AN141

Bidirectional Multifiber Insertion and Return Loss Testing Using OP940 and OP721

Software and cable configurations that will yield high quality return loss measurements

Overview

With 100G Ethernet and beyond quickly becoming the standard for the fiber optics communication industry, many cable manufacturers want to be able to test multifiber cables with relative speed and ease. Using an OP940 and OP721 with OPL-MAX, an operator can test bidirectional insertion loss and return loss on high-fiber-count cables.

The test setup should be as follows:

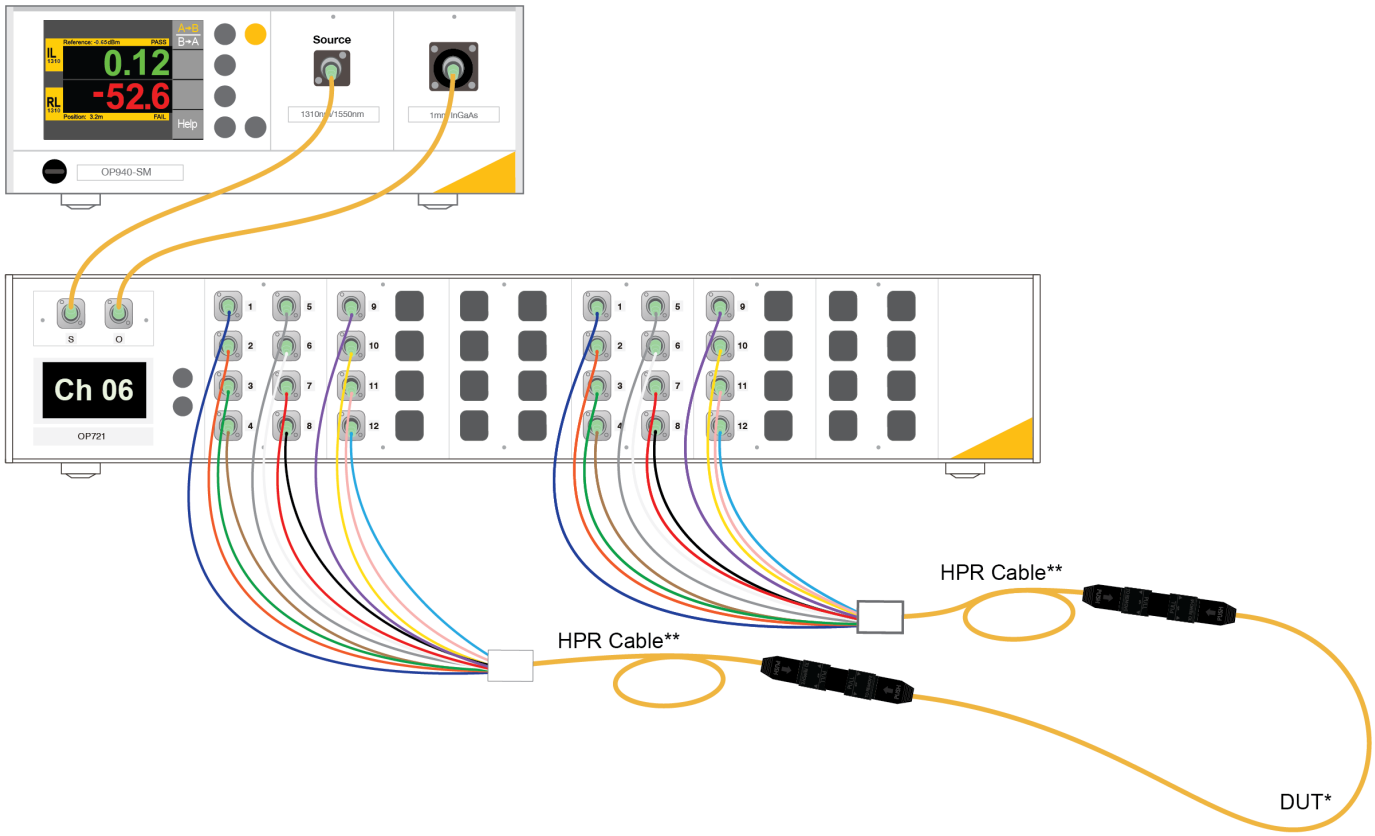


Figure 1: Test setup for measuring IL/RL bidirectionally for multiple channels

The OP940 Insertion Loss and Return Loss Test System connects to the input and output of the OP721 Bidirectional Optical Switch. HPR cables are then connected to the switch channels of the OP721 (up to 24 channels in each direction) which then connect to fanouts with the DUT residing between these fanouts; an MPO ribbon fiber DUT is used in this illustration.

**DUT: Device Under Test*
***HPR: High Performance Reference Cable*

SANTEC CORPORATION
5823 Ohkusa-Nenjozaka, Komaki,
Aichi 485-0802, Japan
+81-568-79-3536

www.santec.com
The Photonics Pioneer

SANTEC USA CORPORATION
USA Toll Free +1-800-726-8321

SANTEC EUROPE LIMITED
Tel. +44-20-3176-1550

OPL-MAX Test Sequence

The test configuration in OPL-Max is the same for this equipment setup as it is for the setup outlined in Application Note 113. For a 12-fiber MPO cable, the sequence file should be as follows:

			Source Instrument				OPM						Return Loss		Alternate Reference						
Seq	Sequence Label	Source Instrument	Source Channel	WavelengthA	WavelengthB	OPM Rack	OPM Channel	Termination for Pass/Fail	Measurement Type	Delay	Comment	Reflection Number	Reference Channel	Reference Module	Reference Channel	14dB offset? 0=No, 1=Yes		Direction 1: A-B , 2: B-A	Assigned Source Channel	Assigned Power Meter
<num>	<string>	<num>	<num>	<num>	<num>	<num>	<num>													
1	Ch1 A-B	RL1	1	1310	1550	OPMRL1	1	2	1	0		1	1	OPMRL1	1	0		1	1	2
2	Ch2 A-B	RL1	2	1310	1550	OPMRL1	2	2	1	0		1	2	OPMRL1	2	0		1	1	2
3	Ch3 A-B	RL1	3	1310	1550	OPMRL1	3	2	1	0		1	3	OPMRL1	3	0		1	1	2
4	Ch4 A-B	RL1	4	1310	1550	OPMRL1	4	2	1	0		1	4	OPMRL1	4	0		1	1	2
5	Ch5 A-B	RL1	5	1310	1550	OPMRL1	5	2	1	0		1	5	OPMRL1	5	0		1	1	2
6	Ch6 A-B	RL1	6	1310	1550	OPMRL1	6	2	1	0		1	6	OPMRL1	6	0		1	1	2
7	Ch7 A-B	RL1	7	1310	1550	OPMRL1	7	2	1	0		1	7	OPMRL1	7	0		1	1	2
8	Ch8 A-B	RL1	8	1310	1550	OPMRL1	8	2	1	0		1	8	OPMRL1	8	0		1	1	2
9	Ch9 A-B	RL1	9	1310	1550	OPMRL1	9	2	1	0		1	9	OPMRL1	9	0		1	1	2
10	Ch10 A-B	RL1	10	1310	1550	OPMRL1	10	2	1	0		1	10	OPMRL1	10	0		1	1	2
11	Ch11 A-B	RL1	11	1310	1550	OPMRL1	11	2	1	0		1	11	OPMRL1	11	0		1	1	2
12	Ch12 A-B	RL1	12	1310	1550	OPMRL1	12	2	1	0		1	12	OPMRL1	12	0		1	1	2
13	Ch1 B-A	RL1	1	1310	1550	OPMRL1	1	2	1	0		1	1	OPMRL1	1	0		2	1	2
14	Ch2 B-A	RL1	2	1310	1550	OPMRL1	2	2	1	0		1	2	OPMRL1	2	0		2	1	2
15	Ch3 B-A	RL1	3	1310	1550	OPMRL1	3	2	1	0		1	3	OPMRL1	3	0		2	1	2
16	Ch4 B-A	RL1	4	1310	1550	OPMRL1	4	2	1	0		1	4	OPMRL1	4	0		2	1	2
17	Ch5 B-A	RL1	5	1310	1550	OPMRL1	5	2	1	0		1	5	OPMRL1	5	0		2	1	2
18	Ch6 B-A	RL1	6	1310	1550	OPMRL1	6	2	1	0		1	6	OPMRL1	6	0		2	1	2
19	Ch7 B-A	RL1	7	1310	1550	OPMRL1	7	2	1	0		1	7	OPMRL1	7	0		2	1	2
20	Ch8 B-A	RL1	8	1310	1550	OPMRL1	8	2	1	0		1	8	OPMRL1	8	0		2	1	2
21	Ch9 B-A	RL1	9	1310	1550	OPMRL1	9	2	1	0		1	9	OPMRL1	9	0		2	1	2
22	Ch10 B-A	RL1	10	1310	1550	OPMRL1	10	2	1	0		1	10	OPMRL1	10	0		2	1	2
23	Ch11 B-A	RL1	11	1310	1550	OPMRL1	11	2	1	0		1	11	OPMRL1	11	0		2	1	2
24	Ch12 B-A	RL1	12	1310	1550	OPMRL1	12	2	1	0		1	12	OPMRL1	12	0		2	1	2

Figure 2: Sequence file for 12-fiber MPO cable

As with all sequence files, Column D will specify which fiber in the cable will be tested, Columns E and F will specify wavelength(s) and Columns G and H specify the power meter and channel used for testing. In the case of the bidirectional test with an OP940 and OP721, these Columns G and H, as above, should read “OPMRL1” and “1-12”, respectively.

Since the distance from the front panel to the RL reference is not guaranteed to be the same for both directions, it is advised that Column N appears as shown above. The “1” in the first channel in the forward direction (coming from the A-B port) and a “-1” for the remaining channels in that direction will allow the RL Reference to be copied from the first channel to all forward direction channels. Likewise, a “2” and “-2” for the reverse direction (coming from the B-A port) channels will have the same effect, but allow for these channels to be referenced separately from the forward channels.

Columns S,T, and U are the only fundamental departure from a standard sequence file since it is not necessary to include on unidirectional sequence files. For all forward direction channels, columns should read “1” and for all reverse direction channels, this column should read “2”.

SANTEC CORPORATION
5823 Ohkusa-Nenjozaka, Komaki,
Aichi 485-0802, Japan
+81-568-79-3536

www.santec.com
The Photonics Pioneer

SANTEC USA CORPORATION
USA Toll Free +1-800-726-8321

SANTEC EUROPE LIMITED
Tel. +44-20-3176-1550

Referencing Instructions

Bidirectional Insertion Loss Reference

To properly reference insertion loss bidirectionally, connect the simplex cables from the source and OPM ports on the OP940 to the corresponding ports on the OP721, labeled S and O respectively. Do not use an external power meter for reference. Connect the reference fanout from the left-hand side to the reference fanout on the right-hand side via a mating adapter and perform an insertion loss reference in the software. This will perform two separate reference cycles—one for the left-to-right (A-B) direction and one for the right to left (B-A) direction.

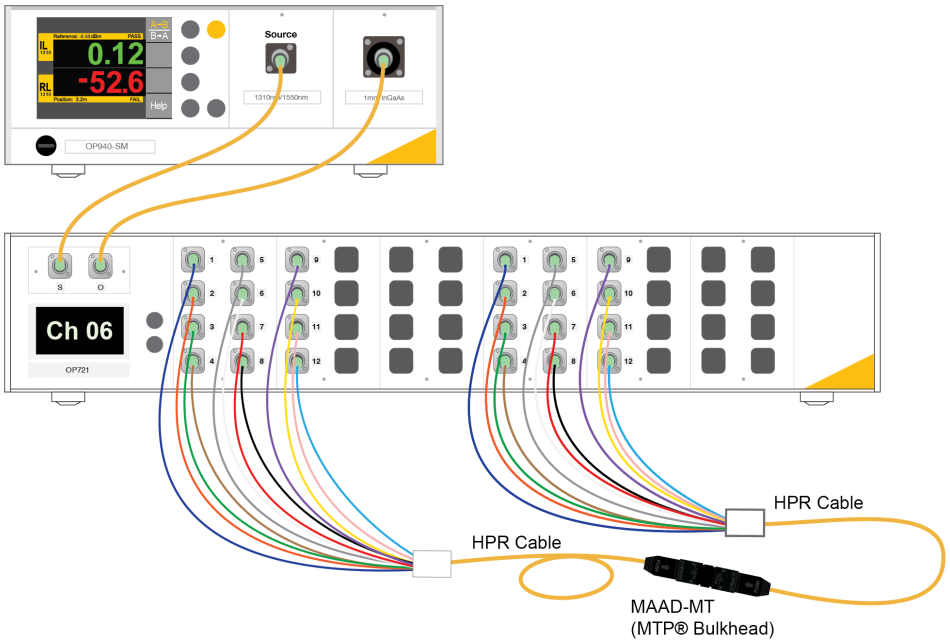
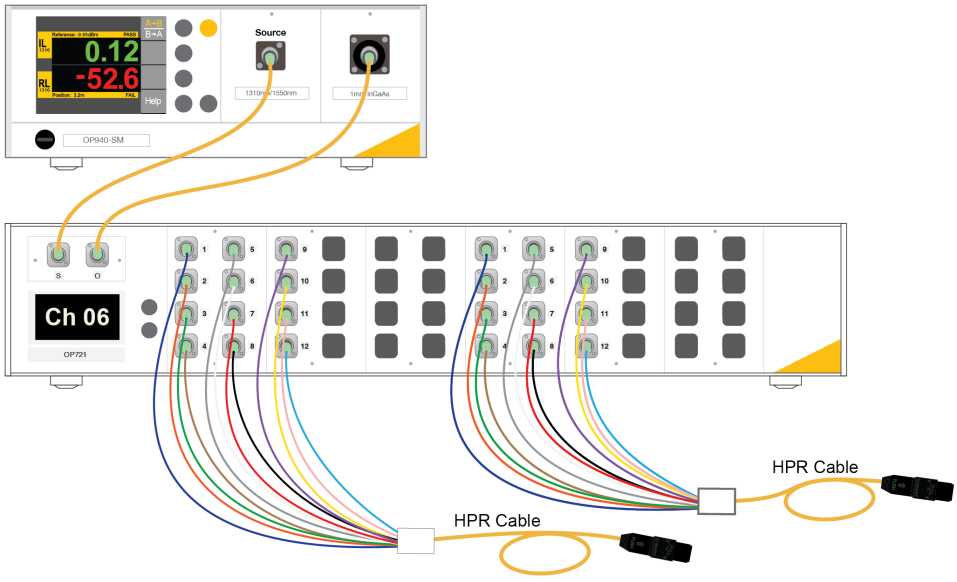


Figure 3: Test setup for measuring bidirectional Insertion Loss

Bidirectional Return Loss Reference

To reference return loss for a bidirectional test system, connect the system as above leaving end faces open between the two HPR cables to create the Fresnal reflection *(if either fanout is terminated in an APC connector, an APC-to-PC stub will need to be utilized to produce an adequate reference reflection)*. Once the reflection is established, perform a return loss reference cycle in the software. During the reference cycle, the unit will reference both in the A-B direction and the B-A direction and retain these distances separately for their respective measurement cycles.



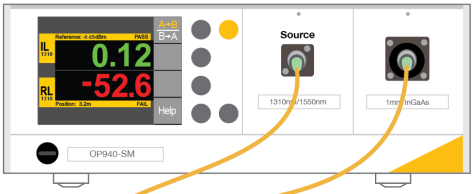
SANTEC CORPORATION
5823 Ohkusa-Nenjozaka, Komaki,
Aichi 485-0802, Japan
+81-568-79-3536

www.santec.com
The Photonics Pioneer

SANTEC USA CORPORATION
USA Toll Free +1-800-726-8321

SANTEC EUROPE LIMITED
Tel. +44-20-3176-1550

Measurement Instructions



Once the system has been referenced, place the device-under-test into the setup between the two fanouts (as illustrated on the left) and simply select the Test option. Following this, the software will test the cables in the forward direction and then the reverse direction.

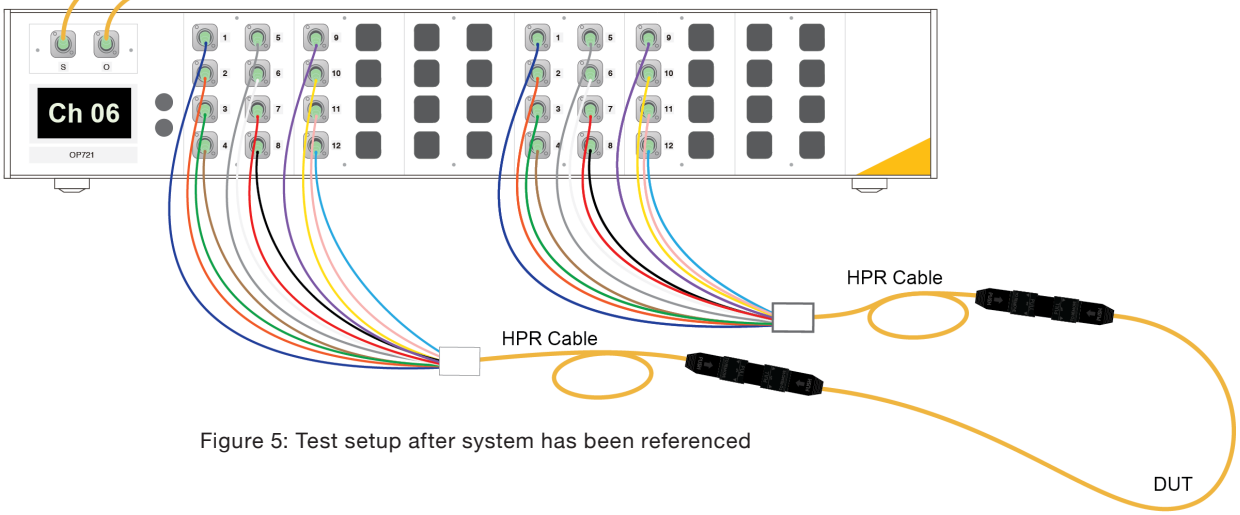
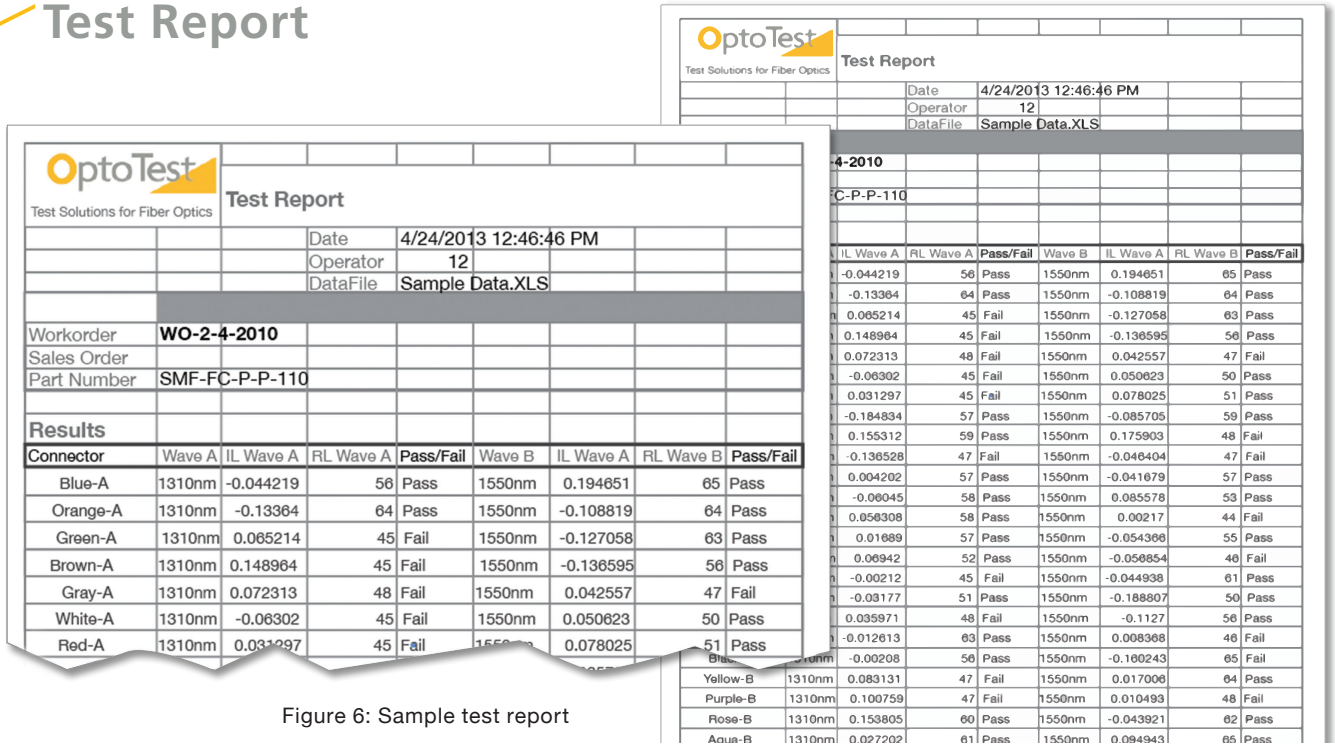


Figure 5: Test setup after system has been referenced

Test Report



OptoTest
Test Solutions for Fiber Optics

Test Report

Date	4/24/2013 12:46:46 PM
Operator	12
DataFile	Sample Data.XLS
Workorder	WO-2-4-2010
Sales Order	
Part Number	SMF-FC-P-P-110

Results

Connector	Wave A	IL Wave A	RL Wave A	Pass/Fail	Wave B	IL Wave A	RL Wave B	Pass/Fail
Blue-A	1310nm	-0.044219	56	Pass	1550nm	0.194651	65	Pass
Orange-A	1310nm	-0.13364	64	Pass	1550nm	-0.108819	64	Pass
Green-A	1310nm	0.065214	45	Fail	1550nm	-0.127058	63	Pass
Brown-A	1310nm	0.148964	45	Fail	1550nm	-0.136595	56	Pass
Gray-A	1310nm	0.072313	48	Fail	1550nm	0.042557	47	Fail
White-A	1310nm	-0.06302	45	Fail	1550nm	0.050623	50	Pass
Red-A	1310nm	0.031297	45	Fail	1550nm	0.078025	51	Pass
Yellow-B	1310nm	0.083131	47	Fail	1550nm	0.017008	64	Pass
Purple-B	1310nm	0.100759	47	Fail	1550nm	0.010493	48	Fail
Rose-B	1310nm	0.153805	60	Pass	1550nm	-0.043921	62	Pass
Aqua-B	1310nm	0.027202	61	Pass	1550nm	0.094943	65	Pass

Figure 6: Sample test report

SANTEC CORPORATION
5823 Ohkusa-Nenjozaka, Komaki,
Aichi 485-0802, Japan
+81-568-79-3536

www.santec.com
The Photonics Pioneer

SANTEC USA CORPORATION
USA Toll Free +1-800-726-8321

SANTEC EUROPE LIMITED
Tel. +44-20-3176-1550