Verizon NEBS™ Compliance: Optical Cable Microducts and Accessories

Verizon Technical Purchasing Requirements

VZ.TPR.9442

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CHANGE CONTROL RECORD:

Version	Date	Action*	Reason for Revision
1	*08/21/2007*	New	New Document
2	*05/10/10*	Change	Multiple changes - Updated and/or changed technical criteria
3	*09/06/11*	change	Added Test Slug to Ovality test.
		Added	Define coupler seal methods
		Change	Referenced GR-3155 as appropriate
* **New, Add, Delete, Change, Reissue**			

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PREPARED AND ISSUED BY:

Name, Title, Organization	Date
David Z. Chen DMTS, NEBS, Fiber and Energy Efficiency Corporate Network & Technology Systems Integration and Testing 1201 East Arapaho Richardson, Texas 75081 Phone: 972-728-2573 Email: david.chen@verizon.com	09/06/11

APPROVED BY:

Name, Title, Organization	Date
Howard Davis Manager, NEBS, Fiber and Energy Efficiency Verizon Corporate Network and Technology Systems Integration and Testing 320 St. Paul Place, Floor 14 Baltimore, MD 21202 Phone: 410-736-5906; Fax: 410-736-5144 **Email: howard.davis@verizon.com**	09/06/11

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1.0 PURPOSE

The purpose of this Verizon Technical Purchasing Requirement document is to provide FOC testing requirements for Optical Cable Microducts and Accessories.

2.0 SCOPE

FOC Products

3.0 REFERENCES

Verizon ITL Memo #42	Microduct for Fiber Optic Cables Testing Requirements, August 16, 2006
GR-49-CORE; Issue 2, November 1998	Generic Requirements for Outdoor Telephone Network Interface Devices
	GR 63 can be removed as it is not reference in this TPR
GR-209-CORE; Issue 5, February 2006	Generic Requirements for Product Change Notices (PCN)
GR-356-CORE; Issue 2,	Generic Requirements for Optical Cable Innerduct, Associated Conduit, and Accessories
GR-3108-CORE; Issue, 2 December 2008	Generic Requirements for Network Equipment in the Outside Plant (OSP)
GR-3155-CORE, Issue 1, November 2007	Generic Requirements for Optical Cable Microducts and Accessories
SR-NWT-2759; Issue 3, January 1995	A View of Packaging, Palletizing and Marking Requirements
	Generic Requirements for Modular Connecting Blocks Comment – this is an older document that is no longer in the current database so for the chemical testing section referenced from this TR is covered under GR-3155) - removed the reference in the spreadsheet so this reference is no longer needed
UL 2024; rev 4	Optical Fiber and Communication Cable Raceway
ASQ TL 9000	TL 9000 Quality System Requirements
ASTM G-21; Rev 96	Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
ASTM G 154; Rev 6	Standard Practice for Operating Fluorescent Lighting Apparatus for

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	UV Exposure of Non-Metallic Materials
ASTM G 155; Rev 05A	Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials
ASTM B-117; Rev 07	Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM D-638; Rev 03	Standard Test Method for Tensile Properties of Plastics
NFPA 70	National Electrical Code

4.0 ACRONYMS

A	After
B	Before
D	During
FOC	Fiber Optic Components
IL	Insertion Loss
ITL	Independent Testing Laboratory
NEC	National Electrical Code
NRTL	Nationally Recognized Test Lab

5.0 TEST REQUIREMENTS FOR OPTICAL CABLE MICRODUCTS AND ACCESSORIES

Verizon is considering using Optical Cable Microducts and Accessories for all applications as required. The following are the test requirements for qualifying Optical Cable Microducts and Accessories. All the testing must be completed by a Verizon approved ITL.

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FOC Test Plan For GR-3155 Optical Cable Microducts and Accessories			
Task Name	**# Of Samples**	**Optical Monitoring**	**Test Conditions**
Introduction			
1.1 Purpose and Scope		B/D/A IL	Verizon view of microduct requirements for optical cable microducts for indoor and outdoor use. This specifications covers microducts, microduct splice connectors and end-cap assemblies. The Punchlist covers both airblown, pulled and direct placement fiber
1.2 Target Audience			Users, purchasers, manufacturers and suppliers of optical cable microducts
1.3 Reason for Issuing GR-3155 Punchlist			Provide adequate information to properly test the product
1.4 Structure and Use of This Document			This GR Punchlist includes sections as noted below
1.5 Requirements Terminology			(R) - Requirement, (CR) - Conditional Requirement, (O) - Objective
1.6 Requirement Labeling Conventions			Discusses numbering system for the GR
1.7 Test, Sample and Retest	3 samples per group unless noted		All samples used for testing must be thermally aged first. One extra system will be used to simulate real life environments (age and run temperature & humidity cycle) with optical measurements.
General Information			
2.1 General Description			See product literature - includes requirements for product installations.
2.2 Operating Environment			Indoor controlled -5C (23F) to 50C (122F) to 85%RH, GR3108 section 1.3.2, Outdoor -40C (-40F) to 75C (167F) 5 to 95%RH, section 1.3.3 GR-3108.
General Requirements			
3.1 Product Samples			Production Samples labeled with name, model number and date code.
3.2 Product Changes			Must follow PCN guidelines per GR-209-CORE
3.3 Safety and Reliability			No sharp objects or burrs from the production line samples.
3.4 Listing			Must meet 2011 NEC applicable and local codes. NRTL Listed covering Riser and Plenum applications. (See UL2024) Listing markings shall be R - every 5 ft, O - every 2 ft.
3.5 Materials			5% plastic regrind max for all microduct components and accessories.

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Task Name	**# Of Samples**	**Optical Monitoring**	**Test Conditions**
3.6 Craft Interaction			Ability to install fiber without special tools for pull string applications; need blower or other tool for air blown application; Air blown fiber and equipment must be capable of being interoperable. For pull string application use: Corning 3mm riser, AFL 200 ft, 6 bends, radius of bends in accordance with NEC criteria for 1.25" EMT conduit.
3.7 Instructions and Labeling			Instructions shall be provided for installation and use. Marking shall include manufacturers name, model number, and length of duct on reel and date code. Should include NRTL Listing. Instructions shall include all disclaimers required by the service provide.
3.8 Package Label			GR2759 for packaging labels. Suppliers name, product part number, material ID number (SSI, Item ID no.), product length and date code shall be on the outside box or reel. Lettering minimum 1/4 inch. Should include NRTL Listing.
3.9 Toxic Materials			There shall be no toxic materials as defined by OSHA
3.10 Tools			No special equipment or tools needed for installation of microducts. Exception - air blown installation would require special air blowers, which are not part of the crafts normal tool set.
3.11 Dimensions			GR-3155 Section 3.11
3.12 Ability to Cut			Ability to cut using standard tools
3.13 Quality			(TL9000); A recertification is needed every 3 years.
3.14 Documentation			GR-3155 Section 3.14 on *Documentation* - Proper documentation shall be provided for installation and operation. Provide specific instructions for indoor and outdoor usage.

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FOC Test Plan For GR-3155 Optical Cable Microducts and Accessories			
Task Name	**# Of Samples**	**Optical Monitoring**	**Test Conditions**
3.15 Packaging, Shipping, Marking			GR-3155 Section 3.15 Proper packaging shipping and marking requirements to reduce the risk of damage during shipping and to help assure that proper marking is provided on the product and its shipping container.
3.16 Product Compatibility			Innerducts shall be compatible with tools, equipment, and procedures used by the service provider.
Mechanical Requirements: All test samples for this section must be aged at 75°C ± 1°C (167°F ± 2°F) for 30 days prior to the application of the individual tests. (Per GR-3155 section 4 requirements.) For all test procedures described in this document the ambient lab conditions shall be 23°C ± 2°C and 20% ≤ RL ≤ 70%.			
4.1 Operational	3 Test samples		The connector and end cap must withstand 10 operations of assembly and disassembly. Following this conditioning the sealing arrangements shall operate at blowing pressure of (150 psi)
4.2 Ovality	3 Test samples		See GR-356 4.2.4 Max ovality 5% when tested at 50C for 15 days Ovality is verified on the delivered samples by performing the conduit "diameter slug" test on the test sample that have been aged at 75C for 30 days. The length of the test sample = 4xπ x 20 x OD, where OD is the outside diameter of the micro-conduit. The microduct is bent 180 degrees around a mandrel (20 x OD of Microduct) and aged at 50C for 15 days. The cable test (slug or ball) is blown through the conduit when bent 180° around a mandrel. The air pressure = blowing pressure of the manufacturer's cable/fiber blowing system. The dimensions of the test (slug or ball) are show in the diagram below.
4.3 Coefficient of Friction	3 Test samples		See GR-356 4.2.5 Without lubricants 0.35, with lubricants 0.20.

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FOC Test Plan For GR-3155 Optical Cable Microducts and Accessories			
Task Name	**# Of Samples**	**Optical Monitoring**	**Test Conditions**
4.4 Tensile and Pull Strength	3 Test samples		The min. pull strength/tensile strength should be as follows when tested with a rate of extension of 25mm/min. 7mm Microduct - 55lbs (245 Newtons) For all other size samples record the lowest tensile load for which the first of any one of the 3 events defined below occurs Pull Strength Definitions – For any of the samples tested, the lowest tensile load at which one of the following occurs: 1. Separation of the duct, complete separation or tears or holes or splits, etc 2. Duct elongation exceeding 10% of the gauge length for non-corrugated duct, or 25% for corrugated designs 3. A permanent reduction in the outside diameter of the duct of more than 5% For those products that are and assembly of “microducts inside of a duct” the method of attachment to the measuring device and the application of the pass fail criteria may be product specific. In such cases the method of attachment and pass/fail criteria shall be determined by Verizon.
4.5 Elongation	3 Test samples		Non-Corrugated - ≤ 2.5% of the gauge length with an applied tensile load of -. 44 lbs for a 7 mm OD microduct. Corrugated - ≤ 5% of the gauge length with an applied tensile load of 40lbs Pull Rate: Products with OD >12.7mm – 12.7mm/min Products with OD ≤ 12.7mm/min – 25.4mm/min

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FOC Test Plan For GR-3155 Optical Cable Microducts and Accessories			
Task Name	**# Of Samples**	**Optical Monitoring**	**Test Conditions**
4.6 Compression	3 Test samples		Apply 150 lbs between two (100mmx100mm) metal plates, at 50C no visual or physical evidence of wall cracking, crazing, delamination, or rupture. No more than 15% deformation immediately after the load is removed. For those microduct products that are "microduct within an overall duct, the weight shall be applied to the total assembly, however, physical damage shall apply to both the inner and outer ducts, but the % deformation shall apply only to the inner ducts.)
4.7 Impact	3 Test samples		Test at -5°C (indoor), -40°C Outdoor, place on 0.5" steel plate Impact: products with OD >12.7mm - 50 ft-lbs products with OD ≤12.7mm - 4ft-lbs
4.8 Bending	3 Test samples		Bend over 180-degree mandrel for 1 hour. Tested at -5C (indoor), -18C Outdoor. The 5% ovality shall be met as well as the micro duct shall be able to be straighten without damage. Kink Resistance No kinking when bent to 15 times OD.
4.9 Pressure Burst Strength	3 Test samples		The product shall withstand. (150 PSI for 5 minutes without loss of pressure (for blown fiber only). Post test - ≤ 5% Ovality when measured using the dimensional definitions of (4.2)
4.10 Field Blowing	3 Test samples	B/A IL	Fiber cable shall be able to be blown following the manufactures instructions over all anticipated installation without damaging the fiber cable. The cable manufacturer shall provide these pressures. Measure the attenuation coefficient at 1625 nm before and after fiber installation. Change ≤ 0.20 dB/km. The test course is the one specified in Section 4.10 of GR-3155
Environmental Requirements			

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FOC Test Plan For GR-3155 Optical Cable Microducts and Accessories			
Task Name	**# Of Samples**	**Optical Monitoring**	**Test Conditions**
5.1 Assembly- Craft Interaction	3 Test samples	B/A IL	Product shall be able to be assembled following manufacturers instructions, with all parts shall be provided in kit. Test with different fiber sizes and manufactures of fiber cable and different blower equipment. Change in attenuation coefficient ≤ 0.20 dB/km.
5.2 Dimensions	3 Test samples		Measure dimensions (OD, ID, Thickness, Length) of all samples. Then subject to aging, 75C for 30 days. Measure dimensions after. Change in (OD, ID, Thickness) ≤ 5%, Change in Length ≤ 2%
5.3 Aging - Mold Stress	3 Test samples		75C for 30 days
5.4 Temperature/Humidity Cycle	3 Test samples	B/D/A IL	Indoor: 60 -12 hours cycles (30 day test) -5C (23F) to 50C (122F);, Outdoor: GR-49 60 -12 hours cycles (30 day test) -40C (-40F) to 75C (167F). Mount as shown in the configurations. Pull the fiber and measure at 1625nm continuous. Temp Humidity D/A the average change in atten coeff ≤ 0.3 dB/km. Max change in atten coeff ≤ 0.6 dB/km.
5.5 Chemical Resistance	3 Test Bars/Group		Test per GR3155 Section 5.5: **Indoor** WD-40, Wasp Spray, 10% Igepal, Oil and latex Based House Paint, 3.5% NaOH, **Outdoor:** GR 3120 3% H_2SO_4, 0.2N NaOH, NH_3, 90% Alcohol, Kerosene, 10% Igepal. Shall not craze or crack and must retain 75% of original strength. Chemical Immersion: 30 days at 22°C +/- 2°C Stress Cracking: 7 days at 22°C +/- 2°C
5.6 Fungus	3 Test samples		All ducts and accessories shall meet the zero rating per ASTM G21.
5.7 UV (outdoor only)	3 Test Bars/Group		See GR-3155 Section 5.7 - Per ASTM G 154 1,500 hours, or ASTM G 155 1,000 hours. Shall note craze or crack and must retain 75% of original tensile and elongation strength. Tensile Test before and after exposure. Tensile per ASTM D 638 Type 25mm/min.
5.8 Flammability	3 Test samples		Shall be UL94V-0 for Riser Rated Microducts and UL94V-0 for Plenum Rated Microducts

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FOC Test Plan For GR-3155 Optical Cable Microducts and Accessories			
Task Name	**# Of Samples**	**Optical Monitoring**	**Test Conditions**
5.9 Dielectric Withstand	3 Test samples		No dielectric breakdown with 1500V AC for one minute break down current is defined as current > 20ma.
5.10 Hardness	3 Test samples		For Indoor and Outdoor applications, Rockwell hardness of R87.
Microduct Accessory Requirements			
6.1 Couplers[1]	3 Test samples		GR-3155 Section 6.1 (Supplier shall indicate whether couplers are reusable or not as well as providing adequate labeling instructions.) Per 6.1 of GR-3155 R6-2 of GR-3155 R6-3 of GR-3155 CR6-4 of GR-3155 R6-5 of GR-3155 except that pressure (150 psi rating shall be used, Couplers can be tested when burst test is completed in Section 4.9 of this TPR document. R6-5 of GR-3155 R5-8 per GR356 R5-10 per GR-356: Coupler maximum OD shall be ≤ 1.414 times the duct OD.
6.2 End Caps	3 Test samples		Meet GR-3155 Section 6.2 GR-356 - 5-3 End caps shall be connected to the duct and withstand 10-foot waterhead for 7 days. Applicable for blown fiber applications only. R6-10 of GR-3155 R6-7 of GR-3155

[1] Please note that couplers may be slipped on, screwed on, use rubber seals or heat shrink type materials to provide holding strength. Any of these methods is acceptable as long as the coupler and conduit meet the requirements of this TPR.

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FOC Test Plan For GR-3155 Optical Cable Microducts and Accessories			
Task Name	**# Of Samples**	**Optical Monitoring**	**Test Conditions**
6.3 Pull Line/String Requirements	3 Test samples		Comment – the pull line requirements of GR-3155 are more appropriate for smaller microducts and pull lines than those in GR-356 designed for larger cables and pull lines. GR-3155 – 6.3 (Supplier to provide specific information for verification) GR-3155 – 6.3 (Supplier to provide specific information for verification) Meet GR-3155 - R6-13 → Pull Line Duct Cutting Meet GR-3155 - R6-14 and R6-15 → Pull Line Tensile Strength Meet GR-3155 - R6-17 → Pull Line Stretch Meet GR-3155 - R6-18 → Pull Line Length Meet GR-3155 - R6-16 → Pull Line Splice – not allowed
6.4 Mounting Hardware	3 Test samples		Any Metallic mounting hardware shall be ASTM B-117 compliant (salt fog 7 days) as per R6-19 of GR-3155

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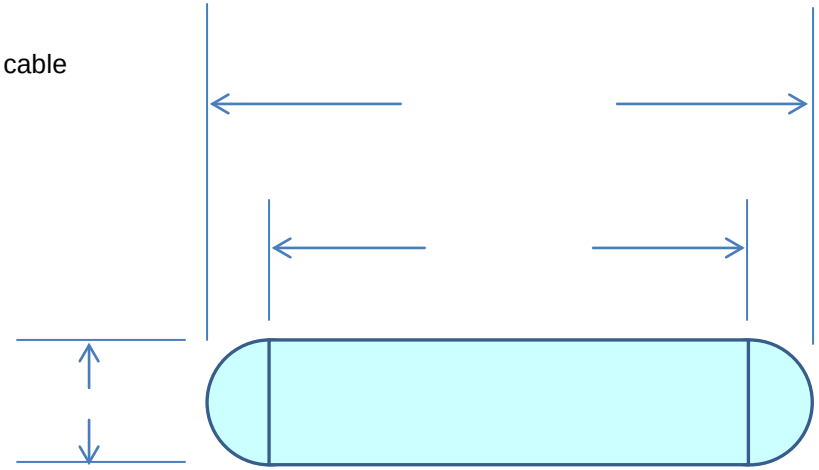
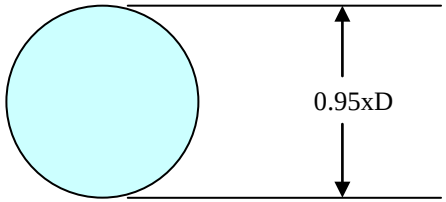
Notes: Test without and with pre-installed cable



OR

Test Ball, stainless steel, diameter =
0.95X nominal inside diameter (D) of micro-duct.



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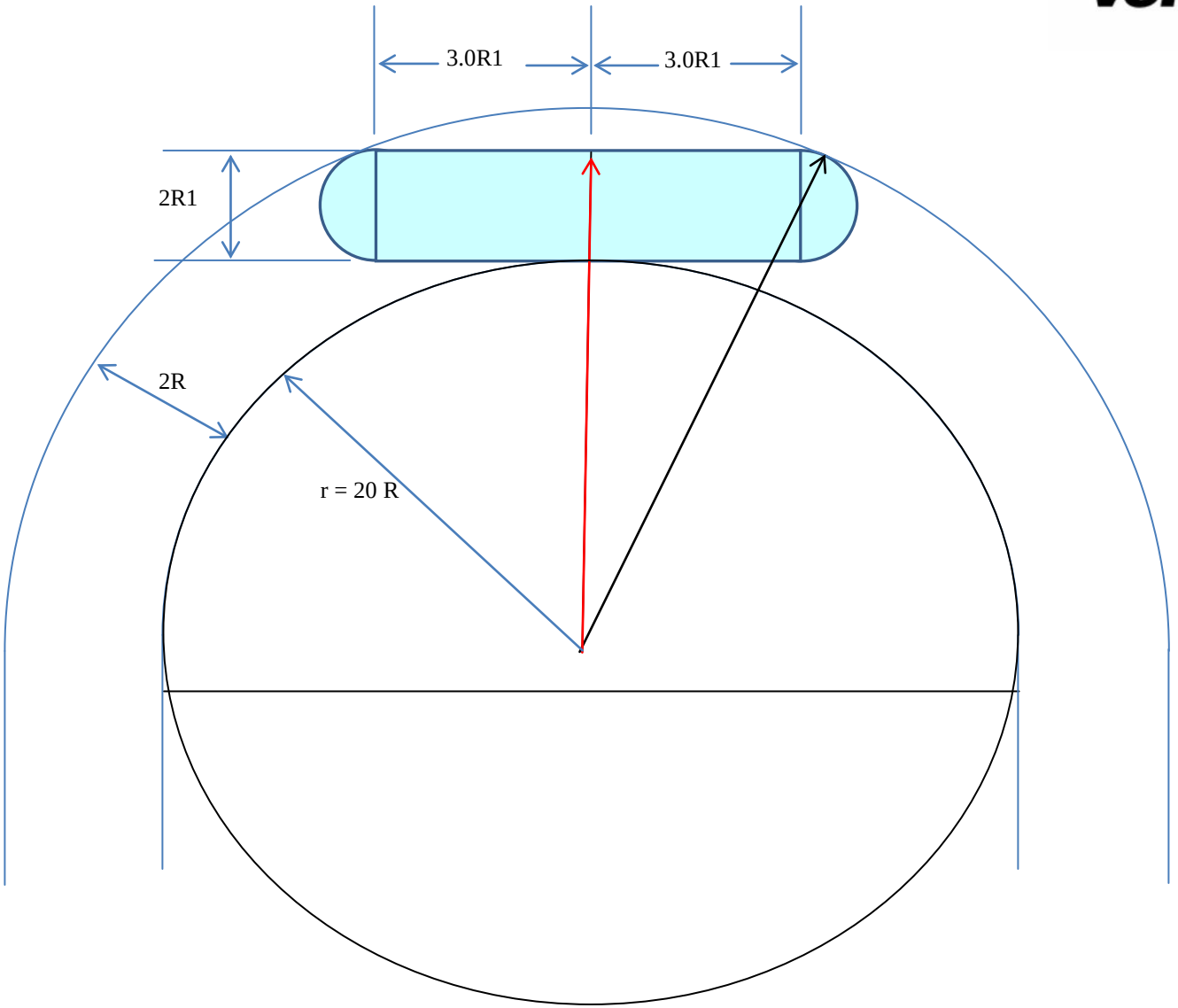

Test Setup for Micro-conduit “Slug” test.

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