

O-04 BER Characterization

ENGINEER: _____Sonnichsen_____

DATE: _____8/2004_____

COMMENTS:

This test was aborted since it was subsumed by test O-03 SUBMARINE CABLE BER on the II De Re

O-04 BER Characterization

The ability to port data at the proper Bit Error Rate is to be tested. This test is comprised of a physical layer and link layer (ISO-0,1) BER test to insure that the optical and electrical media are capable of conducting gigabit ethernet frames with an error rate of less than 1 error in 10^{12} . Also a Layer4 Data Rate test will be performed. This test will be performed on various lengths of SMF28E cable in the lab.

- 1) The test will be performed with both pre-amp and booster EDFAs
- 2) Several tests will be performed to determine the maximum optical reach of the equipment over the test fibers
- 3) Tests are done separately for the East then the West paths of the node

The required equipment for this test is:

- 1) Suitable gigabit ethernet BER optical test set
- 2) Rack Mounted MARS subsea node assembly completely fibered including Switches, NE optical assemblies, and EDFAs
- 3) SMF28E test fiber- spools of 4x50km 4x25km
- 4) Rack Mounted MARS shore station completely fibered including Switches, NE optical assemblies, and EDFAs
- 5) Optical Power Meter
- 6) Optical attenuators per following text
- 7) Optical Laser Source
- 8) LANforge Test Set

Possible Additional Tools:

- 1) Fusion splicer
- 2) Spare FC and SC connectors
- 3) FC and SC couplers

MARS
Org: WHOI
Engr: Fritz Sonnichsen
Date: 08/19/04

O-04 BER Characterization

Each of the 3 sea to shore channels will be tested, concurrently if BERT equipment is available via loopback techniques.

- > Proper fiber handling and safety techniques are assumed throughout and not further mentioned.
- > Use SM fiber for all loopbacks
- > **CAUTION!** We cannot discuss the optical test set configuration since this will vary with the unit procured for the test. However, be sure to insert an appropriate attenuator or you may damage the receiving MRTR transponder. Using a power meter insure that the output of the test set measured *after* the attenuator is at -6dBm or slightly less.
- > The MARS node will be tested in two stages-the east side and the west side. The test procedures are identical.

NOTE ON ATTENUATORS

In addition to the attenuator to the input to the EDFA, attenuators will be required on the inputs into the MRTRd units. This is to eliminate optical return loss. You must select attenuators compliant with the results for test O-05-Transponder. Failing to have this information attenuators sufficient to set the input signals to -10 dB may be used on all MRTRd inputs. Also you will need to attenuate the input into the BERT tester. Use the manufacturers guideline here.

PRELIMINARY SETUP TEST - OPTICAL BER TEST with Booster Amp

- 1) This test will verify basic setup of the BER tester
- 2) Using the following two diagrams (Setup 0), set up SM fiber loopbacks to complete the optical circuit
- 3) After setup run the BER test per the test-set vendor for 10 minutes
- 4) No errors should be detected.
- 5) If errors are detected chase the optical path with a power meter to insure proper connections. Check the power levels for proper attenuation

FIRST TEST - OPTICAL BER TEST with Booster Amp

- 1) This test will verify basic connectivity of the system. Start with 50km of fiber.
- 2) Using the two diagrams (Setup 1), set up SM fiber loopbacks to complete the optical circuit
- 3) After setup run the BER test per the test-set per vendor for 1/2 hours
- 4) No errors should be detected in 1/2 hour
- 5) Repeat this test for 100km, 125km and 150km.

SECOND TEST - OPTICAL BER TEST with Pre Amp

- 1) This test will verify basic connectivity of the system. Start with 50km of fiber.
- 2) Using the diagram Setup 2 and 2a, set up SM fiber loopbacks to complete the optical circuit
- 3) Remove the 1AEC28 booster amps from the prior test and reinsert the MGMFP-1AO pre-amp at the *receive* end of the fiber
- 4) After setup run the BER test per the test-set per vendor for 1/2 hours
- 5) No errors should be detected in 1/2 hour
- 6) Repeat this test for 100km, 125km and 150km.

O-04 BER Characterization

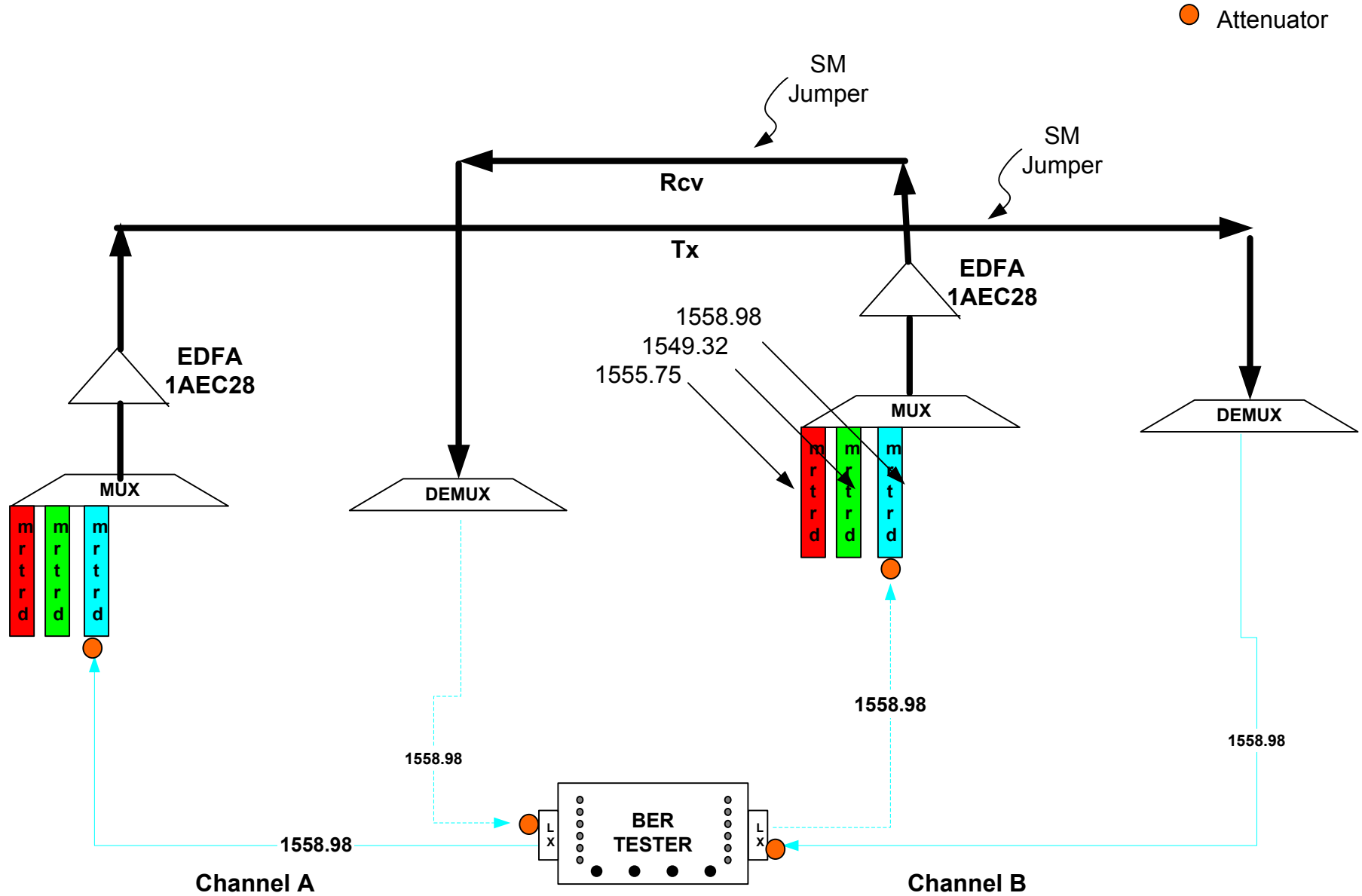
THIRD TEST - ELECTRICAL BER TEST with Booster Amp

- 1) Start with the maximum length of fiber that worked in the prior test.
- 2) Using the diagram Setup 4 set up SM fibers as shown. Note the loopback for the 3rd regeneration channel
- 3) Attach BER testers as available to each pair of GbE converters/SPFs
- 4) After setup run the BER test per the test-set vendor for 1 hour
- 5) No more than 1 error in 10^{12} should be detected Record the error number in the results table

FOURTH TEST - ELECTRICAL BER TEST with Pre-Amp

- 1) Start with the maximum length of fiber that worked in the prior test.
- 2) Using the diagram Setup 5 set up SM fibers as shown. Note the loopback for the 3rd regeneration channel
- 3) Attach BER testers as available to each pair of GbE converters/ SFPs
- 4) After setup run the BER test per the test-set vendor for 24 hours
- 5) No more than 1 error in 10^{12} should be detected Record the error number in the results table

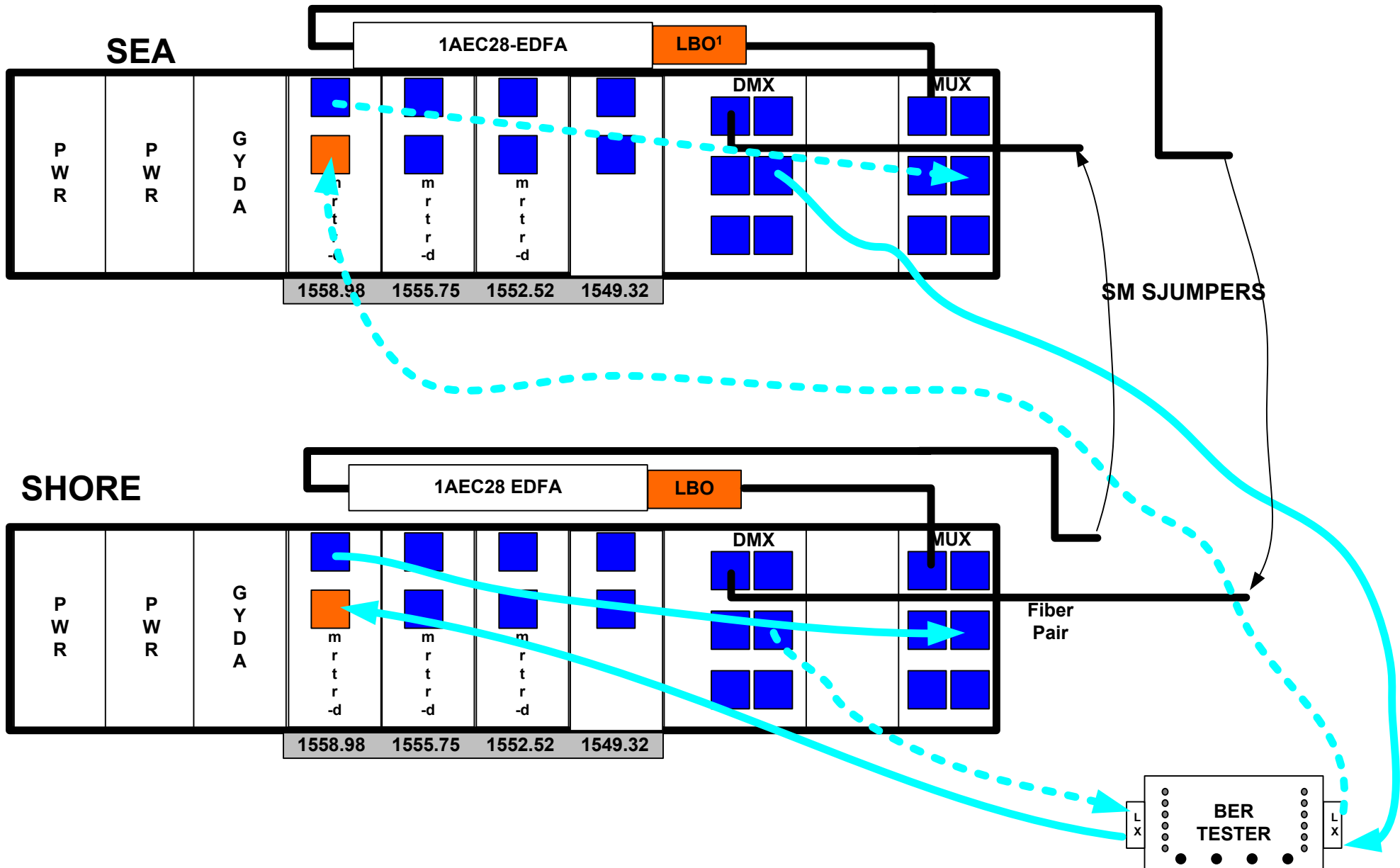
O-04 BER Characterization 0-Preliminary Setup



O-04 BER Characterization 0- Preliminary Setuo

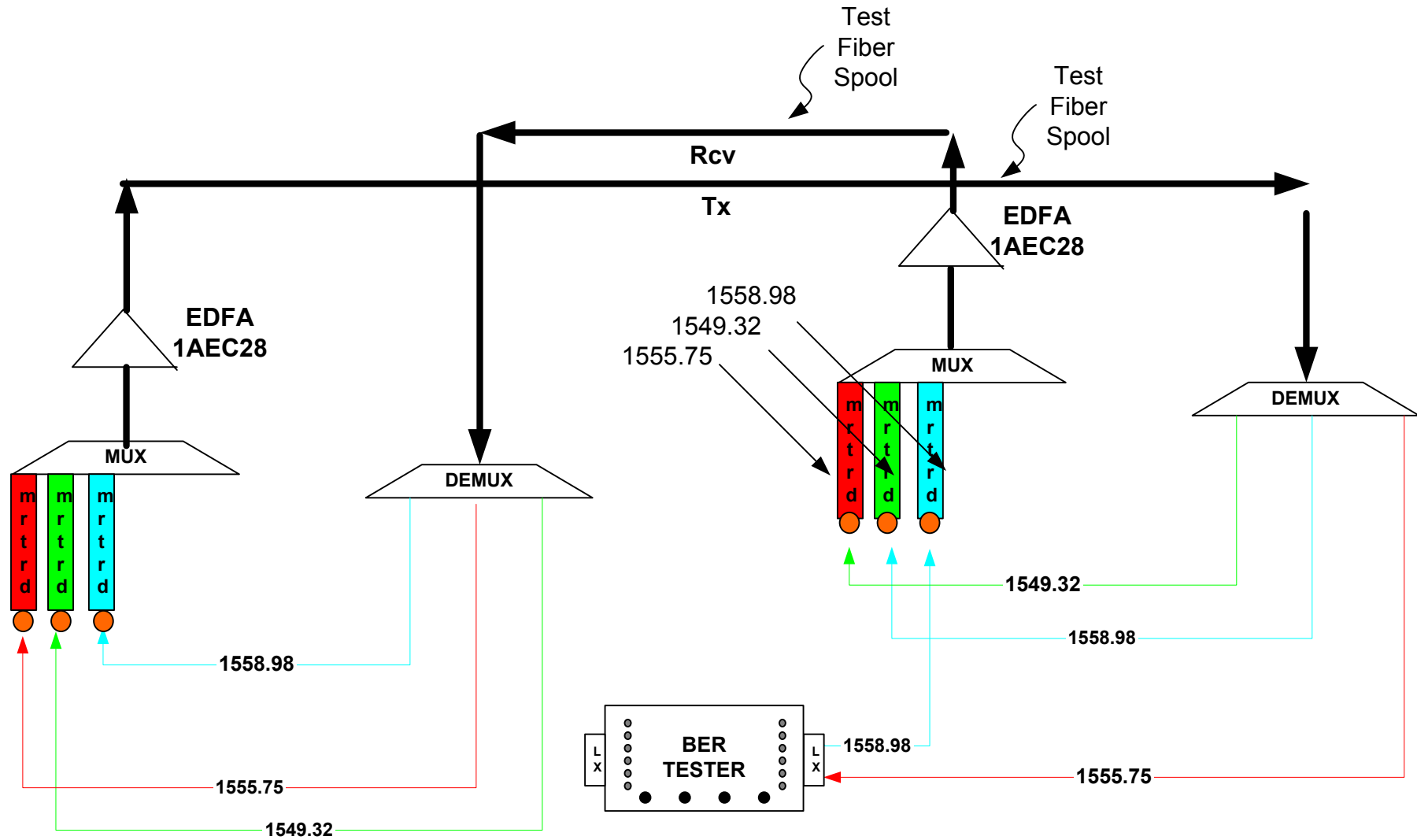
ORANGE PORTS ARE ATTENUATED PER PROCEDURE

USE SM FIBER FOR LOOPBACKS



O-04 BER Characterization 1-Booster Amplifier Test

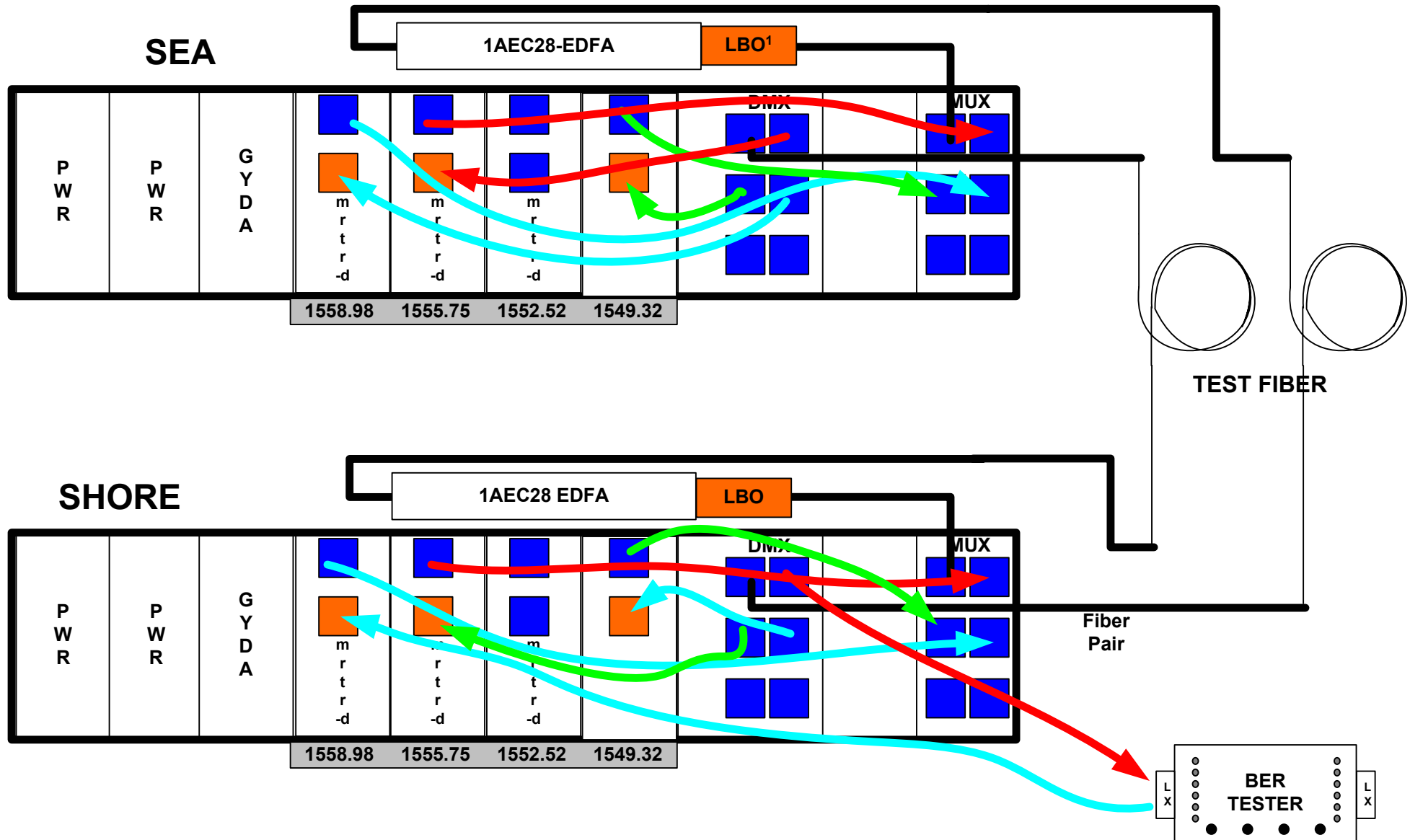
● Attenuator



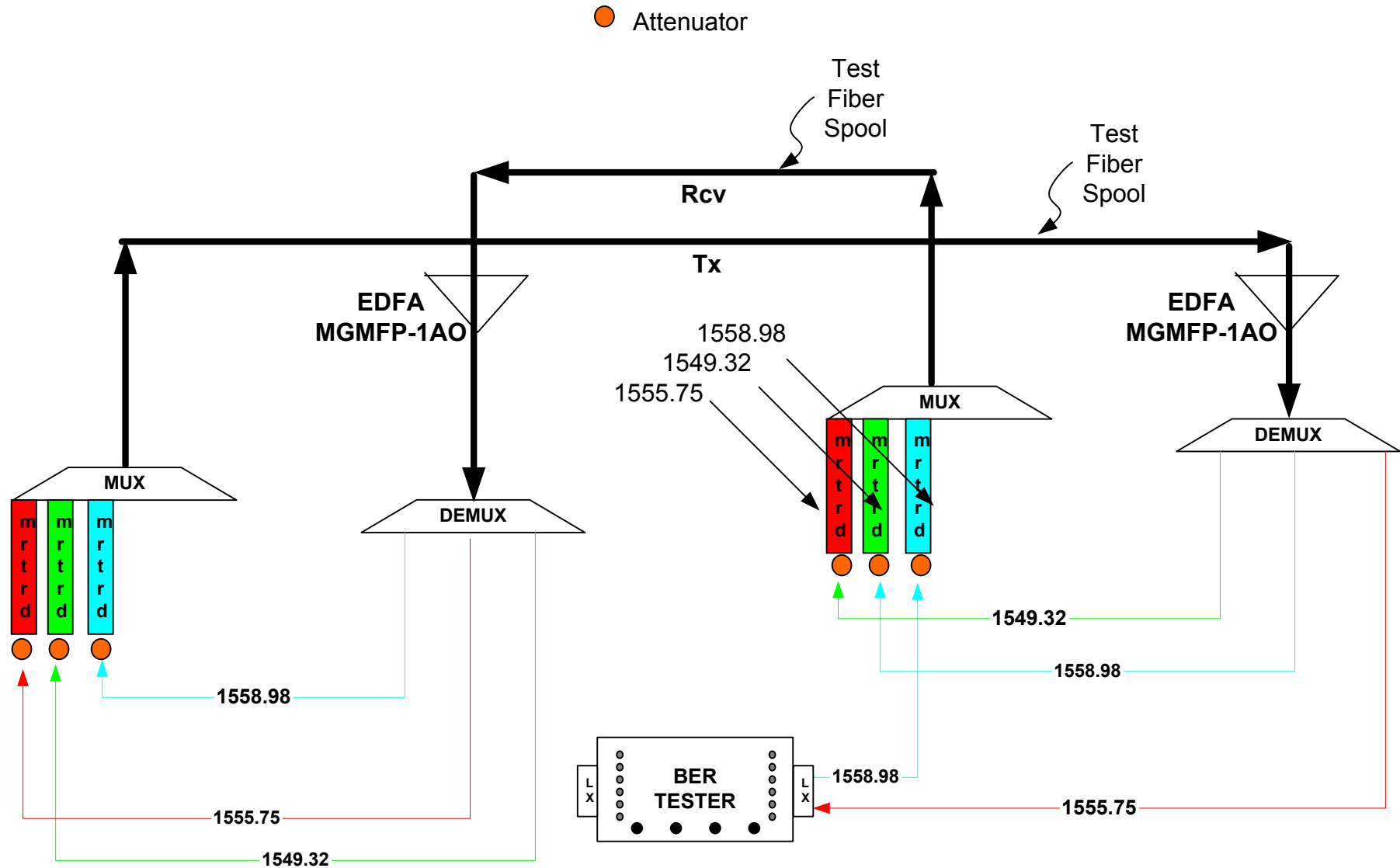
O-04 BER Characterization 1-Booster Amplifier Test

ORANGE PORTS ARE ATTENUATED PER PROCEDURE

USE SM FIBER FOR LOOPBACKS



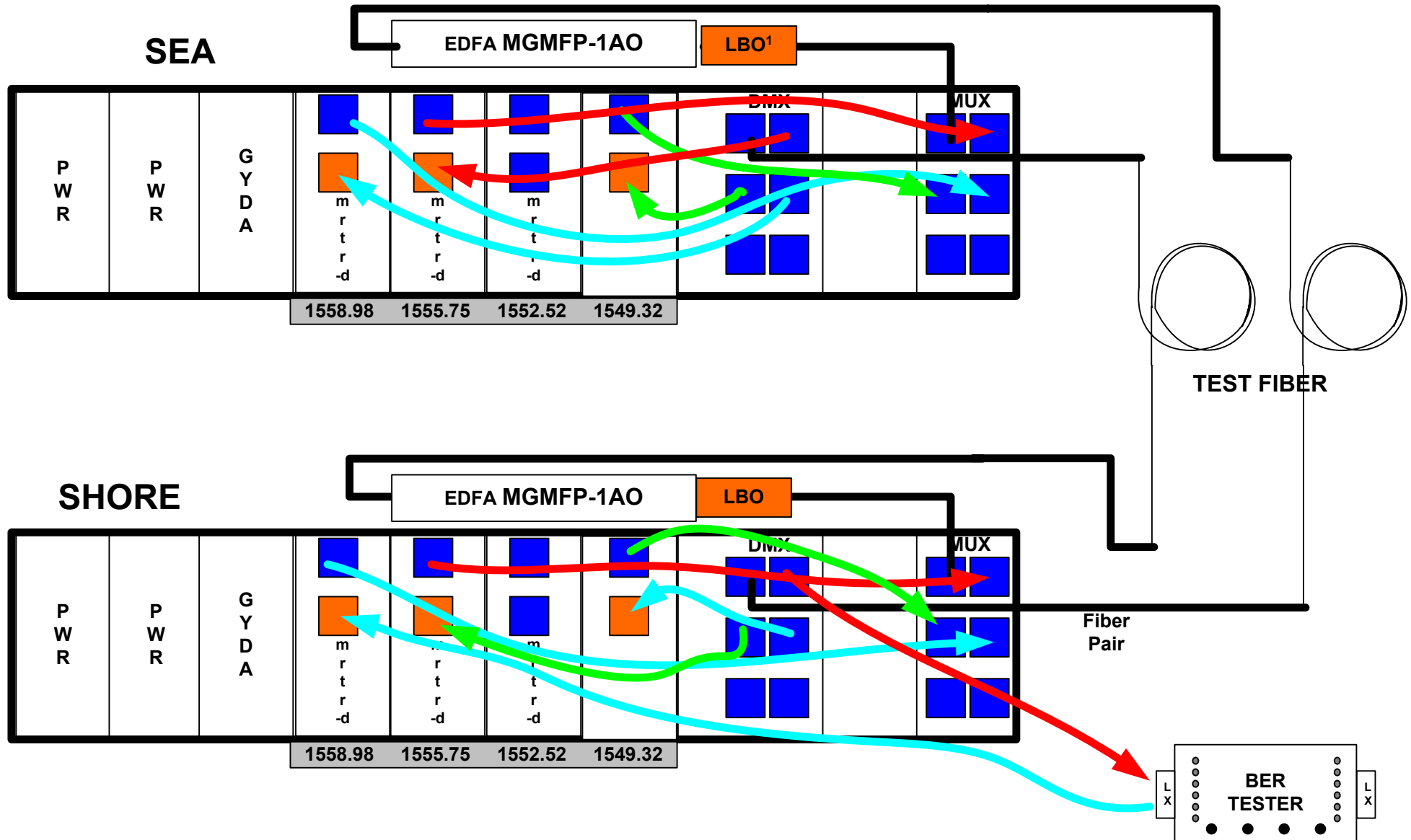
O-04 BER Characterization 2- Pre-Amplifier Test



O-04 BER Characterization 2- Pre-Amplifier Test

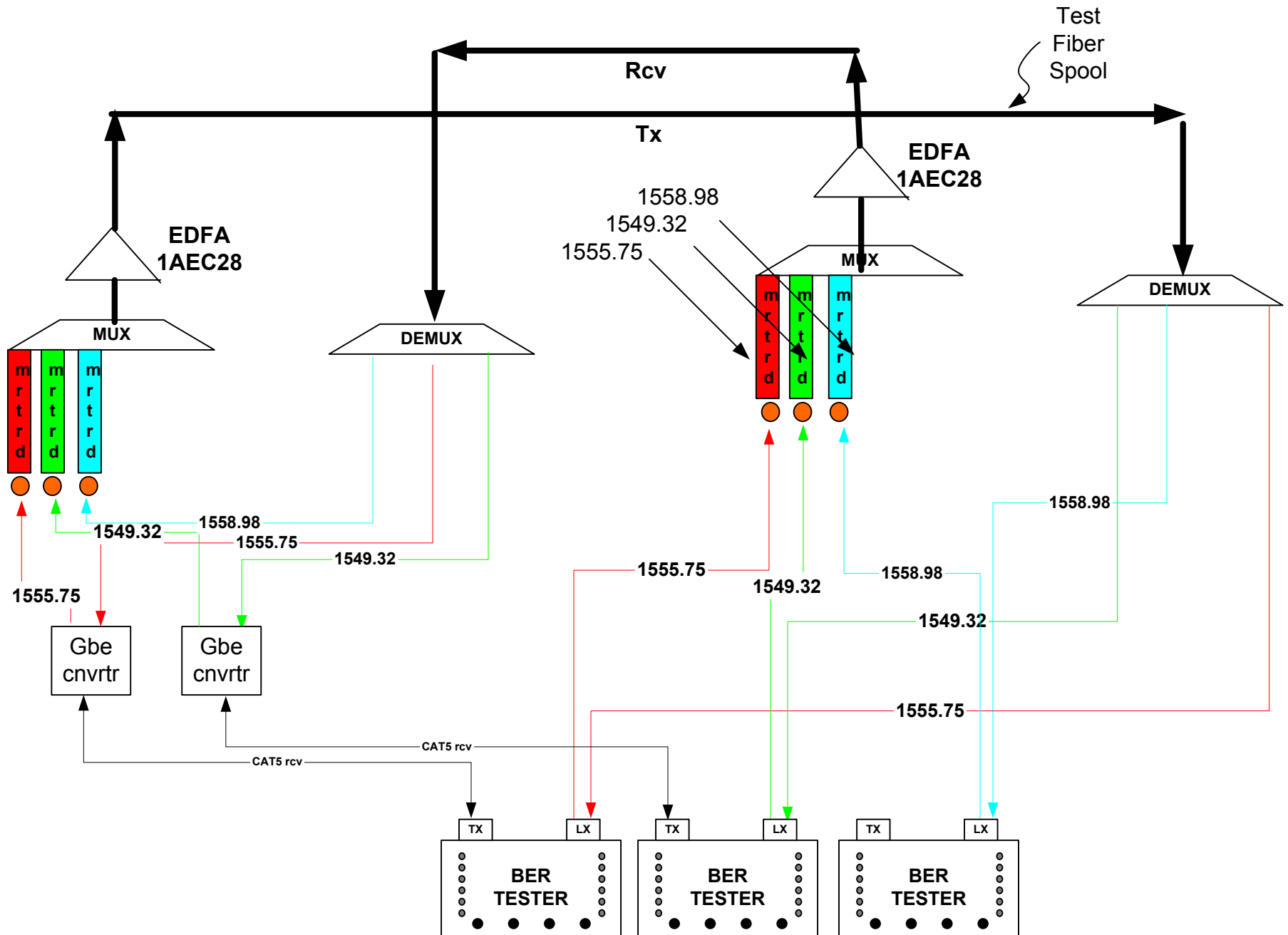
USE SM FIBER FOR LOOPBACKS

ORANGE PORTS ARE ATTENUATED PER PROCEDURE



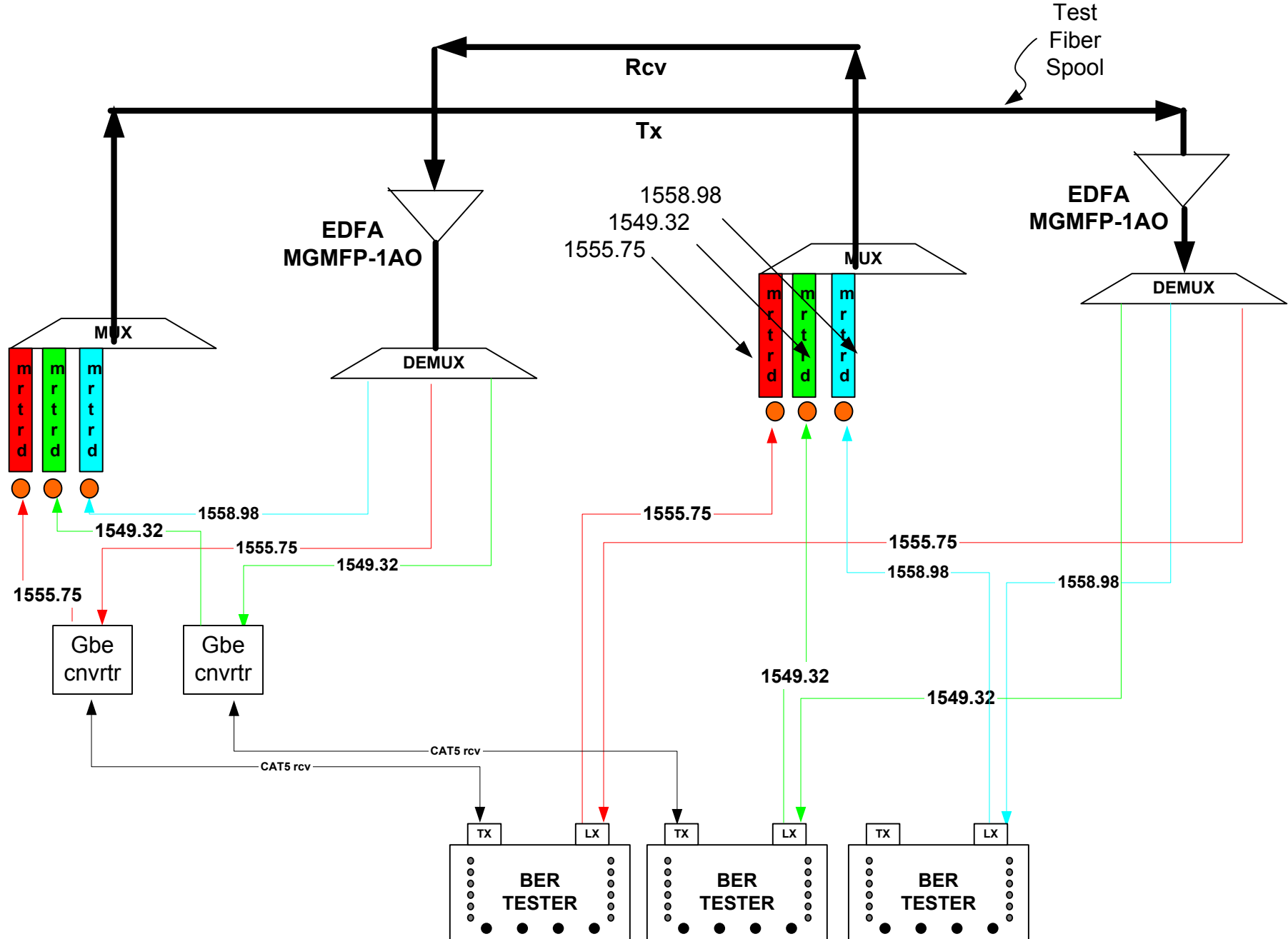
O-04 BER Characterization with Booster Amplifier

3- Electrical GbE Converters



O-04 BER Characterization with Pre - Amplifier

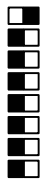
3- Electrical GbE Converters



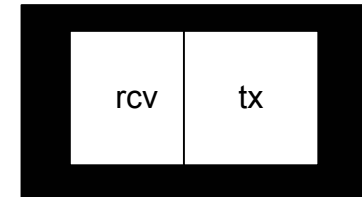
Some Useful Details about Optical Components

com-mon	1555.75
1549.32	1558.98
1552.52	upgrade

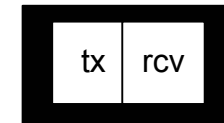
NE Mux and DeMux port layouts



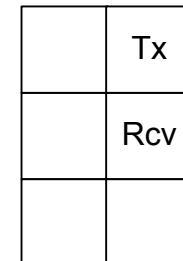
DIP settings for MRTRD in gB ether mode



CISCO GBIC Paths



CISCO SFP GBIC Paths



NE MR-TR-D15xx Port Layout

Some Important Optical Specs

Device	Sensitivity dBm	Overload dBm	Damage dBm	Output dBm	Loss /Gain dB
NE MRTRD	-20	-3	-1	-0 (1mW)	
NE MRTR	-25			-7.5	
NE MRTR enhancd	-3 to -19			6 (4mW)	
LX SFP ¹	-3 to -19			-3 to -9.5	
GbE Converter	-3 to -21			-3 to -9.5	
1EC28 EDFA		-6			+23
NE Mux/Demux					-3 per side
MARS Cable					-15

1 - SFP is same spec as a GBIC

NE Channels		
Channel	Wavelength	frequency Ghz
493	1549.32	193500
557	1555.75	192700
589	1558.98	192300

O-04 BER Characterization- Results Sheet- GENERAL

GENERAL	
RUN	01
Cable Length	
Ambient Temp.	72
COMMENTS	

PRELIMINARY SETUP TEST-Channel A				
Xpondr	Duration	Attenuation	# Errors	Injection
1559.98	20h 42m	10 dB	0	-12.95
1555.75	15m	10 dB		-13.04
1549.32				

PRELIMINARY SETUP TEST-Channel B				
Xpondr	Duration	Attenuation	# Errors	Injection
1559.98	20h 42m	5 dB	0	-9.89
1555.75	15m	5 dB	0	-9.98
1549.32				

O-04 BER Characterization- Results Sheet

FIRST TEST - OPTICAL BER TEST with Booster Amp

Duration of Run	
Number of Errors	
1559.98 input power	
1555.75 input power	
1549.32 input power	

SECOND TEST - OPTICAL BER TEST with Pre Amp

Duration of Run	
Number of Errors	
1559.98 input power	
1555.75 input power	
1549.32 input power	

THIRD TEST - ELECTRICAL BER TEST- booster Amp

Duration of Run	
Number of Errors	
1559.98 input power	
1555.75 input power	
1549.32 input power	

FOURTH TEST - ELECTRICAL BER TEST - pre Amp

Duration of Run	
Number of Errors	
1559.98 input power	
1555.75 input power	
1549.32 input power	

This portion of the test was omitted since it was subsumed by the tests performed on the Il De Re with the actual optical cable in place