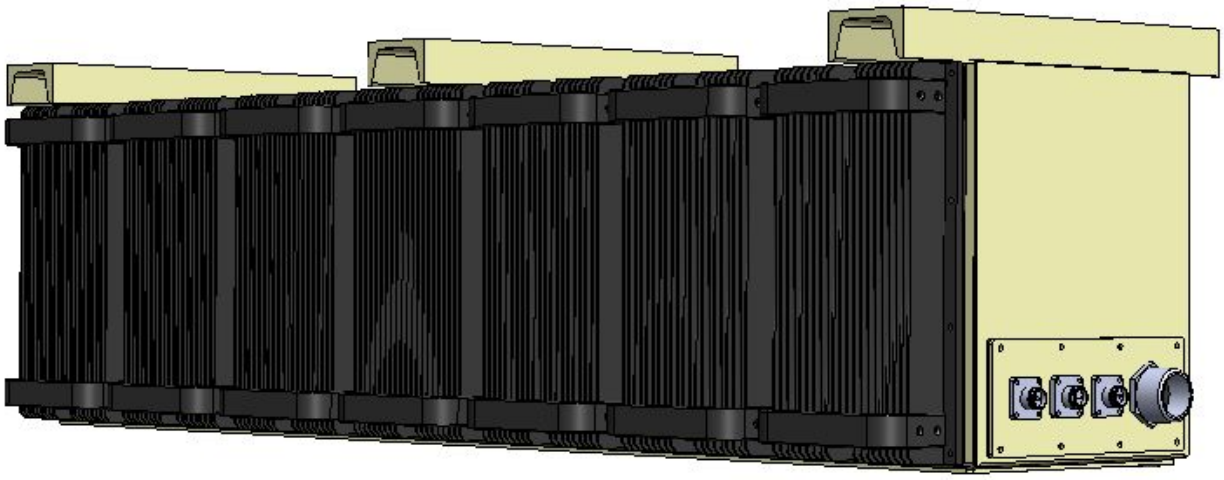
Fiber-Span
RF ON FIBER® EXPERTS OVER 15 YEARS

User Manual

Remote Fiber Node (RFN)

Multi-service ruggedized equipment extends carrier services



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Fiber-Span

3434 Route 22 W.
Branchburg, New Jersey
08876

Tel: (908) 253-9080
Fax: (908) 253-9086

www.fiber-span.com

2. Introduction

The FS47 Remote Fiber Node (RFN) is a multi-service equipment designed to extend multiple wireless carrier services such as 700, 800/900 iDEN, Cellular, PCS, AWS, WiFi and WiMAX. The RFN's unique design allows it to be easily adapted to meet the demands of new generations of communication schemes.

All three DAS interface ports are capable of providing a high linear output power greater than **25 dBm** per band.

Incorporating a unique feature, the system provides three downlink/ uplink RF ports for connection to distributed antenna systems (DAS) capturing distributing and launching, the many frequency bands at once using Dense Wavelength Division Multiplex (DWDM) technology allowing simultaneous extended wireless coverage from many of the carrier services.

The RFN utilizes a rugged enclosure to withstand high vibration, and the front façade of each plug-in module has a large heat sink for efficient heat dissipation. The RFN employs modular construction, offering trouble-free access to individual carrier services for maintenance and upgrade, without disrupting the operation of any of the others.

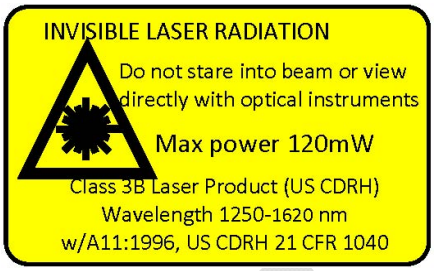
3. Revision History

Version	Description	Date	Author
0.1	Draft release	8-Mar-2011	C.M.

4. Table of Contents

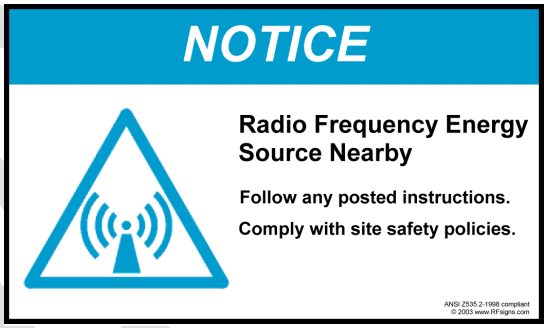
5. Warnings

Invisible radiation exits from areas labeled "Aperture"



All fibers at both ends of the optical link connected before applying power to either fiber transceiver unit and remote fiber node will prevent exposure.

Follow and comply with all site safety policies.



- Exclamation point denotes attention to statement.
- Terminate all RF ports with a 50 Ohm load.
- While in operation do not touch RFN front façade heat sink because surface is very **HOT**.
- Maximum RF Input level -30 dBm.

Only a qualified technician shall be allowed to operate the unit, after reading and understanding all the guidelines in this manual.

6. Product Overview

A Remote Fiber Node (RFN) chassis has 7 compartments that houses a variety of modular plug-in modules, of which their internal components and rear-mount mechanisms are mapped according to operating frequency bands. Chassis inside slots have a mating rear receptacle that provides primary power to the plug-ins as well as the RF Input / Output interface functions.

There is no optical interface between any of the plug-ins and the back receptacle.

As viewed with heat sink facing you, (from left-to-right) each chassis slot is dedicated to a frequency band; a list of which is shown in Figure 1 below:

Slot 1	WiFi 2.4 GHz
Slot 2	Unused, but accommodates WiMAX
Slot 3	iDEN 800/900 MHz
Slot 4	AWS 2.1 GHz
Slot 5	700 MHz
Slot 6	Cell 850 MHz
Slot 7	PCS 1.9 GHz

Figure 1

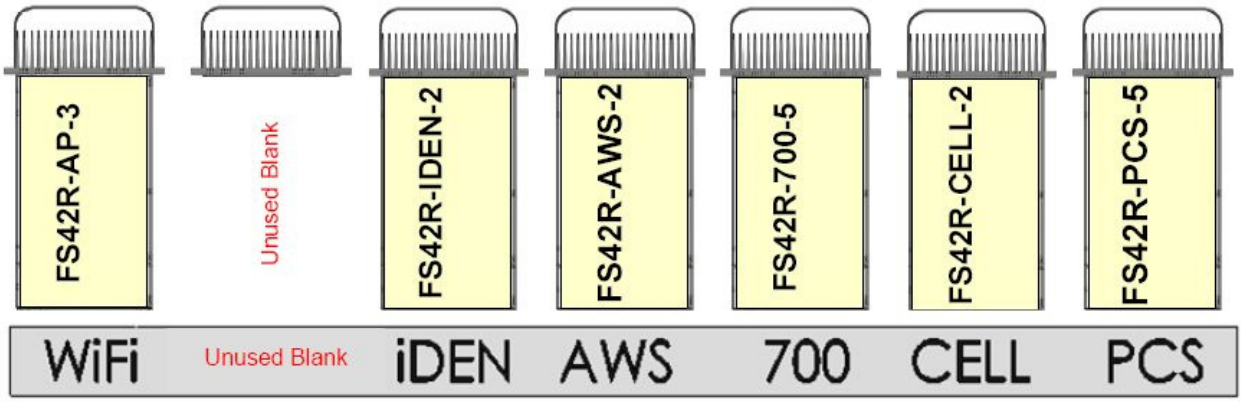


Figure 2: Frequency Band Layout

Internally, the Plug-ins employ similar circuitry and layout designs using filters, attenuators, low noise amps and power amplifiers for their respective allocated frequency band, excluding the WiFi Plug-in.

For future upgrade purposes, the factory may re-position frequency band plug-ins slots from that shown here.

All the plug-ins are HOT-swappable which allows removal and replacement while the RFN is ON and operating.

6.1. WiFi

WiFi is short for "Wireless Fidelity", and uses IEEE 802.11 specifications with protocols for communicating end-to-end via a wireless network.

The WiFi Plug-in has 3 access points each one independently going to antenna 1,2 and 3 with the Channel set to:

Access-Point Position	Antenna ID	Channel Name
Left	ANT 1	WiFi Channel 1
Center	ANT 2	WiFi Channel 6
Right	ANT 3	WiFi Channel 11

For **802.11g** operation, typical receive sensitivity ranges from **-73 dBm** at **54 Mbps** to **-96 dBm** at **1 Mbps**. For all practical purposes, as Mbps data rate doubles sensitivity drops by **3 dB**.

Indoor wireless coverage ranges from **460 ft.** at **1 Mbps** to **105 ft.** at **54 Mbps** data rate. Outdoor use (compared to indoor) with no obstruction distance doubles between **1- 48 Mbps**, but not much higher of **120 ft**. at **54 Mbps**.

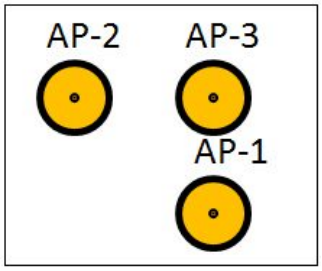
Measurements were taken with a **2.2-dBi** dipole antenna for **2.4 GHz**.

Maximum power draw per access point is **12.95 Watts** x **3** equals **38.85 Watts** Total.

For added isolation access point ports have an in-line band pass filter. Instrument operates in the 2400-2483.5 MHz region.

Figure 3 displays Plug-in WiFi RF connections in rear.

Figure 3



6.2. iDEN

The iDEN Plug-in is a bi-directional service module comprising of uplink and downlink circuitry. Internally it houses all the devices that condition, filter and amplify the specified frequency band while rejecting the adjacent family bands operating within the chassis.

Although it accommodates both paths, circuitry is kept shielded providing **120 dB** of isolation between them which prevents any RF crosstalk.

The iDEN uplink has 2 independent internal inputs that combined iDEN 8 and iDEN 9 allocated bands. Downlink last stage output power amplifier accommodates both iDEN 8 and iDEN 9 frequency bands.

Circuitry is similar in the UL and DL paths, with uplink RF Gain at **40 dB** while the downlink has more gain, with the addition of a high power amplifier module that provides **40 dB** to drive the DAS for a total of **70 dB** from end to end. In both directions, inserted between the pre-amplifier and mid-amplifier is an attenuator with a **31 dB** adjustment range.

Instrument operates in the **iDEN8**: UL 817-824, DL 862-869, **iDEN9**: UL 896-902, DL 935-941 MHz regions.

Figure 4 displays Plug-in iDEN RF connections in rear.

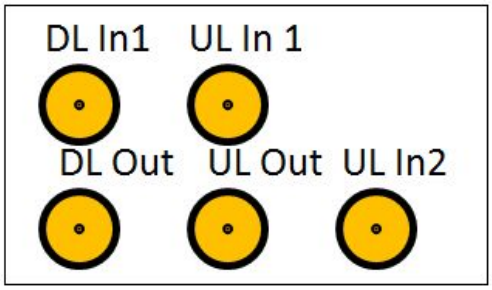


Figure 4

6.3. AWS

The AWS Plug-in is a bi-directional service module comprising of uplink and downlink circuitry. Internally it houses all the devices that conditions, filters and amplifies the specified frequency band while rejecting the adjacent family bands operating within the chassis.

Although it accommodates both paths, circuitry is kept shielded providing 120 dB of isolation between them which prevents any RF crossover.

Circuitry is similar in the UL and DL paths, with uplink RF Gain at **40 dB** while the downlink has more gain, with the addition of a high power amplifier module that provides **40 dB** to drive the DAS for a total of **70 dB** from end to end. In both directions, inserted between the pre-amplifier and mid-amplifier is an attenuator with a **31 dB** adjustment range.

Integrated with the AWS plug-in is E911 input port that provides capability for an emergency signal path that is combined, condition, and amplified using the same downlink output power amplifier module. Because it is transparent not external peripherals required.

Instrument operates in the UL 1710-1755, DL 2110-2155 MHz region.

Figure 5 displays Plug-in Cell, PCS, and AWS RF connections in rear which are the same for all three bands.

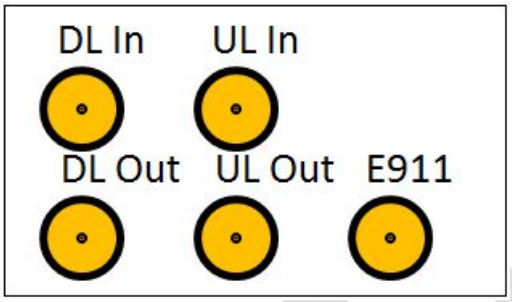


Figure 5

6.4. 700

The 700 Plug-in is a bi-directional service module comprising of uplink and downlink circuitry. Internally it houses all the devices that conditions, filters and amplifies the specified frequency band while rejecting the adjacent family bands operating within the chassis.

Although it accommodates both paths, circuitry is kept shielded providing 120 dB of isolation between them which prevents any RF crossover

Circuitry is similar in the UL and DL paths, with uplink RF Gain at **40 dB** while the downlink has more gain, with the addition of a high power amplifier module that provides **40 dB** to drive the DAS for a total of **70 dB** from end to end. In both directions, inserted between the pre-amplifier and mid-amplifier is an attenuator with a **31 dB** adjustment range.

Instrument operates in the UL1: 698-716, UL2: 776-787, DL 728-757 MHz regions.

Figure 6 displays Plug-in 700 RF connections in rear.

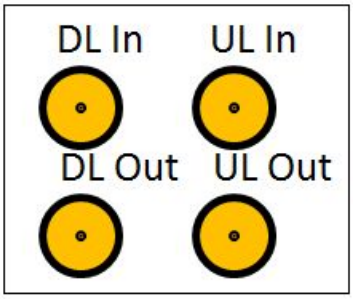


Figure 6

6.5. Cellular

The CELLULAR Plug-in is a bi-directional service module comprising of uplink and downlink circuitry. Internally it houses all the devices that conditions, filters and amplifies the specified frequency band while rejecting the adjacent family bands operating within the chassis.

Although it accommodates both paths, circuitry is kept shielded providing 120 dB of isolation between them which prevents any RF crossover.

Circuitry is similar in the UL and DL paths, with uplink RF Gain at **40 dB** while the downlink has more gain, with the addition of a high power amplifier module that provides **40 dB** to drive the DAS for a total of **70 dB** from end to end. In both directions, inserted between the pre-amplifier and mid-amplifier is an attenuator with a **31 dB** adjustment range.

Instrument operates in the UL 824-849, DL 869-894 MHz

Figure 5 displays RF connections in rear.

6.6. Extended PCS

The Extended PCS Plug-in is a bi-directional service module comprising of uplink and downlink circuitry. Internally it houses all the devices that conditions, filters and amplifies the specified frequency band while rejecting the adjacent family bands operating within the chassis.

Although it accommodates both paths, circuitry is kept shielded providing **120 dB** of isolation between them which prevents any RF crossover.

Circuitry is similar in the UL and DL paths, with uplink RF Gain at **40 dB** while the downlink has more gain, with the addition of a high power amplifier module that provides **40 dB** to drive the DAS for a total of **70 dB** from end to end. In both directions, inserted between the pre-amplifier and mid-amplifier is an attenuator with a **31 dB** adjustment range.

Integrated with the Extended PCS plug-in is **E911** input port that provides capability for an emergency signal path that is combined, condition, and amplified using the same downlink output power amplifier module. Because it is transparent not external peripherals required.

Instrument operates in the UL 1850-1915, DL 1930-1995 MHz region.

Figure 5 displays RF connections in rear.

Note: the rear plug-in RF connections shown in this section, upon looking into the RFN chassis (facing you), the connections are mirrored.

7. Block Diagram

7.1. RFN Block diagram

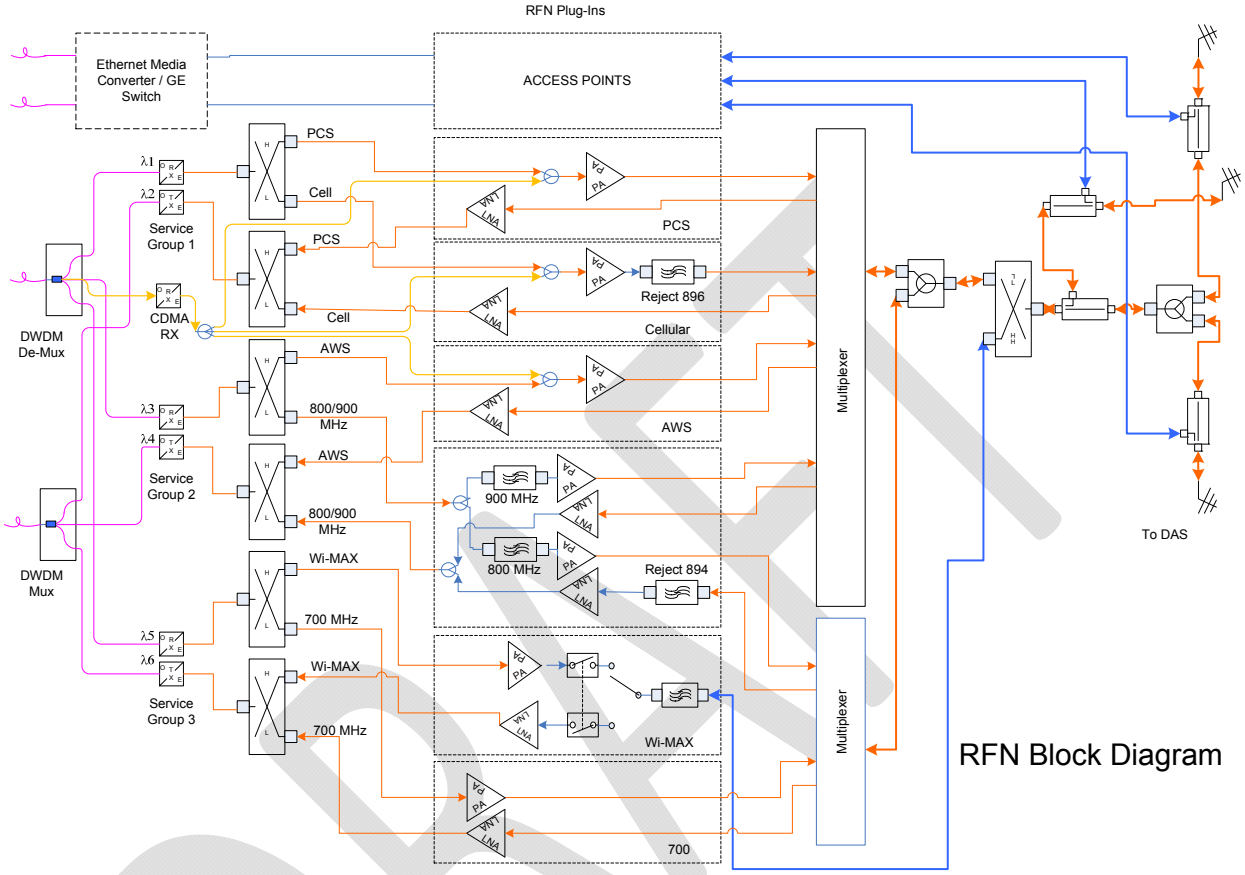


Figure 7

Figure 7 displays the internal components and their connections, including optical interfaces which come from the left-end while the right-end are the DAS connections.

Figure 8 is a typical internal configuration of a Plug-in. As depicted, uplink and downlink are within the confines of the plug-in but shielded from each other.

Shown on the plug-in module block diagram's right side are the rear plug-in connectors.

7.2. Plug-in

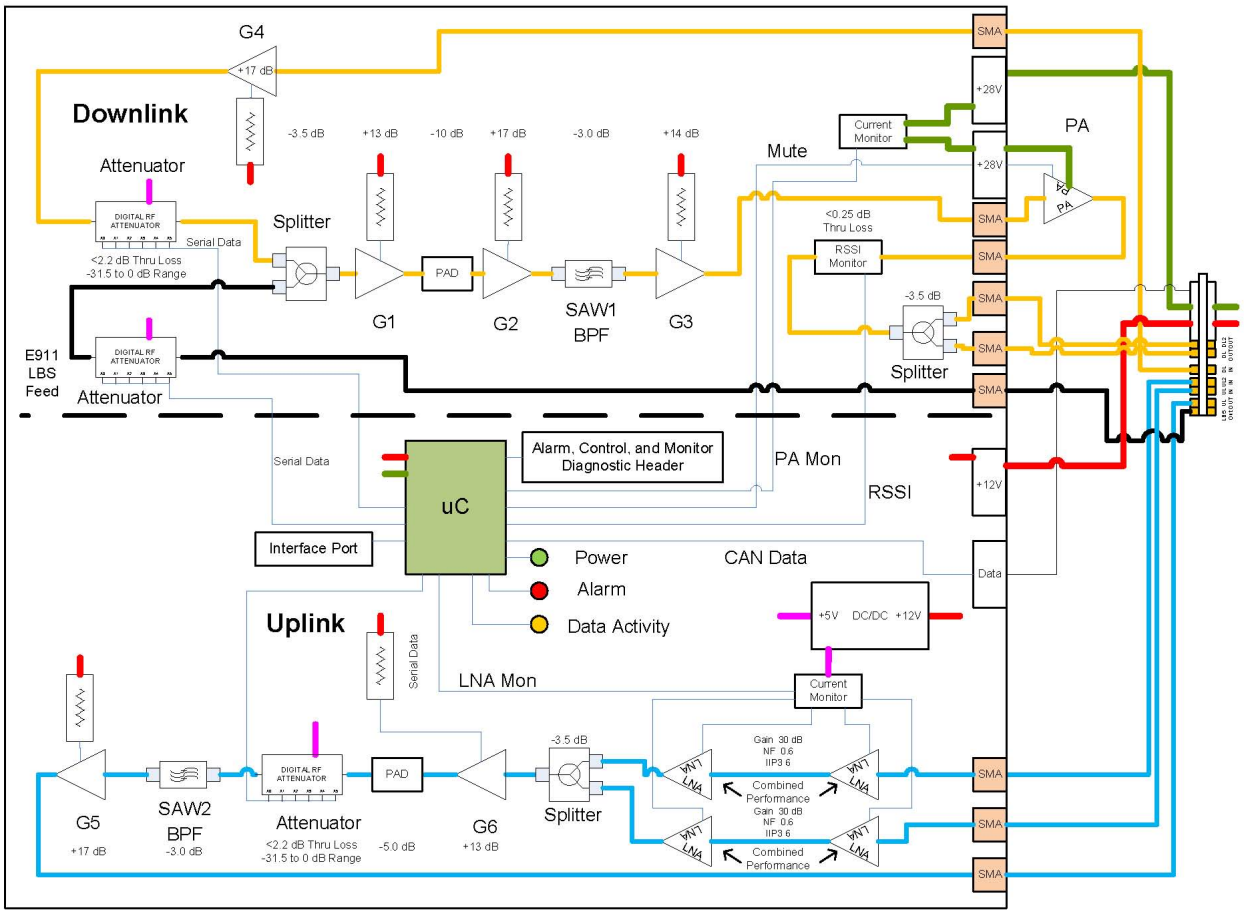


Figure 8

7.3. System Block Diagram

Figure 9 demonstrates a 1 x 4 system link configuration comprising of 4 RFNs and Headend segments that makeup a link, such as OMU, FTU-RF, FTU-E and RIS. RIS is the last F-S equipment interfacing with the end-user Base Transceiver Station (BTS).

In this section, an overview is provided of the Headend equipment incorporated as part of a typical RFN application.

Optical Multiplex Unit (OMU) houses all the passive optical devices interfacing with incoming and outgoing fiber bundles which are then neatly individualized, routed and channeled to interface with the Optical Add/Drop Multiplex (OADM). Next, each designated ITU connection interfaces with the FTU-RF and FTU-E.

Fiber Transceiver Unit – Radio Frequency (FTU-RF) houses all the active optical devices that converts light into electrical and vice-versa launches light from received electrical. In the receiver there is filtering, post amplification, and gain adjustability for fine tuning as required.

Fiber Transceiver Unit – Ethernet (FTU-E) houses the media converter.

??-Write a brief summary.-

Radio Interface System (RIS) houses all the RF devices that condition, filter, rssi and control gain that is required between the BTS and FTU-RF, in part because an ideal RF level into FTU is 0 dBm and levels from BTS are considerably higher up to 30 dBm. As planned, based on the service group, configuration for simplex, duplex and full duplex or combination of them are arranged in the RIS.

Fibers interconnecting the FTU-RF, OMU and RFN are 9/125 um single mode.

Fiber medium operational range is from **0** to **8 dBo** optical loss.

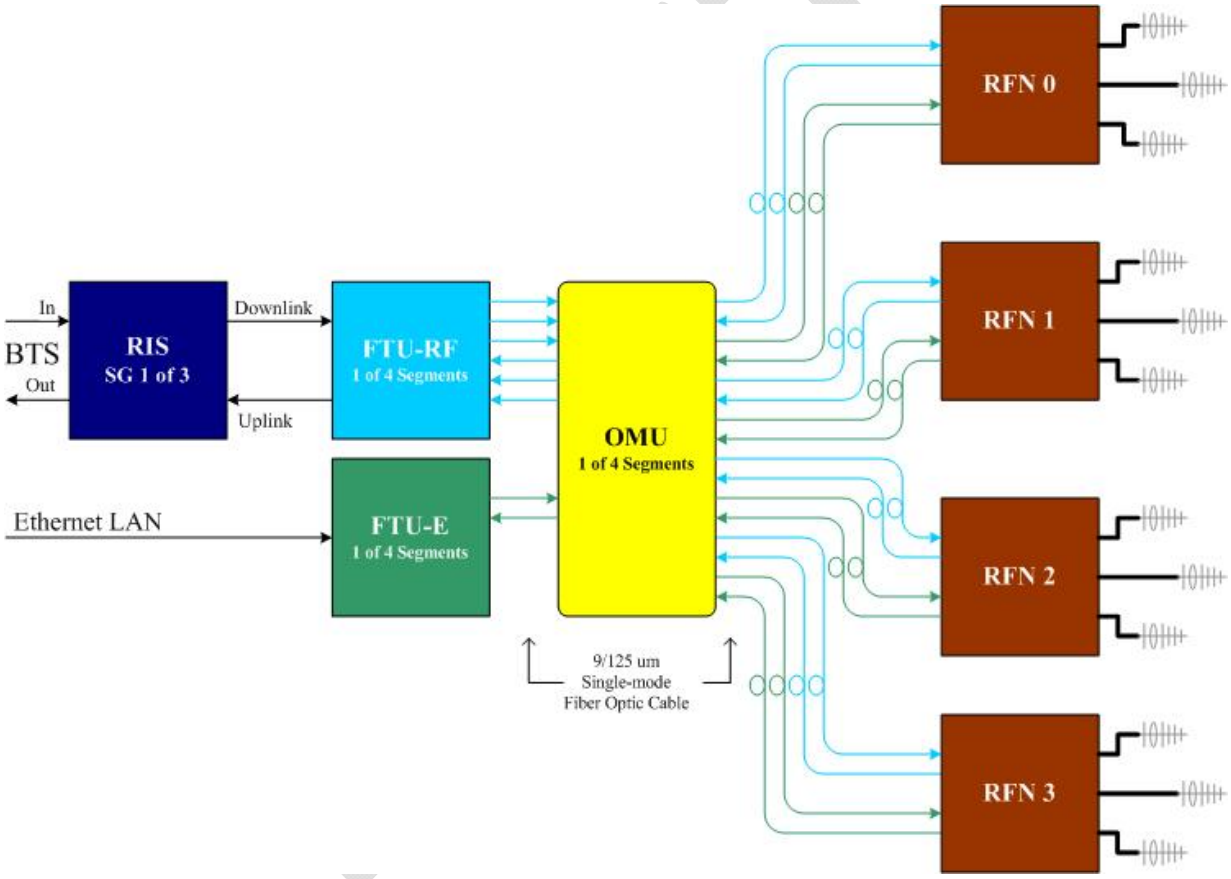


Figure 9

7.4. Optics

Behaving identical all 3 internal fiber optic transmitters (FOTX) that converts the electrical input into output modulated light using a cooled distributed feedback (DFB) laser.

Figure 11 displays 3 optical links that represent the Service Groups for the downlink and another alike setup makes up the uplink.

Figure 10

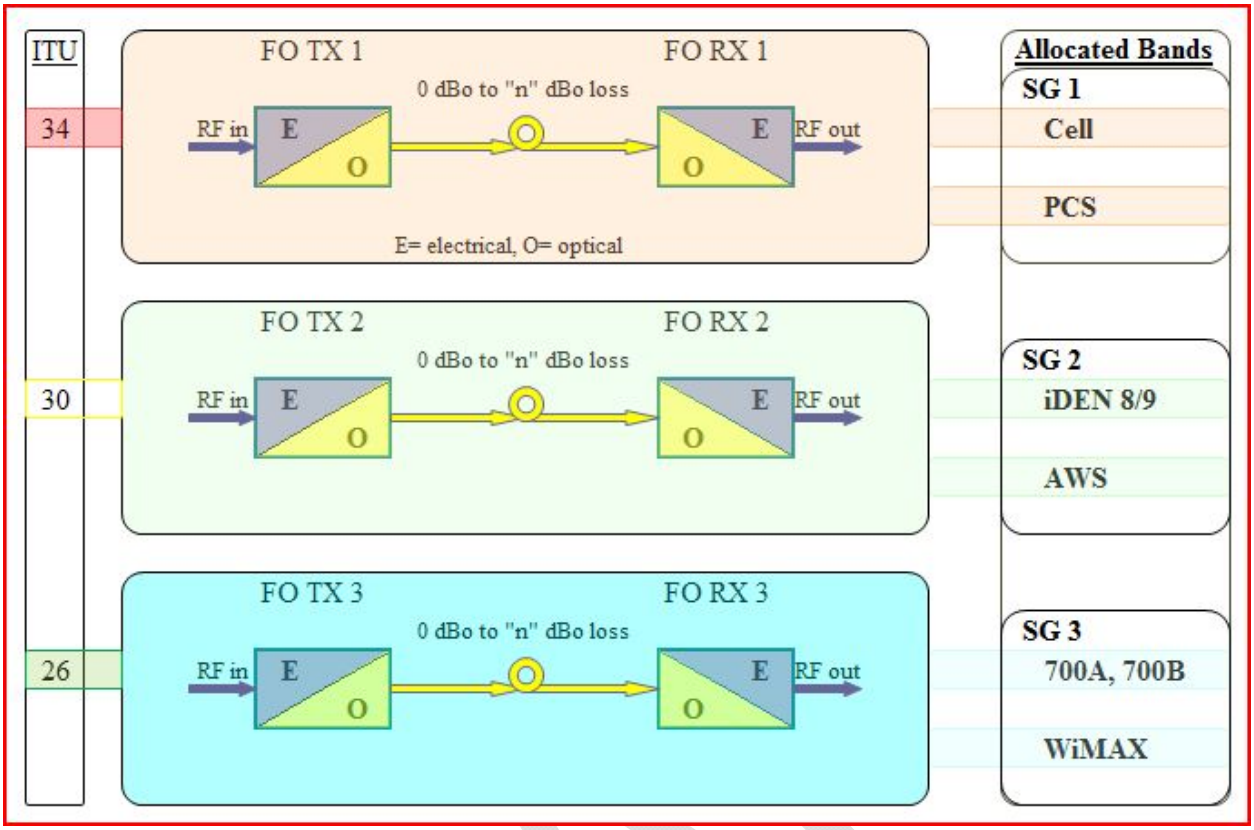


Figure 11

Note: Service Group (SG) 3 has provisions for WiMAX, pending its release.

DWDM Configuration

Tucked in the RFN lower left tier is the Add Drop Multiplex arrangement, housing all the optics and external interface connections.

Designated optical channels are ITUs 26,30,34,38 for the downlink (DL) path and ITUs 26, 30, 34 for the uplink (UL) path which are dedicated for the Service Groups (SG1, SG2, SG3) excluding the Ethernet paths. Duplex configuration allows use of the same ITU channels, see **Error! Reference source not found.**.

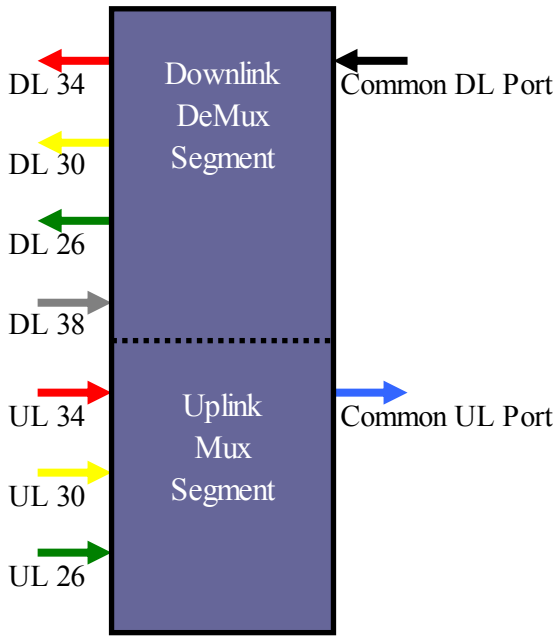


Figure 12

Beneath the optical housing is a shallow splice tray compartment for the end-user to loop, make interconnections, and secure the fibers.

8. General

8.1. RF

Notwithstanding the specific operating frequency band of each plug-in, circuitry are alike with a 40 dB gain on the uplink path and 70 dB gain on the downlink path. Uplink noise figure is optimized to be lower than 2. Downlink can drive DAS in excess of 25 dBm per band. And In both paths, for tuning, the same attenuator device is implemented that provides 31 dB of range.

Multiplexer is the external gateway that combines all the plug-in up/down paths user interface ports which introduces 12 dB loss for Ant1 and Ant 3 while Ant 2 has an additional 6 dB more loss.

8.2. Optical

All optics are housed in the lower left tier compartment called "Optical Stack", namely because carefully inside, sections are one on top of the other. Beginning with the FOTXs, middle FORXs and last the OADMs.

FOTX further discussion

Each unique 1.5 um wavelength is routed into their corresponding OADM channel exiting the common conduit and launched through the interface optical port uplink path.

At factory, FOTXs are normalized called TX Set-point that regulate batch with a consistent resultant output. Laser incorporates average optical power feedback keeping output power steady over temperature and lifetime. For best performance laser bias is also tuned.

A typical UL FOTX optical output power is 6 dBm, minus 2 dB loss through the OADM for a net launched of 4 dBm. Result using Optical Meter will be the composite power. But with an optical spectrum analyzer (OSA) one or all side-to-side wavelengths spectrum are displayed on screen for precise measurement.

Figure 13 demonstrates how the optical configuration for the downlink behaves as a function of muxing the lasers through the OADM. Measurement at the optical port with an optical meter yields 8.8 dBm, on the other hand measuring with an OSA outcome is 4.0 dBm for each laser.

For the uplink path each laser launch power is typically 6 dBm but no higher than 8 dBm and would put composite launched power at 10.8 dBm.

Device	ITU 34	ITU 30	ITU 26	Units
Laser	6.0	6.0	6.0	(dBm)
OADM	-2.0	-2.0	-2.0	(dBo)
Net Power	4.0	4.0	4.0	(dBm)
Composite launched power >			8.8	(dBm)

Figure 13

Note: Allow for 0.25 dBo loss for every interconnection.

FORX discussion

On the opposite side, complimenting is the fiber optic receiver (FORX) which converts the optical input to an electrical output for the **downlink** (DL) path. By also adding an OADM in the receiver side only matching light goes through while rejecting all others.

Most photo detector optical input limits are about 8 dBm, but the system receivers will never see such high levels, with practical values at 5 dBm or much lower due to the external fiber medium optical loss which is around 4 dBo.

Further explanation, with a 7 dBm **source** optical power at the **Headend** which is split 4-Ways (-7dBo) then the OADM thru loss (-2 dBo) and a typical (-4 dBo) loss thru fiber medium, putting the upper optical input limit of the fiber receiver at -6 dBm. So the upper limits are un-reachable into FORX.

Alarm threshold for excessive optical loss is set to -14 dBm which is a 4 dBo margin from the expected fiber medium maximum loss of 8 dBo.

8.3. Alarm Monitor and Control Software

8.3.1. PC Requirements

8.3.2. Launch Program

8.3.3. Firmware Revision

8.3.4. General Settings

8.3.5. Username / Password

8.3.6. Default and Status Settings

8.3.7. Block Diagram

8.3.8. Controls

8.3.9. Alarm Settings

8.3.10. Software Windows

(In ascending order insert windows of all the settings in use)

Downlink

Uplink

8.3.11. Alarms and Controls

- FOTX temp, power
- PA: FPM, VSWR

8.4. Connector Type

RF connections are made using DIN-female connectors.

Optical connectors are SC/APC type for downlink / uplink signal paths, and LC connectors for Ethernet paths.

8.5. Mechanical

All Plug-ins are secured each with 10 tamper resistant pin-in-Hex socket cap screws size 8-32 x ¾ inches in length.

Bottom access panel-door is secured with twenty-one and side panel-doors each require 8 tamper resistant pin-in-Hex socket cap screws size 8-32, ½ inches in length, totaling 37.

8.6. Switches & Indicators

TBD.

9. Installation

9.1. Mounting

The wall or ceiling bolts securing unit must be sufficiently able to carry the weight of the RFN which must be aligned properly balancing weight throughout the supports. While mounting the RFN a platform underneath must sustained all its weight until all the mounting bolts are tighten and secured. See outline section in this manual for bracket hole dimensions and recommended bolt size.

Fully populated unit nearly weighs **200 lbs**; therefore proper lifting equipment is required to bear its weight during installation. Do not attempt to install equipment on your own.

For proper air flow, keep a minimum clearance of 8 inches in front, underneath and top of the black heat-sink section of the RFN.

Allow at least **14 inches** in front of the unit for removal and installation of the Plug-ins. Each plug-in comes out independently of the other. Remove all the screws around the perimeter of the plug-in, then to remove the plug-in, hold both handles and pull horizontally straight out from its housing slot.

9.2. Optical Connections

Travelling from the outside 4 External 9/125 um single mode fiber strands (2- SC/APC, 2- LC connectors) can either be inserted through the side (left or right) access panels.

See Figure 14 Side Access Panel.

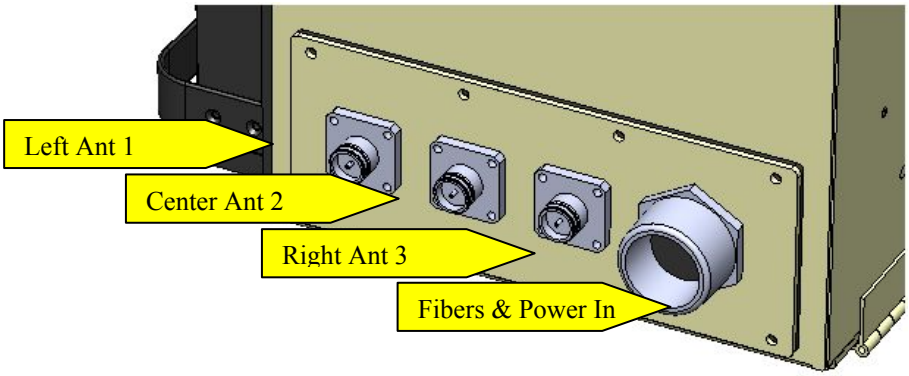


Figure 14 Side Access Panel

After inserting the 4 fibers through aperture, route two, (DL and UL) fibers inside all the way to the optical stack. See Figure 15 Optical Stack. View is from underneath the RFN bottom access panel. The DL and UL fiber strands are distinguish by their connector type which is SC/APC type, see Figure 16.

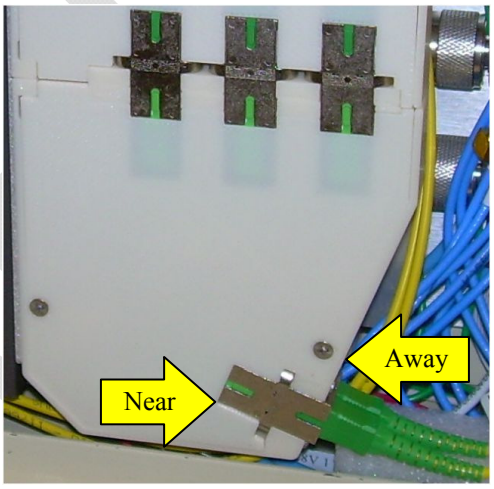


Figure 15 Optical Stack

The inner fiber adapter (away) is the uplink path connection and the outer fiber adapter (near) is the downlink path connection.

Incoming Ethernet fibers 3, 4 connect to the media converter commonly called EtherDevice Switch (EDS) see Figure 18. This Figure to the left also shows the 3 Access Points connections that come from the WiFi Plug-in.

Fiber strands for the Ethernet interface are noticeable by the dual LC connectors see Figure 17. Here shown paired TX / RX that mate to the SFP module.

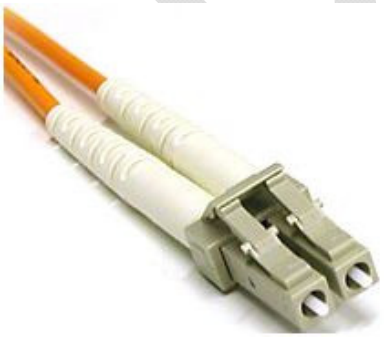


Figure 17

Figure 16

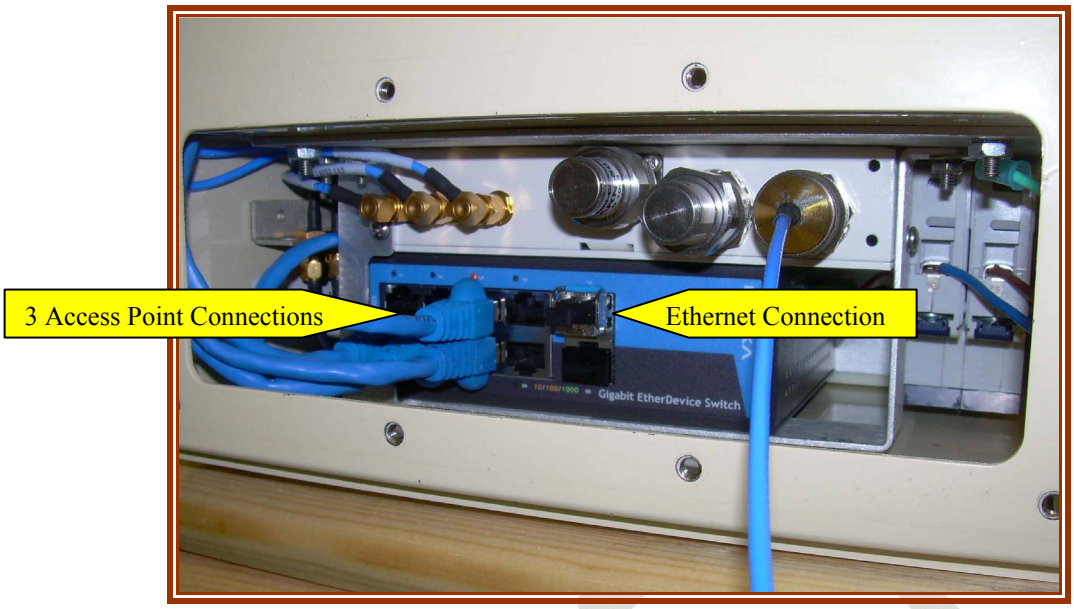


Figure 18

9.3. Tools

All external screws are the same head type 5-32, for Plug-in slightly longer, at ¾" and side / bottom access panels are ½" pin-in-Hex screw, see Figure 19.

Only a single 5-32 Hex hand driver required, see Figure 20 for Plug-in and access panel maintenance.

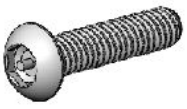


Figure 19

Figure 20

9.4. Grounding

Immediately inside the RFN side access panels are ground lugs to attach incoming ground wires. See Figure 21 which shows the ground wire with lug inserted into bolt and secured with an external tooth lock washer nut. ?? lock-nut material.

Figure 21

10. General Precautions

- Do not change the parameters unless instructed to do so by an authorized supervisor and you are a qualified technician to operate instrument.
- Do not attempt to move product without the proper tools and man power, because product is extremely heavy.
- Terminate all the RF ports with a 50 Ohm load prior to powering up.

11. Startup Checklist

Confirm all necessary parts accompanied product before beginning installation or operation.

11.1. Equipment List

Remote Fiber Node (RFN) fully populated*

- FS42R-AP-3
- FS42R-iDEN-2
- FS42R-AWS-5
- FS42R-700-5
- FS42R-CELL-2
- FS42R-PCS-5

*Does not include WiMAX Plug-in.

11.2. On Site Requirements

On site will require a 3 wire (Hot, Neutral, and Ground) 120 VAC input to the RFN including a separate earth ground bus bar that connects to the RFN chassis.

Two 9/125 um single-mode fiber strands with SC/APC connectors, one for the downlink path and the other for the uplink path. Two 9/125 um single-mode fiber strands with LC connectors for the Ethernet connections.

Three high quality RF cables with DIN-Male connectors that attached from the individual DAS antennas to the Left, Center, and Right RFN interface ports.

12. Maintenance

12.1. Periodic Inspection Checklist

Perform an On-Site assessment of the wireless coverage for use as a baseline, so that upon re-inspecting quarterly or semiannually a comparison is made to ensure peak performance throughout equipment lifespan.

Test and keep a record of the insertion loss of all the fiber strands that interconnect with the equipment from end-to-end.

12.2. Preventative Measure for Optimal Operation

12.2.1. Optical Maintenance

Once optical connectors are secured the ports no maintenance is required. However when necessary to unplug it, immediately cap the tip with cover, see Figure 22. This prevents scratching exposed glass tip which deteriorates performance and possibly becoming unusable.

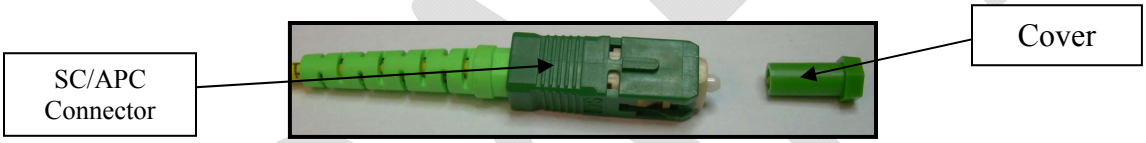


Figure 22

12.2.2. RF

Once RF connectors are secured no maintenance is required. However perform periodic on-site wireless coverage assessment to compare it to the baseline this will ensure optimum performance.

13. Factory Settings

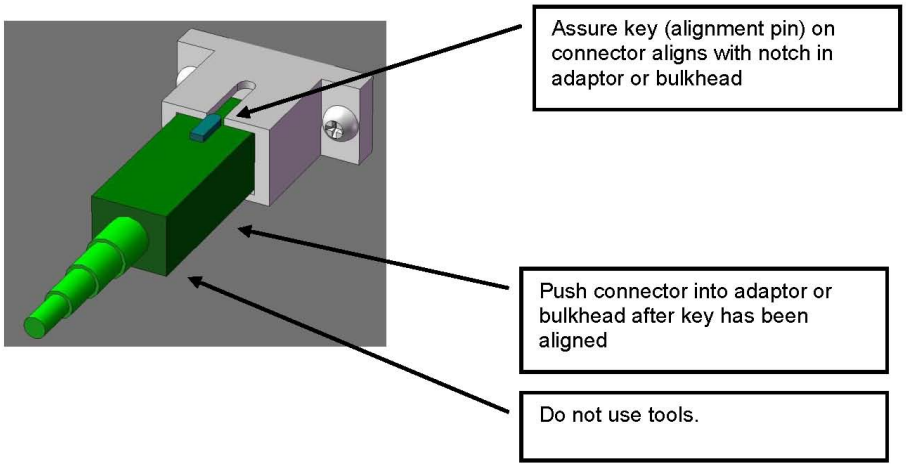
Tuning and testing performed at factory are:

Fiber transmitter FOTX	Fiber receiver FORX	RF
• Optical power • TX Set-point • Laser Bias • Temperature Alarm	• Optical minimum input threshold	• Gain at 4 dBo loss • Attenuation Range • Two tone intermodulation intercept point • Output Noise

Guidelines for Using SC-APC Connectors and Adaptors

Warning: Improper installation and care of SC-APC connectors and adaptors can permanently damage parts, and seriously degrade performance of fiber optic devices. All installation personnel using SC-APC equipped Fiber-Span equipment should review this document. Fiber-Span is not responsible for damage caused by improper use of SC-APC equipment.

1. Clean SC-APC connectors with isopropyl alcohol (99%) and dust free fiber optic cleaning cloth.
2. Clean the inside of fiber optic adaptors and bulkheads with swab and alcohol. Protect connector tips from scratching.
3. Always use connector covers when connector is not in use.
4. Align connector keys (alignment post) with notch on adaptors and bulkheads, by rotating connector. Forcing connectors into adaptors or bulkheads without proper key alignment can damage ferrule tips.
5. Connectors should be inserted into adaptors and bulkheads as straight as possible to prevent damage.
6. Never force connectors into adaptors or bulkheads.
7. After assuring key alignment, push connector forward into adaptor or bulkhead until connector clicks, this click indicates connector has been seated properly.
8. No tools are required.



14. Specifications

14.1. Electrical Specifications

Externally 3 wires (Hot, Neutral, Ground) conduit route through either side (left / right) access panel orifice (Hot, Neutral) go to two in-line breakers that connect to VAC In (range 85-265) power supply, Outputting 28 Volt DC with 600 Watts capability providing power to all the power amplifiers and in part regulated to 48 and 12 Volts for discrete devices.

Figure 23

The Hot and Neutral wires connect internally to 2 in-line 1 pole 10 amp circuit breaker (FS-Pn 760-0025 see Figure 23), mfr's pn 1BU10 by Altech Corp., that provides RFN protection.

Incoming external ground (GND) wire connects inside to a chassis ground lug.

In the event primary power supply shuts off, as backup, design incorporates a second parallel equivalent power supply so that the equipment will continue to operate without interruption.

Both breakers are DIN Rail mounted and have the UL508 safety standard.

For recommended terminal connection to the circuit breaker see Figure 24.

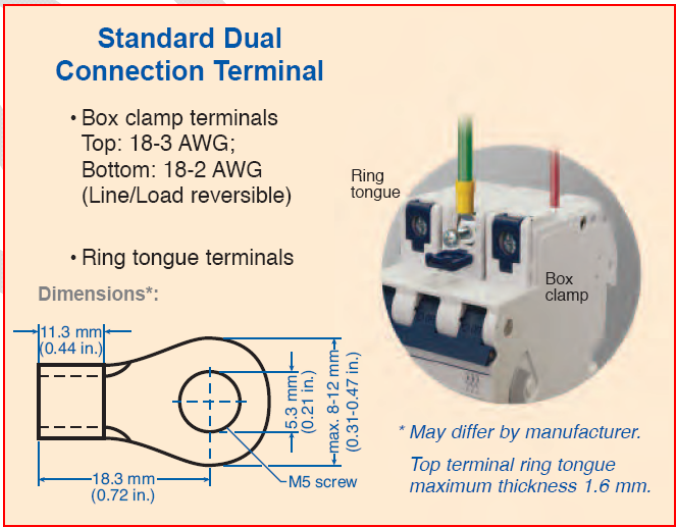


Figure 24

14.1.1. FS47R

Fully populated including WiMAX,

AC Current is 4.3 Amps / 120 VAC.

14.1.2. Plug-in

All VCC plug-ins are 28 Volts, except FS42R-AP-3 which is 48 Volts. Figure 25 shows current for each plug-in.

Item	Current (A)
FS42R-AP-3	0.81
FS42R-IDEN-2	3.63
FS42R-AWS-5	4.00
FS42R-700-5	3.18
FS42R-CELL-2	2.58
FS42R-PCS-5	2.58

Figure 25

14.2. Mechanical Specifications

14.2.1. Chassis

Fully populated (**7 Slots**) weighs **198 lbs**.

14.2.2. Plug-in

Plug-in typical weight is **12 lbs**.

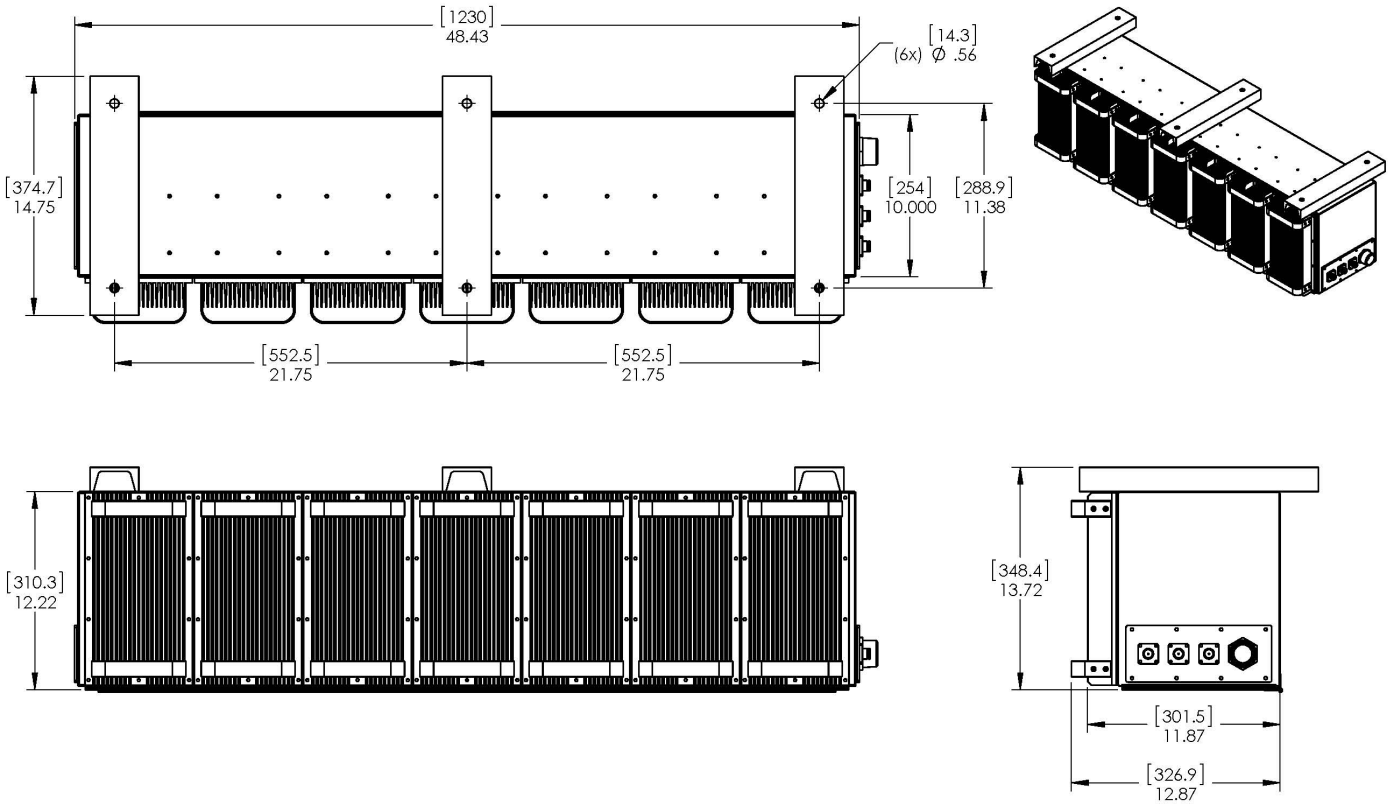
14.3. Other Specifications

Approvals testing in process for IP66 environmental rating.

(i.e., MTBF, FCC, Underwriters Laboratory, IP66, Certificates, Warranty)

15. Outline Drawing

An outline drawing of the RFN is shown below. Dimensions are in inches [enclosed brackets in mm].



16. Illustrations

16.1. Internal

All plug-in modules are identical in size. Rear DC connections are the same pin-out while RF connections are custom to each plug-in. Figure 26 is the isometric rear view of a plug-in. The downward extended black facade is the heat sink which maximizes surface area, and thus heat transfer.

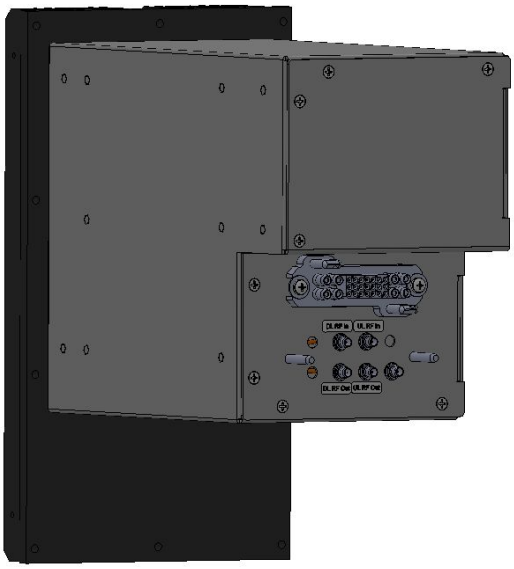


Figure 26

16.2. External

??-del- Include identification of all the ports.

16.3. Plug-in DC

Figure 27 displays the DC connector in rear of all the plug-ins. It also provides the data connection between the plug-ins and the Alarm Monitor and Control network. As shown in the illustration, diagonal corners have a locking flat pin that blindly aligns with the mating socket.

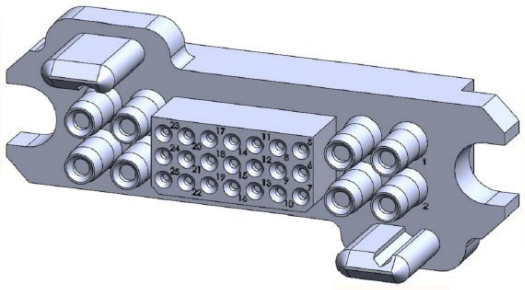


Figure 27

17. Troubleshooting

The RFN is designed and built to provide trouble-free performance without the need for service. If it does not appear to be functioning properly, please follow these troubleshooting steps.

17.1. RF

17.2. Optics

17.3. Ethernet

18. Warranty

18.1. General Warranty

The RFN carries a standard warranty period of one (1) year unless otherwise indicated on the shipping packages as noted in the purchase order agreement.

18.2. Limitations of Warranty

The warranty is limited to the repair or replacement of the defective product. Fiber-Span will decide which remedy to provide for defective components as its own discretion. Fiber-Span shall have a reasonable time after determining that a defective product exists to repair or replace the problem unit. The warranty applies to any repaired or replaced products for the balance of the applicable period of the original warranty or ninety (90) days from date of shipment of a repaired or replaced component, whichever is longer.

The Fiber-Span standard warranty does not cover products which have been received improperly packaged, altered, or physically damaged. For example, broken warranty seal, labels exhibiting tampering, physically abused enclosure, broken pins on connectors, any modifications made without Fiber-Span authorization, will void all warranty.

18.3. Limitations of Damages

The liability for any defective product shall in no event exceed the purchase price for the defective product. Fiber-Span has no liability for general, consequential, incidental or special damages.

18.4. Return Material Authorization (RMA)

No product may be returned directly to Fiber-Span without first getting an approval from Fiber-Span. If it is determined that the product may be defective, you will be given an RMA number and instructions in how to return the product.

An unauthorized return, i.e., one for which an RMA number has not been issued, will be returned to you at your expense. Authorized returns are to be shipped to the address on the RMA in an approved shipping container. It is suggested that the original box and packaging materials should be kept if a defective product needs to be shipped back to Fiber-Span.

To request an RMA, please call **908.253.9080**.

19. FCC Required Statement

Manufacturers Notes

"Changes or modifications not expressly approved by the manufacturer could "Void" the user's authority to operate the equipment".
This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their own expense.

This device has been designated to operate with the antennas having a maximum gain of [9] dBi for a 1 meter distance and antennas having a gain greater than [15] dBi are strictly prohibited for use with this device. The required antenna impedance is [50] Ohms.

To improve and correct equipment performance the following can be performed.

1. Re-orient or relocate the receiving antenna.
2. Increase the separation between the equipment and receiver.
3. Connect the equipment into an outlet on a different circuit from that to which the receiver is connected.
4. Consult the dealer or an experienced radio/TV technician for help.

20. Glossary

dBe	unit of measure for RF.	
dBo	unit of measure for Optical loss which translates 1 dBo equals 2 dBe in RF.	
DAS	Distributed Antenna System	
DWDM	Dense Wavelength Division Multiplex	
FO	Fiber Optic	
F1, F2	Frequency one, Frequency two	also called tones
Headend	Houses the local fiber transmitter / receiver and interfaces with the Base transceiver station	
Mbps	Mega bits per second	
RF	Radio Frequency	
RFN	Remote Fiber Node	
RX	Receiver	
SA	Spectrum Analyzer	
SFDR	Spur Free Dynamic Range	
SG1	Signal Generator 1	also called signal source
SG2	Signal Generator 2	
TOI	Third Order Intercept	also called OIP3
TTT	Two Tone Test	
TX	Transmitter	

21. Reference Documents

-del- Include list of critical loose leaflets documents comprising user manual.

22. Company Information

Fiber-Span

Corporate Headquarters

3434 Rt. 22W, Suite 140

Branchburg, NJ 08876

Phone Number: +1.908.253.9080

Fax Number: +1.908.253.9086

E-mail: **techinfo@fiber-span.com**