. with a specific insurance company.

With changing technology, regulations and electrical codes, it is feasible to have a generic cabling infrastructure that serves all purposes other than for mains distribution, and comprising only three groups of applications conveying information as shown in Table D. 1, column 9: CCCB, ICT and BCT, since the electrical characteristics of the channels and the topologies required by these different applications are similar enough to allow few cable types and two topologies to serve all applications.

Taking into account

- the transmission characteristics of the channels required by different groups of application; and
- the differences in technique and demand situation for low and high performance balanced cables;

a generic cabling infrastructure serving all purposes other than mains presently consists of three channel classes as outlined in Table D. 2. This table summarises the most obvious characteristics, which are described in detail in the relevant clauses.

NOTE In some cases local rules and regulations may limit the degree of integration allowed in a specific implementation.

Compared to ICT and BCT cabling, the requirements of CCCB cabling can be more demanding with respect to power load and may require a higher insulation. It is however, less demanding with respect to transmission performance.

ICT cabling generally uses balanced cabling, as specified in ISO/IEC 11801 Ed.2.

BCT may use coaxial and balanced cables. Therefore for pre-cabling both cable constructions are specified.

**Table D. 2 – Characteristics of ICT, BCT & CCCB Cabling**

| | ICT Cabling | BCT Cabling | CCCB Cabling |
|---|---|---|---|
| Topology | (Hierarchical) star<br>see Figure 4 | (Hierarchical) star,<br>see Figure 4 | Bus, tree, star ,<br>see Figure 8 |
| Type of media | Balanced cables, optical fibres | Balanced cables, coaxial cables, optical fibres | Balanced cables |
| Typical frequency range | Up to 100 MHz | Up to 3 GHz [a] | Up to 100 kHz |
| Channel Classes According to ISO/IEC 11801 Ed.2 | Class D [b] | N/A | N/A |
| Power distributed on network | Occasionally | Occasionally | Frequently |
| Device Mobility or frequent Relocation | YES | YES | NO for sensors, switches<br>YES for specific appliances |
| Interface at device | Balanced connector:<br>IEC 60603-7 [c],<br>Optical fibre connectors:<br>IEC 60874-14,<br>IEC 60874-19, SC type | Coaxial connectors:<br>IEC 60169-2 or<br>IEC 60169-24 (“F type”)<br>Balanced connector:<br>IEC 61076-3-104 [d] | Fixed connection,<br>CCCB connector(s) |

NOTE Vicinity to mains depends on installation preferences and local regulation.

[a] On balanced cabling up to 1 GHz

[b] This definition is from ISO/IEC 11801 Ed.2.

[c] IEC 60603-7 is also known as RJ45 in the market place.

[d] In installations where other factors, such as interoperability with IEC 60603-7 series take preference over the connector sharing offered with IEC 61076-3-104, also the interface specified in IEC 60603-7-7 may be used.

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# Bibliography


| | |
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| CISPR 24 | *Information technology equipment – Immunity characteristics – Limits and methods of measurement* |
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| IEC 60227-1 | *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V - Part 1: General requirements* |
| IEC 60332-1 | *Tests on electric cables under fire conditions Part 1: Test on a single vertical insulated wire or cable.* |
| IEC 60332-3 | *Tests on electric cables under fire conditions Part 3: Tests on bunched wires or cables.* |
| IEC 60364-1 | *Electrical installations of buildings - Part 1: Fundamental principles, assessment of general characteristics, definitions* |
| IEC 60364-3 | *Electrical installations of buildings - Part 3: Assessment of general characteristics* |
| IEC 60364-4-444 | *Electrical installations of buildings – Part 4: Protection for safety – Section 444: Protection against electromagnetic interference (EMI) in installations of buildings* |
| IEC 60364-5-52 | *Electrical installations of buildings – Part 5: Selection and erection of electrical equipment – Chapter 52: Wiring systems* |
| IEC 60364-5-548 | *Electrical installations of buildings – Part 5: Selection and erection of electrical equipment – section 548: Earthing arrangements and equipotential bonding for information technology installations* |
| IEC 60512-23-7 | *Connectors for electronic equipment - Tests and measurements - Part 23-7: Screening and filtering tests - Test 23g: Effective transfer impedance of connectors* |
| IEC 60603-8 | *Connectors for frequencies below 3 MHz for use with printed boards. Part 8: Two-part connectors for printed boards, for basic grid of 2.54 mm (0.1 in), with square male contacts of 0.63 mm x 0.63 mm* |
| IEC 60670 | *General requirements for enclosures for accessories for household and similar fixed electrical installations* |
| IEC 60708 series | *Low-frequency cables with polyolefin insulation and moisture barrier polyolefin sheath* |
| IEC 60708-1 | *Low-frequency cables with polyolefin insulation and moisture barrier polyolefin sheath – Part 1 : General design details and requirements* |
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| IEC 60874-14 (all parts) | *Connectors for optical fibres and cables – Part 14: Sectional specification for fibre optic connector – Type SC* |
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| | |
|---|---|
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| IEC 61312 series | *Protection against lightning electromagnetic impulse* |
| IEC 61386 series | *Conduit systems for electrical installations* |
| IEC 61537 | *Cable tray systems and cable ladder systems for cable management* |
| IEC 61935-2 | *Generic cabling systems - Specification for the testing of balanced communication cabling in accordance with ISO/IEC 11801 - Part 2: Patch cords and work area cords* |
| IEC/PAS 62255-1 | *Multi-pair cables used in high bit rate digital access telecommunication networks - Part 1: Outdoor cables* |
| ISO/IEC 10192 series | *Information technology - Home Electronic System (HES) interfaces* |
| ISO/IEC TR 15044 | *Information technology - Terminology for the Home Electronic System (HES)* |
| ISO/IEC TR 14543 series | *Information technology – Home Electronic System (HES) architecture* |
| ISO/IEC 18010 | *Information technology - Pathways and spaces for customer premises cabling* |

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