

Contents

Telcordia GR-2882 - Documentation Information

1. Introduction	1-1
1.1 Purpose and Scope of Document	1-1
1.2 Requirements Terminology	1-2
1.3 Requirement Labeling Conventions	1-2
1.3.1 Numbering of Requirement and Related Objects	1-2
1.3.2 Requirement, Conditional Requirement, and Objective Object Identification	1-3
1.4 Organization	1-3
2. General Information	2-1
2.1 General Product Description	2-1
2.2 Isolator and Circulator Classes	2-4
2.2.1 Polarizer/analyzer Isolators	2-4
2.2.2 Walk-off Isolators	2-6
2.2.3 Optical Circulators	2-8
2.3 Isolator Technology	2-10
2.4 Isolator Parameters	2-12
2.4.1 Isolation	2-12
2.4.2 Insertion Loss	2-12
2.4.3 Reflectance	2-12
2.4.4 Polarization	2-12
2.4.4.1 Polarization-Dependent Loss	2-13
2.4.4.2 Polarization-Mode Dispersion	2-13
2.5 Isolator Applications	2-13
2.5.1 Transmitter Protection	2-13
2.5.2 Optical Amplifiers	2-14
2.5.3 In-line Noise Reduction	2-15
2.5.4 Circulator Applications	2-16
2.5.5 Bidirectional Transmission	2-16
2.5.6 Optical Amplifiers and Systems	2-17
2.5.7 Optical MUX/DEMUX	2-18
2.6 Environmental Conditions	2-19
3. General and Design Criteria	3-1
3.1 Documentation	3-1
3.1.1 General Documentation	3-1
3.1.2 Workcenter Information Package	3-3
3.2 Marking, Packaging and Shipping	3-3
3.3 Physical Design Criteria	3-3
3.3.1 Optical Fiber	3-3
3.3.2 Optical Connectors	3-5
3.3.3 Materials	3-5
3.3.3.1 Toxicity	3-5
3.3.3.2 Corrosion Resistance	3-5
3.3.3.3 Dissimilar Metals	3-6

3.3.3.4 Fungus Resistance	3-6
3.3.3.5 Flammability	3-6
3.3.4 Safety	3-6
3.3.5 Mounting	3-7
3.3.5.1 Central Office Location	3-7
3.3.5.2 Outside Plant Location	3-9
4. Performance Criteria	4-1
4.1 Optical Criteria	4-2
4.1.1 Optical Bandpass	4-2
4.1.2 Insertion Loss	4-3
4.1.3 Isolation	4-3
4.1.4 Circulator Directivity	4-4
4.1.5 Reflectance	4-5
4.1.6 Polarization-Dependent Loss (PDL)	4-5
4.1.7 Polarization Mode Dispersion (PMD)	4-6
4.2 Environmental Criteria	4-6
4.2.1 Operating Environment	4-8
4.2.2 Non-Operating Environment	4-8
4.2.3 Shock Criteria	4-9
4.2.3.1 Shipment from Manufacturer	4-9
4.2.3.2 Local Transportation	4-9
4.2.3.3 During Use	4-9
4.2.4 Vibration Test	4-9
4.2.5 Airborne Contaminants	4-10
4.2.6 Flex Test	4-10
4.2.7 Twist Test	4-10
4.2.8 Side Pull	4-11
4.2.9 Cable Retention	4-11
5. Performance Verification/Test Procedures	5-1
5.1 Optical Testing	5-1
5.1.1 Optical Bandpass	5-2
5.1.2 Insertion Loss	5-2
5.1.3 Isolation	5-3
5.1.4 Circulator Directivity	5-3
5.1.5 Reflectance	5-3
5.1.6 Polarization-Dependent Loss (PDL)	5-4
5.1.7 Polarization-Mode Dispersion	5-4
5.2 Environmental Testing	5-4
5.2.1 Operating Environment	5-4
5.2.2 Non-Operating Environment	5-5
5.2.3 Shock Tests	5-5
5.2.3.1 Shipment from Manufacturer	5-5
5.2.3.2 Local Transportation	5-5
5.2.3.3 In Use	5-5
5.2.4 Vibration Test	5-5
5.2.5 Airborne Contaminants Test	5-5

5.2.6 Flex Test	5-5
5.2.7 Twist Test	5-6
5.2.8 Side Pull	5-6
5.2.9 Cable Retention	5-6
6. Reliability and Quality Assurance Program	6-1
6.1 Reliability Assurance Requirements Philosophy	6-1
6.2 Overview of Reliability Assurance	6-2
6.3 Qualification Criteria	6-3
6.3.1 Characterization	6-3
6.3.2 Reliability Tests	6-4
6.3.3 Failure Rate Prediction	6-8
6.3.4 Optical Adhesives	6-11
6.3.5 Quality Assurance and Lot Controls	6-11
6.3.5.1 Visual Inspection	6-12
6.3.5.2 Optical Testing	6-12
6.3.5.3 Stress Screening	6-12
6.3.6 Optical Adhesives	6-13
6.3.7 Optical Connectors	6-13
6.3.8 Optical Fiber	6-13
6.4 Quality and Reliability Criteria	6-13
6.4.1 Reliability Assurance	6-14
6.4.2 Quality Technology Program	6-15
Appendix A: The Transfer Matrix	A-1
A.1 Definition of Terms	A-1
Appendix B: References	B-1
Appendix C: Glossary	C-1

List of Figures

Figure 2-1	Symbols for (a) an Optical Isolator, (b) a three-port Optical Circulator	2-2
Figure 2-2	Schematic showing operation of a magneto-optical isolator	2-3
Figure 2-3	An example of temperature dependence of the backward loss in single-stage and double-stage isolators	2-4
Figure 2-4	Configuration of a cascaded optical isolator	2-5
Figure 2-5	Operating principle of a reciprocal isolator	2-6
Figure 2-6	Operating principle for a polarization independent walk-off isolator	2-7
Figure 2-7	Schematic for a polarization independent quasi-circulator	2-8
Figure 2-8	Positions and polarization of Beam 2 and Beam 2' on some element surfaces (a) A – A', (b) B – B', (c) C – C', and (d) D – D' in Figure 2-7	2-9
Figure 2-9	Isolation bandwidths for isolators made using Yttrium Iron Garnet (YIG) and Bismuth Iron Garnet (BIG) at 1550 nm	2-11
Figure 2-10	A schematic configuration of the DFB integrated laser module . .	2-14
Figure 2-11	OFA gain module followed (a) or preceded (b) by an isolator . . .	2-15
Figure 2-12	Three discrete reflectances between a transmitter and receiver . .	2-16
Figure 2-13	Bidirectional transmission using circulators	2-16
Figure 2-14	A reflective double-pass fiber amplifier using an optical circulator	2-17
Figure 2-15	Dispersion compensation using an optical circulator	2-18
Figure 2-16	A schematic for an optical add/drop multiplexer using optical circulators	2-19
Figure 3-1	Generic Frame Mountable Circulator	3-8
Figure 3-2	Possible Isolators and Circulator Location in a Central Office . . .	3-8
Figure 3-3	Example of an Isolator/Circulator Mounted in an OSP Closure . . .	3-9
Figure 6-1	Elements of a Comprehensive Reliability Assurance Program	6-3

List of Tables

Table 4-1	Summary of Optical Isolator and Circulator Performance Criteria and Test Sequence	4-1
Table 4-2	Tensile Loads for Mechanical Tests	4-8
Table 4-3	Fiber Retention Loads	4-11
... Table 1	(R) Required Characterization Tests	6-4
... Table 2	(R) Required Reliability Tests	6-5
Table 6-1	Test Matrix for Demonstrating Acceleration Factors [Relative Humidity as a Function of Temperature and Absolute Humidity]	6-7
... Table 3	(O) Sample Format for Reporting Failure Rate Predictions	6-10
... Table 4	(O) Sample Report Format for Reliability Test Status	6-11