

# Reliability Requirements for Passive Optical Components

## Contents

[Telcordia GR-1221 - Documentation Information](#)

Preface.....	Preface-1
1. Introduction.....	1-1
1.1 Scope and Purpose .....	1-1
1.2 Changes in the Document.....	1-2
1.2.1 Changes From TA-NWT-001221 Issue 2 to GR-1221-CORE Issue 1.....	1-2
1.2.2 Changes From GR-1221-CORE, Issue 1 to Issue 2.....	1-3
1.2.3 Future Additions/Changes.....	1-3
1.3 Related Telcordia Documents.....	1-4
1.4 Requirements Terminology .....	1-4
1.5 Requirement Labeling Conventions .....	1-5
1.5.1 Numbering of Requirement and Related Objects.....	1-5
1.5.2 Requirement, Conditional Requirement, and Objective Object Identification.....	1-5
1.6 Operating Environments.....	1-6
1.6.1 Central Office (CO) Environment.....	1-6
1.6.2 Remote Terminal (RT) Environment .....	1-6
1.6.3 Uncontrolled Environment.....	1-7
1.7 Other Terminology.....	1-7
1.7.1 Suppliers, Vendors, and Manufacturers.....	1-7
1.7.2 Quality Levels.....	1-7
2. Reliability Assurance - Overview and Philosophy.....	2-1
2.1 Overview of Reliability Assurance.....	2-1
2.2 Generic Requirements Philosophy .....	2-2
3. Basic Reliability Assurance Program Requirements.....	3-1
3.1 Vendor and Device Qualification.....	3-1
3.1.1 Specification and Control.....	3-2
3.1.2 Vendor Approval.....	3-2
3.1.3 General Criteria for Device Qualification.....	3-3
3.1.3.1 Qualification Tests .....	3-4
3.1.3.2 Device Codes that Fail Qualification .....	3-4
3.1.3.3 Qualification of Devices by Similarity .....	3-4
3.1.3.4 Use of Nonconforming Devices for Qualification.....	3-5
3.1.3.5 Provisional Use of Devices.....	3-5
3.1.3.6 Low Volume Parts .....	3-6
3.1.3.7 Hermeticity.....	3-7
3.1.3.8 Solder Flux.....	3-7
3.1.3.9 Use of Vendor-Supplied Data.....	3-7
3.1.3.10 Treatment of Internally Manufactured Devices .....	3-8

3.1.4	Environment, Health, and Safety Considerations .....	3-8
3.1.4.1	Environment Considerations .....	3-8
3.1.4.2	Health Considerations .....	3-8
3.1.4.3	Safety Considerations .....	3-9
3.1.5	Other General Information for Qualification .....	3-9
3.1.6	Requalification .....	3-12
3.2	Lot-To-Lot Quality and Reliability Controls .....	3-13
3.2.1	General Criteria for Lot Controls.....	3-14
3.2.1.1	Definition of a Lot .....	3-14
3.2.1.2	Purchase Specifications .....	3-15
3.2.1.3	Source Inspection/Incoming Inspection.....	3-15
3.2.1.4	Ship-to-Stock Programs.....	3-16
3.2.1.5	Test Plan.....	3-17
3.2.1.6	Test Equipment.....	3-17
3.2.1.7	Data Recording and Retention.....	3-17
3.2.1.8	Treatment of Defective Devices and Lots .....	3-18
3.2.1.9	Summary of Vendor History Data .....	3-18
3.2.1.10	Low Volume Parts .....	3-18
3.2.1.11	Use of Vendor-Supplied Data.....	3-19
3.2.1.12	Treatment of Internally Manufactured Devices .....	3-19
3.2.2	Other General Information for Lot-To-Lot Controls .....	3-19
3.3	Standardized Test Procedures .....	3-20
3.4	Feedback and Corrective Action .....	3-20
3.4.1	Incoming Inspection and Screening.....	3-22
3.4.2	System-Level Testing.....	3-22
3.4.3	Repair of Field Returns.....	3-22
3.4.4	Data Collection and Analysis .....	3-23
3.4.5	Unconfirmed Failures .....	3-23
3.4.6	Device Failure Analysis.....	3-23
3.5	Device Storage and Handling .....	3-24
3.5.1	Nonconforming Material.....	3-24
3.5.2	Material Review System.....	3-24
3.5.3	Stockroom Inventory Practices .....	3-25
3.5.3.1	FIFO Inventory Policy .....	3-25
3.5.3.2	Reworked Parts .....	3-25
3.5.4	ESD.....	3-25
3.6	Documentation and Test Data .....	3-26
3.6.1	Availability of Documentation .....	3-26
3.6.2	Availability of Other Information .....	3-27
3.7	Availability of Devices.....	3-28
4.	Specific Reliability and Quality Criteria .....	4-1
4.1	Qualification of Passive Optical Devices .....	4-1
4.1.1	Characterization.....	4-1
4.1.2	Reliability Tests.....	4-2
4.2	Qualification of Integrated Passive Optical Module.....	4-7
4.3	Quality Assurance and Lot Controls.....	4-8

4.3.1	Visual Inspection.....	4-8
4.3.2	Optical Testing .....	4-8
4.3.3	Stress Screening.....	4-9
4.3.4	Optical Adhesives .....	4-11
4.3.5	Optical Fiber.....	4-11
4.4	Reliability and Quality of Optical Adhesives.....	4-11
4.4.1	Qualification and Requalification .....	4-12
4.4.2	Raw Material Storage .....	4-14
4.4.3	Lot-To-Lot Controls .....	4-15
5.	Performance Criteria.....	5-1
5.1	Optical Requirements and Objectives .....	5-1
5.2	Optical Test Procedures.....	5-1
5.3	Optical Fiber and Optical Connectors .....	5-1
6.	Reliability Test Procedures .....	6-1
6.1	Reliability Test Pass/Fail Criteria .....	6-1
6.2	Reliability Test Procedures .....	6-2
6.2.1	Mechanical Shock (Impact Test).....	6-2
6.2.2	Variable Frequency Vibration Test.....	6-3
6.2.3	Thermal Shock Test.....	6-3
6.2.4	High Temperature Storage Test (Dry Heat) .....	6-4
6.2.5	High Temperature Storage Test (Damp Heat).....	6-4
6.2.6	Low Temperature Storage Test.....	6-5
6.2.7	Temperature Cycling Test .....	6-6
6.2.8	Cyclic Moisture Resistance Test.....	6-6
6.2.9	Residual Gas Analysis .....	6-7
6.2.10	ESD Threshold .....	6-7
	Appendix A: Lot Tolerance Percentage Defective (LTPD) Table .....	A-1
	Appendix B: Reliability Calculation.....	B-1
	References.....	References-1
	Glossary.....	Glossary-1



## List of Figures

Figure 2-1.	Elements of a Comprehensive Reliability Assurance Program.....	2-2
Figure 6-1.	Thermal Profile of Cyclic Moisture Resistance Test .....	6-6
Figure B-1.	Example of a Lognormal Probability Plot.....	B-4
Figure B-2.	Goldthwaite Curves .....	B-5
Figure B-3.	Nomograph for Calculating Random Failure Rates.....	B-7



## List of Tables

Table 1-1.	Definition of Quality Levels .....	1-8
Table 3-1.	Sample Format for Reporting Failure Rate Predictions.....	3-11
Table 3-2.	Sample Report Format for Reliability Test Status .....	3-11
Table 4-1.	Typical Characterization Tests for Branching Components.....	4-2
Table 4-2.	Required Reliability Tests .....	4-4
Table 4-3.	Test Matrix for Demonstrating Acceleration Factors .....	4-6
Table 4-4.	Typical Optical Parameters s for Branching Components.....	4-9
Table A-1.	LTPD Sampling Plan .....	A-1
Table B-1.	Sample Format for Reporting Reliability Information .....	B-8