

**NOTE**

The product described in this document has not been fully tested to ensure conformance to the requirements outlined below. Therefore, TE Connectivity (TE) makes no representation or warranty, express or implied, that the product will comply with these requirements. Further, TE may change these requirements based on the results of additional testing and evaluation. Contact TE Engineering for further details.

27GHz SMA Series High Frequency Coaxial Cable Assembly

1. SCOPE

The 27GHz SMA interface cable assembly is designed to meet the rising performance needs of in microwave applications requiring high performance.

This specification gives an overview of all relevant specifications or requirements related to 27GHz SMA series Cable Assembly

1.1. Content

This specification covers performance, tests and quality requirements for TE Connectivity (TE) 27GHz SMA series high frequency coaxial cable assembly of nominal characteristic impedance 50 ohms and have an operating frequency range of up to 27GHz

1.2. Qualification

All components for the cable assembly, connectors, over-mold and cable were subject to their individual design objectives and were qualified accordingly.

This document addresses the total cable assembly

When tests are performed on the subject product line, procedures specified in table 1 shall be used. All inspections shall be performed using the applicable inspection plan and product drawing.

2. APPLICABLE DOCUMENTS

The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the latest edition of the document applies. In the event of conflict between the requirements of this specification and the product drawing, the product drawing shall take precedence. In the event of conflict between the requirements of this specification and the referenced documents, this specification shall take precedence.

2.1. TE Connectivity (TE) Documents

TEC-109-201	Component heat resistance to lead-free reflow soldering.
501-160277	Qualification Test Report (27GHz SMA series RF cable assembly)
109-197	Test Specification (TE Test Specification vs EIA and IEC Test Methods)

2.2 Commercial Standards and Specifications

EIA-364	Electrical Connector/Socket Test Procedures Including Environmental Classifications
IEC 60966-1	Radio-frequency and coaxial cable assemblies: General requirements and test methods
IEC 61169-1	Radio frequency connectors-Generic specification
IEC 61169-15	Radio-frequency connectors-Part 15:Sectional specification-RF coaxial connectors with inner diameter of outer conductor 4.13mm(0.163in) with threaded coupling-Characteristic impedance 50ohm (type SMA)

ISO 21207 Corrosion tests in artificial atmospheres -- Accelerated corrosion tests involving alternate exposure to corrosion-promoting gases, neutral salt-spray and drying

2.3 Reference Documents

- 109-1 General Requirements for Testing
- 102-950 Qualification of Separable Interface Connectors

3. REQUIREMENTS

3.1 Design and Construction

Product shall be of the design, construction, materials and physical dimensions specified on the applicable product drawing.

3.2 Materials

Materials used in the construction of this product shall be as specified on the applicable TE drawing.

3.2.1 Connector:27GHz SMA

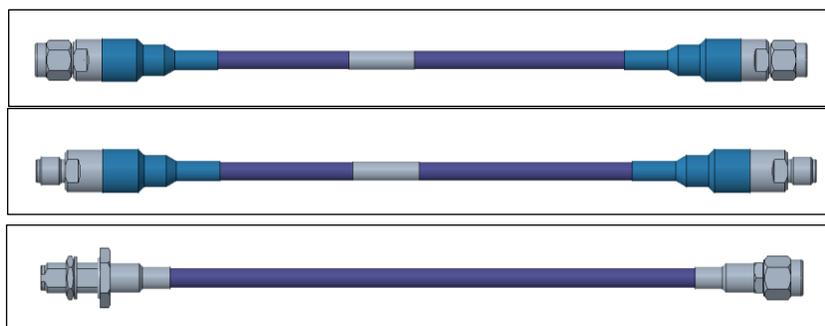
3.2.2 Cable: Armor or without armor

3.3 Ratings

- 3.3.1 Voltage: 335 VAC RMS at sea level for 2016748 & 2016750
250VAC RMS at sea level for 2016752,2016756,2016757,2016759
100VAC RMS at sea level for 2016753
- 3.3.2 Temperature Range: -40 to 85 °C
- 3.3.3 Characteristic Impedance: 50 ohms Normal
- 3.3.4 Frequency Range: DC to 27 GHz

3.4 Performance Requirements and Test Description

Cable assembly of 27GHz SMA plug or socket, accurate and stable for all needs with guaranteed low loss value, RF leakage,phase stable, VSWR due to smallest form factor, good mechanical and physical stable characteristic,Included below figure and part number.



2016748-X	EP-SMA,27GHz STRAIGHT, MALE-MALE, RG402(.141) FLEX (figure1)
2016750-X	EP-SMA,27GHz FEMALE-FEMALE, RG402(.141) FLEX (figure 2)
2016757-X	EP-SMA,27GHz STRAIGHT, MALE-MALE, RG405(.086) FLEX (figure 1)
2016759-X	EP-SMA,27GHz FEMALE-FEMALE, RG405(.086) FLEX (figure 2)
2016753-X	EP-SMA,27GHz STRAIGHT MALE-MALE, .047" FLEX (figure 1)
2016752-X	EP-SMA,27GHz STRAIGHT MALE-MALE, RG405(.086) SEMI-FLEX (figure 1)
2016756-X	EP-SMA,27GHz MALE-FEMALE, RG405(.086) SEMI-FLEX (figure 3)
6-2016752-X	EP-SMA,27GHz STRAIGHT MALE-MALE, RG405(.086) SEMI-RIG (figure 1)
6-2016756-X	EP-SMA,27GHz MALE-FEMALE, RG405(.086) SEMI-RIG (figure 3)

3.5 Performance and Test Description

Products is designed to meet the electrical, mechanical and environmental performance requirements specified in upper Figure. Unless otherwise specified, all tests shall be performed at ambient environmental conditions.

3.6 Test Requirements and Procedures Summary (table 1)

Test Description	Requirement	Procedure
Initial examination of product	Meets requirements of product drawing.	EIA-364-18/IPC 620 class 2 Visual and dimensional (Certificate of Conformance) inspection per product drawing.
ELECTRICAL		
Impedance	50±2ohm	EIA-364-108/ IEC 60966-1. Measurement is made using a time domain reflectometer with input step applied to the cable assembly through an air line acting as an impedance reference per figure 1
Insertion loss	Before and after mechanical test: See Detail product drawing	EIA-364-101/IEC60966-1 Measurements shall be made using a suitable network analyser, a slotted line may be used where frequency and accuracy requirements permit as figure2
Insertion loss stability	During and after the test, the specified change of IL shall not exceed 0.1dB	IEC60966-1 during measurement insertion loss, and wound cable on a mandrel of radius equal to the dynamic bending radius and 2~3turns
VSWR(Return Loss)	Before and after mechanical test, The value can meet 1.25 Max @DC~27GHz	EIA-364-108/IEC 60966-1 Measurements shall be made using a suitable network analyser, a slotted line may be used where frequency and accuracy requirements permit,as figure2
Low Level Contact Resistance (LLCR) for cable assembly	Before and after, the LLCR changed will not exceed 3.2m-ohm for center contact 4m-ohm for outer contact	EIA-364-23/ IEC 61169-1. Subject specimens to 100 milliamperes maximum and 20 millivolts maximum open circuit voltage.
Voltage proof	without breakdown or flashover, Apply below AC voltage at sea-level 1000V for 2016748 & 2016750; 750V for 2016752,2016756,2016757, and 2016759; 500V for 2016753	IEC61169-32/IEC61169-1 Measured between the contact with a A.C.Volatage of 500±50V apply an electrification time of 1min+/-5s,refer to figure 3
Insulation Resistance	5000 ohm min; after test 200Mohm min	IEC60966-1 Measured between the contact with a d.c.Volatage of 500±50V after an electrification time of 1min+/-5s, Refer to figure 3
Velocity of propagation	78~86%	IEC60966-1 TDR or a pulse echo test set can be used (the measured echo delay time should be divided by a factor of 2 to obtain the propagation time of the cable assembly
Shielding effectiveness	100dB @1~3GHz (Zt ≤ 1mohm)	IEC60966-1 According to IEC62153-4-7

Test Description	Requirement	Procedure
MECHANICAL		
Interface dimension	The dimensions of the interface shall be in accordance with drawing or standard specification	IEC61169-15 interface dimension
Centre contact captivation	The permanent displacement of centre contact should meet interface dimension after remove the stress	IEC 61169-15/IEC 61169-1 An axial force 22N applied smoothly to the centre contact in both directions. An axial torque 0.03N.M applied smoothly to the centre contact in both directions
Coupling torque	-coupling nut friction: ≤ 0.23 N.m -Normal: 0.79N.M TO 1.13 N.m -Proof: 1.69N.M	IEC 61169-15/IEC 61169-1 The test shall be carried out on connector coupling or with a gauge. 5cycles engagement and separation, shall be measured fifth cycle
Tensile strength of coupling mechanism	Load 180N min keep 60s	IEC 61169-15/IEC 61169-1 An axial tensile force shall be applied smoothly to mated connector pairs of coupling.
Vibration, random	No discontinuities of 1 microsecond or longer duration	IEC61169-1/IEC61169-15 Subject mated specimens to 100m/S^2 , 10Hz~2000Hz, 10g, time to be 15minutes on each of three mutually perpendicular axes
Mechanical Shock	No discontinuities of 1 microsecond or longer duration	IEC61169-1/IEC61169-15 Subject mated specimens to 500m/s^2 , 1/2 sine 11ms duration, 50g, 3 shocks in each direction applied along 3 mutually perpendicular planes, 18total shocks
Flexure test	Before and After 500cycles test, interface dimensions shall be within specified limits, VSWR, IL can meet specification requirement	IEC 60966-1 The test shall be performed using a fixture and load 2N Refer to figure 4
Flexing endurance	Before and After 500cycles test, interface dimensions shall be within specified limits, VSWR, IL can meet specification requirement	IEC 60966-1 One end is fixed, the other end is moved back and forth in the direction of the cable axis as figure 5
Multiple bending	After 20 cycles, no less of transmission performance and physical damage on cable	IEC 60966-1 Apply suitable pulling go and return over on two pulleys of min dynamic bending radius of the cable as figure 9
Cable crushing test	Before and After test, VSWR, IL, Mechanical phase stability and mechanical amplitude stability can meet specification requirement	IEC 60966-1 Load force 1000N/25mm, keep 1min Refer to figure 6
Cable pulling test	Cable can endure specification defined pulling force, after test no any damage for cable assembly, and interface can meet standard requirement	IEC 60966-1 Load a force (113N) to the free end of the cable for period of 60s min as figure 7

Test Description	Requirement	Procedure
Cable torque	The cable shall neither slip nor rotate in relation to the connectors	IEC 60966-1 An axial torque of specified magnitude shall be applied to the free end of straight cable for a duration of 60s min As figure 8
ENVIRONMENT		
Thermal Shock	before and After test, VSWR, IL can meet specification requirement	EIA-364-32, method A, condition I apply specimen on -55°C-→+85°C 5cycles
Salt mist and sulphurdioxide test	After test, insulation resistance,visual, insertion loss should meet specification	IEC60966-1 Apply specimen on salt mist 48hours, and then on Sulphur dioxide conditioning 96hours, after remove to standard atmospheric recovery for 1~2hours
Heat aging	After in room temperature for 1h max, unwind specimen, no cracks,flaws or other damage in the jacket and dielectric	IEC61169-15 Put samples on 85°C cabinet, keep 50hours

NOTE Shall meet visual requirements, show no physical damage, and meet requirements of additional tests as specified in the Product Qualification and Requalification Test Sequence shown in Table 1.

3.8. Product Qualification and Requalification Test Sequence (Table 2)

Test or Examination	Test Group (a)					
	1	2	3	4	5	6
	Test Sequences (b)					
Initial Examination of Product	1	1	1	1	1	1
Visual inspection	2,13	211,20	2,11,20,27	2,21	2,22	2,11,13,18,22
Interface dimensions	3,14	3,12,21	3,12	3,11,22	3,12,23	3,23
Low Level contact reistance	4,15	4,13,22	4,13,21	4,12,17	4,13	4,14,19
Voltage proof	5,16	5,14,23	5,14,22		14	5,15,20
Insulation resistance	6,17	6,15,24	6,15,23		15	6,16,21
Impedance	7,18	7,16,25	7,16,24	5,13,18	7,16	7, 24
VSWR(Return Loss)	8,19	8,17,26	8,17,25	6,14,19	8,17	8, 25
Insertion Loss	9,20	9,18,27	9,18,26	7,15,20	9,18	9, 26
Screen effectiveness	10					
Velocity of propagation	11					
Vibration						12
Mechanical shock						17
Flexure test			10			
Flexing endurance		10				
Multiple bending		19				
Cable crushing test			19			
Centre contact captivation---axial force					19	

Coupling torque---proof					20	
Tensile strength of coupling mechanism					21	
Cable pulling test				8		
Cable torque				9		
Mechanical endurance				16		
Thermal Shock					11	
Salt mist and sulphurdioxide test						10
Heat aging	12					

NOTE (a) See paragraph 4.2
 (b) Numbers indicate sequence in which tests are performed.

4. QUALITY ASSURANCE PROVISIONS

4.1. Test Conditions

Unless otherwise specified, all the tests shall be performed in any combination of the following test conditions shown in table 3.

(Table 3)

Temperature	15°C – 35°C
Relative Humidity	45% – 75%
Atmospheric Pressure	86.6 – 106.6 kPa

4.2. Qualification Testing

A. Specimen Selection

Specimens shall be prepared in accordance with applicable Instruction Sheets and shall be selected at random from current production. Each test group shall consist of a minimum of 1 Specimens.

B. Test Sequence

Qualification inspection shall be verified by testing specimens as specified in table2.

4.3. Requalification Testing

If changes significantly affecting form, fit or function are made to the product or manufacturing process, product assurance shall coordinate requalification testing, consisting of all or part of the original testing sequence as determined by development/product, quality and reliability engineering.

4.4. Acceptance

Acceptance is based on verification that the product meets the requirements of Figure 1. Failures attributed to equipment, test setup or operator deficiencies shall not disqualify the product. If product failure occurs, corrective action shall be taken and specimens resubmitted for qualification. Testing to confirm corrective action is required before resubmitted.

4.5. Quality Conformance Inspection

The applicable quality inspection plan shall specify the sampling acceptable quality level to be used. Dimensional and functional requirements shall be in accordance with the applicable product drawing and this specification.

5. ADDITIONAL



Figure 1

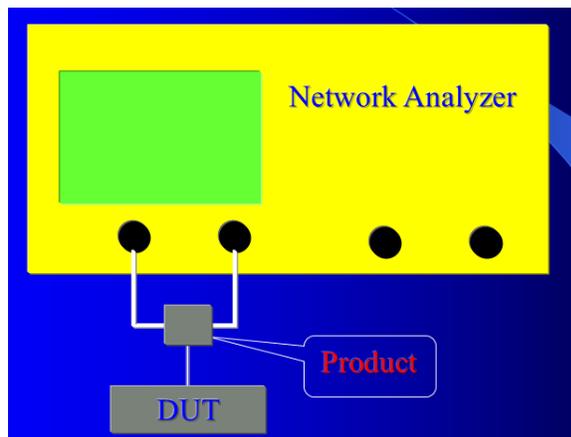
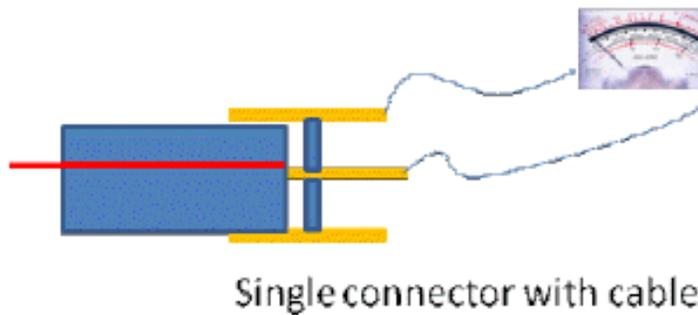


Figure 2



Single connector with cable

Figure3

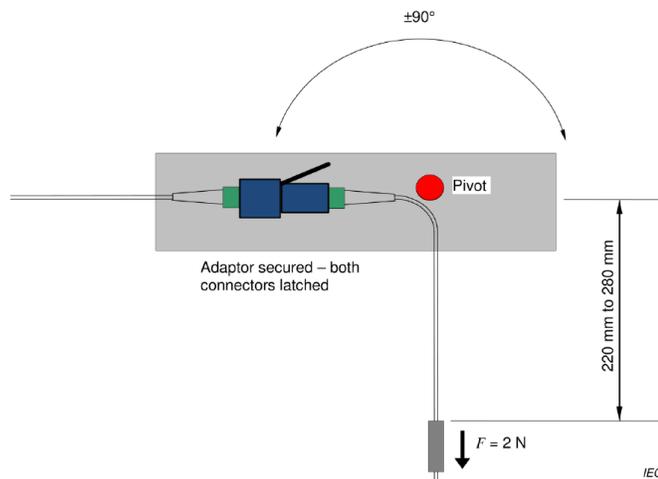
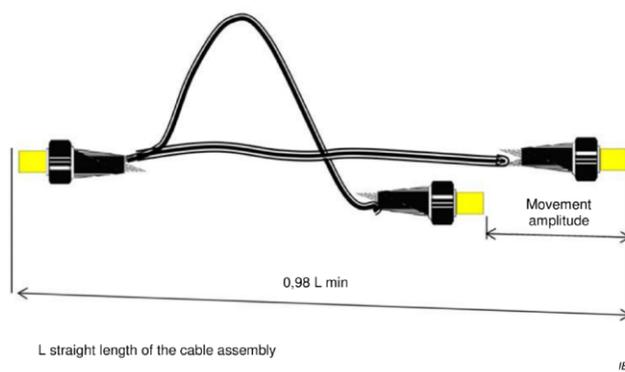


Figure 4



Key
L min minimum length to be tested (in metres)

Figure 5

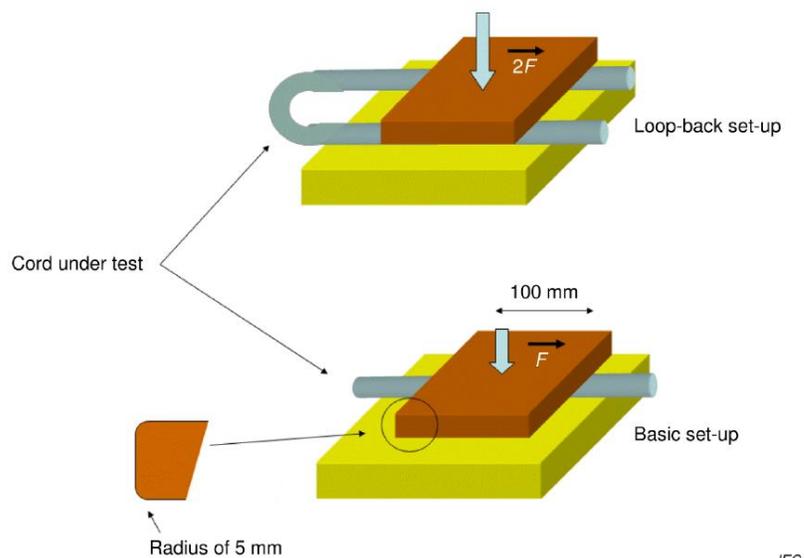


Figure 6



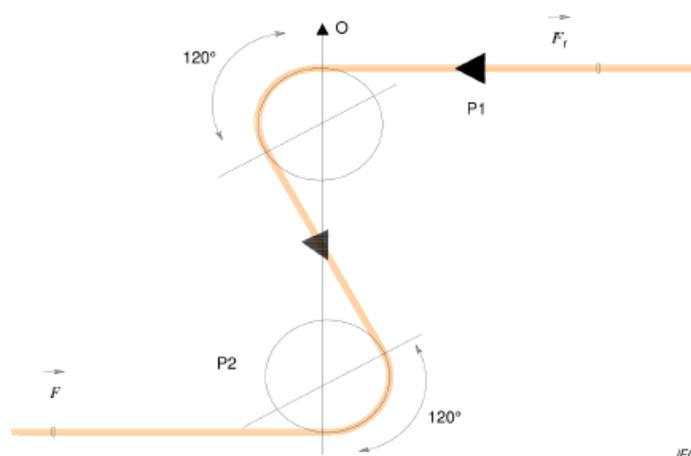
IEC 1639/13

Figure7



IEC 1641/13

Figure8



IEC

Figure 9 multiple bending

REV	DATE (DD-MM-YY)	CATEGORY	ADDITIONS, DELETIONS, CHANGES
1.0	25-Mar-2021	All	Preliminary version