SCTE · ISBE

STANDARDS

Interface Practices Subcommittee

AMERICAN NATIONAL STANDARD

ANSI/SCTE 71 2018

Specification for Series 15, Braided, 75 Ω, Coaxial, Multi-Purpose Cable

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1. Introduction

1.1. Executive Summary

This specification is intended to apply to general-purpose, flexible, 75 Ohm, Braided, Low Loss Multi-Purpose Cables.

When reference to other regulations or specifications is made, the user should adhere to the latest revision of the regulation or specification

1.2. Scope

This specification defines the materials, electrical and mechanical properties of 75 ohm Braided, Low Loss Subscriber Access Cable (Series 15) as defined herein.

These cables are used in the transmission of RF signals and power for voice, data and video applications.

This document provides specifications or procedures for frequencies up to 1218 MHz. DOCSIS 3.1 specifications include operation at frequencies up to 1218 MHz, and optionally, to 1794 MHz. Specifications or procedures for frequencies above 1218 MHz should be considered in a future revision of this document.

2. Normative References

The following documents contain provisions, which, through reference in this text, constitute provisions of this document. At the time of Subcommittee approval, the editions indicated were valid. All documents are subject to revision; and while parties to any agreement based on this document are encouraged to investigate the possibility of applying the most recent editions of the documents listed below, they are reminded that newer editions of those documents might not be compatible with the referenced version.

2.1. SCTE References

- ANSI/SCTE 03 2008: Test Method for Coaxial Cable Structural Return Loss
- ANSI/SCTE 09 2016: Test Method for Cold Blend
- ANSI/SCTE 10 2014: Test Method for Flexible Coaxial Cable Impact Test
- SCTE 11 2018: Test Method for Aerial Cable Corrosion Protection Flow
- ANSI/SCTE 31 2016: Test Method for Measuring Diameter Over Core
- ANSI/SCTE 32 2016: Ampacity of Coaxial Telecommunications Cables
- ANSI/SCTE 33 2016: Test Method for Diameter of Drop Cable
- ANSI/SCTE 44 2010: Test Method for DC Loop Resistance
- ANSI/SCTE 47 2007: Test Method for Coaxial Cable Attenuation
- ANSI/SCTE 49 2011: Test Method for Velocity of Propagation
- SCTE 51 2018: Test Method for Determining Drop Cable Braid Coverage
- SCTE 61 2018: Test Method for Jacket Web Separation
- ANSI/SCTE 63 2015: Test Method for Voltage Withstand of Outer Jacket
- ANSI/SCTE 66 2016: Test Method for Coaxial Cable Impedance
- ANSI/SCTE 69 2007: Test Method for Moisture Inhibitor Corrosion Resistance
- ANSI/SCTE 88 2012: Test Method for Polyethylene Jacket Longitudinal Shrinkage
- ANSI/SCTE 108 2018: Test Method for Dielectric Withstand of Coaxial Cable

2.2. Standards from Other Organizations

- ANSI/UL1581-2017: Reference Standard for Electrical Wires, Cables and Flexible Cords
- ASTM A641-92: Zinc Coated (Galvanized) Carbon Steel Wire
- ASTM B566-93: Standard Specification for Copper-Clad Aluminum Wire
- ASTM D1248-02: Standard Specification for Polyethylene Plastics Extrusion Materials For Wire and Cable
- ASTM D 4565: Physical and Environmental Performance Properties of Insulations and Jackets for Telecommunications Wire and Cable
- ASTM E8-01e1: Standard Test Methods for Tension Testing of Metallic Materials

2.3. Published Materials

- No normative references are applicable.

3. Informative References

The following documents might provide valuable information to the reader but are not required when complying with this document.

3.1. SCTE References

- SCTE 59 2018: Test Method for Drop Cable Center Conductor Bond to Dielectric
- ANSI/SCTE 72 2007: Test Method for Insertion Force of Connector to Drop Cable Interface
- ANSI/SCTE 78 2017: Test Method for Transfer Impedance
- IPS TP 119: Test Procedure for Determining the Thermal Oxidative Stability of Foamed Polyethylene

3.2. Standards from Other Organizations

- ASTM B1-90: Standard Specification for Hard-Drawn Copper Wire
- ASTM B193-87: Resistivity of Electrical Conductive Materials
- ASTM B3-90: Standard Specification for Soft or Annealed Copper Wire
- NFPA-70-2017: National Electric Code
    - NEC Article 820: Community Antenna Television and Radio Distribution Systems
    - NEC Article 830: Network-Powered Broadband Communications Systems

3.3. Published Materials

- IEEE: Standard Dictionary of Electrical and Electronic Terms
- Jones Dictionary: Cable Television Terminology 3rd Edition

4. Compliance Notation

shall	This word or the adjective "***required***" means that the item is an absolute requirement of this document.
shall not	This phrase means that the item is an absolute prohibition of this document.
forbidden	This word means the value specified shall never be used.
should	This word or the adjective "*recommended*" means that there may exist valid reasons in particular circumstances to ignore this item, but the full implications should be understood and the case carefully weighted before choosing a different course.
should not	This phrase means that there may exist valid reasons in particular circumstances when the listed behavior is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behavior described with this label.
may	This word or the adjective "*optional*" means that this item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because it enhances the product, for example; another vendor may omit the same item.
deprecated	Use is permissible for legacy purposes only. Deprecated features may be removed from future versions of this document. Implementations should avoid use of deprecated features.

5. Definitions

Attenuation	The decrease in magnitude of a wave as it travels through any transmitting medium, such as cable or circuitry. It is the difference between transmitted and received power
Coaxial Cable	A type of cable used for broadband data and cable systems. Composed of a center conductor, insulating dielectric, conductive shield and optional protective covering. This type of cable has excellent broadband frequency characteristics, noise immunity and physical durability. Synonymous with Coax Drop Cable – In a cable telecommunications system the transmission cable from the distribution cable to a dwelling
Conductivity	The ability of a material to allow electrons to flow, measured by the current per unit of voltage applied. It is the reciprocal of resistivity
Core Ovality	The difference between the minimum and maximum dimensions over the first Laminated Shield Tape
DC Resistance	The opposition a conductive material offers to current flow, measured in ohms
DC Loop Resistance	A resistance measurement of the center conductor and outer conductor when connected in series (measured in ohms/1000 feet)
Dielectric	A nonconductive insulator material between the center conductor and outer conductor of coaxial cable
Dielectric Withstand	The ability of the drop cable insulation to withstand a minimum of 1000 VAC
Impedance	The total opposition a circuit, cable or component offers to alternating current flow. It includes both resistance and reactance and is generally expressed in ohms and designated by the symbol Z

6. Center Conductor

6.1. Copper Clad Aluminum

The center conductor shall be copper clad aluminum. The outer layer of copper shall be metallurgically bonded and continually cover the aluminum core prior to processing; the composite applicable conductor shall meet requirements of ASTM B566-93, Class 10A or 10H.

6.2. Solid Copper

Solid copper center conductor may also be available if required by the user. Low DC resistance is the major advantage to using solid copper; therefore, this document will only cover copper clad aluminum.

6.3. Joints

Factory joints in the finished product shall be allowed. The ultimate tensile strength in the joint area when tested per ASTM E8-01e1 shall be 90% of the original unspliced wire.

6.4. Dimensions

6.4.1. Center Conductor

Center conductor dimension shall be 0.109 ± 0.001 inches (2.769 ± 0.03 mm).

6.4.2. Minimum Break Strength

Mechanical - Minimum break strength (MBS) of the copper clad aluminum shall be determined by multiplying the minimum cross-sectional area by 20,000 psi. (138 MPa). Minimum MBS for 0.109" (2.769 mm) conductor equals 187 lbf (84.8 kgf).

6.5. Electrical

6.5.1. Conductivity

The center conductor electrical conductivity shall be 62.5 percent IACS minimum.

6.5.2. DC Resistance

Maximum DC Resistance shall be measured per ANSI/SCTE 44 2010 and shall be 1.42 ohms/1000 feet (4.66 ohms/km).

7. Dielectric

7.1. Dielectric Material

Dielectric material extruded over the center conductor shall be an insulating grade virgin polyethylene and shall not contain reground, reprocessed or recycled materials. The insulation shall consist of gas injected foamed polyethylene with a closed cell structure. It shall be applied concentrically and bonded to the center conductor. The dielectric shall also contain a stabilization package to meet the requirements of Section 12.1.4 Thermal Oxidative Stability (TOS).

7.2. Polyethylene

Unless otherwise specified, polyethylene materials for the dielectric shall meet all applicable requirements of ASTM D1248-02 and requirements of this document.

7.3. Nominal Diameter

Nominal Dielectric Diameter – 0.455 inches (11.56 mm)

8. Shield Construction (Tape & Braid, Trishield, or Quadshield)

8.1. Single Tape & Braid

8.1.1. Laminated Shielding Tape (LST)

8.1.1.1. LST Construction

The first outer conductor shall be a Laminated Shielding Tape (LST). The LST shall be constructed of two aluminum foils laminated to a strength member and a bonding resin on one side. The LST shall have a maximum thickness of 0.0032 inches (82 microns) and a minimum thickness of 0.00185 inches (47 microns).

Note: The tape thickness specified in this section includes the tape bonding agent.

8.1.1.2. Overlap

The LST shall overlap the dielectric circumference by 18 percent minimum to 35 percent maximum on the finished product.

8.1.1.3. Application

The LST shall be applied longitudinally to the dielectric and shall be free of creases or twists over the entire length.

8.1.1.4. Core Diameter

The average core diameter shall be determined by measuring the diameter over the LST in the finished product as described in ANSI/SCTE 31 2016. Average Core Diameter – 0.463 inches ± 0.008 inches (11.76 mm ± 0.20 mm).

8.1.1.5. Core Ovality

Core ovality shall be determined by subtracting the measured minimum diameter from the measured maximum diameter over the LST in the finished product. Core Ovality Maximum – 0.018 inches (0.46 mm).

8.1.2. Braid Wire

8.1.2.1. Braid Wire Construction

The braiding wire shall be a round aluminum wire consisting of 33 AWG size. 0.0071 ± 0.0003 inches, (0.180 ± 0.01 mm) using an aluminum alloy of 5056, 5154, 5154A, or 5954.

8.1.2.2. Tensile Strength

Minimum, raw material (before braiding), tensile strength for individual strands of aluminum alloy braid wire shall be 43,000 psi.

8.1.2.3. Elongation

Minimum, raw material (before braiding), elongation for individual strands of aluminum alloy braid wire shall be 3 percent.

8.1.2.4. Braid Coverage

Braid coverage over the first outer conductor shall be a minimum of 59 percent for single tape and braid products. The braid coverage shall be determined by SCTE 51 2018.

8.2. Trishield

8.2.1. Laminated Shielding Tape (LST)

Refer to Section 8.1.1

8.2.2. Braid Wire

Refer to Section 8.1.2 except as indicated in 8.2.2.1 below

8.2.2.1. Braid Coverage

4.2.2.2 Braid coverage over the first outer conductor shall be a minimum of 59 percent for Trishield products. The braid coverage shall be determined by SCTE 51 2018.

8.2.3. Outer Laminated Shielding Tape (LST)

An outer (LST) shall be applied over the Section 8.2.2 braid wires

8.2.3.1. Outer LST Construction

The outer LST shall be a laminated shielding tape constructed of two aluminum foils laminated to a central strength member with or without a bonding resin on one side. The LST shall have a maximum thickness of 0.0032 inches (82 microns) and a minimum thickness of 0.00098 inches (25microns).

Note: The tape thickness specified in this section includes the tape bonding agent, if applicable.

8.2.3.2. Application

The outer LST shall be applied longitudinally over the second outer conductor with an overlap of 18 percent minimum to 35 percent maximum and shall be free of creases, twists and discontinuities over the entire length.

8.3. Quadshield

8.3.1. Laminated Shielding Tape (LST)

Refer to Section 8.1.1

8.3.2. Braid Wire

Refer to Section 8.1.2 except as indicated in 8.3.2.1

8.3.2.1. Braid Coverage

Braid coverage over the first outer conductor shall be a minimum of 59 percent for Quadshield products. The braid coverage shall be determined by SCTE 51 2018.

8.3.3. Outer Laminated Shielding Tape (LST)

See Section 8.2.3

8.3.4. Outer Braid Wires

Refer to Section 8.1.2 except as indicated in 8.3.4.1

8.3.4.1. Braid Coverage

Braid coverage over the outer LST shall be a minimum of 40 percent for Quadshield products. The braid coverage shall be determined by SCTE 51 2018.

9. Flooding Compounds

9.1. Corrosion Protection

Cables for indoor, aerial or below grade applications may contain corrosion protection materials applied between the cable jacket and cable outer conductor. Corrosion protection shall be tested as described in ANSI/SCTE 69 2007.

9.2. Non-flowing Requirement

Cables intended for aerial or indoor applications, which contain a corrosion protection material, shall meet the non-flowing requirement as described in SCTE 11 2018.

10. Jacket

10.1. Polyvinylchloride

Polyvinylchloride (PVC) compound may be used for aerial and indoor applications.

10.2. Polyethylene

Polyethylene (PE) compound may be used below grade or aerial applications.

10.3. UV Stability

The jacket material shall be UV stable, as defined in UL 1581, paragraph 1200*, Reference Standard for Electric Wire, Cables and Flexible Cords.*

10.4. Jacket Diameter

The diameter over the jacket shall be as shown in Table 1 when measured as described in ANSI/SCTE 33 2016.

Table 1 – Jacket Diamater

Construction	inches (mm)
Tape & Braid	0.590 ± 0.010 (14.99 ± 0.254)
Trishield	0.595 ± 0.010 (15.11± 0.254)
Quadshield	0.623 ± 0.010 (15.82± 0.254)

11. Intergral Messenger (Optional)

11.1. Messenger Construction

Where utilized, the messenger shall be zinc coated (galvanized) carbon steel wire, as specified in ASTM A641-92. Table 2 lists the most commonly used sizes.

Table 2 – Messenger Diamater

(inches)	(mm)
0.083 ± 0.003	2.11 ± 0.05
0.109 ± 0.003	2.77 ± 0.05

11.2. Coating

The zinc coating measured in ounces per square foot of surface shall meet Class 1 ASTM A641-92 specification.

11.3. Messenger Minimum Break Strength (MBS)

The messenger minimum break strength (MBS) shall conform to the requirements of Table 7.1. The messenger minimum break strength is calculated by multiplying the minimum cross-sectional area by the minimum tensile strength as specified in ASTM A641-92.

Table 3 – Messenger Minimum Break Strength

Nominal Size inches (mm)	Pounds (Newtons)	Tensile (psi)
0.083 (2.11)	427 (1,899)	85,000
0.109 (2.77)	706 (3,140)	80,000

11.4. Continuous Length

The messenger shall be one continuous length. Welds and butt splices are prohibited.

11.5. Web Speration

If utilized, the integral messenger must separate from the cable in the web area without leaving any visible signs of splits, holes or grooves as specified in SCTE 61 2018.

CAUTION: A protruding ridge may exist that may need to be trimmed.

12. Finished Product Test

12.1. Mechanical

12.1.1. Cold Bend

The cable shall withstand a Cold Bend Test at -40°F/C with PVC jacket and -67° F (-55° C) with PE jacket. No visible damage to the jacket is allowed, as described in ANSI/SCTE 09 2016.

12.1.2. Impact Withstand

The cable shall withstand an impact test without damaging the jacket. The test is to be conducted at 5° F (-15° C) for cables with PVC jackets and at -22° F (-30° C) for cables with PE jackets, as described in ANSI/SCTE 10 2014.

12.1.3. Jacket Shrinkage

Jacket longitudinal shrinkage shall be no more than 5 percent of the length under test and tested per ANSI/SCTE 88 2012.

12.1.4. Thermal Oxidative Stability

To ensure the desired life expectancy of the dielectric insulation, determine its Oxidative Induction Time (OIT) before and after aging at 90°C for 14 days by measuring OIT according to IPS TP119. The test utilizes insulation removed from the completed cable and tested at 180 ± 0.3 °C. Requirements for OIT – Initial: 20 minutes minimum, after aging: 70 percent of initial value.

12.2. Electrical

12.2.1. Velocity of Propagation

Velocity of Propagation (Vp) shall be 87 percent nominal when measured per ANSI/SCTE 49 2011.

12.2.2. Impedance

Impedance shall be 75 ± 3 ohms per ANSI/SCTE 66 2016.

12.2.3. Structural Return Loss

When tested in accordance with ANSI/SCTE 03 2008, the minimum Structural Return Loss (SRL) shall be as shown in Table 5.

Table 4 – Structural Return Loss, Minimum

Frequency (MHz)	Structural Return Loss (dB)
5 - 1002	≥ 20
1002 - 1218	≥ 15

12.2.4. DC Loop Resistance

When tested in accordance with ANSI/SCTE 44 2010 the maximum DC loop resistance at 68°F (20°C) shall be as shown in Table 5.

Table 5 – Maximum DC Loop Resistance at 68°F (20°C)

Construction	Ohms/1000 ft (Ohms/km)
Tape & Braid	6.06 (19.88)
Trishield	3.95 (12.96)
Quadshield	4.05 (13.29)

12.2.5. Ampacity

The cable minimum ampacity shall be determined per ANSI/SCTE 32 2016 and shall be 41 amperes assuming 68°F (20°C) ambient temperature, current in both conductor and shield and a maximum center conductor and shield temperature or 149°F (65°C).

12.2.6. Attenuation

The maximum attenuation for all construction types shall be as specified in Table 6 per ANSI/SCTE 47 2007.

Table 6 – Series 15 Maximum Attenuation at 68˚F (20˚C)

Frequency (MHz)	dB/100ft	dB/100m
5	0.21	0.69
55	0.60	1.97
211	1.16	3.81
250	1.26	4.13
270	1.31	4.30
300	1.39	4.56
330	1.45	4.76
350	1.50	4.92
400	1.61	5.28
450	1.71	5.61
500	1.80	5.91
550	1.90	6.23
600	1.98	6.50
750	2.23	7.32
870	2.41	7.91
1002	2.59	8.50
1218	2.86	9.38

12.2.7. Jacket Integrity

The overall cable jacket integrity when tested in accordance with ANSI/SCTE 63 2015 shall pass a spark test at a minimum 2.5 kV RMS to ensure the absence of faults in the jacket during manufacturing.

12.2.8. Leakage Withstand

The dielectric between inner conductor and outer conductor of the cable shall withstand without breakdown, for one minute, a voltage of 1000V RMS at a frequency of 60 Hz, or the equivalent DC voltage at 1 milliamp/100 ft. leakage detection when tested at 68º F (20º C) per ANSI/SCTE 108 2018.