

N AND SMA Series High Frequency Coaxial Cable Assembly

1. INTRODUCTION

1.1 Purpose

Testing was performed on the TE connectivity (TE) N & SMA Series High Frequency Coaxial Cable Assembly and connectors to determine their conformance to the requirements of Product Specification 108-160059 Revision 1.

1.2 Scope

This report covers the electrical, mechanical, and environmental performance of the N & SMA Series High Frequency Coaxial Cable Assembly and Connectors.

1.3 Conclusion

All of the N & SMA 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 108-160059, Revision 1

1.4 Product Description

The TE Connectivity N & SMA interface connectors and Radio Frequency Coaxial Cable Assembly products are designed with innovative features, optimized performance, and full compatibility with all industry standard N & SMA RF interconnect products. N & SMA interface connectors series include: 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 | 1-2016658-0 | Cable assembly N type to N type, with Armor cable | 1 | Mechanical: Flexure test |
| | 1-2016657-0 | Cable assembly SMA to SMA, without Armor cable | 1 | |
| | 1-2016656-0 | Cable assembly SMA to SMA, with Armor cable | 1 | |
| | 1-2016655-0 | Cable assembly N type to N type, without Armor cable | 1 | |
| | 1-2016703-0 | Cable assembly N type to SMA, with Armor cable | 1 | |
| 2 | 1-2016658-0 | Cable assembly N type to N type, with Armor cable | 1 | Mechanical: cable crushing test |
| | 1-2016657-0 | Cable assembly SMA to SMA, without Armor cable | 1 | |
| | 1-2016656-0 | Cable assembly SMA to SMA, with Armor cable | 1 | |
| | 1-2016655-0 | Cable assembly N type to N type, without Armor cable | 1 | |
| | 1-2016703-0 | Cable assembly N type to SMA, with Armor cable | 1 | |

| | | | | |
|---|-------------|--|---|--------------------------------|
| 3 | 1-2016658-0 | Cable assembly N type to N type, with Armor cable | 1 | Mechanical: cable pulling test |
| | 1-2016657-0 | Cable assembly SMA to SMA, without Armor cable | 1 | |
| | 1-2016656-0 | Cable assembly SMA to SMA, with Armor cable | 1 | |
| | 1-2016655-0 | Cable assembly N type to N type, without Armor cable | 1 | |
| | 1-2016703-0 | Cable assembly N type to SMA, with Armor cable | 1 | |

1.6 Test Sequence

Table 2 - Test Sequences

| Test or Examination | Test Group (a) | | |
|--------------------------------|--------------------|-----|-----|
| | 1 | 2 | 3 |
| | Test Sequences (b) | | |
| Initial Examination of Product | 1 | 1 | 1 |
| Visual inspection | 2 | 2 | 2 |
| Interface dimensions | 3 | 3 | 3,6 |
| VSWR/IL | 5,7 | 5,7 | |
| Mechanical phase stable | 8 | 8 | |
| Mechanical amplitude stable | 9 | 9 | |
| Mechanical Compatibility | 4 | 4 | 4 |
| Flexure test | 6 | | |
| Cable crushing test | | 6 | |
| Cable pulling test | | | 5 |

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°C to 35°C
 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 Impedance –All Groups

The impedance can meet specification defined 50+/-2ohm

The result is pass.

2.3 Flexure – Test Groups 1

After the test, the cable assembly interface dimensions shall be within the specified limits. Electrical test requirement stated in the relevant detail specification shall be complied with.

The result is pass.

N-N cable assembly

| Item | Inspection | Instrument | Testing Data | | | | | | | Result |
|--------------------------------|---|------------------|--------------|------------|------------|------------|---|---|---|--------|
| | | | NO | first time | 10000times | 12000times | \ | \ | \ | |
| Appearance of bending point | NO damage to the bending part of the wire | visual | / | OK | OK | OK | \ | \ | \ | PASS |
| VSWR | 0-18GHZ<1.30 | Network analyzer | S11 | 1.1856 | 1.1982 | 1.2159 | \ | \ | \ | PASS |
| | | | S22 | 1.1971 | 1.1745 | 1.2242 | \ | \ | \ | PASS |
| IL | 0-18GHZ -2.9dB/Min | Network analyzer | S21 | -2.5195 | -2.5187 | -2.5449 | \ | \ | \ | PASS |
| Mechanical phase stability | ≤ ±5° | Network analyzer | S12 | -348.75m° | -349.52m° | -355.74m° | \ | \ | \ | PASS |
| Mechanical amplitude stability | ≤ ±0.1dB | Network analyzer | S21 | -0.025 | -0.027 | -0.035 | \ | \ | \ | PASS |

SMA-SMA cable assembly

| Item | Inspection | Instrument | Testing Data | | | | | | | Result |
|--------------------------------|---|------------------|--------------|------------|------------|------------|---|---|---|--------|
| | | | NO | first time | 10000times | 12000times | / | / | / | |
| Appearance of bending point | NO damage to the bending part of the wire | visual | / | OK | OK | OK | / | / | / | PASS |
| VSWR | 0-18GHZ<1.30 | Network analyzer | S11 | 1.1487 | 1.1495 | 1.1508 | / | / | / | PASS |
| | | | S22 | 1.1348 | 1.1384 | 1.1654 | / | / | / | PASS |
| IL | 0-18GHZ -2.9dB/Min | Network analyzer | S21 | -2.0997 | -2.0985 | -2.1045 | / | / | / | PASS |
| Mechanical phase stability | ≤ ±5° | Network analyzer | S12 | -231.68m° | -229.85m° | -258.24m° | / | / | / | PASS |
| Mechanical amplitude stability | ≤ ±0.1dB | Network analyzer | S21 | -0.022 | -0.025 | -0.031 | / | / | / | PASS |

N-SMA cable assembly

| Item | Inspection | Instrument | Testing Data | | | | | | | Result |
|--------------------------------|---|------------------|--------------|------------|------------|------------|---|---|---|--------|
| | | | No | first time | 10000times | 12000times | / | / | / | |
| Appearance of bending point | NO damage to the bending part of the wire | visual | / | OK | OK | OK | / | / | / | PASS |
| VSWR | 0-18GHZ <1.35 | Network analyzer | S11 | 1.26 | 1.26 | 1.27 | / | / | / | PASS |
| | | | S22 | 1.25 | 1.25 | 1.25 | / | / | / | PASS |
| IL | 0-18GHZ -2.25dB/Min | Network analyzer | S21 | -1.93 | -1.92 | -1.93 | / | / | / | PASS |
| Mechanical phase stability | ≤ ±8° | Network analyzer | S12 | -131.69m° | -134.87m° | -165.63m° | / | / | / | PASS |
| Mechanical amplitude stability | ≤ ±0.15dB | Network analyzer | S21 | -0.01 | -0.01 | -0.03 | / | / | / | PASS |

2.4 Cable Assembly Crushing – Test Groups 2

After the test, the cable assembly Electrical test requirement stated in the relevant detail specification shall be complied with.

The result is pass.

N-N cable assembly

| Item | Inspection | Instrument | Testing Data | | | | | | | Result |
|--------------------------------|-----------------------------|------------------|--------------|------------|-----------------------|---|---|---|---|--------|
| | | | NO | first time | After the compressive | / | / | / | / | |
| Appearance | There is no physical damage | visual | / | OK | OK | / | / | / | / | PASS |
| VSWR | 0-18GHZ <1.30 | Network analyzer | S11 | 1.19 | 1.20 | / | / | / | / | PASS |
| | | | S22 | 1.23 | 1.23 | / | / | / | / | PASS |
| IL | 0-18GHZ -2.9dB/Min | Network analyzer | S21 | -2.51 | -2.51 | / | / | / | / | PASS |
| Mechanical phase stability | $\leq \pm 5^\circ$ | Network analyzer | S21 | 313.02m° | 325.17m° | / | / | / | / | PASS |
| Mechanical amplitude stability | $\leq \pm 0.1\text{dB}$ | Network analyzer | S21 | -0.03 | -0.04 | / | / | / | / | PASS |

SMA-SMA cable assembly

| Item | Inspection | Instrument | Testing Data | | | | | | | Result |
|--------------------------------|-----------------------------|------------------|--------------|------------|-----------------------|---|---|---|---|--------|
| | | | NO | first time | After the compressive | / | / | / | / | |
| Appearance | There is no physical damage | visual | / | OK | OK | / | / | / | / | PASS |
| VSWR | 0-18GHZ <1.30 | Network analyzer | S11 | 1.20 | 1.21 | / | / | / | / | PASS |
| | | | S22 | 1.23 | 1.22 | / | / | / | / | PASS |
| IL | 0-18GHZ -2.9dB/Min | Network analyzer | S21 | -2.20 | -2.20 | / | / | / | / | PASS |
| Mechanical phase stability | $\leq \pm 5^\circ$ | Network analyzer | S21 | 580.91m° | 581.27m° | / | / | / | / | PASS |
| Mechanical amplitude stability | $\leq \pm 0.1\text{dB}$ | Network analyzer | S21 | -0.01 | -0.01 | / | / | / | / | PASS |

N-SMA cable assembly

| Item | Inspection | Instrument | Testing Data | | | | | | | Result |
|--------------------------------|-----------------------------|------------------|--------------|------------|-----------------------|---|----|----|---|--------|
| | | | NO | first time | After the compressive | / | / | / | / | |
| Appearance | There is no physical damage | visual | / | OK | OK | / | OK | OK | / | PASS |
| VSWR | 0-18GHZ <1.35 | Network analyzer | S11 | 1.19 | 1.25 | / | / | / | / | PASS |
| | | | S22 | 1.20 | 1.21 | / | / | / | / | PASS |
| IL | 0-18GHZ -2.25dB/Min | Network analyzer | S21 | -1.93 | -1.93 | / | / | / | / | PASS |
| Mechanical phase stability | $\leq \pm 8^\circ$ | Network analyzer | S21 | 134.69m° | 142.38m° | / | / | / | / | PASS |
| Mechanical amplitude stability | $\leq \pm 0.15\text{dB}$ | Network analyzer | S21 | -0.01 | -0.01 | / | / | / | / | PASS |

2.5 Cable pulling – Test Groups 3

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.

N-N cable assembly

| Item | Inspection | Instrument | Testing Data: Unit(lbf) | | | | Result |
|-----------------------|------------|-------------------------|--------------------------|-------|---|---|--------|
| Cable Retention Force | >30 lbs | Tensile testing machine | 169.6 | 157.5 | / | / | PASS |

SMA-SMA cable assembly

| Item | Inspection | Instrument | Testing Data: Unit(lbf) | | | | Result |
|-----------------------|------------|-------------------------|--------------------------|-------|---|---|--------|
| Cable Retention Force | >30 lbs | Tensile testing machine | 106.0 | 117.5 | / | / | PASS |

N-SMA cable assembly

| Item | Inspection | Instrument | Testing Data: Unit(lbf) | | | | 检验结果 |
|-----------------------|------------|-------------------------|--------------------------|-----|---|---|------|
| | | | | | | | |
| Cable Retention Force | >30 lbs | Tensile testing machine | 231 | 209 | / | / | 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 Flexure

The test shall be performed using a fixture as shown in Figure and below requirement.

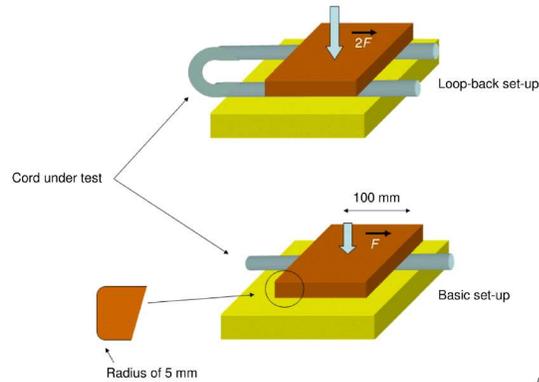
- 1) Apply 300g weight,
- 2) A flexure is a rotation of the fixture of +/-60°
- 3) The rate of flexure shall be 20 per minute
- 4) Number of flexures: 10000 and 12000 times
- 5) Visual inspection and electrical test (VSWR, Insertion Loss, Mechanical phase stability and Amplitude stability)



3.3 Flexure

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.

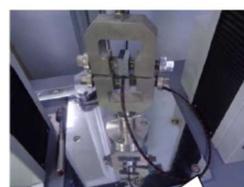
- 1) Value of the force F, 1000N,
- 2) Distance from the test region to one of the connectors, normally 1m maximum
- 3) Visual inspection and electrical test (VSWR, Insertion Loss, Mechanical phase stability and Amplitude stability)



Test samples



Tensile testing machine



Crush resistance test



Conduct VSWR&IL&phase testing before and after the test

3.4 Pulling

The cable as specified in the relevant specification shall be attached to the connector in accordance with TE specification. A tensile force as specified by the relevant specification shall be applied to the free end of the cable, The force shall then be maintained for 60+/-10S.

- 1) Value of the force F, 133N min,
- 2) Value of force, method of application and its point of application;
- 3) Duration of application of force if other than 60s min



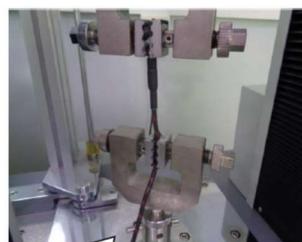
IEC 1639/13



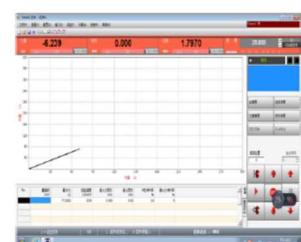
Test samples



Tensile testing machine



Cable retention force is testing



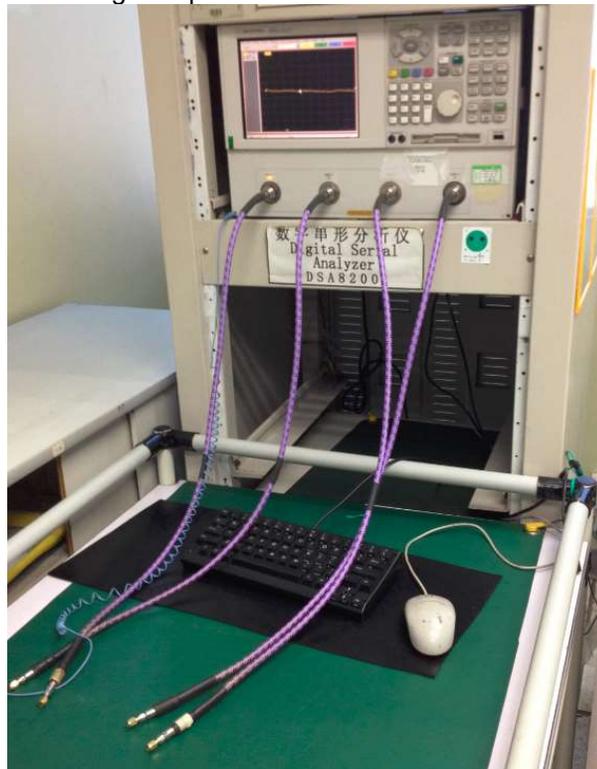
Test Data

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

The return loss and Insertion Loss was performed using an Agilent PNA Network Analyzer. The N & SMA 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 67.0 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 N & SMA 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.



Changed history

| REV | DATE (DD-MM-YY) | CATEGORY | ADDITIONS, DELETIONS, CHANGES |
|-----|--------------------|----------|-------------------------------|
| 1 | 08-July-2020 | All | Preliminary version |
| 2 | 15-July-2020 | All | Used the latest template |
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