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**Access, Terminals, Transmission and Multiplexing (ATTM);
In Home Cabling for Integrated Broadband Cable and Television Services**

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ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Access, Terminals, Transmission and Multiplexing (ATTM).

Introduction

The present document provides references to published standards that present information about the in home network cables and installations for the delivery of integrated broadband and cable television services. Further revisions of the present document are expected to present best practices for the in home network cables and installations as developed by the cable sector such as through the knowledge sharing within SCTE [i.23] and the experiences as adopted widely by Cable Operators.

The present document examines relevant standards that provide information about the in-home cabling and installation for connectivity between the Cable Operators network termination point (NTP) and customers premises equipment (CPE).

Cable Network Operators RF signal is delivered to the customers premises terminated by what is generally described in the market as a 'wall plate' and is the NTP for the cable side.

The customers in home network is that part of the installation between the NTP and CPE.

At the NTP a 'wall plate' is installed by the Cable Operator to enable connectivity of customers FM radio service, TV service and internet service via 3 ports, an FM port, TV port and Data port respectively.

The in home cable and installations are described by CENELEC and SCTE [i.23] standards.

1 Scope

The present document presents references to European and International standards that describe requirements for the in home cabling and installations for the delivery of an Integrated Cable Broadband and Television Services.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

2.1 Normative references

The following referenced documents are necessary for the application of the present document.

Not applicable.

2.2 Informative references

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] CENELEC EN/IEC 60728-1 (2007): "Cable networks for television signals, sound signals and interactive services - Part 1: System performance of forward paths".

[i.2] CENELEC EN/IEC 60728-1-1 (2010): "Cable networks for television signals, sound signals and interactive services - Part 1-1: RF cabling for two way home networks".

[i.3] CENELEC EN 60728-3 (2010): "Cable networks for television signals, sound signals and interactive services - Part 3: Active wideband equipment for cable networks".

[i.4] CENELEC EN 60728-4 (2007): "Cable networks for television signals, sound signals and interactive services - Part 4: Passive wideband equipment for coaxial cable networks".

[i.5] CENELEC EN 50117-1:2002/A1:2006: "Coaxial cables - Part 1: Generic specification".

[i.6] CENELEC EN 50290-1-1: "Communication cables - Part 1-1: General".

[i.7] CENELEC EN 50117-2-1:2005/A1:2008: "Coaxial cables - Part 2-1: Sectional specification for cables used in cabled distribution networks - Indoor drop cables for systems operating at 5 MHz - 1 000 MHz".

[i.8] CENELEC EN 50117-2-3:2004/A1:2008: "Coaxial cables - Part 2-3: Sectional specification for cables used in cabled distribution networks - Distribution and trunk cables for systems operating at 5 MHz - 1 000 MHz".

[i.9] CENELEC EN 50117-2-4:2004/A1:2008: "Coaxial cables - Part 2-4: Sectional specification for cables used in cabled distribution networks - Indoor drop cables for systems operating at 5 MHz - 3 000 MHz".

[i.10] CENELEC EN 50117-3-1 (2002): "Coaxial cables - Part 3-1: Sectional specifications for cables used in Telecom applications - Miniaturized cables used in digital communication systems".

[i.11] CENELEC EN 60966: "Radio frequency and coaxial cable assemblies".

[i.12] CENELEC EN 60966-2-1 (2003): "Radio frequency and coaxial cable assemblies - Part 2 1: Sectional specification for flexible coaxial cable assemblies".

[i.13] CENELEC EN 60966-2-1 (2009): "Radio frequency and coaxial cable assemblies - Part 2 1: Sectional specification for flexible coaxial cable assemblies".

[i.14] CENELEC EN 60966-2-3 (2009): "Radio frequency and coaxial cable assemblies - Part 2-3: Detail specification for flexible coaxial cable assemblies - Frequency range 0 MHz to 1 000 MHz".

[i.15] CENELEC EN 60966-2-4 (2009): "Radio frequency and coaxial cable assemblies - Part 2-4: Detail specification for cable assemblies for radio and TV receivers - Frequency range 0 MHz to 3 000 MHz".

[i.16] CENELEC EN 60966-2-5 (2009): "Radio frequency and coaxial cable assemblies - Part 2-5: Detail specification for cable assemblies for radio and TV receivers - Frequency range 0 MHz to 1 000 MHz".

[i.17] CENELEC EN 60966-2-6 (2009): "Radio frequency and coaxial cable assemblies - Part 2-6: Detail specification for cable assemblies for radio and TV receivers - Frequency range 0 MHz to 3 000 MHz".

[i.18] CENELEC EN 60966-3 (2009): "Radio frequency and coaxial cable assemblies - Part 3: Sectional specification for semi-flexible coaxial cable assemblies".

[i.19] CENELEC EN 60966-4 (2003): "Radio frequency and coaxial cable assemblies - Part 4: Sectional specification for semi-rigid coaxial cable assemblies".

[i.20] CENELEC EN 61169-2 (2007): "Radio-frequency connectors - Part 2: Sectional specification - Radio frequency coaxial connectors of type 9,52".

[i.21] IEC 61169-1: "Radio-frequency connectors - Part 1: Generic specification - General requirements and measuring methods".

[i.22] CENELEC EN 61169-24 (2007): "Radio-frequency connectors - Part 24: Sectional specification - Radio frequency coaxial connectors with screw coupling, typically for use in 75 ohm cable networks (type F)".

[i.23] SCTE, Society of Cable Telecommunication Engineers.

NOTE: Available at www.scte.org.

[i.24] CENELEC CLC/TC 209: "Cable networks for television signals, sound signals and interactive services".

3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

CATV	Cable Television
CENELEC	European Committee for Electrotechical Standardisation
CLC	CeneLeC
CPE	Customer Premises Equipment
DS	Detailed Specification
EN	European Norme
FM	Frequency Modulation
HNI	Home Network Interface
IEC	International Electrotechical Commission
IT	Information Technology
MATV	Master Attenna Television
NTP	Network Termination Point
RF	Radio Frequency

SCTE	Society of Cable Telecommunications Engineers
SS	Sectional Specification
TEM	Transverse Electromagnetic Mode
TV	Television
V_{AC}	Volts Alternating Current
V_{DC}	Volts Direct Current

4 Radio Frequency Cabling for in home networks

The following standards published by the technical committee CLC/TC 209 [i.24] describe requirements for the RF cabling for in home networks, their performance and description of passive and active elements.

The following sub-clauses give the reference to the document number, title, date of publication from the time of writing the present document and a synopsis. These standards are published by CENELEC and relate to Cable networks for television sigbnals, sound signals and interactive services.

These standards provide information also about the cable network and associated methods of measurement for the reception of signals at the headend and their distribution. These references added for completeness since they address the characteristics of the signal received at the NTP for delivery over the in home cable installation to the CPE.

NOTE 1: The EN/IEC standards describe a Home Network Interface (HNI) which for the purposes of the present document may is the NTP.

NOTE 2: Further revisions of the present document are expected to present best practices for the in home network cables and installations as developed by the cable sector such as through the knowledge sharing within SCTE [i.23] and the experiences as adopted widely by Cable Operators.

5 System performance of forward paths

System performance of forward paths is specified by EN/IEC 60728-1 [i.1]. The cable network equipment and CENELEC's view on the approach to measurement covering the headend reception, processing and distribution of television signals, sound signals and their associated data signals are given by EN/IEC 60728-1 [i.1] along with an overview for processing, interfacing and transmitting all kinds of signals for interactive services using all applicable transmission media.

The standard applies to any cable network, including individual receiving systems with a coaxial cable output in the forward path used for television and sound signals operating between 30 MHz and 3 000 MHz.

The measurements assess the performance limits of cable network's with coaxial cable outputs, between the input(s) to the headend or headends and any system outlet when terminated in a resistance equal to the nominal load impedance of the system.

Where system outlets are not used, then these requirements are applied at the subscriber's end of the subscriber's feeder.

Taking into account the performance requirements given at the system outlet or at the terminal input, requirements for the HNI are obtained.

6 RF cabling for two way home networks

RF cabling for two way home networks is specified by EN/IEC 60728-1-1 [i.2].

Describes implementation guidelines of RF cabling for two-way home networks that distributes signals provided by CATV/MATV/SMATV cable networks using wired links,(including individual receiving systems) having a coaxial cable output as well applying to networks using wireless links. It applies to services operating between about 5 MHz and 3 000 MHz. The frequency range is extended to 6 000 MHz for distribution techniques that replace wired cords with a wireless two-way communication inside a room (or a small number of adjacent rooms) that uses the 5 GHz to 6 GHz band.

With multi dwelling units the signal distribution within the building commences from the home network interface (HNI), up to the system outlet or terminal input.

In IEC 60728-1 [i.1], clause 5 gives the requirements at the system outlet with EN/IEC 60728-1 [i.1], clause 7 gives the requirements at the HNI with EN/IEC 60728-1-1 [i.2], clause 5 presenting additional requirements.

EN/IEC 60728 presents basic measurement methods of home cable network's operational characteristc is in order to assess its performance limits obtained between the input(s) at the home network interface (HNI) and the output at any system outlet when terminated in a resistance equal to the nominal load impedance of the system. Where system outlets are not used, the above applies to the terminal input.

7 Wideband Equipment for cable networks

7.1 Active wideband equipment for cable networks

Active wideband equipment for cable networks is specificed by EN 60728-3 [i.3]. This standard applies to all broadband amplifiers used in cable networks, covers the frequency range 5 MHz to 3 000 MHz, applies to one-way and two-way equipment, lays down the basic methods of measurement of the operational characteristics of the active equipment in order to assess the performance of this equipment, identifies the performance specifications that are supposed to be published by the manufacturers and states the minimum performance requirements of certain parameters.

This standard divides the amplifiers into two quality levels, grade 1 amplifiers intended to be cascaded and grade 2 amplifiers for use within an apartment block, or within a single residence, to feed a few outlets.

7.2 Passive wideband equipment for coaxial cable networks

Passive wideband equipment for coaxial cable networks is specified by EN 60728-4 [i.4]. This standard applies to system outlets, splitters and taps, passive single or multiple port equipment comprising filters, attenuators, equalizers, galvanic isolators, power injectors, cable splices, terminating resistors and transfer points, but excluding coaxial cables and receiver leads.

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

This standard refers to three grades for all passive equipment except system outlets where there is only one.

8 Coaxial cables

The following standards are relevant for describing requirements of the coaxial cable:

EN 50117-1:2002 + A1:2006 [i.5**]**

This European Standard covers coaxial cables for use in analogue and digital systems.

This standard should be used in conjunction with EN 50290-1-1 [i.6].

Coaxial cables covered by this standard operate in transverse electromagnetic mode (TEM) and are suitable for use in a wide range of digital and analogue applications including CATV, radio frequency systems, instrumentation, broadcasting, telecommunications and data network systems. Various constructions and materials provide for indoor and outdoor applications, including underground and overhead installations, and other environmental protection characteristics.

Generally, cables are designed for use in 50 Ω and 75 Ω characteristic impedance systems, although other types (e.g. 93/95 Ω) are also covered.

Coaxial cables defined by this standard may be incorporated into hybrid cable constructions with optical fibre or multi-element cable components.

All cables covered by this standard may be subjected to voltages greater than 50 V_{AC} or 75 V_{DC}. However, these cables are not intended for direct connection to the mains electricity supply or other low impedance sources.

EN 50290-1-1 [i.6**]**

This standard gives directly or by reference all common requirements for communication cables.

They are completed by generic, sectional, family and detail specifications, as appropriate, to describe in a detailed manner each type of cables with its specific characteristics.

This standard harmonizes the standardisation of symmetrical, coaxial and optical cables used for the infrastructure of communication, multimedia and control networks. Most of the cables covered by this standard are primarily intended to be used in IT networks. However they can also be used for other applications with the exception of those which presume a direct connection to the mains electricity supply.

EN 50117-2-1:2005 + A1:2008 [i.7]

EN 50117-2-3:2004 + A1:2008 [i.8]

EN 50117-2-4:2004 + A1:2008 [i.9]

EN 50117-3-1:2002 [i.10**]**

9 Radio frequency and coaxial cable assemblies

Requirements for radio frequency coaxial cable assemblies operating in the transverse electromagnetic mode (TEM) are given by the standard EN 60966 [i.11].

Testing the electrical, mechanical and environmental properties of radio frequency coaxial cable assemblies composed of cables and connectors are given by this standard.

Requirements for families of cable assemblies are given by the following sub-sections as listed below:

- EN 60966-2-1:2003 [i.12];
- EN 60966-2-1:2009 [i.13];
- EN 60966-2-3:2009 [i.14];
- EN 60966-2-4:2009 [i.15];
- EN 60966-2-5:2009 [i.16];
- EN 60966-2-6:2009 [i.17];
- EN 60966-3:2009 [i.18];
- EN 60966-4:2003 [i.19].

10 Radio-Frequency Connectors

The following RF connectors are relevant for cable in-home installations.

10.1 Sectional specification of Radio frequency coaxial connectors of type 9,52

Radio-frequency connectors, sectional specifications is given by EN 61169-2 [i.20]. This is a sectional specification (SS). It provides guidance for preparing detailed specifications for RF coaxial connectors of type 9,52.

Dimensional details of interface connectors are described for general purpose grade 2 connectors, standard test connectors, grade 0, together with gauging information and the mandatory tests selected from IEC 61169-1 [i.21], applicable to all DS relating to type 9,52 connectors.

The consideration to be given for recommending performance characteristics when writing a DS are explained and ctest schedules and inspection requirements are addressed.

10.2 Sectional specification of Radio frequency coaxial connectors with screw coupling, typically for use in 75 Ω cable networks (type F)

The RF connector specification EN 61169-24 [i.22] is a sectional specification (SS), providing information and rules for the preparation of detail specifications for RF coaxial connectors with screw coupling, typically for use in 75 Ω cable networks (type F).

It describes the interface dimensions with gauging information and the mandatory tests selected from IEC 61169-1 [i.21], applicable to all DS relating to type F connectors and indicates the recommended performance characteristics.

Annex A: Bibliography

- CENELEC EN 60966-1 (1999): "Radio frequency and coaxial cable assemblies - Part 1: Generic specification - General requirements and test methods".

History

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