



**Verizon NEBS™ Compliance: Factory  
Installed Termination System (FITS)  
Verizon Technical Purchasing Requirements  
VZ.TPR.9419  
Issue 6, June 2010**





**CHANGE CONTROL RECORD:**

Version	Date	Action*	Reason for Revision
1	10/3/2007	New	New Document.
2	11/26/2007	Change	Change made to Section 4.2 Cable Flexing
3	03/06/2008	Change	Corrected Test Conditions for Section 4.1 Corrected Test Conditions for Section 4.8 Corrected Sample Size for Section 5 Corrected description for Sample G Corrected Optical Monitoring for Section 5.9
4	8/12/2008	Change	2.7 Sample Configuration- change sample G 4 Mechanical Requirements- add clarification 5 Environmental Requirements- add clarification 6 Electrical Requirements- change from 4 overmolds to 1 overmold 7 Conditional Requirements- change from 4 overmolds to 1 overmold
5	3/18/2009	Change	4.6 Sheave wheel- Specify 5ms tension sampling rate, avg tens > 600, min tens not < 95% of 600 5.3 T/H cycling- Allow sample G express fiber concatenation and only 1 monitored express fiber per tube for 144 fiber count cable or greater Optical Measurements section- Add attenuation coefficient requirements 5.7 UV Resistance- Add allowance for UVA-340 Cycle 1 per ASTM G154 or Xenon Cycle 1 per ASTM G155
6	06/01/2010	Change	Clarified Pass Fail Criteria.
* New, Add, Delete, Change, Reissue			

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## 1.0 PURPOSE

The purpose of this Verizon Technical Purchasing Requirement (VZTPR) document is to provide additional and/or overriding FOC testing requirements to those specified in GR-3122: Generic Requirements for Factory Installed Termination System (FITS).

## 2.0 SCOPE

Factory Installed Termination Systems (FITS)

## 3.0 REFERENCES

<b>GR-3122-CORE, Issue 1, October 2006</b>	Generic Requirements for Factory Installed Termination System (FITS)
<b>GR-771-CORE, Issue 1, July 1994</b>	Generic Requirements for Fiber Optic Splice Closures
<b>GR-63-CORE, Issue 3, March 2006</b>	NEBS Requirements: Physical Protection
<b>GR-20-CORE, Issue 2, July 1998</b>	Generic Requirements for Optical Fiber and Optical Fiber Cable
<b>GR-209-CORE Issue 4, October 2002</b>	Generic Requirements for Product Change Notices
<b>GR-449-CORE Issue 2, July 2003</b>	Generic Requirements and Design Considerations for Fiber Distributing Frames
<b>FOC Memo # 3 GR-771 2005</b>	Applicable to GR-771 Test Conditions
<b>FOC Memo # 3 Rev.1 2005</b>	Applicable to Fiber Monitoring
<b>FOC Memo # 3 Rev.2 2005</b>	Applicable to optical test and criteria clarification
<b>FOC Memo # 19, 2005</b>	Applicable to Pre GR-3122 Release Information
<b>FOC Memo # 19a, 2005</b>	Applicable to Punch List
<b>FOC Memo #1 9, Rev. 1 2006</b>	Applicable to Punch List
<b>FOC Memo #1 9, Rev. 3 2006</b>	Applicable to Punch List

## 4.0 ACRONYMS

<b>DUT</b>	Device Under Test
<b>FITS</b>	Factory Install Termination Systems
<b>FOC</b>	Fiber Optic Components
<b>IL</b>	Insertion Loss
<b>ITL</b>	Independent Test Laboratory
<b>VATS</b>	Verizon Advanced Termination System



## **5.0 TEST REQUIREMENTS FOR FACTORY INSTALLED TERMINATION SYSTEMS (FITS)**

Verizon purchases Factory Installed Termination System (FITS) Products aka VATS (Verizon Advanced Termination System) as an alternative to using splice closures and drops in specific applications. Factory Installed Termination System (FITS) shall meet the requirements specified in the following tables, which are based on to the requirements specified in Telcordia document GR-3122 Generic Requirements for Factory Installed Termination System (FITS). All the testing must be completed by a Verizon approved ITL.



**FOC Test Plan for Factory Installed Termination Systems (FITS) – based on GR-3122**

Name	Samples / Group	Optical Monitoring	Comments
<b>2. General Information</b>			
2.1 Product Description			Provides general product description and use
2.2 Installation and Operating Environment			Provides general description of Installation Environment which is (-10C to +40C) worse case environment (-40C to +65C) 95% RH
2.3 FITS Component Devices			All components used in FITS must meet individual specs: Connectors: GR-326; Hardened Fiber Optic Connectors: GR-3120; Hardened Multifiber Connectors: GR-3152; Stub Terminal Closures: GR-771 and Cable: GR-20
2.4 Optical Requirements			(See Optical Monitoring Requirements listed after this table)
2.5 Test Configuration			(See Test Configurations listed after this table)
2.6 Test Sequence			Follow sample groups and size as outlined in this test plan
2.7 Sample Configuration			<p>Sample A - Overmold configured and cable length as required</p> <p>Sample B - Overmold configured and cable length as required</p> <p>Sample C - Overmold configured and cable length as required, with overmold having enough cable on each side to mount on the test fixture</p> <p>Sample D - One system consisting of a minimum of 400 ft. total length, with approximately 50 ft. of raw cable on each end, and four overmolds spaced (distributed) equally along the cable</p> <p>Sample E - Overmold configured and cable length as required.</p> <p>Sample F - Overmold with enough cable to connect to test fixture</p> <p>Sample G – Test 4 systems; 1 System = Four overmolds equal to 400 ft. total length, with approximately 50 ft. of raw cable on each end, and four overmolds spaced (distributed) equally along the cable. (Test 2 minimum and 2 maximum size cables, also include HMFOC on tethers with terminals connected to HMFOC)</p>



FOC Test Plan for Factory Installed Termination Systems (FITS) – based on GR-3122			
Name	Samples / Group	Optical Monitoring	Comments
			<p>Sample H - Reeled samples on a spool as shipped and packaged. One systems consisting of 400 ft. total length, with approximately 50 ft. of raw cable on each end, and four overmolds spaced (distributed) equally along the cable. Include connectors as shipped.</p> <p>Sample I - Overmold with one foot capped stubs on each end            Sample J - Overmold with one foot capped stubs on each end            Sample K - Overmold with one foot capped stubs on each end            Sample L - Overmold with one foot capped stubs on each end            Sample M - Overmold with one foot capped stubs on each end            Sample N - Overmold with one foot capped stubs on each end            Sample O - Overmold with one foot capped stubs on each end</p>
2.8 Test Environmental Criteria			
2.8.1 Ambient Laboratory Conditions			Temperature: 23° ± 2°C Humidity 75% RH
2.8.2 Environmental Test			Temperature: -40°C to 85°C ± 2°C, Humidity 95% ± 2% RH
2.8.3 Thermal Soak Time			Soak time - Minimum 2 hours
2.9 Safety Precautions			Proper safety precautions to be followed
<b>3. General Requirements</b>			
3.1 Documentation			
3.1.1 Practices			See GR-771
3.2 Marking, Packaging and Shipping			
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-771





FOC Test Plan for Factory Installed Termination Systems (FITS) – based on GR-3122			
Name	Samples / Group	Optical Monitoring	Comments
3.2.3 Package Label			Packaged parts clearly labeled with part number and names per instructions; FITS clearly identified (man name, model or part number, and date code) to include proper documentation. Permanent label located on FITS
3.2.4 Installation Markings			<ul style="list-style-type: none"> <li>FITS to identify which side is central office</li> <li>Cable shall be marked with orange plastic bands to line the FITS cable up with the poles or other positioning locators.</li> <li>FITS shall be provided with engineering drawings to assist in the installation.</li> </ul>
3.2.5 Cable Reel Shipping Requirements			<p>Data sheets included, must be legible and packaged in waterproof wrapping. Minimum data to include:</p> <ul style="list-style-type: none"> <li>Customer order number or factory order number</li> <li>Unique Cable Identifier</li> <li>Length of Cable</li> <li>Type of Cable</li> <li>Beginning and ending length markings</li> <li>Weight of cable and reel</li> <li>Attenuation coefficient specified by customer</li> <li>Specific Instructions, if applicable</li> </ul>
3.2.6 Cable Reel			Cable Reels designed to prevent damage, Arbor Holes min - 68mm max-101mm w/metal bushings or reinforced with a bearing plate. Reel marked to indicate direction.
3.3 Labels			See GR-449 section 12.1.3.1.C
3.4 Consumable Materials			See GR-771, Items packaged with FITS assembly must be clearly marked on sides per SR-NWT-2759.
3.5 Product Changes			See PCN GR-209
3.6 Safety and Reliability			No sharp objects or burrs or other hazards. Must meet MEC and OSHA requirements, FITS materials shall present no dermal, environmental or other safety hazard.
3.7 Tools			No special tools shall be required



**FOC Test Plan for Factory Installed Termination Systems (FITS) – based on GR-3122**

Name	Samples / Group	Optical Monitoring	Comments
3.8 Quality			(TL9000)
<b>4 Mechanical Requirements</b>			
4.1 Sheath Retention Reference: GR-771 Issue 1, 5.3.2	Group A 4 Overmolds	IL B/A	Test (4 Overmold samples at each temperature) @ -10C, 40C. Drop 100 lbs, Tethers 100lbs. Cables pulled on both ends during the test. (OVM) (OM – IL 4 B/A). Condition for 2 hours and test for half hour. Test both tether and drop cable. Notes: Distribution cable covered by Sheave Wheel Test; -10 C is lower temp limit due to hydraulics of trucks
4.2 Cable Flexing Reference: GR-771 Issue 1, 5.3.3	Group A 4 Overmolds	IL B/A	Test (4 Overmold samples at each temperature) @ -30C, 40C. Test fixture shall have a bend radius limiter based on 20X diameter of the cable. For flat cable use the cross section as the cable diameter. 22 lbs weight, overmold shall extend 4 inches or half its total length from the end of the test fixture whichever is less. (OVM) Condition for 2 hours and test for 5 mins for each rotation. Test/rotate in all directions every 90 degrees (360 degrees total). Test both distribution and drop cable. For drop cable with distribution cables held in place. Note: -30 C is lower limit for Cables.
4.3 Cable Torsion Reference: GR-771 Issue 1, 5.3.4	Group A 4 Overmolds	IL B/A	Test (4 Overmold samples at each temperature) temp. -30C, 40C. Overmold shall extend 4 inches from the end of the test fixture or half its total length from the end of the test fixture whichever is less. (OVM) Condition for 2 hours and then 1 meter from OVM twist +90, -180 back to 0 degrees. Hold at each point for one minute. Test both distribution and drop cable. Note: -30 C is lower limit for Cables.
4.4 Compression Reference: GR-771 Issue 1, 5.3.6	Group B 4 Overmolds	IL B/A	Test (4 Overmold samples at each temperature) @ -40C, 40C. 300 lbs. Only review deformation after the test, no more than 20% deformation allowed after compression. The plates shall be large enough to cover the entire product, if using smaller plates, repeat test to cover the whole product. (OVM)
4.5 Impact Reference: GR-771 Issue 1, 5.3.7	Group C 4 Overmolds	IL B/A	Test (4 Overmold samples at each temperature) @ -40C, 40C. Impact 4 locations, front, back, and sides. Include pendulum (50ft-lbs aerial) latched to a strength member messenger wire between 6 ft poles for aerial. All others 10 ft-lbs drop tube. For aerial testing the impactor shall be a 2-inch round steel bar long enough to impact the complete overmold surface. (OVM).



**FOC Test Plan for Factory Installed Termination Systems (FITS) – based on GR-3122**

Name	Samples / Group	Optical Monitoring	Comments
4.6 Sheave Wheel	Group D 1 System	IL B/A	Test fixture shall have a bend radius limiter based on FOTP-33 B section 3.2.3. Speed of 7.33 ft/sec based on a truck pulling at 5mph. Test @ -10C, 40C. The overmold shall pass over the sheave wheel 10 times (5 in each direction). (OVM-CN) 600 lbs force distribution cable. Notes: -10 C is lower temp limit due to hydraulics of trucks; Must test single and dual tether (if available), can split 50/50% on system used for Sample D. Requires 5ms tension sampling rate, avg tension > 600 lbf, & min tension ≥ 95% of 600 lbf
4.7 Water Resistance Reference: GR-771 Issue 1, 5.4.6	Groups A,B,C,D		Immersion (Buried) 10 ft water head 7 days, WDR (Aerial). Immersion covers both. Use UV dye to look for water in immersion. WDR samples will need to be opened and reviewed. (OVM)
4.8 Pull	Group E 4 Overmolds	IL B/A	Test (4 Overmold samples at each temperature) @ -10C, 40C. Place the overmold in a smooth fixture that is the negative of the side of the overmold being tested to evenly distribute the weight on the overmold and allows the cable to pass through and hang a 400 lbs (Objective 600 lbs) weight on the end of the cable that is exiting the overmold. (OVM) Condition for 2 hours and test for half hour. Test only the end or ends (can be both directions if intended for bi-directional pulling) that passes forward during installation. Notes: -10 C is lower temp limit due to hydraulics of trucks; Weights are applied to distribution cables only; test simulates obstruction during placing
4.9 Cable Bend Memory Low Temperature	Group F 4 Overmolds		Precondition the samples over a hub that is the smallest diameter spool used for shipping with 5 feet of cable on each end and with a 22 lb weight on each distribution cable @ -10C for two hours. The overmold shall be removed from the hub and shall be hung vertically with 15 lb weight for 1 minute at -10C. The overmold shall straighten itself out, and shall not deform. A tube that is 4 inches inside diameter that is equal to or greater than the length of the overmold shall be used as a gauge. The overmold shall pass through the gauge. Notes: -10 C is lower temp limit due to hydraulics of trucks Objective conduct at -30C. (OVM)
<b>5 Environmental Requirements</b>			



**FOC Test Plan for Factory Installed Termination Systems (FITS) – based on GR-3122**

Name	Samples / Group	Optical Monitoring	Comments
5.1 Accelerated Thermal Aging Reference: GR-771 Issue 1, 5.4.1	Group G 4 System		85C – 7 days. Mark cable at overmold looking for movement. (OVM-CN) (Test 2 minimum and 2 maximum size cables, also include HMFOC on single and dual tethers with terminals connected to HMFOC - terminals are placed outside of chamber)
5.2 Assembly/Installation			FITS must be rated for install temperatures of (-10C to +40C)
5.3 Temperature and Humidity Cycling Reference: GR-771 Issue 1, 5.4.3	Group G 4 System	IL B/D/A	Test @ (-40C, 65C) 30 days. Mark cable at overmold area where cable exits the overmold looking for movement. (OVM-CN). (Test 2 minimum and 2 maximum size cables, also include HMFOC on single and dual tethers with terminals connected to HMFOC terminals are placed outside of chamber) For 144 fiber count cables and greater, monitor 1 fiber per tube in expressed buffer tubes. Concatenation of fibers is allowed as required
5.4 Freeze/Thaw Reference: GR-771 Issue 1, 5.4.4  5.4.1 Aerial 5.4.2 Direct Buried	Group G 4 Overmolds	IL B/D/A	(Test 2 minimum and 2 maximum size cables, also include HMFOC on single and dual tethers with terminals connected to HMFOC - terminals are placed outside of container for Direct Buried) <ul style="list-style-type: none"><li>• Aerial NEMA 250 external icing. (OVM-CN)</li><li>• Buried TR251 for test cycles sand freeze thaw in a container to hold system with one foot of sand/water on each side. Use 10 cycles. Objective) If used in a duct then the place the overmold in a 2 inch duct filled with water buried in 12 inches of sand and use the TR251 cycles with 10 cycles -40C to 70C 10 hours dwells at temp. Extremes and 4 hours between extremes. (OVM-CN)</li></ul>
5.5 Water Resistance Reference: GR-771 Issue 1, 5.4.6 5.5 -a Water Immersion  5.5-b Wind Driven Rain	Group G 4 Overmolds		<ul style="list-style-type: none"><li>• Immersion 10 ft water head (Buried). Immersion covers both. Use UV dye to look for water. (OVM)</li><li>• WDR (Aerial) (OVM)</li></ul>
5.6 Chemical Resistance			



**FOC Test Plan for Factory Installed Termination Systems (FITS) – based on GR-3122**

Name	Samples / Group	Optical Monitoring	Comments
5.6.1 Stress Cracking Reference: GR-771 Issue 1, 5.4.8.A  5.6.2 Chemical Immersion Reference: GR-771 Issue 1, 5.4.8.B	5 Test bars per material per exposure  Group F 1 Overmold per chemical		<ul style="list-style-type: none"> <li>• Dog bone samples. 6 chemicals 24 hours, each sample group only exposed to one chemical.</li> <li>• Separate sample per chemical. Kerosene immerse expose for 1 day and then remove and sit at room temp for 7 days. (OVM)</li> </ul>
5.7 Ultraviolet Resistance Reference: GR-771 Issue 1, 5.4.9	5 Test bars per material per exposure		Test bar exposure: 2,000 hours per ASTM G154: UVA-340 Cycle 1 or UVB-313 Cycle 3; or 1,000 hours per ASTM G155: Xenon. Shall not craze or crack and must retain 80% of original strength. Tensile testing required prior to exposure on 1 group of samples (per material) and after exposure on all samples.
5.8 Fungus Resistance Reference: GR-771 Issue 1, 5.4.10	5 Test bars per material per exposure		Test bars. ASTM G21
5.9 Transportation Shock Reference: GR-63 Issue 3, 5.3.1	Group H 1 System	IL B/A (before reeling product)	Test conducted on complete reeled samples (Fully configured system). (OVM-CN-ST)
5.10 Transportation Vibration Reference: GR-63 Issue 3, 5.4.3	Group H 1 System	IL B/A (on reel) & A unreeled	Test conducted on complete reeled samples (Fully configured system). (OVM-CN-ST)
5.11 Environmental Vibration Reference: GR-63 Issue 3, 5.4.2	Group H 1 System	IL B/D*/A	ETSI EN 300 019 1-4 V2.1.2 (2003-4) "Environmental Engineering: Environmental Conditions and Environmental Test for Telecommunications Equipment" Low Level Vibration Resistance. D* (during) @ 1626nm; monitor 5 readings per sec. Mount samples directly to vibration fixture (OVM-CN-ST)
<b>6 Electrical Requirements</b>			
6.1 Bond Clamp Retention Reference: GR-771 Issue 1, 5.2.1	Group I 1 Overmold		Do not apply to Dielectric cables. (OVM)



<b>FOC Test Plan for Factory Installed Termination Systems (FITS) – based on GR-3122</b>			
<b>Name</b>	<b>Samples / Group</b>	<b>Optical Monitoring</b>	<b>Comments</b>
6.2 Corrosion Resistance Reference: GR-771 Issue 1, 5.4.7.A	Group I 1 Overmold		Performed in Section 7.4
6.3 AC Fault Test Reference: GR-771 Issue 1, 5.2.2	Group I 1 Overmold		Do not apply to Dielectric cables. (OVM)
<b>7 Conditional Requirements</b>			
7.1 Bulletproof Resistance Reference: GR-771 Issue 1, 5.5.1	Group J 1 Overmold		(OVM)
7.2 Cable Core Blocking Ability Reference: GR-771 Issue 1, 5.5.2	Group K 1 Overmold		(OVM)
7.3 Rodent Resistance Reference: GR-771 Issue 1, 5.5.3	Group L 1 Overmold		(OVM) Rockwell Hardness R87
7.4 Corrosion Resistance Reference: GR-771 Issue 1, 5.4.7.A	Group M 1 Overmold		If all polymer, test acidified salt water with chemical resistance for 7 day. If exposed metal 30 day Acidified Saltwater (Buried), 30 day Salt fog (Aerial) (OVM)
7.5 Steam Resistance Reference: GR-771 Issue 1, 5.4.4	Group N 1 Overmold		(OVM)
7.5 Fire Resistance	Group O 1 Overmold		Indoor only. Covered by NRTL Listing



Note – some tests are done in sequence  
Assumes GR326 Connector  
Assumes GR20 Cable  
Assumes GR771 Splice Closure  
Assumes GR3120 Hardened Fiber Optic Connector  
Assumes GR3152 Hardened Multi-Fiber Optic Connector  
Assumes GR2866 Fan Out

### **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

**The optical in testing insertion loss (IL) criteria change for all four wavelengths (1310, 1490, 1550, 1625nm) is equal to:**

1. The pass-fail criterion for each test in this TPR applies to each individual product tested. Each size or make-up of a FITS product is different. Therefore, the cable/overmold construction could harbor product specific issues that could go undetected if the pass/fail criterion were based on the performance of sample combinations, e.g., "the total number of fibers from a number of different samples".
2. If two identical samples are tested then each must pass the criterion. If the size of the cables is such that there are less than 10 “express/through” fibers tested, then the fiber count from two or more identical FITS samples can be combined to provide a minimum of 10 fibers. If there are not enough samples for at least 10 express fibers of each type/size of FITS product, then all express fibers must pass the 0.05 dB criterion.
3. Since the optical path through the tethers traverses different numbers/types of components than the optical path through the “express” fibers, the pass/fail criterion for each is treated separately.



4. The 10%-90% fiber count rule does not apply to tethers. The minimum IL pass-fail criterion for a tether is 0.15 dB (assuming at least one splice and one connector and the test is a mechanical test). A single fiber failure of a tether is a failure regardless of the number of fibers tested.
5. For “Express” fibers, any fiber exceeding the 0.15 dB threshold is a failure.
6. For through fibers, any combination of fibers exceeding the 0.05 dB threshold and the 10% fiber count is a failure. See the following example: Assume that the total through fiber count is 20, e.g., 10% of 20 = 2 fibers.
  - a. Two or less fibers exceed the 0.05 dB threshold but none exceed the 0.15 dB threshold– Compliant
  - b. Three fibers exceed the 0.05 dB threshold none exceed the 0.15 db threshold – One non-compliant
  - c. One fiber exceeds the 0.15dB threshold and two other fibers exceed the 0.05 dB threshold – Two non-compliant
  - d. Two fibers exceed the 0.15 dB threshold and one other fiber exceeds the 0.05 dB threshold – Three non-compliant
  - e. Three fibers exceed the 0.15 dB threshold and no other fiber exceeds the 0.05 dB threshold – Three non-complaint. (No double jeopardy for the 0.05 dB threshold for those already exceeding 0.15 dB threshold)
  - f. Three fibers exceed the 0.15 dB threshold and one other fiber exceeds the 0.05 dB threshold – Four non-compliant

**7. Mechanical Tests Optical Criteria for tethers:**

*The optical in testing insertion loss (IL) criteria change for all four wavelengths (1310, 1490, 1550, 1625nm) is equal to:*

- **Mechanical:**  $\pm[(\text{The number of fusion splices} \times 0.05 \text{ dB}) + (\text{the number of connector interfaces} \times 0.10 \text{ dB})]$ .

**8. Mechanical Tests Optical Criteria for “express” fibers:**

*The optical in testing insertion loss (IL) criteria change for all four wavelengths (1310, 1490, 1550, 1625nm) is equal to:*

- **Mechanical:**  $\pm(0.05 \text{ dB } 90\% \text{ of fibers})$   
 $\pm(0.15 \text{ dB for } 10\% \text{ of fibers})$

**9. Temperature/Humidity and Freeze Thaw (only) Optical Criteria for tethers:**

*The optical in testing insertion loss (IL) criteria change for all four wavelengths (1310, 1490, 1550, 1625nm) is equal to:*

- **Temperature/Humidity:**  $\pm[(\text{The number of fusion splices} \times 0.05 \text{ dB}) + (\text{the number of connector interfaces} \times 0.30 \text{ dB})]$ .

**10. Temperature/Humidity (only) and Freeze Thaw Optical Criteria for “express” fibers:**

*The optical in testing insertion loss (IL) criteria change for all four wavelengths (1310, 1490, 1550, 1625nm) is equal to:*

- **Temperature/Humidity:**  $\pm(0.05 \text{ dB } 90\% \text{ of fibers})$   
 $\pm(0.15 \text{ dB for } 10\% \text{ of fibers})$





- Concatenation of “express” fibers is allowed as required during the temperature and humidity cycle and Freeze/Thaw test.
- The following attenuation coefficients shall be used in conjunction with the use of concatenation:

	<i>Average Change in Fiber Attenuation Coefficient</i>	<i>Maximum Change in Fiber Attenuation Coefficient</i>
<i>All Wavelengths</i>	$\leq 0.05 \text{ dB/km}$	$\leq 0.15 \text{ dB/km}$

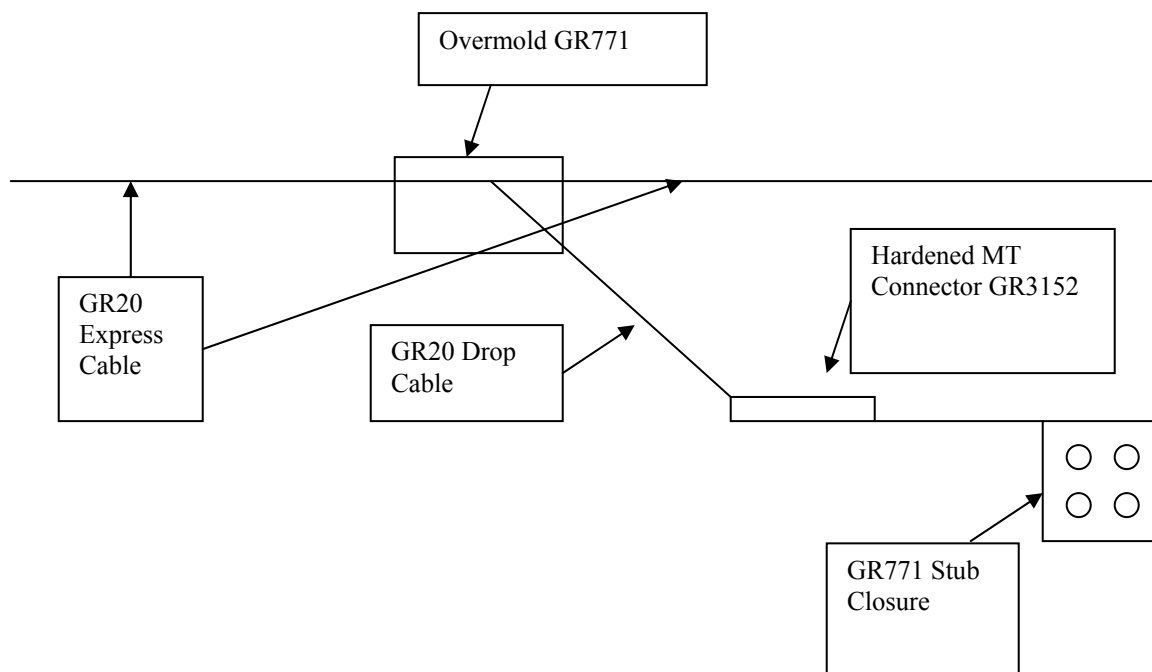
#### Test Configurations:

- Express/Distribution Cable :
  - < 144 fiber-count cables: monitor 2 channels per tube, 3 channels per drop tube (center and two extreme)
  - $\geq 144$  fiber-count cables: monitor 1 channel per tube, 3 channels per drop tube (center and two extreme)
- Testing to be performed on all components of the system, closure, overmold, etc.
- Testing to be performed on both sides of the overmold and on both distribution cables sides and drop cable.
- Test at temperature extremes should be conducted on the same group of samples are both extremes.
- Testing with the same sample group designation are to be conducted in series
- For environmental tests, install as intended for aerial applications using a simulated aerial installation.
- It is the suppliers’ responsibility to ensure that the worse case configuration sample is submitted for testing. The supplier is to define the configurations, and lengths that are to be evaluated for product qualification.
- It may be necessary to test more than one configuration to thoroughly demonstrate product performance.
- All tests shall be conducted on both sides of the distribution cable and drop cable.
- If a product is tested for buried applications, it will cover analysis for an aerial application.
- The VATS cable assembly shall have HMFOC stub lengths of a minimum of 5 feet for aerial and 15 feet for below grade.

**(OVM):** denotes testing the overmold, no hardened connectors needed.

**(OVM-CN):** notes testing that requires both the overmold and hardened connector.

**(OVM-CN-ST):** notes testing that require testing with the overmold, hardened connector and stub terminal if provided.



**Figure 1: Overview of VATS Configuration**