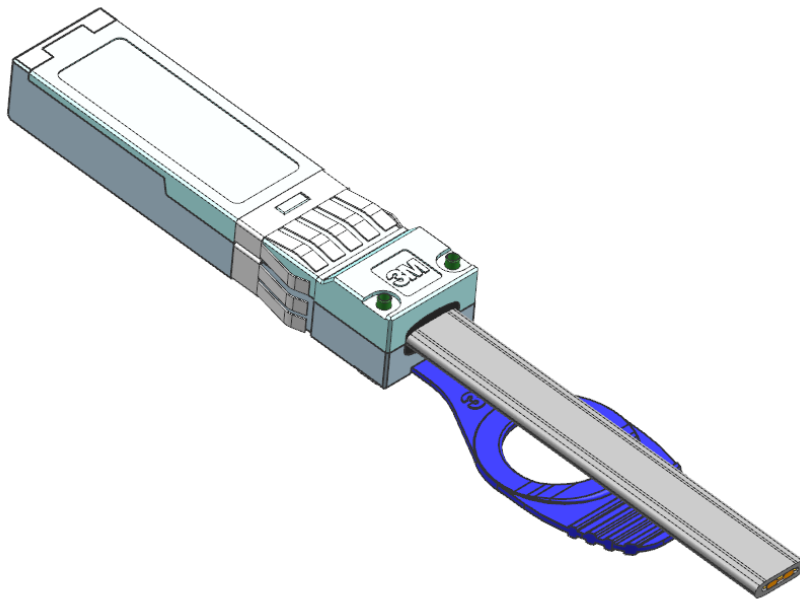


Product Data Sheet

3M™ SFP+ Direct-Attach Passive Copper Cable Assembly



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1.0 Scope

This data sheet summarizes test methods, test conditions and product performance for the 3M SFP+ Direct Attach Passive Copper Cable Assembly

2.0 Product Tested

Product:	SFP+ Direct-Attach Passive Copper Cable Assembly
Product Number:	1410, 1411, 1412 Series

3.0 General Conditions

3.1 Test Specimens

The test specimens shall be strictly in compliance with the design, construction details and physical properties detailed in the relevant Technical Specification Sheet (See Section 2).

3.2 Standard Test Conditions

The test shall be done under the following conditions:

Temperature:	15°C to 35°C
Relative Humidity:	45% to 75%
Atmospheric pressure:	650 to 800 mmHg

4.0 Test Results Summary

	Items	SFF 8431 Rev 4.1	Test Method	Results
General	Visual	No defects such as deformation, blister, damage, crack, etc.	EIA-364-18	Pass
Environmental	High Temperature Aging	No Physical abnormalities after test Measure SCC_{11} and Sdd_{21} 85°C for 500 Hours	EIA-364-17	Pass
	Low Temperature Aging	No Physical abnormalities after test Conditions: -30°C for 96 Hours Measure SCC_{11} and Sdd_{21}	EIA-364-17	Pass
	Thermal Shock	No Physical abnormalities after test 5 Cycles -30°C to +85°C Measure SCC_{11} and Sdd_{21}	EIA-364-32	Pass
	Temperature and Humidity	No Physical abnormalities after test Cyclic test between 25 °C and 65 °C at 80-98% RH for 240 Hrs. Measure SCC_{11} and Sdd_{21}	EIA-364-31	Pass
Mechanical	Mating and Unmating Forces	Mating force: 18 N Max Unmating force: 12.5 N Max	N.A	Pass
	Durability	100 Flexing Test Cycles Measure SCC_{11} and Sdd_{21}	N.A	Pass
	Pull Tab and Mechanical Metal Latch Pull Strength	No Physical damage of the Pull Tab and Mechanical Latch	N.A	Pass
Signal Integrity	Voltage Modulation Amplitude (VMA) Loss	≤ 4.4 dB	SFF 8431 Rev4.1	Pass
	VMA Loss to Crosstalk Ratio (VCR)	> 32.5 dB	SFF 8431 Rev4.1	Pass
	Differential Output and Input Reflection Coefficient (SDD _{xx})	0.01 to 4.1 GHz ¹ 4.1 to 11.1 GHz ²	SFF 8431 Rev4.1	Pass
	Common Mode Output and Input Reflection Coefficient (SCC _{xx})	0.01 to 2.5 GHz ³ 4.1 to 11.1 GHz < -3 dB	SFF 8431 Rev4.1	Pass
	Difference Wavelength Dispersin Penalty	≤ 6.75 dB	SFF 8431 Rev4.1	Pass

1. Reflection Coefficient given by equation $SDD_{xx}(dB) = -12 + 2 \times \text{SQRT}(f)$, with f in GHz.
2. Reflection Coefficient given by equation $SDD_{xx}(dB) = -6.3 + 13 \times \log_{10}(f/5.5)$, with f in GHz.
3. Reflection Coefficient given by equation $SCC_{xx}(dB) < -7 + 1.6 \times f$, with f in GHz.

5.0 Testing

Test methods are based upon EIA Standard 364.

5.1 General

Visual (Appearance) — EIA-364-18

Purpose

The purpose of this test is to visually examine and dimensionally inspect the connector in order to determine whether the connector conforms to the applicable specification and detail documents not covered by performance requirements.

Test Method

The examination shall be made in accordance with EIA-364-18. The visual examination shall include inspection of the following features as a minimum: workmanship, marking, materials, finish, standards, design and construction. The dimensional inspection shall be a check for compliance with the outline drawings of the detail specification.

5.2 Environmental

High Temperature Aging — EIA-364-17

Purpose

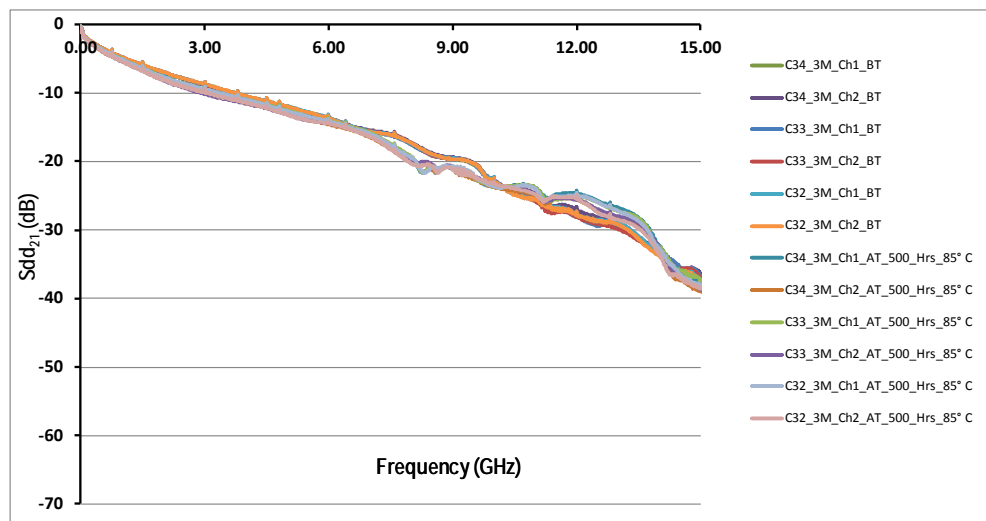
The purpose of this test is to determine the effects on the electrical and mechanical characteristics of the cable assembly resulting from exposure of the cable assembly to an elevated ambient temperature for a specified length of time.

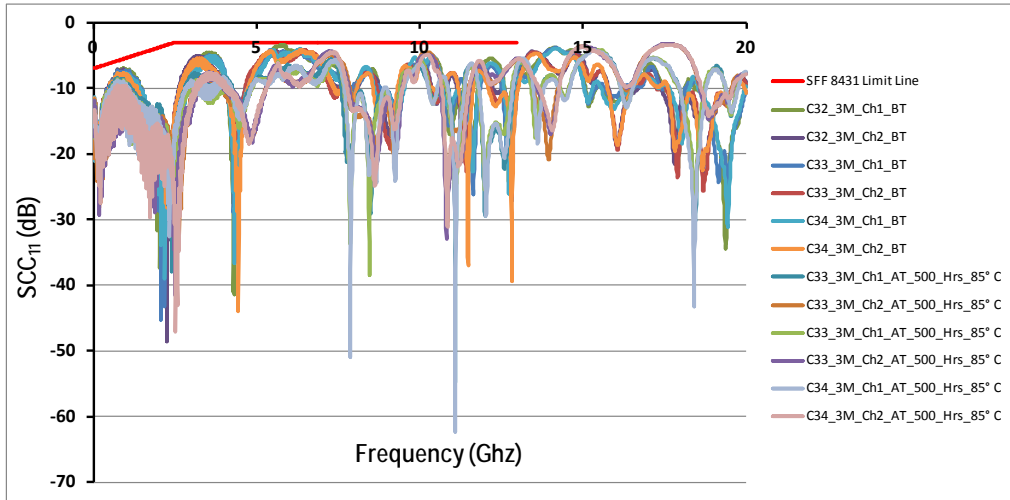
Test Method

Mated connectors shall be tested in accordance with EIA-364 17.

Temperature:	85°C
Duration:	500 hours

Test Results





Low Temperature Aging — EIA-364-17

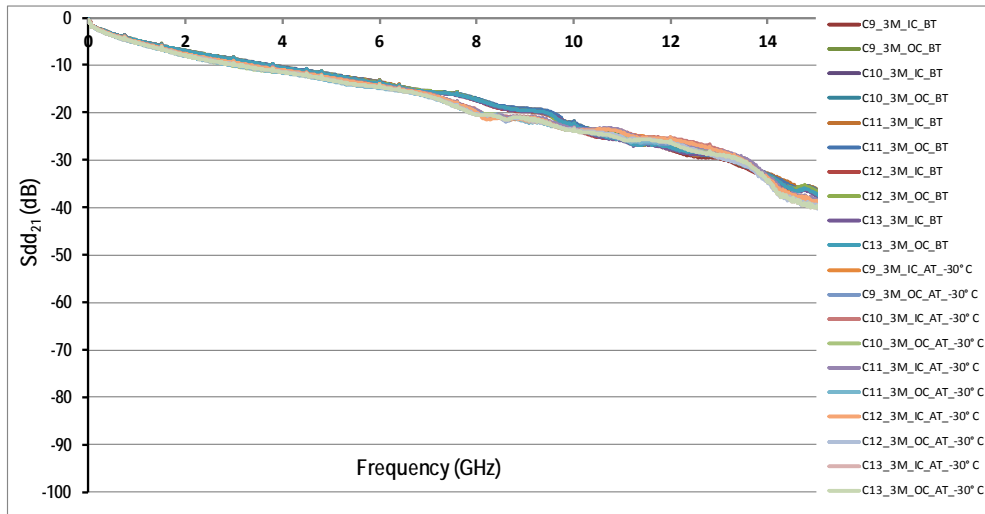
Purpose

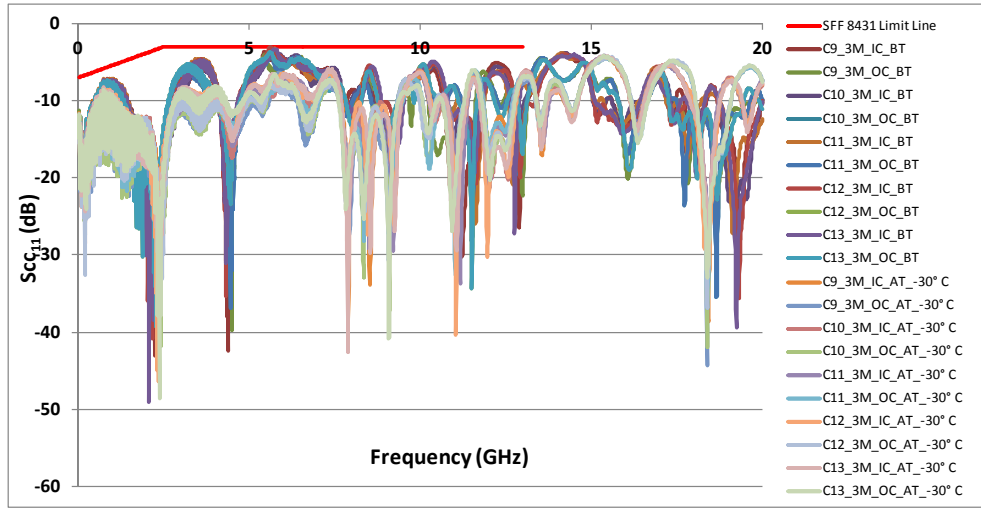
The purpose of this test is to permit evaluation of the properties of materials used in cable assembly as they are influenced or deteriorated by the effects of low temperature condition.

Test Method

Mated connectors shall be tested in accordance with EIA-364-17.

Temperature:	-30°C
Duration:	96 hours





Thermal Shock — EIA-364-32

Purpose

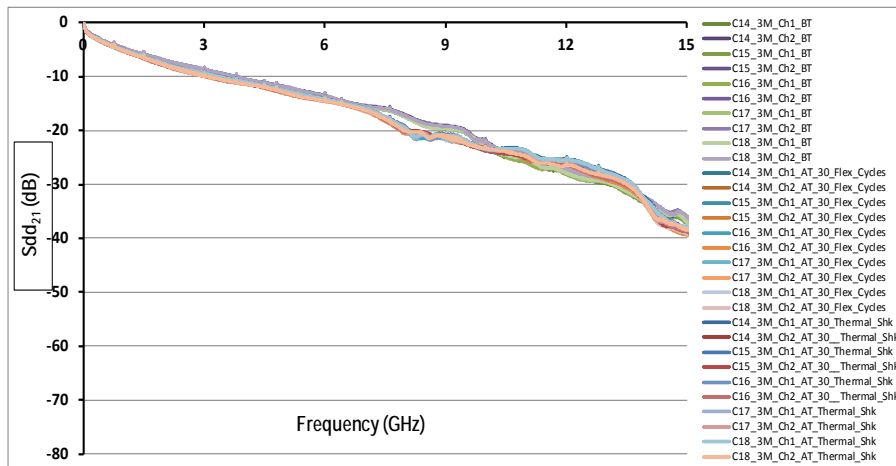
The purpose of this test is to determine the resistance of a given cable assembly to exposure at extremes of high and low temperatures and to the shock of alternate exposures to these extremes, simulating the worst probable conditions of storage, transportation and application.

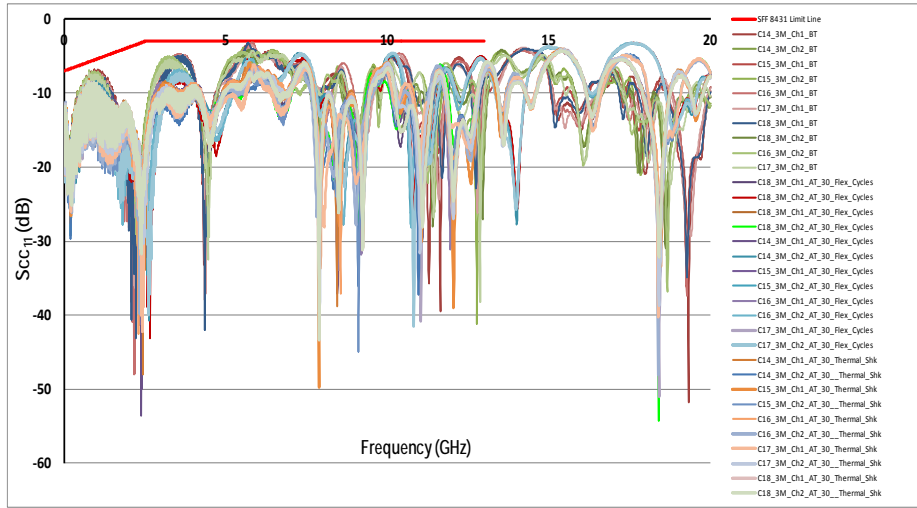
Test Method

Mated connectors shall be tested in accordance with EIA-364-32.

Temperature:	-30°C and +85°C
Cycle Time:	30 minutes each Temperature
Transition Time:	1 minute maximum
Cycles:	5

Test Results





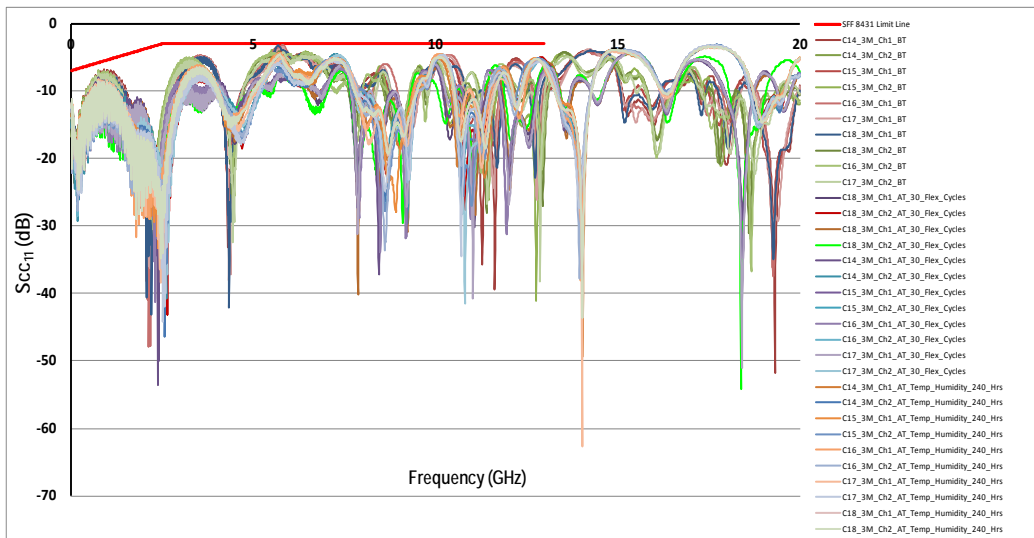
Humidity — EIA-364-31

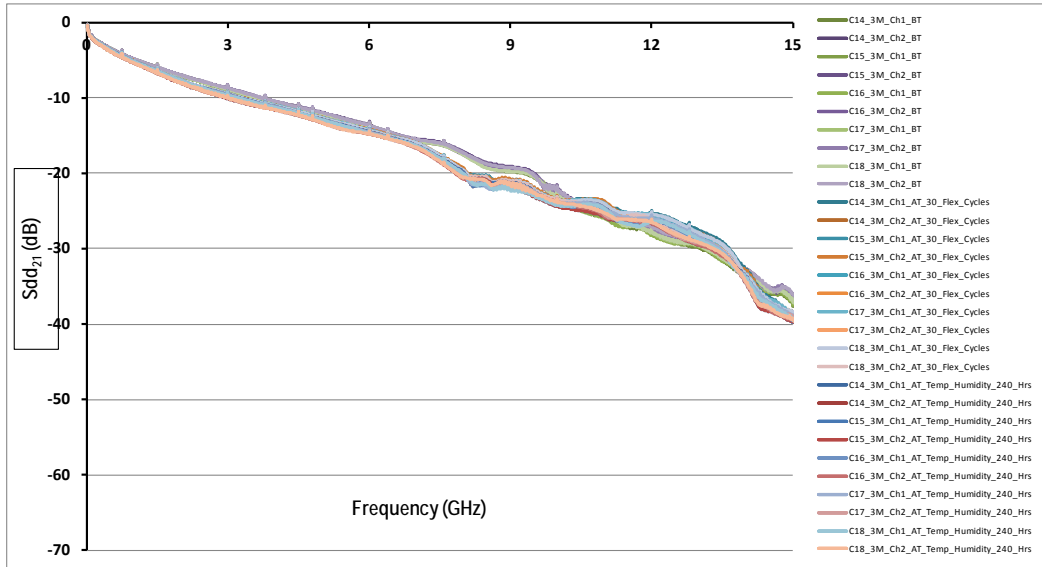
Purpose

The purpose of this test is to permit evaluation of the properties of materials used in connectors as they are influenced or deteriorated by the effects of high humidity and heat condition.

Test Method

Mated connectors shall be tested in accordance with EIA-364-31.





5.3 Mechanical

Mating and Unmating Forces

Purpose

The purpose of this test is to determine the mechanical forces required to mate and unmate electrical connectors.

Test Method

The mechanical forces required to mate and unmate these electrical connectors.

Test Results

Force (units):	Newtons
Mating:	18 N Max.
Unmating:	12.5N Max

Durability

Purpose

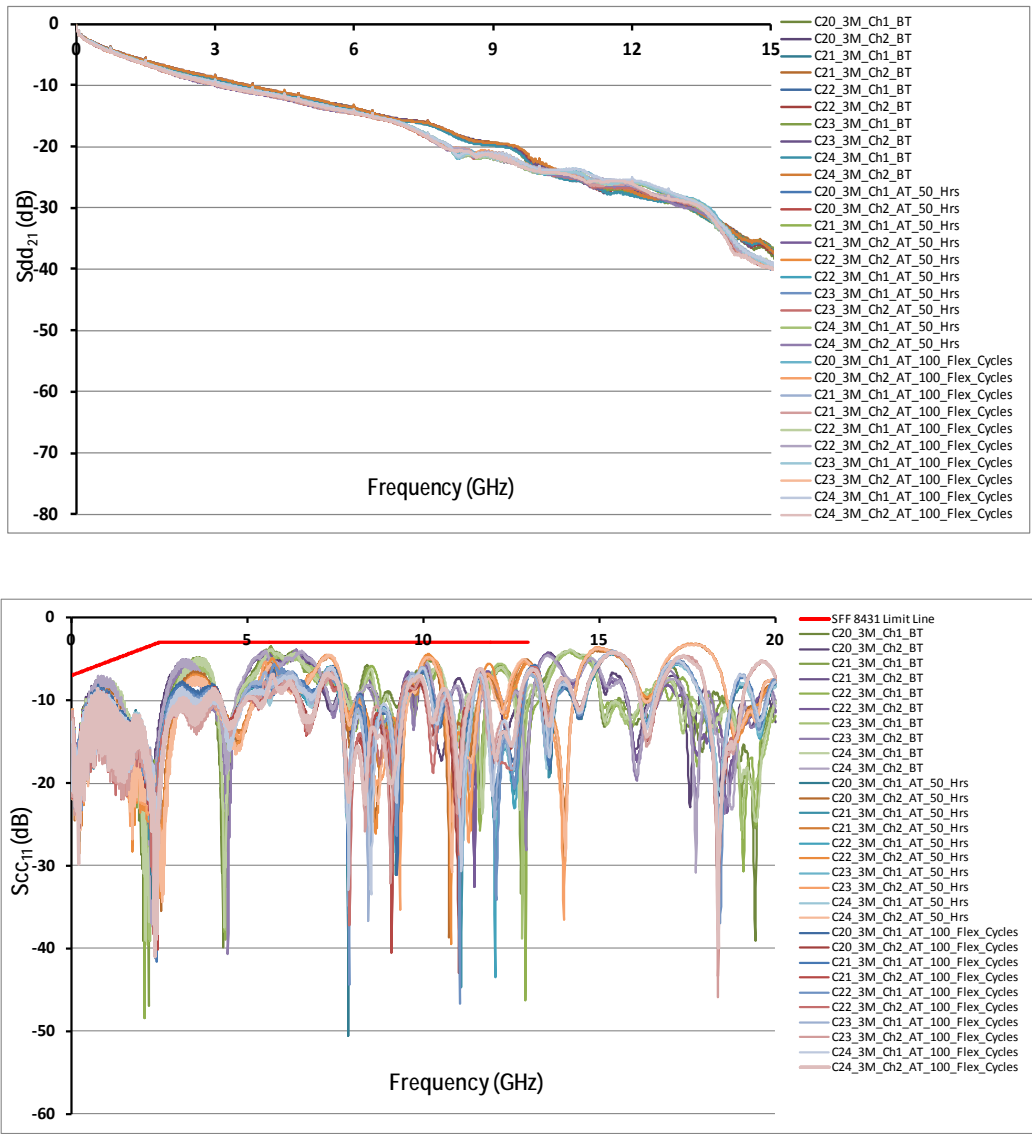
The purpose of this test is to determine the effects of subjecting the cable assembly to a condition of flexing of the cable assembly simulating operations approximating the life of the connector.

Test Method

Cable Flexing testing has been performed for 100 cycles.

Condition:	100 Cycles
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Test Results



Pull Tab and Mechanical Metal Latch Pull Strength

Purpose

The purpose of this test is to determine mechanical reliability of SFP+ cable assembly pull tab and mechanical latch under different pull force configuration.

Test Method

- i. Pull tab axially pull with fixed load (Pull Tab, fixed at an angle 45 °) for 10 seconds
- ii. Pull tab axially pull with fixed load (Pull Tab fixed at angle of 90 °) for 10 seconds
- iii. Pull tab axially pull with fixed load (Pull Tab fixed vertically) for 10 seconds

Test Category	Pull Force (N)	Observation
Pull tab axially pull with fixed load (Pull Tab, fixed at an angle 45 °) for 10 seconds	30	No damage to the pull tab and metal locking latch
Pull tab axially pull with fixed load (Pull Tab fixed at angle of 90 °) for 10 seconds	30	No damage to the pull tab and metal locking latch
Pull tab axially pull with fixed load (Pull Tab fixed vertically) for 10 seconds	30	No damage to the pull tab and metal locking latch

5.4 Signal Integrity

Voltage Modulation Amplitude (VMA) Loss — SFF 8431 Rev 4.1

Purpose

The purpose of this test is to determine the difference between the nominal one and zero level of an electrical signal in a Passive SFP+ cable assembly.

Test Method

Voltage Modulation Amplitude (VMA) Loss is defined with square wave pattern as defined in IEEE standard 802.3. VMA Loss of the Passive SFP+ cable assembly has been tested in accordance with standard SFF 8431 Rev4.1.

Cable Wire Gauge (AWG)	Cable Length	Specification (dB)	Results
30	3m and 5m	< 4.4	Pass
26	5m, 6m and 7m	< 4.4	Pass

VMA Loss to Crosstalk (VCR) Ratio — SFF 8431 Rev 4.1

Purpose

The purpose of this test is to determine the the VCR measurement is determined by computing VMA and NEXT RMS voltage measurements in a Passive SFP+ cable assembly.

Test Method

VMA Loss to Cross Talk ratio of the Passive SFP+ cable assembly has been tested in accordance with standard SFF 8431 Rev 4.1.

Cable Wire Gauge (AWG)	Cable Length	Specification (dB)	Results
30	3m and 5m	> 32.5	Pass
26	5m, 6m and 7m	> 32.5	Pass

Differential Output and Input Reflection Co-efficient (SDD₁₁ and SDD₂₂) — SFF 8431 Rev 4.1

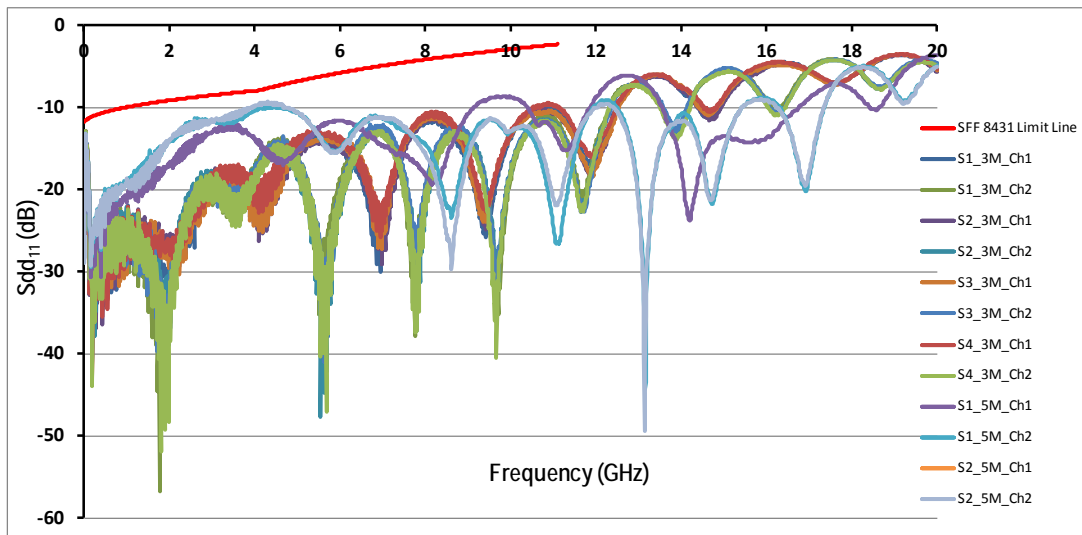
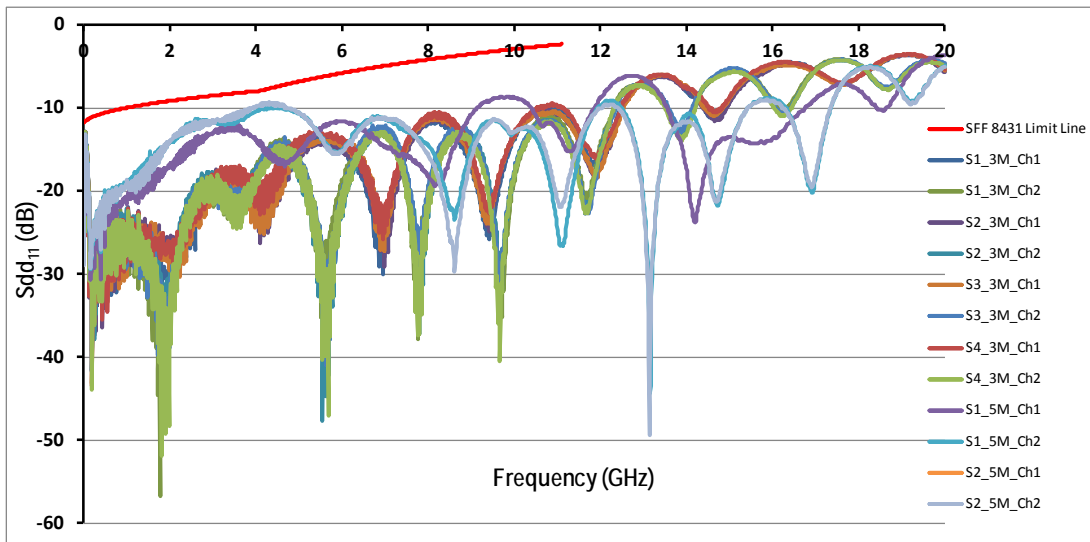
Purpose

The purpose of this test is to determine the The Input and Output Reflection Co-efficient SDD₁₁ and SDD₂₂ in a Passive SFP+ cable assembly.

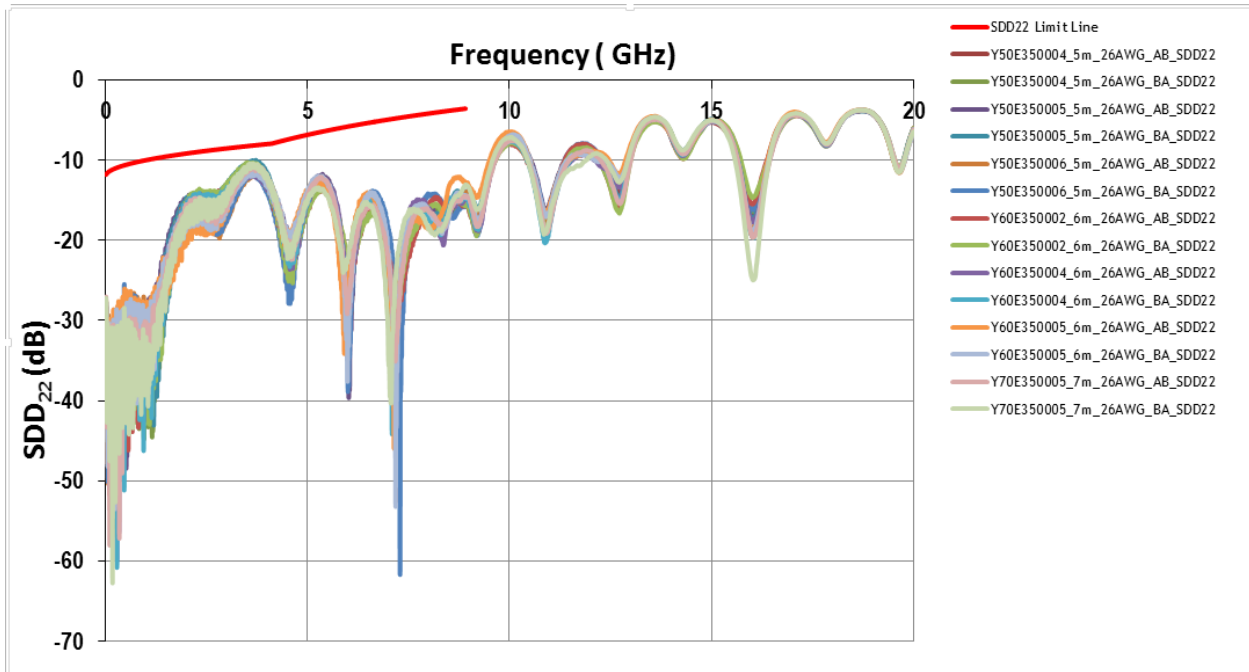
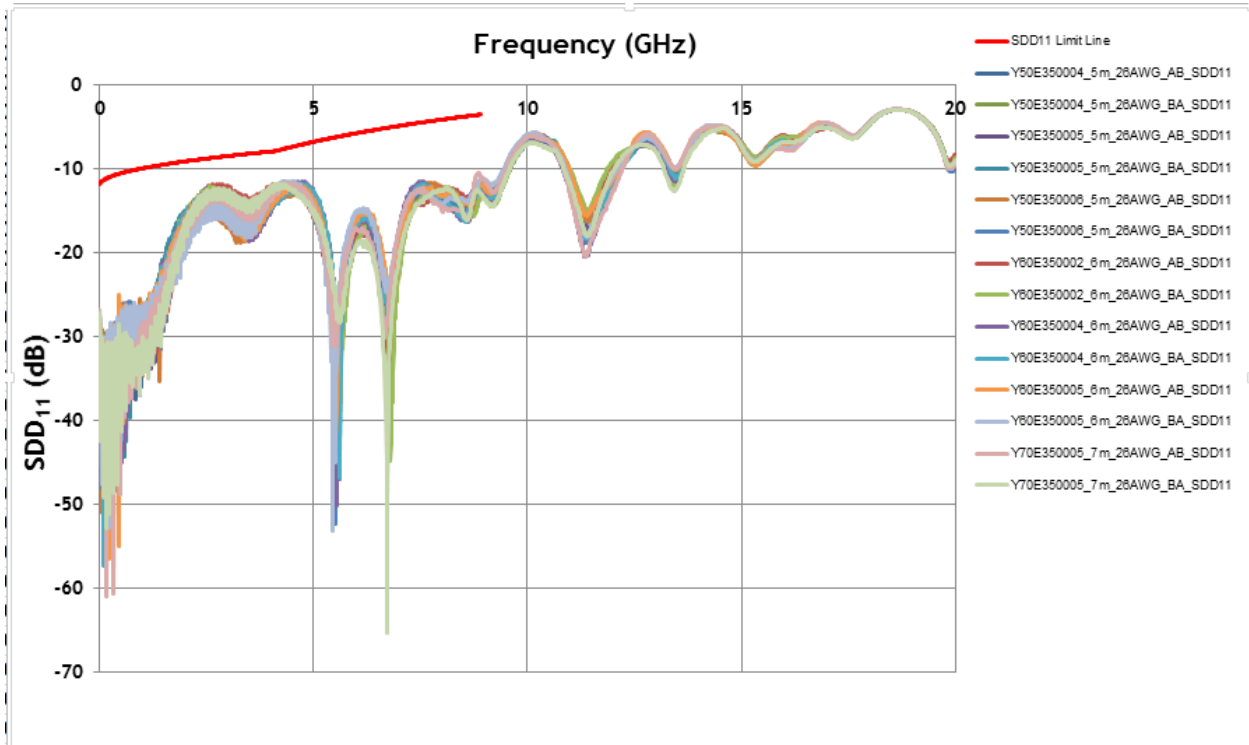
Test Method

Differential Output and Input Reflection Co-efficient of the Passive SFP+ cable assembly has been tested in accordance with standard SFF 8431 Rev 4.1.

30AWG 3m and 5m Testing Results



26AWG 5m, 6m and 7m Testing Results



Common Mode Output and Input Reflection Co-efficient (SCC₁₁ and SCC₂₂) — SFF 8431 Rev 4.1

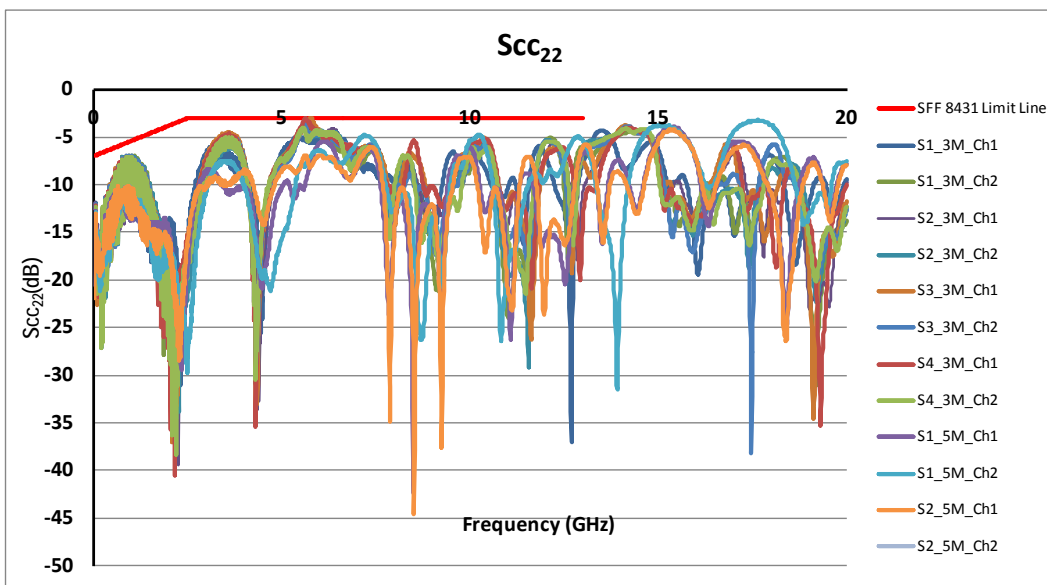
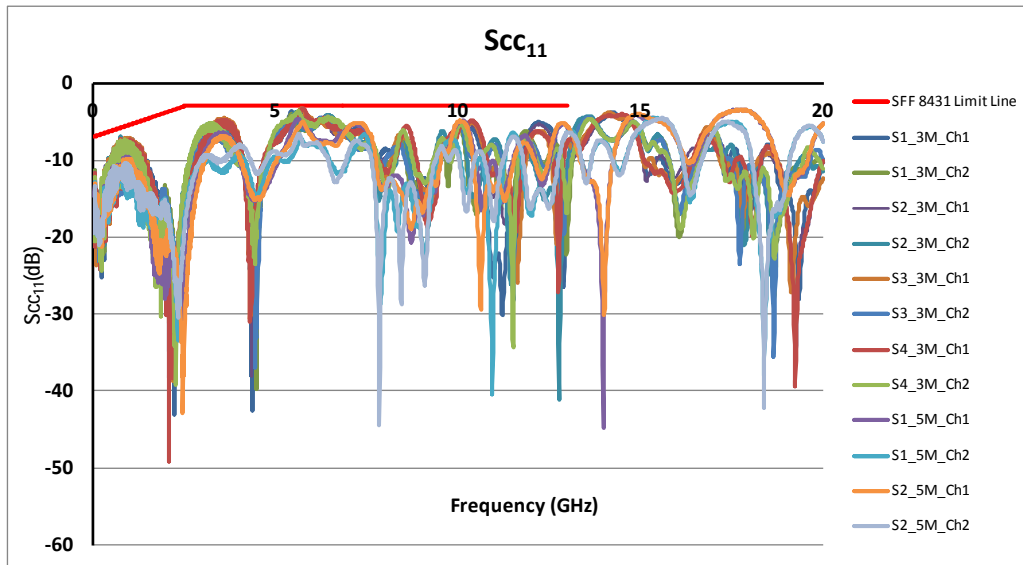
Purpose

The purpose of this test is to determine the The Common Mode Reflection Co-efficient SCC₁₁ and SCC₂₂ in a Passive SFP+ cable assembly.

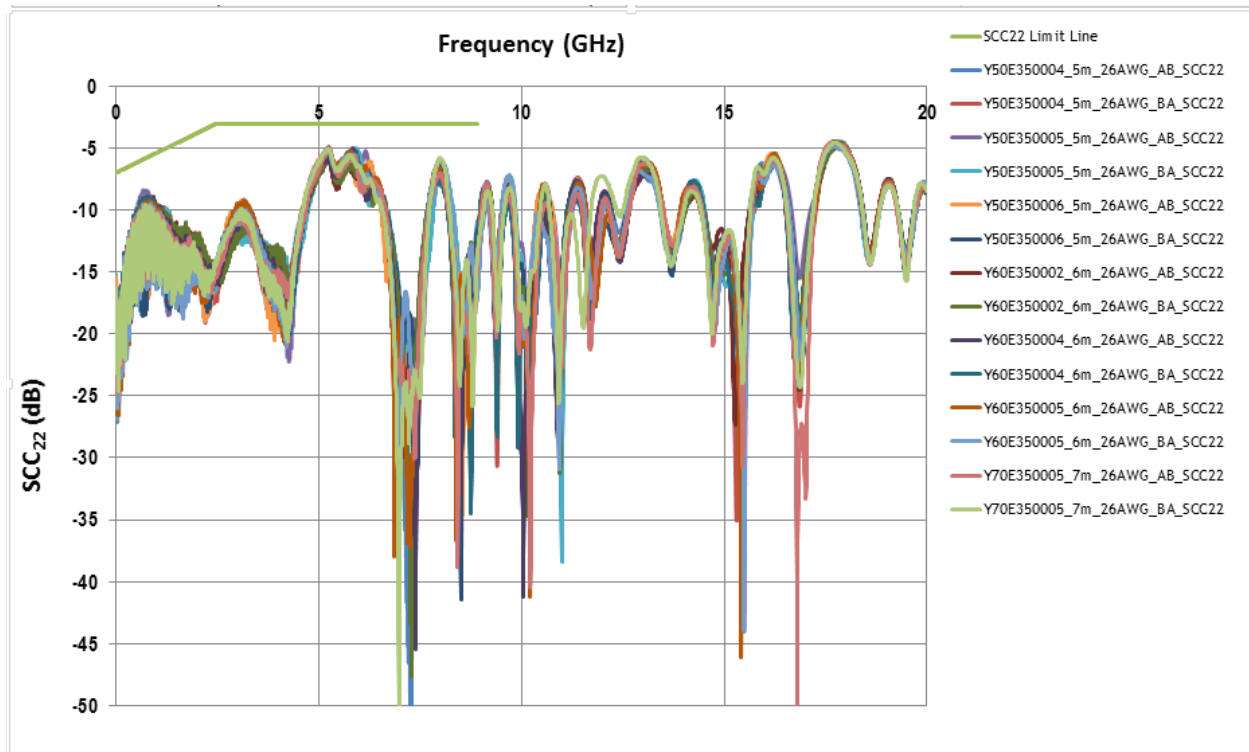
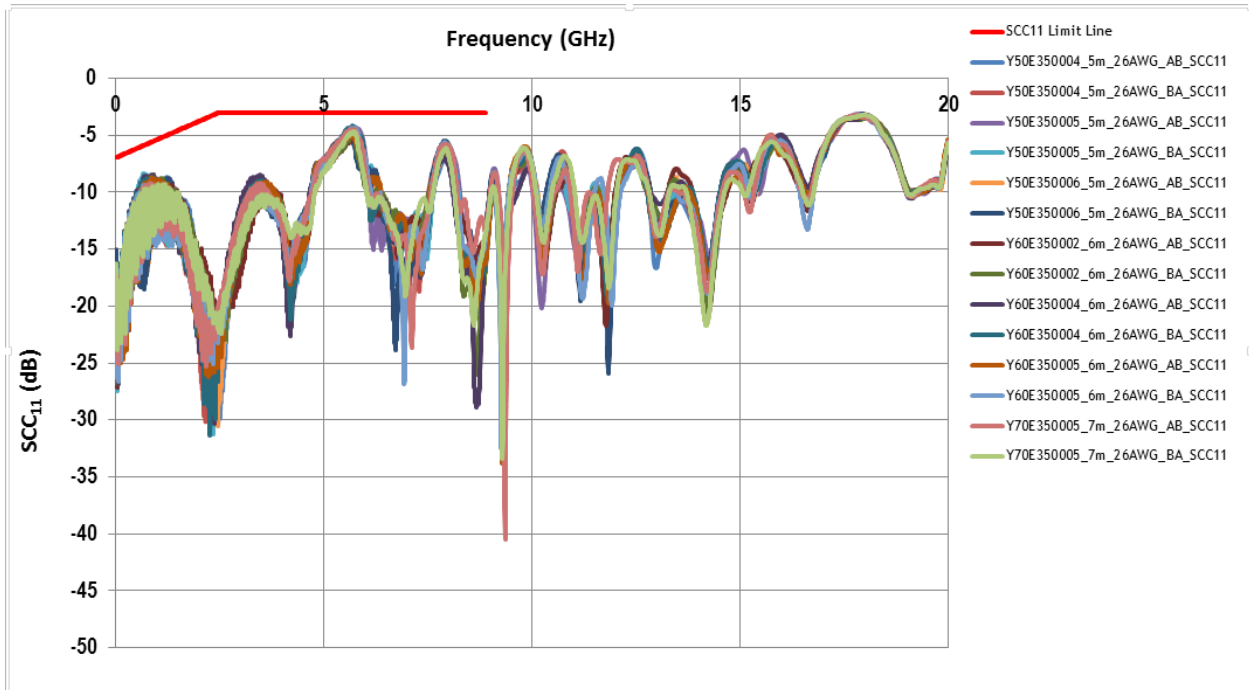
Test Method

Common Mode Reflection Co-efficient of the Passive SFP+ cable assembly has been tested in accordance with standard SFF 8431 Rev 4.1.

30AWG 3m and 5m Testing Results



26AWG 5m, 6m and 7m Testing Results



Difference Wavelength Distortion Penalty (dWDP) — SFF 8431 Rev 4.1*Purpose*

The purpose of this test is to determine a measure of waveform filtering and other distortion associated with the linear optical receiver.

Test Method

Difference Wavelength Distortion Penalty (dWDP) of the Passive SFP+ cable assembly has been tested in accordance with standard SFF 8431 Rev 4.1.

Cable Wire Gauge (AWG)	Cable Length	Specification (dBe)	Results
30	3m and 5m	< 6.75	Pass
26	5m, 6m and 7m		

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