Verizon NEBS^{TM} Compliance: Screening Requirements for Optical Components

Verizon Technical Purchasing Requirements

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1.0   PURPOSE

The purpose of this Verizon Technical Purchasing Requirement document is to provide Stress Screening Requirements for Optical Components

2.0   SCOPE

FOC Products

3.0   REFERENCES

GR-1221-CORE; Issue 2, January 1999	Generic Reliability Assurance Requirements for Passive Optical Components
VZ.TPR.9405	Reliability Assurance Requirements for Passive Optical Components

4.0   ACRONYMS

FOC	Fiber Optic Components
IL	Insertion Loss
RL	Return Loss
B	Before
D	During
A	After
nm	Nano Meter

5.0   STRESS SCREENING REQUIREMENTS FOR OPTICAL COMPONENTS

Verizon is considering using Passive Optical Components for all applications as required. The following are the stress screening requirements for Optical Components and Modules. All of the tests must be conducted.

Stress Screening Requirements:

Components:

- Temperature cycling: Temperature cycling testing is performed for all components. The testing condition is as follows.
    - Number of cycle: 10
    - Temperature limits: -40 and 85 degree C

- **Measurement before Temp cycling**
    - Insertion loss at 1310 nm and 1550 nm

- **Measurement after Temp cycling**
    - All the applicable tests listed in Table-1
    - Example for PLC Splitters following tests shall be conducted:
        - Insertion loss at 1310 nm and 1550 nm
        - Insertion loss change by Temp cycling at 1310 nm and 1550 nm
        - Uniformity at 1310 nm and 1550 nm
        - PDL at 1310 nm and 1550 nm
        - Return loss at 1310 nm and 1550 nm
        - Bandpass
        - Directivity (adjacent channels only @ 1310 nm and 1550 nm)

- **Pass/Fail Criteria**

    - The pass/fail criteria should be no more than 5% changes on the specified parameters.

If a supplier is buying components from some other manufacturer, it is the responsibility of the supplier to Verizon to ensure that above listed conditions are followed by the manufacturer.

Modules:

No Stress Screening is required for the Modules; however, a Lot-to-Lot reliability test program is required. Manufacturer of Modules can decide on the number of samples to be tested for reliability per lot.

It is advisable for all the suppliers to establish a Lot-to-Lot reliability test program for all the FOC products such as connectors, fiber cable etc.

Table 1: Optical Performance Criteria Summary

Optical Characteristics	Ref. Sect	Criteria
All Filters **		
Shortpass Passband (nm)	4.1.2	1280 – 1335 or 1455 – 1610
Longpass Passband (nm)	4.1.2	1510 – 1610
Center Wavelength Range (nm):	4.1.2	
-Fixed Bandpass	4.1.2	1300 – 1330 or 1530 – 1610
-Tunable Bandpass	4.1.2	1290 – 1330 or 1520 – 1610
Shortpass/longpass Loss (dB)	4.2.3	2
Bandpass insertion Loss (dB)	4.2.3	3.5
Flatness (dB)	4.3.3	1
Transmission Crosstalk (dB)	4.4.3	25 (55)
Reflection Crosstalk (dB)	4.4.3	10
Return Loss* (dB)	4.4.3	40 (55)
PDL (dB)	4.7.3	0.2
DWDM Filters		
Criteria as for 'All Filters' above **plus** the following additional overriding criteria:		
Transmission Spectrum:	4.1.2	>0.35 times the channel spacing
-1 dB bandwidth	4.1.2	>0.50 times the channel spacing
-3 dB bandwidth	4.1.2	<1.5 times the channel spacing
-20 dB bandwidth	4.1.2	<2.2 times the channel spacing
-30 dB bandwidth		
Reflection Spectrum:	4.1.2	<1.6 times the channel spacing
-0.2 bandwidth	4.1.2	>0.3 times the channel spacing
-9.6 dB bandwidth	4.1.2	>10 (15)
Isolation depth (dB)	4.1.2	<0.8
Out of band insertion loss (dB)	4.1.2	<0.2
Out of band flatness	4.2.3	1.0
Bandpass Insertion Loss	4.1.2	20% the channel spacing
Center wavelength tolerance	4.10	<4 pm/ºC
Temp sensitivity of center wavelength		
Gain Flattening Filters		
Criteria for 'All Filters' above **plus** the following additional overriding criteria:	4.2.4	<1.0
Wavelength independent insertion loss (dB)	4.2.4	<2.0

Optical Characteristics	Ref. Sect	Criteria	
Range of insertion loss error func. (dB)			
Couplers/Splitters ***		**Digital (CR)**	**AM-Video (CR)**
MxN Optical Bandpass (nm),	4.2.1	1260 to 1640 (user defined)	1290 to 1330 & (1530 to 1570)‡
1 x N insertion loss (dB)	4.2.1	$0.8 + 3.4 \log_2(N)$	
2 x N insertion loss (dB)	4.2.1	$1.0 + 3.4 \log_2(N)$	$0.6 + 3.3 \log_2(N)$
1 x N uniformity	4.3.1	$0.6 \log_2(N)$	$0.9 + 3.3 \log_2(N)$
2 x N uniformity	4.3.1	$0.7 \log_2(N)$	$0.4 \log_2(N)$ $0.6 \log_2(N)$
Coupling Ratio	4.5.1	User defined	
Directivity* (dB)	4.5.1	55	55 (60)
Return Loss* (dB)	4.6.1	55(CR65)	
Polarization Dependent Loss (dB)	4.7.1	$0.1 [1+ \log_2(N)]$	
Polarization Mode Dispersion (ps)	4.9.1	$0.1 [1 + \log_2(N)]$	
WDMs			
Optical Bandpass (nm)	4.1.2	1260 to 1640 (user defined)	1290 to 1330 & (1530 to 1570)‡
Central Frequency	4.1.2	$193.1 + 0.li$ THz (i=integer)	
Central Frequency Deviation	4.1.2	20% of channel spacing	
Insertion Loss L_1 (dB)	4.2.1	$1.5 \log_2 N$	$1.0 \log_2 N$
Insertion Loss Slope (dB/nm)	4.2.1		≤0.1 dB/0.1 nm
Isolation (dB)	4.4.1	25	55
Directivity* (dB)	4.5.1	50	50 (60)
Return Loss*	4.4.1	40 (65)	55 (65)
PDL (dB)	4.7.1	$0.1 (1 + \log_2 N)$	$0.1 (1 + \log_2 N)$
PMD (ps)	4.9.1	$0.1 (1 + \log_2 N)$	
DWDMs			
Criteria as for 'WDMs' above plus the Following additional overriding criteria:			
Insertion loss	4.2.1	$2.2 + 0.6 (N-1)$	-
Central Frequency			
Central frequency deviation	4.1.2	$193.1 + 0.05i$ THz (i = integer)	
Wavelength temp. sensitivity	4.1.2	<0.01 of channel spacing	
Loss temperature stability	4.10	$\Delta\lambda_c \leq 4$ pm/ºC	
	4.10	≤0.5 dB	
Passive Optical Modules			
Insertion Loss, L_1 (dB)	4.1.2	User Defined	User Defined
Return Loss*, L_{RE}	4.6.1	User Defined	User Defined

Optical Characteristics	Ref. Sect	Criteria	
Isolators and Circulators			
Optical Bandpass (nm)	4.1.2	1260 to 1680 (user defined)	
Insertion Loss, L_1 (dB)			
-In-Line	4.2.1	1.0	1.0
-Free-Space	4.2.1	0.5	0.5
-Circulator (Ports 1:2 & 2:3)	4.2.1	1.5	1.5
Isolation (dB)(all products)	4.4.2	32	47
Circulator Directivity*(dB)	4.5.2	50	50 (60)
Return Loss* (dB)	4.6.2	40	55 (65)
PDL (dB)			
-Isolators	4.7.2	0.2	0.2
-Circulators	4.7.2	0.5	0.5
PMD (ps)	4.9.2	0.2	0.2