FS42R-1719E
Dual Band Fiber Fed
Outdoor Das System

Series FS42R

User Manual

RF On Fiber ®
Signal Distribution
Products for Outdoor DAS Coverage
Extension Applications

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Revision History

Version	Author	Description	Date Release
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1. Summary

This document is intended to cover the operation of the Fiber-Span Dual Band Outdoor DAS FS42R-1719E. It provides the reader with a general description of the product and its interfaces. It contains information intended for engineers, technicians and operators working with the Dual Band Outdoor DAS.

2. General Description

The Fiber-Span fiber fed Distributed Antenna System (DAS) is a wireless optical network which can be used to expand network and capacity needs and to overcome site location constraints involving zoning issues, limited space availability or prohibitive BTS based site lease costs . It provides connectivity between a BTS site and several Remote Antenna sites through a fiber optic link. The DAS is made up of two main components; one FTU and three Remote Fiber Nodes. Shown below are the FTU and the three Remote Fiber Nodes. The FTU is located near the BTS site and the Remote Fiber Node is located at the antenna site.

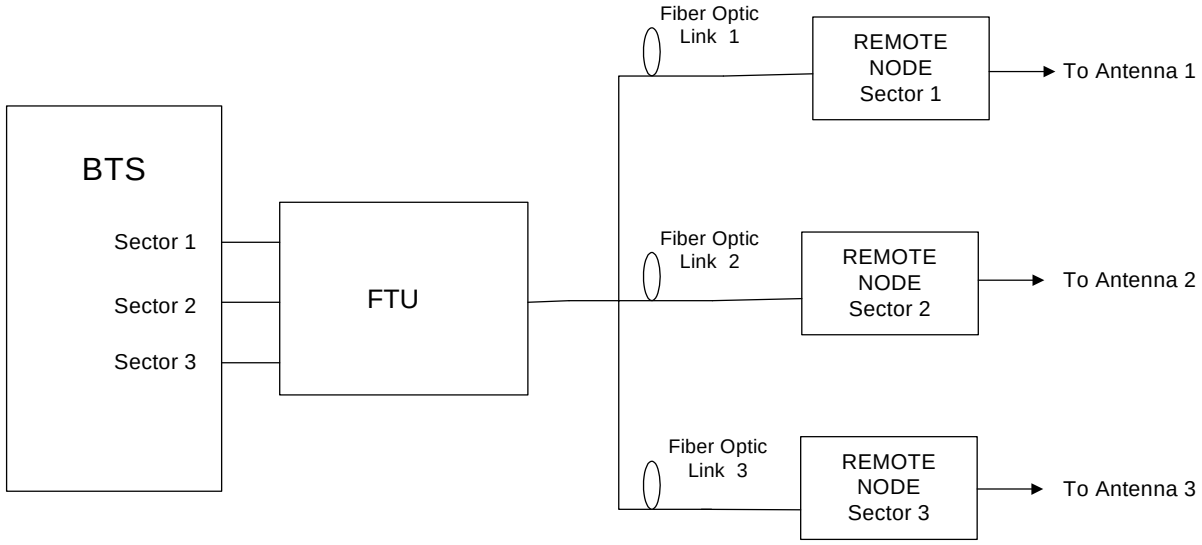


Figure 1: DAS System Diagram

The Fiber-Span Dual Band Distributed Antenna System (DAS) FS42R-1719E is a dual band version of the Fiber-Span DAS. It designed to work in the AWS band and the PCS band.

The Fiber-Span Dual Band Outdoor DAS is made-up of three main components:

1. Dual Band Remote Fiber Node (RFN)
2. PCS and AWS Band Fiber Transceiver Unit (FTU)
3. Element manager

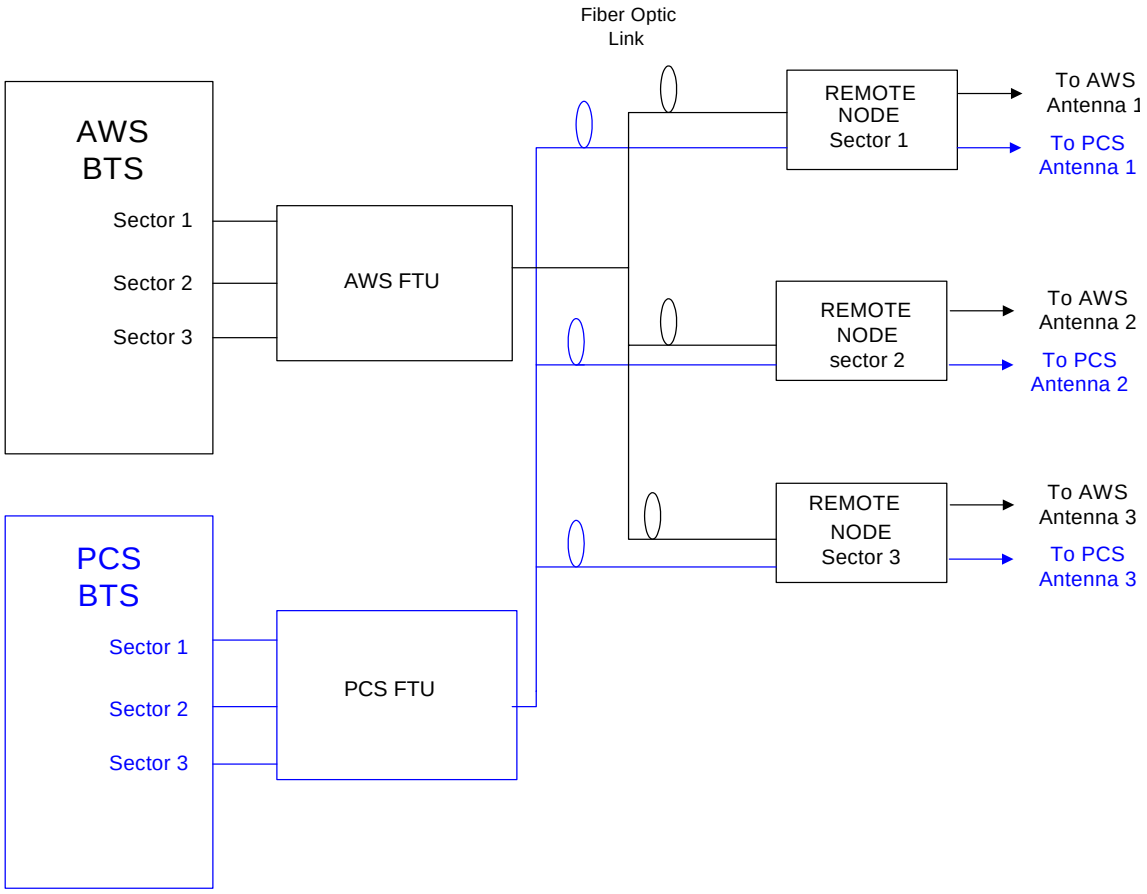


Figure 2: Dual Band Outdoor DAS System Diagram

Remote Fiber Node:
The Remote Fiber Node is dual band; it supports AWS and PCS bands.
On the UL path (RX), the Remote Fiber Node converts RF signal to optical and improves the system's receive (Rx) noise. floor. On the DL path (TX), the Remote Fiber Node converts optical to RF and amplifies the RF output to 20Watts (43 dBm).

Fiber Transceiver Unit:
The FTU is designed as two separate units: a PCS model and an AWS model.
On the UL path (RX), it converts optical to RF. On DL path (TX) RF to optical. The FTU also monitors and controls the network (FTU and RFN) via the Element manager.

Element Manager: This unit can monitor and control multiple DAS Systems via the FTU's.

3. Dual Band Outdoor DAS Remote Fiber Node (RFN) [Standard Configuration]

3.1 Remote Fiber Node Model Drawing

Figure 3: Remote Fiber Node Model Drawing

3.2 Remote Fiber Node Block Diagram (Common to all configurations)

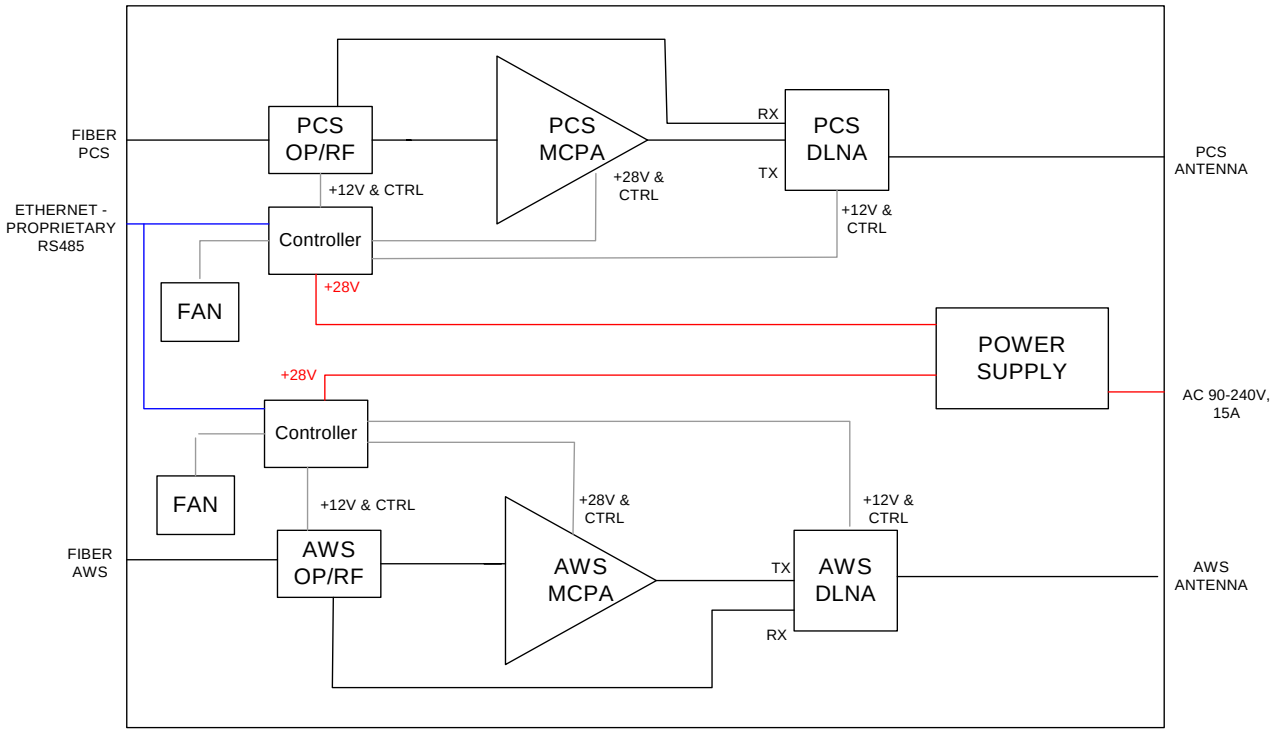


Figure 4 Remote Fiber Node Block Diagram

3.3 Remote Fiber Node Detailed Description

The Remote Fiber Node is a dual band duplexer/amplifier system. On the UL path, the Remote Fiber Node amplifies the RF signal (low noise amplifier) and converts it to optical. On the DL path (TX), the Remote Fiber Node converts the input optical signal to RF and amplifies the signal to 20Watts (power amplifier). Following is a brief description of each module.

OP/RF Module: Converts RF to optical and optical to RF. One is used for the PCS band and a second one is used for the AWS band.
MCPA: Multi-carrier Power Amplfiier. The MCPA amplifies the RF output power to 20Watts (43dBm). Both MCPAs are multicarrier, thereby insuring optimal ACP performance.
DLNA: Duplexer/Low Noise Amplifier. The DLNA duplexes the Rx and Tx signals and is designed to amplify the RX path and improve the sysem's noise floor.
Controller: The Controller provides power, control and monitoring to the various modules of the Remote Fiber Node. The controller also provides communication with the unit, via a GUI based application, that can be used to display information on the operating conditions and alarm conditions of the Remote Fiber Node.

3.4 Remote Fiber Node (RFN) External Interfaces (Standard Configuration)

3.4.1 Remote Fiber Node Interface Description

Interface	Description	Limits, Max.
FIBER PCS Single Mode FC ACP	Optical Input /output Port – for PCS Band Input from FTU on DL path Output to FTU on UL path	
PCS ANTENNA 7/16 DIN FEMALE	RF Antenna Port – for PCS Band (RF in for UL path) (RF out for D path)	Max. input Power (UL Path): 10 dBm Rated Output Power (DL path): 20Watts
FIBER AWS Single Mode FC ACP	Optical Input /output Port – for AWS Band Input from FTU on DL path Output to FTU on UL path	
AWS ANTENNA 7/16 DIN FEMALE	RF Antenna Port – for AWS Band (RF in for UL path) (RF out for DL path)	Max. input Power (UL Path): 10 dBm Rated Output Power (DL path): 20Watts
AC 90-250V, 15A	Power Supply Input Voltage	90 – 250 V 15 A
ETHERNET PROPRETARY – RS485	RS485 Communication Port For local commisioning	

3.4.2 Remote Fiber Node Front Panel Drawing

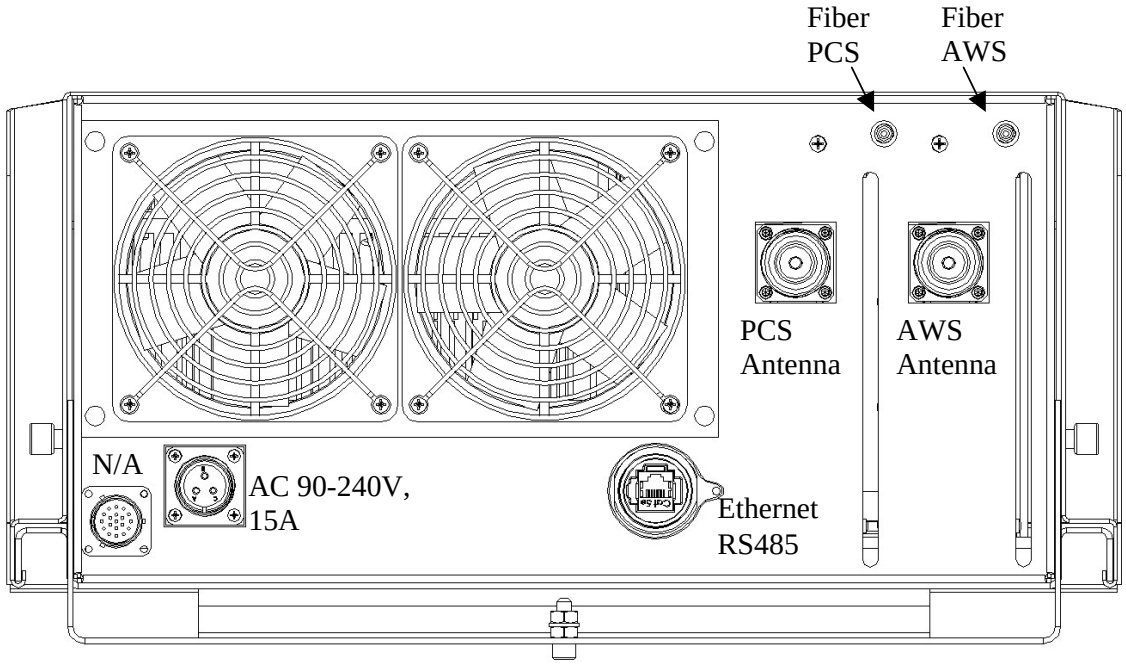


Figure 5: Remote Fiber Node Front Panel

4. Dual Band Outdoor DAS Fiber Transceiver Unit (FTU)

4.1 Fiber Transceiver Unit Model Drawing (Shown with Optional Duplexed Interface)

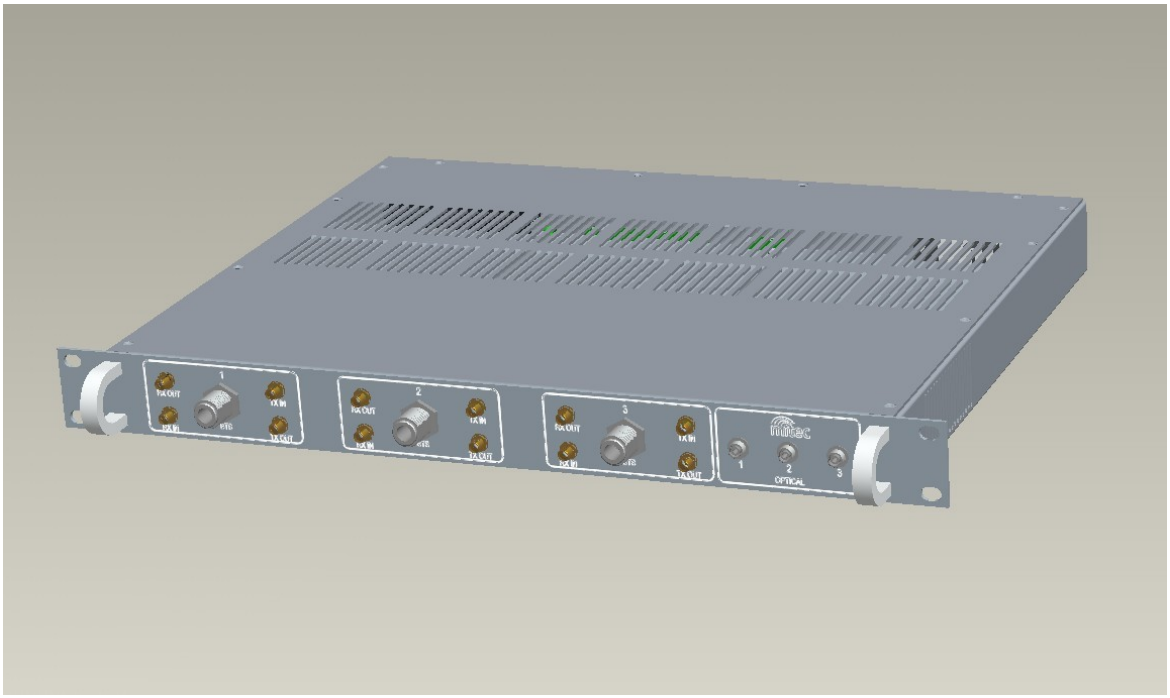


Figure 6: FTU Model Drawing

4.2 Fiber Transceiver Unit Detailed Description

The Fiber Transceiver Unit (FTU) has two different functions: it converts the input optical signal to RF on the UL path (Rx), converts the RF input signal to optical on the DL path (Tx) and it also monitors and controls the network (FTU and RFN) via the Element manager.
The FTU has two different input configurations:

- Separate Tx & Rx: For low power compact base station with separate Rx and Tx signals, input power –5dBm to 5dBm.
- Optional Diplexed Tx/Rx: For Tx/Rx diplexed signal from base station, input power 0- 43dBm. In this configuration, the FTU attenuates the RF input to a suitable level for the fiber optic link (0dBm) on the DL path (Tx).

Following is the block diagram of the FTU and a brief description of each module.

OP/RF Module: Converts RF to optical and optical to RF.
RF Board: On the BTS port, duplexes the Rx and Tx signals and attenuates the RF input signal to 0dBm. On the RX separate path (Rx out), it sets the gain of the Rx path. On the TX separate path (Tx in), it sets the gain of the Tx path.
Controller: The Controller provides power, control and monitoring to RF Board and OP/RF modules. The controller also provides communication with the unit via a GUI based application that can be used to display FTU information. The controller also provides communication with the Remote Fiber Node via the fiber optic link. Communication to the controller is established by an RS485 local Ethernet port.

4.3 Fiber Transceiver Unit Block Diagram

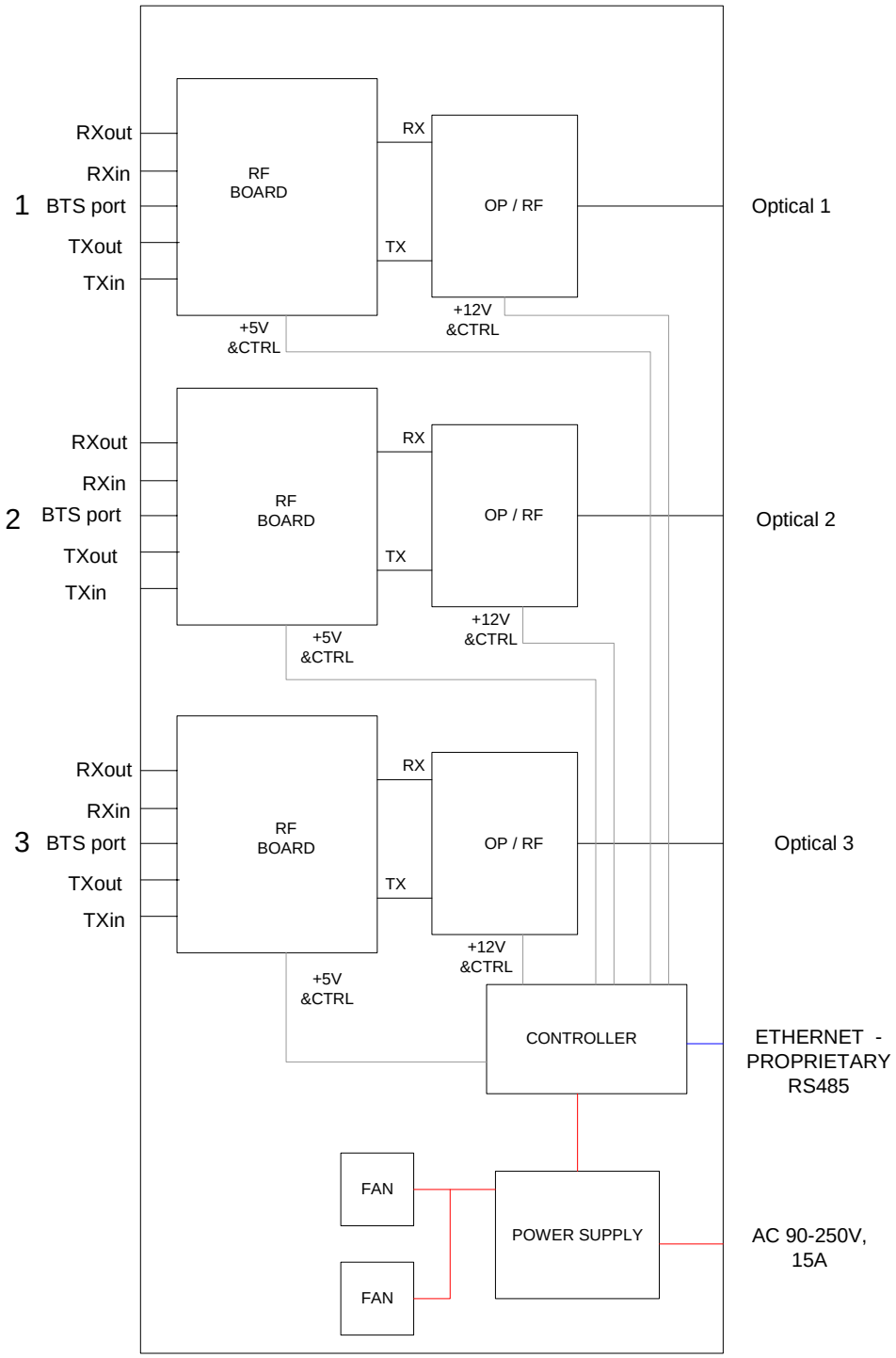


Figure 7: FTU Block Diagram

4.4 Fiber Transceiver Unit External Interfaces (with optional Duplexed Ports)

4.4.1 FTU Interface Description

Interface	Description	Limits, Max.
Rxout (1-2 and 3) SMA FEMALE	Rx output (separate Rx/Tx ; for low power compact BTS)	
RXin (1-2 and 3) SMA FEMALE	RX input from RXout when using diplexed Rx/Tx Port connection.	
BTS Port (1-2 and 3) N-TYPE FEMALE	TX and RX diplexed BTS Port	Max. Input Power: 43dBm Min. Input Power: 36dBm
Txout (1-2 and 3) SMA FEMALE	Tx output from BTS port when using diplexed Rx/Tx Port connection	
Txin (1-2 and 3) SMA FEMALE	Tx In (separate Rx/Tx ; for low power compact BTS)	Max. Input Power: 5dBm Min. Input Power: -5dBm
Optical (1-2 and 3) FC/ACP	Optical Input /output Port Output to RFN on TX path Input from RFN on RX path	
ETHERNET	RS485 Communication Port	
AC POWER IN 110/220 VAC	Input Voltage	Min. Input Voltage: 90V Max. Input Voltage : 220V

4.4.2 FTU Front Panel Description (show with optional Duplexed Ports)

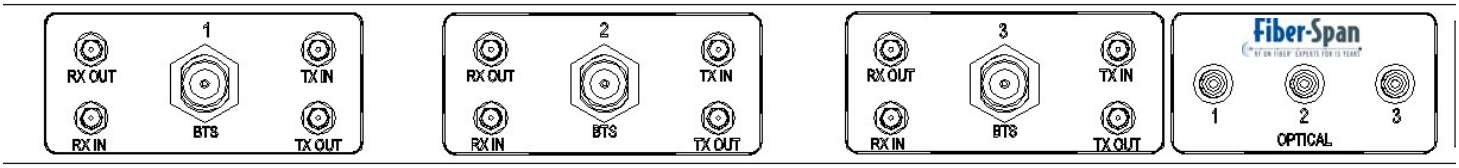
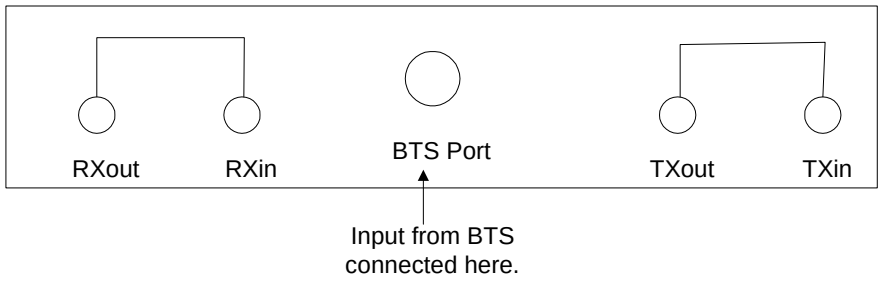


Figure 8: FTU Front Panel

Depending on the input configuration of the FTU, there are different connections required to the front panel :

1. TX/ RX diplexed
2. TX and RX separate

TX/RX Diplexed:



TX/RX Seperate:

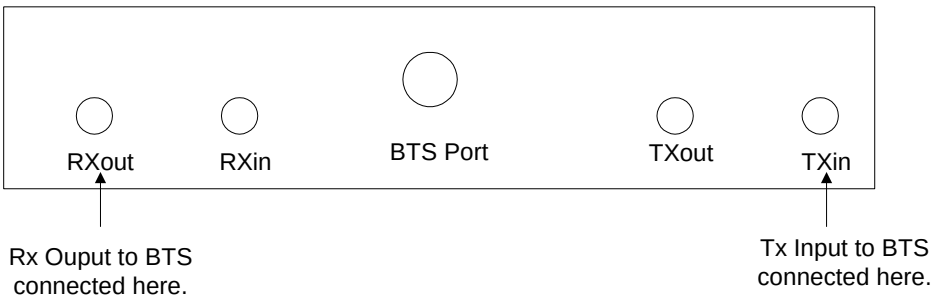


Figure 9: FTU Front Panel Configurations

5. Dual Band Outdoor DAS System Connections

Following is a system connection diagram showing how to connect the 3 Remote Fiber Nodes and 2 FTUs for the Dual Band Outdoor DAS. Connections shown with optional Duplexed input configuration.

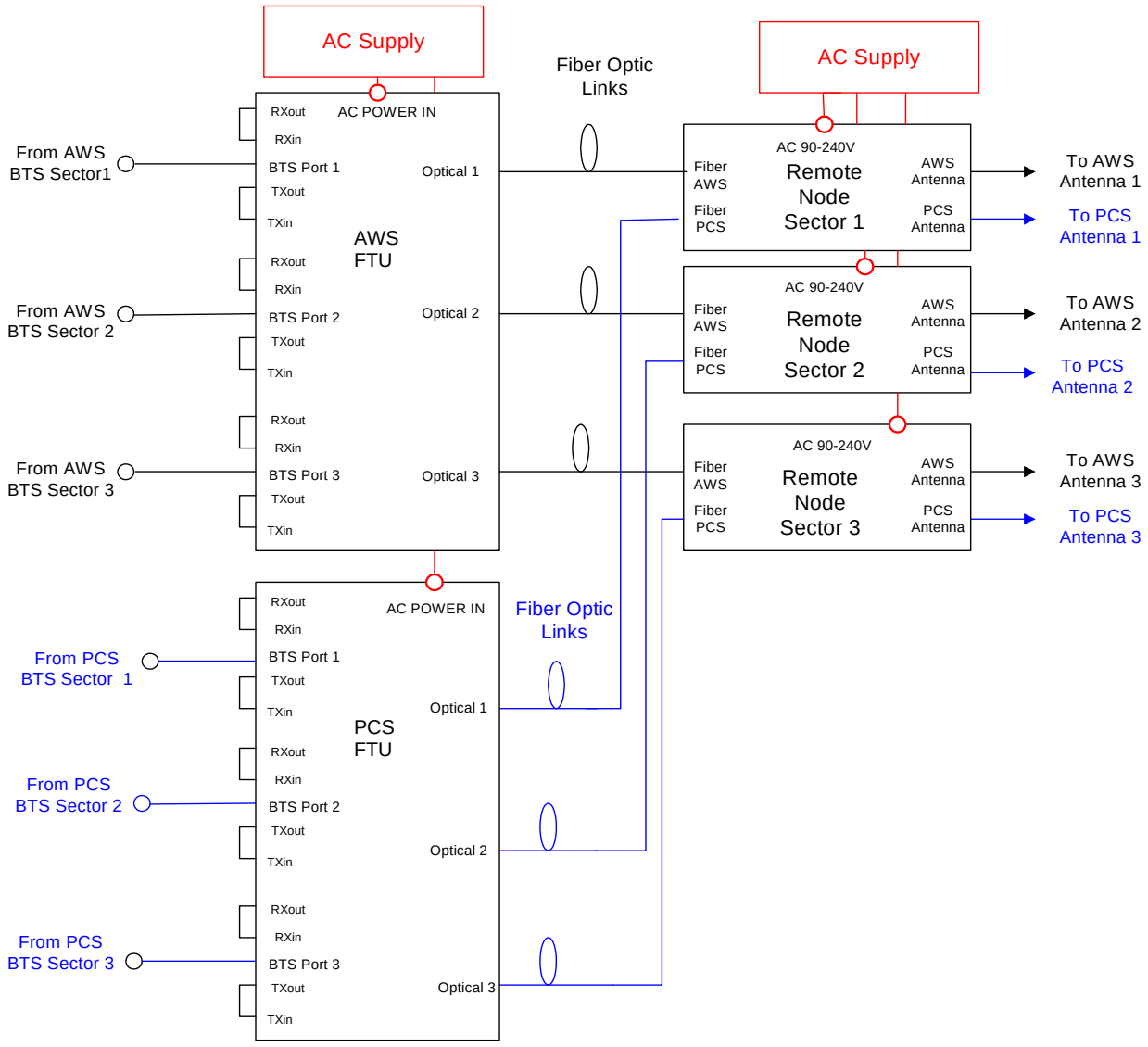


Figure 10: Dual Band Outdoor DAS System Connections

6. Dual Band Outdoor DAS Electrical Specifications

Electrical Requirements	Specification PCS	Specification AWS
DL (TX)	**PCS**	**AWS**
Frequency of Operation	1930-1900MHz	2110 – 2155 MHz
RF Output Power	36 to 43 dBm	36 to 43 dBm
Gain	0 dB (Factory Set 0 dB, Field Adjustable)	0 dB (Factory Set 0 dB, Field Adjustable)
Emission Mask	Compliant to 3GPP2 (4xEDGE signal, spacing 600KHz)	Compliant to 3GPP2 (2 x CDMA2k signals, 20 MHz instantaneous BW)
UP (Rx)	**PCS**	**AWS**
Frequency of Operation	1850-1910 MHz	1710-1755 MHz
Gain	6.0 dB 10 miles (13km) fiber length between FTU and RFN.	6.0 dB 10 miles (13km) fiber length between FTU and RFN
Noise Figure for G<5dB	5.0 dB	5.0 dB
IP3	-5 dBm	-5 dBm

7. Monitoring & Control

The system can be monitored and controlled using the RS-485 interface. Following is a list of the monitoring and control features that are available on this product.

Monitoring and Control Description & Specification

Monitoring	Description	Specification
Remote Fiber Node Forward Output Power (RF)	RF Output Power level (dBm) of the Remote Fiber Node at Antenna port.	
Remote Fiber Node Reflected Power (RF)	RF Reflected Power level (dBm) of the Remote Fiber Node at Antenna Port.	
Remote Fiber Node Temperature	Temperature (ºC) of the Remote Fiber Node (controller board).	± 3 degrees
FTU Input Power (RF)	RF input power level (dBm) at the BTS input port of the FTU.	
FTU Temperature	Temperature (ºC) of the FTU (RF board).	
System Gain	DL path gain (Tx) from the input to the FTU to the output of the Remote Fiber Node.	
Control		
Remote Fiber Node Tx Path Gain Control	User Control – The customer can adjust the gain of the Remote Fiber Node DL path (Tx) through the GUI interface.	

Alarms		
MCPA Alarm	Alarm if any of the MCPA RF devices fail.	
Power Supply Alarm	Alarm if any of the power module (DC/DC converters) fail.	
Temperature Alarm	Alarm when temperature > 85 ºC.	
LNA Current Alarm	Alarm if current > 200mA on the LNA of the AWS or PCS DLNA.	Default value is 200mA can be modified by user
VSWR Alarm	Alarm if at antenna port of Remote Fiber Node Forward Output Power – Refelected Power < 5dB	
Fiber Optic Module Alarm	Alarm if one of the fiber optic module fails	
Fan Failure Alarm	Alarm if any of the fans fail	

8. Graphic User Interface (GUI)

A Fiber-Span GUI is provided to control and monitor the performance of the Dual Band Outdoor DAS. The GUI can be used to monitor 1 FTU and 3 Remote Fiber Nodes using a local connection.

The GUI that needs to be installed on the computer to monitor both the AWS and PCS FTUs.:
DAS GUI vX.YY.exe

Following are the steps required to install and run both GUIs.

Create a folder for each AWS and PCS and copy the corresponding GUI inside along with a copy of DAS-Profile.ini file
Install WinPcap software
Connect each FTU to a hub and to PC
Run both GUI from their new folders

GUI Interface – 1 FTU

In order for the GUI to communicate with the Dual Band Outdoor DAS, a cable needs to be connected between a PC/Laptop and the FTU communication port – ETHERNET port. The FTU controller uses RS485 protocol on its ETHERNET port. The FTU communicates with the Remote Fiber Node through Fiber Optic Link, no other connection is required to the Remote Fiber Node to communicate with the GUI. The PCS GUI is required to connect to the PCS FTU and the AWS GUI is required to connect to the AWS FTU. Therefore, there are two instances of the Fiber-Span GUI running at the same time to monitor both FTUs.

Following is the snapshot of the GUI, there are two pages which are displayed on the screen:

1. Settings Page: This is the page where all the settings for the network, e-mail server, and dialy logs are entered. This is the first page to come up every time the user starts-up the GUI. It is also available from the Display Page using the “Settings”button.

2. System Performance Page: This is where the DAS system performance parameters are displayed for 1 FTU.

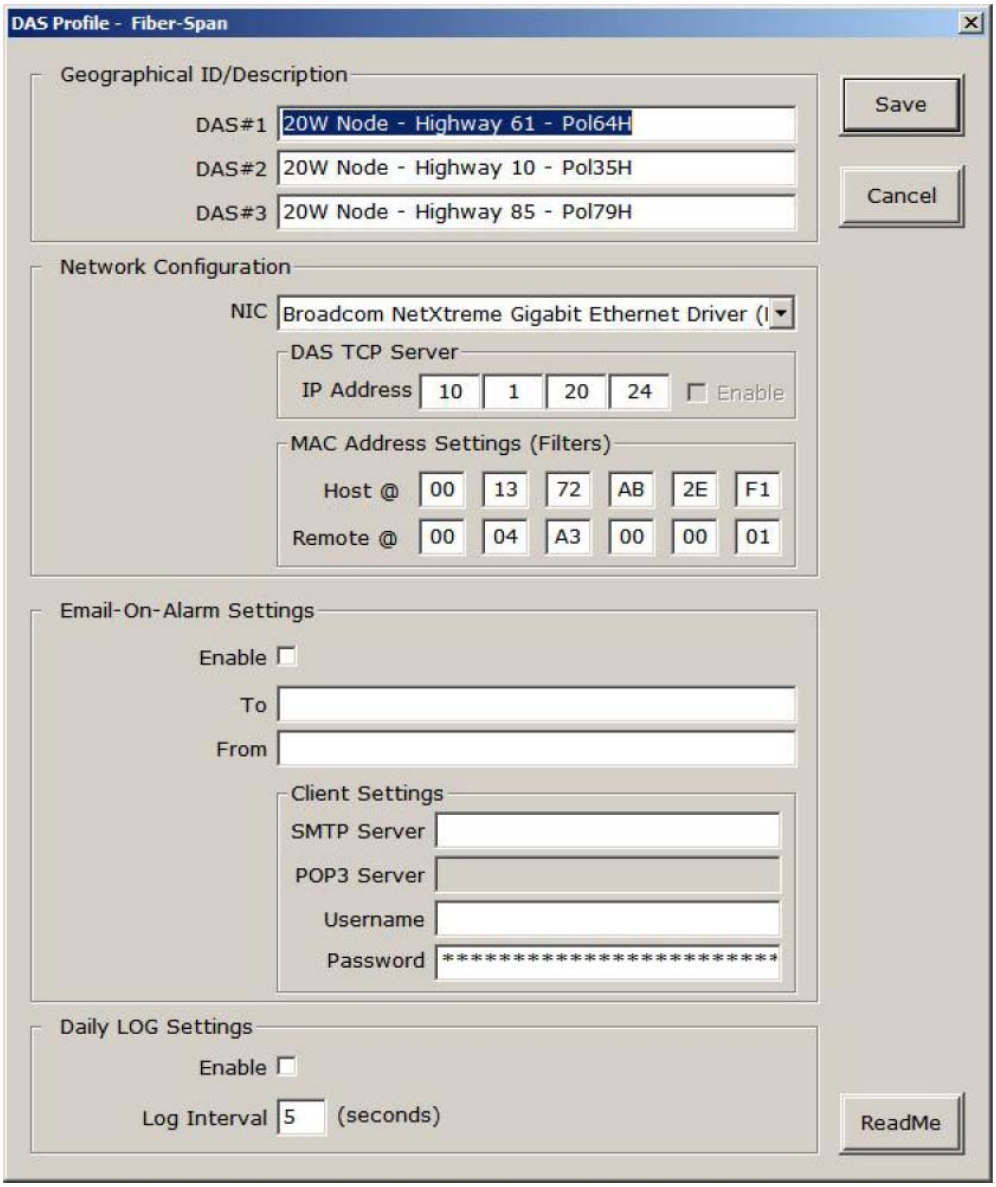


Figure 11: Fiber-Span GUI Settings Page

Geographical ID/Description:
Field to describe each Remote Fiber Node that is connected to the FTU, to be able to distinguish one from the other on the display page.
DAS # 1: Unit that is physically connected to Optical 1 Port.
DAS # 2: Unit that is physically connected to Optical 2 Port.
DAS # 3: Unit that is physically connected to Optical 3 Port.

Email-On-Alarm Settings:

Check enable Box to Receive e-mail notification when an alarm arises. The client settings are the e-mail server settings that the customer is using for the e-mail notification.

Daily Log Settings:

Check enable Box to log the performance display page at a particular interval.

ReadMe: Not Used.

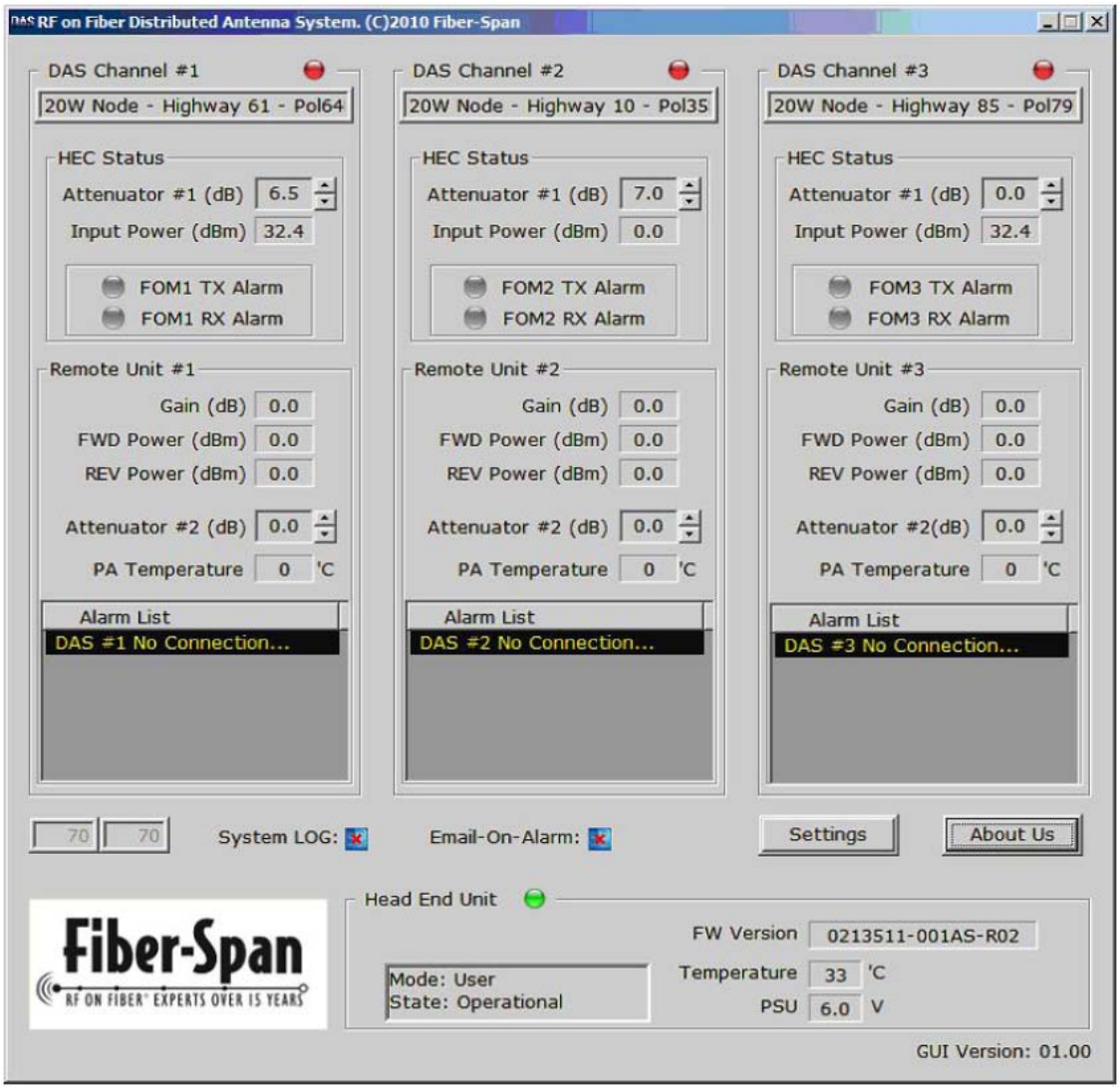


Figure 12: GUI System Performance Display Page

There are 4 sections on the DAS system performance page:

Head End Unit Section: System Performance parameters for the FTU

If the Head End Unit Button is Green, the communication with the FTU has been extablished.

FW Version: Firmware Version installed on the FTU
Temperature: Temperature in degrees celcius of the controller inside the FTU unit.
PSU: Power Supply Voltage Output

DAS Channel # 1, DAS Channel # 2 and DAS Channel # 3 Section: Performance parameters for the 3 individual Remote Fiber Nodes.

If the DAS Channel # X is Green, the communication with the Remote Fiber Node has been established.

Underneath the DAS Channel # X is the description given to the Remote Fiber Node (from settings page).

FTU Status:

Attenuator # X: Setting for the digital attenuator of the FTU to control gain of the system.

Fiber-Span

Input Power (dBm): Power level in dBm at the input of the FTU, BTS Port.

FOM1 TX Alarm and FOM1 RX Alarm: Alarm from Fiber Optic Module of the FTU, Tx / RX respectively.

Remote Unit # X:

Gain (dB): System Gain Calculated from the input to the FTU (BTS port) to the output of the Remote Fiber Node (Antenna Port)

FWD Power (dBm): Power Level at the output of the Remote Fiber Node (Antenna Port)

REV Power (dBm): Power Level of power reflected back into the unit at the output of the Remote Fiber Node (Antenna Port)

Attenuator # 2: Setting for the digital attenuator of the Remote Fiber Node to control gain of the system.

PA Temperature: Temperature in degrees celcius of the MCPA inside the Remote Fiber Node unit.

Alarm List: List of Alarms currently active on the unit:

FAN 1 Alarm

FAN 2 Alarm

9. Mechanical Specifications

Mechanical	Specification
Size	26.5”H x 13.2”W x 7.3”D
RF Connectors	DIN
Control connector	RJ-45
Optical Connector	FC/APC
Finish	Enamel Paint

10. Environmental Specifications

Environmental	Specification	Notes
Temperature of operation	-40 to +45	Warm up of 20 minutes at -40
Enclosure	IP65	

11. Regulatory Statements:

“Changes or modifications not expressly approved by the manufacturer could “Void” the user’s authority to operate the equipment”.

This device has been designated to operate with antennas having a maximum gain of [14] dBi for a [5] meter distance and antennas having greater values are strictly prohibited for use with this device. The required antenna impedance is [50] Ohms.

12. Appendix A : Installation Instructions

Preparing for Installation

Before attempting to install, we recommend that you first familiarize yourself by reading through the installation instructions. Understanding the system operation will reduce the possibility of incorrect installation, thereby causing damage or injury to yourself or others.

The system **must** be installed in accordance with the conditions and recommendations contained in the following sections.

Safety Precautions

Carelessness or mishandling of the DAS may damage the equipment causing serious injury to yourself or others. All installation activity must be carried out in compliance with the safety instructions supplied with the BTS and with local standard authority warnings and precautions.

Please adhere to the following:

WARNING!!

This equipment is designed for use with high power radio frequency (RF) radiating systems. Personnel must take precautions to minimize exposure to the RF fields.

WARNING!!

The equipment is designed for use with equipment that generates high voltages. Proper precautions must be taken when working with this equipment.

CAUTION!

To prevent damage to static sensitive devices, ESD (electrostatic discharge) precautions must be observed when handling or installing the equipment.

Do not tamper with, or attempt to reconfigure, the cords or plugs supplied with the hardware, as this can:

- *result in personal injury*
- *void the warranty*
- *cause damage to the units or related equipment*

Warranty Information

Fiber-Span will warranty each product that it manufactures to be free from defects in materials and workmanship for a period of twelve (12) months.

Fiber-Span's only obligation under this warranty is to, at its option, repair or replace any product or part thereof that is returned with transportation charges prepaid to **Fiber-Span** by the original purchaser within one year after delivery to the original purchaser, and which, upon examination by **Fiber-Span**, is determined to be defective or to have failed the normal service.

Equipment Damage or Loss

Fiber-Span is not responsible for damage or loss of equipment during transit. For further information, contact the responsible transport carrier.

When declaring equipment as damaged during transit, preserve the original shipping cartons to facilitate inspection reporting.

Return of Equipment

All warranty returns must be authorized by the **Fiber-Span Customer Service Department**, which will issue a Return Material Authorization (RMA) number. This is important for prompt, efficient handling of the returned equipment and of the associated complaint

When returning equipment to Fiber-Span for repair or replacement:

1. Notify **Fiber-Span Customer Service Department** of the equipment condition and obtain a Return Material Authorization (RMA) number and shipping instructions at:
    a. Email: sales@fiber-span.com
    b. Telephone: (908) 253-9080
    c. Fax: (908) 253-9086
2. Identify, in writing, the condition of the equipment.
3. Include to the Part Number, Serial Number, Sales Order, Purchase Order and the date the equipment was received.

Fiber-Span will pay for the cost of shipping the product to the customer after the repairs are completed.

System Installation

DAS Remote Fiber Node System Block Diagram:

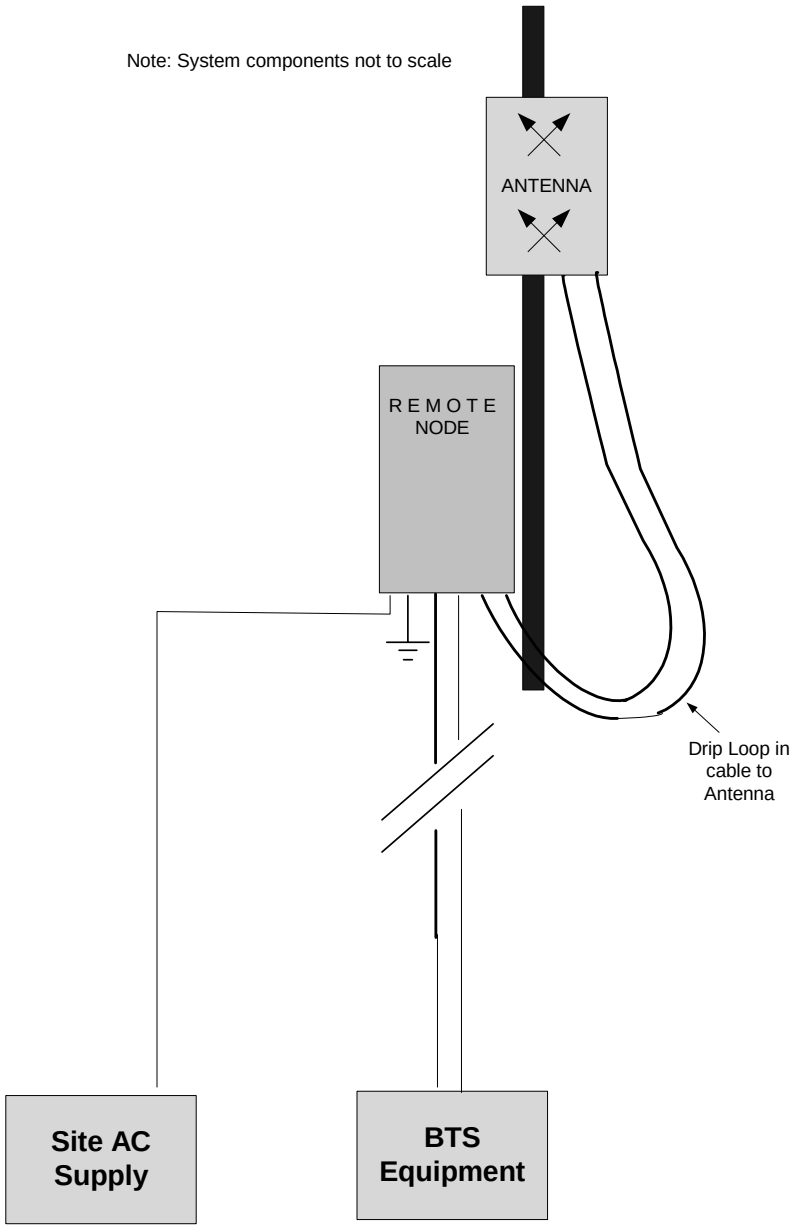
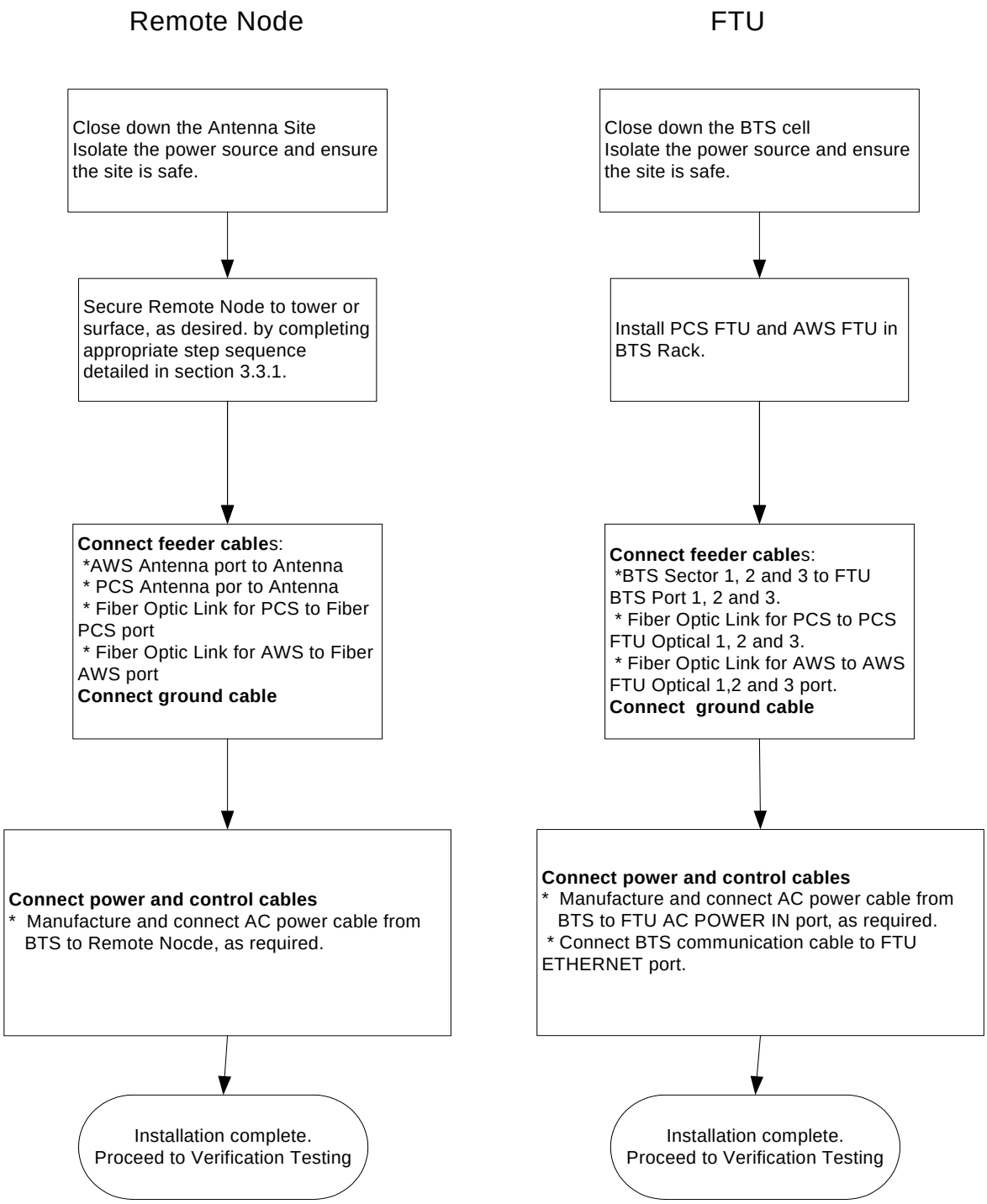


Figure 13 – System Block Diagram

Installation Overview

The flow chart below illustrates the steps required to install the DDAS Remote Fiber Node and FTU. Details and graphic explanations for the installation steps are shown in the following detailed installation sections, as indicated.



Detailed Installation Instructions

Remote Fiber Node Installation

The DAS Remote Fiber Node has been designed to be mounted outdoors directly on the antenna mast. If this is not feasible, it may be mounted on a flat wall surface as close as possible to the associated antenna. Each DAS Remote Fiber Node comes equipped with integrated mounting brackets which are used for either installation option .

Remote Fiber Node Verification Testing

Standard site testing done by the operator includes drive testing and base station Key Performance Indicators (KPI).