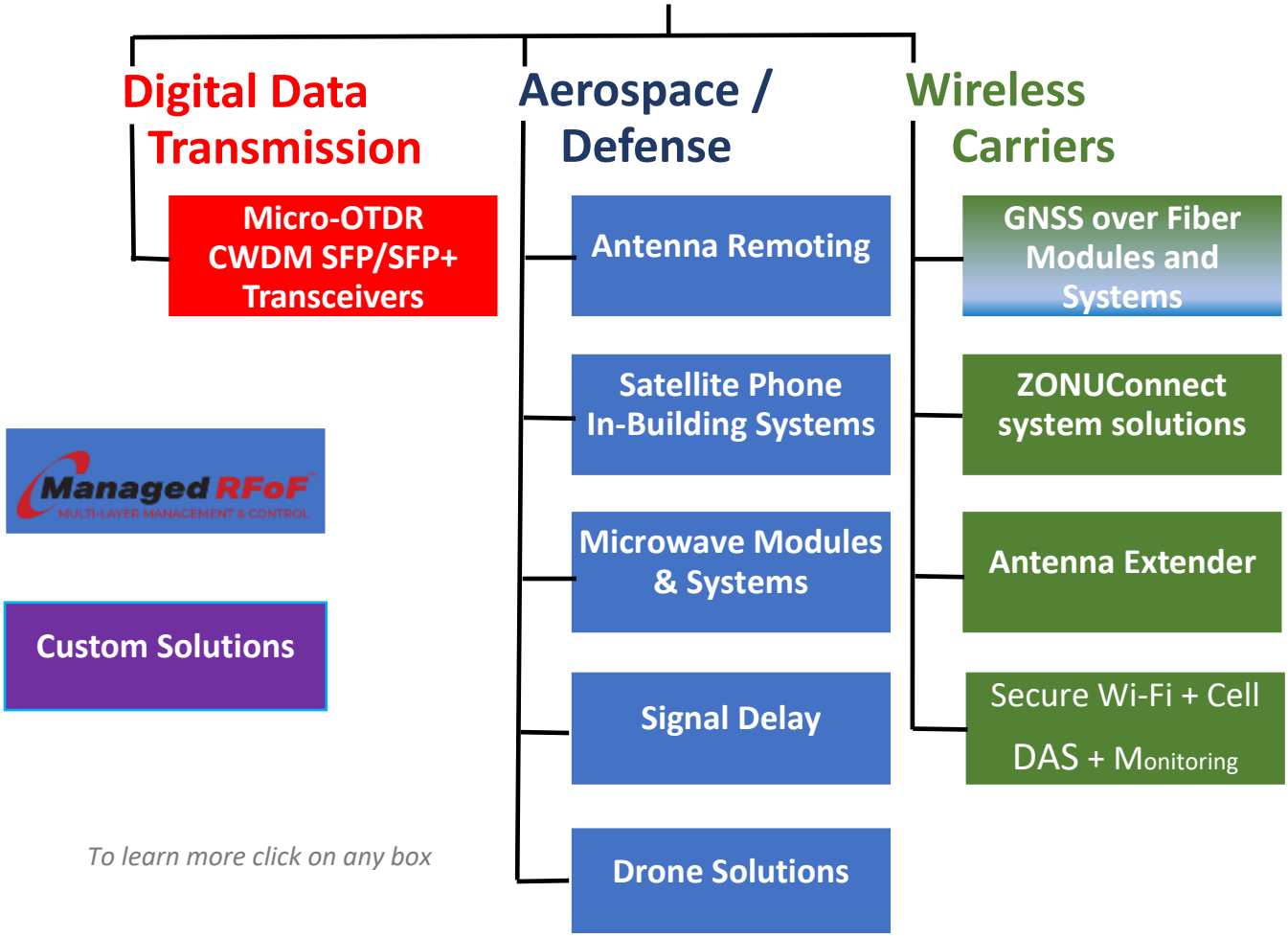
Optical Zonu Corporation specializes in unique fiber optic transport solutions for communication

Fiber Optic Transport

Modules and Systems



Optical Zonu, the innovator in radio frequency transport over fiber (RFoF) for the cellular, aerospace/defense and satellite industries, is based in Los Angeles CA. We utilize fiber optic signal transport and build the electronics interface to and from the optical fibers. Producing a broad range of products and systems including wireless bands transported over fiber, secure Wi-Fi, GPS distribution in tunnels and infrastructure, patented fiber break location detection and more. We work closely with Verizon, AT&T, Sprint and T-Mobile, we also support clients like SpaceX, Boeing, The US Navy, NSA and more. We offer end-to-end solutions for defense contractors, system integrators and Wireless Carriers. We are the only GPS over Fiber solution approved by all 3 US cellular carriers.

7/2025

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What is SPECIAL about the Micro-OTDR SFP/SFP+ Fiber Optic Transceivers?

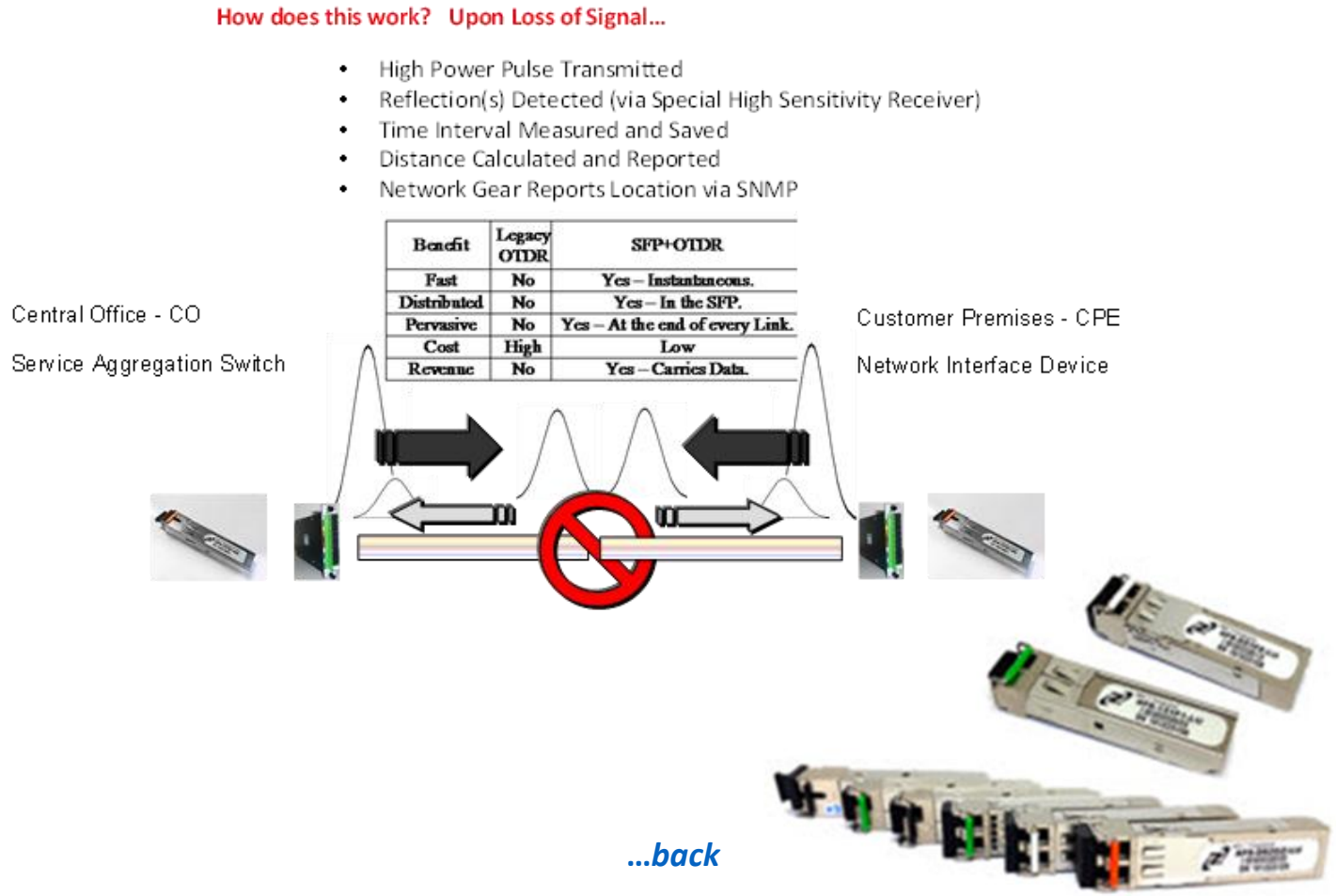
Thrifty approach to optical fiber monitoring, without all the unnecessary “extras”.
Keeping it simple: **What is the status? Where is the problem?**

Micro-OTDR™ feature:

- Instantaneously detects faults;
- Calculates the distance to the faults;
- Stores the results in the ***Micro-OTDR™*** SFP/SFP+ EEPROM.

Is the fault in the optical fiber link? => Dispatch the field optical fiber Techs.
Is the fault in the remote facility? => Notify the network equipment Techs.

OPEX savings better than 25% - only one Truck roll per event required.
Overall CAPEX savings significant - transports network revenue data.
The ***Micro-OTDR™*** feature is Fast, Distributed, Pervasive, Low Cost and Generates Revenue.



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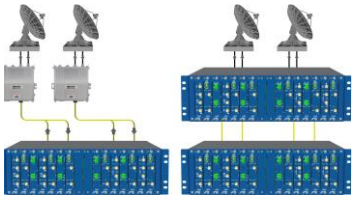
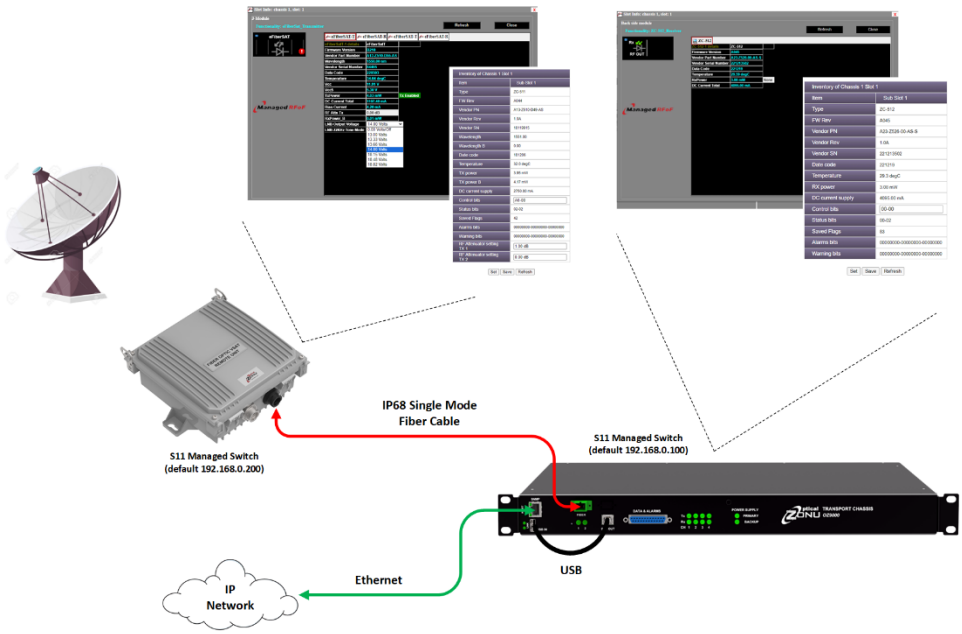


Fiber optic transport solutions for Antenna Remoting

Satellite networks, commercial and military, require a simple replacement for coaxial cables between the Antenna(s) and Satcom modem. Waveguide and coax are inherently bulky and inflexible with RF insertion losses that increase with transmission distance and RF frequency. Coaxial cables are limited to ~ 100 meters (at L-Band) and shorter at higher RF frequencies. RF attenuation through fiber is typically 0.65 dB/km. As a benefit, signals may be transported with fiber over long distances without the need for amplification. Optical fiber is immune to virtually all types of interference (including lightning) and will not conduct electricity or create ground loops. As optical fiber does not radiate RF, signal detection and interception are greatly reduced.



Add tactical radio image

The eFiberSAT antenna remoting subsystem provides an easy means to remote four uplink and/or downlink polarities. It accommodates RF transport up to 6 GHz, 10 MHz reference and Ethernet over fiber transport, all over a single fiber. Remotely configurable LNB biasing and Optical Zonu's patented uOTDR are available.

Tactical radio remoting separates radio from antenna over fiber in challenging or high-risk environments. This capability significantly enhances operational efficiency, safety, and adaptability in scenarios such as military operations, emergency services, and disaster relief.

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Satellite Phone Distribution

Satellite phone networks offer voice and data communication worldwide by means of a line-of-sight connection of a user handset and the appropriate satellite constellation. Within buildings, tunnels, mines, etc., service is interrupted.

Optical Zonu offers complete solutions that enable users to communicate via the satellite network while in the building. The outdoor antennas are essentially connected to indoor locations via fiber. In this way, usage of satellite phone connectivity is expanded to include data services (military and civil) and tracking (cargo and sensitive equipment).

Iridium, Globalstar, Inmarsat, and Thuraya are supported. Indoor configurations include fixed locations for phone cradles as well as re-radiating indoor antennas.

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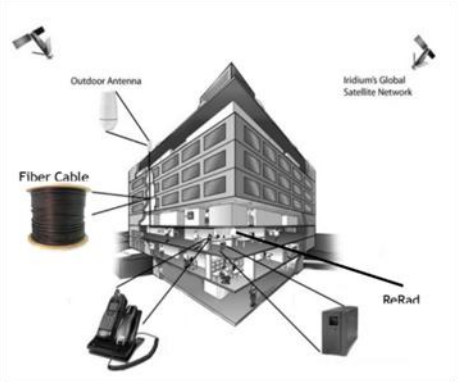

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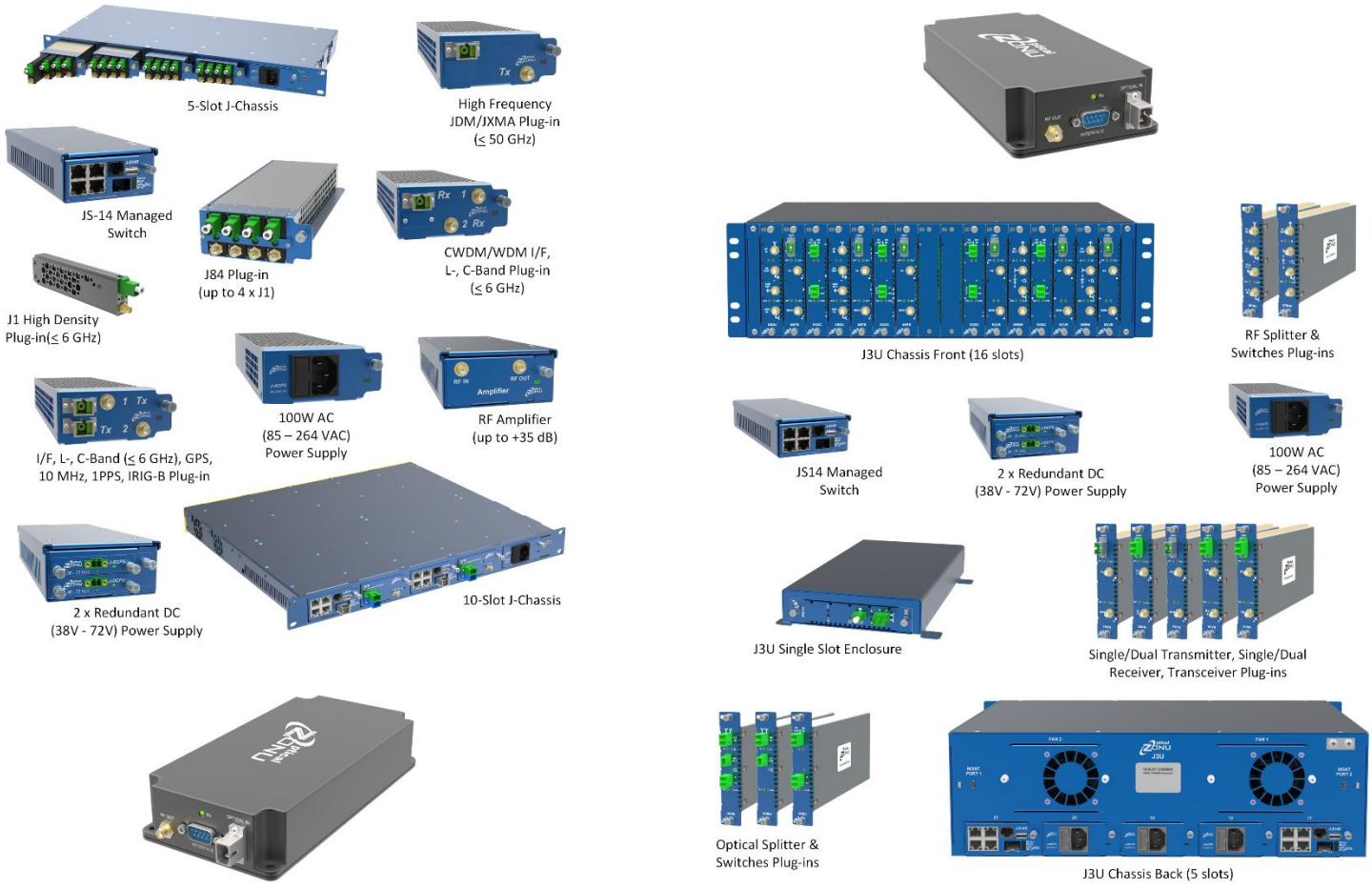
Fiber optic transport solutions for microwave communications

RF transport over coaxial cable is even more limited at higher frequencies. 40 GHz is attenuated 10 dB for every 100 feet in 1.25” Heliax cable. Fiber attenuation at 100 feet is negligible. Optical Zonu provides RF signal transport over fiber up to 60 GHz, in three form factors: indoor flange mount (OZ18xx), 19” chassis plug-in (JDM/JXM), and IP68 outdoor enclosures (TS Box).



Additional benefits of fiber include the following.

- **EMI Immunity:** Fiber optic cables are immune to electromagnetic interference, ensuring signal integrity in noisy environments.
- **High Bandwidth:** Fiber optics can carry significantly more data than coaxial cables, enabling higher bandwidth applications.
- **Security:** Fiber optic cables are more difficult to tap than coaxial cables, enhancing security.
- **Reduced Size and Weight:** Fiber optic cables are smaller and lighter than coaxial cables, making them suitable for applications with space and weight constraints.

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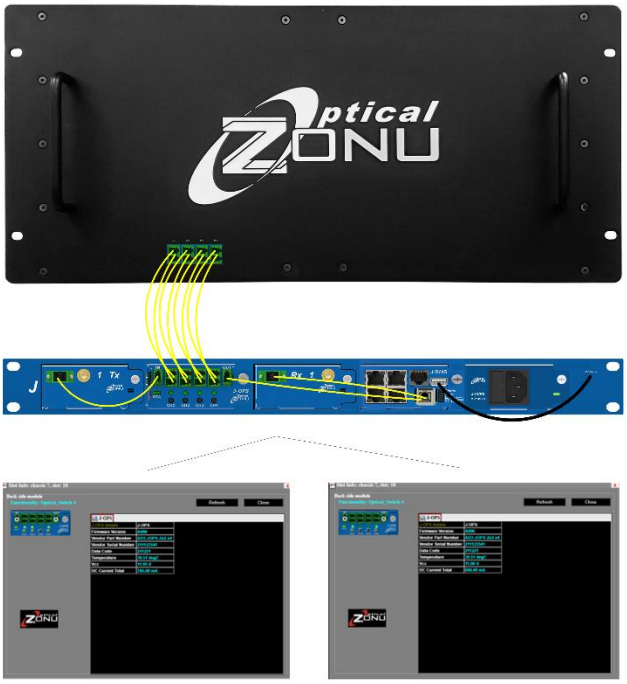
Signal Delay & Phase Matching

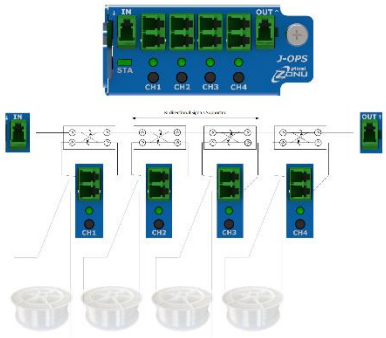
RF delay lines, have application in radar systems, communication systems, and electronic warfare. They are used for calibration, simulation, and signal processing purposes across various industries.

Delay lines are crucial for calibrating radar systems by simulating target distances. Switched delay lines are useful in moving target identification and to differentiate between stationary and moving targets (clutter cancellation). , enhancing radar performance. in canceling out unwanted signals (clutter) from stationary objects, improving target detection.

In commercial applications, RF delay lines can simulate channel characteristics, including multipath propagation and interference, in communication systems.



19" 5RU Multiple Delay Chassis



Integrated Delay Line Assembly (τ < 110 µsec)

Managed RFoF™
MULTI-LAYER MANAGEMENT & CONTROL

- Optical Zonu offers
- Fixed, switchable, or variable delays (up to 2 msec)
- RF frequencies up to 50 GHz
    - Switched delays with 4-, 8-, 12-bit (or more) delay resolution
    - 0 - 660 psec fine tuning elements available
    - RF stability (Gain, NF, P1dB) over temperature
    - Phase stability over temperature and time

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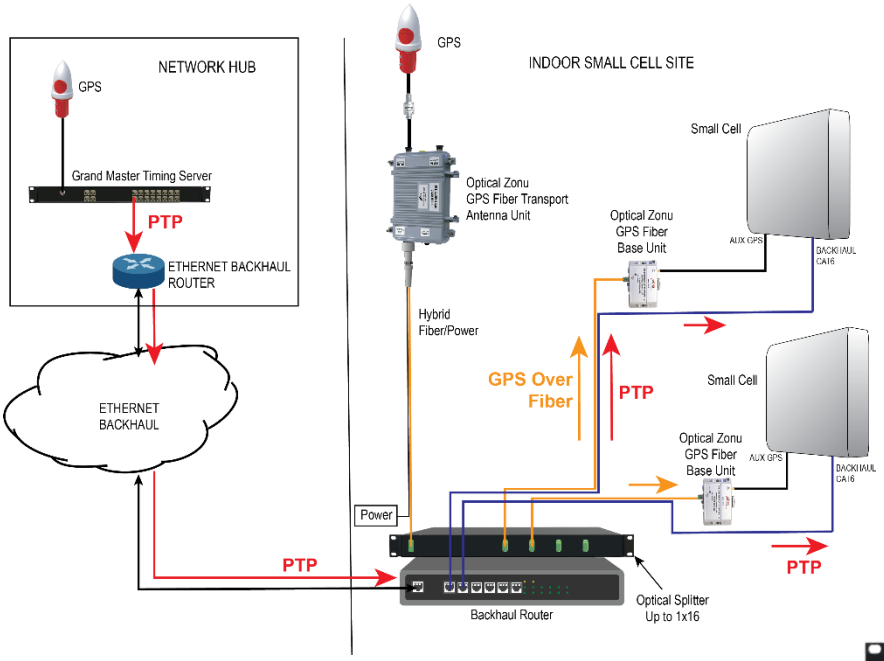
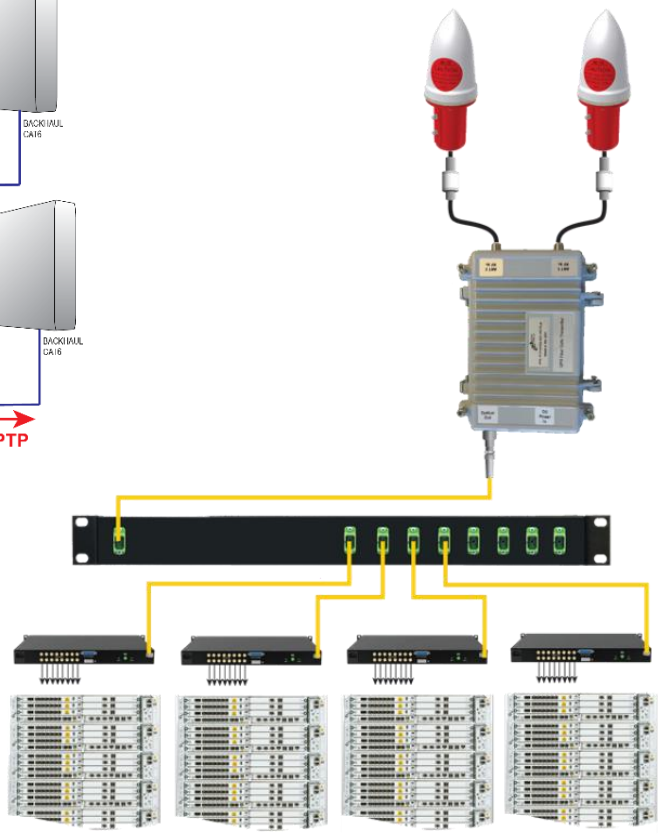
GNSS Transport – timing solutions

4G and 5G mobile wireless networks require very accurate timing signals to ensure network synchronization and maximum throughput. These signals are provided by GNSS-based timing servers and base stations with built-in GNSS receivers. The timing servers and base stations are often far from the rooftop where the GNSS antennas must be deployed – too far for coaxial cable. Our GNSS Fiber Transport provides a compact, reliable (automatic redundancy) easy-to-install and cost-effective RFoF link between the antenna and the base station or timing server for distances up to more than 10km. Our patented signal transport is available for point-to-point connections for small sites, distributed GNSS for large, centralized RAN architectures, and distributed GNSS directly to the small cells at the network edge. SNMP monitoring is an option. Skyshot™ is a handheld test equipment - to verify and document an installation. ***…back***





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Unique fiber optic transport solutions for wireless/cellular communications: Cellular BaseStation(s) to/from DAS – universal transport

ZONUConnect provides a universal RF-Over-Fiber connection between any configuration of cellular base station radios and any active Distributed Antenna System (DAS). DAS are deployed in buildings, airports, stadiums, and other high user density venues to ensure uniform, robust mobile coverage throughout the indoor environment. It is often the case that there is not enough room next to the DAS headend for a direct connection to the base station equipment. ZONUConnect gives the wireless service provider a low-profile method of connecting to any third-party DAS from their own location using the minimum number of fibers (a cost) and the minimum rack space (another cost). The system is supported by full SNMP monitoring and an NMS application that enables easy commissioning and gives the service provider NOC 24/7 access to their radio equipment thus keeping maintenance costs low.

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Two Sectors MIMO – up to 6 bands – over a single fiber [48 RF streams – 24 Uplinks and 24 Downlinks]

POI Systems

Fully Modular Point of Interface (POI) trays support up to 5W input and one MIMO sector per 1RU. Two POI trays work together with a single transport to provide the combined capacity of 2MIMO or 4SISO sectors per fiber optic cable. The system works with the ZonuConnect system as a whole for transparent analog transport of cellular base station carrier signals over fiber to a DAS headend.

DIT Systems

DIT Systems

ZonuConnect 3.0 modular DAS Interface Tray (DIT) system that provides simplex interfaces for up to 6 bands for 1MIMO or 2SISO sectors per 1RU. These systems work in the same configuration as the POI systems, requiring two DIT trays to interface with a single optical transport chassis to provide a total combined capacity of 2MIMO or 4SISO sectors per fiber.

Optical Transport

The optical transport provides 4 broadband inputs and 4 broadband outputs that support transport for up to 2MIMO or 4SISO sectors on a single fiber. The interface trays work together to separate the uplink and downlink portion of each band and multiplex them into a stacked carrier. That broadband carrier is then transported optically to the corresponding tray.

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Unique fiber optic transport solutions for wireless/cellular communications:

OZC's Antenna Extender

Extending cellular coverage for campuses, warehouses, small buildings, etc. OZC offers Antenna Extender Solutions to improve indoor cellular coverage where the coaxial cable from the donor antenna to a bi-directional amplifier (BDA) or RF Booster is not feasible.

- Offering all cellular bands, 700/800 Public Safety and VHF/UFH band
- Point-to-Point or Point-to-Multipoint (Distributed up to 8 BDAs)
- Compact Size and IP67 Rated.

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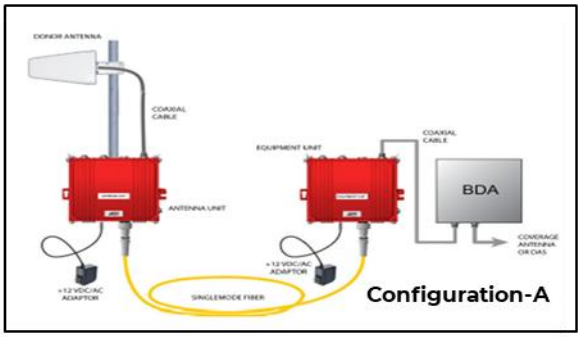
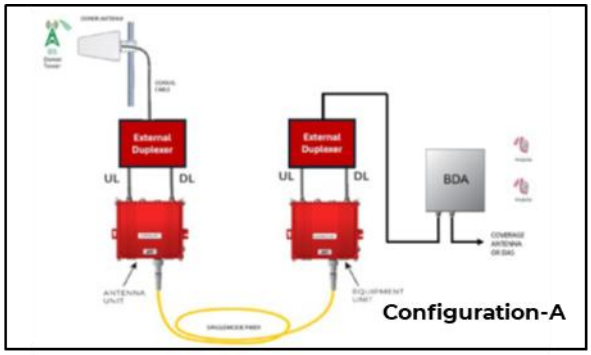
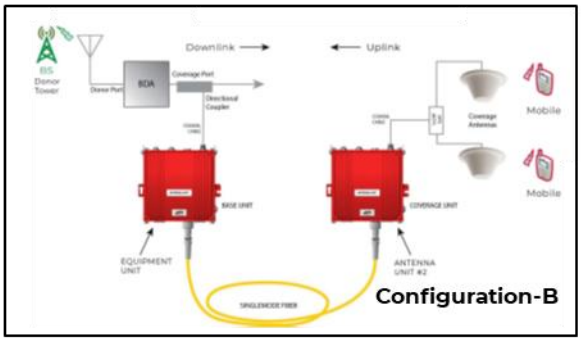
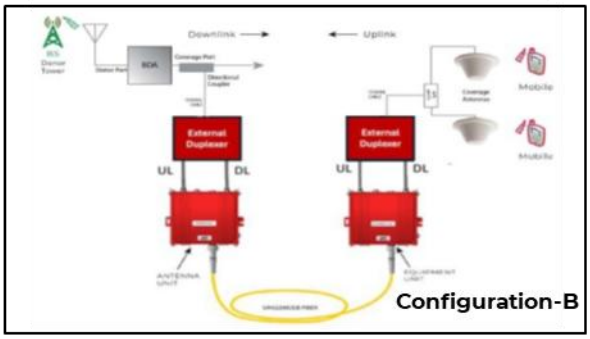


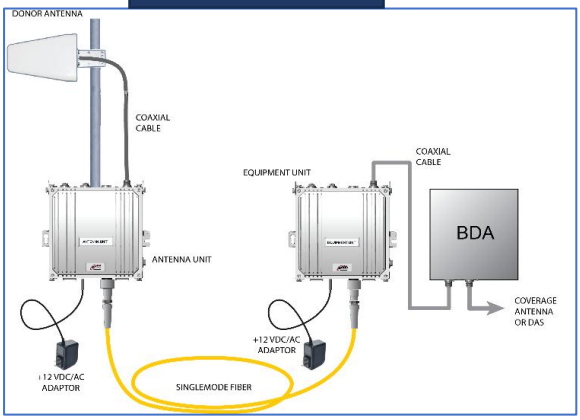




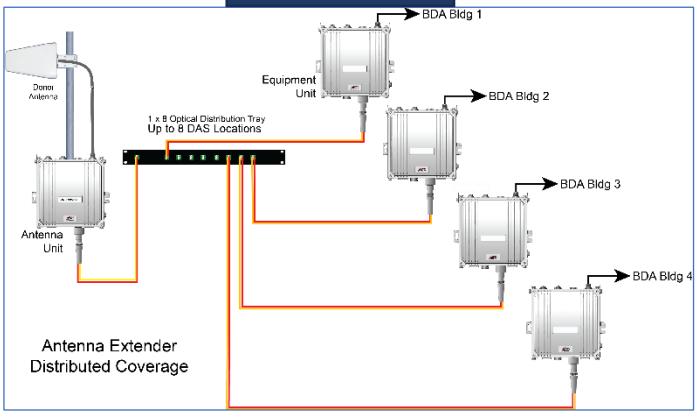


Public Safety 700/800MHz **VHF/UHF**

Point-to-Point



Point-to-Multipoint



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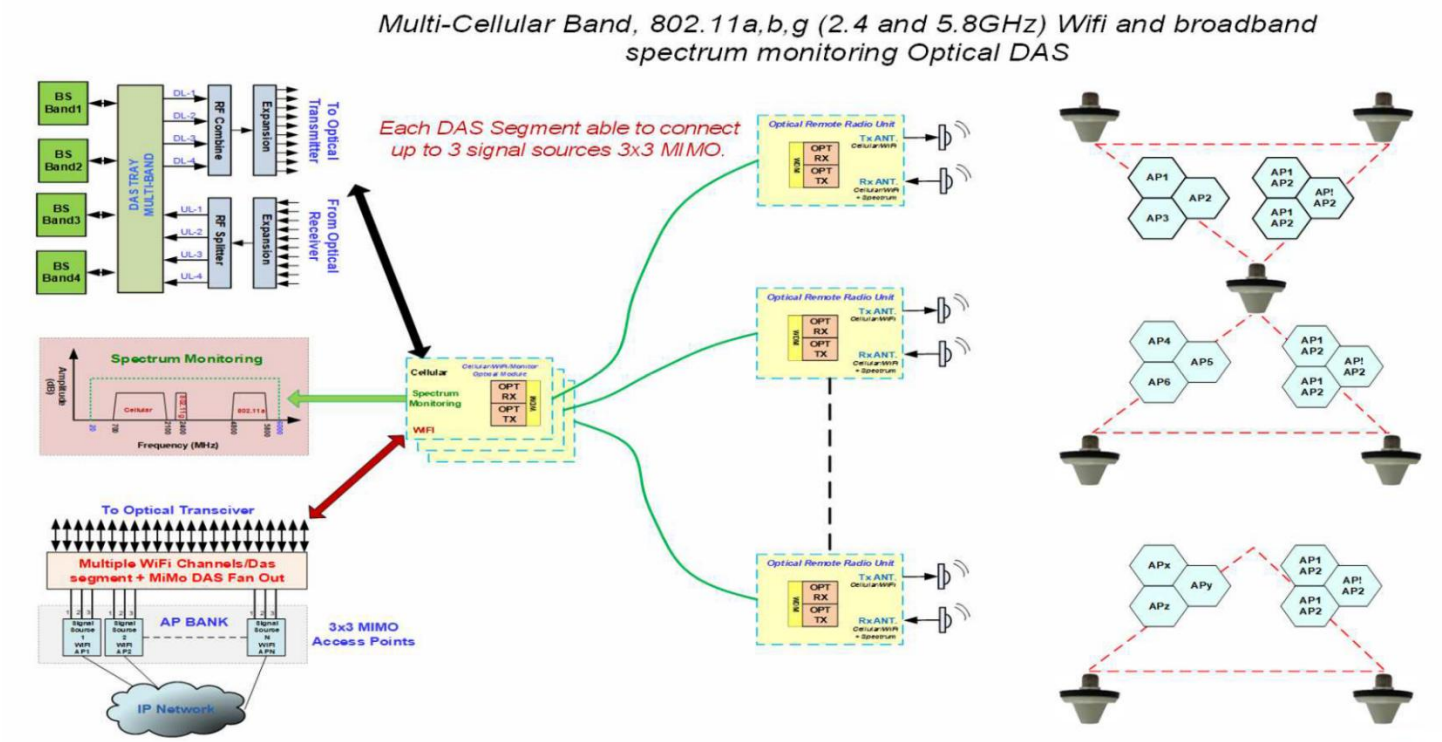
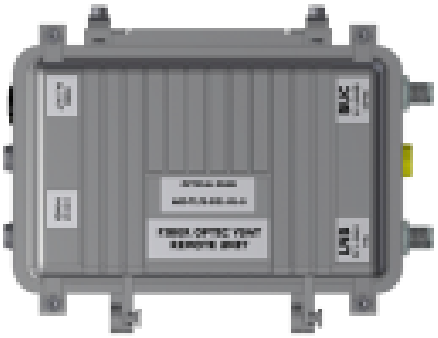
Wi-FI DAS with optional Cellular Wireless coverage and Spectrum Monitoring



System Description

For high security environment the Wi-Fi Over fiber DAS system allows the network to operate at a lower power minimizes eavesdropping. From a network performance point of view a Wi-Fi DAS eliminates dead zone and spotty coverage since Mobile user will never be far from an antenna either in MIMO or SISO. Furthermore, DAS future proofs the network since it allows multiple wireless technologies to be simultaneously carried and does not have to be configured for a specific wireless provider. Spectrum monitoring port (6GHz) is available.



System Architecture

From the above diagram, there is a 1:1 correlation between MIMO ports and number of optical transceiver required. For example to support 3x3 MIMO, three optical links will be required, however the system will be able to support multiple access points with one optical link. The individual access points should be set to operate on non-adjacent frequencies to not cause problems with interference. Once the signal is transported to the remote unit, two antennas are connected, one for transmitting and one for receiving. When used with the JDDAFW control module, RF gain and attenuation parameters can be controlled from the Headend.

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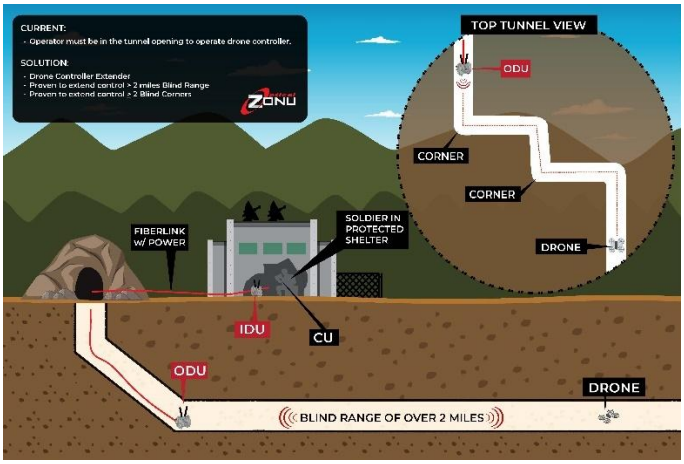
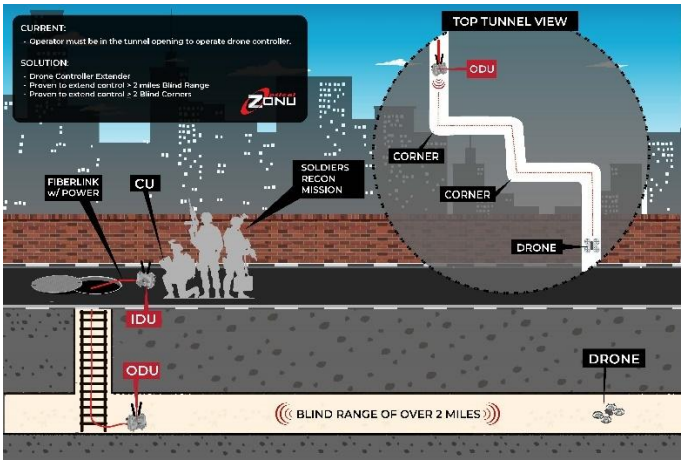
Drone Solutions

Drone Controller Extender

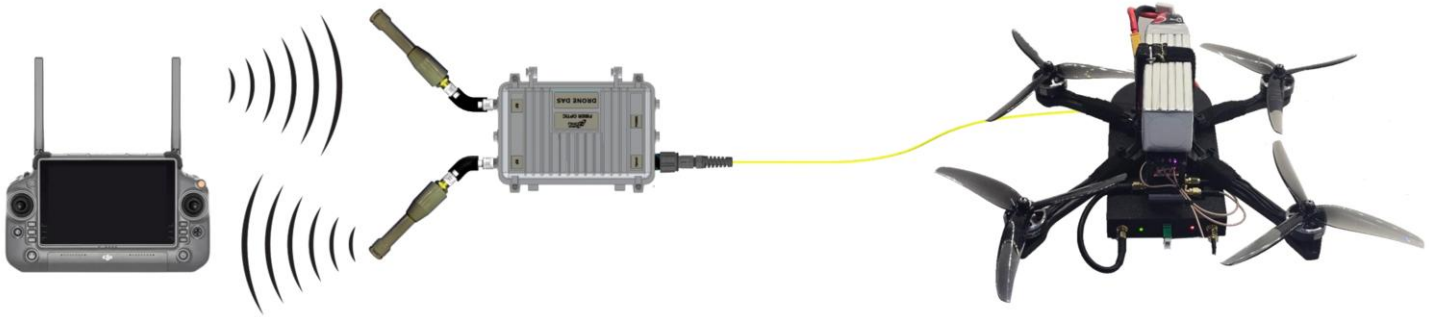




Optical Zonu drone extender is used to extend the range of ISM band 2.4 and 5.8GHz controlled drone systems. The link acts as a fiber optic repeater to remote locate the transmit and receive antennas for a drone system. This is useful for commercial applications in hard to access areas, or for military applications to protect the safety of the drone operator. The controller side can be either wireless or directly connected to the flight controller via Coax cable.

Tethered

ts Tethered drones come in two flavors; stationary loitering drones that are powered by the tether and fiber controlled drones that spool out a control cable. Stationary drones are used as antenna relays for communications or for video surveillance. Fiber controlled drones are used to access areas that have poor signal coverage or hostile RF environments



This type of architecture is used for either commercial hazardous area inspection or for military target strikes. The fiber can be either a fixed hybrid cable for stationary applications or up to 40km long for military strikes.

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Custom Solutions - Examples

Optical Zonu works closely with key customers to customize and build specialty solutions to fit withing customer's systems. OZC participates in the end-to-end system signal transport modeling and commits to specifications required by the customer. Collaborative work to define a doable efficiently executed SOW. Contact the factory for more details.

- **5G repeater**

Custom high integration of 4GHz IF multi-stream transport. Custom PCBA, FW, Enclosure

- **High density KU band multiplexing**

Dense multichannel direct modulation 18GHz LD within a customer specified environment and boundary conditions. LD, EDFA and DWDM Mux.

- **Specialty – Wide Temperature Range fixed KU delay**

12GHz delay in a single module capable of operating at 85 degC. Embedded MilSTD requirements in the SOW

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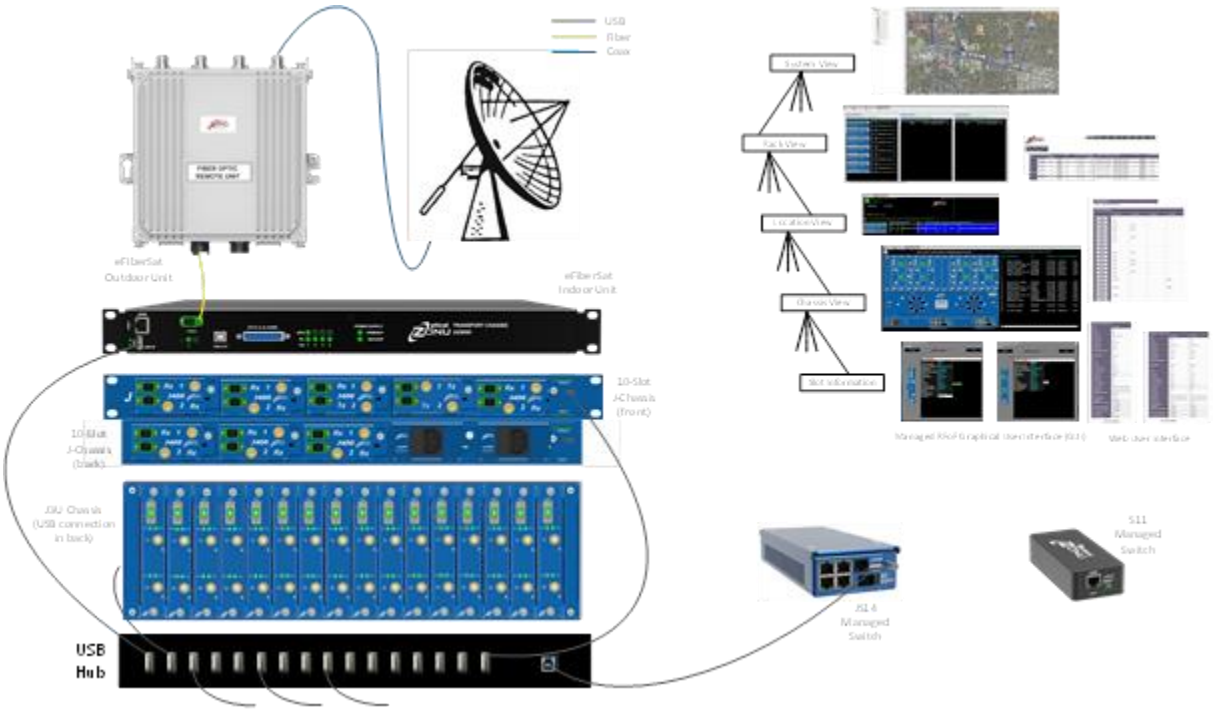
Managed RFoF – Comprehensive Monitoring and Control

. Managed RFoF is a suite of tools and applications used to monitor/control local and geographically dispersed signal transport systems. Only a standard web browser is required to connect to an embedded Managed RFoF agent. SNMP v2/v3 enables all user interfaces. All Optical Zonu equipment (ZonuConnect, J3U Chassis, J-Chassis, OZC9500 chassis, Antenna Extender, eFiberSat, Switched Delay Lines, etc.) may be accessed through a single IP address. Systems may be monitored via Optical Zonu graphical user interface (GUI), simple HTTP TCP/IP tabular user interface, and SSH command line interface (CLI).



Managed RFoF provides a hierarchical user interface presentation for drill down capability – view System (via any 3rd party NMS), Rack, Location, Chassis, Module levels. The Managed RFoF firmware is easily updated remotely and provides three levels of system access, all password protected. Systems may be segregated per user or application via redundant managed switches. Multiple racks of equipment may be monitored (by accessing a single IP address) by interconnection with a serial USB interface. OZC's patented µOTDR technology facilitates fast fiber fault finding to increase System Availability. Managed RFoF applications may be integrated into monitoring tools such as SITE Portal.

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