
LC-UPC Build Out Attenuators

1. SCOPE

1.1. Content

This specification covers the performance, tests and quality requirements for 10 dB LC-UPC Fiber Optic Build Out Attenuators (BOA).

1.2. Qualification

When tests are performed on the subject product line, procedures specified in Figure 2 shall be used. All inspections shall be performed using the applicable inspection plan(s) and product drawing(s).

1.3. Reliability

When tests are performed on the subject product line, procedures specified in Figure 3 shall be used.

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 requirements of this specification and the product drawing, the product drawing shall take precedence. In the event of conflict between requirements of this specification and referenced documents, this specification shall take precedence.

2.1. Tyco Electronics Documents

- 102-952: Quality Specification
- 501-604: Qualification Test Report

2.2. Commercial Standards

- Telcordia Technologies GR-63-CORE, Issue 1: Network Equipment-Building System (NEBS) Requirements: Physical Protection
- Telcordia Technologies GR-326-CORE, Issue 3: Generic Requirements for Singlemode Optical Connectors and Jumper Assemblies
- Telcordia Technologies GR-910-CORE, Issue 2: Generic Requirements for Fiber Optic Attenuators

3. REQUIREMENTS

3.1. Design and Construction

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

3.2. Optical Power Source

Except where noted, nominal optical power source wavelengths shall be 1310 and 1550 nm for qualification and reliability testing.

3.3. Ratings

Performance	Value	Units
Attenuation, typical (see Note)	10.0	dB
Return Loss, typical (see Note)	55	dB
Polarization Dependent Loss (PDL), typical (see Note)	0.04	dB
Storage Temperature	-40 to 75	°C
Durability	200	Cycles

NOTE Typical values represent the median of the sample data. See Figure 2 for attenuation, return loss and PDL requirement values.

Figure 1

3.4. Performance and Test Description

Product is designed to meet the mechanical, environmental and optical transmittance performance requirements specified in Figure 2. Unless otherwise specified, all tests shall be performed at ambient environmental conditions.

3.5. Test Requirements and Procedures Summary

Test Description	Requirement	Procedure
Initial optical performance.	Attenuation tolerance: \pm (0.10 X attenuation value), measured at 1310 and 1550 nm. Return loss: \geq 55 dB, measured at 1310 and 1550 nm. PDL range: \leq 0.5 dB, measured at 1310 and 1550 nm.	GR-910-CORE, Section 5.2.1. Measure using reference quality leads. For each attenuator, record a single attenuation (insertion loss) measurement at 1310 and 1550 nm wavelengths, and apply the attenuation tolerance criteria. Record a single return loss measurement for each attenuator and calculate the minimum return loss. For PDL, record the maximum loss variation (PDL range) for each attenuator.
Controlled operating environment.	Change in attenuation \leq 0.5 dB, and return loss \geq 55 dB, before and after test. See Note.	GR-910-CORE, Section 5.1.1. Subject specimens to temperatures between -5 and 50°C with RH varying between 5 and 95% as specified by the test profile in Section 5.1.2 of GR-63-CORE. Minimum exposure time 182 hours. Measure attenuation and return loss before and after test. See paragraph 5.

Figure 2 (cont)

Test Description	Requirement	Procedure
Uncontrolled operating environment.	Change in attenuation ≤ 0.5 dB, and return loss ≥ 55 dB, before and after test. See Note.	GR-910-CORE, Section 5.1.2. Subject specimens to 21 cycles (168 hours) between -40 and 75°C and uncontrolled humidity. Measure attenuation and return loss before and after test (after stabilizing at ambient for a minimum of 2 hours). See paragraph 5.
Non-operating environment.	Change in attenuation ≤ 0.5 dB, and return loss ≥ 55 dB, before and after test. See Note.	GR-910-CORE, Section 5.1.3. Measure attenuation and return loss at ambient before and after test. Part 1: Low Temperature Exposure and Thermal Shock per Section 5.1.1.1 of GR-63-CORE. Subject specimens to -40°C for 72 hours, then thermal shock (< 5 minute transition time) back to ambient. Part 2: High-Temperature Exposure and Thermal Shock per Section 5.1.1.2 of GR-63-CORE. Subject specimens to 72 hours at 70°C , then thermal shock back to ambient. Part 3: High Relative Humidity Exposure per Section. 5.1.1.3 of GR-63-CORE. Subject specimens to 40°C with 90 to 95% RH for 96 hours. See paragraph 5.
Humidity/condensation cycling.	Change in attenuation ≤ 0.5 dB, and return loss ≥ 55 dB, before and after test. See Note.	GR-910-CORE, Section 5.1.4. Subject specimens to 14 cycles (168 hours) between -10 and 65°C with RH $\geq 90\%$ at 65 and 23°C . Measure attenuation and return loss before and after test. Final measurements shall be made after stabilizing at ambient conditions for a minimum of 2 hours. See paragraph 5.
Water immersion.	Change in attenuation ≤ 0.5 dB, and return loss ≥ 55 dB, after test. See Note.	GR-910-CORE, Section 5.1.5. Subject mated specimens to water immersion for 168 hours (7 days). Water shall be 5.5 ± 0.5 pH and $43 \pm 2^{\circ}\text{C}$. Measure attenuation and return loss before test and 24 hours after specimens have been removed from the bath.

Figure 2 (cont)

Test Description	Requirement	Procedure
Vibration.	Change in attenuation ≤ 0.5 dB, and return loss ≥ 55 dB, after test. See Note.	GR-910-CORE Section 5.1.6. Subject specimens to 10-55-10 Hz traversed in approximately 4 minutes, with 1.52 mm [.06 in] maximum total excursion. Test for 2 hours in each of 3 mutually perpendicular planes. Measure attenuation and return loss before and after test.
Durability.	Change in attenuation ≤ 0.5 dB, and return loss ≥ 55 dB, after test. See Note.	GR-910-CORE, Section 5.1.11. Mount specimens at 3, 4.5 and 6 feet per GR-326-CORE. Subject specimens to 200 cycles. Record attenuation and return loss at ambient before and after test.
Impact.	Change in attenuation ≤ 0.5 dB, and return loss ≥ 55 dB, after test. See Note.	GR-910-CORE, Section 5.1.12. Subject unmated specimens to 8 drops from a height of 1.8 m [6 ft]. Perform test in 3 mutually perpendicular axes. Measure attenuation and return loss before and after test. Calculate change in attenuation after test.

NOTE *Shall meet visual requirements, show no physical damage, and shall meet the requirements of additional tests as specified in the Product Qualification Test Sequence in Figure 4.*

Figure 2 (end)

3.6. Reliability Test Requirements and Procedures Summary

Test Description	Requirement	Procedure
Mechanical shock (impact).	Change in attenuation ≤ 0.5 dB after test. Return loss ≥ 55 dB before and after test.	GR-910-CORE, Section 7.3.2. Subject unmated specimens to 8 drops from a height of 1.8 m [6 ft]. Perform 5 cycles in each of 3 mutually perpendicular axes. Record attenuation and return loss before and after test.
Variable frequency vibration.	Change in attenuation ≤ 0.5 dB after test. Return loss ≥ 55 dB before and after test.	GR-910-CORE, Section 7.3.2. Subject specimens to 10-2000-10 Hz traversed in 20 minutes; 20 G. Perform 12 sweeps in each of 3 mutually perpendicular planes. Measure attenuation and return loss before and after test.

Figure 3 (cont)

Test Description	Requirement	Procedure
Water immersion.	Change in attenuation ≤ 0.5 dB after test. Return loss ≥ 55 dB after test.	GR-910-CORE, Section 7.3.2. Subject specimens to water immersion for 168 hours (7 days). Water shall be 5.5 ± 0.5 pH and $43 \pm 2^\circ\text{C}$. Measure attenuation and return loss at ambient before and after test.
Thermal shock.	Change in attenuation ≤ 0.5 dB after test. Return loss ≥ 55 dB before and after test.	GR-910-CORE, Section 7.3.2. Subject specimens to 20 cycles between 0 and 100°C . Dwell at each temperature extreme for 30 minutes. Transfer time ≤ 2 minutes. Measure attenuation and return loss at ambient before and after test.
Temperature cycling.	Change in attenuation ≤ 0.5 dB after test. Return loss ≥ 55 dB before and after test.	GR-910-CORE, Section 7.3.2. Subject specimens to 500 cycles between -40 and 75°C . Measure attenuation and return loss at ambient before and after test.
Temperature-humidity cycling (cyclic moisture resistance).	Change in attenuation ≤ 0.5 dB after test. Return loss ≥ 55 dB before and after test.	GR-910-CORE, Section 7.3.2. Subject specimens to 5 cycles between -40 and 75°C with 90% RH at 75°C . Dwell at each temperature extreme for 5 hours. Measure attenuation and return loss at ambient before and after test.
Low temperature storage.	Applicable to each measurement interval: Change in attenuation ≤ 0.5 dB. Return loss ≥ 55 dB.	GR-910-CORE, Section 7.3.2. Subject specimens to 2500 hours at -40°C . Record attenuation and return loss at 0, 168, 500, 1000 and 2500 hours. Specimens may temporarily be removed from the chamber to obtain optical measurements.
High temperature storage (damp heat).	Applicable to each measurement interval: Change in attenuation ≤ 0.5 dB. Return loss ≥ 55 dB.	GR-910-CORE, Section 7.3.2. Subject specimens to 2000 hours at 85°C with 85% RH. Record attenuation and return loss at 0, 100, 168, 500, 1000 and 2000 hours. Specimens may temporarily be removed from the chamber to obtain optical measurements.
High temperature aging (dry heat).	Applicable to each measurement interval: Change in attenuation ≤ 0.5 dB. Return loss ≥ 55 dB.	GR-910-CORE, Section 7.3.2. Subject specimens to 5000 hours at 85°C with RH $< 40\%$. Record attenuation and return loss at 0, 168, 500, 1000, 2000 and 5000 hours. Specimens may temporarily be removed from the chamber to obtain optical measurements.

Figure 3 (end)

3.7. Product Qualification Test Sequence

Test or Examination	Test Group (a)
	1
	Test Sequence (b)
Controlled operating environment	1
Uncontrolled operating environment	2
Non-operating environment	3
Humidity/condensation cycling	4
Water immersion	5
Vibration	6
Durability	7
Impact	8

NOTE

- (a) See paragraph 4.1.A.
- (b) Numbers indicate sequence in which tests are performed.

Figure 4

3.8. Reliability Test Sequence

The following tests may be performed on unique specimens or sourced from another test.

Test or Examination	Sample Quantity
Mechanical shock (impact)	11
Variable frequency vibration	11
Water immersion	11
Thermal shock	11
Temperature cycling	11
Temperature-humidity cycling (cyclic moisture resistance)	11
Low temperature storage	11
High temperature storage (damp heat)	22
High temperature aging (dry heat)	22

Figure 5

4. QUALITY ASSURANCE PROVISIONS

4.1. Qualification Testing

A. Specimen Selection

Specimens shall be selected at random from current production. Each test group shall contain a minimum of 11 specimens.

B. Test Sequence

Qualification inspection shall be verified by testing specimens as specified in Figure 4.

4.2. Reliability Testing

A. Specimen Selection

Specimens shall be selected at random from current production. Each test shall contain the minimum quantity of specimens shown in Figure 5.

B. Test Sequence

Tests shown in Figure 5 may be run individually or sequenced in any order.

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 requirements of Figure 2. Failures attributed to equipment, test setup or operator deficiencies shall not disqualify the product. When product failure occurs, corrective action shall be taken and specimens resubmitted for qualification. Testing to confirm corrective action is required before resubmittal.

4.5. Quality Conformance Inspection

The applicable quality inspection plan will 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. CONTROL CABLES

Control cables shall be subjected to climatic environmental tests. Transmittance shall be recorded each time a specimen transmittance is made. Changes in control cable power of less than 0.05 dB may be neglected in the test specimen power and loss calculations. If control cable power changes by more than 0.05 dB during the duration of the test or sequence of tests, change in control cable power shall be included in power and loss calculations per TIA/EIA-455-20A or IEC 61300-3-3.