Single Fiber Single Wavelength
Laboratory Testing Guide
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Lab Testing of Single Fiber Single Wavelength Products

Equipment Required (Testing point-to-point):

- Two (2) Single Fiber Single Wavelength SFP Transceivers
- Two(2)Patch cables or
- Fiber spool with LC/APC connectors (to be plugged into SFP receptacle)*
- Two (2) GigE SFP switch ports
- One or two (1 or 2) 5dB Attenuator(s)
- (LC/APC if used in SFP receptacle, LC/UPC acceptable if in going through a UPC patch panel) to simulate adequate link attenuation on short runs.

  *If testing through a single fiber, single wavelength multiplexer/demultiplexer, LC/APC patch cables should be used to minimize initial surface back-reflections (see testing details below).

About the Technology:
Single Fiber Single Wavelength SFP transceivers utilize the same wavelength on both sides of a simplex fiber link for full-duplex transmission of Gigabit Ethernet data. Prior to the development of this technology, full duplex transmission required a PAIR of fiber strands (transmitting and receiving east-to-west on one fiber, and west-to-east on another fiber), or a matched set of single fiber (bi-directional or "bi-di") transceviers that utilized built-in wavelength specific filters to allow for single fiber operation.

Single Fiber, Single Wavelength (or single lambda) technology achieves this full-duplex, single strand transmission of data by utilizing a specifically designed transmitter/receiver sub-assembly within a standard MSA-compliant SFP transceiver. The transmitter portion achieves 'smart' isolation of the incoming signal from any noise or backreflection by means of beam isolators and optical comparators. This is why it's no longer necessary to have a matched 'pair' of transceviers to achieve a reduction in fiber used, which results in fewer operational errors (namely, deploying the 'same' wavelength on both sides of a 'bi-di' link, which will not link).

Testing Details:
The isolator/comparator portion of the transceiver is specialized, but does need some designed-in 'assistance' in its operation. This comes in the form of APC connectors in the fiber plant whereever possible, but most DEFINITELY at the receptacle of the SFP. The inital surface that the transmitting laser will interact with is also the surface that can cause the greatest amount of back-reflection. Whereas APC connectors have often been deployed in high-powered optical transmission systems to avoid laser-damaging back reflections, the APC connector in a single fiber single wavelength link is there to also assist the isolator/comparator logic in determining what is a TRANSMITTED and a RECEIVED signal. More points in the link with APC surfaces will result in better rejection of back-reflected signals.
When testing is done through a single-fiber, single wavelength multiplexer/demultiplexer, the inputs of the passive device are designed as APC connectors for this very reason.
It is also advisable to add in-line attenuation to the fiber run, especially in a short-distance laboratory environment, as the 'sweet spot' of the specialized receiver is not merely a function of receiver sensitivity versus input power, but also a function of link loss. "Back to back" testing is not advisable without in-line attenuators in place because the comparator will have difficulty in resolving a hot incoming signal from a hot back-reflection, and such a scenario could result in rejected signal, which in turn translates to increased packet loss and bit-errors.

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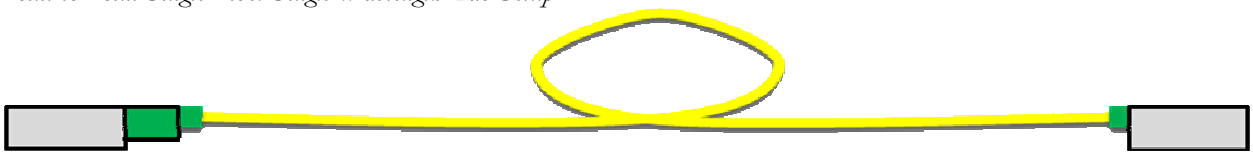
Test Setup:

Point-to-Point Single Fiber Single Wavlength Lab Setup



In this scenario, a length of fiber is connected between two (2) single fiber single wavelength SFPs in Gigabit Ethernet switch ports. Depending on the length of the fiber, an attenutator is added to one side, or the other of the link. In this case, we assume a fiber length or spool with APC connectors on both ends. However, if UPC fiber patch panels are in place in the fiber plant, a UPC attenuator may be placed anywhere along the fiber run. However, as mentioned above, the key is to have APC connectors going INTO the receptacles of the SFPs. The table below shows the power range of the transmitting laser and the maximum input power for the receiver in dBm. Adjust the link attenuation to fall into this range.

Parameter	Symbol	Min	Typ	Max	Unit
Output Power	Pout	-7.0		-2.0	dBm
Extinction Ratio	ER	9.0			dB
Rx Sensitivity	RSENS			-23	dBm
Max Input Power	Pmax	0			dBm

One of the interesting features of the single fiber single wavelength transceiver is the fact that, unlike a bi-directional (two wavelength) single fiber optic, a physical loopback can be achieved with the use of a reflector on the far end of the fiber jumper. This is achieved when the input power from the reflection is great enough that the comparator simply 'sees' the back-reflection as a received signal, and is very helpful in troubleshooting possible port issues. However, as a loopback is not something that is desired in every day operations, we again recommend adequate link loss (by means of in-line attenuation or adequate fiber length).

Once the physical plant is set up in the ways mentioned above, standard throughput and bit-error testing can be performed, in a manner identical to testing done on standard dual-fiber transceiver links.