



**Verizon NEBS™ Compliance: Endface
Geometry Test Equipment Repeatability and
Accuracy Validation Procedure**
Verizon Technical Purchasing Requirements
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1.0 PURPOSE

The purpose of this Verizon Technical Purchasing Requirement document is to provide FOC Endface Geometry Test Equipment Repeatability and Validation Procedure.

2.0 SCOPE

FOC Endface Geometry Test Equipment

3.0 REFERENCES

TPR.9409	Singlemode Optical Connectors and Jumper Assemblies
TPR.9413	Multi-Fiber Optical Connectors
TPR.9418	Hardened Fiber Optic Connectors (HFOC)
TPR.9432	Hardened Multi-Fiber Optical Connectors (HMFOC)
GR-326-CORE	Generic Requirements for Singlemode Optical Connectors and Jumper Assemblies

4.0 ACRONYMS

FOC	Fiber Optic Components
IL	Insertion Loss
ITL	Independent Testing Laboratory
ROC	Radius of Curvature



5.0 ENDFACE GEOMETRY TEST EQUIPMENT REPEATABILITY AND ACCURACY VALIDATION PROCEDURE

Verizon requires Endface geometry testing to be performed on all optical connectors deployed in the Verizon network. Verizon also requires specific levels of repeatability and accuracy for the endface geometry equipment utilized for this testing. Endface Geometry Equipment used for FOC testing must be validated in the following manner.

Equipment Required:

Accuracy Artifact
Mapped Reference connector

Accuracy Artifact

1. The artifact used for determining accuracy of the measurement system should be of the type that requires the use of the test systems standard connector fixtures. This is to ensure that defects in the endface geometry hardware, such as fixture wear, are detected by this procedure. Other artifacts may be used if a mapped reference connector is used during the repeatability part of this procedure. The artifact must be provided with valid traceable test data. The measurement distance provided by the artifact should be in the same range as that of a typical good connector.

Mapped Reference Connector

2. The repeatability portion of this procedure requires the use of a mapped reference connector.
3. Please note that the interferometer relies on valid pixel ratio for repeatability. Therefore, the artifact should reflect as close as possible the conditions of an actual sample that exist during an actual measurement.
4. The mapped reference connector may be purchased from an endface geometry equipment supplier or a connector supplier.
5. Reference connectors purchased from a connector manufacturer should be sufficiently aged, prior to characterizing, to ensure that the epoxy is adequately cured to minimize fiber movement.
6. The mapped reference connector must be initially and periodically characterized by an appropriate outside industry-accepted organization, such as a calibration laboratory or an endface geometry equipment manufacturer.
7. The mapped referenced connector data must include two types of data and be in the following format.

Measurements Taken without Removing Mapped Connector

Measurement	Parameter 1	Parameter 2	...	Parameter N
1				
2				
3				



.				
.				
.				
25				
Min				
Max				
Ave				
Std Dev				

- Where Parameter 1 through Parameter N = Angle, ROC, Apex Offset, Undercut for single fiber connectors
- Parameters 1 through Parameter N = X Angle, Y Angle, X ROC, Y ROC, Fiber Height and Co-planarity for multi-fiber connectors.
- The left had column identifies the specific measurement (total of 25) and the required result stats.

**Data Taken While Removing and Re-Inserting Mapped Connector
Between Each Measurement**

Measurement	Parameter 1	Parameter 2	...	Parameter N
1				
2				
3				
.				
.				
.				
25				
Min				
Max				
Ave				
Std Dev				

- Where Parameter 1 through Parameter N = Angle, ROC, Apex Offset, Undercut for single fiber connectors
- Parameters 1 through Parameter N = X Angle, Y Angle, X ROC, Y ROC, Fiber Height, Differential fiber Height and Co-planarity for multi-fiber connectors.
- The left had column identifies the specific measurement (total of 25) and the required result stats.

Accuracy Procedure

8. Turn on the interferometer and allow the instrument to thermally stabilize.



9. Perform any required nulling or offset adjustments.
10. Verify that the accuracy artifact is within its valid calibration interval.
11. If a separate accuracy artifact is used perform accuracy verification by measuring the accuracy artifact a minimum of 25 times. Record the results.
12. Calculate the Max, Min, Ave and Standard Deviation of the results and compare to the know value (measured by a calibration house or other outside source) of the accuracy artifact.
13. If a separate accuracy artifact is not used, follow the procedure below.

Repeatability – Reproducibility Procedure

14. Obtain the Endface Geometry Instrument’s repeatability and reproducibility data from the manufacturer. An example is provided.

Parameter	Repeatability	Reproducibility
ROC (mm)	±0.12%	±0.23%
Apex Offset (um)	±0.6 um	±1.1 um
Fiber Height (nm)	±1.1nm	±1.6 nm

15. Please note that there may be two sets of data, one for repeatability/reproducibility of a specific instrument and the repeatability/reproducibility between instruments.
16. Turn on the interferometer and allow the instrument to thermally stabilize.
17. Perform any required nulling or offset adjustments. See the following procedure.
18. Using the appropriate mapped reference connector measure the endface geometry parameters as specified in step 5 above. Perform the required number of measurements without disturbing the mapped reference connector. Record the results.
19. Calculate the Min, Max, Ave and Standard Deviation of each of the parameters.
20. Compare the results to the value of the **mapped reference connector** and the repeatability data provided by the equipment manufacturer.
21. Repeat the measurements of the endface geometry parameters as specified in step 5 above. Perform the required number of measurements while removing and re-inserting the mapped reference connector between each measurement.
22. Calculate the Min, Max, Ave and Standard Deviation of each of the parameters.
23. Compare the results to the value of the mapped reference connector and the repeatability data provided by the equipment manufacturer.