

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

Verizon Technical Purchasing Requirements

VZ.TPR.9417

Issue 5, March 2017

CHANGE CONTROL RECORD:

Version	Date	Action*	Reason for Revision
1	10/4/2007	New	New Document
2	11/26/2007	Change	Change to Title
3	2/27/2008	Change	Multiple changes throughout the document
4	4/3/2008	Change Add	Changed section 5.5.2 Environmental Vibration to include the phrase "Random Profile" and modified the reference in Section 5.4.14 Fire Resistance from GR-487 to GR-13 for the test method reference. Added RL requirement for Craftsperson interaction testing with a max change of 2dB.
5	2/1/17	Add	Updates based on changes in GR-3125 Issue 2
* New, Add, Delete, Change, Reissue			

Trademark Acknowledgement – NEBS is a trademark of Telcordia Technologies, Inc.

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1.0 PURPOSE

The purpose of this Verizon Technical Purchasing Requirement document is to provide FOC testing requirements for Fiber Distribution Hubs (FDH's). This TRR covers Outdoor, Indoor and Below Grade FDH products.

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 #17 Rev 1, June 27 2005	GR-3125 Punch List Requirements for Outdoor Fiber Distribution Hubs (FDH)
Verizon FOC Memo #17 Rev 1, June 28 2005	GR-3125 Punch List Requirements for Outdoor Fiber Distribution Hubs (FDH)
Verizon FOC Memo #17 Rev 2, July 7 2005	GR-3125 Punch List Requirements for Outdoor Fiber Distribution Hubs (FDH)
Verizon FOC Memo #17 Rev 2, July 7 2005 - Punchlist	GR-3125-CORE Outdoor FDH - Punchlist
Verizon FOC Memo #17 Rev 3, Nov 11 2005 - Punchlist	GR-3125-CORE Outdoor FDH - Punchlist
Verizon FOC Memo # 26	Notes and Information – Various GR's
Verizon FOC Memo # 36, March 26 2005	Executive Summary of 17 GR's
ASTM B117	Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM G154	Standard Practice for Operating Fluorescent Lightning Apparatus for UV exposure of Nonmetallic Materials
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
ISO 17025	General Requirements for the Competence of Testing and Calibration Laboratories
ASTM D6578	Standard Practice for Determination of Graffiti Resistance
UL 50E	Enclosures for Electrical Equipment
ISO 17025	<i>General Requirements for the Competence of Testing and Calibration Laboratories</i>
ETSI EN 300 019 1-4 V2.1.2 (2003-4)	Environmental Engineering: Environmental Conditions and Environmental Tests for Telecommunications Equipment

GR-20-CORE, Issue 4, July 2013	Generic Requirements for Optical Fiber and Optical Fiber Cables
GR-63-CORE, Issue 4, April 2012	NEBS™ Requirements: Physical Protection
GR-209-CORE, Issue 6, December 2011	Generic Requirements for Product Change Notices (PCNs)
GR-326-CORE, Issue 4, February 2010	Generic Requirements for Singlemode Optical Connectors and Jumper Assemblies
GR-409-CORE, Issue 2, November 2008	Generic Requirements for Premises Fiber Optic Cable
GR-449-CORE, Issue 3, March 2013	Generic Requirements and Design Considerations for Fiber Distribution Frames
GR-454-CORE, Issue 1, December 1997	Generic Requirements for Supplier Provided Documentation
GR-487-CORE, Issue 5, Issue 5, March 2016 Updated May 2016	Generic Requirements for Electronic Equipment Cabinets
GR-769-CORE, Issue 1, October 1994	Generic Requirements for Organizer Assemblies
GR-771-CORE, Issue 2, July 2008	Generic Requirements for Fiber Optic Splice Closures
GR-1081-CORE, Issue 2, October 2010	Generic Requirements for Field Mountable Optical Fiber Connectors
GR-1209-CORE, Issue 4, September 2010	Generic Requirements for Passive Optical Components
GR-1221-CORE, Issue 3, September 2010	Generic Reliability Assurance Requirements for Passive Optical Components
GR-2866-CORE, Issue 2, October 2007	Generic Requirements for Optical Fiber Ribbon Fanouts
GR-2919-CORE, Issue 1, December 1996	Generic Requirements for Hybrid Optical/Splice Connectors for Single-mode Optical Fibers
GR-3125-CORE, Issue 1, March 2006	Generic Requirements for Outdoor Fiber Distribution Hubs (FDH's)
GR-3125-CORE, Issue 2, December 2016	Generic Requirements for Fiber Distribution Hubs (FDH's)

4.0 ACRONYMS

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

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

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

FOC Test Plan for Outdoor Fiber Distribution Hubs (FDHs) – based on GR-3125 Issue 2			
Name	Samples	Optical Monitoring	Comments
Optical Monitoring			OM - 24 fibers or 10% of the fibers, which ever is greater, No Concatenation unless other wise noted.
2. General Information			
2.1 Product Description			Provides general product description and use
2.2 Deployment Environments			Provides general description of OSP environment (-40C to +65C) 95% RH
2.3 Installation & Operating Environment			Installation (-18C to +40C), Operating (-30C to +40C)
2.3.1 Connector-Harsh Environment			Refers to GR-326, GR-1081, GR-1435, and GR-2919
2.4 Related Telcordia Documents			Includes other documents that might be helpful, GR-771, GR-950, GR-487 and GR-449
2.5 Test Environmental Criteria			Proper Safety Precautions Must be Followed. Equipment used shall be calibrated to ISO 17025. When a weight or force is specified that is the minimal that should be plied during testing. Damage is considered to be any change in form, fit, or function as a result of an applied stress. Materials in the FDH shall present no known dermal, environmental, or other safety hazard
2.6 Safety Precautions			Proper safety precautions shall be followed for all tests conducted. Tests shall be conducted only by properly trained personnel following local codes, laws, and practices.
2.7 Measurements			Where numeric measurements are obtained in testing and are required to determine conformance, the values shall be rounded up or down based on standard rounding techniques
2.8 Laboratory Conditions			Normal conditions for the test laboratory are 23°C ± 3°C (73°F ± 6°F) and 30-60% RH. Ambient temperatures, humidity, and air pressure for performing tests shall be as specified in the test method of the criteria, or in the referenced GR or referenced standard. If no temperature, humidity, or air pressure is provided, these parameters are not considered critical in the performance of the test.

FOC Test Plan for Outdoor Fiber Distribution Hubs (FDHs) – based on GR-3125 Issue 2			
Name	Samples	Optical Monitoring	Comments
2.9 Sample Preparation			All samples, systems, FDHs, and components, shall be representative of production. It is acknowledged that complete (full) FDHs may not be appropriate or desired for all tests, but all test samples and their configuration shall be fully documented.
2.10 Calibration			Calibration and use of equipment shall be in accordance with ISO 17025, <i>General Requirements for the Competence of Testing and Calibration Laboratories</i> .
2.11 Standard Conflicts			If the customer requirement includes Nationally Recognized Testing Laboratory (NRTL) safety approvals, the NRTL approval shall take precedence if there is any conflict with this GR-3125 document.
2.12 Force and Weight Tolerances			Throughout this document, applied forces, voltages, currents, and weights are described. The weight or force specified shall be the minimum force applied during testing.
2.13 Damage Definition			Be any change in form, fit, or function as a result of an applied stress. As a result of applied stress, there shall be no change to the product's or component's form, fit, function, or optical performance, unless otherwise stated in a specific requirement or criteria.
2.14 Re-Testing			Where multiple FDHs are tested, all samples shall meet the performance criteria. In the event of a nonconformance, the following options are available as defined in GR3125 Issue 2
2.14.1 Re-Testing Matrix			If there are test results that do not meet the criteria for a specific test, it is suggested that additional testing on new samples be conducted to help characterize product performance.
2.15 Product Integrity			During the testing in this document, the product integrity shall be maintained, and there shall be no deviations that will degrade the product with respect to safety, reliability, interchangeability, life, performance, operation, quality, protectants, and maintenance.
2.16 Safety and Reliability Standards and Regulations			Products shall be manufactured in accordance with the following requirements or standards: defined in GR3125
2.17 Safety of Materials			Materials in the FDH shall present no known dermal, environmental, or other safety hazard as defined by current industry standards or applicable federal or state laws and regulations.
3. General Requirements			

FOC Test Plan for Outdoor Fiber Distribution Hubs (FDHs) – based on GR-3125 Issue 2			
Name	Samples	Optical Monitoring	Comments
3.1 Documentation			
3.1.1 Practices			See GR-454
3.2 Marking, Packaging and Shipping	1 sample		
3.2.1 Identification			
3.2.1.1 General			Manufacturer. Name, Model, Date code, Network providers name and logo
3.2.1.2 Listing			Listed per NEC (National Electrical Code) NFPA70
3.2.2 Shipping Container			See GR-63.
3.2.3 Package Label			Same as 3.2. Also see GR-3125
3.3 Labels			See GR-499 section 12.1.3.1.C
3.4 Consumable Materials			See GR-3125
3.5 Product Change			See PCN GR-209
3.6 Safety and Reliability			No sharp objects or burrs or other hazards.
3.7 Installation Size and Weight			Can be assembled by a single trained person. If less than 48 fibers, less than 50 lbs.
3.8 Maintenance			Per GR-3125
3.9 Components			All fasteners shall be captive
3.10 Tools			No special tools shall be required
3.11 Quality			(TL9000)
3.12 Security			Per GR-3125
3.13 FDH Component Devices			Components must meet TPR's for 326, 2866, 1209, 1221, 20 and 409
3.14 Connector Performance in Harsh Environments			All connectors used with FDHs must conform to the appropriate generic requirements criteria noted in GR-3125-CORE
4. Functional Design Criteria			
4.1 Materials			

FOC Test Plan for Outdoor Fiber Distribution Hubs (FDHs) – based on GR-3125 Issue 2

Name	Samples	Optical Monitoring	Comments
4.1.1 Metallic Materials			List of materials used available upon request, Threaded hardware shall be zinc-Plated per ASTM A 153, Should be corrosion resistant. No external coatings or wraps required for corrosion protection.
4.1.2 Polymeric and Other Non-Metallic Materials			List of materials used available upon request, Materials shall be free of stress cracks, stripping, molting and texture color change after exposure to solvents. Materials shall be non-corrosive to metals. 94 V-1 Rated unless exterior housing, then 94-5VA
4.2 Cable Management			Access compartment must be secure. Cable entrance from two ports. Cables shall meet GR-20, 409. An FDH that is not full should accept other cables. Includes a Caution Marking if needed. Includes requirements for bonding and grounding
4.2.1 Cable Entrance Capacity			Min of 2 cable entrance ports (service provider and customer sides). One cable entrance port on top, bottom and each side.
4.2.2 Cable Compatibility			Capable of accepting any standard cable
4.2.3 Cable Termination Hardware			Per GR-3125
4.2.4 Bonding and Grounding Hardware		Includes testing in Section 5.2	Bonding and Grounding provision shall be addressed.
4.3 Service Provider Compartment			Splice organizer per GR-769, accept different splicing methods of single and ribbon fiber. Includes splice and bend radius protection 1.5 inches protection. Lower levels may be allowed when using bend optimized fiber.
4.3.1 Splice Storage Capacity			Provide enough capacity for max fiber supported, Max capacity label shall be easily found on FDH
4.3.2 Fiber and Splice Protection			Per GR-3125

FOC Test Plan for Outdoor Fiber Distribution Hubs (FDHs) – based on GR-3125 Issue 2

Name	Samples	Optical Monitoring	Comments
4.4 Connector Bulkhead			Minimum capacity 6 connections between service provider and customer. (O) For accepting modular packs of 6 or 12 connections. Connectors must meet GR-326, 1081, 1435, 2919, pigtails shall meet GR-409
4.5 Fundamental FDH Requirements			
4.5.1 Deployment Configurations		Per GR-3125	<ul style="list-style-type: none"> ▪ An aerial FDH shall accommodate pole, strand, or outdoor wall mount configurations. ▪ Pole-mounted FDHs equipped with cable stubs shall provide mechanical strain relief to the cable stub to permit shipping, handling, and hoisting of the box without causing damage to the box or stub. ▪ Stub pole or wall-mounted FDHs shall be capable of resisting the turning moment resulting from a uniform wind load as defined in Section 5.4.8. ▪ A safety strap attachment point shall be provided on pole-mounted, aerial FDHs. This safety strap attachment point shall withstand the specified test load of Section 5.4.18 without permanent deformation of any cabinet components. ▪ A ground-level FDH shall accommodate pedestal, pad, or outdoor wall mount configurations.
4.5.3 FDH Mounting Hardware			<ul style="list-style-type: none"> • Mounting shall be secure for frame and all interior components. Mount FDH as intended, fully loaded, 600lbs on top of FDH, 1 hour, no damage. Must permit attachment to a handhole. Vapor barrier grommets provided, floor attachment to withstand 1000lbs pull
4.5.4 Door Restrainers			<ul style="list-style-type: none"> ▪ FDH doors shall be equipped with a device that restrains the door(s) in the open position to facilitate craft/customer access. (FDHs may incorporate multiple open positions.) ▪ The door-restraining device shall be self-activating when the doors are opened and shall be released manually to close the doors. Door restrainers shall be designed to minimize audible “rattling” when in the engaged position. ▪ These door restraints shall be capable of resisting the opening

FOC Test Plan for Outdoor Fiber Distribution Hubs (FDHs) – based on GR-3125 Issue 2			
Name	Samples	Optical Monitoring	Comments
			and closing forces resulting from wind gust without mechanical damage or loss of function.
4.5.5 Drainage and Condensate			<ul style="list-style-type: none"> ▪ FDHs shall provide a means for the drainage of condensate. Consideration shall be given in the design of the FDH to manage the flow of condensate away from the splice organizer assembly, connectors, and other optical components that may be present. ▪ The manufacturer shall provide instructions and procedures to prevent the formation of condensation on installed telecommunications equipment prior to turn-up and when the equipment is in operation. These procedures shall be documented in the FDH installation and maintenance practices.
4.5.6 Insect Resistance			Not allow entrance of insects or vermin, be replaceable,
4.5.7 Fire resistance			FDHs designed for use in the outside plant environment shall maintain internal temperatures that preclude ignition of equipment inside the box (cable, organizer splices, and optical components) when subjected to a simulated brush fire test. See the Fire Resistance Test in Section 5.4.16 .
4.6 Finish		2 - 8" x 8" samples	Includes color requirements, paint adhesion, flexibility, gloss, and UV. See GR-3125.
4.7 Graffiti-Resistant Paint			Shall meet the finish requirements of section 4.6 Finish and tested in accordance with ASTM D6578, <i>Standard Practice for Determination of Graffiti Resistance</i> ,
4.8 Screens and Filters			Shall be non-corrosive and meet section 4.5.6 Insect Resistance
4.9 Operational Movement			The below grade FDH, and all its mechanisms, shall withstand, without damage, 500 operations below grade from the fully stored and maintenance positions
5. Application-Specific Requirements			

FOC Test Plan for Outdoor Fiber Distribution Hubs (FDHs) – based on GR-3125 Issue 2

Name	Samples	Optical Monitoring	Comments																		
			<p align="center">Table 5-2 Installation Test Temperatures</p> <table border="1"> <thead> <tr> <th colspan="2">Outdoor/Below Grade</th> <th colspan="2">Indoor</th> </tr> <tr> <th>Cold</th> <th>Hot</th> <th>Cold</th> <th>Hot</th> </tr> </thead> <tbody> <tr> <td>-18°C ± 2°C (-0.4°F ± 3.6°F)</td> <td>40°C ± 2°C (104°F ± 3.6°F)</td> <td>-5°C ± 2°C (23°F ± 3.6°F)</td> <td>50°C ± 2°C (122°F ± 3.6°F)</td> </tr> </tbody> </table>	Outdoor/Below Grade		Indoor		Cold	Hot	Cold	Hot	-18°C ± 2°C (-0.4°F ± 3.6°F)	40°C ± 2°C (104°F ± 3.6°F)	-5°C ± 2°C (23°F ± 3.6°F)	50°C ± 2°C (122°F ± 3.6°F)						
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5.1 General			Includes general information on Outdoor FDH use. See GR3125 Table 5-1 Performance Test Sequence																		
5.2 Electrical	2 Samples		Includes bond clamp retention. AC fault Test 1KA ac 20 sec																		
5.3 Mechanical Criteria			(See Mechanical Criteria Notes following table)																		
5.3.1 Soak Times			If laboratories do not wish to determine the appropriate soak time, a 4-hour minimum thermal soak time must be used																		
5.3.2 Cable Clamping	2 / Group A	IL - B/A	-Install fiber optic cables per the manufacturer's instructions. Very loosely secure the cables to permit pigtail splicing. Sheath retention clamps and environmental seals shall not be used at this time.																		
5.3.3 Sheath Retention	2 / Group A	IL - B/D/A	100 lbs Distribution and OSP, 50lbs General Purpose; 1/2 hr; OM,																		
5.3.4 Cable Flexing	2 / Group A	IL - B/D/A	90 degree flexing for 8 cycles OM,																		
5.3.5 Cable Torsion**	2 / Group A	IL - B/A	10 cycles of torsion loading OM, **																		
5.3.6 Impact	2 / Group A		100 ft-lbs pad mounted, 50 pole or wall mount (Top & Side) – Pendulum and Drop Tube (per GR-3125: Bowling Ball) 10-ft-lbs for small FDH less than 8 cubic feet in size using 1.1lb 2-inch steel ball.																		
5.3.7 Central Member Protrusion	1 / Group A		100-lb pull @ 23C +/-5 RH 30-70%																		
5.4 Environmental Criteria																					
5.4.1 Accelerated Thermal Aging	2 / Group B		Seals and gaskets 30 days, 80C																		

FOC Test Plan for Outdoor Fiber Distribution Hubs (FDHs) – based on GR-3125 Issue 2

Name	Samples	Optical Monitoring	Comments
5.4.2 Assembly	2 / Group B		(OC +30C)
5.4.3 Temperature/Humidity	2 / Group B	IL - B/D/A	30 days total OM - B, D, A all wavelengths;
5.4.4 Weather Tightness	2 / Group B		Dust testing per GR-3125
5.4.5 Water Resistance	2 / Group B		<ul style="list-style-type: none"> • Ground level FDH (flood resistant): 3 ft water head for 1 days, and maximum total accumulation of water in the FDH shall not exceed 1 cm³ (1 gram of water) per 0.028 m³ (1 ft³) of FDH volume. • Ground level FDH (rain resistant), Pole Mount or Aerial: Subject to WDR per GR-3125.or below grade water immersion.
5.4.6 Wind Resistance Vertical Doors	2 Samples		See GR-3125
5.4.7 Wind Resistance Horizontal Doors	2 Samples		See GR-3125
5.4.8 Wind Resistance	2 Samples		See GR-3125
5.4.9 Compression	2 Samples		300 lbs at 5 locations tested independently. Below grade 300 lbs for one hour. Not required for wall- or pole-mounted products that have a roof surface of less than 0.14 square meter
5.4.10 External Icing	2 Samples		UL 50E, Section 8.5, "External Icing Test."
5.4.11 Corrosion Resistance	2 Samples		ASTM B117 Salt fog 30
5.4.12 Chemical Resistance	5 test bars per material		See GR-3125 for chemicals, 3 point test fixture 24 hours @ ambient. End products tested for 30 days
5.4.13 UV	5 test bars per material		ASTM G-154 2,160 hours or ASTM G-155 for 1,000 hours.
5.4.14 Fungus	3 test plaques, 2 x 2 inches.		Fungus rating of zero or one from ASTM G-21
5.4.15 Firearms Resistance	1 Sample		12 gauge shotgun blast from 50 feet. See GR-3125

FOC Test Plan for Outdoor Fiber Distribution Hubs (FDHs) – based on GR-3125 Issue 2			
Name	Samples	Optical Monitoring	Comments
5.4.16 Fire Resistance	1 Sample	IL B/A	Brush Fire - Visual Inspection and OM Before & After IL Readings (all wavelengths) on 24 fibers, see GR-3125 for test method. Optical Performance Criteria: 0.05-dB change in IL per fiber for 90% of the fibers monitored and up to 0.15-dB channel (Test product as configured for Verizon – Splitters included)
5.4.17 Rodent Resistance	5 test bars per material		Rockwell hardness R-87
5.4.18 Pole Mounted, Aerial FDH	2 Samples		See GR-43125, 300-lb safety strap drop test
5.4.19 Lifting Details	2 Samples		See GR-3125
5.5 Earthquake, Environmental Vibration, and Transportation Vibration			Optical Performance Criteria: 0.05-dB change in IL per fiber for 90% of the fibers monitored and up to 0.15-dB change in IL for 10% of the fibers monitored.
5.5.1 Transportation Shock - Packaged Equipment Shock Criteria	1 Sample	IL B/A	A packaged FDH, with contents as normally packaged for shipment, shall withstand without damage the Handling Drop tests outlined in GR-3125.
5.5.2 Transportation Shock (Rail)	1 Sample	IL B/A	If shipped by rail, packaged equipment weighing more than 91 kg (200 lbs) and intended for shipment by rail shall withstand the impact loads resulting from railroad car coupling. The supplier shall indicate if the FDH will be shipped by rail.
5.5.3 Transportation Vibration – Packaged Environmental Criteria	1 Sample	IL B/A	Packaged equipment shall withstand the loads applied by simulated transportation vibration, per ETSI EN 300 019-2-2, T2.3 Public Transportation, Random Vibration test, with a 30-minute test per axis. This exposure shall not result in any functional degradation of the equipment or physical damage
5.5.4 Packaged Environment Exposure	1 Sample	IL B/A	To determine compliance, see the following requirements in GR-63, <ul style="list-style-type: none"> Section 4.1.1, Transportation and Storage Environmental Criteria: Section 4.1.1.1, Low-Temperature Exposure and Thermal Shock, R4-3 [69]

FOC Test Plan for Outdoor Fiber Distribution Hubs (FDHs) – based on GR-3125 Issue 2

Name	Samples	Optical Monitoring	Comments
			<ul style="list-style-type: none"> Section 4.1.1.2, High-Relative-Humidity Exposure, R4-4 [71] Section 4.1.1.3, High-Temperature Exposure and Thermal Shock, R4-5 [70].
5.5.5 Installation Shock - Vertical Drop-Unpackaged Equipment Shock Criteria	1 Sample		The unpackaged equipment shall not sustain any physical damage or deteriorate in functional performance when subjected to the applicable shock levels of GR-3125 Table 5-15 .
5.5.6 Environmental Vibration	1 Sample	IL - B/D*/A	Follow test procedure outlined in ETSI EN 300 019-2-4 V2.4.1, Table 5, Vibration, Random, and corresponding to a 0.04 m2/s3 ASD test severity, shall be followed. See 5.5.7 Earthquake for mounting
5.5.7 Earthquake	1 Sample	IL - B/D*/A	Visual inspection and OM @ four wavelengths see GR-63 zone 4, A Minimum of 24 fibers monitored for IL before and after; one fiber monitored @ 1625 nm for IL during the tests (No concatenation). <i>Pad Mount</i> - Mount directly to table, <i>Pole Mount</i> The test pole shall be fabricated from a Schedule-80 steel pipe of Nominal Pipe Size 8. (NPS-8) <i>2 feet off table to the base of FDH. Wall mount attach to simulated wall.</i>
5.6 Craft Interaction			Follow GR-3125 for a concatenated network..
5.6.1 Front Plane Connector Disconnect and Reconnect	1 Sample	IL- B/D*/A RL – D*	See GR-3125 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.
5.6.2 Rear Plane FOT Jumper Disconnect, Adaptor replacement	1 Sample	IL- B/D*/A RL – D*	See GR-3125OM 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 Outdoor Fiber Distribution Hubs (FDHs) – based on GR-3125 Issue 2

Name	Samples	Optical Monitoring	Comments
Verizon Special Test: GR449 Fiber Accessibility: Handling Test - OM	2 Sample	IL - 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.
6. Component Qualification			
6.1 Components			Connectors GR-326, Fanouts GR-2866, Splitters (GR-1209, 1221), Cable (GR-20, 409)

Optical Measurements

B & A – Before and After	IL Testing @ (1310, 1490, 1550 and 1625nm)
D – During	IL Testing @ (1310, 1490, 1550 and 1625nm)
D* - During (1 wavelength)	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

Fiber Monitoring Testing Requirements

Number of Fibers to Monitor

Monitor a minimum of 24 fibers up to 144 fiber capacity, 42 fibers up to 432 fiber capacity, and 10% of fibers monitored for capacities greater than 432 fibers. See GR3125 Table 5-6 for calculations. 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 5-3 of GR-3125 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 $1\text{ m} \pm 0.03\text{ m}$ (39 in ± 0.5 in) from the closure/cable interface. Additionally, ensure the cable is restrained at a distance of 4 meters $\pm 0.03\text{ m}$ from the point of torsion application.

Notes:

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