Champion ONE
23400 Mercantile Road, Ste 2,
Beachwood, OH 44122
P: 800-860-7466/F: 216-831-2541
sales@championone.net

I. Optical Return Loss (ORL) Test:

Optical Return Loss (ORL) testing is of concern to transmission systems with laser transmitters, and any system with a high connector density. Return loss is measured with a return loss meter, and while back reflections of individual components can be measured with an OTDR, it is of limited accuracy, and in some situations the back reflections may cause saturation of the instrument input amplifier, making measurement impossible.

Measures:

- The total light reflected back to the starting point caused by the system components of the span under test
- Total fiber span ORL value
- Total reflectance of each component within the system under test

Tested with:

- Power Meter and Light Source combination at 1550nm

Specification:

> 26 dB return loss for SM connector
> 20 dB return loss for MM connectors

Correction Method:

- Remove the source by using low reflection connectors (preferably APC polish) and low reflection (fusion) splices
- Installing isolators can reduce reflections
- Clean the interfaces

II. Power Meter and Light Source Test:

Link Budget testing is performed to calculate the total loss across a span of fiber. This is a cumulative test, taking into consideration all connectors, splices, and patches, and can have a variety of values. As it is dependent upon the fiber type, length and the aforementioned physical characteristics, a 'limit' cannot be assigned. It is utilized to determine which optics are used, and whether or not regeneration and/or amplification is required.

Measures:

The point-to-point loss readings for a fiber span, the loss readings will include:

- Loss of fiber span including end connectors
- Attenuation associated with fiber
- Loss associated with artifacts within fiber span, such as a fusion splice

Tested with:

Power Meter and Light Source combination at 1550nm

Specification:

All loss readings must be within the calculated loss budget per Telecordia requirements for specific optics to be deployed.

Correction Method:

- Clean the interfaces
- Use higher-powered optics
- Use amplification
- Use amplification and/or regeneration

III. Optical Time Domain Reflectometer (OTDR) Test:

Optical Time Domain Reflectometry (OTDR) testing is utilized to determine the source and location of attenuation over the fiber. The sources are either loss or reflectance, and while the ORL and Power Meter/Light source tests will help determine the bulk effect, the OTDR test can identify the location and type of loss/reflectance source on the fiber, and if it is the cause for a failure on a previous test (ORL or Link Budget), corrections can be made (in the form of cleaning connectors, re-polishing/replacing connectors, or re-splicing bad splices).

Measures:

- End to end average loss budget (Bi-directional) of fiber span
- Total length of fiber under test
- Average loss (bi-directional) of each splice in the fiber under test
- Reflectance and average loss of each connector in the fiber under test

Tested with:

OTDR at 1550nm and 1625nm

Specification:

All loss readings must be within the calculated loss budget per Telecordia requirements for specific optics and connectors to be deployed

Correction Method:

- Clean the interfaces
- Use higher-powered optics
- Re-splice
- Replace/Re-polish connectors

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IV. Polarization Mode Dispersion (PMD) Test:

Polarization Mode Dispersion Testing (PMD) is used to determine how much a transmission pulse has broadened (which is critical to high bit rate transmission systems). This value is calculated as a 1st and 2nd order value, and the 2nd order approximation gives information linking the PMD variation to the wavelength transmitted, which is useful in specifying DWDM systems.

Measures:

Ability of the embedded fiber plant to support the high data rate DWDM system to be deployed at the desired transmission rate

Tested with:

Polarization Mode Dispersion Tester at 1550nm

Specification:

Bit Rate	Max PMD	PMD Coefficient
(Gbps)	ps (picoseconds)	
2.5	40	<2.0
10	10	<0.5
40	2.5	<0.125

Correction Method:

- Re-splice
- Fixed mechanical PMD compensators (passive clamps)
- Electrical PMD compensators in-line.

V. Chromatic Dispersion Test:

Chromatic Dispersion (CD) Testing is usually of interest on longer-haul runs at higher data rate, but when a fiber plant is made up of varying 'vintages' of fiber ,it comes into play. CD should be tested on the bare fiber plant and also during the installation or splicing of the fiber runs. It should be measured before any other compensation device is put into place (filters, amplifiers, etc.) to determine the true distance allowed on the fiber, as CD causes pulse broadening due to the variation in the wavelengths of light in the glass of the fiber.

Measures:

- Ability for the embedded fiber plant to support the DWDM system to be deployed at the desired transmission rate
- Chromatic Dispersion test instrument will help determine the proper compensation plan to resolve any issues if the desired transmission rate cannot be supported

Tested with:

Chromatic Dispersion Tester at desired data rate

Specification:

Bit Rate (Gbps)	Max CD (ps/nm)
2.5	16,640
10	1,040
40	65

Correction Method:

- Fixed dispersion compensation modules (DCMs)
- Tunable dispersion compensation modules