Verizon NEBS™ Compliance: Generic Requirements for Indoor Fiber Distribution Hubs (FDH's)

Verizon Technical Purchasing Requirements

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CHANGE CONTROL RECORD:

Version	Date	Action*	Reason for Revision
1	*08/21/2007*	New	New Document
2	*10/3/2007*	Update	Included additional detail for mechanical requirements – specifically product setup and monitoring.
3	*2/27/2008*	Change	Multiple changes throughout the document
4	*4/3/2008*	Update	Included the statement "Random Profile" in section 5.5.4 Environmental Vibration Criteria.
	4/3/2008	Add	Added RL requirement for Craftsperson interaction testing with a max change of 2dB.
5	*8/11/08*	Change	Multiple Changes
* **New, Add, Delete, Change, Reissue**			

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1.0 PURPOSE

The purpose of this Verizon Technical Purchasing Requirement document is to provide FOC testing requirements for Indoor Fiber Distribution Hubs (FDH's).

2.0 SCOPE

FOC Products

3.0 REFERENCES

Verizon FOC Memo #3 Rev #2, June 2006	Various Items related go GR-326, 3120, 771, 3125/21/23 and 3122
Verizon FOC Memo #20	2005
Verizon FOC Memo #20 Punchlist	GR-3123 Indoor FDH Test Punch List
Verizon FOC Memo #20 Punchlist Rev 2	GR-3123 Indoor Fiber Distribution Hubs (FDH) Punch List Test Requirements Rev 2
Verizon FOC Memo # 26	Notes and Information – Various GR's
GR-20-CORE, Issue 2, July 1998	Generic Requirements for Optical Fiber and Optical Fiber Cables
GR-63-CORE, Issue 3, March 2006	NEBS™ Requirements: Physical Protection
GR-209-CORE, Issue 5, February 2006	Generic Requirements for Product Change Notices (PCNs)
GR-326-CORE, Issue 3, September 1999	Generic Requirements for Singlemode Optical Connectors and Jumper Assemblies
GR-454-CORE, Issue 1, December 1997	Generic Requirements for Supplier Provided Documentation
GR-499-CORE, Issue 3, September 2004	Transport Systems Generic Requirements (TSGR): Common Requirements
GR-1081-CORE, Issue 1, January 1995	Generic Requirements for Field Mountable Optical Fiber Connectors
GR-1435-CORE, Issue 1, October 1994	Generic Requirements for Multi-Fiber Optical Connectors
GR-2919-CORE, Issue 1, December 1996	Generic Requirements for Hybrid Optical/Splice Connectors for Single-mode Optical Fibers
GR-3120-CORE, Issue 1,	Generic Requirements for Hardened Fiber Optic Connectors

March 2005	
GR-3123-Core – Issue 1, March 2006	Generic Requirements for Indoor Fiber Distribution Hubs (FDH's)
ASTM B117	Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM D1654	Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D2197	Standard Test Method for Adhesion of Organic Coatings by Scrape Adhesion
ASTM D2244	Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
ASTM D2794	Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D3928	Standard Test Method for Evaluation of Gloss or Sheen Uniformity
ASTM G21	Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

4.0 ACRONYMS

A	After
B	Before
D	During
DUT	Device Under Test
FDH	Fiber Distribution Hubs
FOC	Fiber Optic Components
IL	Insertion loss
ITL	Independent Testing Laboratory
NRTL	Nationally Recognized Testing Laboratory
OM	Optical Monitoring

5.0 TEST REQUIREMENTS FOR INDOOR FIBER DISTRIBUTION HUBS (FDH'S)

Verizon is considering using Indoor Fiber Distribution Hubs (FDH's) for all applications as required. The following are the test requirements for qualifying Indoor Fiber Distribution Hubs (FDH's). All the testing must be completed by a Verizon approved ITL.

FOC Test Plan for Indoor Fiber Distribution Hubs (FDHs) – based on GR-3123			
Task Name	**Sample / Group**	**Optical Monitoring**	**Test Conditions**
2. General Information's			
Operating Environment (Indoor)			Temp -5 to 50C (23F to 122F)
Connectors			**GR-326-CORE**, Generic Requirements for Singlemode Optical Connectors and Jumper Assemblies. **GR-1081-CORE**, Generic Requirements for Field Mountable Optical Fiber Connectors. **GR-1435-CORE**, Generic Requirements for Multi-Fiber Optical Connectors. **GR-2919-CORE** Generic Requirements for Hybrid Optical/Splice Connectors for Single-mode Optical Fibers. **GR-3120-CORE** Generic Requirements for Hardened Fiber Optic Connectors
3. General Requirements			
3.1 Documentation			
3.1.1 Practices			GR-454 "Supplier Documentation"
3.2 Markings, Packaging, and Shipping	1 sample		
3.2.1 Identification			Manufacturers Name, Model Number, Date Code
3.2.2 Shipping Container and Packaging Arrangement			Manufacturers Name, Model Number, Date Code Tests per GR-63 Issue 3 - 4.1.1.1 Low temp exposure and thermal shock - 4.1.1.2 High RH exposure - 4.1.1.3 High Temperature Exposure and Thermal Shock - 5.3.5.1 Packaged drop
3.2.3 Package Label			SR-2759 "Packaging, Packing, Palletization"
3.3 Labels			GR-499 "Common Requirements"
3.4 Consumable Materials			1 Yr shelf live, expiration date, storage temp
3.5 Product Changes			GR-209
3.6 Safety and Reliability Considerations			No burrs, sharp edges, or other hazards
3.7 Installation Size & Weight			48 lines or less, less than 50 lbs.
3.8 Maintenance			All components shall be replaceable without disturbing service

FOC Test Plan for Indoor Fiber Distribution Hubs (FDHs) – based on GR-3123			
Task Name	**Sample / Group**	**Optical Monitoring**	**Test Conditions**
3.9 Components			Fasteners should be captive
3.10 Tools			Use of tools normally used by craft
3.11 Quality			TL 9000
3.12 Security			Shall be self locking
3.13 Listing			Listing per NRTL
4. Functional Design Criteria			
4.1 Materials			
4.1.1 Metallic Materials			Shall be resistant to various forms of corrosion, including general and localized corrosion, as well as galvanic effects associated with dissimilar metals. 30 day Salt Fog - ASTM B-117 and Temp humidity Cycling.
4.1.2 Polymeric and Non-Metallic Materials			Non-corrosive, internal parts UL94V-1, external housing UL94-5V, Fungus ASTM G-21 - zero rating
4.2 Cable Management Compartments			Provide proper access and management
4.2.1 Cable Entrance Capacity			
4.2.2 Cable Compatibility			
4.2.3 Cable Termination Hardware			
4.2.4 Bonding and Grounding Hardware			TR-NWT-1001 "Cable Shield Clamps"
4.3 Service Provider Splice Compartment			Provide proper access and management
4.3.1 Splice Storage Capacity			
4.3.2 Fiber and Splice Protection			
4.4 Connector Bulkhead			
4.4.1 Bulkhead Capacity			
4.4.2 Connector Sleeves			
4.4.3 Connector Requirements			
4.4.4 Pigtail Requirements			
4.5 Fundamental Indoor FDH Requirements			
4.5.1 Deployment Configurations			
4.5.2 Optical Power Monitoring			
4.5.3 Indoor FDH Mounting Hardware			
4.5.4 Door Restrainers			Must be self locking

FOC Test Plan for Indoor Fiber Distribution Hubs (FDHs) – based on GR-3123			
Task Name	**Sample / Group**	**Optical Monitoring**	**Test Conditions**
4.5.5 Drainage for Condensate			Provide for drainage
4.5.6 Insect Resistance			1/8 inch for most bugs
4.5.7 Fire Safety			GR-63 sections 4.2 and 5.2
4.6 Finish			
4.6.1 Color			ASTM D2244
4.6.2 Appearance			ASTM D3928
4.6.3 Paint Adhesion			ASTM D2197
4.6.4 Paint Adhesion after Exposure			ASTM D1654, including exposure to salt fog
4.6.5 Flexibility			ASTM D2794
4.7 Screens and Filters			Inhibit entrance of water and have ability to drain, non-flammable
5. Application Specific Requirements			
5.1 General			
5.2 Electrical Criteria			
5.2.1 Bond Clamp Retention	2/Group C		20 lb pull
5.2.2 AC Fault Test	2/Group C		1000A for 20 seconds.
5.3 Mechanical Criteria			
5.3.1 Cable Clamping	2/Group A	IL - B/D/A	
5.3.2 Sheath Retention	2/Group A	IL - B/D/A	100 lbs Distribution and OSP, 50lbs General Purpose; 1/2 hr; OM, -5C and 50C
5.3.3 Cable Flexing	2/Group A	IL - B/D/A	90 degrees, 8 cycles -5C and 50C
5.3.4 Cable Torsion **	2/Group A	IL - B/D/A	10 cycles -5C and 50C**
5.3.5 Vertical Drop	2/Group A		Follow GR-63 for packaged and unpackaged drop test.
5.3.6 Compression	2/Group A		300 lbs
5.3.7 Impact	2/Group A		50 foot labs (pendulum and drop tube) -5C and 50C (per 3123: Bowling Ball)
5.3.8 Central Member (CM) Protrusion	1/Group A		100 lb force
5.4 Environmental Criteria			
5.4.1 Accelerated Thermal Aging	2/Group B		80C for 14 days, FDH and supplied materials in chamber
5.4.2 Assembly	2/Group B		Must be able to assemble 0C and 40C
5.4.3 Temperature and Humidity	2/Group B	IL - B/D/A	-5C and 95%RH to 50C and uncontrolled Humidity - 72 hours. OM before, during and after (1310, 1490. 1550, 1625)
5.4.4 Weather Tightness	2/Group B		Dust testing per GR-3125
5.4.5 Water Resistance	2/Group B		

FOC Test Plan for Indoor Fiber Distribution Hubs (FDHs) – based on GR-3123			
Task Name	**Sample / Group**	**Optical Monitoring**	**Test Conditions**
5.4.5.1 Water Spray	2/Group B		Per GR-3123
5.4.6 Chemical Resistance	50 test bars per material		30 days, Test all plastic materials (stress cracking, color, texture, color change)
5.4.7 Fungus Resistance	3 test plaques, 2 x 2 inches.		ASTM G21 Rating 0 - Pass, 1 - Verizon Review, 2- Replace Material
5.4.8 Rodent Resistance	5 Bars		Rockwell R87
5.4.9 Lifting Detail	2 Sample		3 x weight - no damage, 6 x weight - no catastrophic failures
5.5 Earthquake, Environmental Vibration, and Transportation Vibration	2 Sample		
5.5.1 Earthquake - Physical Performance Criteria	1 Sample	IL - B/D/A	GR-3123 section 5.5.1.1. before and after (1310, 1490. 1550, 1625). One fiber monitored @1625 nm for IL during the tests; No concatenation.
5.5.2 Earthquake - Functional Performance Criteria	1/Group D	IL - B/D/A	GR-3123 section 5.5.1.2. before and after (1310, 1490. 1550, 1625). One fiber monitored @1625 nm for IL during the tests; No concatenation.
5.5.3 Earthquake - FDH and Anchor Criteria	1/Group D		GR-3123 section 5.5.1.3
5.5.4 Environmental Vibration Criteria	1/Group D	IL - B/D/A	ETSI EN 300 019 2-4 V2.2.2 (2003-4) Mechanical Class 4M5 – Random Profile. Record IL @ 1625nm, 200ms sampling rate
5.5.5 Earthquake Test Method Details	1/Group D		
5.5.6 Transportation Vibration	1/Group D	IL - B/A	GR-3123 section 5.5.1.6 before and after (1310, 1490. 1550, 1625). No concatenation.
5.5.9 Installation Shock			GR63 section 5.3.2
5.6 Airborne Contaminants			
5.6 Airborne Contaminants	2 Sample	IL - B/A	GR-3123 section 5.6.1 and 5.6.2 - OM before and after (1310, 1490. 1550, 1625)
5.7 Craft Interaction			
5.7.1 Front Plane Connector Disconnect and Re-Connect	1 Sample	IL- B/D*/A RL – D*	See GR-449 OM before and after (1310, 1490. 1550, 1625), during 1625. Before and After IL readings with the combined IL increase of < 0.25 dB of adjacent connector ports. During the test, an IL increase of 1.5 dB is allowed and an increase of 2dB in RL is allowed.

FOC Test Plan for Indoor Fiber Distribution Hubs (FDHs) – based on GR-3123			
Task Name	**Sample / Group**	**Optical Monitoring**	**Test Conditions**
5.7.2 Rear-Plane Fiber Optic Terminal (FOT) Jumper Disconnect, Adapter Replacement and Reconnect Test	1 Sample	IL- B/D*/A RL – D*	See GR-449 OM before and after (1310, 1490. 1550, 1625), during 1625. Before and After IL readings with the combined IL increase of < 0.25 dB of adjacent connector ports. During the test, an IL increase of 1.5 dB is allowed and an increase of 2dB in RL is allowed.
GR-449 Fiber Accessibility Handling Test - OM	2 Sample	IL/RL B/D/A	This test looks at the result of accessing fiber on products with multiple splice trays. For example if there is a product that has three splice trays, are the customers on splice tray one effected if the craft has to access splice tray three. 50 cycles of handling with OM - IL 1625 wavelength before, during and after 1 sample at -5C and +40C. Applies only to closures with splice trays. 200 ms sweep rate needed. Concatenation using one fiber.

Optical Measurements

B & A – Before and After — IL Testing @ (1310, 1490, 1550 and 1625nm)

D – During — IL Testing @ 1625nm (200ms sweep rate) Concatenation using one fiber. RL is also to be performed for craftsperson interaction testing only – max change of 2dB.

Configurations –

- The allowable IL deltas of a connection consisting of several series optical components is a function of the DUT and is dependent on the number and types of series optical component in the monitoring path (Environmental Testing, Vibration). For these situations, the insertions loss criteria are defined as equal to the sum of the individual allowable IL deltas of each series device. For example, during temperature cycling, the IL criteria of a monitored path that consists of a series connection of a connector, splitter, and length of cable (assuming IL connector = 0.3 and IL splitter = 0.2dB) shall be IL (0.3 + 0.2 + 0.05 or 0.55) dB for 90% of monitored fibers and (0.3 + 0.2 + 0.15 or 0.65) dB for the remaining 10% of the fibers The allowable change in IL per fiber is dependent on the number and types of series component in the monitoring path. The allowable IL deltas of a connection consisting of a number of series optical components are equal to the sum of the individual allowable IL deltas of each series device.

- Optical Monitoring is required before, during and after many of the environmental and vibration tests. Due to limitations in test system repeatability, the insertion loss criteria has been defined for many of the test as 0.05 dB on each monitored fiber with 10% of the fibers not measuring a change greater than 0.15 dB.

Sample Configurations

2 products per group

Mechanical Testing Requirements: (Section 5.3)

Number of Fibers to Monitor

Use the same number as required for temperature and humidity testing which is 24 fibers monitored up to 144 fiber capacity, 42 fibers monitored up to 432 fiber capacity and 10% of fibers monitored for capacities over 432 fibers. Capacity is the size of the cabinet. If feeder cables do not have the required number of fibers, monitor all fibers available in the feeder cable that are connected to the rear plane of the connector field for factory stubbed units or all feeder fibers that can be spliced in non-factory stubbed units.

Location of Fibers to Monitor

For ribbon cables use the layout shown in Figure 6-2 of GR-771 where fibers are selected in the corners, along the edges and in the center of the stack of fiber ribbons, with 2 fibers located in the center of small cables and 4 in the center of cables with 24 or more fibers to be monitored. For cables with buffer tubes select most of the fibers evenly distributed throughout the buffer tubes located in the outer areas of the cable with 2 fibers located in the center buffer tubes of small cables and 4 in the center buffer tubes of cables with 24 or more fibers to be monitored.

Optical Criteria

Individual fibers are to be monitored at 1310, 1490, 1550 and 1625 nm before, during and after the application of mechanical stress at the required temperatures. The maximum change in insertion loss allowed is 0.05dB/fiber for 90% of the fibers monitored and 0.15dB/fiber for 10% of fibers monitored. If necessary, hold the stress condition as required to collect at least 2 data points for during measurements.

Optional Test Method

Concatenated circuits up to 24 fibers may be monitored but the optical criterion is not increased above that allowed for single fiber circuits. Circuits with 20 to 24 fibers can have no more than 0.15dB total change in insertion loss and circuits with 10 to 19 fibers can have no more than 0.10dB total change in insertion loss. Circuits with less than 10 fibers can have no more than 0.05dB change in insertion loss. RL changes of no more than 2dB are allowed. More than one concatenated circuit will be used to monitor the required number of fibers when that number is greater than 24.

Method of Concatenation

Fusion splices will be used at the end of the cable outside the cabinet to join fibers on that end, including the launch and detect pigtails. For field-installed cables, fusion splices will be used inside the cabinet to complete the concatenated circuit. In order for standard, factory stubbed products to be tested; jumpers will be used on the front plane to complete the circuit.

****Cable Torsion:** Mount the closure used in the cable flex test in a fixture, which restrains the closure and permits rotation of the cable at a distance of 1 m ± 0.03 m (39 in ±0.5 in) from the closure/cable interface. Additionally, ensure the cable is restrained at a distance of 4 meters ± 0.03 m from the point of torsion application. (See GR-771, Section 6.3.4; Figure 6-5 for further information).

Notes:

- Groups are to be tested in sequence, top to bottom.
  Assumes GR-326 Connector, Assumes GR-20 Cable