Fiber-Span
RF ON FIBER® EXPERTS FOR 15 YEARS

Application Note

RF On Fiber® Basics

Traditional signal distribution systems for In-building, tunnel and outdoor coverage extension systems consist of signal booster devices and a passive network of cable, splitters, and antennas. These passive networks oftentimes require thousands of feet of coax cable to interconnect the network of antennas needed to produce the desired RF coverage.

The rising cost of coaxial cable and installation costs are leading many system designers to consider fiber optics in their applications. At what point a fiber distribution system becomes a viable alternative for your application is dependant on many variables, such as: local installation rates, availability of existing fiber, building construction, coverage area size, and number of services to be distributed, just to name a few. Consult Fiber-Span's Application engineering group to find out if a fiber optic distribution system is right for your application.

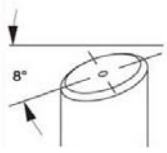
The purpose of this document is to provide a general understanding of the various elements that make up a typical RF-on-Fiber distribution system and a few rules to get you started.

Rule #1 – Single-Mode Cable
Fiber optic cable must be Single-Mode Fiber (SMF), 9/125um.

Rule #2 – Always use Angle polished connectors
It is recommended that all fiber optic cable terminations, including cross-connects, be either SC/APC or FC/APC connector types (8° Angle Physical Contact). These connectors produce <-55 dB back reflections which is critical in RF-on-Fiber links.

SC/APC

FC/APC



Rule #3 – Plenum or Riser Rated?
If your application requires new fiber, confirm with the facility manager which type is required. For example: use plenum rated for horizontal runs that are to be installed in plenum areas, use riser rated for vertical runs. Install fiber cables in innerduct where necessary.

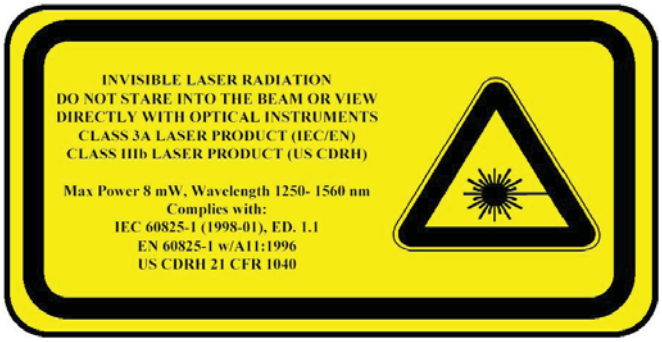
Corrugated Innerduct

Rule #4 – 0 dBm Composite Power Max.
When connecting RF signals to a fiber transceiver device, take care to not exceed the maximum input power level. The optimum composite power appearing at the RF input connector should be adjusted to 0 dBm. Composite levels exceeding +10 dBm may damage the laser.

Rule #5 – 1 dBo = 2 dB
The optical detector in RF-on-Fiber systems operates in the Square Law region, which means that the optical input (a power parameter) corresponds to the voltage output. It's this relationship that creates the 2-to-1 outcome of optical loss to RF Gain. In short, when calculating link budgets don't forget to use 2 dB of RF loss for every 1 dB of optical loss.

Rule #6 – Cleanliness
To achieve best performance, connectors must be kept clean and free from scratches. To clean a connector, gently wipe it with a cotton swab wetted with isopropyl alcohol and then dry it with dust-free compressed air (available in convenient cans).

Rule #7 –Warning
Do not disconnect optical cables from any equipment unless power has been disconnected from all of the equipment connected to that fiber optic cable.



Rule #8 –FC/APC Connectors
These types of connectors create an extremely reliable connection; however, care must be taken to ensure that the key on the fiber connector lines up with the keyway on the mating connector.

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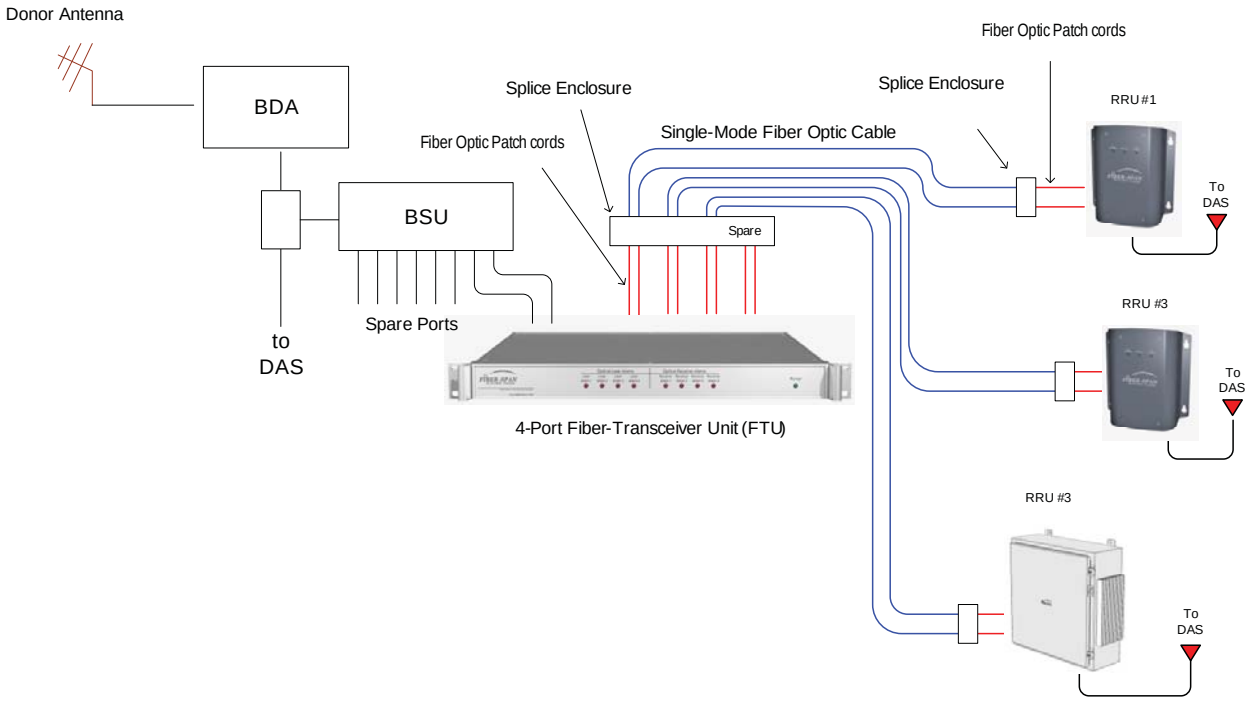
Most coverage extension system applications are configured with either an off-air headend system or a direct-fed configuration. The off-air configuration usually requires a Bi-directional Amplifier (BDA) to amplifier and filter signals transmitted and received over the air. A direct-fed headend configuration typically is connected directly to the base station or repeater equipment.

Off-air Configuration

1. Use a BDA to amplify signals
2. Use a directional coupler to minimize attenuation to RF DAS.
3. Use a Base Station Interface Unit (BSU) to separate TX and RX signals, and to condition (attenuate and split/combine) signals in preparation for conversation to light.
4. Use a Fiber Transceiver Unit (FTU) to perform the RF-to-optical and optical-to-RF conversation.
5. Use Fiber Optic Patch cords to connect the FTU to the Splice enclosure.
6. The Splice enclosure housing includes all the fiber optic connector panels, pigtails, splice trays, and fusion splice sleeves required to terminate the premise fiber cable system.
7. All fiber optic links require Single-Mode 9/125um cable and SC/APC or FC/APC connectors.
8. A Remote Repeater Unit is used to convert optical-to-RF and RF-to-optical, and to provide amplification and filtering at the remote location requiring coverage enhancement.



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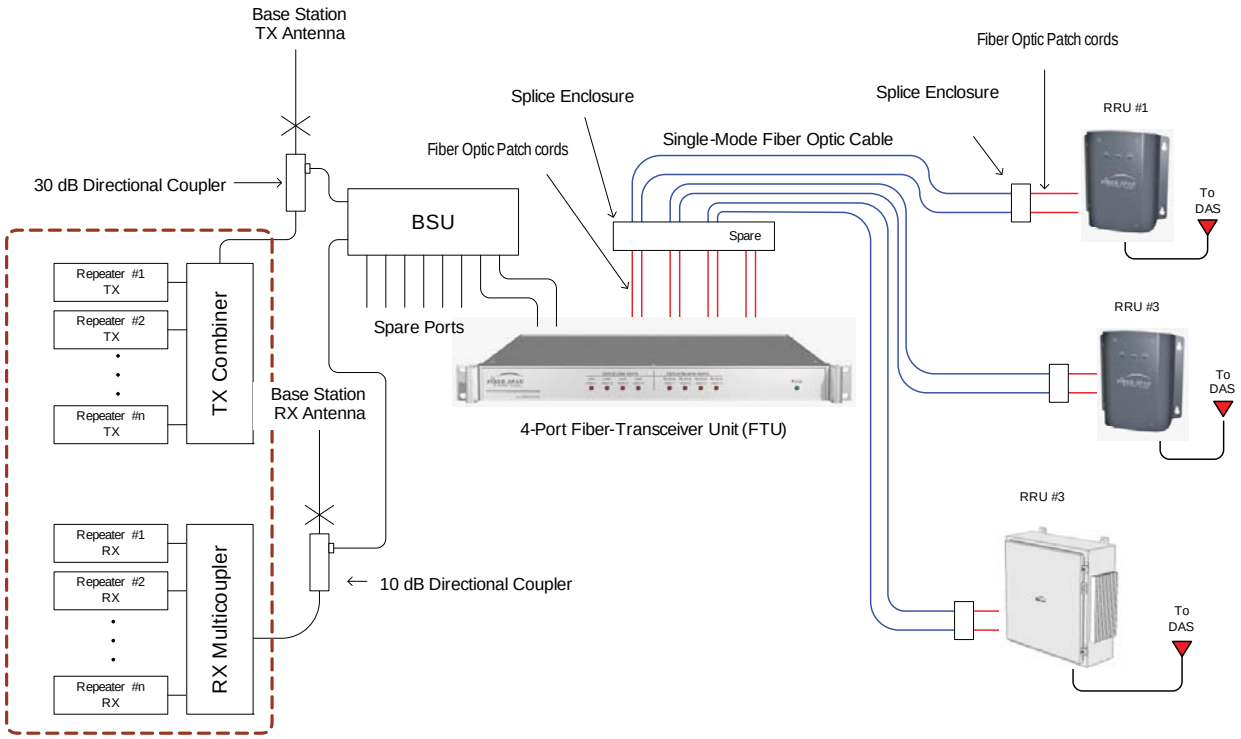
Direct-fed Configuration

1. Use directional couplers to minimize loss to outdoor system performance.
2. Use a Base Station Interface Unit (BSU) to separate and condition (attenuate and split/combine) signals in preparation for conversation to light.
3. Use a Fiber Transceiver Unit (FTU) to perform the RF-to-optical and optical-to-RF conversation.
4. Use Fiber Optic Patch cords to connect the FTU to the Splice enclosure.
5. The Splice enclosure housing includes all the fiber optic connector panels, pigtails, splice trays, and fusion splice sleeves required to terminate the premise fiber cable system.
6. All fiber optic links require Single-Mode 9/125um cable and SC/APC or FC/APC connectors.
7. A Remote Repeater Unit is used to convert optical-to-RF and RF-to-optical, and to provide amplification and filtering at the remote location requiring coverage enhancement.



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