Fiber Management Considerations for Optical Components

By: Tom Warren

Fiber Management Considerations for Optical Splitters

Fiber is a "future-proofing" technology. The bandwidth capacity of a single fiber dwarfs any other physical medium. In an effort to capture this advantage and to limit future infrastructure builds, many companies are dedicating fibers -- running a single fiber between the central office or head-end and every customer premise unit.

As a result, the service provider will be deploying optical splitters, which traditionally is an outside plant technology, in an inside plant environment. There are two common methods of deploying optical splitters in an inside plant application: adapter output or pigtail output. Each deployment environment has strengths and weaknesses. The method you choose will be dependent upon the priorities you place on space conservation, flexibility and price.

Basics of Optical Splitters

There are two main types of splitters: PLC (or Planar) and FBT (Fused Biconic Taper). The PLC splitter is a light circuit on an 'optical chip'. It is then mounted and the fibers, usually in ribbon form, are bonded to the edges of the chip. The assembly is encapsulated in a protective enclosure. PLC devices support direct split counts up to 64. FBT splitters are two or more fibers twisted together, heated and then drawn to bring the optical cores into near contact. The combined fibers are mounted on a low-expansion carrier and encapsulated in a low expansion tube. FBT devices allow direct splitting up to 4 ways. Higher split counts are achieved by splicing multiple devices to form multi-stage, concatenated splitters. The optical performance values of these splitters are shown below.

PLC (Planar)

Type	IL	RL	PDL	Uniformity	Directivity	Operating Temp	Storage Temp
1x32	< 16.8 dB	> 50 dB	< .3 dB	< 1.7 dB	> 55 dB	-40 to 85 C	-40 to 85 C
2x32	< 17.8 dB	> 50 dB	< .3 dB	< 1.8 dB	> 55 dB	-40 to 85 C	-40 to 85 C
1x16	< 13.8 dB	> 50 dB	< .3 dB	< 1.2 dB	> 55 dB	-40 to 85 C	-40 to 85 C
1x8	< 10.8 dB	> 50 dB	< .3 dB	< 0.8 dB	> 55 dB	-40 to 85 C	-40 to 85 C
1x4	< 7.5 dB	> 50 dB	< .3 dB	< 0.6 dB	> 55 dB	-40 to 85 C	-40 to 85 C

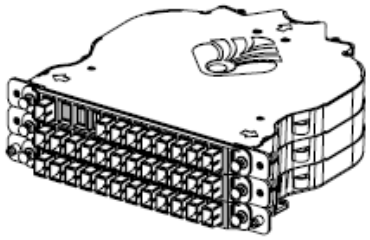
**Terminated Specifications

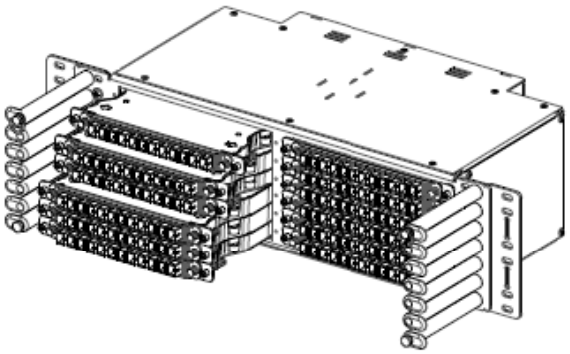
FBT

Dual Window – Wavelength Flattened (Terminated Specifications)						
		1x2	1x4	1x8	1x16	1x32
Max. Insertion Loss	dB	3.6	7.2	10.7	14.0	17.6
Max. Uniformity	dB	0.8	1.0	1.3	1.6	1.9
Max. PDL	dB	0.2	0.3	0.4	0.5	0.6
Center Wavelengths	nm	1310 and 1550				

Due to the better uniformity values and lower price at higher split ratios, most FTTH networks will use PLC splitters.

Adapter Outputs





Splitters are housed inside some type of enclosure. Clearfield uses the Clearview Cassette. A cassette and each splitter leg are loaded into the rear of an adapter. This allows jumpers to be plugged into the front of the cassette.

Space Conservation: **Poor**

Since each cassette needs to accommodate adapter ports, more real estate is needed per splitters. Since the cassettes are larger, more rack space is consumed and more optical component chasses are required. In addition, two ports must be consumed for each splitter as the patch cord is plugged in at each end. In a typical 576-port environment, using a Clearfield chassis application, housing 18 optical splitters, 37 inches of rack space would be utilized.

Price: **Fair**

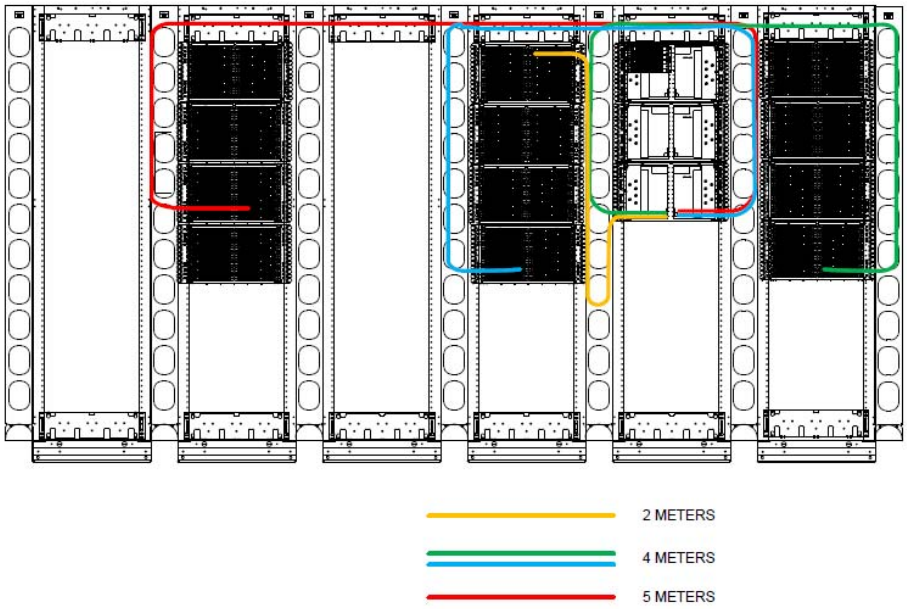
With this solution, patch cords are required for every customer.

Flexibility: **Excellent**

Since any length jumper can be plugged into the front of the splitter cassette, any splitter can be used with any customer distribution port in the system. This will allow the PON electronics blade to be used very efficiently. It will also allow damaged splitter legs to be replaced without replacing the splitter.

Additional considerations:

The adapter on the front of the cassette will add some additional loss to your optical link budget. Jumper management is key with this solution. Clearfield can provide a "suggested jumper length" and routing diagram to keep the solution looking organized over time.



Pigtail Outputs

In this solution, the optical splitter is contained in some type of cartridge and each splitter leg is up-jacketed to 2mm or 3mm and connectorized. The output legs are typically around 2 meters in length. These cartridges are then loaded into some type of chassis or housing in the frame. After an optical splitter has been activated with a PON port on an electronics blade, the splitter output pigtails are routed directly into a distribution port. The splitter here is housed in an LGX compatible module and could be mounted in a LGX-rack mount chassis.

Space Utilization: **Excellent**

Since this solution does not use adapters, limited real estate is needed on the front of the splitter cartridge. This allows the splitter cartridge to be a very small form factor and many cartridges can be installed into a small space. This solution works well in applications where space is at a premium. Some service providers have called for a "parking lot" for unused splitter legs. The parking lot is simply an area with clips, foam block or dead adapters that hold the connectors until they are needed for the next customer. This will consume some space.

Price: **Excellent**

This solution does not require the purchase of additional patch cords -- reducing the cost of the overall solution. As a 3 meter jumper is roughly $12, the savings per 1x32 splitter is nearly $400.

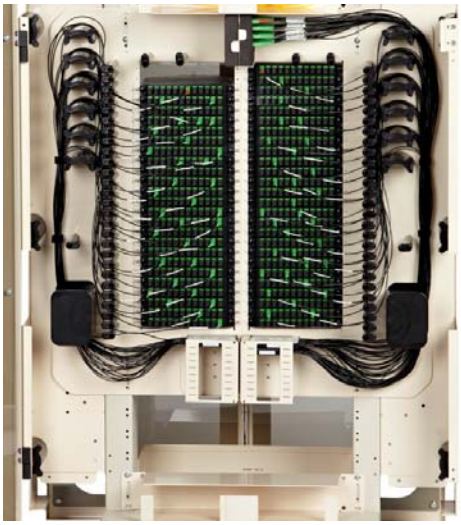
Flexibility: **Poor**

Since the splitter legs are limited to two meters in length, the splitter cannot be utilized anywhere else in the network. Deployment is limited to the distribution ports that are located within two meters of the splitter chassis. Another limitation of this solution is that if one of the splitter legs is damaged, the splitter will need to be replaced. There is no way to replace individual splitter legs. Keep in mind that a large portion of a FTTH budget will be spent on electronics. Each PON blade is very costly and should be utilized to its fullest capacity to avoid stranding capital investment dollars. Using the Pigtail method, a splitter consumes one port on the electronics blade. As discussed earlier, a limitation of this solution is that this splitter can only service distribution ports that are within 2 meters of the optical component chassis. There may be situations where additional blades, chassis and splitters are needed when a customer in a patch panel is farther than two meters from the chassis wants service.

Additional considerations:

One unique advantage of this solution is that when deploying Clearfield's FieldSmart product line, only one part number is needed for both OSP FTTH splitter cabinets and central office applications.

FxDS PON Insert



A recent development at Clearfield is the PON Insert Kit. This is a specialized pig-tail output deployment kit that can be installed into the FieldSmart Fiber Crossover Distribution System (FxDS) fiber frame system. It mimics the fiber management found in the FieldSmart Fiber Scalability Center (FSC) splitter cabinet. Eighteen splitters can be housed in each PON insert kit. Each kit can accommodate up to 576 customers and can be scaled to any required port count as needed.

Space Conservation: **Excellent**

The PON insert kit integrates all the components needed in an inside plate PON system. The distribution ports, OCC and parking lot are all located inside the same bulkhead plate. Two 576 capacity kits can be loaded into the 7 foot FxDS frame. This allows for maximum density without sacrificing good fiber management techniques.

Price: **Excellent**

Since separate parking lots, OCCs and panels are now combined into one bulkhead kit, the overall cost of the solution is reduced. The pigtail splitters eliminated the need for separate jumpers which also reduces the price of the overall solutions.

Flexibility: **Fair**

Since the splitter cages face the outside of the PON insert kit, the splitters on the left side of the kit can service any distribution port on the left side of the kit (ports 1-288). Conversely, the right splitter cage can service any of the port on the right side of the kit (ports 289-576). This allows a high number of customers to be serviced by each PON blade. The downside of this solution is that there is not the "any splitter port to any distribution port" feature of the adapter output solution.

Additional considerations:

The fiber management in this solution is a very strong feature of this product. Since there is only one route path for each splitter cage, there will never be any jumper cross over or congestion. Technicians cannot overstuff troughs or interbays or use bad cable management practices. There is also an intuitive routing guide included with each PON insert that ensures the product will look good over time. If fiber routing and pricing are the main consideration of your build, the PON insert kit is a good choice.

Summary

Price, density and flexibility must all be considered when deploying splitters in the inside plant. To fulfill the promise of future-proofing the FTTH, selecting a sustainable, tech friendly solution will be critical. Please contact Clearfield for any additional information that is needed.