Telcordia Test Report

Compact Size CWDM Module

Per

Telcordia GR-1209-CORE and

Telcordia GR-1221-CORE

Standards

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Revision:	**A**

Content

1.0 INTRODUCTION

Shenzhen Reliable Photonics Co., Ltd. has developed for Compact Size CWDM Module. In order to fairly assess and qualify our packaging manufacturing capability, the device performance and reliability, we select an Reliable existing Low Loss Compact Size CWDM Module, which is one of the most difficult Compact Size CWDM Module we have manufactured.

We built 6pcs of Low Loss Compact Size CWDM Module finished a series of verification tests on them according to the test procedures of Telcordia GR-1209-Core and GR-1221-Core at Reliable" s factory in Shenzhen, China.

The purposes of this test program are:

- To demonstrate the devices conforming to the performance specifications required by Telcordia Standard, Reliable, and its potential customers, and to qualify the manufacturing process.
- To verify the environmental and mechanical stability of the Device.

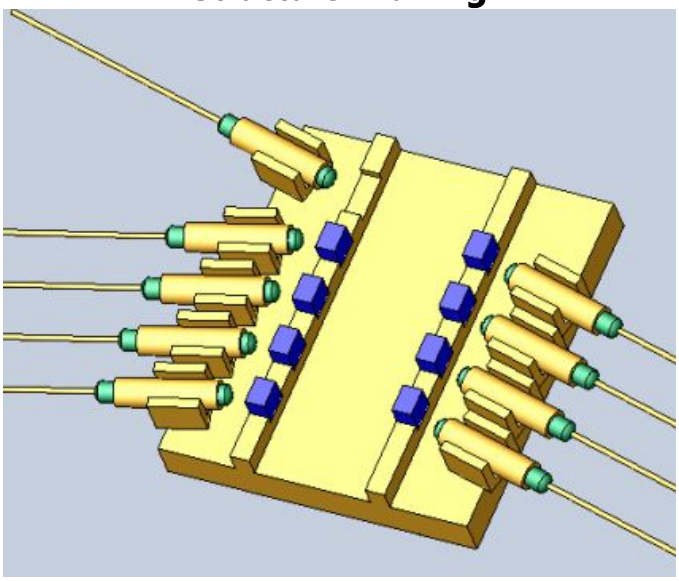
This report presents the complete test results, which demonstrate that all parameters meet the Telcordia GR-1209-CORE and GR-1221-CORE standard. All parameters also meet Reliable" s internal specifications.

2.0 DEVICE DESCRIPTION

2.1 Module CONFIGURATION

The picture below illustrates the structure of the Compact Size CWDM Module. No epoxy is in the optical path of the device. Because Reliable uses a non-soldering process, no detectable amount of any hazardous substances in the European Association of Consumer Electronics Manufacturers (EACEM) list is used in the device.

Structure Drawing



2.2 Module MANUFACTURING INFORMATION

The Products used for this qualification test were randomly selected from the finished products. The following table lists the serial number and manufacturing date of these devices. The devices were all manufactured in Reliable" s factory in Shenzhen, China.

	SN	Manufacturing date
High Temperature Storage (Damp Heat) and High Temperature Storage Test (Dry Heat)	RB01	2012-08-12
Temperature Cycling and Low Temperature Storage Test	RB02	2012-08-12
Water Immersion Test	RB03	2012-08-12
Vibration Test	RB04	2012-08-12
Fiber Pull	RB05	2012-08-12
Impact Test	RB06	2012-08-12

3.0 VERIFICATION TEST CONDITIONS AND STANDARDS

3.1 ENVIRONMENTAL AND MECHANICAL TEST

Environmental and Mechanical test usually includes mechanical/physical tests and short-term endurance tests. The following table lists the tests that have been performed on the Compact Size CWDM Module. Optical performance measurements were completed before and after each of the tests. 6 samples per test allowing no failures is suggested for testing .

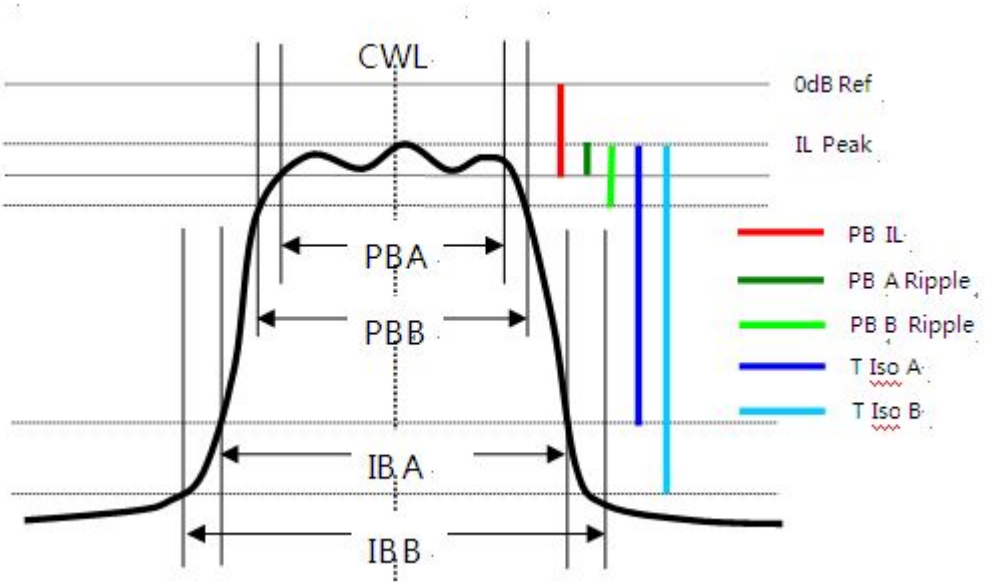
Test	Start Date	Completed Date	Sample size	Failures Number	Test Result
High Temperature Storage (Damp Heat) and High Temperature Storage Test (Dry Heat)	9/25/2012	12/18/2012	1	0	Pass
Temperature Cycling and Low Temperature Storage Test	9/25/2012	11/25/2012	1	0	Pass
Water Immersion	11/3/2012	11/8/2012	1	0	Pass
Vibration	12/8/2012	12/9/2012	1	0	Pass
Fiber Pull	12/23/2012	12/23/2012	1	0	Pass
Impact Test	12/17/2012	12/18/2012	1	0	Pass

3.2 PASS/FAIL CRITERIA

3.2.1 MAXIMUM ALLOWABLE CRITERIA WIDELY ADOPTED BY WDM MANUFACTURER

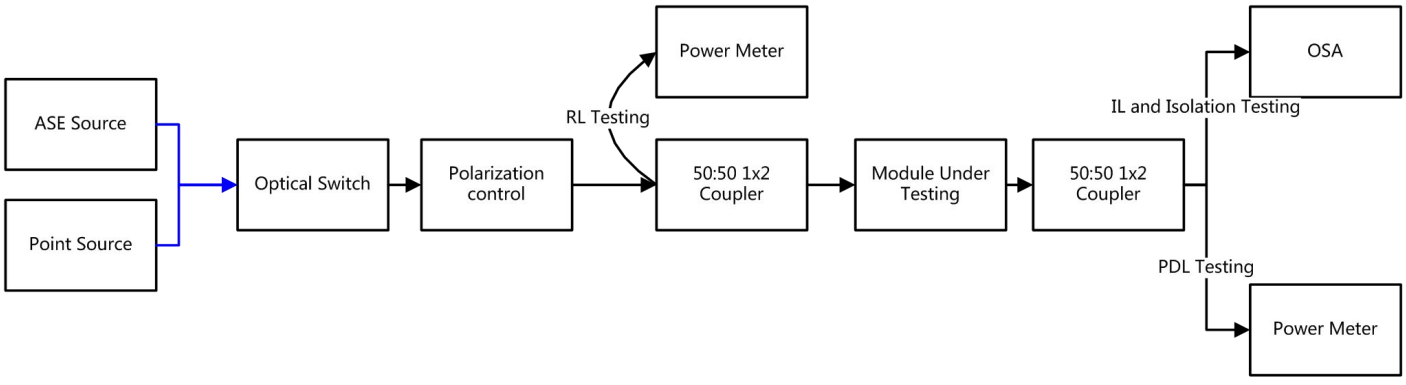
Max. Insertion Loss Variation	± 0.5 dB
Max. Isolation Variation	± 5dB
Max. PDL Variation	± 0.05 dB
Max. Return Loss Variation	± 5dB

3.3 SPECTRAL DEFINITION



3.4 TEST EQUIPMENT SETUP

The following graph illustrates the equipment setup when the optical parameter tests were conducted.



4.0 TEST REPORT

The following pages reports in details all the test samples, test conditions, test methods, instrument and all test data and analysis.

4.1 High Temperature Storage (Damp Heat) and High Temperature Storage Test (Dry Heat)

TEST OBJECTIVE:

To test the reliability performance of Compact Size CWDM Module after 85°C /85% damp heat for 2000hrs.

TEST CONDITIONS:

Temperature:	85°C±2°C
Humidity:	85% ±5% RH
Test duration:	2000hrs for qualification
Sample size:	1 pcs
Readout:	0, 500, 1000 and 2000 h

TEST EQUIPMENT:

(1) ESP

EC LH-113 damp heat chamber, RT~85°C, RH 45~95%;

(2) Agil

ent 81960 tunable laser source;

(3) 1x2 50:50 fused fiber coupler;

(4) Agilent 8153A power meter;

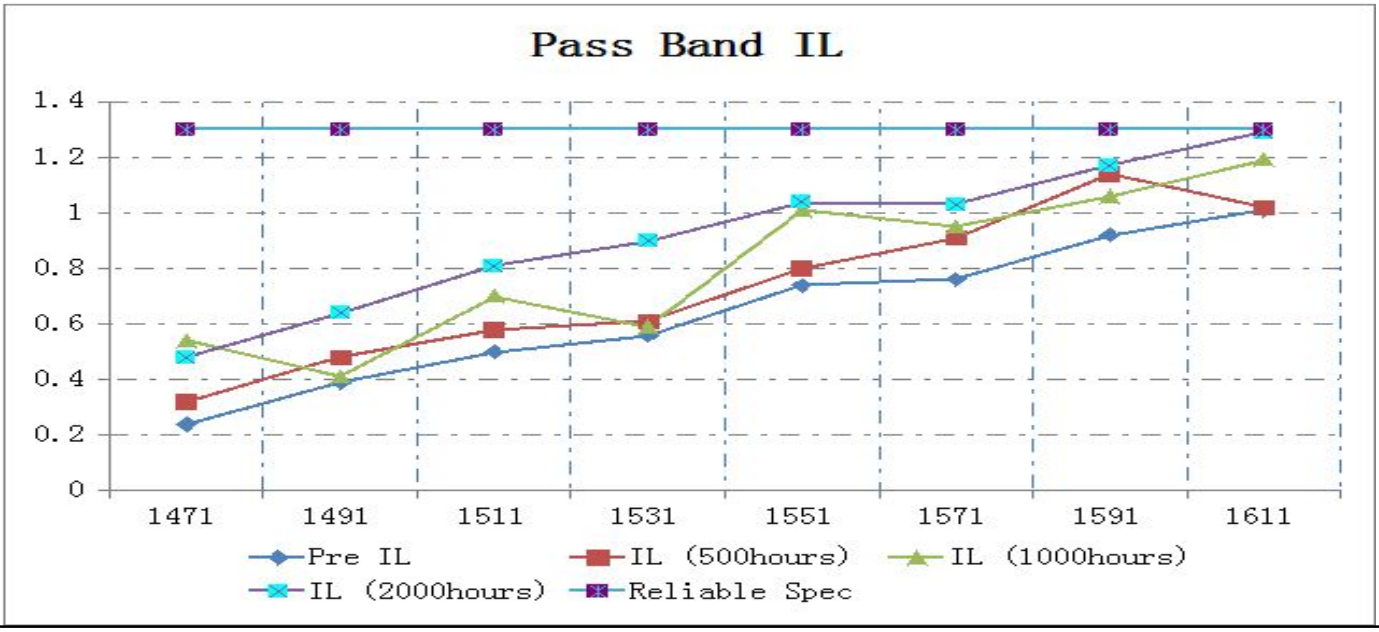
(5) Fujikura FSM-30S fiber fusion plicer ;

(6) Cleaver;

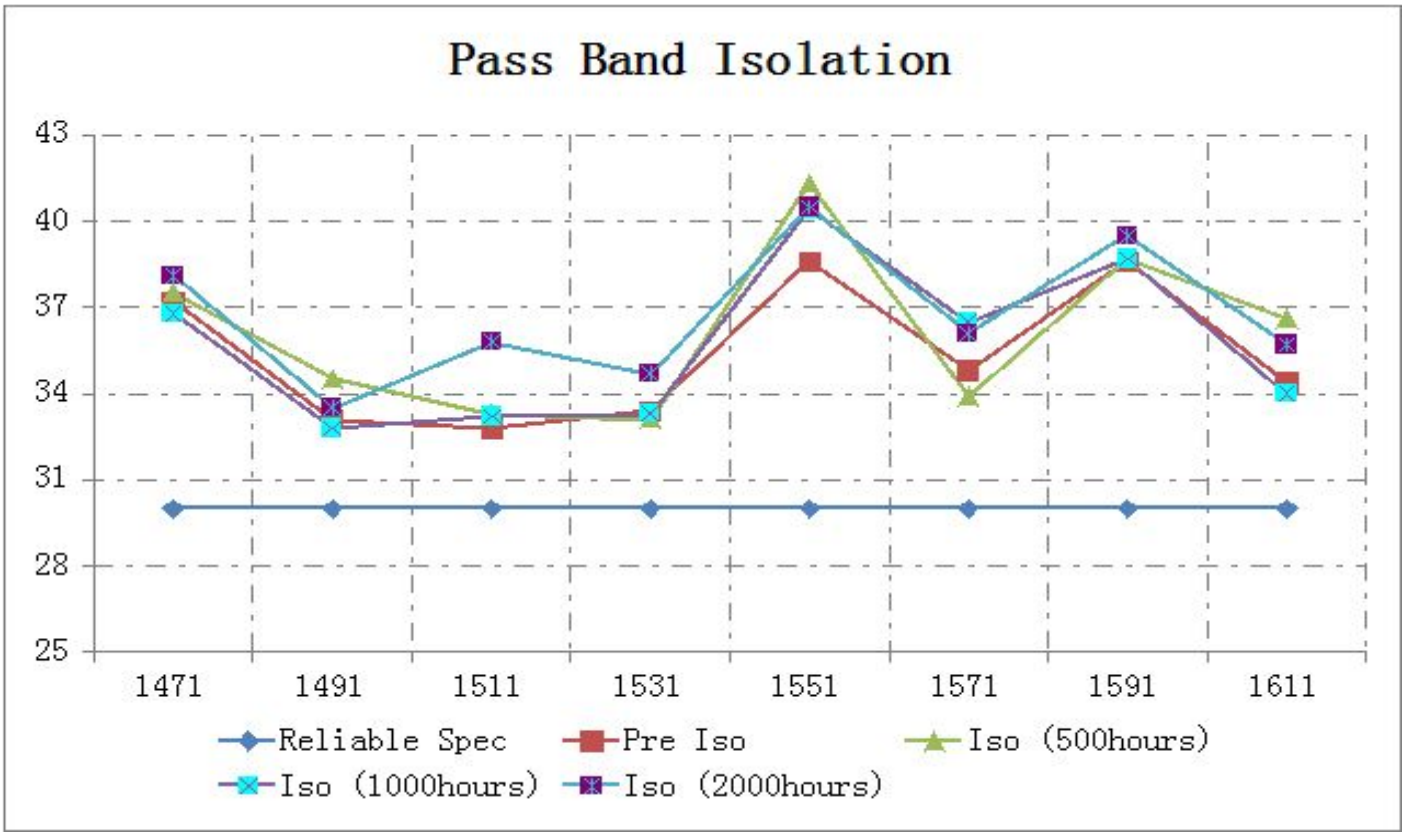
(7) Third Ring Road polarization Control

High Temperature Storage (Damp Heat) and High Temperature Storage Test (Dry Heat)

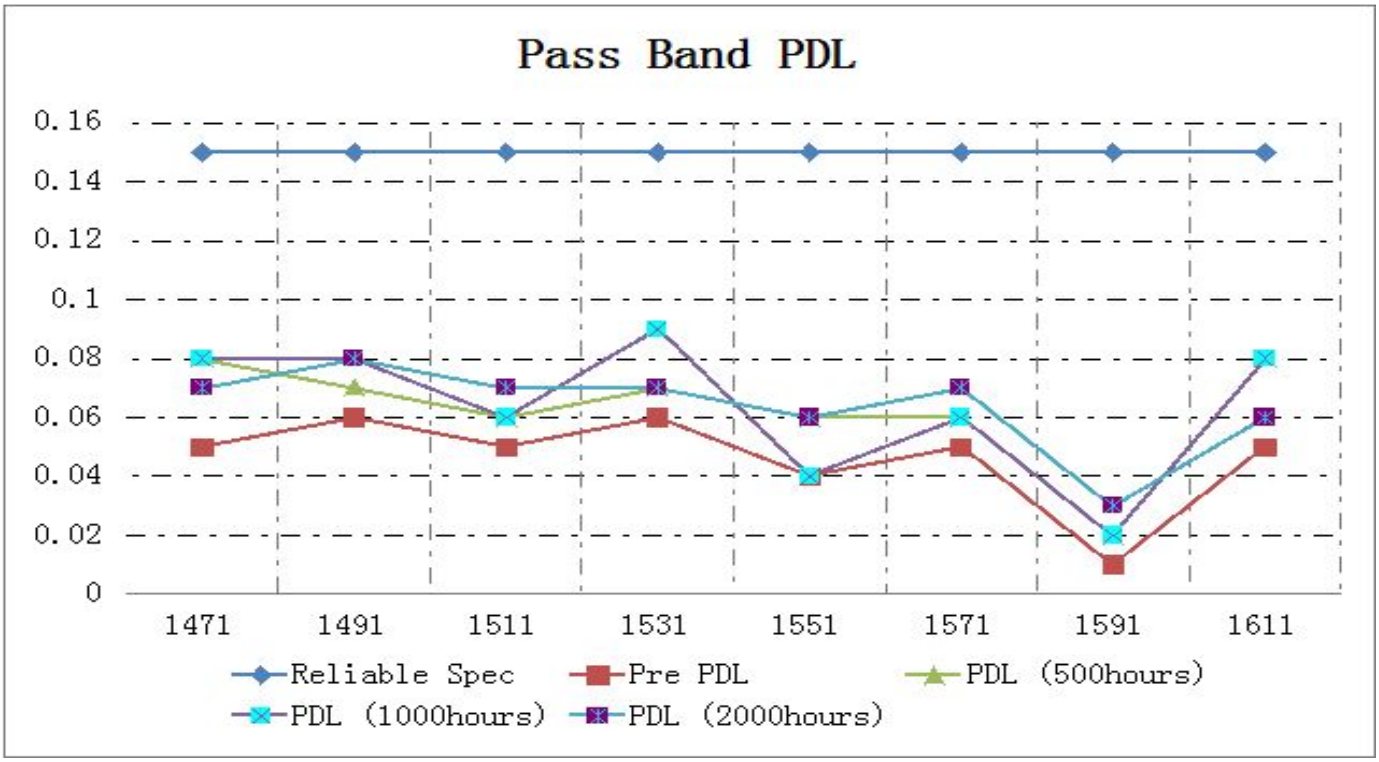
Pass Band IL										
Item	Reliable Spec	Pre IL		IL (500h)	▵ IL (500-Pre)	IL (1000h)	▵ IL (1000-Pre)	IL (2000h)	▵ IL (2000-Pre)	Pass /Fail
RB01	1.3	1471	0.24	0.32	0.08	0.54	0.3	0.48	0.24	Pass
		1491	0.39	0.48	0.09	0.41	0.02	0.64	0.25	
		1511	0.50	0.58	0.08	0.70	0.2	0.81	0.31	
		1531	0.56	0.61	0.05	0.59	0.03	0.90	0.34	
		1551	0.74	0.80	0.06	1.01	0.27	1.04	0.3	
		1571	0.76	0.91	0.15	0.95	0.19	1.03	0.27	
		1591	0.92	1.14	0.22	1.06	0.14	1.17	0.25	
		1611	1.01	1.02	0.01	1.19	0.18	1.29	0.28	



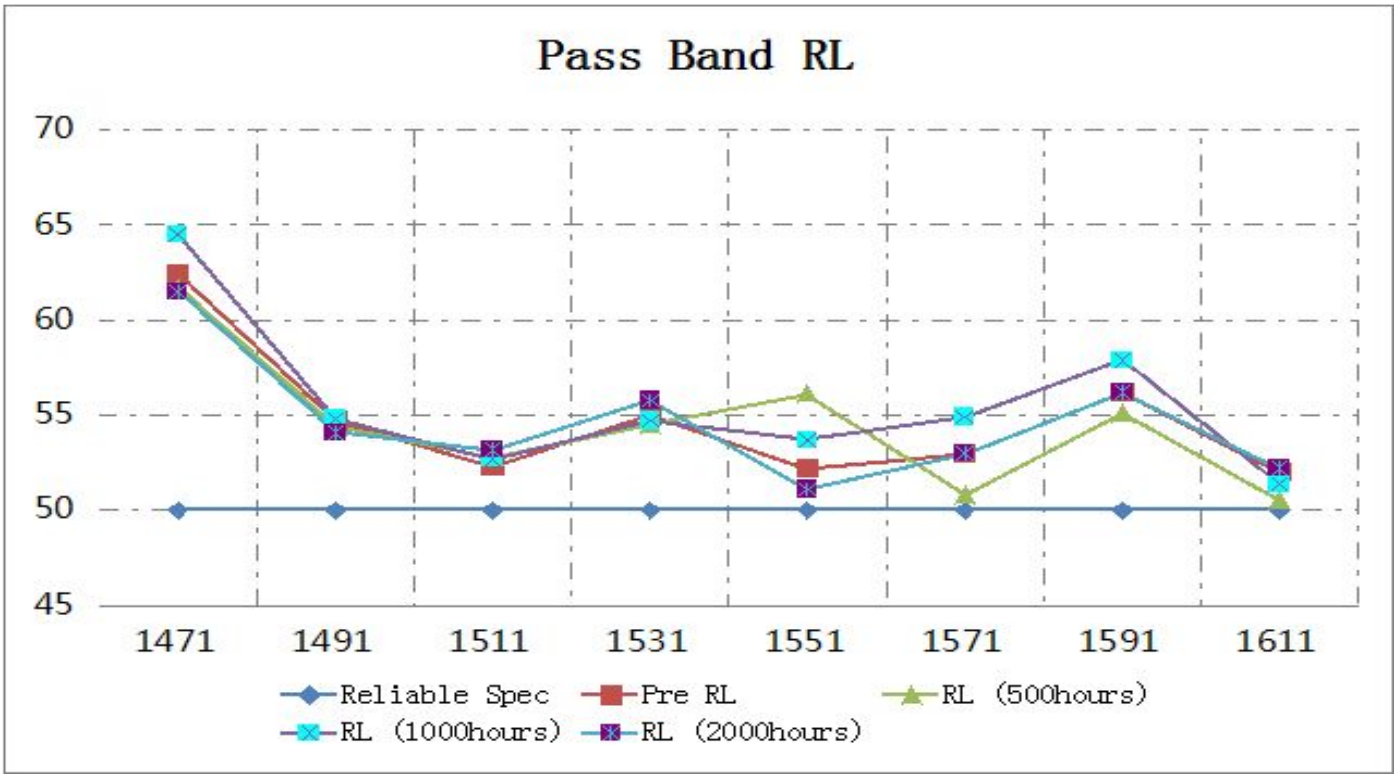
Pass Band Isolation										
Item	Reliable Spec	CW	Pre Iso	Iso (500h)	▵ Iso (500-Pre)	Iso (1000h)	▵ Iso (1000-Pre)	Iso (2000h)	▵ Iso (2000-Pre)	Pass /Fail
RB01	30	1471	37.2	37.5	0.3	36.8	-0.4	38.1	0.9	Pass
	30	1491	33.1	34.5	1.4	32.8	-0.3	33.5	0.4	
	30	1511	32.8	33.3	0.5	33.2	0.4	35.8	3	
	30	1531	33.4	33.1	-0.3	33.3	-0.1	34.7	1.3	
	30	1551	38.6	41.3	2.7	40.4	1.8	40.5	1.9	
	30	1571	34.8	33.9	-0.9	36.5	1.7	36.1	1.3	
	30	1591	38.6	38.7	0.1	38.7	0.1	39.5	0.9	
	30	1611	34.4	36.6	2.2	34.0	-0.4	35.7	1.3	



Pass Band PDL										
Item	Reliable Spec	CW	Pre PDL	PDL (500h)	▵ PDL (500-Pre)	PDL (1000h)	▵ PDL (1000-Pre)	PDL (2000h)	▵ PDL (2000-Pre)	Pass /Fail
RB01	0.15	1471	0.05	0.08	0.03	0.08	0.03	0.07	0.02	Pass
	0.15	1491	0.06	0.07	0.01	0.08	0.02	0.08	0.02	
	0.15	1511	0.05	0.06	0.01	0.06	0.01	0.07	0.02	
	0.15	1531	0.06	0.07	0.01	0.09	0.03	0.07	0.01	
	0.15	1551	0.04	0.06	0.02	0.04	0	0.06	0.02	
	0.15	1571	0.05	0.06	0.01	0.06	0.01	0.07	0.02	
	0.15	1591	0.01	0.02	0.01	0.02	0.01	0.03	0.02	
	0.15	1611	0.05	0.08	0.03	0.08	0.03	0.06	0.01	



Pass Band RL										
Item	Reliable Spec	CW	Pre RL	RL (500h)	▵ RL (500-Pre)	RL (1000h)	▵ RL (1000-Pre)	RL (2000h)	▵ RL (2000-Pre)	Pass /Fail
RB01	50	1471	62.4	61.7	-0.7	64.5	2.1	61.5	-0.9	Pass
	50	1491	54.7	54.4	-0.3	54.8	0.1	54.1	-0.6	
	50	1511	52.3	52.8	0.5	52.7	0.4	53.2	0.9	
	50	1531	55	54.5	-0.5	54.7	-0.3	55.8	0.8	
	50	1551	52.2	56.1	3.9	53.7	1.5	51.1	-1.1	
	50	1571	53	50.8	-2.2	54.9	1.9	53	0	
	50	1591	56.2	55.1	-1.1	57.9	1.7	56.2	0	
	50	1611	52	50.5	-1.5	51.4	-0.6	52.2	0.2	


Pass Band RL
70
65
60
55
50
45
1471
1491
1511
1531
1551
1571
1591
1611
Reliable Spec
Pre RL
RL (500hours)
RL (1000hours)
RL (2000hours)

TEST CONCLUSIONS

The test results shown in the above tables indicate that Reliable" s Compact Size CWDM Module have met the Telcordia standard and Reliable" s own specifications.

1) The maximum delta insertion loss measured during and after the test is 0.34 dB, which is better than Telcordia standard of +/-0.5 dB.

2) The maximum isolation variation is 3 dB, which is better than Telcordia standard of +/-5 dB.

3) The maximum PDL measured during and after the test is 0.03 dB, which is better than Reliable" s specification of < 0.15 dB. The maximum PDL variation is 0.03dB, which is better than Telcordia standard of +/-0.05dB.

4) The minimum return loss measured during and after the test is 50.5 dB for all ports, which meets Reliable" s specification of ≮ 50 dB. The maximum return loss variation is 3.9dB for all ports, which is better than Telcordia standard of +/-5dB.

5) Visual inspection shows no physical damage after the test.

THEREFORE, ALL SAMPLES MET RELIABLE INTERNAL SPECIFICATIONS AND PASSED THE HIGH TEMP STORAGE (DAMP HEAT) 2000 H TEST UNDER THE CONDITIONS OF TELCORDIA STANDARDS.

4.2 TEMPERATURE CYCLING TEST

TEST OBJECTIVE:

To test the reliability performance of Compact Size CWDM Module after 500 temperature cycles.

TEST CONDITIONS:

Temperature:	-40°C to 85°C (±2°C)
Dwell time at extremes:	≮15minutes
Transition rate:	Approximately 1°C/ min
Number of cycles	500cycles for qualification
Sample size (LTPD=20%)	1 pcs
Readout:	0, 100, 200 and 500 cycles

TEST EQUIPMENT:

(1) ESPEC LH-113 damp heat chamber, RT~85°C, RH 45~95% ?

(2) Agilent 81960 tunable laser source ?

(3) 1x2 50:50 fused fiber coupler ?

(4) Agilent 8153A power meter ?

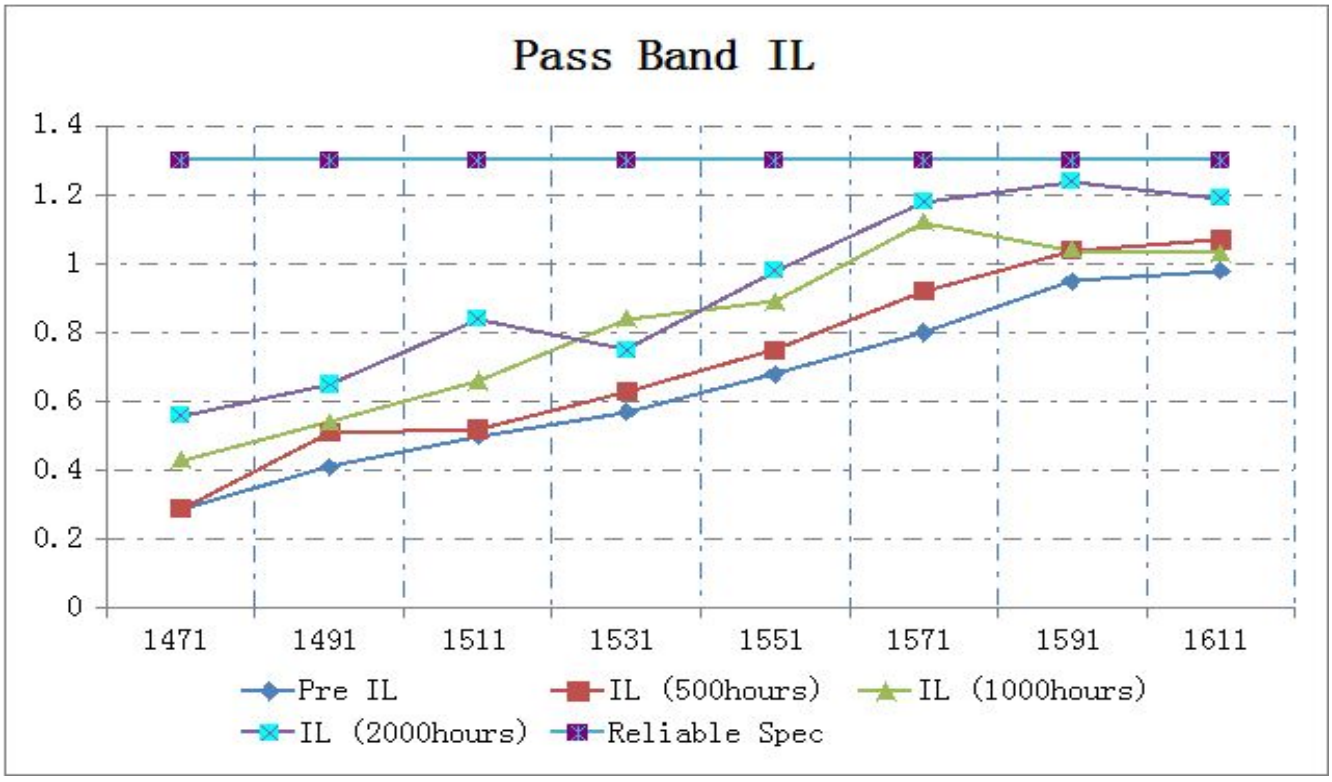
(5) Fujikura FSM-30S fiber fusion plicer ?

(6) CleaverThird ?

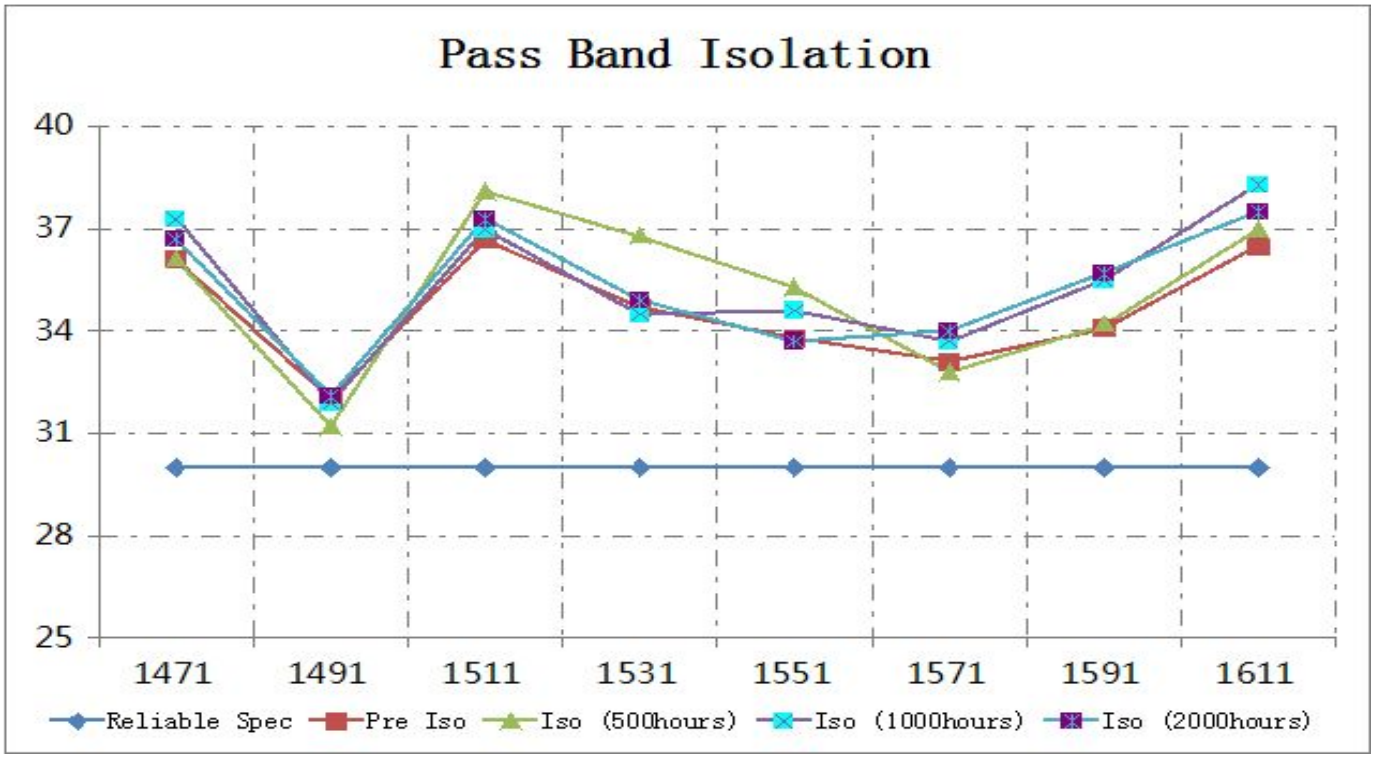
(7) Ring Road polarization Control

TEST DATA FOR TEMPERATURE CYCLING

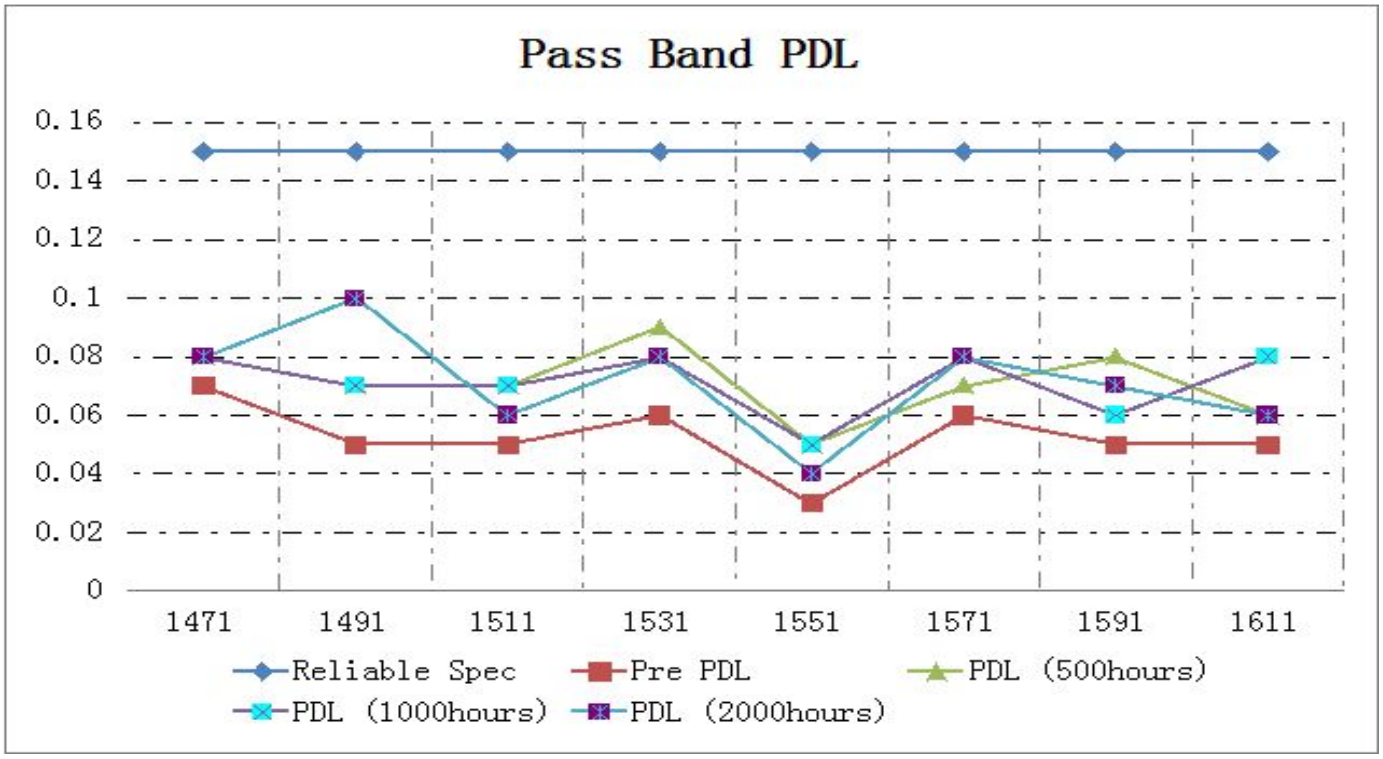
Pass Band IL										
Item	Reliable Spec	CW	Pre IL	IL (500hours)	▵ IL (500-Pre)	IL (1000hours)	▵ IL (1000-Pre)	IL (2000hours)	▵ IL (2000-Pre)	Pass /Fail
RB02	1.3	1471	0.29	0.29	0	0.43	0.14	0.56	0.27	Pass
	1.3	1491	0.41	0.51	0.1	0.54	0.13	0.65	0.24	
	1.3	1511	0.5	0.52	0.02	0.66	0.16	0.84	0.34	
	1.3	1531	0.57	0.63	0.06	0.84	0.27	0.75	0.18	
	1.3	1551	0.68	0.75	0.07	0.89	0.21	0.98	0.3	
	1.3	1571	0.8	0.92	0.12	1.12	0.32	1.18	0.38	
	1.3	1591	0.95	1.04	0.09	1.04	0.09	1.24	0.29	
	1.3	1611	0.98	1.07	0.09	1.03	0.05	1.19	0.21	



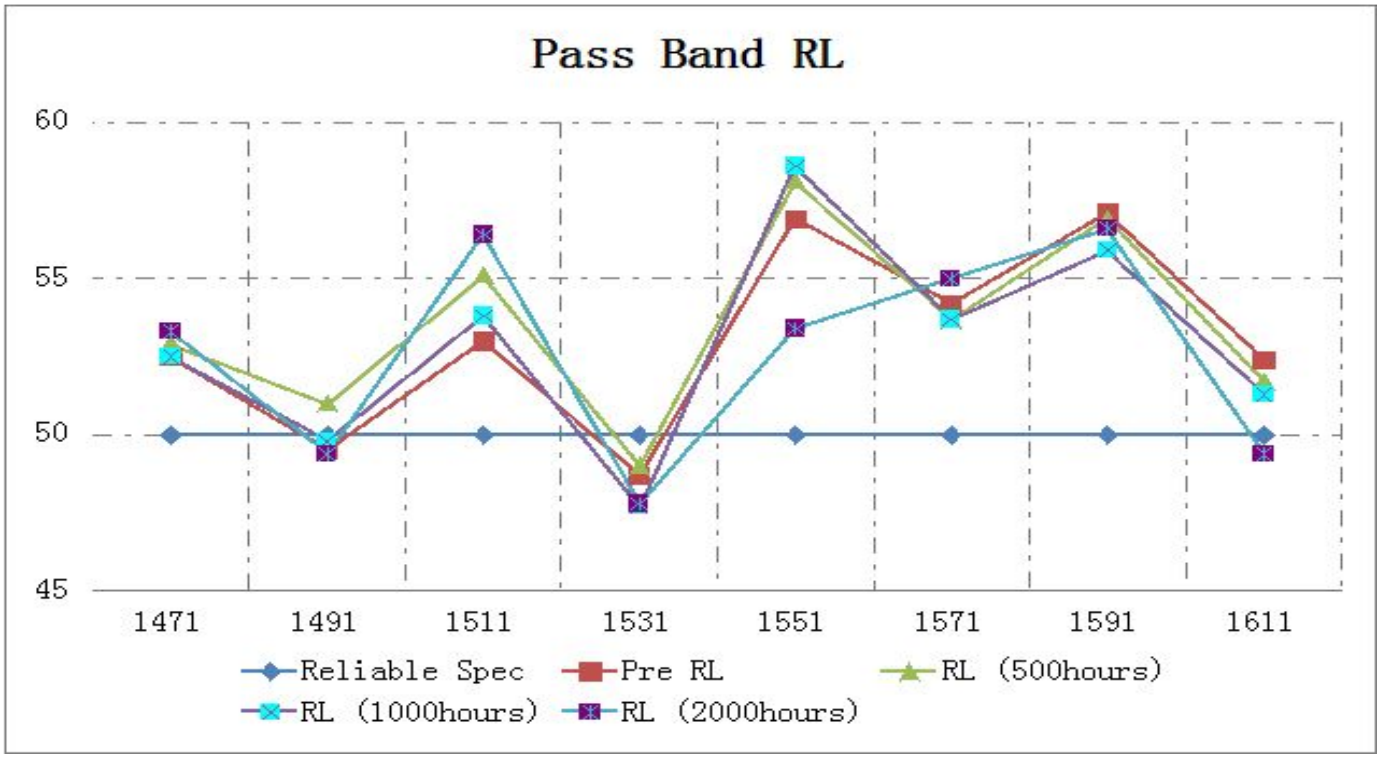
Pass Band Isolation										
Item	Reliable Spec	CW	Pre Iso	Iso (500hours)	▵ Iso (500-Pre)	Iso (1000hours)	▵ Iso (1000-Pre)	Iso (2000hours)	▵ Iso (2000-Pre)	Pass /Fail
RB02	30	1471	36.1	36.1	0	37.3	1.2	36.7	0.6	Pass
	30	1491	32	31.2	-0.8	31.9	-0.1	32.1	0.1	
	30	1511	36.7	38.1	1.4	37	0.3	37.3	0.6	
	30	1531	34.7	36.8	2.1	34.5	-0.2	34.9	0.2	
	30	1551	33.8	35.3	1.5	34.6	0.8	33.7	-0.1	
	30	1571	33.1	32.8	-0.3	33.7	0.6	34	0.9	
	30	1591	34.1	34.2	0.1	35.5	1.4	35.7	1.6	
	30	1611	36.5	37	0.5	38.3	1.8	37.5	1	



Pass Band PDL										
Item	Reliable Spec	CW	Pre PDL	PDL (500hours)	▵ PDL (500-Pre)	PDL (1000hours)	▵ PDL (1000-Pre)	PDL (2000hours)	▵ PDL (2000-Pre)	Pass /Fail
RB02	0.15	1471	0.07	0.08	0.01	0.08	0.01	0.08	0.01	Pass
	0.15	1491	0.05	0.07	0.02	0.07	0.02	0.1	0.05	
	0.15	1511	0.05	0.07	0.02	0.07	0.02	0.06	0.01	
	0.15	1531	0.06	0.09	0.03	0.08	0.02	0.08	0.02	
	0.15	1551	0.03	0.05	0.02	0.05	0.02	0.04	0.01	
	0.15	1571	0.06	0.07	0.01	0.08	0.02	0.08	0.02	
	0.15	1591	0.05	0.08	0.03	0.06	0.01	0.07	0.02	
	0.15	1611	0.05	0.06	0.01	0.08	0.03	0.06	0.01	



Pass Band RL										
Item	Reliable Spec	CW	Pre RL	RL (500hours)	▵ RL (500-Pre)	RL (1000hours)	▵ RL (1000-Pre)	RL (2000hours)	▵ RL (2000-Pre)	Pass /Fail
RB02	50	1471	52.5	52.9	0.4	52.5	0	53.3	0.8	Pass
	50	1491	49.5	51	1.5	49.8	0.3	49.4	-0.1	
	50	1511	53	55.1	2.1	53.8	0.8	56.4	3.4	
	50	1531	48.7	49	0.3	47.7	-1	47.8	-0.9	
	50	1551	56.9	58.1	1.2	58.6	1.7	53.4	-3.5	
	50	1571	54.2	53.7	-0.5	53.7	-0.5	55	0.8	
	50	1591	57.1	56.9	-0.2	55.9	-1.2	56.6	-0.5	
	50	1611	52.4	51.7	-0.7	51.3	-1.1	49.4	-3	



TEST CONCLUSIONS

The test results shown in the above tables indicate that Reliable" s Compact Size CWDM Module have met the Telcordia standard and Reliable" s own specifications.

1) The maximum delta insertion loss measured during and after the test is 0.38 dB, which is better than Telcordia standard of +/-0.5 dB.

2) The maximum isolation variation is 2.1 dB, which is better than Telcordia standard of +/-5 dB.

3) The maximum PDL measured during and after the test is 0.05 dB, which is better than Reliable" s specification of < 0.15 dB. The maximum PDL variation is 0.05dB, which is better than Telcordia standard of +/-0.05dB.

4) The minimum return loss measured during and after the test is 47.7 dB for all ports, which meets Reliable" s specification of ≮ 45 dB. The maximum return loss variation is 3.5dB for all ports, which is better than Telcordia standard of +/-5dB.

5) Visual inspection shows no physical damage after the test.

THEREFORE, ALL SAMPLES MET RELIABLE INTERNAL SPECIFICATIONS AND PASSED THE TEMPERATURE CYCLING TEST UNDER THE CONDITIONS OF TELCORDIA STANDARDS.

4.3 WATER IMMERSION

TEST OBJECTIVE:

To test the reliability performance of Compact Size CWDM Module after water immersion for 7 days.

TEST CONDITIONS:

Temperature :	43±2°C
Water PH:	5.5±0.5
Time:	7 days
Sample size:	1 pcs
Readout:	0/7days

TEST EQUIPMENT:

(1) Agilent 81960 tunable laser source;

(2) 1x2 50:50 fused fiber coupler;

(3) Agilent 8153A power meter;

(4) Fujikura FSM-30S fiber fusion plicer ;

(5) Cleaver;

(6) Thir

d Ring Road polarization Control

(7) The

rmometer ?

(8) Wat

er tank

(9) PH

test paper

TEST DATA FOR WATER IMMERSION

Water Immersion Test										
	CW	Pre IL	Post IL	Pre ISover PBA	Post ISover PBA	Pre PDL	Post PDL	Pre RL	Post RL	Pass / Fail
Spec		<1.3	<1.3	>30	>30	<0.15	<0.15	>50	>50	
RB03	1471	0.29	0.32	33.8	35.3	0.05	0.06	58.9	59.4	Pass
	1491	0.4	0.51	36.7	36.3	0.05	0.07	55	55.7	Pass
	1511	0.53	0.62	37.3	38.5	0.04	0.07	54.7	55.2	Pass
	1531	0.58	0.6	36	33.7	0.08	0.11	56.3	59.1	Pass
	1551	0.7	0.83	37.6	38.3	0.02	0.03	50	51.4	Pass
	1571	0.79	0.89	34.1	35.6	0.04	0.06	57.5	54.1	Pass
	1591	0.86	0.97	38.8	39.9	0.04	0.05	55.3	55.8	Pass
	1611	1	1.13	35	35.3	0.04	0.07	58.5	58.1	Pass
	Max	◆ IL	0.13	◆ Iso	1.5	◆ PDL	0.03	◆ RL	2.8	
	AVERAGE		0.09		0.45		0.02		0.325	
	AVEDEV		0.0325		0.9375		0.0075		1.1125	

TEST CONCLUSIONS

The test results shown in the above tables indicate that Reliable" s Compact Size CWDM Module have met the Telcordia standard and Reliable" s own specifications.

1) The maximum delta insertion loss measured during and after the test is 0.13 dB, which is better than Telcordia standard of +/-0.3 dB.

2) The maximum isolation variation is 1.5 dB, which meets Telcordia standard of +/-3dB.

3) The maximum PDL measured during and after the test is 0.03dB, which is better than Reliable" s specification of < 0.15 dB. The maximum PDL variation is 0.01dB, which is better than Telcordia standard of +/-0.05dB.

4) The minimum return loss measured during and after the test is 50 dB for all ports, which is better than Reliable" s specification of ≮ 50 dB. The maximum return loss variation is 2.8 dB for all ports, which is better than Telcordia standard of +/-5dB.

5) Visual inspection shows no physical damage after the test.

THEREFORE, ALL SAMPLES MET RELIABLE INTERNAL SPECIFICATIONS AND PASSED THE WATER IMMERSION TEST UNDER THE CONDITIONS OF TELCORDIA STANDARDS.

4.4 VIBRATION TEST

TEST OBJECTIVE:

To test the reliability performance of Compact Size CWDM Module after vibration .

TEST CONDITIONS:

Vibration type:	Sinusoidal
Frequency:	Range 10 to 2,000 Hz
Amplitude:	1.52mm
Sweep time:	10 to 2,000 Hz and returned to 10 in 20 minutes.
Duration:	Sweep cycle performed 12 times in each of three mutually perpendicular directions, total of 36 times (12 h)
Sample size:	1 pcs
Readout:	Initial, after

TEST EQUIPMENT:

(1) Agil ent 81960 tunable laser source;

(2) 1x2 50:50 fused fiber coupler;

(3) Agil ent 8153A power meter;

(4) Fuji kura FSM-30S fiber fusion plicer ;

(5) Clea ver;

(6) Thir d Ring Road polarization Control

(7) Elec tric magnetic vibration machine , SM-105-MP

TEST DATA FOR VIBRATION

Vibration Test										
	CW	Pre IL	Post IL	Pre ISover PBA	Post ISover PBA	Pre PDL	Post PDL	Pre RL	Post RL	Pass / Fail
Spec		<1.3	<1.3	>30	>30	<0.15	<0.15	>50	>50	

	1471	0.3	0.43	33.5	34.3	0.06	0.07	50.4	51.4	Pass
	1491	0.38	0.46	39.9	41.8	0.04	0.04	54.1	57.1	Pass
	1511	0.51	0.75	37.8	37.9	0.05	0.05	52.1	51.8	Pass
	1531	0.61	0.74	36.3	37	0.07	0.08	52.4	52.1	Pass
	1551	0.69	0.81	35.4	35.5	0.05	0.08	58.9	59.5	Pass
RB04	1571	0.8	0.88	38	39.9	0.07	0.08	51.5	52.7	Pass
	1591	0.88	0.94	35.3	34.1	0.03	0.03	55.8	52.1	Pass
	1611	1.03	1.12	32.7	33.2	0.04	0.05	55.9	57.8	Pass
	Max		0.24		1.9		0.03		3	
	AVERAGE	◆ IL	0.11625	◆ Iso	0.6	◆ PDL	0.00875	◆ RL	0.425	
	AVEDEV		0.03875		0.725		0.0065625		1.39375	

TEST CONCLUSIONS

The test results shown in the above tables indicate that Reliable" s Compact Size CWDM Module have met the Telcordia standard and Reliable" s own specifications.

1) The maximum delta insertion loss measured during and after the test is 0.24 dB, which is better than Telcordia standard of +/-0.3 dB.

3) The maximum isolation variation is 1.9 dB, which is better than Telcordia standard of +/-3 dB.

4) The maximum PDL measured during and after the test is 0.08 dB, which is better than Reliable" s specification of < 0.15 dB. The maximum PDL variation is 0.03dB, which is better than Telcordia standard of +/-0.05dB.

5) The minimum return loss measured during and after the test is 50.4 dB for all ports, which is better than Reliable" s specification of ≮ 50 dB. The maximum return loss variation is 3.0 dB for all ports, which is better than Telcordia standard of +/-5 dB.

6) Visual inspection shows no physical damage after the test.

THEREFORE, ALL SAMPLES MET RELIABLE INTERNAL SPECIFICATIONS AND PASSED THE VIBRATION TEST UNDER THE CONDITIONS OF TELCORDIA STANDARDS.

4.5 IMPACT TEST

TEST OBJECTIVE:

To test the reliability performance of Compact Size CWDM Module after impact.

TEST CONDITIONS:

Acceleration:	500G, 1msec
Repetition:	5 times/direction
Sample Size:	1 pcs
Readout:	Initial, after

TEST EQUIPMENT:

(1) Agilent 81960 tunable laser source;

(2) 1x2 50:50 fused fiber coupler;

(3) Agilent 8153A power meter;

(4) Fujikura FSM-30S fiber fusion plicer ;

(5) Clever;

(6) Third Ring Road polarization Control

(7) Shock Tester Test Partner Software VER.2 Vs-400.1.5

TEST METHOD:

Fix the CCWDM Module on a board and then mount it inside a box filled with sand, bind the box tightly. Let the box drop freely 8 times from the height of 1.8 meters along the 3 perpendicular axes, which is considered 1 cycle. Repeat the cycle 5 times.

TEST DATA FOR IMPACT

Impact Test										
	CW	Pre IL	Post IL	Pre IS over PBA	Post IS over PBA	Pre PDL	Post PDL	Pre RL	Post RL	Pass / Fail
Spec		<1.3	<1.3	>30	>30	<0.15	<0.15	>50	>50	
RB05	1471	0.30	0.46	34.3	36.7	0.06	0.08	57.3	58.4	Pass
	1491	0.34	0.45	35.7	36.1	0.01	0.03	50.9	52.1	Pass
	1511	0.54	0.49	36.5	37.1	0.06	0.08	50.7	49.2	Pass
	1531	0.56	0.64	34.9	37.9	0.05	0.06	53.6	55.9	Pass
	1551	0.70	0.66	39.7	40.8	0.07	0.09	54.1	50.2	Pass
	1571	0.78	0.84	32.9	34.2	0.06	0.07	61.3	60.5	Pass
	1591	0.91	1.05	33.4	34	0.04	0.06	55.1	54.2	Pass
	1611	1.00	1.13	34.4	33.8	0.03	0.04	60.1	59.9	Pass
	Max	◆ IL	0.16	◆ Iso	3	◆ PDL	0.02	◆ RL	2.3	
	AVERAGE		0.07375		1.1		0.01625		-0.3375	
	AVEDEV		0.0628125		0.85		0.0046875		1.4375	

TEST CONCLUSIONS

The test results shown in the above tables indicate that Reliable" s Compact Size CWDM Module have met the Telcordia standard and Reliable" s own specifications.

1) The maximum delta insertion loss measured during and after the test is 0.16 dB, which is better than Telcordia standard of +/-0.3 dB.

2) The maximum isolation variation is 3dB, which meet Telcordia standard of +/-3dB.

3) The maximum PDL measured during and after the test is 0.08 dB, which is better than

Reliable" s specification of < 0.15 dB. The maximum PDL variation is 0.02 dB, which is better than Telcordia standard of +/-0.05dB.

4) The minimum return loss measured during and after the test is 50.7 dB for all ports, which is better than Reliable" s specification of ≮ 50 dB. The maximum return loss variation is 2.3 dB for all ports, which is better than Telcordia standard of +/-5dB.

6) Visual inspection shows no physical damage after the test.

THEREFORE, ALL SAMPLES MET RELIABLE INTERNAL SPECIFICATIONS AND PASSED THE IMPACT TEST UNDER THE CONDITIONS OF TELCORDIA STANDARDS.

4.6 Fiber PULL

TEST OBJECTIVE

To test the reliability performance of Compact Size CWDM Module after fiber pull.

TEST CONDITIONS:

1-2.2 lb., 1 minute hold, 5 sec, 3x

TEST EQUIPMENT:

(1) Agilent 81960 tunable laser source;

(2) 1x2 50:50 fused fiber coupler;

(3) Agilent 8153A power meter;

(4) Fujikura FSM-30S fiber fusion plicer ;

(5) Clever;

(6) Third Ring Road polarization Control

(7) Sundo instrument modern SN-50

TEST DATA FOR FIBER PULL

Fiber Pull										
	CW	Pre IL	Post IL	Pre IS over PBA	Post IS over PBA	Pre PDL	Post PDL	Pre RL	Post RL	Pass / Fail
Spec		<1.3	<1.3	>30	>30	<0.15	<0.15	>50	>50	
RB06	1471	0.29	0.32	37.8	38.6	0.02	0.04	54.3	51.9	Pass
	1491	0.4	0.46	33.4	34.4	0.04	0.04	55.3	54.9	Pass
	1511	0.49	0.56	34.6	36.4	0.06	0.05	54.4	53.8	Pass
	1531	0.63	0.77	33.4	33.3	0.02	0.04	61.8	60.7	Pass
	1551	0.7	0.8	36.1	37.7	0.06	0.07	54.6	54	Pass
	1571	0.8	0.86	36.2	36.2	0.05	0.06	56.9	57.1	Pass
	1591	0.93	1.02	38	36.9	0.02	0.05	58.8	56.4	Pass
	1611	1.01	1.19	35.7	37.4	0.04	0.05	59	57.5	Pass
	Max	◆ IL	0.18	◆ Iso	1.8	◆ PDL	0.03	◆ RL	2.4	
	AVERAGE		0.09125		0.7125		0.01125		1.15	
	AVEDEV		0.0365625		0.834375		0.0090625		0.7125	

TEST CONCLUSIONS

The test results shown in the above tables indicate that Reliable" s Compact Size CWDM Module have met the Telcordia standard and Reliable" s own specifications.

1) The maximum delta insertion loss measured during and after the test is 0.18 dB, which is better than Telcordia standard of +/-0.3 dB.

2) The maximum isolation variation is 1.8dB, which meets Telcordia standard of +/-3dB.

3) The maximum PDL measured during and after the test is 0.07 dB, which is better than Reliable" s specification of < 0.15 dB. The maximum PDL variation is 0.03dB, which is

better than Telcordia standard of +/-0.05dB.

4) The minimum return loss measured during and after the test is 51.9 dB for all ports, which meets Reliable" s specification of ≮ 50 dB. The maximum return loss variation is 2 .4 dB for all ports, which is better than Telcordia standard of +/-5 dB.

5) Visual inspection shows no physical damage after the test.

THEREFORE, ALL SAMPLES MET RELIABLE INTERNAL SPECIFICATIONS AND PASSED THE FIBER PULL TEST UNDER THE CONDITIONS OF TELCORDIA STANDARDS.