1.85mm Series High Frequency Coaxial Cable Assembly(70GHz)

1. INTRODUCTION

1.1 Purpose

Testing was performed on the TE connectivity (TE) 1.85mm Series High Frequency Coaxial Cable Assembly and connectors to determine their conformance to the requirements of Product Specification 108-160049 Revision 1.

1.2 Scope

This report covers the electrical, mechanical, and environmental performance of the 1.85mm Series Radio Frequency Coaxial Cable Assembly and Connectors.

1.3 Conclusion

All of the 1.85mm Series Radio Frequency Coaxial Cable Assembly and Connectors part number listed in paragraph 1.5, conformed to the electrical, mechanical, and environmental performance requirements of Product Specification 108-160049, Revision A

1.4 Product Description

The TE Connectivity 1.85mm interface connectors and Radio Frequency Coaxial Cable Assembly products are designed with innovative features, optimized performance, and full compatibility with all industry standard 1.85mm RF interconnect products.1.85mm interface connectors series include: screw, hand screw, quick lock install method.

1.5 Test Specimens

Table 1 – Test Specimens

Specimens list of cable assembly for testing				
Test Group	Sample			
	Part Number	Description	Qty	Note
1	1-2016490-0	HF CA,1.85 M-M,70GHz,L1000,SMOOTH JACKET	2	Flex under load testing
	1-2016487-0	HF CA,1.85 M-M,70GHz,L1000,BRAID JACKET	2	
2	1-2016490-0	HF CA,1.85 M-M,70GHz,L1000,SMOOTH JACKET	2	Temperature Shock
	1-2016487-0	HF CA,1.85 M-M,70GHz,L1000,BRAID JACKET	2	
3	1-2016490-0	HF CA,1.85 M-M,70GHz,L1000,SMOOTH JACKET	2	Durability testing
	1-2016487-0	HF CA,1.85 M-M,70GHz,L1000,BRAID JACKET	2	
4	1-2016490-0	HF CA,1.85 M-M,70GHz,L1000,SMOOTH JACKET	2	Crushing testing
	1-2016487-0	HF CA,1.85 M-M,70GHz,L1000,BRAID JACKET	2	
5	1-2016490-0	HF CA,1.85 M-M,70GHz,L1000,SMOOTH JACKET	2	Heating Aging
	1-2016487-0	HF CA,1.85 M-M,70GHz,L1000,BRAID JACKET	2	
6	1-2016490-0	HF CA,1.85 M-M,70GHz,L1000,SMOOTH JACKET	1	Vibration and Shock, Salt Spray
	1-2016487-0	HF CA,1.85 M-M,70GHz,L1000,BRAID JACKET	2	
7	1-2016490-0	HF CA,1.85 M-M,70GHz,L1000,SMOOTH JACKET	1	Shielding Effectiveness
	1-2016487-0	HF CA,1.85 M-M,70GHz,L1000,BRAID JACKET	1	

1.6 Test Sequence

Table 2 - Test Sequences

Test or Examination	Test Group *(a)*						
	1	2	3	4	5	6	7
	Test Sequences *(b)*						
Initial Examination of Product	1	1	1	1	1	1	1
Visual inspection	2,7,12,17,22	2,7,12,17,22	2,7,12,17,22	2,7,12,17	2,7,12,17	2,8,14,20 22,24	2,4,6
Interface dimensions						3,9,15	
Impedance	3,8,13,18,23	3,8,13,18,23	3,8,13,18,23	3,8,13,18	3,8,13,18	3,10,16	
Return Loss	4,9,14,19,24	4,9,14,19,24	4,9,14,19,24	4,9,14,19	4,9,14,19	4,11,17	
Insertion Loss	5,10,15,20,25	5,10,15,20,25	5,10,15,20,25	5,10,15,20	5,10,15,20	5,12,18	
Screen effectiveness							3
Vibration						6	
Mechanical shock						7	
Bending test-wound on mandrel	16	16	16	11	11		
Flexure test	6						
Bending test-bend on 4 different orientation	21	21	21	16	16		
Abrasion test							5
Cable crushing test				6			
Centre contact captivation---axial force						13	
Coupling torque---proof						19	
Tensile strength of coupling mechanism						21	
Cable torque	11	11	11				
Mechanical endurance			6				
Heating and aging					6		
Temperature Cycling		6					
Salt mist						23	

NOTE

(a) See paragraph 1.5
(b) Numbers indicate sequence in which tests were performed

1.7 Environmental Conditions

Unless otherwise stated, the following environmental conditions prevailed during testing:

Temperature: 15℃ to 35℃
Relative Humidity 20% to 80%

2. SUMMARY OF TESTING

2.1 Visual Inspection – All Groups

A Certificate of Conformance stating that all specimens submitted for testing were representative of normal production lots and met the requirements of the applicable product drawing was provided. Where specified, specimens were visually examined, and no evidence of physical damage detrimental to product performance was observed.
The result is pass.

2.2 Mechanical Compatibility –All Groups

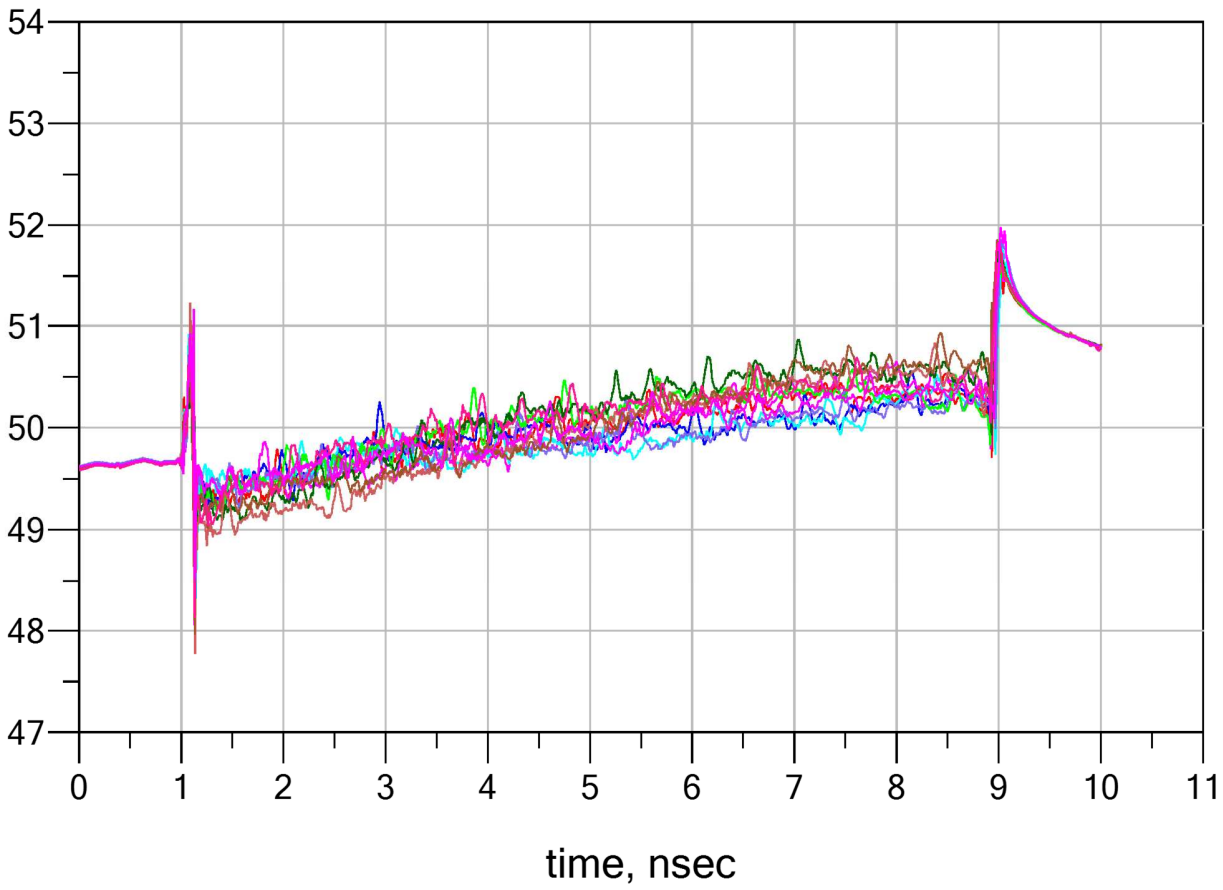
The mating face of the specimens shall be compatibility with the gauges which base on the IEC 61169-32 industry specifications.
The result is pass.

2.3 Interface dimension –Group 6

The connector interface can meet IEEE287 GPC specification
The result is pass.

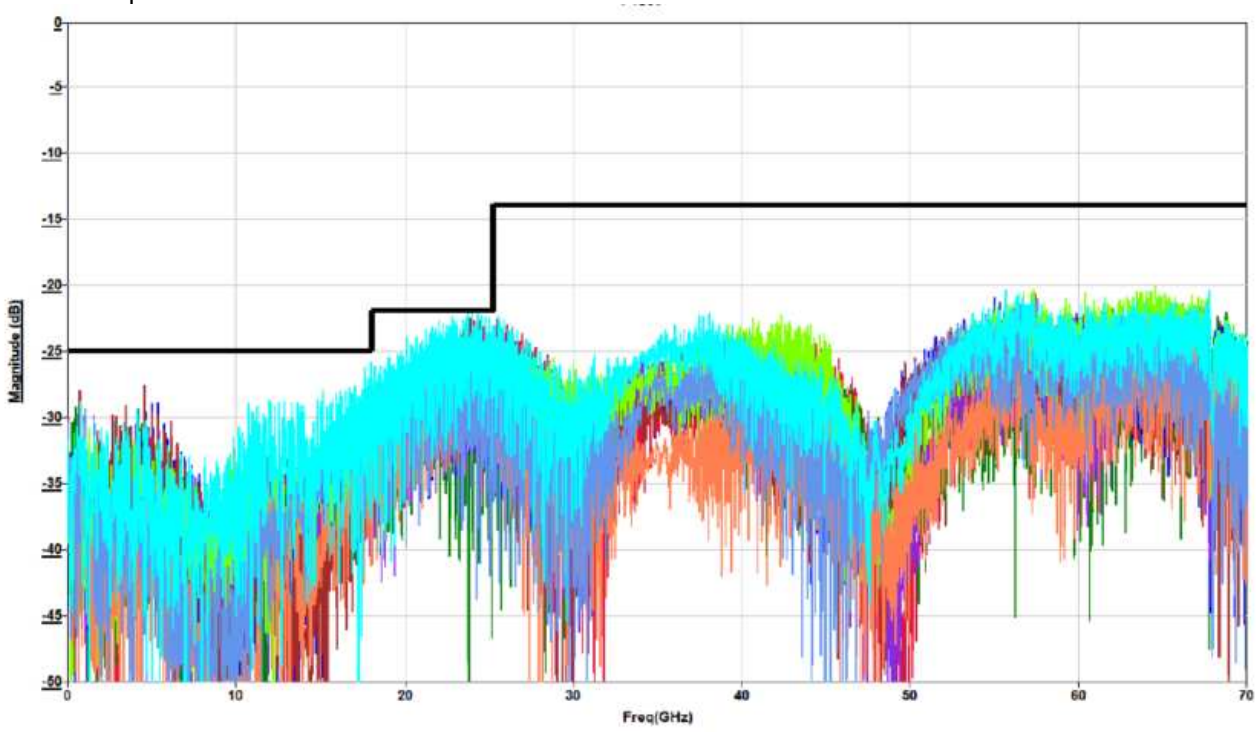
2.4 Impedance –Groups 1~5

Before and after reliability test, The impedance can meet specification defined 50±2ohm
The result is pass.



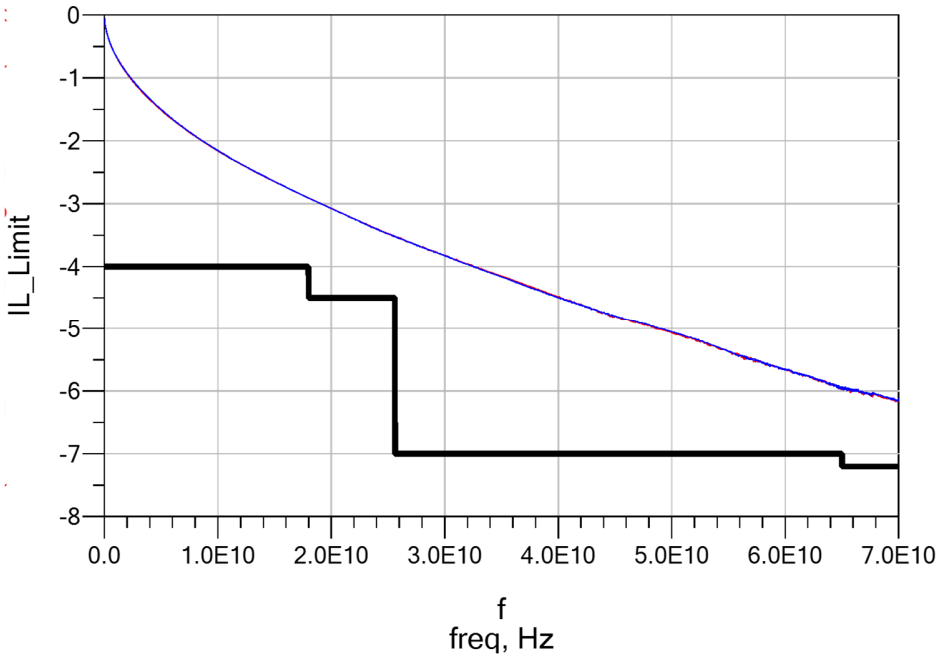
2.5 Return Loss –Group 1~5

Before and after reliability test, The return loss can meet specification defined -22dB max @DC~18GHz; -20dB max @18~26.5GHz; -16dB max @26.5~65GHz; -15.5dB max@65~70GHz
The result is pass.



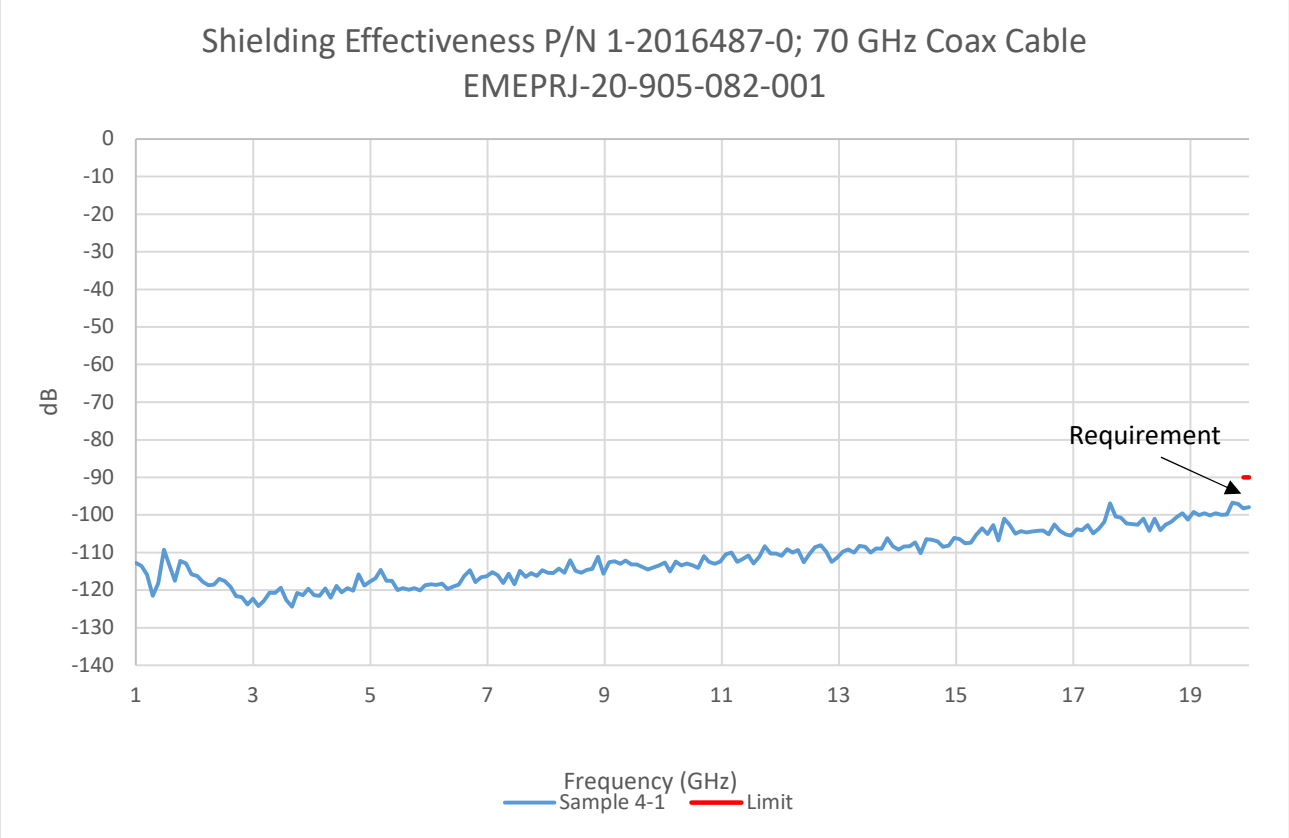
2.6 Insertion Loss –Group 1~5

Before and after reliability test, The return loss can meet specification defined -7.6dB (1m)
The result is pass.



2.7 Screen effectiveness – Test Groups 7

The cable assembly the screen shielding can meet 90dB min @DC~18GHz
The result is pass.
1.85mm cable assembly



2.8 Vibration – Test Groups 6

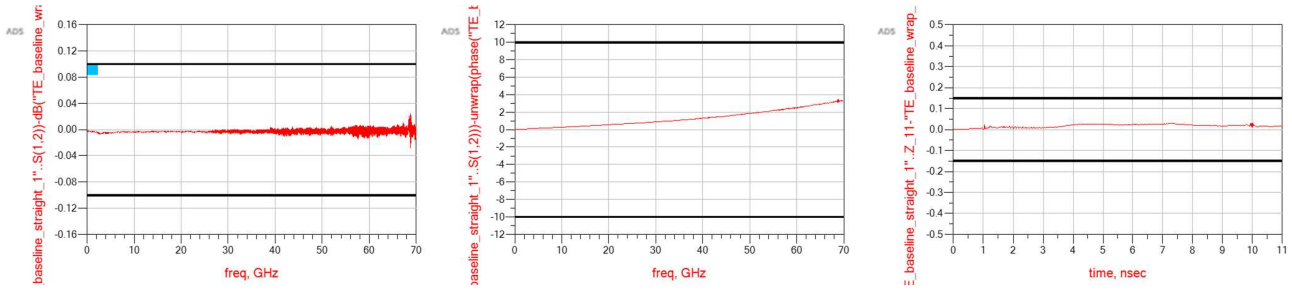
After the test, neither the dielectric nor the sheath shall have moved in relation to the cable outlet of the connector, No discontinuities of 1 microsecond or longer duration
The result is pass, detail may refer to TP-21-01540 from Shanghai Lab

2.9 Mechanical Shock – Test Groups 6

After the test, neither the dielectric nor the sheath shall have moved in relation to the cable outlet of the connector, No discontinuities of 1 microsecond or longer duration
The result is pass, detail may refer to TP-21-01540 from Shanghai Lab

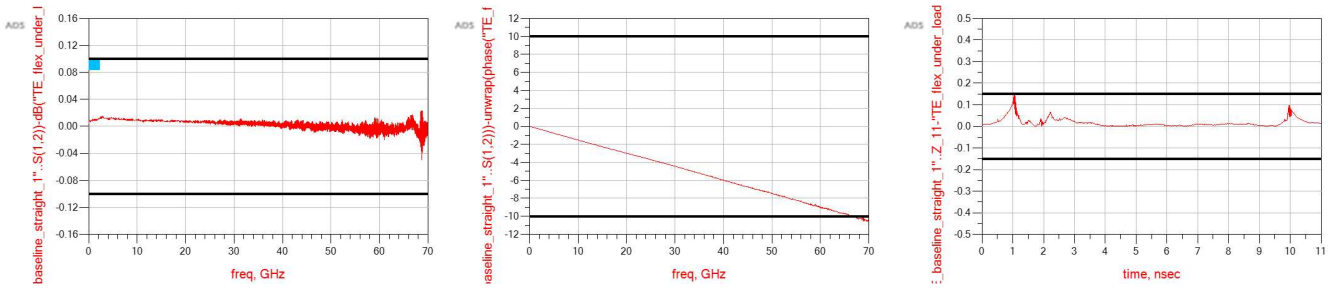
2.10 Bending test (wound 360° on mandrel) – Test Gr oups 1~5

After the test, neither the dielectric nor the sheath shall have moved in relation to the cable outlet of the connector; SI parameter can meet specification defined, Insertion Loss shifts no more than 0.10dB, Phase Shifts no more than 10degree
The result is pass



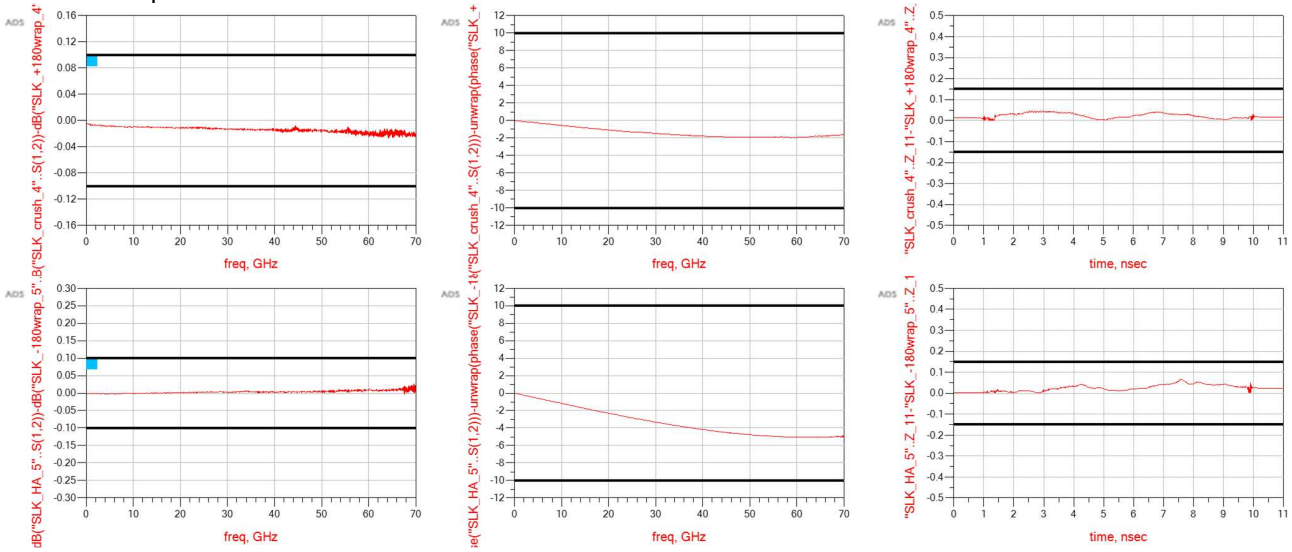
2.11 Flexure test – Test Groups 1

After 2000cycles test, neither the dielectric nor the sheath shall have moved in relation to the cable outlet of the connector; SI parameter can meet specification defined, Insertion Loss shifts no more than 0.10dB, Phase Shifts no more than 10degree



2.12 Bending test (bend on +/-180degree) – Test Groups 1~5

After the test, neither the dielectric nor the sheath shall have moved in relation to the cable outlet of the connector; SI parameter can meet specification defined, Insertion Loss shifts no more than 0.10dB, Phase Shifts no more than 10degree
The result is pass



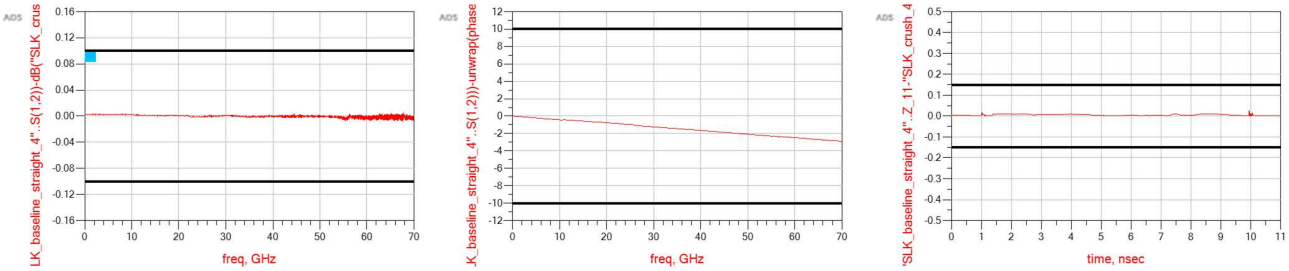
2.13 Abrasion test – Test Groups 7

After the test, cable sheath should not be damaged.

The result is pass.

2.14 Cable crushing test – Test Groups 4

After the test, neither the dielectric nor the sheath shall have moved in relation to the cable outlet of the connector; cable should not be damaged, SI parameter can meet specification defined, Insertion Loss shifts no more than 0.10dB, Phase Shifts no more than 10degree
The result is pass

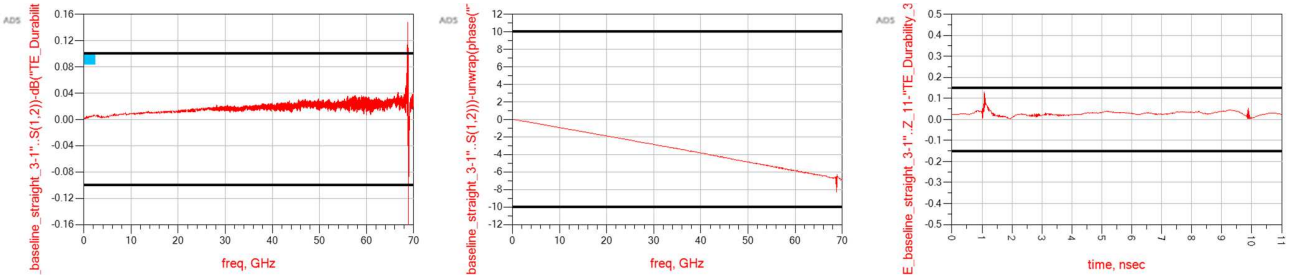


2.15 Cable torque test – Test Groups 1~3

After the test, neither the dielectric nor the sheath shall have moved in relation to the cable outlet of the connector; cable should not be damaged, SI parameter can meet specification defined, Insertion Loss shifts no more than 0.10dB, Phase Shifts no more than 10degree
The result is pass

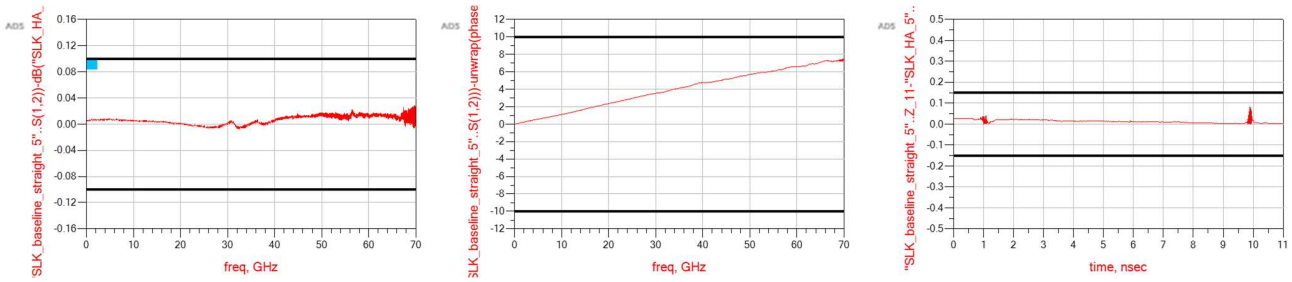
2.16 Mechanical endurance test(Durability test) – Test Groups 3

After 500 cycles test, neither the dielectric nor the sheath shall have moved in relation to the cable outlet of the connector, the connector should not be damaged, SI parameter can meet specification defined, Insertion Loss shifts no more than 0.10dB, Phase Shifts no more than 10degree
The result is pass.



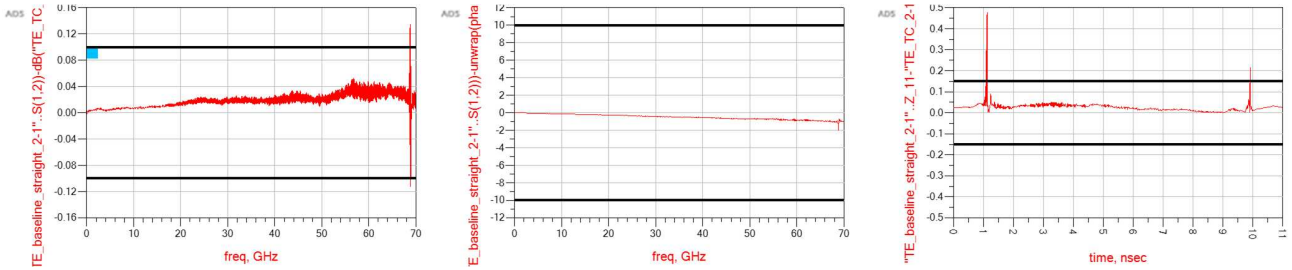
2.17 Heating aging test – Test Groups 5

After the test, neither the dielectric nor the sheath shall have moved in relation to the cable outlet of the connector.
The result is pass.



2.18 Temperature shock test – Test Groups 2

After the test, neither the dielectric nor the sheath shall have moved in relation to the cable outlet of the connector.
The result is pass.



2.19 Salt mist test – Test Groups 6

After the test, neither the dielectric nor the sheath shall have moved in relation to the cable outlet of the connector.
The result is pass.

3. TEST METHODS

3.1 Visual Examination

A Certificate of Conformance was issued stating that all specimens have been produced, inspected, and accepted as conforming to product drawing requirements, and made using the same core manufacturing processes and technologies as production parts. Where specified, specimens were visually examined and no evidence of physical damage detrimental to product performance was observed. Testing was performed in accordance with Test Specification EIA-364-18B.

3.2 Interface

The test shall be performed using a fixture and gauge.

3.3 Shielding effectiveness

The test shall be performed IEC62153-4-7 or EIA364-66A as below figure 1

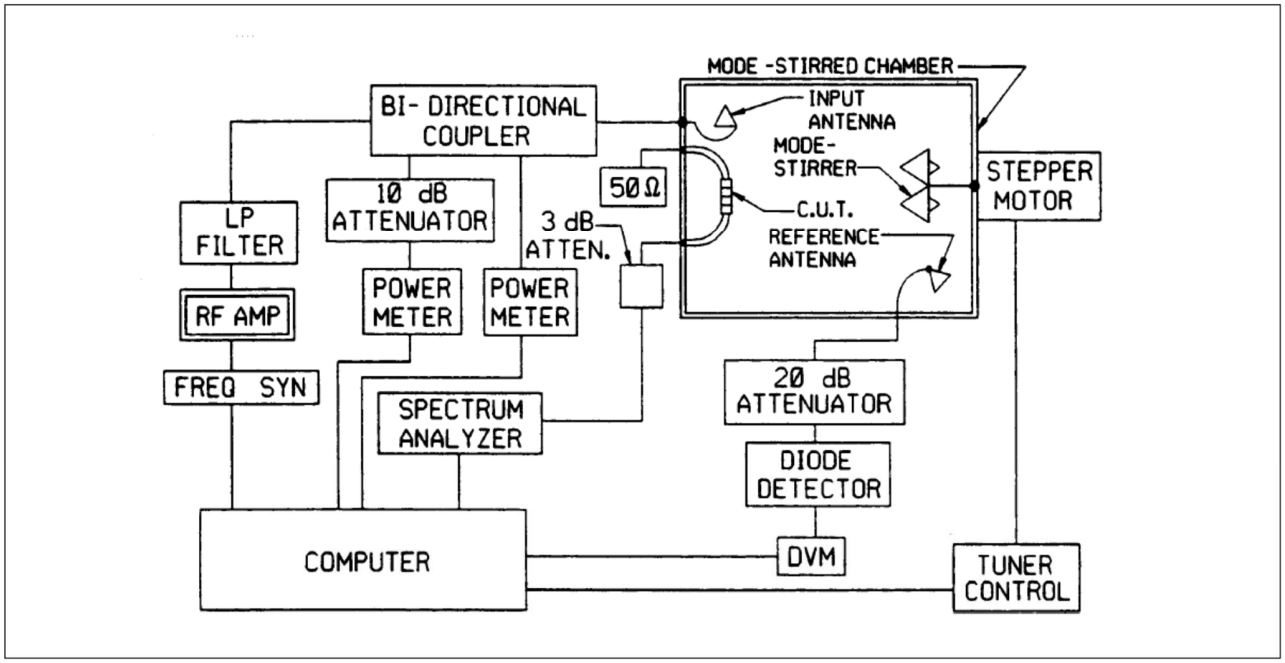
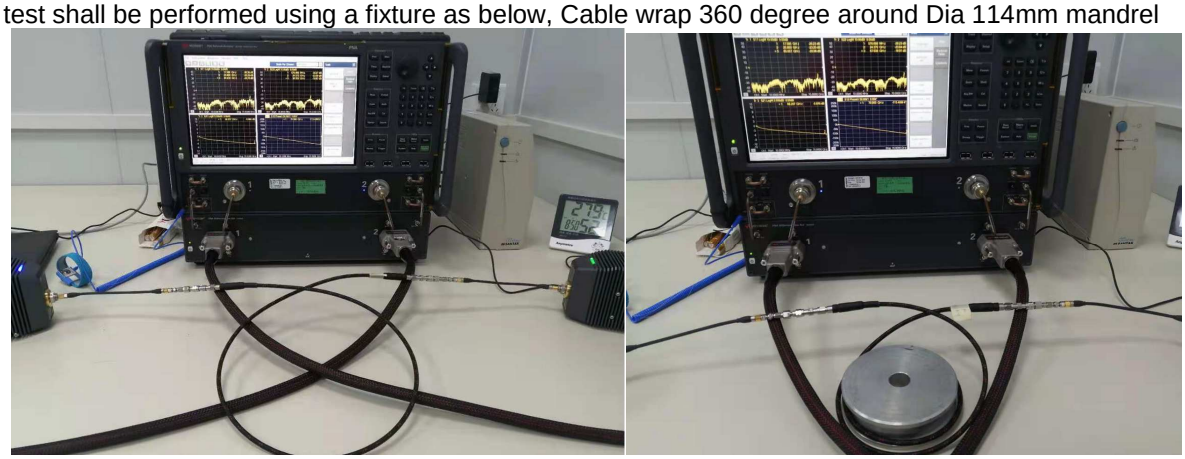


Figure 1 – Mode stirred shielding effectiveness measurement system

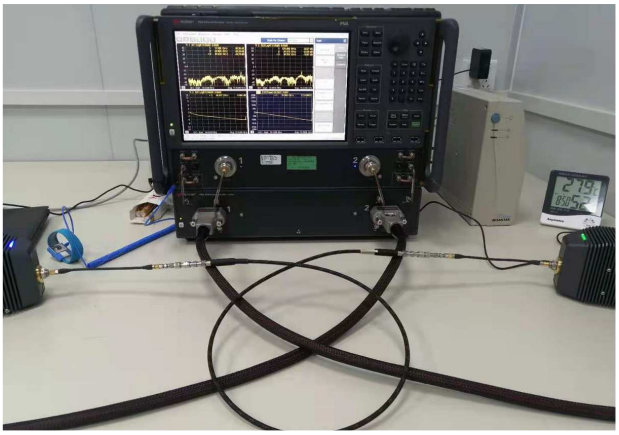
3.4 Bending test-wound on mandrel

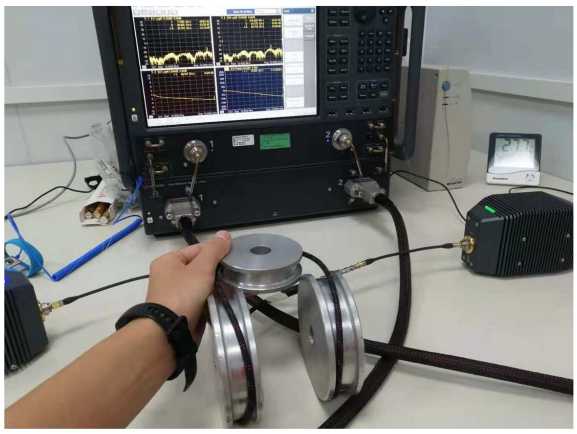
The test shall be performed using a fixture as below, Cable wrap 360 degree around Dia 114mm mandrel



3.5 Bending test-bend ±180°

The test shall be performed using a fixture as below,
Bend cable in 4 different direction as picture from SR end
L=40mm, R=57mm,A=180°





3.6 Temperature Shock

The test shall be performed as below table 3, apply specimen on (-55℃-→+85℃ 130min/cycle,5cycles)

Table 3 – Method A, air-to-air thermal shock test conditions

Step	Test condition I		Test condition II		Test condition III	
	Temperature, °C	Time, minutes	Temperature, °C	Time, minutes	Temperature, °C	Time, minutes
1	+0 -55 -5	See table 2	+0 -65 -5	See table 2	+0 -65 -5	See table 2
2	Specimen transfer time from cold to hot.	5 max (see 2.1.3)	Specimen transfer time from cold to hot.	5 max (see 2.1.3)	Specimen transfer time from cold to hot.	5 max (see 2.1.3)
3	+3 85 -0	See table 2	+3 105 -0	See table 2	+3 125 -0	See table 2
4	Specimen transfer time from hot to cold.	5 max (see 2.1.3)	Specimen transfer time from hot to cold.	5 max (see 2.1.3)	Specimen transfer time from hot to cold.	5 max (see 2.1.3)

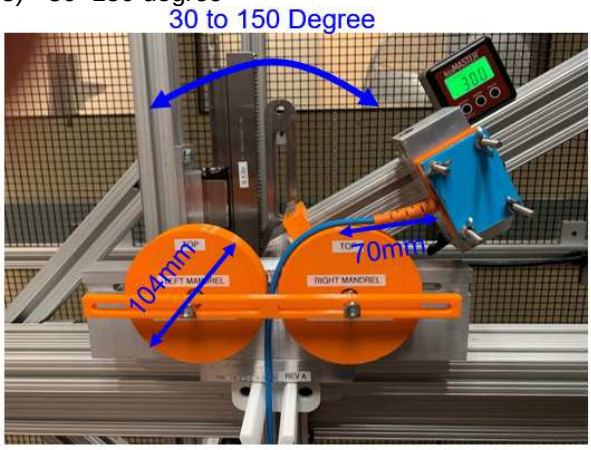
3.7 Cable torque

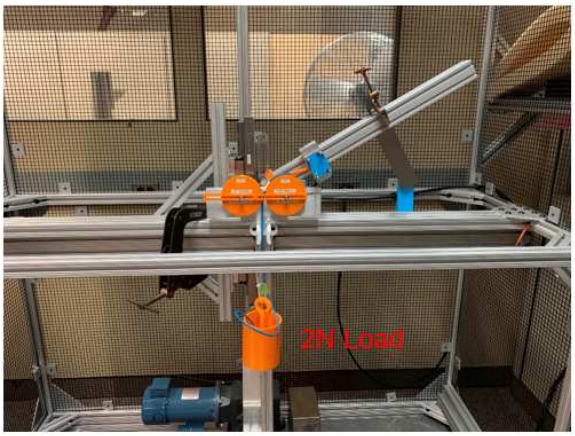
An axial torque 0.1N.m of specified magnitude shall be applied to the free end of straight cable for a duration of 60s min

3.8 Flex Under Load

A force F=2N shall be applied to a test fixture as shown in Figure.

1) Value of the force F,2N,
2) Number of flexures, 2000cycles,
3) 30~150 degree

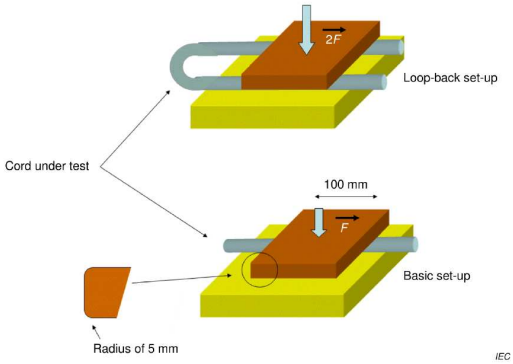




3.9 Cable assembly crushing

A force F shall be applied to a test fixture as shown in Figure at the rate of 0, 2F per second maximum. The force shall then be maintained for 60+/-10S.

4) Value of the force F,1000N,
5) Distance from the test region to one of the connectors, normally 1m maximum
6) Visual inspection and electrical test (VSWR, Insertion Loss, Mechanical phase stability and Amplitude stability)



3.10 Vibration:MIL-STD-202,method 204,test condition D (20g) and Mechanical shock: MIL-STD-202,method 213,test condition I (100g)

1) Subject mated specimens to 98m/S^2,10Hz~2000Hz, 10g,time to be 15minutes on each of three mutually perpendicular axes, for Vibration test
2) Subject mated specimens to 490m/s^2,1/2 sine 11ms duration, 50g,3 shocks in each direction applied along 3 mutually perpendicular planes,18total shocks, for mechanical shock test

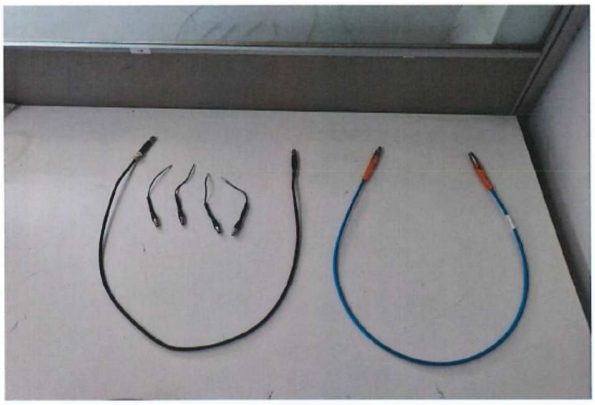


Photo 1: Before the test

Photo 2: Z axis Vibration

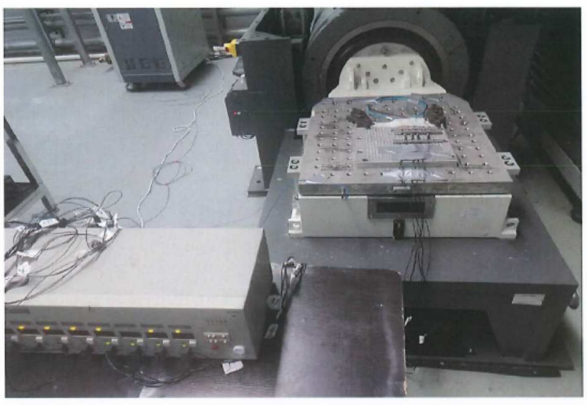


Photo 3: X axis Vibration

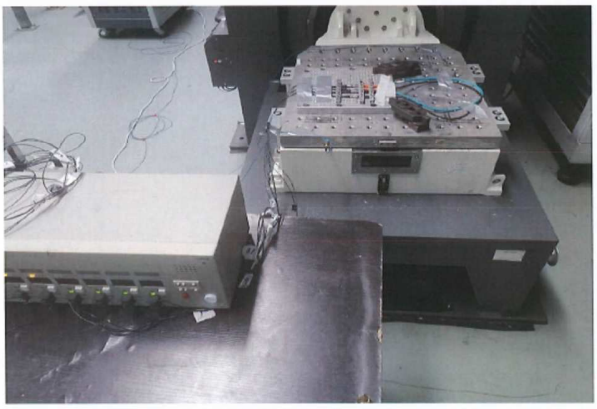
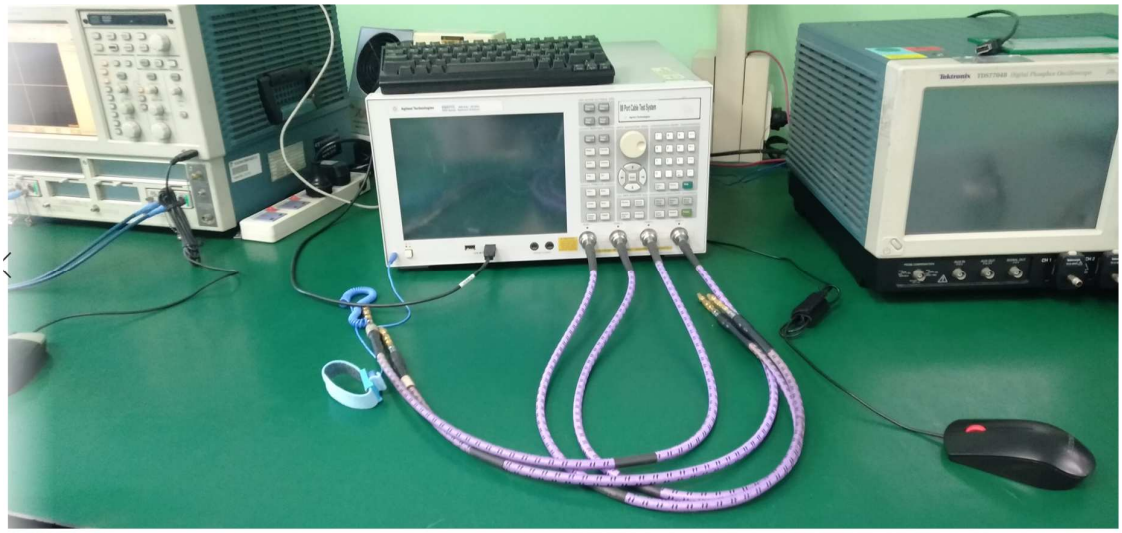


Photo 4: Y axis Vibration

3.12 Insertion Loss / VSWR / Impedance/mechanical phase and amplitude stability

The return loss and Insertion Loss was performed using an Agilent PNA Network Analyzer. The 1.85mm/2.4mm/2.92mm/3.5mm to 3.5mm (m) adapter was connected to port 1 and port 2 of the network analyzer. The network analyzer was set to collect 501 data points across a frequency range of 50.0 MHz to 70.0 GHz with a bandwidth of 1 kHz in step mode.
A full 2 port calibration was performed employing the precision calibration Kit. After calibration either the 1.85mm/2.4mm/2.92mm/3.5mm to 3.5mm (m) adapter was added to adapt to the DUT and is included in the final return loss and Insertion Loss measurement.
The test specimens on cables were placed between port 1 and port 2 of the network analyzer. A S22, S12 measurement was performed driven. Testing was performed in accordance with Test Specification EIA-364-108.



REV	DATE (DD-MM-YY)	CATEGORY	ADDITIONS, DELETIONS, CHANGES
1	08-Jul-2021	All	Preliminary version
1.1	29-Dec-2021	All	Updated test result

Change history: