

SCTE | **STANDARDS**

Interface Practices Subcommittee

AMERICAN NATIONAL STANDARD

ANSI/SCTE 146 2021

Outdoor “F” Female to “F” Female Inline Splice

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Table of Contents

Title	Page Number
NOTICE.....	2
Table of Contents.....	3
1. Introduction.....	4
1.1. Executive Summary.....	4
1.2. Scope.....	4
1.3. Benefits.....	4
1.4. Intended Audience.....	4
1.5. Areas for Further Investigation or to be Added in Future Versions.....	4
2. Normative References.....	4
2.1. SCTE References.....	5
2.2. Standards from Other Organizations.....	5
2.3. Published Materials.....	5
3. Informative References.....	5
3.1. SCTE References.....	5
3.2. Standards from Other Organizations.....	5
3.3. Published Materials.....	5
4. Compliance Notation.....	6
5. Abbreviations and Definitions.....	6
5.1. Abbreviations.....	6
5.2. Definitions.....	6
6. Mechanical.....	7
6.1. Dimensions.....	7
6.2. Center Conductor Mating and Retention Force.....	7
7. Electrical.....	7
7.1. Bandwidth.....	7
7.2. Insertion Loss / Return Loss.....	7
7.3. Shielding Effectiveness.....	8
7.4. Surge Withstand.....	8
7.5. Center Conductor Contact Resistance.....	8
7.6. Outer Conductor Contact Resistance.....	8
7.7. Current Carrying Capacity.....	8
8. Environmental.....	8
8.1. Salt Spray.....	8
8.2. Temperature.....	8
9. Dimensions.....	9

List of Figures

Title	Page Number
Figure 1 – Dimensions.....	9

List of Tables

Title	Page Number
Table 1 – Insertion Loss / Return Loss.....	7
Table 2 – Descriptions of Dimensions.....	9

1. Introduction

1.1. Executive Summary

This specification provides the mechanical and electrical performance of the outdoor “F” inline splice that provides uniform “F” port lengths for proper sealing in outdoor environments.

1.2. Scope

The purpose of this document is to specify mechanical and electrical standards for 75 ohm broadband radio frequency (RF) devices whose purpose is to provide an outdoor inline connection between two type “F” male connectors that conform to ANSI/SCTE 123; Specification for “F” Connector, Male, Feed-Through or ANSI/SCTE 124; Specification for “F” Connector, Male, Pin Type and ANSI/SCTE 160, Specification for Mini “F” Connector, Male, Pin Type. The mechanical configuration is designed to accommodate sealing rings for external applications.

DOCSIS 4.0 specifications include operation at frequencies up to 1794 MHz and many service providers would like to futureproof their networks for eventual operation up to 3000 MHz.

The outdoor “F” splice is capable of 3000 MHz operation but, is typically used to connect two “F” male connectors and associated cable together. The bandwidth performance of the “F” splice is dependent on the components to which it is attached.

1.3. Benefits

This specification is necessary to provide manufacturers and users of this product a basic set of standard dimensional and performance requirements from which to gauge design performance.

It’s useful for cable and equipment manufacturers to ensure proper mating with varied connector manufactured designs. This specification provides confidence to end users that designs which meet these minimum criteria will perform properly in their systems.

1.4. Intended Audience

Manufacturers, test laboratories, and end-users.

1.5. Areas for Further Investigation or to be Added in Future Versions

None

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 04 2020, Test Method for “F” Connector Return Loss
- ANSI/SCTE 05 2020, Test Method for “F” Connector Return Loss In-Line Pair
- ANSI/SCTE 48-1 2015, Test Method for Measuring Shielding Effectiveness of Passive and Active Devices Using a GTEM Cell
- ANSI/SCTE 81 2018 Surge Withstand Test Procedure
- ANSI/SCTE 103 2018, Test Method for DC Contact Resistance, Drop Cable to F- Connectors and F81 Barrels
- ANSI/SCTE 123 2020 Specification for “F” Connector, Male, Feed-Through
- ANSI/SCTE 124 2020, Specification for “F” Connector, Male, Pin Type
- ANSI/SCTE 143 2018, Test Method for Salt Spray
- ANSI/SCTE 144 2017, Test Procedure for Measuring Transmission and Reflection
- ANSI/SCTE 160 2018, Specification for Mini ‘F’ Connector, Male, Pin Type
- SCTE 269 2021, Test Procedure for “F” Port Center Conductor Retention Force

2.2. Standards from Other Organizations

- No normative references are applicable.

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

- No informative references are applicable.

3.2. Standards from Other Organizations

- No informative references are applicable.

3.3. Published Materials

- No informative references are applicable.

4. Compliance Notation

<i>shall</i>	This word or the adjective “ <i>required</i> ” means that the item is an absolute requirement of this document.
<i>shall not</i>	This phrase means that the item is an absolute prohibition of this document.
<i>forbidden</i>	This word means the value specified shall never be used.
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<i>should not</i>	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.
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<i>deprecated</i>	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. Abbreviations and Definitions

5.1. Abbreviations

lb	pound
in	inch
mm	millimeter
DC	direct current
lb-in	pound inch
MHz	megahertz
Hz	hertz
ISBE	International Society of Broadband Experts
SCTE	Society of Cable Telecommunications Engineers

5.2. Definitions

thread relief	A reduced diameter section of the threaded surface to allow the tool to run out. This feature is optional.
center conductor	The inner conductor of a coaxial port, cable or pin of mating male connector.
mating male center conductor clearance	The distance from the reference plane of the female “F” port to which the center conductor of the mating male connector may penetrate without damaging the port or encountering a blockage.
positive contact point	The distance from the reference plane of the female “F” port to the first point of contact in the female center contact when the installed mating center conductor is centered.

reference plane	The reference plane on the female outdoor “F” port is the mating surface that seats against the male “F” port. It is also the plane from where all horizontal dimensions are taken.
parting line (relevant to casting process only)	A raised mark left on the surface of a part as a result of the gap between two halves of a die.

6. Mechanical

6.1. Dimensions

The physical dimension of the inline splice *shall* meet the dimensional requirements specified in Figure 1, Table 2, and the notes below Table 2.

6.2. Center Conductor Mating and Retention Force

The center conductor port of both ends *shall* accept male “F” connector center conductors whose diameters are between 0.030 inches (0.76 mm) and 0.042 inches (1.066 mm). The center conductor port of both ends *shall* meet the requirements of SCTE 269 2021.

7. Electrical

7.1. Bandwidth

All devices shall be designed to operate over a bandwidth of 5 MHz to 3000 MHz with an impedance of 75 ohms.

7.2. Insertion Loss / Return Loss

The insertion loss of the device, measured from the input port to the output port, *shall not* exceed the values in Table 1 when tested in accordance to ANSI/SCTE 144, Test Procedure for Measuring Transmission and Reflection.

The return loss, as measured at either RF port, with the other port terminated into 75 ohms, *shall* meet the requirements listed in Table 1 when mated with cables of size 6-series and/or 11-series, which meet the requirement of ANSI/SCTE 74 and which have male “F” connectors meeting and installed in accordance with ANSI/SCTE 123 for 6-series cables or ANSI/SCTE 124 for 11-series cables. All measurements *should* be made in accordance with the procedures outlined in ANSI/SCTE 144.

ANSI/SCTE 04 and/or ANSI/SCTE 05 *may* be used as guidance in conducting these measurements.

All electrical specifications *shall* apply to both ports and either signal flow direction.

Table 1 – Insertion Loss / Return Loss

Frequency (MHz)	Insertion Loss (dB)	Return Loss (dB)
5 - 1002	≤ 0.05	≥ 30
1002 - 1218	≤ 0.05	≥ 30
1218 - 1794	≤ 0.10	≥ 25
1794 - 2250	≤ 0.15	≥ 20
2250 - 3000	≤ 0.20	≥ 18

7.3. Shielding Effectiveness

When the outdoor inline splice interface is attached to cables manufactured to SCTE approved standards with connectors manufactured and installed per SCTE approved standards, the assembly *shall* meet shielding performance levels of an unspliced section of the same cable within a +/- 3 dB tolerance when both are tested with the same method. One of the methods used for this testing *shall* be ANSI/SCTE 48-3, Test Procedure for Measuring Shielding Effectiveness of Coaxial Cable and Connectors Using the GTEM Cell.

7.4. Surge Withstand

The surge withstand, when measured in accordance with ANSI/SCTE 81, *shall* be a minimum of IEEE C62.41-1991 Category A3 Ring Wave, 6 KV, 200 ampere.

7.5. Center Conductor Contact Resistance

After being stressed per the procedure in section 9.1 of SCTE 269 2021, the center conductor junction of the female to male “F” center conductor *shall* have a DC contact resistance of less than 25 milliohms when tested in accordance to ANSI/SCTE 103 with a 0.0320 inch (0.812 mm) diameter center conductor.

7.6. Outer Conductor Contact Resistance

The outer conductor junction of the outdoor female “F” port to male F connector *shall* have a DC contact resistance less than 10 milliohms when tightened to 40 lb.-in. and tested to ANSI/SCTE 103.

7.7. Current Carrying Capacity

The center conductor junction of the outdoor female “F” port to male “F” center conductor *shall* be capable of carrying a minimum of 1 ampere DC continuous current at an ambient temperature of 40 °C without degradation.

8. Environmental

8.1. Salt Spray

Components *shall* meet the electrical performance as outlined in section 7, after 1000 hours of the salt spray when tested in accordance to ANSI/SCTE 143.

8.2. Temperature

The devices *shall* meet all performance requirements during and after exposure to temperatures ranging from -40 °F (-40 °C) to +140 °F (+60 °C) as per ANSI/SCTE 158, Class 1, Condition A.

The temperature cycle *shall* be:

1. 2 hours at low limit
2. 1 hour transition to high limit
3. 2 hours at high limit
4. 1 hour transition to low limit
5. Repeat for 15 cycles

9. Dimensions

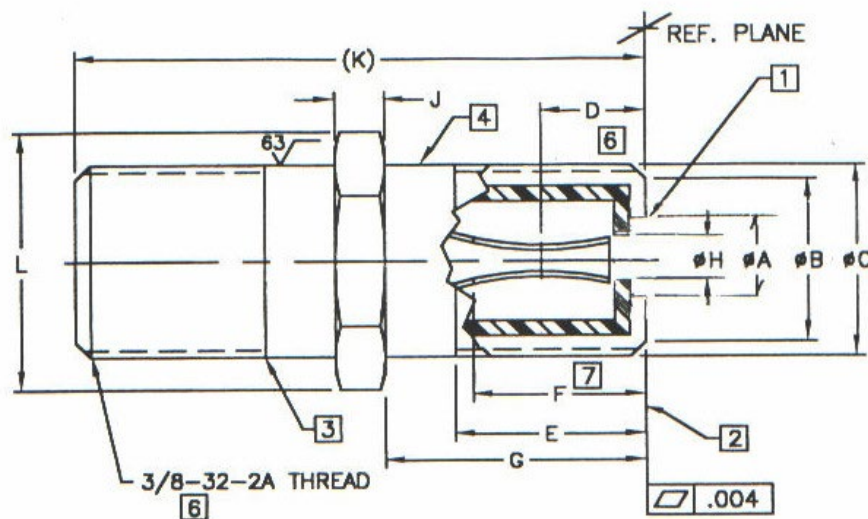


Figure 1 – Dimensions

Table 2 – Descriptions of Dimensions

DESCRIPTION	DIM	mm		inches		NOTES
		min	max	Min	max	
Reference Plane Opening Diameter	A	4.32	6.10	0.170	0.240	
Reference Plane Outer Diameter	B	7.11	8.00	0.280	0.315	
Base Outer Diameter	C	9.35	9.65	0.368	0.380	
Positive Contact Point Depth	D	-	5.08	-	0.200	5
Full Thread Depth	E	8.26	8.89	0.325	0.350	
Mating Male Center Conductor Clearance	F	9.65	-	0.380	-	7
Port Length	G	12.07	13.21	0.475	0.520	
Center Conductor Guide Inner Diameter	H	-	1.73	-	0.068	
Length	J	2.29	-	0.090	-	
Over All Length (Reference)	K	27.67	-	1.090	-	
Maximum Crown Envelope Dimension	L	-	16.58	-	0.653	

Notes:

1. No material shall impede the entry of the male connector.
2. Reference Plane
3. Thread relief not to exceed 1 full thread.
4. Finish required for port seal ring.
5. Dimension to point of positive contact of terminal.
6. ANSI specification B1.1 (Major DIA 0.368/0.374)
7. Minimum clearance for maximum center conductor.
8. Recommended Mating Male Center Conductor Diameter Range is 0.030 in. (0.76 mm) Min. to 0.042 in. (1.066 mm) Max.
9. All Dimensions Typical, unless specified.