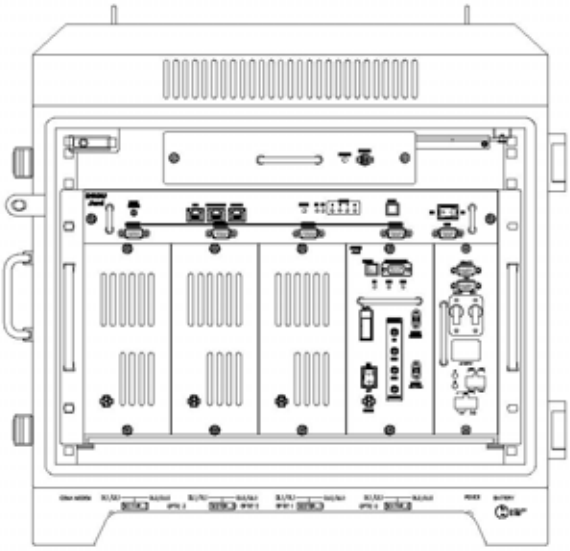
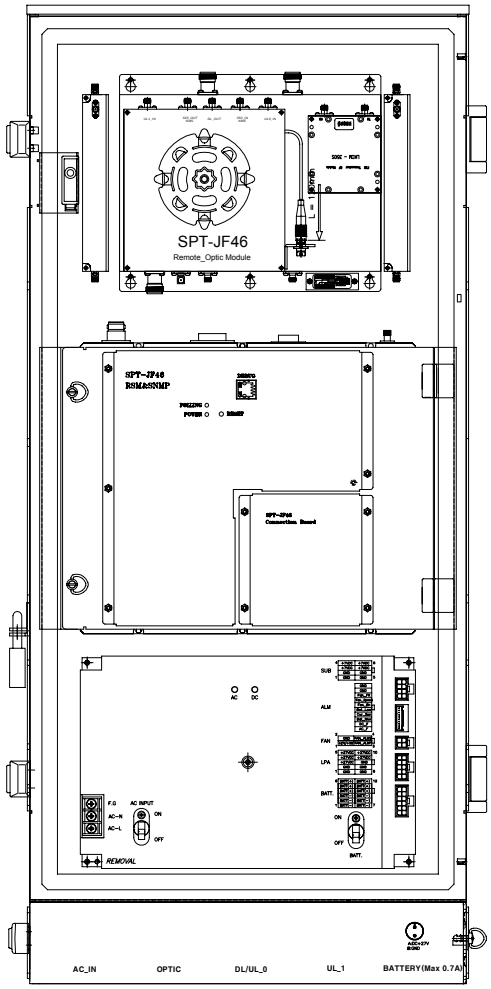
JF-46
Fiber Fed Repeater





OPERATIONS MANUAL

Rev 0.1
November 2008

Juni America Inc.

Change History

Version	Date	Comments
Draft	Dec. 29, 2008	Draft Manual

Any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

Table of Contents

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List of Acronyms and Abbreviations

The acronyms and abbreviations used in this manual are shown in the following list.

AC	Alternating Current
AMP	Amplifier
ATT	Attenuator/Attenuation
BPF	Band Pass Filter
BTS	Base Transceiver System
C	Centigrade
CDMA	Code Division Multiple Access
COM	Common
Config	Configuration
DC	Direct Current
DHU	Donor Hub Unit
DL	Downlink
DOC	Donor Optic Cavity
DRCU	Donor Repeater Control Unit
EMS	Element Management System
EVDO	Evolution Data Only
FFR	Fiber Fed Repeater
FRPS	Ferro Resonant Power Supply
FSK	Frequency Shift Keying
FTP	File Transfer Protocol
FWD	Forward
IP	Internet Protocol
JF-46	Juni Fiber Repeater 46dBm
LD	Laser Diode
LED	Light Emitting Diode
LMT	Local Management Terminal
LNA	Low Noise Amplifier
LPA	Linear Power Amplifier
MHz	Megahertz
OTRU	Optic TRansceiver Unit
PA	Power Amplifier

PC	Personal Computer
PCS	Personal Communications System
PD	Photo Diode
PSU	Power Supply Unit
REV	Reverse
RF	Radio Frequency
RRCU	Remote Repeater Control Unit
RU	Remote Unit
Rx	Receive
SAW	Surface Acoustic Wave
SNMP	Simple Network Management Protocol
TDR	Time Domain Reflectometer
Tx	Transmit
UL	Uplink
USB	Universal Serial Bus
VAC	Voltage Alternating Current
VDC	Voltage Direct Current
VSWR	Voltage Standing Wave Ratio
WDM	Wavelength Division Multiplexer

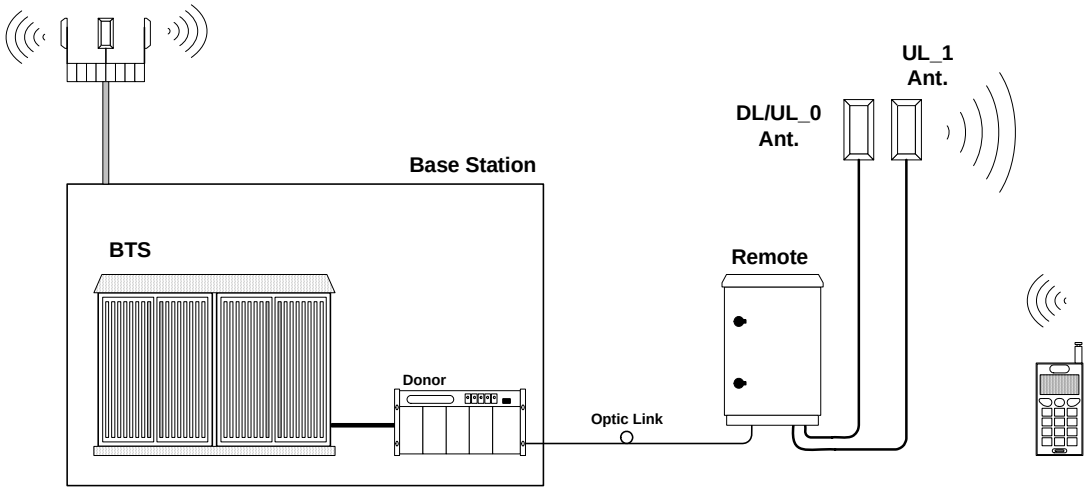
1. Introduction

1.1 Fiber Fed Repeater

The JF-46 FFR provides a cost effective solution for cell coverage extension and increased call quality in shadow areas. It is a RF signal transport system that provides long range RF coverage where it is impractical to install a BTS.

The JF-46 FFR is designed to be strategically placed to overcome difficult zoning issues by allowing the base stations to remain at a central location while placing antennas at remote locations. RF signals can be transported to remote locations to expand coverage into areas not receiving service or to extend coverage into difficult to reach areas such as canyons, tunnels and underground parking lots and roadways.

The JF-46 FFR provides a high-tech, highly-efficient service system which enables high quality communication at low cost, due to the system's utilization of one optical fiber core between the DHU and RU supporting full duplex transmission of signals for both the DL and UL.



[FIGURE 1.1.1] SYSTEM CONFIGURATION

1.2 Search Window

The purpose of using a repeater is to extend the coverage of the BTS by re-transmitting the BTS signals to mobile stations in a non BTS coverage area. This means that the BTS handles all kinds of call processing including calls being received via the repeater. There may be a negative impact of service on the BTS if the interface between BTS and repeater does not operate properly.

There would be an increase in time delay with calls received from the repeater, compared to a call from its BTS coverage. Thus the additional delay introduced from calls via the repeater must be considered while setting BTS parameters.

Window-size is the time range of the BTS traffic channel to search for the signal originating from the MS. If the delayed signal is out of window-size, the BTS cannot acquire the signal, which will result in dropped calls due to chip-delay.

Table 1.2.1 describes the two parameters used for controlling the window length, to prevent the deterioration of call quality caused by chip delay. It is required to search the signal properly by adjusting the two parameters.

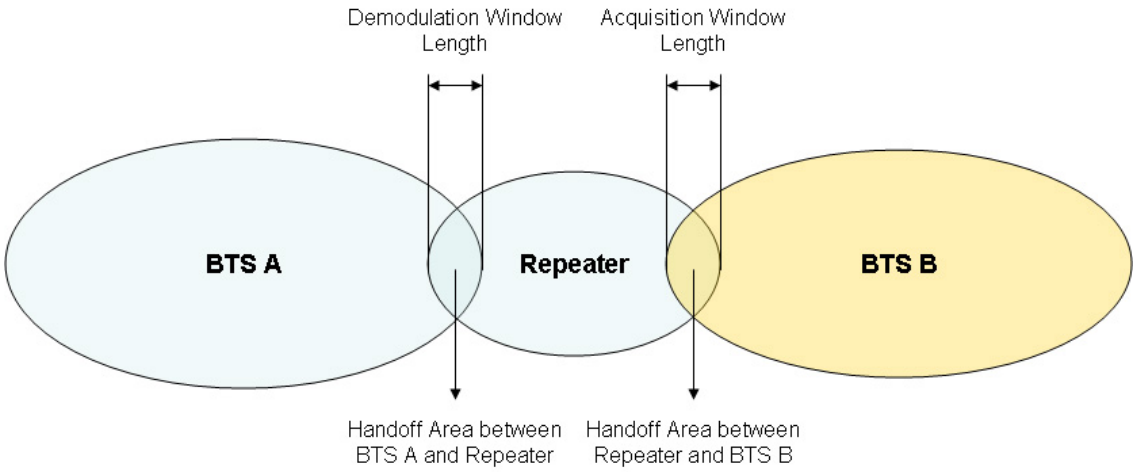
Acquisitioin_Window_Length is adjusted to change the window size used to search/monitor the neighboring PN and allow soft handoff while traveling to the neighboring BTS where new traffic channels will be allocated to the MS.

Demodulation_Window_Length is adjusted to change the window size which searches for the Rx signals. This parameter should be adjusted when the delay (with no change of traffic channel) between transmission and reception is increased i.e. MS in repeater service area.

	Acquisition_Window_Length	Demodulation_Window_Length
Purpose	Window Range of BTS traffic channel to search for time sync of other BTS	Window Range of BTS traffic channel to search multi path referring to the time-offset
Unit	1/8 chip/unit	1/8 chip/unit
Remark	Use this parameter when traffic channel is changed (Soft hand off)	Use this parameter when traffic channel is not changed. (Tracking multi path signal)
Notice	Too big a Window_size causes increase of time for the mobiles to search for BTS signal. It should be set up with proper values considering time delay.	

[Table1.2.1] Two Parameters for Search Window Setup

Therefore, the two parameters stated can be used to adjust the interface between the BTS and the repeater considering the movement of the MS. Picture 1 shows an example of two window size parameters for the JF-46 repeater application.



[FIGURE 1.2.1] HANDOFF BETWEEN BTS AND REPEATER

The Demodulation_Window_Length is used to adjust the time sync to compensate the chip delay introduced by the optic core when the MS moves into the repeater coverage area.

When the MS travels from the repeater coverage to the BTS B area, Acquisition_Window_Length is used to adjust this time offset differences. With this adjustment, the MS will be able to perform soft handoff from BTS A traffic channel (while in repeater coverage) to the BTS B traffic channel.

Without these adjustments, there may have been two call drops while the MS traveled from BTS A to BTS B.

1.3 Total Optical Delay (Window Size)

With the adjustments described above, good call quality should be maintained without call drops. This section will show how to calculate the total delay and how the parameters should be set up in the BTS. The equation below is an example of total delay for an optic repeater.

SD(μsec) + OD(km) + RD(μsec) + RR(km)

SD : BTS System Delay (Time delay between antenna input port and demodulator in BTS)

OD : Optic Distance between BTS and repeater.

RD : Repeater System Delay

RR : Repeater Coverage Radius

** 1 chip = around 244 m*

The total chip delay of 2km of RR and 5km of OD is as below.

36chip + 5000m(20.63chip) + 5 μ sec(6.6chip) + 2000m(8.25chip) = 71.45 chips (Approx. 72chips)

Based on the calculation of total chip delay, the two parameters should be adjusted for good call quality when installing a new repeater. 71.45 chip delay corresponds to 12 (set value) Search window size (Size = 160 chips). Therefore, the demodulation_window_length of BTS A should be set up as 12 in this configuration and acquisition_window_length of BTS A and BTS B should also be set up as 12.

The table below shows the Search window size values for different optic distances and repeater coverage.

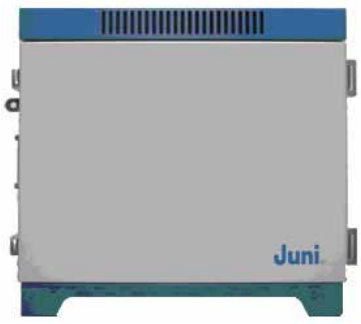
OD + RR		SD + RD (Chips)	Sum (Chips)	2 x Sum (Chips)	Search Window Size	
km	chip				Set Value	Size (Chips)
1	4.13	42.6	46.73	93.45	**11**	114
2	8.25	42.6	50.85	101.70	**12**	160
3	12.38	42.6	54.98	109.95	**12**	160
4	16.50	42.6	59.10	118.20	**12**	160
5	20.63	42.6	63.23	126.45	**12**	160
6	24.75	42.6	67.35	134.70	**12**	160
7	28.88	42.6	71.48	142.95	**12**	160
8	33.00	42.6	75.60	151.20	**13**	226

9	37.13	42.6	79.73	159.45	**13**	226
10	41.25	42.6	83.85	167.70	**13**	226
11	45.38	42.6	87.98	175.95	**13**	226
12	49.50	42.6	92.10	184.20	**13**	226
13	53.63	42.6	96.23	192.45	**13**	226
14	57.75	42.6	100.35	200.70	**13**	226
15	61.88	42.6	104.48	208.95	**13**	226
16	66.00	42.6	108.60	217.20	**14**	320
17	70.13	42.6	112.73	225.45	**14**	320
18	74.25	42.6	116.85	233.70	**14**	320
19	78.38	42.6	120.98	241.95	**14**	320
20	82.50	42.6	125.10	250.20	**14**	320
21	86.63	42.6	129.23	258.45	**14**	320
22	90.75	42.6	133.35	266.70	**14**	320
23	94.88	42.6	137.48	274.95	**14**	320
24	99.00	42.6	141.60	283.20	**14**	320
25	103.13	42.6	145.73	291.45	**14**	320
26	107.25	42.6	149.85	299.70	**14**	320
27	111.38	42.6	153.98	307.95	**14**	320
28	115.50	42.6	158.10	316.20	**15**	452
29	119.63	42.6	162.23	324.45	**15**	452
30	123.75	42.6	166.35	332.70	**15**	452

[Table1.3.1] Example Table for Search Window Size

1.4 FFR Components

The JF-46 FFR system comprises of two main elements, a DHU and RU.



[FIGURE 1.4.1] DONOR HUB UNIT ENCLOSURE

[FIGURE 1.4.2] REMOTE UNIT

The DHU Enclosure includes the following:

- Donor Optic Module
- Donor Tx/Rx (FSK Modem included) Module
- Control Module
- Wireless Modem
- Power Supply.

Donor Hub Unit transforms the RF signals from the BTS into optic signals, and then the optic signals are transmitted to Remote Unit.

Donor Hub Unit also transforms the optic signals from Remote Unit into RF signals, and then the RF signals are transmitted to the BTS.

The RU includes the following:

- Remote Optic Module
- Control Module
- LPA
- LNA
- Cavity BPF
- Power Supply

Remote Unit transforms the optic signals from the Donor Hub Unit into RF signals, and then the RF signals are transmitted to Antenna.

Remote Unit also transforms the RF signals from Antenna into optic signals, and then the optic signals are transmitted to the Donor Hub Unit.

1.5 Advantages

There are many advantages to deploying a FFR.

- Supports adjacent block interference protection which allows just one model of the FFR to cover the entire PCS frequency range.(Changing the Cavity BPF) The FFR is settable to allow a combination of 94 different frequencies to be serviced. This advanced filtering personality prevents interference from adjacent frequency blocks.

- Allows for versatile deployment architectures. Extra optical transceiver modules

can be added to the DHU to increase service coverage. A flexible RF splitter unit can also be implemented to combine multiple RF ports supported by newer BTS.

- The slim and sleek appearance of the RU allows it to be installed and deployed in difficult zoning areas.
- The water and moisture resistant IP55-rated design make it reliable and durable.
- The FFR system is monitored and controlled from a central remote location by making use of a CDMA wireless modem via the SNMP protocol.
- Operation, maintenance and repairs are simple. The system provides alarms and information on the repeater gain settings, output level control, LPA on/off, internal temperature monitoring and problems concerning the optic module. The system is designed to operate with a comprehensive network management system.
- The system uses only one optical fiber core for transmission and reception of signals. To achieve this, WDM is implemented which enables multiple wave-lengths (DL: 1510nm, UL0: 1530nm, UL1: 1570nm) to be simultaneously transmitted and received through the one optical fiber core.

1.6 Key Features

- Uses only 1 optical fiber core for DL, UL0 and UL1
- 1xEV-DO and 1xEV-DO Rev. A are supported
- 40 watts composite RF output
- Rx diversity is standard and provides up to 2~8dBo reverse link benefit
- Provides lower life cycle costs by:
  - ✓ Reducing fiber lease costs per core
  - ✓ Reducing the number of optic cables required for new installations

- Most responsive and highly innovative product features
  - ✓ Remote unit's standard powering is 115-230 VAC(Free voltage)
  - ✓ Multiple mounting options including; wall, pole and floor/pedestal.

- Supports simulcasting of up to 4 RU per sector with one DHU
  - ✓ Reduced pilot pollution, better call quality, reduced soft handoff
  - ✓ Better network efficiency and equipment utilization
  - ✓ Existing base station equipment could be deployed elsewhere
  - ✓ Donor RF Combiner is compatible with newer base station having multiple DL output RF ports and provides Future-Proof BTS interface

SECTION	SPEC	OTHERS
Donor shelf size	482.6*266*400mm^3(W*H*D)	Donor self
Enclosure size	538*545*615.5mm^3(W*H*D)	Enclosure
Remote Weight	<= 180 lbs	Remote Weight
Remote Size	396*875*418mm^3(W*H*D)	Remote Size
Arrester	Lightning Protection on all RF Interface connectors	Arrester
Remote RF Connector	7/16 DIN Female connectors	Remote RF Connector
Donor RF Connector	Donor shelf: SMA Female Enclosure: N Female	Donor RF Connector
Power Connector	MS3102A18-21P (3pin male)	Remote AC 115-230 VAC(Free voltage)
	MS3102A18-21P (3pin male)	Donor AC 115-230 VAC(Free voltage)
	MS3102E20-23P (2pin male)	Battery (Charging Current : 2A_max)

1.7 General Safety Precautions

This equipment contains components that emit laser radiation which can seriously damage the retina of the eye. Do not look into the ends of any optical fiber. Do not look directly into the optical transceiver of any digital unit or exposure to laser radiation may result. An optical power meter or reflectometer should be used to verify active fibers. Place a protective cap or lid immediately over any radiating transceiver or optical fiber connector to avoid potential damage caused by radiation exposure. This practice also prevents dirt particles entering the openings.

The optical fiber emits radiation. Do not look directly into the ends of an optical fiber. This may result in exposure to radiation. Do not assume laser power is turned off or the fiber is disconnected at the other end.

Wet locations and conditions will increase the risk of electrical shock when installing or using electrical powered equipment. To prevent electrical shock, never install or use electrical equipment in wet locations or during lightning storms.

The DHU is powered by 115-230 VAC. To prevent electrical shock when installing or maintaining the DHU, disconnect the wiring at the power source before working with un-insulated wires or terminals.

The RU is typically powered by 115-230 VAC. To prevent electrical shock when installing or maintaining the RU, disconnect the wiring at the power source before working with un-insulated wires or terminals.

Always consider and allow sufficient fiber length to permit routing or patch cords and pigtails without severe bends. Fiber optic patch cords or pigtails may be permanently damaged if bent or curved to a radius of less than 2 inches (50mm).

Static electricity means no risk of personal injury but it can severly damage and corrupt essential circuitry within the equipment, if not handled carefully. Parts on the printed circuit boards as well as other parts in the equipment are sensitive to electrostatic discharge.

Never touch the printed circuit boards or uninsulated conductor surfaces unless absolutely necessary.

If the printed circuit boards must be handled, always use ESD protective devices or first touch the enclosure with your hand and then do not move your feet.

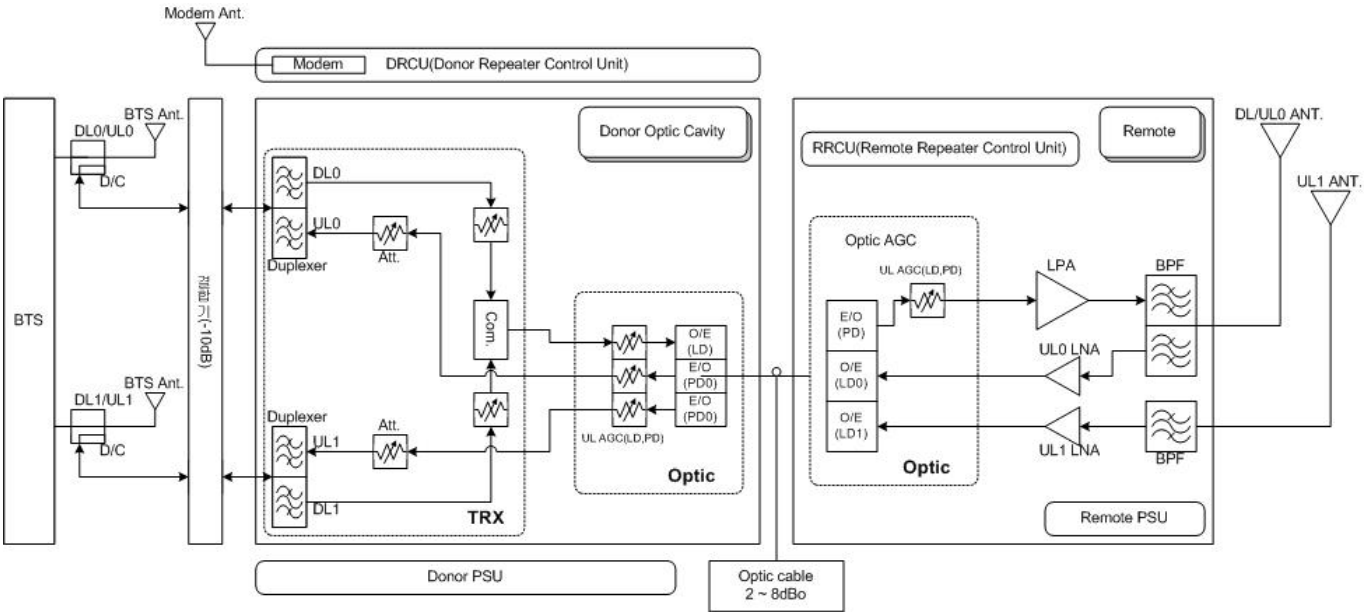
This equipment is only intended to be installed by professionally qualified and trained personnel.

Risk of explosion if battery is replaced by an incorrect type. Dispose of used batteries according to the instructions.

2. System Description

2.1 FFR System

The JF-46 FFR is made up of a main Donor Hub Unit (DHU) and a RU. The DHU and RU are divided into modules to allow easy operation and maintenance. It can operate even in the harshest environmental conditions due to its durable IP55-rated weatherproof enclosure.



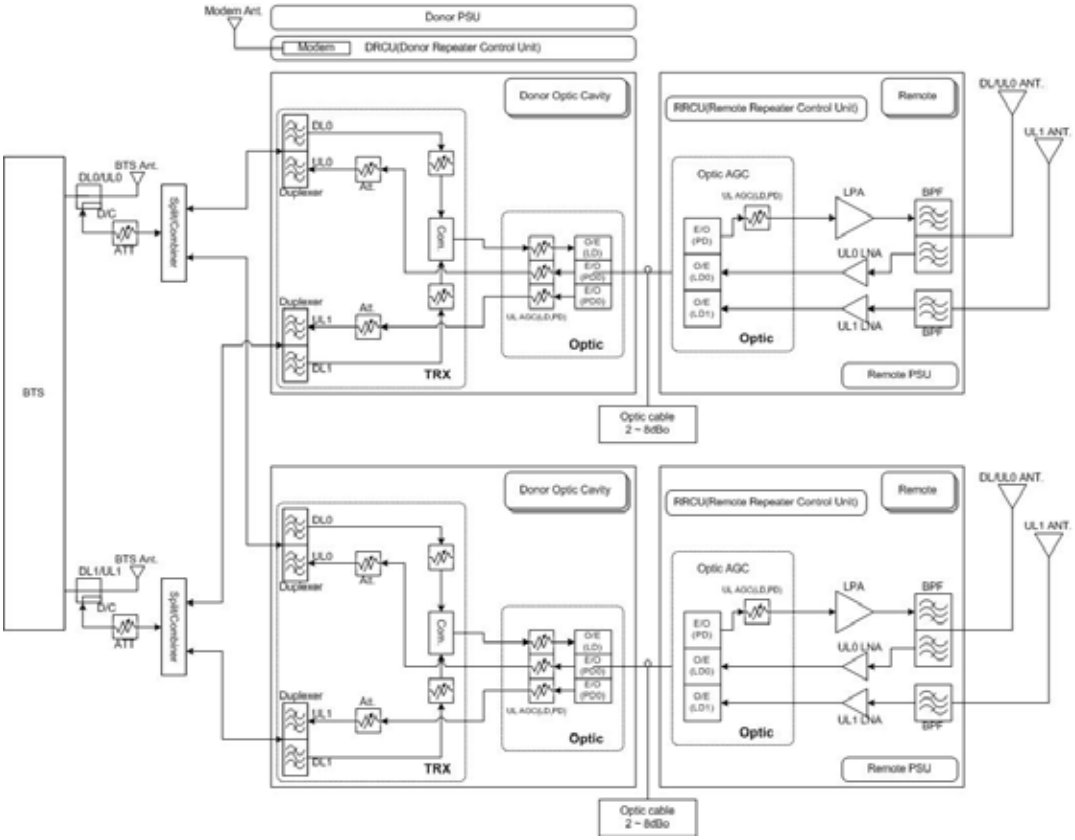
[FIGURE 2.1.1] SYSTEM BLOCK DIAGRAM

2.2 Simulcast Operation

Please refer to Figure 2.2.1 for a system block diagram of a Simulcast FFR configuration, where a single BTS sector provides coverage to two Remote Units. This configuration employs two RF Splitter/Combiner units at the RF ports of the Donor Hub Unit which relate to the two Remote Units.

On the DL path, the BTS signal is split two ways and feeds two DHU input ports. Similarly, on the UL path, the signals from two DHU RF ports are summed and fed to one port of the BTS.

The JF-46 FFR has adequate RF gain margin to support a Splitter/Combiner as shown with loss of up to 10 dB. As a result, a single BTS sector can easily feed 4 or even 8 Remote Units. If more than 4 Remote Units are to be supported, more than one DHU is required since a DHU can support only a maximum of 4 Optic Modules, which drive 4 Remote Units.

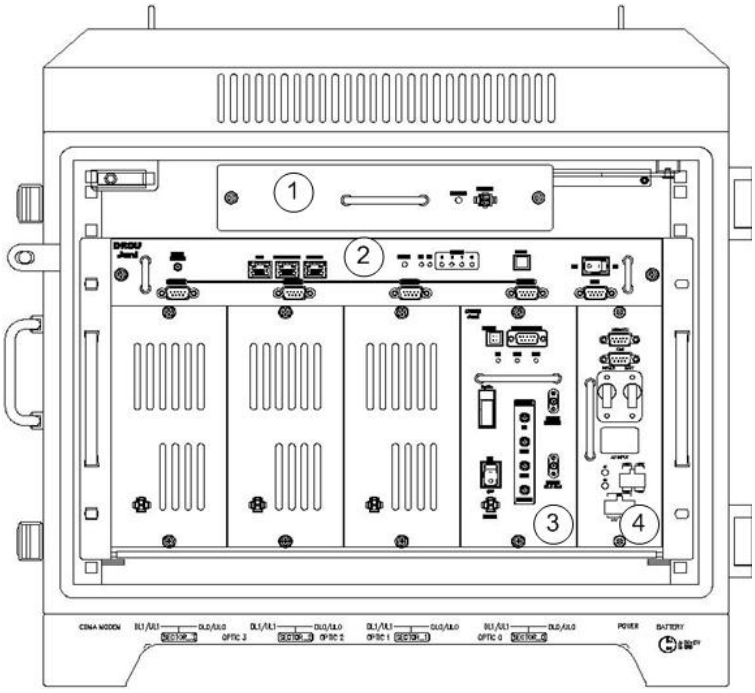


[FIGURE 2.2.1] SIMULCAST BLOCK DIAGRAM

2.3 Donor Hub Unit

This section describes the main components of the DHU, the functions performed by the components and the user interface.

2.3.1 Donor Hub Unit Enclosure and Shelf



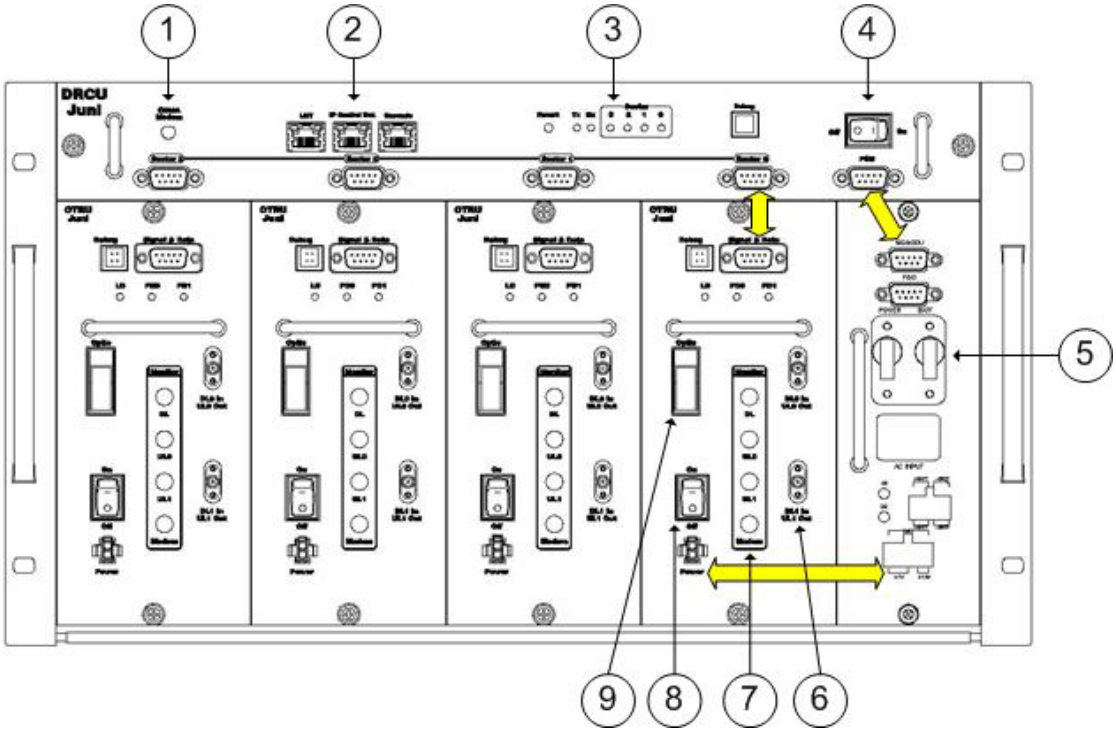
[FIGURE 2.3.1] MAIN COMPONENTS OF THE DONOR HUB UNIT

① FAN: Provides ventilation and disperses heat evenly.

② DRCU (Donor Repeater Control Unit): Monitors and controls each internal module. Also monitors and controls the RU by data communication. Monitoring the control and status of all repeaters can only be managed at an administrative level via the internal SNMP agent.

③ OTRU(Optic Transceiver Unit): Converts the RF signal (from the BTS) into an optical signal and transmits the signal to the RU. Conversely, the RU converts the optic signal and transmits it to the BTS.

④ PSU (Power Supply Unit): Converts the input power AC power (115-230VAC, free voltage) into DC+27V, DC+15V, DC +7V and supplies the power to the modules.



[FIGURE 2.3.2] DONOR HUB UNIT SHELF INTERFACE

① CDMA Modem RF Port (Female SMA-Type): An RF cable connects the CDMA wireless modem port on the DRCU to the modem RF port situated on the outside of the enclosure in case of outdoor type.

② Debug and Ethernet port: Ethernet port to allow connection to any PC for debugging via the GUI, allow connection to IP Control Box for SNMP

③ DRCU and SNMP reset Key and LEDs: Hard reset button to restart the DRCU and SNMP agent. LEDs to display the status of the System.

④ DRCU Power switch: Turns the power on/off for the DRCU only.

⑤ Main and battery power switch: Main power switch located on the power supply which provides power to the entire DHU.

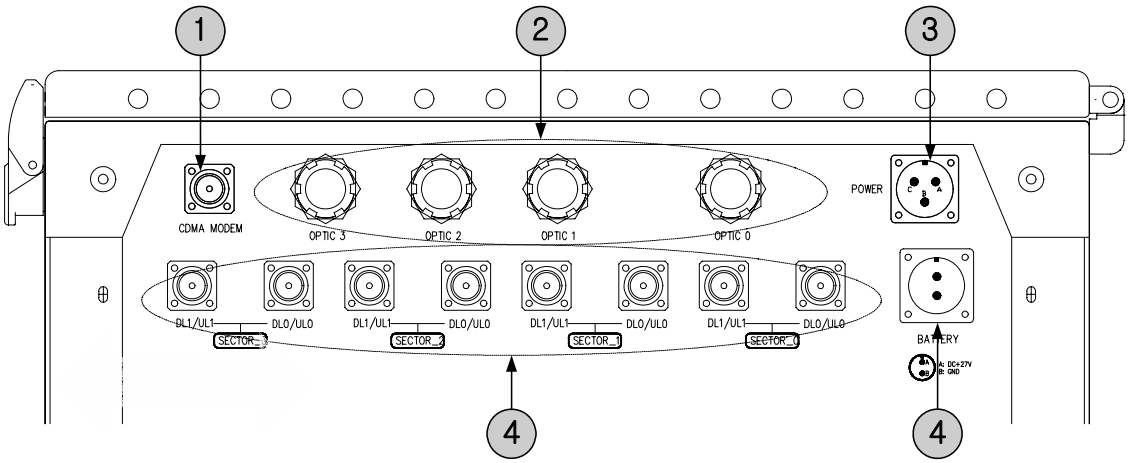
⑥ RF in/out port (Female SMA): RF ports on a single optic transceiver supports only one sector. This port is connected to the enclosure with RF cables.

⑦ Monitoring port (Female SMA): Ports used to monitor signals existing within the DHU with a spectrum analyzer or test equipment.

⑧ OTRU Power switch: Turns the power on/off for the OTRU only.

⑨ Optic connector : Connector to where the fiber is connected to.

⑩ ⟺: Data and power cable



[FIGURE 2.3.3] DONOR HUB UNIT EXTERNAL CONNECTORS (BOTTOM VIEW)

① CDMA modem RF port (Female N-Type): External Antenna for modem connected to this port.

② Fiber Entrance: The fiber is passed through to connect to the optic transceiver.

③ AC power connector (Female weatherproof MS type): Connectors used for AC powering. The AC power cable is supplied by the manufacturer.

④ RF in/out port (Female N type): Provides connection to the BTS.

⑤ Battery connector (Female weatherproof MS type): Connector for backup battery unit.

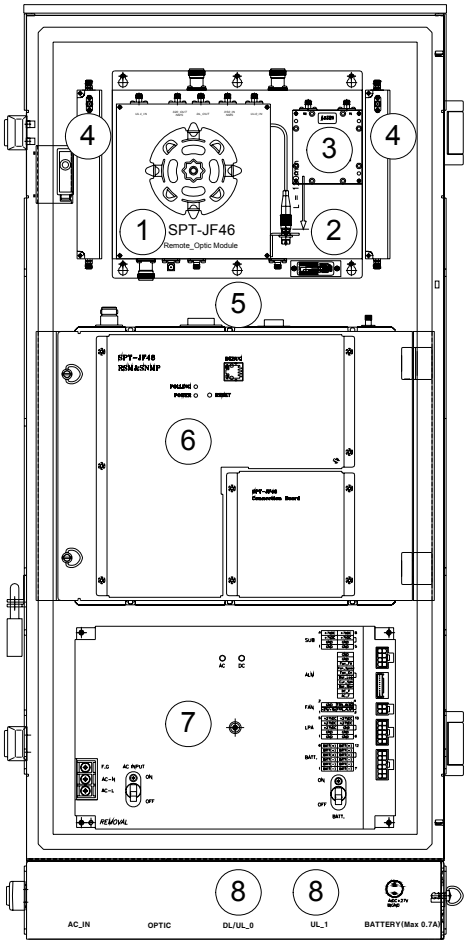
2.3.2 Wireless Modem Antenna

The technical requirements for the Wireless Modem Antenna are dependent on the specific DHU location and network coverage. If the nearest BTS with a local antenna is nearby the DHU, a 3 dBi Gain Omni antenna should be quite adequate. The Modem Antenna is to be connected to the modem antenna connector on the DHU. In the event the nearest BTS with a local antenna is quite some distance from the DHU, a directional antenna with 10 dBi Gain, aimed at the nearest BTS with the local antenna, is the appropriate modem antenna solution.

2.4 Remote Unit

This section describes the main components of the RU, the functions performed by the components and the user interface.

2.4.1 Remote Unit



[FIGURE 2.4.1] MAIN COMPONENTS OF THE REMOTE UNIT

① **Remote Optic Module:** Converts the optic signal (from DHU) into RF signal. Conversely, it converts the RF signal (from the RU) into an optic signal.

② **Duplexer & BPF:** Filters out the unwanted signals on the FWD and REV path.

③ **FSK Modem:** Modem for communications between the DHU and the RU.

④ **Low Noise Amplifier (LNA):** Performs low noise amplification on received signals.

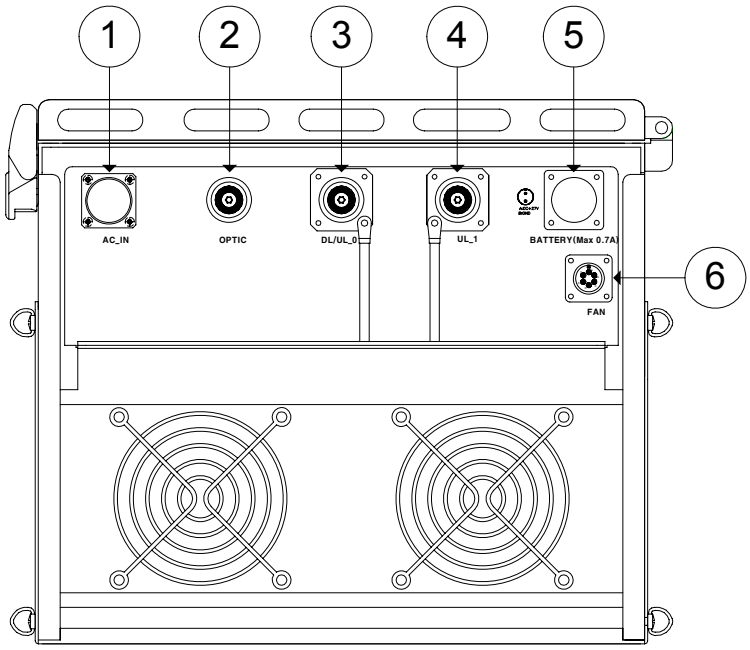
⑤ **LPA (Linear Power Amplifier):** A 60 Watt 6 carrier amplifier which amplifies the signal into high output power for transmitting to the DL antenna. The amplifier is operated by +30VDC and has a 43dB Gain.

⑥ **Control Module:** Used to monitor and control the RU. Also manages the communication with the DHU.

⑦ **Power Supply:** Converts the input power (115-230VAC, free voltage) into DC+30V, DC +7V and supplies this power to the modules. Also, turns the FAN On/Off by detecting the internal temperature of the unit and alerting the Control module (⑥) the current status of the FAN .

⑧ **Arrestor:** Protects the system against lightning surges. No external lightning arrestors are required.

2.4.2 Remote Unit Connectors



[FIGURE 2.4.2] REMOTE UNIT EXTERNAL CONNECTORS (BOTTOM VIEW)

① **AC power connector:** Male AC power connector to allow connection for a female MS3102 Type AC power connector and AC power feeder cable.

② **Fiber entrance port:** A non metallic liquid tight strain relief is connected to the port with a fiber core fed through the center into the RU.

③ **DL/UL0 path in/out port:** Female DIN type DL/UL path port making use of a single fiber core for full duplex operation. An antenna is connected to this port to transmit and receive signals.

④ **UL1 path input port:** Female DIN type Diversity uplink/receive path port to connect a second antenna

⑤ **Battery connector:** A weatherproof two pin MS connector used to connect an external battery backup unit.

⑥ **FAN connector:** A weatherproof six pin MS connector used to connect the fan unit.

3. Installation

3.1 Transportation to the Site

During transportation of the repeater to the site, the following points need to be considered.

- While transporting the repeater unit, it is advised to pack the repeater in its original packaging supplied by Juni America.
- It is important to prevent any shock applied to the repeater units while loading/unloading to/from the vehicle.
- During transportation, it is advised to prevent or minimize any movement of the packed repeater units.

3.2 Handling of the Repeater

The user should prevent any defect caused by an accident, misuse, abuse, insect infestations, “Acts of God”, improper installation or operation, lack of reasonable care, unauthorized modification, and loss of parts, tampering or any repair by a person not authorized by Juni America. As the JF-46 repeater is heavy equipment, the installer should be careful and seek assistance while attempting to lift/carry/move the units.

3.3 Installation Conditions

- Avoid direct sunlight and place the repeater in a well ventilated location.
- The environment temperature should be in a range of –20°C to +55°C.
- Ground connections should be made to all metal cabinets for safety.
- Avoid any vibration.
- The VSWR of the cable which connects the repeater to the antenna should be less than 1:1.5

3.4 Inspection before Installing the Repeater

- Check for any physical damage on the repeater cabinet. If any damage is found, it is advised to perform close inspection on the operating features and RF signal test to verify repeater performance.
- Check for loose RF cables inside the repeater.
- Check whether any part of the cabinet is exposed to water or other liquid substances.
- Before installing the repeater, check the serial number of the units to be installed.
- Check all required accessories are available.

3.5 JF-46 FFR Installation Procedure

3.5.1 Tools and Materials

The following tools and materials are required in order to complete the procedures in the installation process. The installation processes include RF testing and mechanical installation.

Test equipment required for commissioning by the customer

- RF signal generator
- Portable RF Spectrum analyzer or RF power meter
- RF adaptors
- AC/DC voltmeter
- External attenuators (high power and low power)
- MS3102A18-21S Female power feeder connector
- RF test cables
- 99% pure alcohol wipes
- PC with Internet Explorer software installed
- Optical TDR (Time Domain Reflectometer)
- Butyl tape (rubber tape)
- Electric tape
- RJ-45 Ethernet interface cable
- Various tools such as screwdrivers, spanners etc
- Wireless terminal
- Pencil or pen
- Writing pad

3.5.2 Cautions during Installation

Caution when connecting the optic cable:

- Clean the connection part of connector using an industrial tissue and 99.9% pure alcohol.
- After connecting the optic jumper cable, the residual section should be set in a large circular form to prevent it from folding.

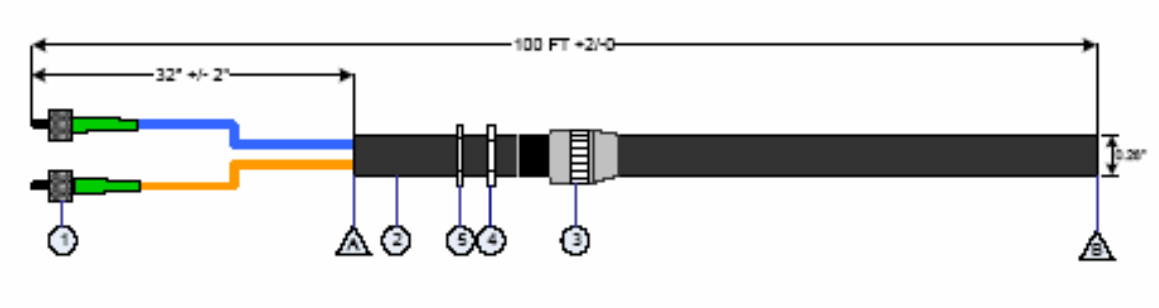
Caution when setting the repeater:

- Do not power on the system while the output port of the system is not connected.
- Before connecting the DHU input from the BTS, measure and confirm the DHU input level is within the DHU input dynamic range.
- Confirm the connections of the cables and connectors are tight.
- Confirm the ground connection complies with the safety specifications for protection against thunderstorms.

3.5.3 Optical Fiber Jumper Cable Assembly

An Optical Fiber Jumper Cable assembly is available from Juni America, Inc. to facilitate connection from a single-mode optical fiber transmission facility (dark fiber) to the DHU or RU. The Optical Fiber Jumper Cable assembly is shown in the figure below. It has an overall length of approximately 100 feet. It includes a weatherproof “boot” assembly which serves to seal the circular opening (in the DHU or RU), where the optical fiber jumper cable enters and connects to the FFR subsystem, via the FC/APC connector provided.

Only one optical fiber core is required for the optical fiber connection between the DHU and RU, and a second optical fiber core is provided within the jumper cable assembly as a “spare”. Should one of the fiber cores fail, ensure the system is turned off by following the “Replacement of faulty units” section. Unplug the problematic fiber core from the DHU and RU and plug the spare jumper cable into the unit. This will only work provided the spare fiber is functioning.

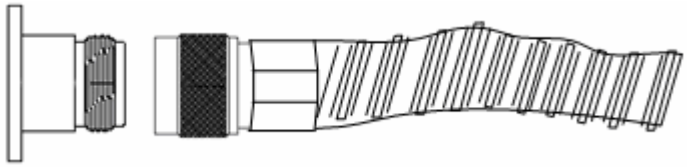


[FIGURE 3.5.1] OPTICAL FIBER JUMPER CABLE

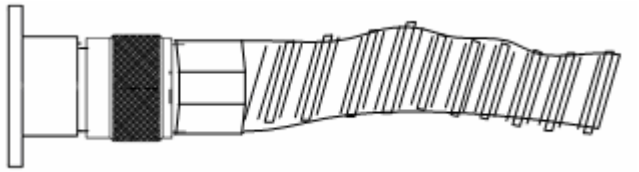
3.5.4 Weatherproofing Connectors

Once all connectors and cables have been configured and assembled, weatherproofing is vital to prevent corrosion due to water ingress which could lead to eventual failure.

1. Making sure that the connector surfaces are clear of residue and dry, firmly tighten the connectors.

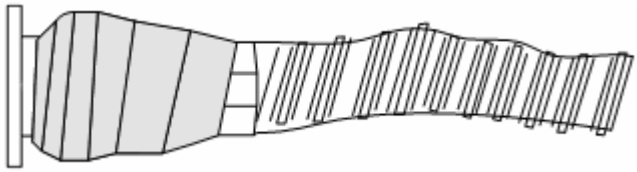


[FIGURE 3.5.2] CONNECT CABLE TO CONNECTOR



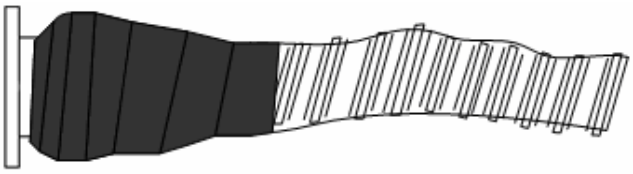
[FIGURE 3.5.3] FASTEN CABLE TO CONNECTOR

2. Seal the connector assembly by tightly wrapping Butyl tape over the connection. Two or more layers should be used so that the tape seals the entire connection and extends beyond the connector by about an inch.



[FIGURE 3.5.4] WRAP CONNECTION WITH BUTYL TAPE

3. Tightly wrap electrical tape around the existing Butyl tape making sure to also extend one inch beyond the Butyl tape to completely envelop the tape and connector.

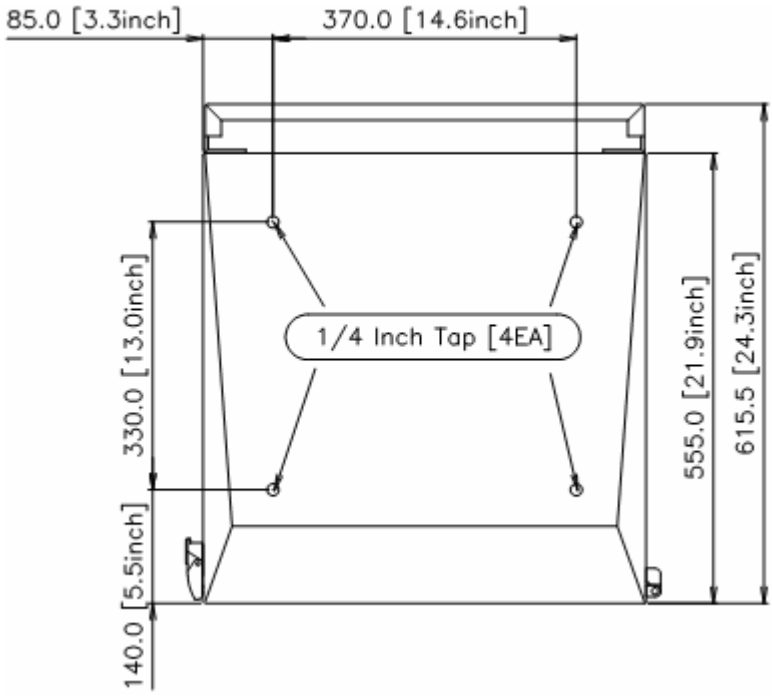


[FIGURE 3.5.5] WRAP OVER BUTYL TAPE WITH ELECTRIC TAPE

3.5.5 Donor Unit Eye Bolts

There are four eye bolt tapped holes located at the top of the DHU as shown below. The length of the tapped hole is 0.97 inches or 25mm. The customer supplied ¼" 20UNC eye bolts may be used to assist in hoisting the DHU above the ground for wall or pole mount solutions.

Ensure that the eyebolts are securely attached to the top of the DHU. Check that the cables used to lift the DHU is securely fastened to the eyebolts before it is lifted.



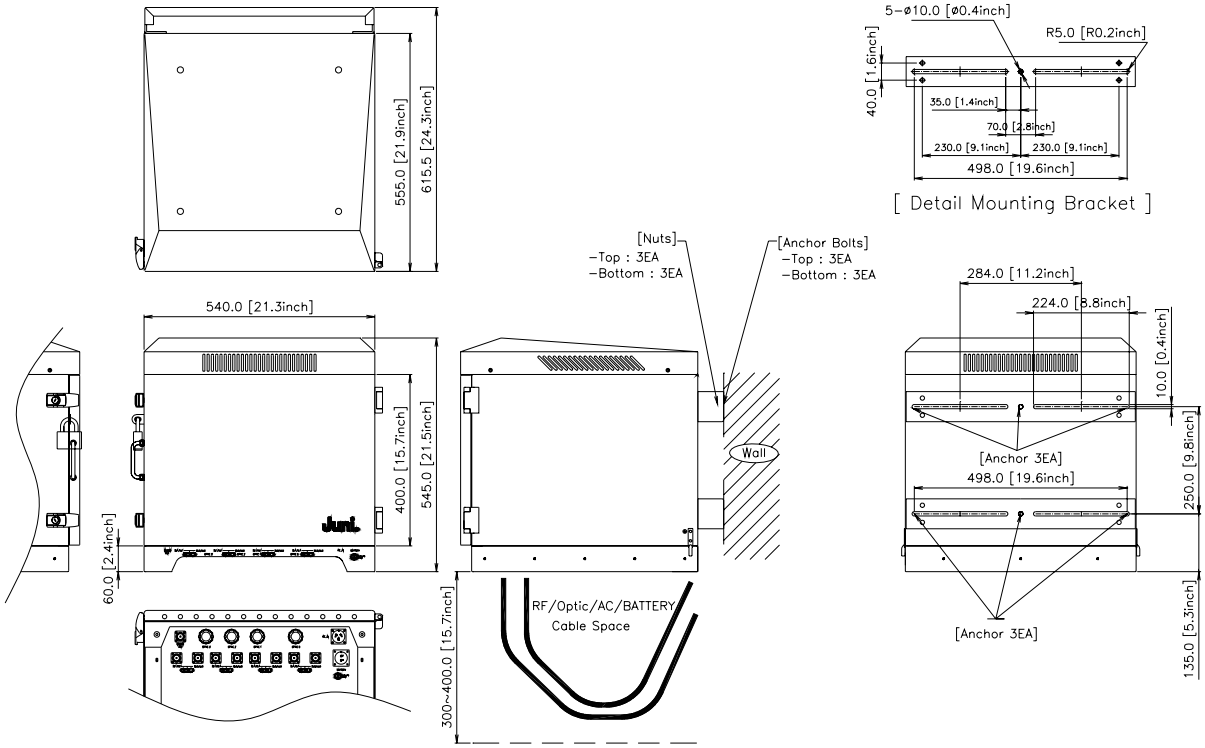
[FIGURE 3.5.6] DONOR UNIT EYE BOLT PATTERNS

3.5.6 Donor Unit Standard Wall Mount Guide

The DHU is capable of being wall mounted. There are two horizontal panels protruding slightly behind the DHU, with holes along the panel to allow bolts and nuts to be fastened. The wall mount holes will accommodate bolt diameters up to a maximum of 0.4 inches. Drill holes in the wall or area in which it is to be installed to match the mounting holes on the panels.

Attach the DHU to the wall using the appropriate fastening method.

The figure below displays the positioning and size of the wall mount holes.

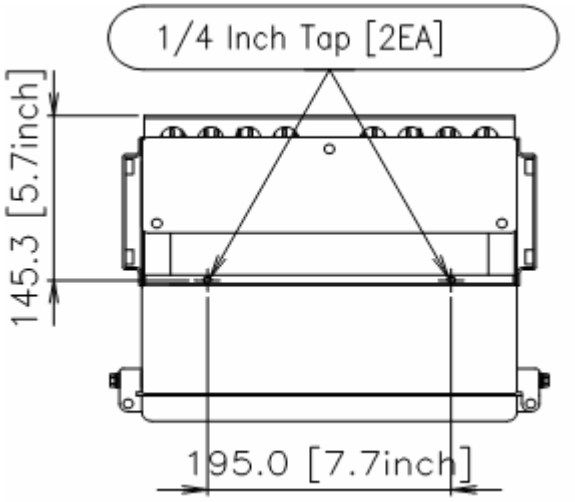


[FIGURE 3.5.7] DONOR HUB UNIT WALL MOUNTING

3.5.7 Remote Unit Eye Bolts

There are two eye bolt tapped holes located at the top of the RU which is located next to the fan compartment. The length of the tapped hole is 0.7 inches or 18mm. The customer supplied ¼" 20UNC eye bolts may be used to assist in hoisting the RU above the ground for wall or pole mount solutions.

Prior to using the eyebolts, ensure that the three eyebolts are securely attached to the top of the RU. Check that the cables used to lift the DHU is securely fastened to the eyebolts before it is lifted.



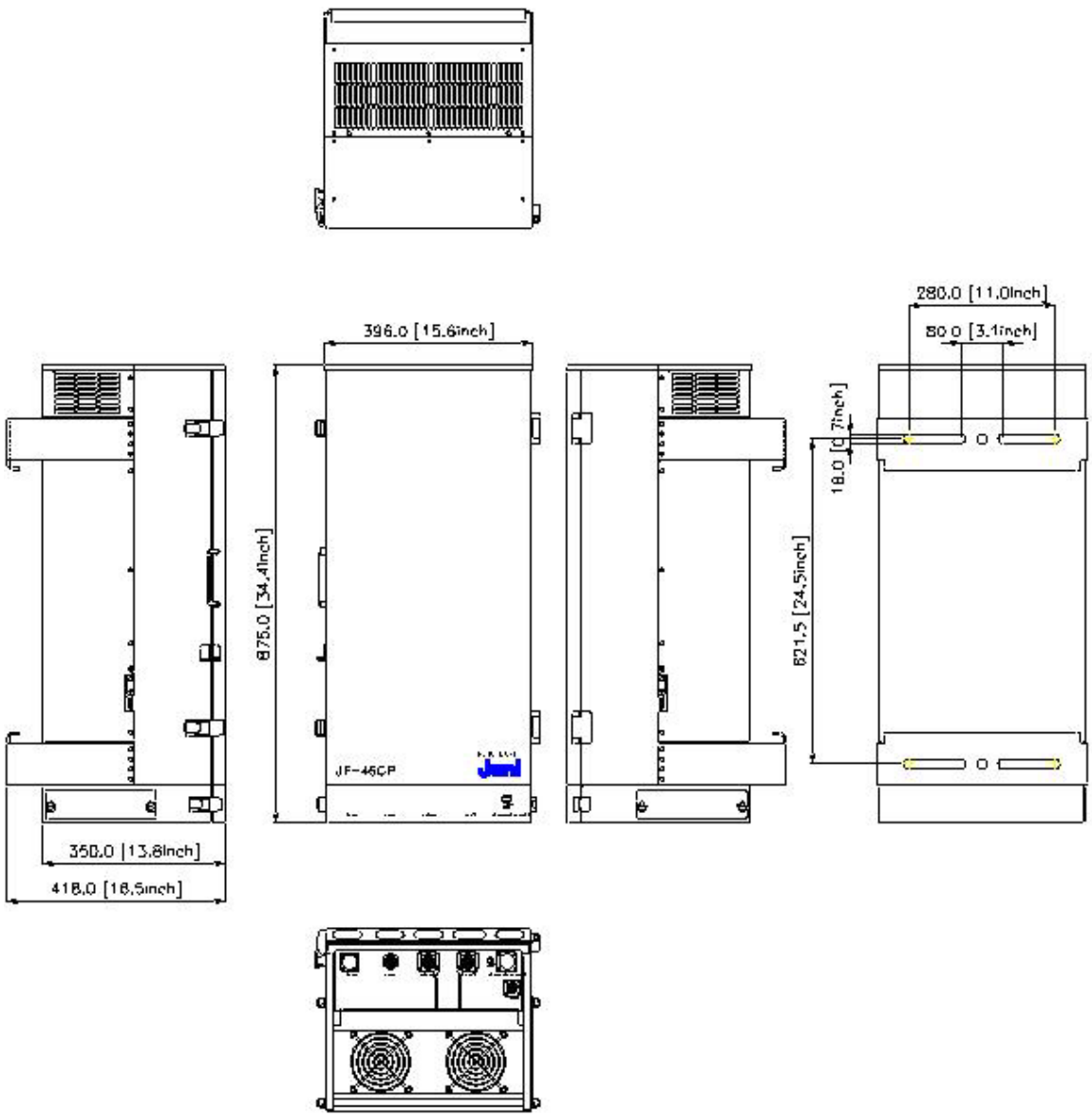
[FIGURE 3.5.8] REMOTE UNIT EYE BOLT PATTERN

3.5.8 Remote Unit Standard Wall Mount Guide

The RU is capable of being wall mounted. There are two horizontal panels extending from the body of the RU at the top and bottom with holes along the panel to allow bolts and nuts to be fastened.

The wall mount holes will accommodate bolt diameters up to a maximum of **0.39 inches**. Drill holes in the wall or area in which it is to be installed, to match the mounting holes on the panels.

Attach the RU to the wall using the appropriate fastening method.
The figure below displays the positioning and size of the wall mount holes.



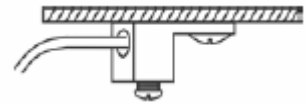
[FIGURE 3.5.9] REMOTE UNIT WALL MOUNTING

3.5.9 AC Cables and Connectors Installation Guide

Please follow the procedure below to safely install an external power supply to the DHU and RU.

1. Check the line power switch of the power supply to ensure that it is OFF.
2. Install a MS3102 Female type AC connector into the chassis connector located on the bottom of the Power Supply.

3. Place #6 copper ground wire into the ground lug located on the bottom of the cabinet.



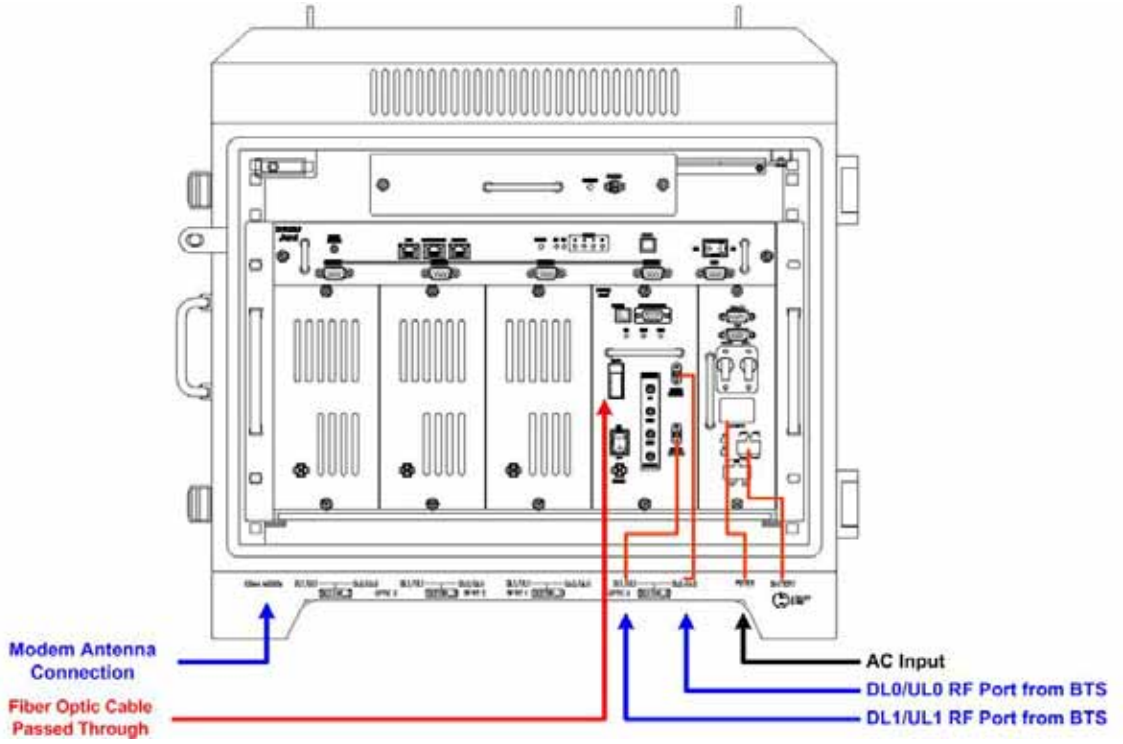
[FIGURE 3.5.10] STEP 1

4. Route and attach the ground wire according to local electrical codes.
5. Install an approved 20 amp high magnetic circuit breaker on the input power side of the power supply.
6. Install a conduit into the opening on the bottom and attach line power in accordance with local electrical codes. The barrier strip is wired with the hot leg at the top. The bottom connector is chassis ground.

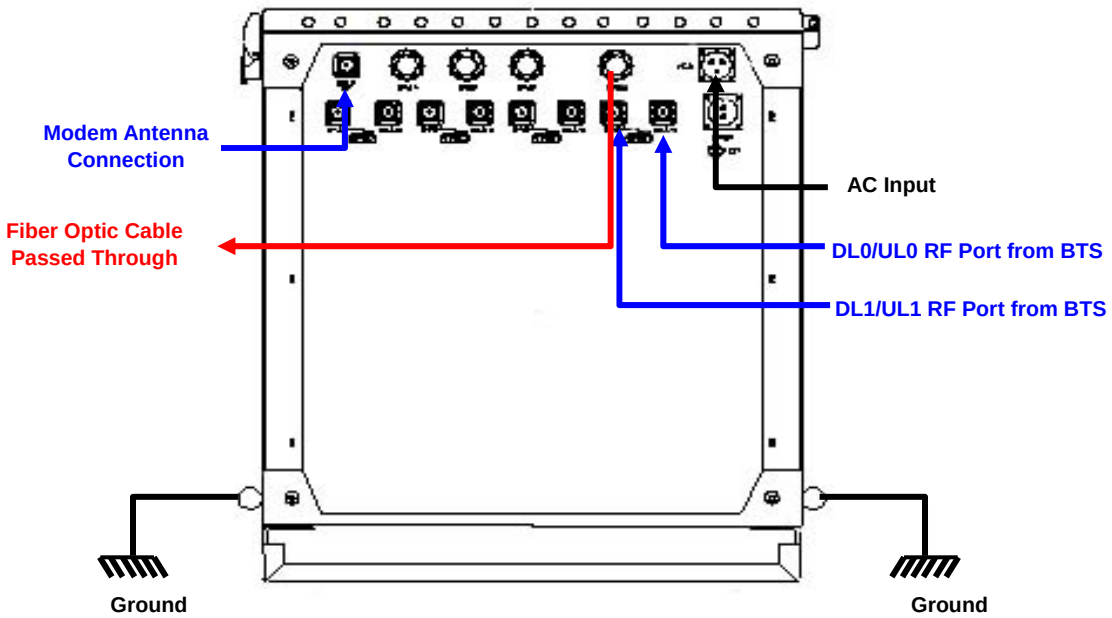
3.5.10 Donor Hub Unit Commissioning and Provisioning

Note: Please refer to the "Initial System Configuration and Set Up Method of Procedure" for a step by step guide to commission the system for both the Donor Hub Unit.

1. Verify that the power supply input voltage is switched OFF.
2. Before any other connections are made, ensure that the ground terminal on the DHU cabinet has been connected to the common ground of the installation site, as described in the previous section.
3. Connect a customer-supplied power cable to the DHU Enclosure.
4. Connect a customer-supplied AC power cable to the front of the DHU power supply when the DHU enclosure is not used.
5. Connect a customer-supplied Optical Fiber cable to the Optic Module in the DHU.
6. Connect a customer supplied modem antenna to the RF modem port on the bottom of the DHU unit when the DHU enclosure is used.
7. Connect a customer supplied Ethernet cable to the IP Control Box when the DHU enclosure is not used.
8. Turn the power on with the main switch located on the PSU and then power on the MCU.
9. Connect a customer supplied PC to the DRCU's LMT port with a RJ-45 cable. Load the Internet Explorer software to check the status and settings of the DHU. Detailed LMT instructions are provided in Section 4.1.



[FIGURE 3.5.11] CABLE CONNECTIONS ON THE DHU (FRONT VIEW)

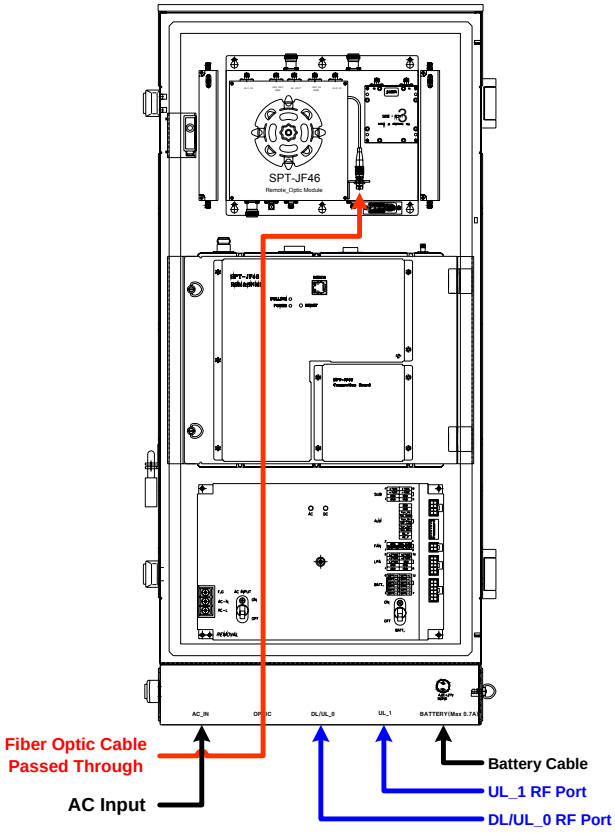


[FIGURE 3.5.12] CABLE CONNECTIONS ON THE DHU (BOTTOM VIEW)

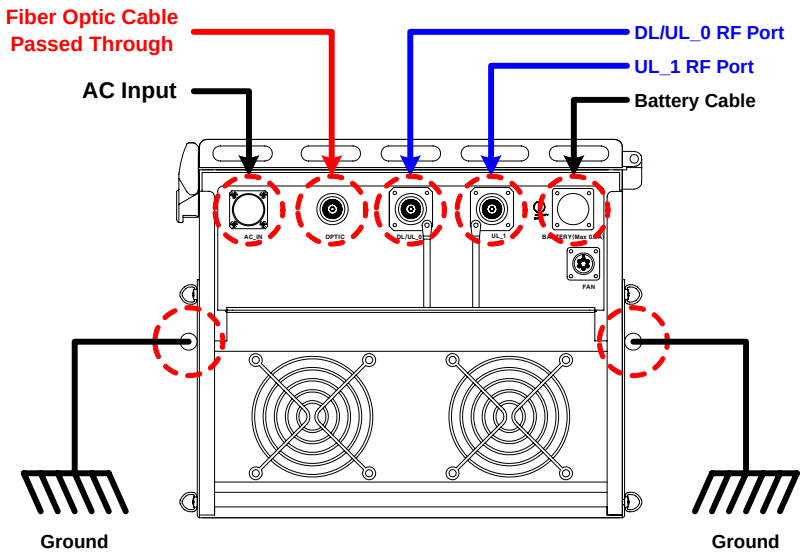
3.5.11 Remote Unit Commissioning and Provisioning

Note: The power to the Remote Unit is then fed via the AC Female MS3102 Type connector. The Male MS3102 Type Connector connected to the enclosure is grounded to provide safety for installation personnel.

1. Verify that the power is switched OFF.
2. Before any other connections are made, ensure that the ground terminal on the RU cabinet has been connected to the common ground of the installation site, as described in the previous section.
3. Using an AC voltmeter, verify that the AC voltage level at the AC outlet is 115 or 230VAC.
4. Check that the AC power cable is earthed and is supplying the correct voltage (115 or 230VAC) and polarity and then connect it to the AC input port of the RU.
5. At the AC breaker box, close the circuit breaker for the circuit that supplies AC power to the RU.
6. Verify that all electrical and optical connections have been completed and that all optical fibers, coaxial cables and wires are properly routed and secured.
7. The incoming electrical line of the RU should be made waterproof and moisture proof by using contraction tubes.
8. Connect one of the customer-supplied antenna cables to the DL/UL0 port of the RU. Connect a second customer-supplied Antenna cables to the UL1 port of the RU.
9. Connect the optic cable to the optic module inside the RU cabinet. (As the optic input level from the DHU would be measured during gain setup, the installer may choose not to connect the optical fiber cable at this point.)
10. Connect the customer-supplied AC power cable to the RU AC power port. (AC power must be turned OFF for safety.)
11. Switch the power on and check the status of power supply LED.
12. Connect a PC to the debug port of the RU with a RJ-45 cable and load the Internet Explorer software to check the status and settings of the RU.
13. Ensure that communication between the RU and DHU is functioning correctly after setting on the RRCU.
14. Check the downlink signal power waveform and level.
15. Close the door of the RU and weatherproof the connectors and boot.



[FIGURE 3.5.13] CABLE CONNECTIONS FOR THE REMOTE UNIT (TOP VIEW)



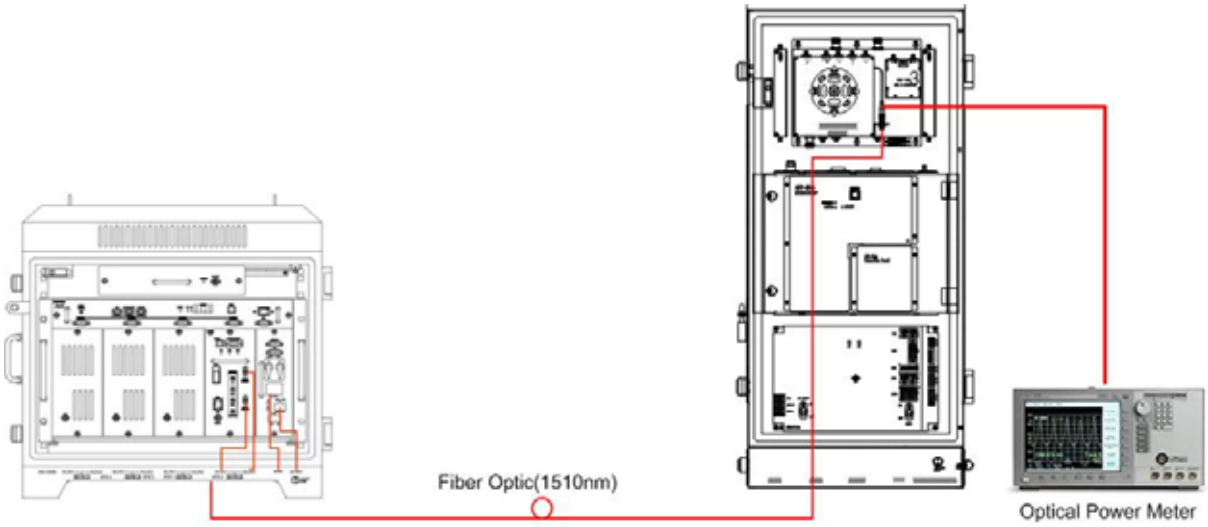
[FIGURE 3.5.14] CABLE CONNECTIONS FOR THE REMOTE UNIT (BOTTOM VIEW)

3.5.12 Operations Tests

This section provides test procedures for the uplink and downlink required to be undertaken in order to set up the JF-46 for optimal service.

3.5.12.1 Optic Cable Loss Test

Connect the system as shown below:



[FIGURE 3.5.15] CONNECTION TO PERFORM OPTIC CABLE LOSS TEST

Check optic cable loss by using an optic power meter or reflectometer

1. With the DHU on, connect the power meter to the optic module of the RU and measure the Forward (1510nm) output level. If the optic input level exceeds +7dBm, check the DHU optic module.
2. If the optic loss is greater than –8dBo (on the basis of **1510nm,** optic loss = donor output optic power – remote input optic power) and the optic cable length between the DHU and RU is less than 15 miles, check for faults in the PD (Photo Diode) or check the optic cable.
3. If the optic loss is lesser than –2dBo (on the basis of **1510nm,** optic loss = donor output optic power – remote input optic power), add the optic jumper cable(2dBo).
4. If a PD fault has occurred, inspect the optic input level and check the optic line. Clean the optic connector and if the fault is still existent, contact Juni technical support.

** Reference*

Optic cable loss is 0.25dB/km at 1510nm, and connection loss is 0.4dB/connector. The total optic loss due to the connector is about 1 to 2dB. (0.4dB ×2 (connector) ≒ approx 1dB)

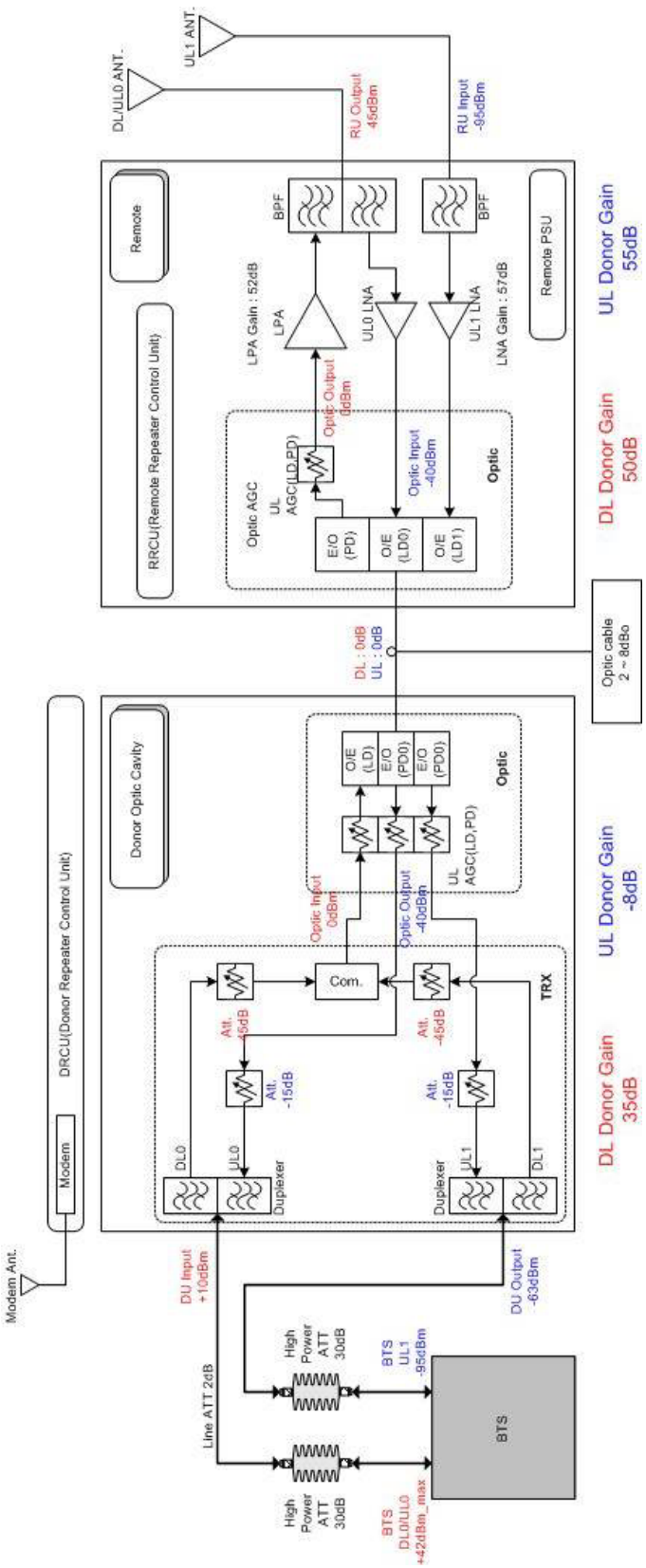
3.5.13 Setup Procedure for DL/UL Path Gain

This section provides test procedures for the uplink and downlink required to be undertaken in order to set up the JF-46 for optimal service.
The table below provides initial settings for three BTS and RU configurations:

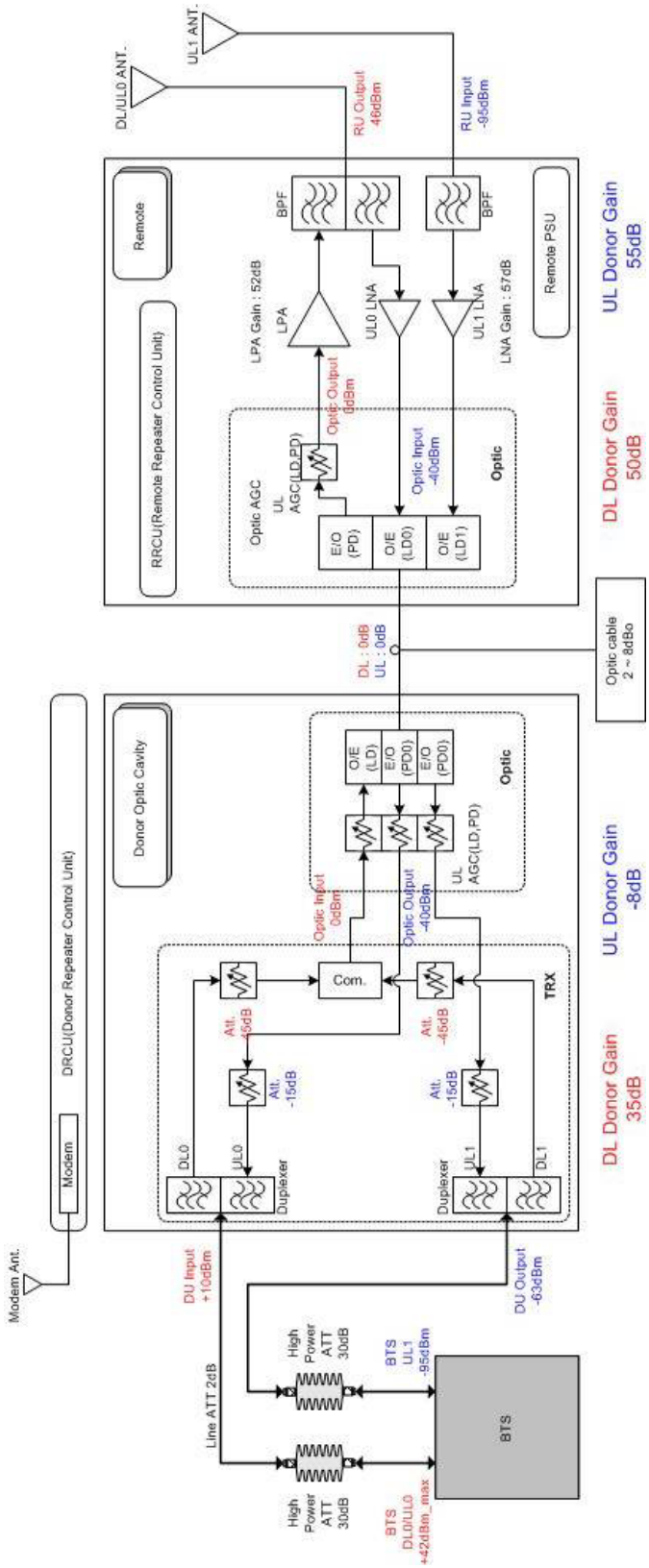
(1) One 1x RTT carrier at 16 Watts output at BTS, 30 Watts output at RU
(2) One 1xRTT carrier at 16 Watts plus one 1xEV-DO carrier at 16 Watts at BTS, 40 Watts output at RU
(3) Two 1xRTT carriers at 16 Watts each at BTS, 40 Watts output at RU

For all three configurations above, the External Loss between BTS and Donor Hub Unit is 37 dB total. For all three configurations, the desired target value of UL gain from RU antenna port to BTS RF port is 0 dB.

Please see section 4 and the “Initial Configuration and Set Up Method of Procedure” for a detailed explanation to what each setting denotes.



[FIGURE 3.5.16] ONE CARRIER TOTAL OUTPUT POWER OF +45DBM



[FIGURE 3.5.17] TWO CARRIER TOTAL OUTPUT POWER VALUE OF +46DBM

3.5.13.1 Setup for DL Gain

The procedures provided below can be used to fine-tune the DHU and RU DL settings to obtain the desired RU Pilot Power output.

a. Refer to Figure 3.5.20 below. Set up the BTS for Pilot-only transmission. Verify with a Power Meter or Spectrum Analyzer that the DL input power level to the DHU (to be connected at the DL0/UL0 port of the DHU) is appropriate, given the BTS Pilot-only output power shown in the table and External Loss value.

b. Turn on the LPA with the GUI

c. While monitoring the forward output power measurement function of the GUI (and optionally while measuring the Remote Unit RF output using Power Attenuator and Spectrum Analyzer or Power Meter, adjust the Remote DL ATT setting to obtain the desired exact RU RF output value shown above.

Caution:

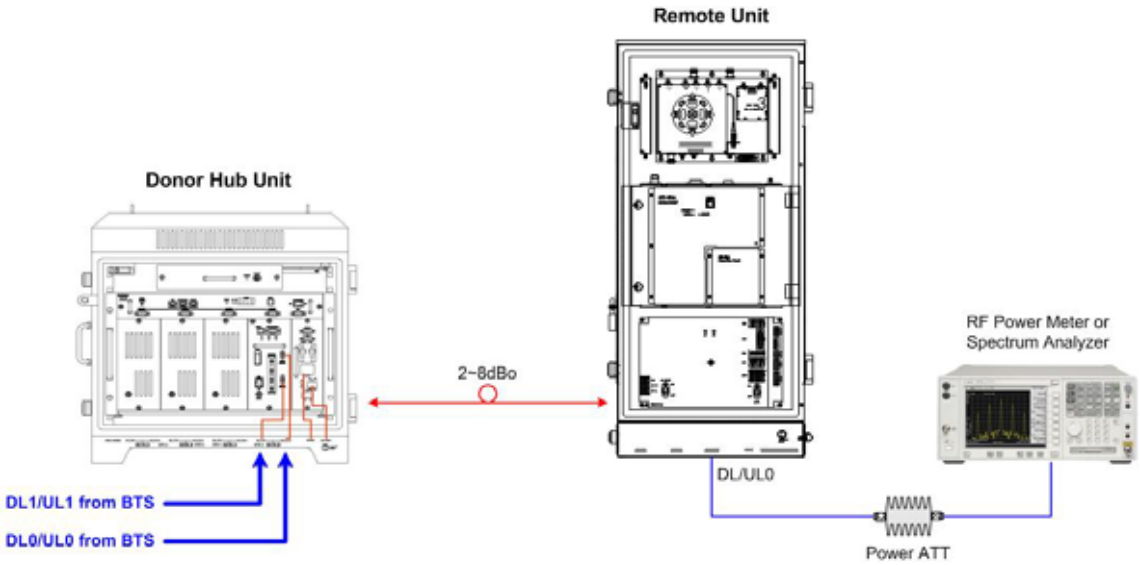
- The power attenuator is needs to be rated at >500W. Using a lower rating power attenuator can fail and cause damage to the spectrum analyzer.

d. Turn off the LPA with the GUI.

e. Disconnect the Power Attenuator and Spectrum Analyzer or Power Meter.

f. This completes the DL setup.

Note: The Maximum RU output power should not exceed +46 dBm or 40 watts composite during operation to prevent damage to the FFR.

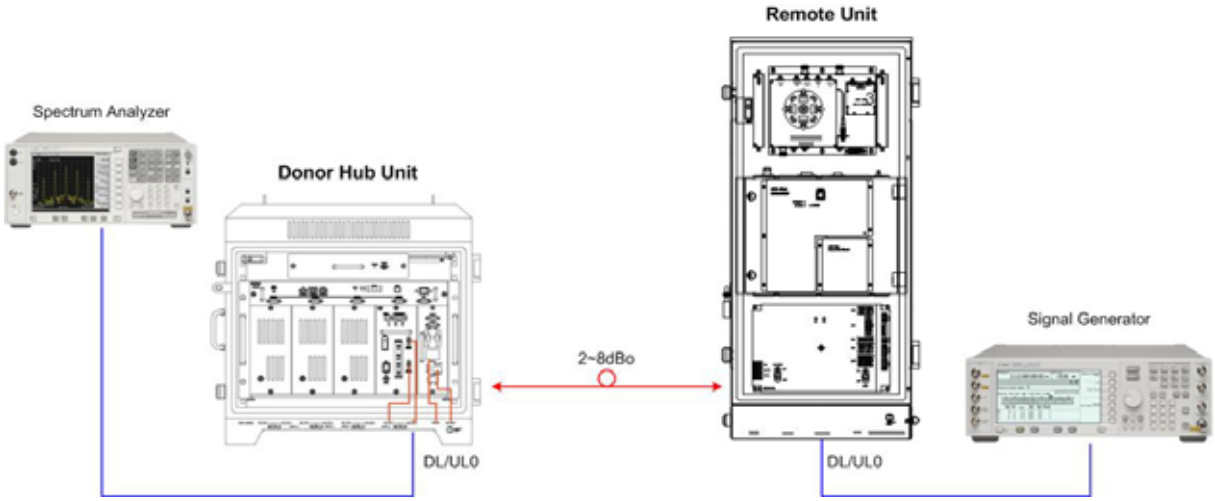


[FIGURE 3.5.18] CONNECTION TO SET UP DL GAIN

3.5.13.2 Setup for UL Gain

The procedures provided below can OPTIONALLY be used to fine-tune the DHU and RU UL settings to obtain the exact desired UL Gain.

a. Refer to Figure 3.5.21. Connect a Spectrum Analyzer to the DL0/UL0 port of the DHU (Span: 5 MHz, Amplitude Offset = measurement cable loss)
b. Inject an Uplink input signal of -95 dBm at the DL/UL_0 port of the RU, and check the output level on the Spectrum Analyzer.
c. Based on the above measurements, adjust the Donor UL0 ATT control to obtain an output power value of 32 dB, which corresponds to 0 dB overall Gain with 32 dB External Loss
d. Repeat the above procedure for the DL1/UL1 port of the DHU, DL/UL_1 port of the RU, and Donor UL1 ATT control.
e. This completes the UL setup.



[FIGURE 3.5.19] CONNECTION TO SET UP UL GAIN

Note: The procedure is the same for the receive diversity

3.5.13.3 Caution Items

- When adjusting the forward gain, start from the minimum gain setting.
- Max. Output Power should not exceed 40W (about +46dBm),
- When adjusting output levels while monitoring the CDMA test equipments, input the appropriate offset level in the Spectrum Analyzer considering the Cable Loss. (offset value = coupling value + measured cable loss)

3.6 Replacement of Faulty Units

Please follow the procedure to replace faulty or failed components and units. The unit replacement procedure is common to both the DHU and RU.

3.6.1 Remote/Donor Unit Replacement

1. For RU replacement, turn off the LPA of the RU
2. Turn off the power of the RU or DHU
3. Disconnect all cables from the faulty unit

Note: The antenna cables must be disconnected after the repeater has been turned 'OFF'

4. Dismount the faulty unit
5. Mount the replacement unit
6. Connect all cables to the replaced unit
7. Turn on the power of the replaced unit
8. For RU replacement, check whether the LPA is off (Turn it off if it is on), and configure the settings of the replaced unit. These settings should be identical to the previous faulty unit settings while it was under service
9. For RU replacement, turn on the LPA of the RU

3.6.2 Optical Module Replacement

1. Turn off the OTRU of the DHU power supply
2. Disconnect al RF connectors, power cable, data cable and optical fiber that are connected to the OTRU
3. Unscrew the multi-turn fastener located at the top and bottom of the module and pull on the handle to free the OTRU
4. Completely remove the module from its slot and place the replacement module back into the same position being careful not to bump the OTRU
5. Tighten the multi-turn fastener and reconnect all cables and connectors

3.7 Storage of the Repeater

- When storing the repeater, it is recommended to pack the repeater in its original package supplied by Juni America.
- The repeater should not be stored in a high temperature or humid environment and avoid direct sunlight.

3.8 Safety Precautions

To avoid the risk of accidental electric shock, do not touch the contact terminals on the power supply unit or the control board during normal operation. If replacement for a component is required, the power of the repeater should be turned 'OFF' before taking any action.

To avoid the risk of accidental fire or electric shock, do not expose this product to rain or any other wet condition.

Only a qualified technician should service this repeater. Opening or removing covers may expose you to dangerous voltages, radiation and/or other risks. Incorrect assembly may cause electric shock when the unit is subsequently used.

Only authorized technician should connect or disconnect the Battery. The Battery Switch of Power Supply of the repeater should be turned 'OFF' before connecting or disconnecting the Battery. When the Battery is not connected, the Battery Switch should be turned 'OFF'.

4. Operation

This section provides guidelines for operating the JF-46 system via GUI interfaces. Information is provided on how to verify the units are operating properly and whether performance requirements are satisfied. This process assumes that the units have been installed in accordance with the system design plan.
Please refer to the “Initial System Configuration and Set up Method of Procedure” document for a step by step guide to provision the FFR.

4.1 Introduction

The process of turning on the system and verifying operation involves powering up various site names and adjusting the RF signal levels. The operator can control and monitor the system parameters by using the Web GUI.(Internet Explorer)

4.2 Web GUI Operation

4.2.1 Introduction

The JF-46 repeater can be controlled via the Web GUI(using Internet Explorer). This enables the operator to monitor and control the repeater by connecting a PC to the repeater via a linked or wireless communication protocol. Connect the PC to the LMT port(Ethernet) on the DRCU with the RJ-45 cable. The technician should be at the DHU site location to view the status of the RU’s.

4.2.2 WEB GUI Connection

1) Using RJ-45 Ethernet cable, connect from LMT port on the front of the Donor unit to Ethernet port of your PC.

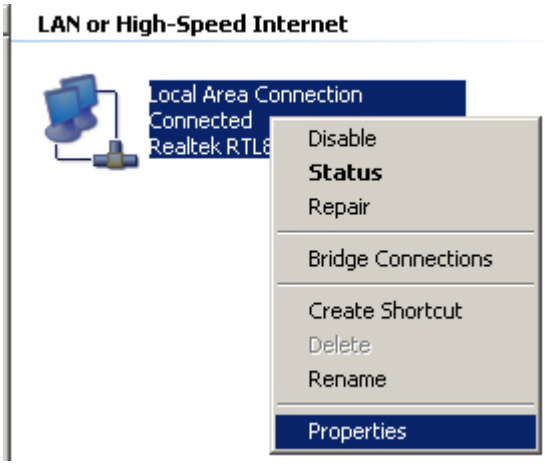
2) First we need to find the TCP/IP properties window. Open the control panel and click the “Network Connections” icon.

[FIGURE 4.2.1] OPEN THE CONTROL PANEL

3) The Network connections window will open. All of your available network connections will be listed. I only have one network interface listed, which is my Local Area Network (LAN) card. You could have several options listed here both physical connections and virtual. For example if you had a wireless network car, and a wired network card, you would see both of these listed. An example of a virtual connection, meaning that there is no physical adapter, would be a Virtual Private Network (VPN). VPN’s are well beyond the scope of the tutorial, but I wanted to give you an example of the icons that you may see. My listing is pictured below.

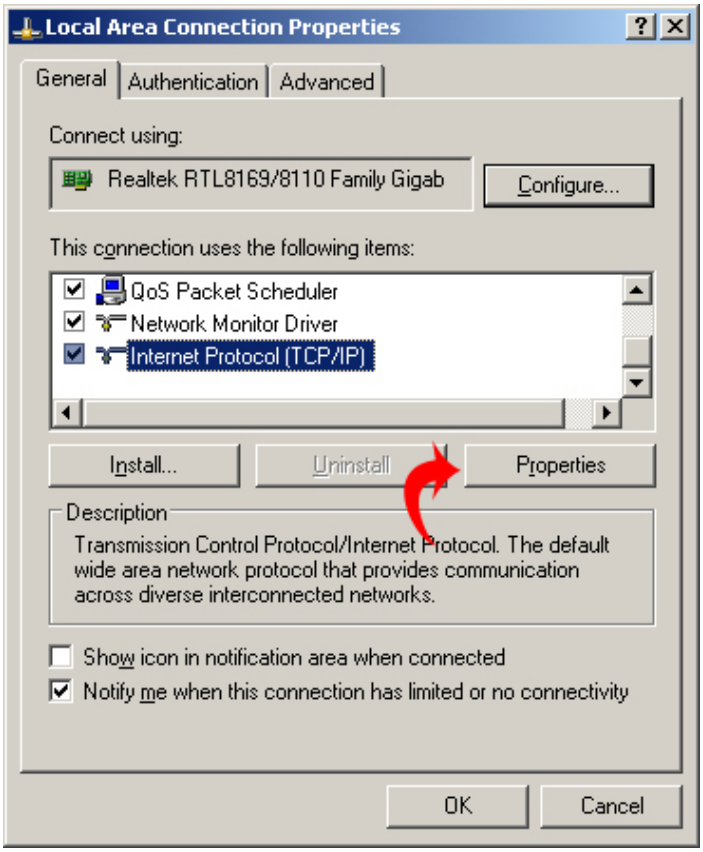
[FIGURE 4.2.2] NETWORK CONNECTIONS

4) I will be explaining the settings of a standard wired connection. Right click on your Local Area Network connection and select properties.



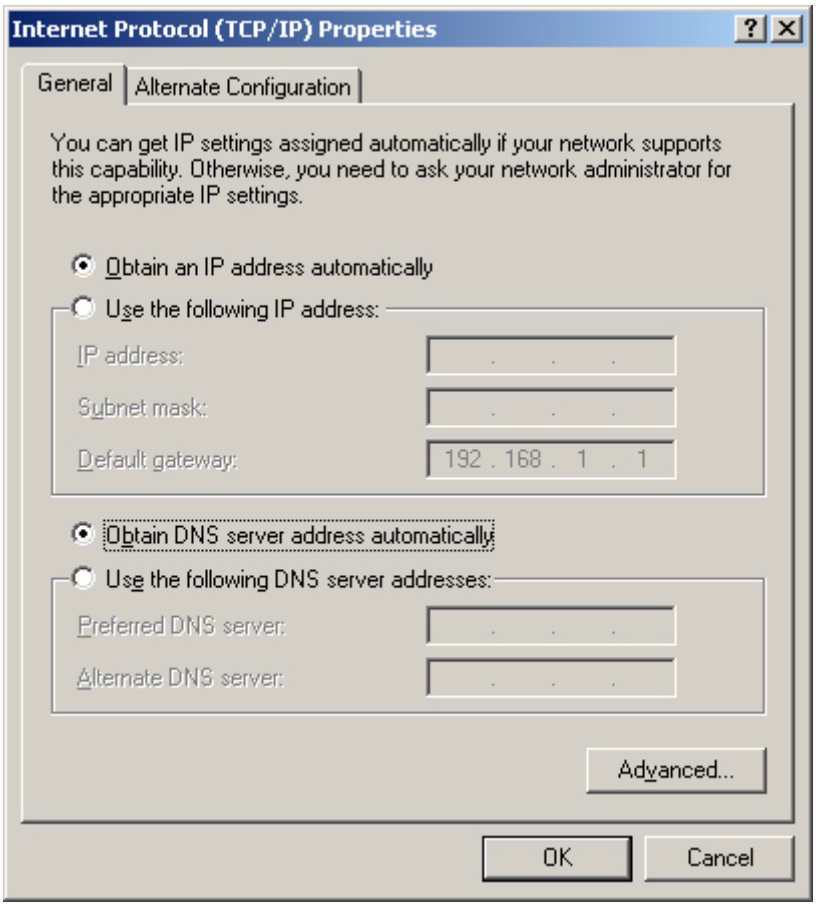
[FIGURE 4.2.3] NETWORK PROPERTIES

5) In the Local Area Connection Properties window find the box that reads “This connection uses the following items.” Use the scroll bar to locate the “Internet Properties (TCP/IP)” then highlight it and click the properties button.



[FIGURE 4.2.4] INTERNET PROTOCOL(TCP/IP)

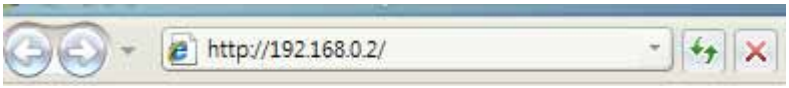
6) When the options “Obtain an IP address automatically” and “Obtain DNS server address automatically are selected, your computer will be set to operating using DHCP. DHCP stands for Dynamic Host Configuration Protocol



[FIGURE 4.2.5] INTERNET PROTOCOL(TCP/IP) PROPERTIES

7) Run “Internet Explorer” and type the IP address as below.

LMT Default Address: 192.168.0.2



[FIGURE 4.2.6] DEFAULT ADDRESS

4.2.3 Repeater Log In

When you see the webpage as below, type the proper user ID and password. The user ID has three categories such as administrator, operator and viewer. Depending on user ID, the display of window will be different.

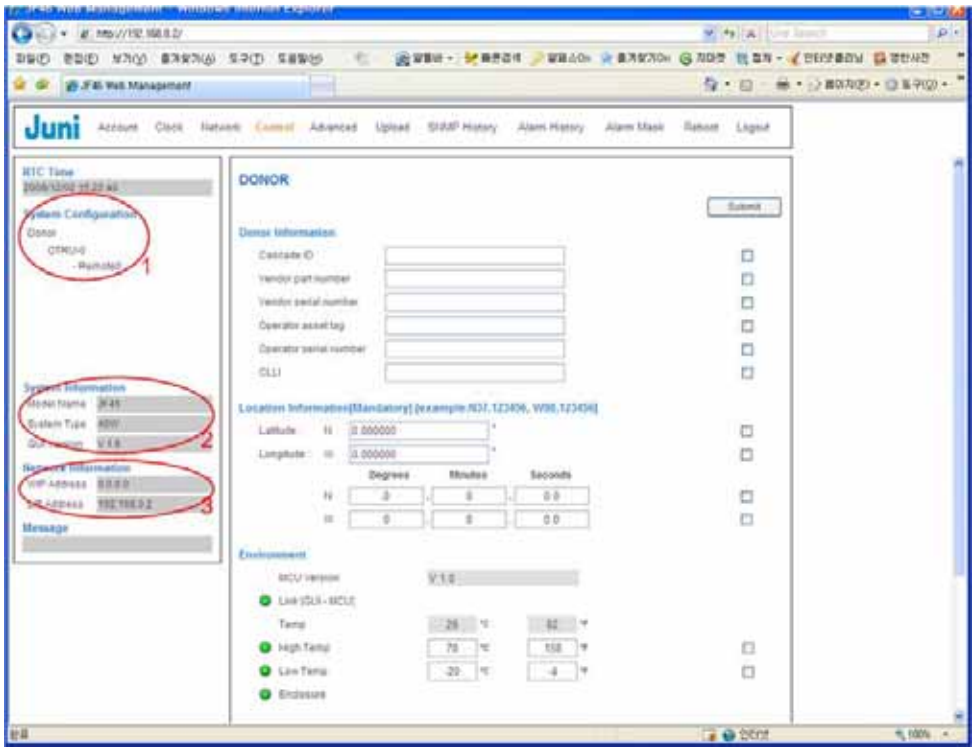
[FIGURE 4.2.7] REPEATER GUI LOG IN

4.2.4 Default Usernames and Passwords

ENTER USER NAME AND PASSWORD HERE.

4.2.5 Initial Window

When you log in, the initial screen is as below.



[FIGURE 4.2.8] INITIAL WINDOW

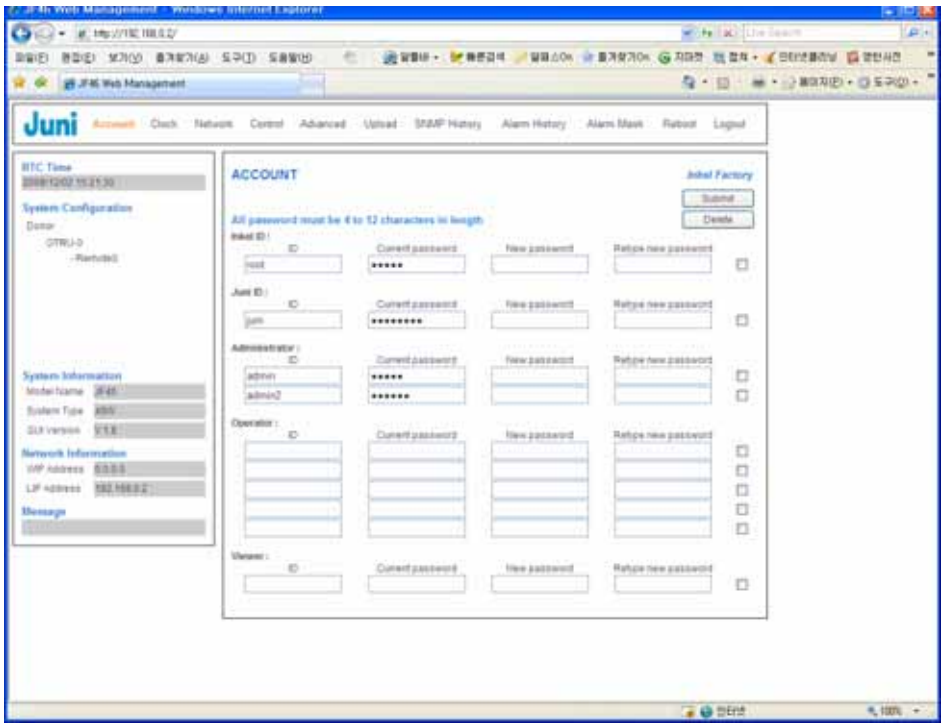
1) System Configuration:: It automatically displays whether OTRU has been installed or not.

2) System Information: It displays model name, system type and GUI version.

3) Network Information: It displays WIP address and LIP address.

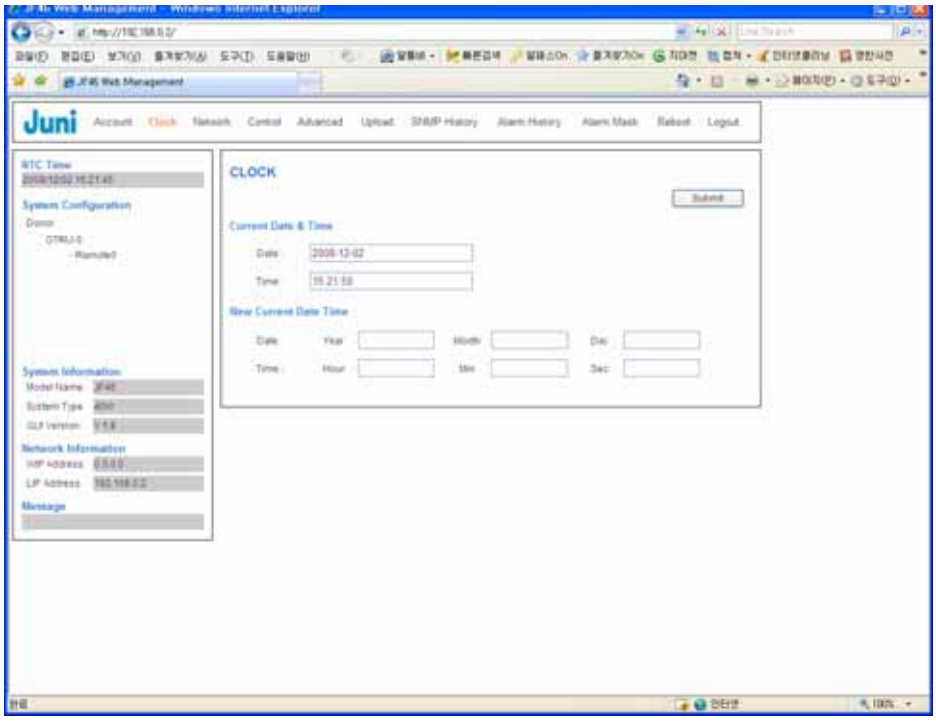
4.2.6 Account Window

Figure 4.2.3 shows the Account window. There are three user IDs for administrator, operator and viewer. The administrator can control and monitor all the functions. And the administrator can also create and delete user IDs and passwords of operator and viewer. The administrator is allowed to create five accounts for operator and two accounts for viewer.



[FIGURE 4.2.9] ACCOUNT WINDOW

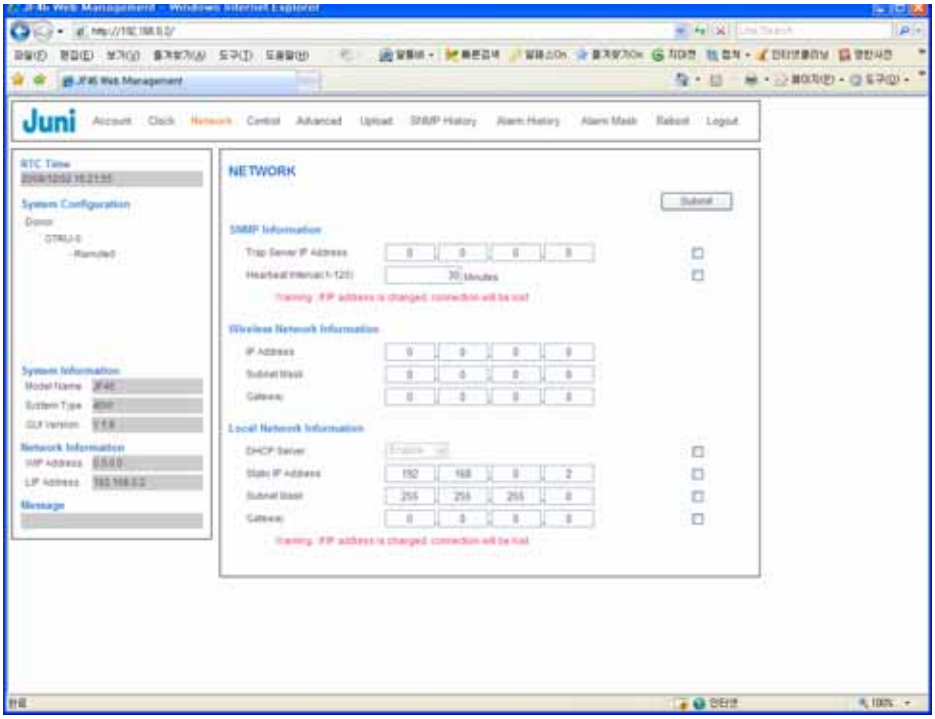
4.2.7 Clock Window



[FIGURE 4.2.10] CLOCK WINDOW

4.2.8 Network Window

This menu is for setting network configuration. Using this menu, you can configure TCP/IP for each interface and SNMP items.

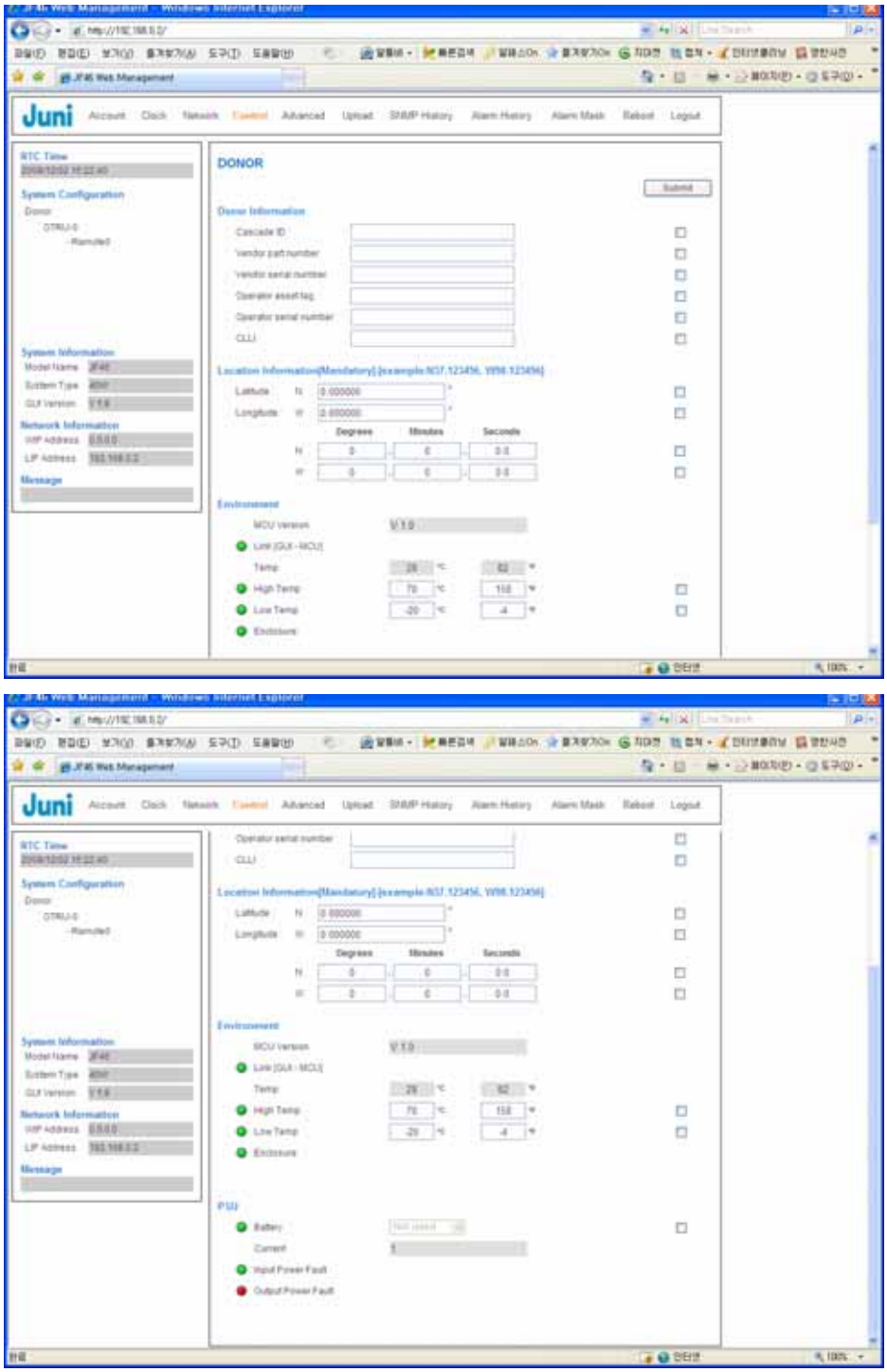


[FIGURE 4.2.11] NETWORK WINDOW

4.2.9 Control Window

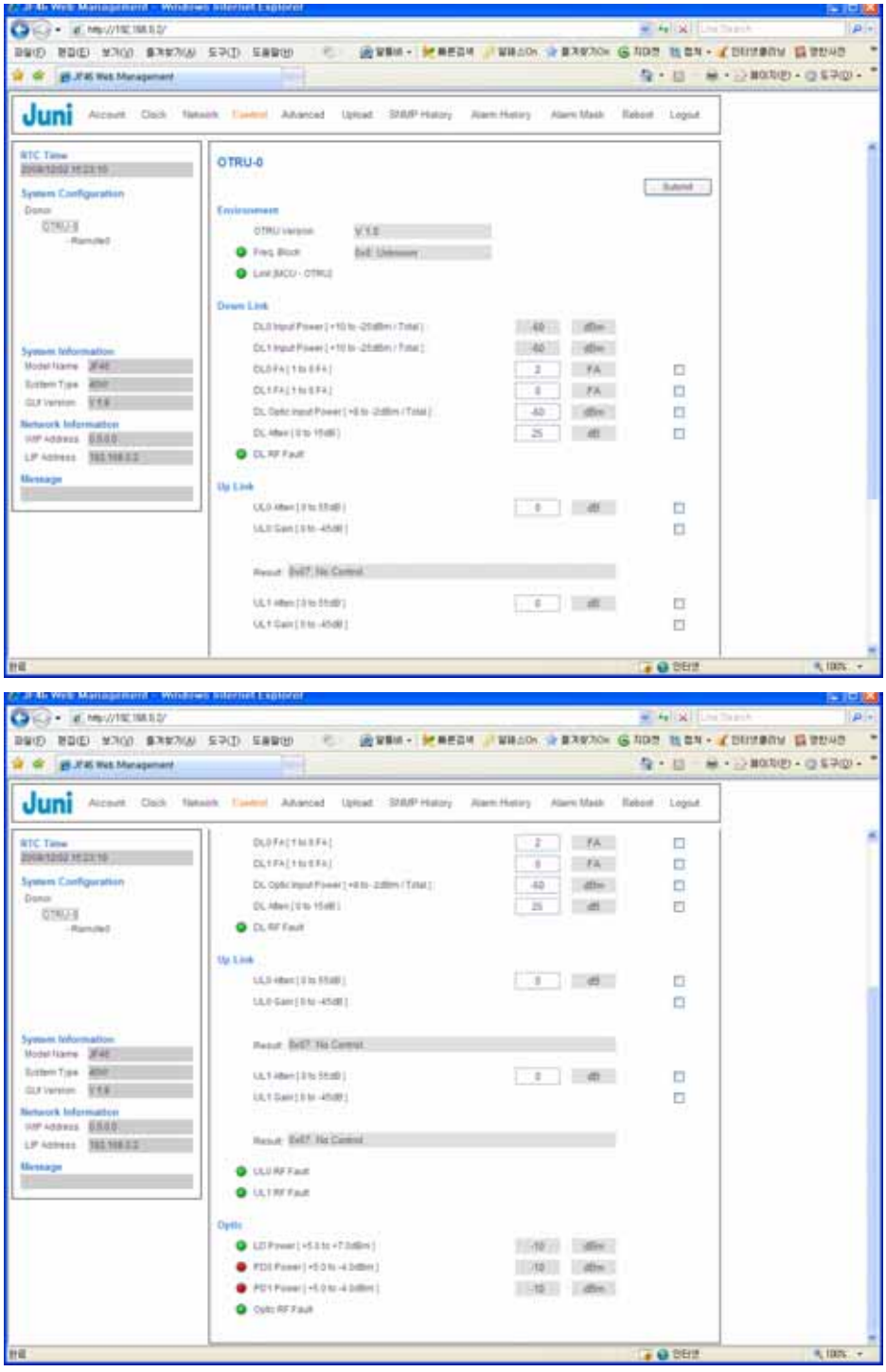
To view the status of installed repeaters, double click on the desired repeater in Figure 4.2.4 to bring up the Status and Control Window. This can also be done by right-clicking on the desired repeater and selecting the “Status & Control” command as shown in Figure 4.2.6.

4.2.9.1 Donor Control Window



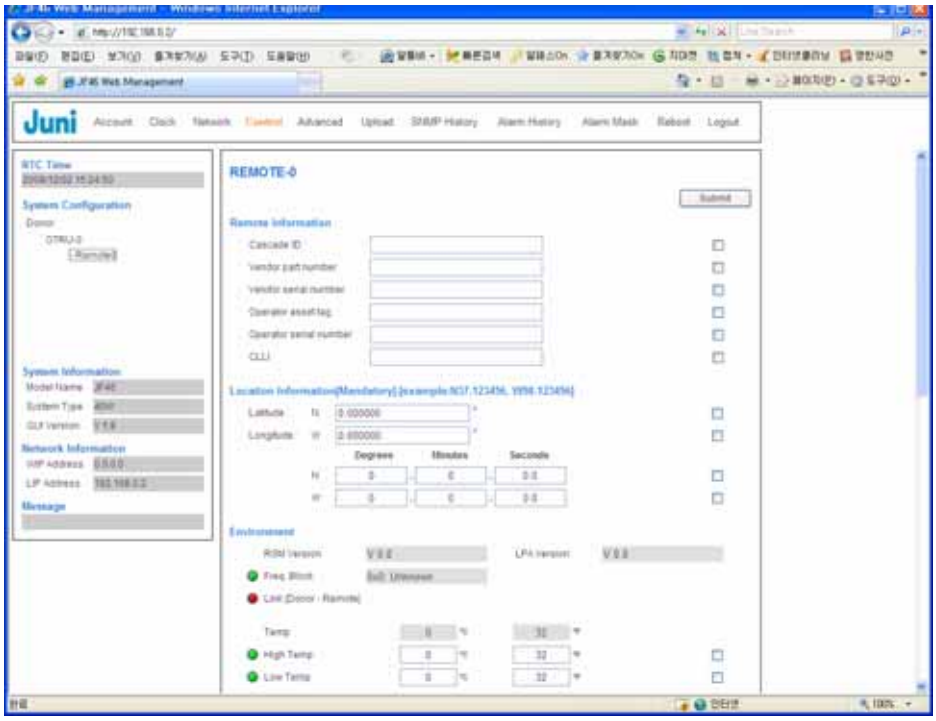
[FIGURE 4.2.12] DONOR CONTROL WINDOW

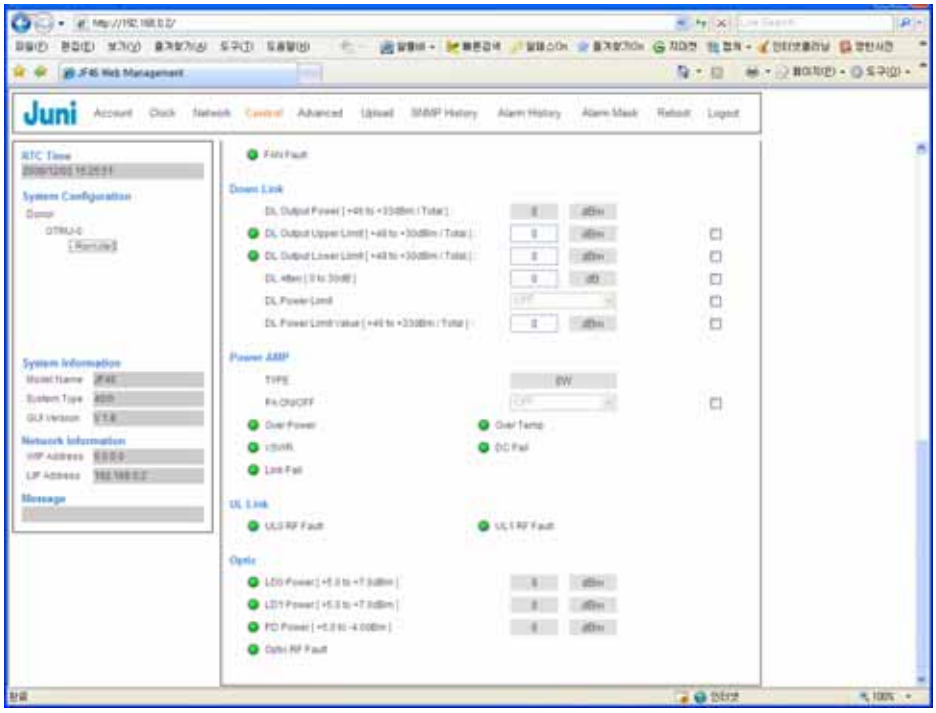
4.2.9.2 OTRU Control Window



[FIGURE 4.2.13] OTRU CONTROL WINDOW

4.2.9.3 Remote Control Window





[FIGURE 4.2.14] REMOTE CONTROL WINDOW

normal 5MHz	normal 15MHz	normal 20MHz	5+5			5+15	15+5
A1	A	A,D	A1+A2	D+B3	E+F	A1+(A3,D,B1)	A+B1
A2	A2,A3,D	A2,A3,D,B1	A1+A3	D+E	E+C1	A2+(D,B1,B2)	(A2,A3,D)+B2
A3	A3,D,B1	A3,D,B1,B2	A1+D	B1+B2	E+C2	A3+ B	(A3,D,B1)+B3
D	D,B1,B2	D,B	A1+B1	B1+B3	E+C3	D+(B2,B3,E)	(D,B1,B2)+E
B1	B	B,E	A2+A3	B1+E	F+C1	B1+(B3,E,F)	B+F
B2	B2,B3,E	B2,B3,E,F	A2+D	B1+F	F+C2	B2+(E,F,C1)	(B2,B3,E)+C1
B3	B3,E,F	B3,E,F,C1	A2+B1	B2+B3	F+C3	B3+(F,C1,C2)	(B3,E,F)+C2
E	E,F,C1	E,F,C1,C2	A2+B2	B2+E	F+G	E+C	(E,F,C1)+C3
F	F,C1,C2	F,C	A3+D	B2+F	C1+C2	F+(C2,C3,G)	(F+C1,C2)+G)
C1	C	C,G	A3+B1	B2+C1	C1+C3		
C2	C2,C3,G		A3+B2	B3+E	C1+G		
C3			A3+B3	B3+F	C2+C3		
G			D+B1	B3+C1	C2+G		
			D+B2	B3+C2	C3+G		

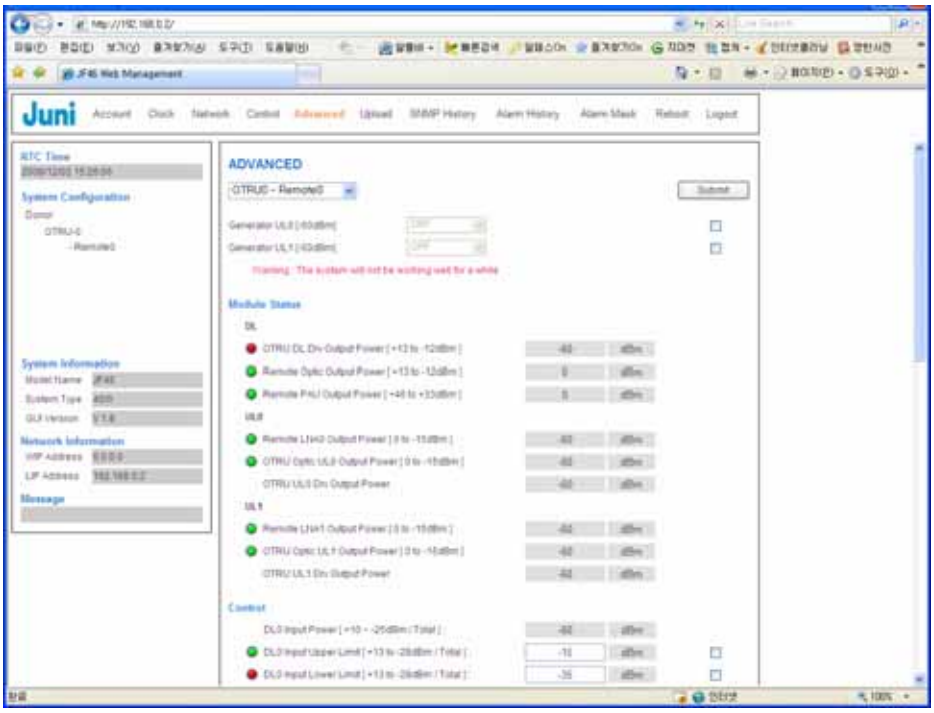
[Table 4.2.1] 94 Possible Frequency Band Combinations

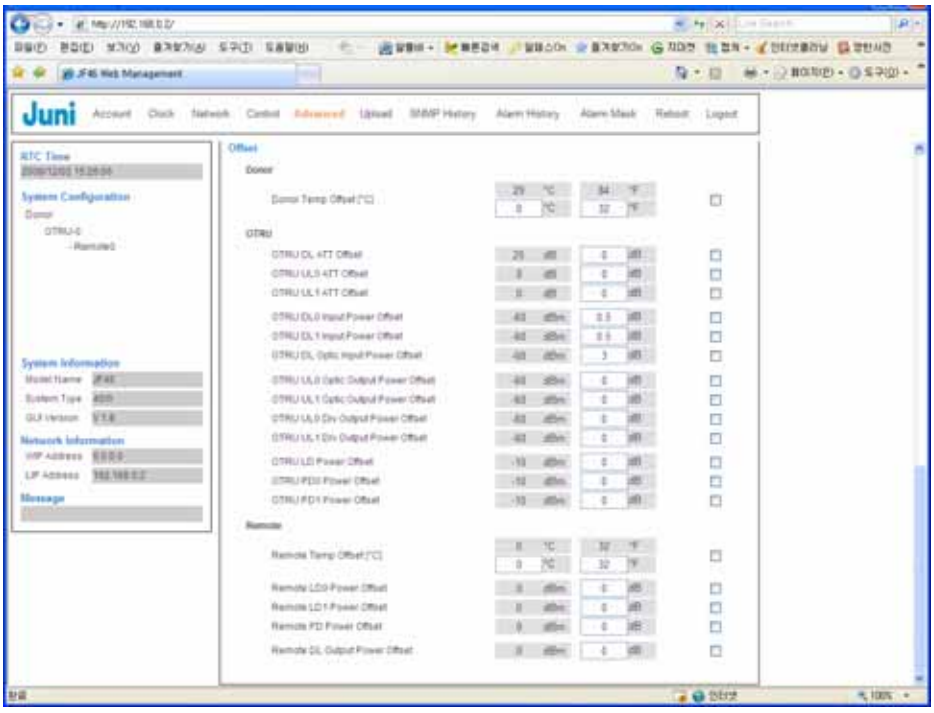
Band	Frequency
A1	1850 to 1855 MHz
A2	1855 to 1860 MHz
A3	1860 to 1865 MHz
D	1865 to 1870 MHz
B1	1870 to 1875 MHz
B2	1875 to 1880 MHz
B3	1880 to 1885 MHz
E	1885 to 1890 MHz
F	1890 to 1895 MHz
C1	1895 to 1900 MHz
C2	1900 to 1905 MHz
C3	1905 to 1910 MHz
G	1910 to 1915 MHz

[Table 4.2.2] Frequency band ranges corresponding to Table 4.2.1

Note: Frequencies C1, C2, C3 are identical to FCC's C3, C4, and C5.

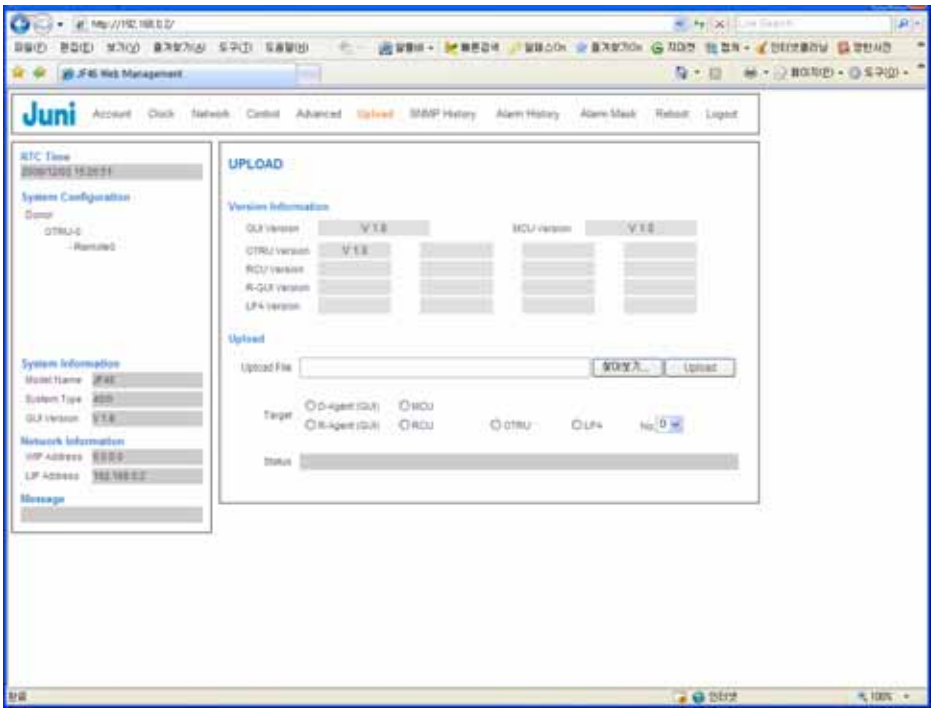
4.2.10 Advanced Window





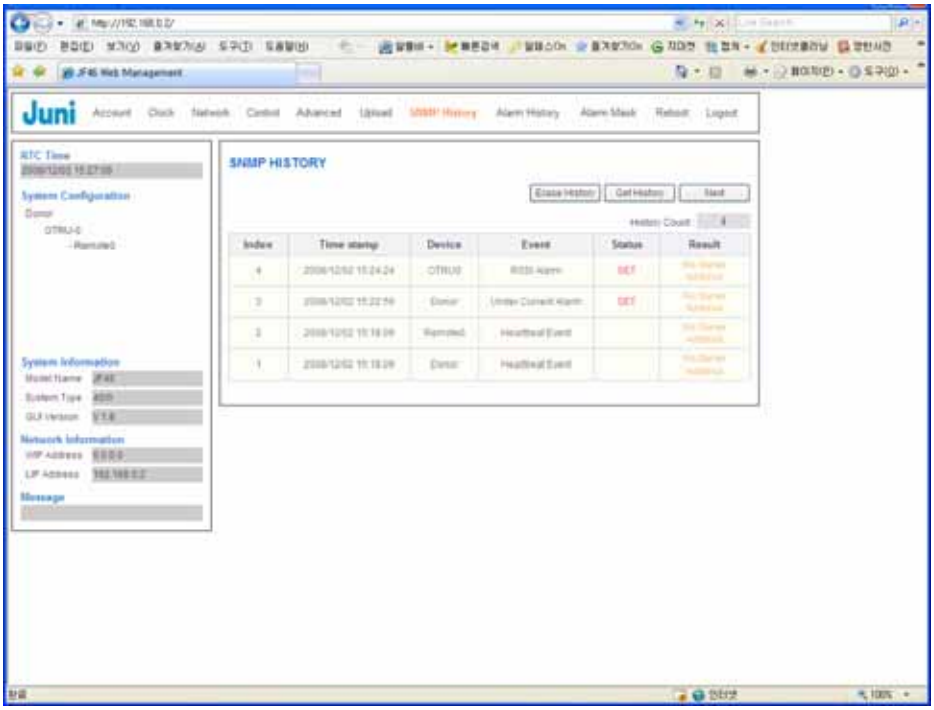
[FIGURE 4.2.15] ADVANCED WINDOW

4.2.11 Upload Window



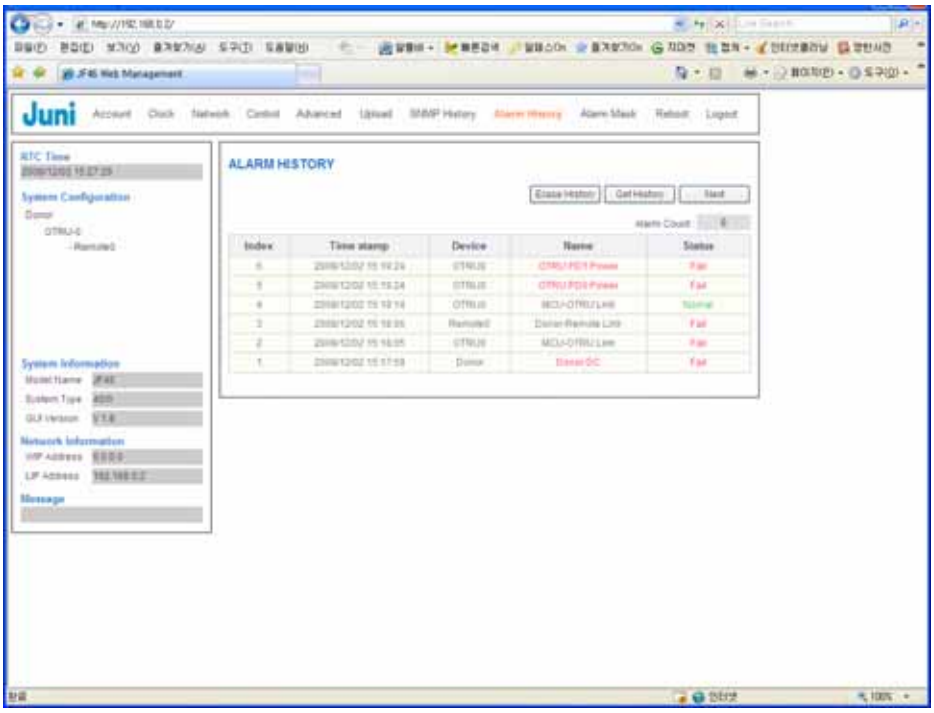
[FIGURE 4.2.16] UPLOAD WINDOW

4.2.12 SNMP History Window



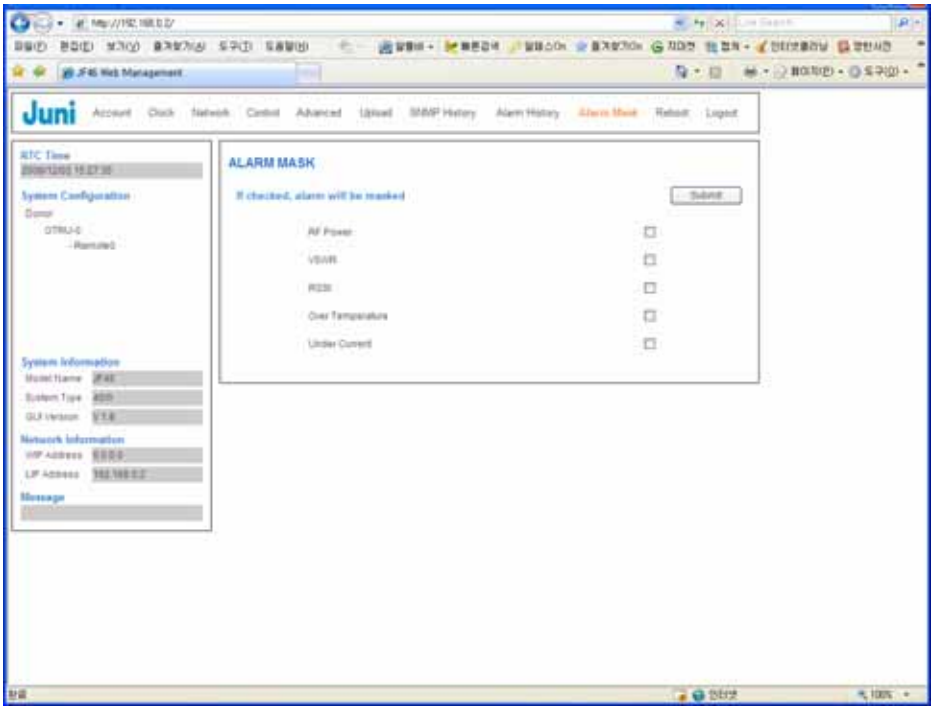
[FIGURE 4.2.17] SNMP HISTORY WINDOW

4.2.13 Alarm History Window



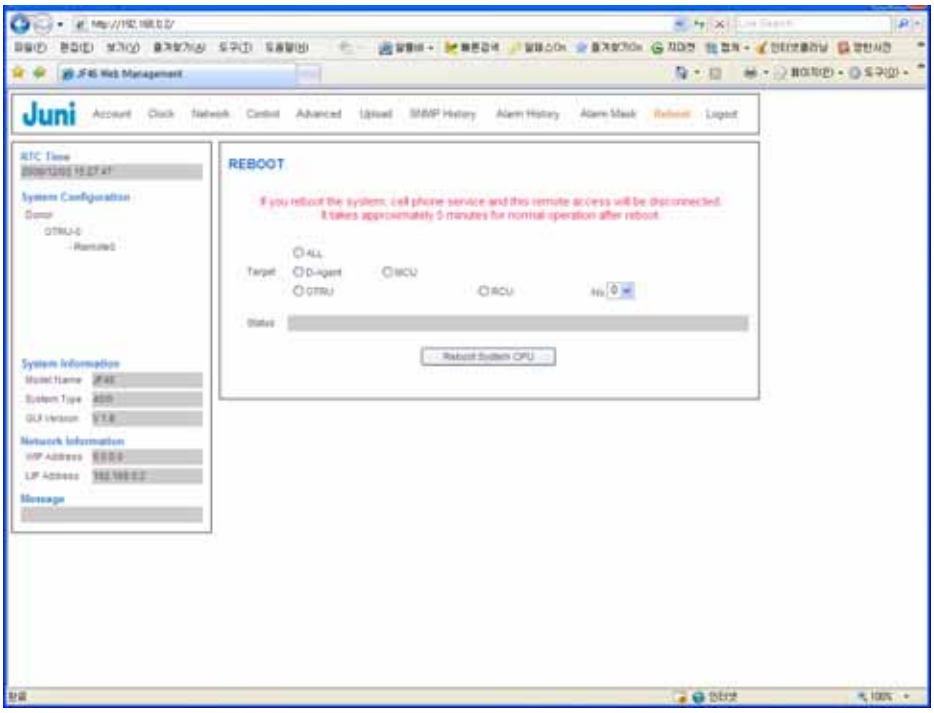
[FIGURE 4.2.18] ALARM HISTORY WINDOW

4.2.14 Alarm Mask Window



[FIGURE 4.2.19] ALARM MASK WINDOW

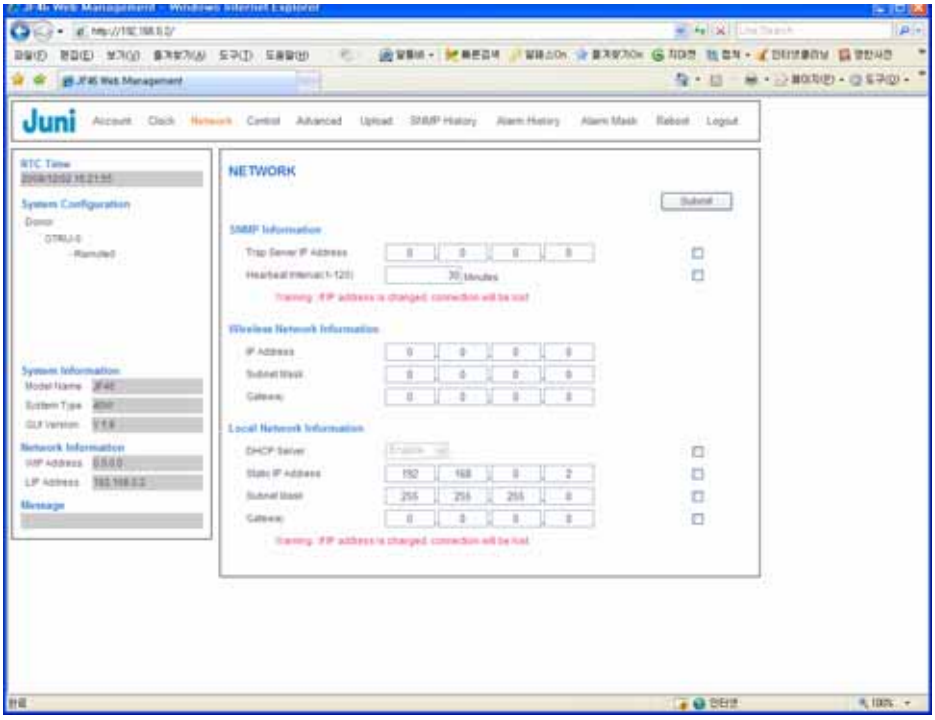
4.2.15 Reboot Window



[FIGURE 4.2.20] REBOOT WINDOW

4.3 Network Menu

This menu is for setting network configuration. Using this menu, you can configure TCP/IP for each interface and SNMP items.

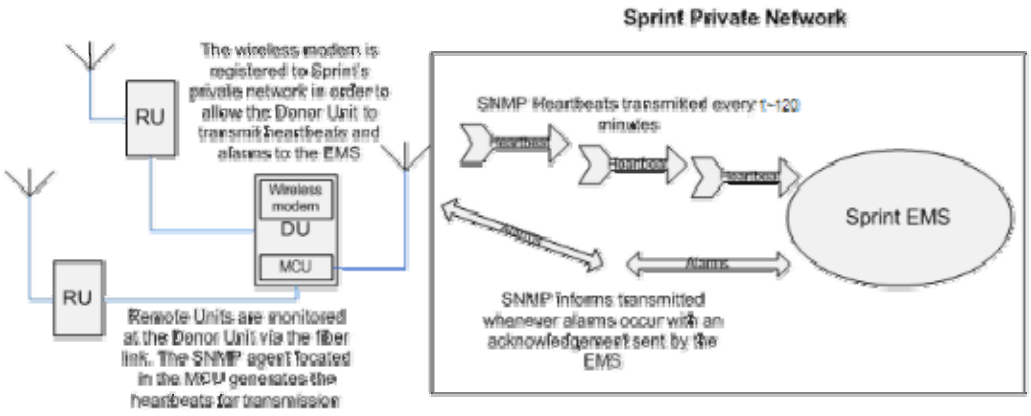


[FIGURE 4.3.1] NETWORK MENU

4.3.1 SNMP Configuration

4.3.1.1 Introduction

The DHU utilizes a wireless CDMA modem connected to the SNMP agent to transmit SNMP TRAPs and INFORMs to a central Sprint EMS (Element Management Server) on the Sprint private network. The TRAPs, or commonly referred to as a heartbeat, are sent at an interval of every 1 ~ 120 minutes and is a method of notifying the EMS that the repeater is still connected to the network and is functioning correctly. INFORMs are transmitted when an alarm at a RU occurs. The INFORM is sent to the EMS providing information on the type of alarm that has occurred and the repeater it originates from.



[FIGURE 4.3.2] SNMP OPERATION OVERVIEW

4.3.1.2 Trap Server IP Address Set up

Set up EMS IP address that belongs to Sprint Private Network in order to transmit messages for SNMP trap and inform.

[FIGURE 4.3.3] TRAP SERVER IP ADDRESS

4.3.1.3 Heartbeat Interval Set up

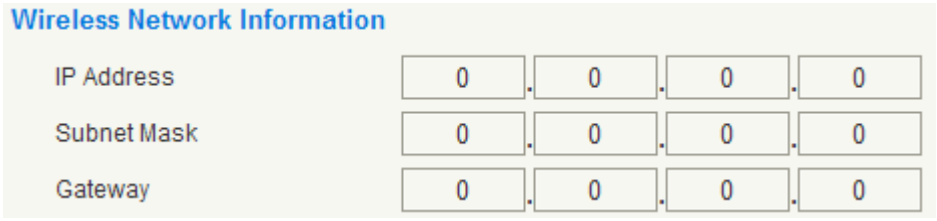
Set up the heartbeat interval for transmitting to EMS.

[FIGURE 4.3.4] HEARTBEAT INTERVAL

4.3.2 Network Set up

4.3.2.1 Wireless Network Information

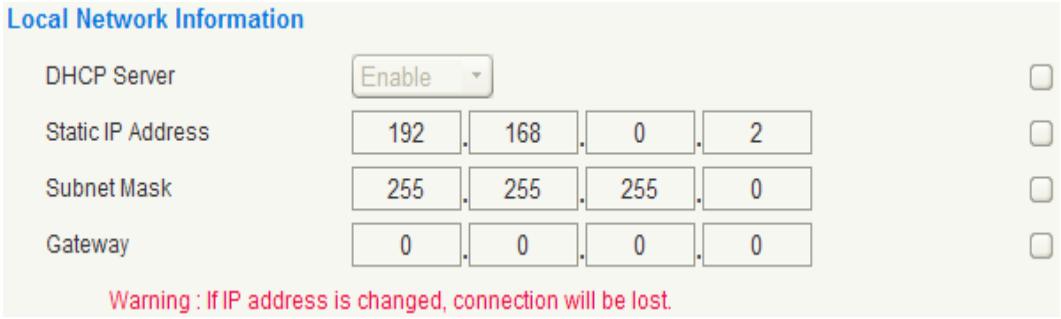
The information shows the interface between CDMA modem and Sprint network. This information is automatically assigned from DHCP server throughout CDMA modem. If interface information shows “0.0.0.0,” there is communication problem between CDMA modem and Sprint network. In this case, you cannot send any information of heartbeat and alarm and it is not possible to connect Web GUI throughout Sprint Network.



[FIGURE 4.3.5] WIRELESS NETWORK INFORMATION

4.3.2.2 Local Network Information

The user can check the information about network information of LMT port that the user can directly connect at the site where the repeater is installed.
In order to use this interface, the user must set DHCP server to be enable and set the “Internet Protocol Option” as “Obtain an IP address automatically” as described on Section 4.2.2.



[FIGURE 4.3.6] LOCAL NETWORK INFORMATION

1) DHCP Server: Sets up for DHCP to be “Enable” or “Disable.” If the user sets up as “Disable,” the user must manually set up proper IP address to connect to the Web GUI on user’s PC.

2) Static IP Address: If the IP address is set up for LMT port, the IP address is used for connecting to Web GUI on web browser throughout Internet Explorer. If the user doesn't figure out the modification information, it can be checked on the "Local Area Connection Status" as Figure 4.3.2.2 below.

3) Subnet Mask: Sub Network Mask for LMT port.

4) Gateway: Gateway for LMT port. The user doesn't usually set this Gateway up.

[FIGURE 4.3.7] SNMP OPERATION OVERVIEW

5. System Maintenance

This section explains the JF-46 FFR system fault detection and alarm reporting system, and provides a method for determining troubleshooting faults. Maintenance also includes diagnosing and correcting service problems as they occur. When an alarm is reported, it will be necessary to follow a systematic troubleshooting procedure to determine the problem. Once the problem has been isolated, the appropriate corrective measures must be taken to restore service. The only internal components that can be replaced are the cooling fans, which are mounted in the DHU and RU, and the optic module. All other failed internal components will require Juni engineers to replace and test the units.

5.1 Periodic Maintenance

The JF-46 FFR requires minimal regular maintenance to insure continuous and optimal operation and performance. However, it is advised that the DHU and RU are checked often. Components that require regular replacement, cleaning, or testing include the DHU and RU fans and backup battery. The IP55 enclosure ensures that the JF-46 FFR can withstand all environmental influences. The following two procedures can also be followed when a fan fails and needs to be replaced.

5.1.1 Donor Unit Fan Maintenance

1. The fan is located above the DRCU and is labeled ‘Fan Control Unit’.
2. Unplug the 24V power cable feeding the Fan Control Unit.
3. Unscrew the two multi-turn fasteners on each side of the compartment.
4. Pull out the Fan Control Unit completely from its position.
5. One fan is used to cool the DHU which will require regular maintenance by cleaning and/or dusting.
6. Once maintenance is complete, return the Fan Control Unit back into its space and tighten the multi-turn fasteners.
7. Plug the power cable back into the Fan Control Unit.

5.1.2 Remote Unit Fan Maintenance

1. The fan compartment is located at the bottom of the RU.
2. Remove the fan power cable underneath the RU.
3. By turning the stud on the side, remove the cover and pull out the fan compartment carefully. Do not pull on it too hard. It will cause a 24V power cable to be jammed.
4. There are two fans in the compartment which is required to be cleaned and checked regularly to ensure proper operation of the fan and allow the fan to perform its duty in cooling the RU.
5. At the completion of the maintenance, return the fan compartment by sliding it back into its designated placement.

5.2 Fault Detection and Alarm Reporting

The JF-46 FFR on board embedded software detects various unit and system faults which generate either a Major or Minor alarm. A major alarm indicates that the repeater has failed in a way that directly affects RF transport performance. When a major alarm occurs, all RF functions are affected and will cause the system to be out of service. A minor alarm means that the system performance is not affected, or in some cases, that the performance may no longer be optimal. When a minor alarm occurs, RF functions continue and the system remains in service.

The following means are used to report major and minor alarms.

- DHU LED's
- Web GUI(Graphical User Interface)

The DHU front panel LED indicators show status and alarm information by displaying various colors; green, red and off.

The Web GUI provides both a summary and detailed list of alarm information that includes unit and module level faults, circuit faults, and measured value faults such as voltages, RF power and temperature.

INDICATOR		COLOR	DONOR UNIT DESCRIPTION
ENVIRONMENT	Input Power Fault	Green → Red →	**Indicates the status of the main input power** The Input power source is on The Input power source is off
	Output Power Fault	Green → Red →	**Indicates the status of the DHU power supply** The power supply is normal The power supply has failed due to faulty circuit or connection
	FAN FAULT	Green → Red →	**Indicates the status of the FAN on the DHU** The fan is normal The fan has failed
	BATT. FAULT	Green → Red →	**Indicates the status of the backup battery** The battery is functioning normally The battery has failed or is not providing power
	HI TEMP	Green → Red →	**Indicates if the DHU is over temperature** The temperature is within the normal range The temperature is above the normal operating temperature
	LOW TEMP	Green → Red →	**Indicates if the DHU is under temperature** The temperature is within the normal range The temperature is below the normal operating temperature
OPTIC	LD FAULT	Green → Red →	**Indicates whether the Laser Diode is detecting any optic output power** The optic output power is normal The optic output power is abnormal
	PD0/PD1 FAULT	Green → Red →	**Indicates whether the Photo Diode is detecting any optic input power** The optic input power is normal The optic input power is abnormal
	OPTIC RF FAULT	Green → Red →	**Indicates the state of the amplifier of the optic module** The amplifier is functioning normally The amplifier has failed or the RF power output has shutdown

DL	DL RF FAULT	Green → Red →	**Indicates the state of the downlink amplifier** The amplifier is functioning normally The amplifier has failed or the RF power output has shutdown
UL	UL RF FAULT	Green → Red →	**Indicates the state of the downlink amplifier** The amplifier is functioning normally The amplifier has failed or the RF power output has shutdown

[Table 5.2.1] Donor Unit Alarm Items

INDICATOR		COLOR	REMOTE UNIT DESCRIPTION
ENVIRONEMNT	AC FAULT	Green → Red →	**Indicates the status of the main input power** The DC power source is on The DC power source is off
	DC FAULT	Green → Red →	**Indicates the status of the RU DC power supply** The power supply is normal The power supply has failed due to faulty circuit or connection
	FAN FAULT	Green → Red →	**Indicates the status of FAN 0 on the RU** The fan is normal The fan has failed
	BATT. FAULT	Green → Red →	**Indicates the status of the backup battery** The battery is functioning normally The battery has failed or is not providing power
	HI TEMP	Green → Red →	**Indicates if the RU is over temperature** The temperature is within the normal range The temperature is above the normal operating temperature
	LOW TEMP	Green → Red →	**Indicates if the RU is under temperature** The temperature is within the normal range The temperature is below the normal operating temperature
OPTIC	LD0/LD1 FAULT	Green → Red →	**Indicates whether the Laser Diode is detecting any optic output power** The optic output power is normal The optic output power is abnormal
	PD FAULT	Green → Red →	**Indicates whether the Photo Diode is detecting any optic input power** The optic input power is normal The optic input power is abnormal
	OPTIC RF FAULT	Green → Red →	**Indicates the state of the amplifier of the optic module** The amplifier is functioning normally The amplifier has failed or the RF power output has shutdown

POWER AMPLIFIER (PA)	OVER POWER	Green → Red →	**Indicates whether the PA is above the optimal power level** The power level is below the normal operating level The power level is above the normal operating level
	OVER TEMP.	Green → Red →	**Indicates if the DHU is over temperature** The RU is operating at correct temperature The RU is above the normal operating temperature
	VSWR	Green → Red →	**Indicates if the power amplifier VSWR is above or below the threshold** The VSWR is below the threshold The VSWR is above the threshold
	DC FAIL	Green → Red →	**Indicates the status of the RU DC power supply** The RU power supply is operating normally The power supply has failed due to fault in circuitry or connection
	LINK FAIL	Green → Red →	**Indicates the link status between the RSM and PA** The link is operating normally The link between the RSM and PA is broken. Check modules and link connections
DL	HI POWER	Green → Red →	**Indicates if the PA is above the normal operating power level** The power level is within the normal range The power level is above the normal threshold
	LO POWER	Green → Red →	**Indicates if the PA is below the normal operating power level** The power level is within the normal range The power level is below the normal threshold
UL	UL0/1 RF Fault	Green → Red →	**Indicates the status of the UL0 Low Noise Amplifier** The UL0/1 LNA is normal The UL0/1 LNA is not functioning correctly. Check the module gain

[Table 5.2.2] Remote Unit Alarm Items

5.3 Troubleshooting for the Donor Unit

Module	Alarm	Possible Reason	Action Required	Action (If problem persists)
Optic	LD	LD Fault	- Confirm alarm - Change optic module	Contact Juni Technical Support
	PD	Bad optic input level	- Inspect optic input level and check the optic line - Clean optic connector - Change optic module	
	Optic RF fault	Optic module AMP Fault	- Confirm alarm - Change optic module	
DL/UL	DL RF fault	DL path AMP Fault	- Check the module gain	
	UL RF fault	UL path AMP Fault	- Check the module gain	
Environment	Input power fault	Input Voltage Fault	- Check Input voltage - Replace PSU	
	output power fault	Output Voltage Fault	- Check Output voltage - Check Battery voltage - Replace PSU	
	BATT fault	There is no battery or battery has depleted	- Check Battery cable - Replace PSU	
	Fan fault	Fan Fault	- Check Fan - Replace Fan	
	Hi temp	Temp is higher than upper limit	- Check temperature and limit - Inspect the reason of temp increase (e.g. fan or over power)	
	Low temp	Temp is lower than lower limit	- Check temperature and limit - Inspect the reason of temp decrease	

[Table 5.3.1] Donor Unit Trouble Shooting Guide

5.4 Troubleshooting for the Remote Unit

Module	Alarm	Possible Reason	Action Required	Action (If problem persists)
Optic	LD	LD Fault	- Confirm alarm - Change optic module	Contact Juni Technical Support
	PD	Bad optic input level	- Inspect optic input level and check the optic line - Clean optic connector - Change optic module	
	Optic RF fault	Optic module AMP Fault	- Confirm alarm - Change optic module	
UL	UL0/1 RF fault	LNA AMP Fault	- Check the module gain	
Environment	AC fault	AC Voltage Fault	- Check AC voltage - Change PSU	
	DC fault	DC Voltage Fault	- Check DC voltage - Check Battery voltage - Change PSU	
	BATT fault	There is no battery or battery has depleted	- Check Battery cable - Change PSU	
	Fan fault	Fan Fault	- Check Fan - Change Fan	
	Hi temp	Temp is higher than upper limit	- Check temperature and limit - Inspect the reason of temp increase(ex. Fan or over power)	
	Low temp	Temp is lower than lower limit	- Check temperature and limit - Inspect the reason of temp decrease	
LPA	Over Power	Alarm: >46dBm±0.5dB Shutdown: >47dBm±0.5dB	- Check input level - Check output level	
	Over Temp	Alarm: 95°C Shutdown: >95°C Auto recovery: <85°C	- Check temp - Check Fan - Check LPA output power level	
	VSWR	Alarm: <10dB (return loss) Shutdown: <6dB (@output power 30to47dBm)	- Check cables after LPA - Check duplex filter - Check antenna	
	DC Fail	≤ 22.5V DC or ≥ 33.5V DC	- Check DC power	

	Link Fail	No communication with RRCU	- Check Data Cable - Check connector	
	PA on/off	LPA power off	- Check LPA	
Forward Output Power	Hi Power	Output power is higher than upper limit	- Check output power level - Check setting limit	
	Lo Power	Output power is lower than lower limit	- Check output power level - Check setting limit	

[Table 5.4.1] Remote Unit Trouble Shooting Guide

6. Technical Customer Support

Technical service support can be received by utilizing the following means during business hours PST:

Technical Assistance: 1-425-702-0848

Technical Support email: support@juniamerica.com

Between 5:30pm and 8:30am please call the extension below for assistance:

Technical Assistance after Hours: 1-425-702-0848 ext. 227

Letters can be sent to request information and can be directed to the following address:

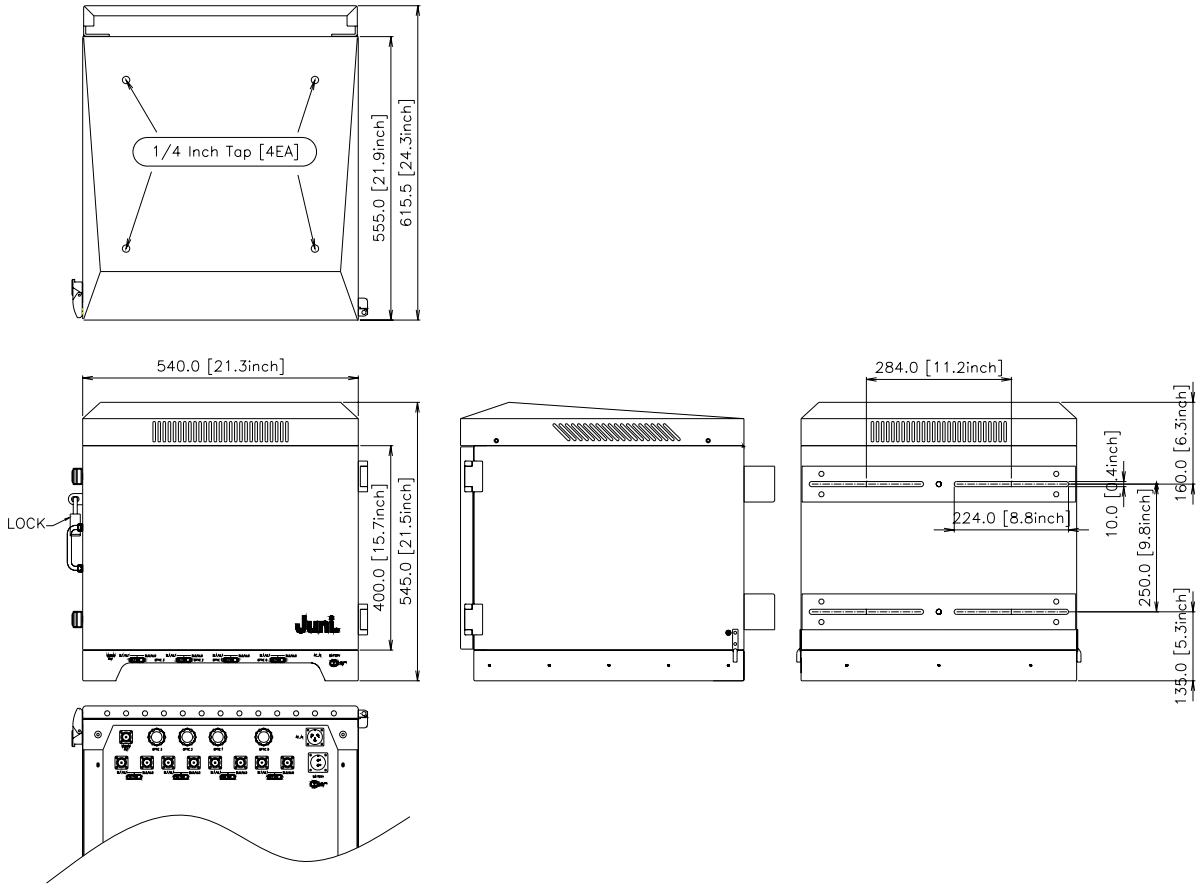
Attn: Juni America JF-46 Technical Group
9825 Willows Rd NE #100,
Redmond, WA, 98052, USA

Prior to making a call or request, please have the following pieces of information ready to speed up the help process:

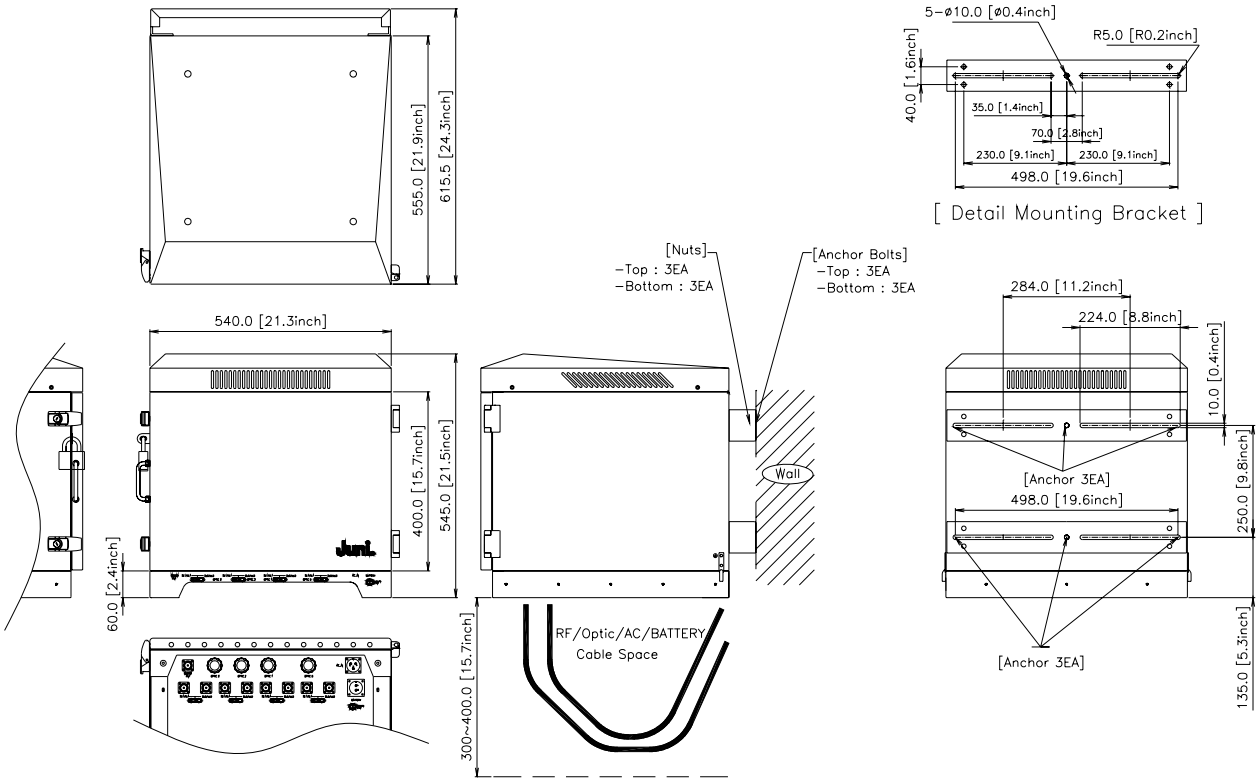
- Repeater serial number
- The repeater Site ID
- Description of problem

Appendix A. JF-46 Mechanical Packaging

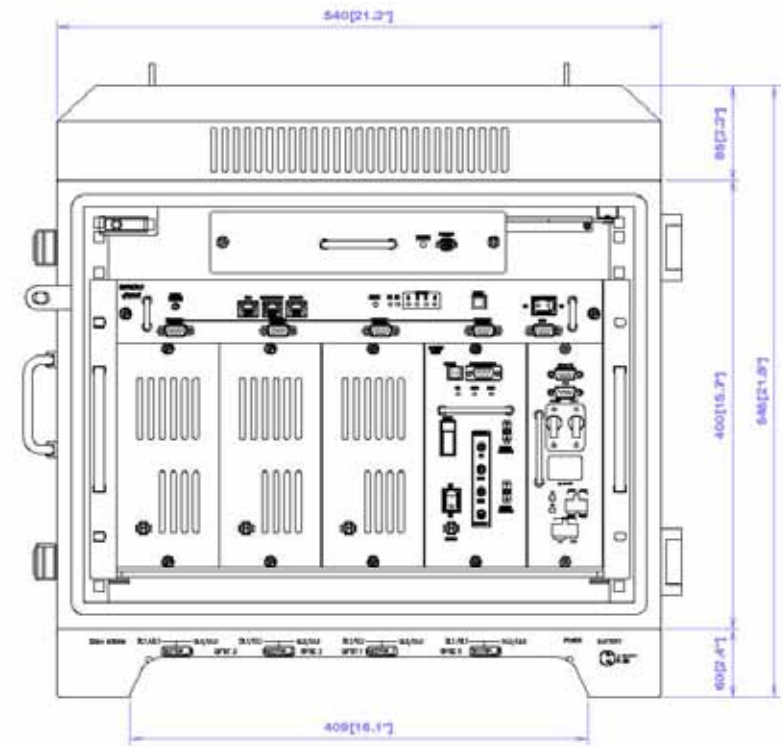
1. Donor Unit



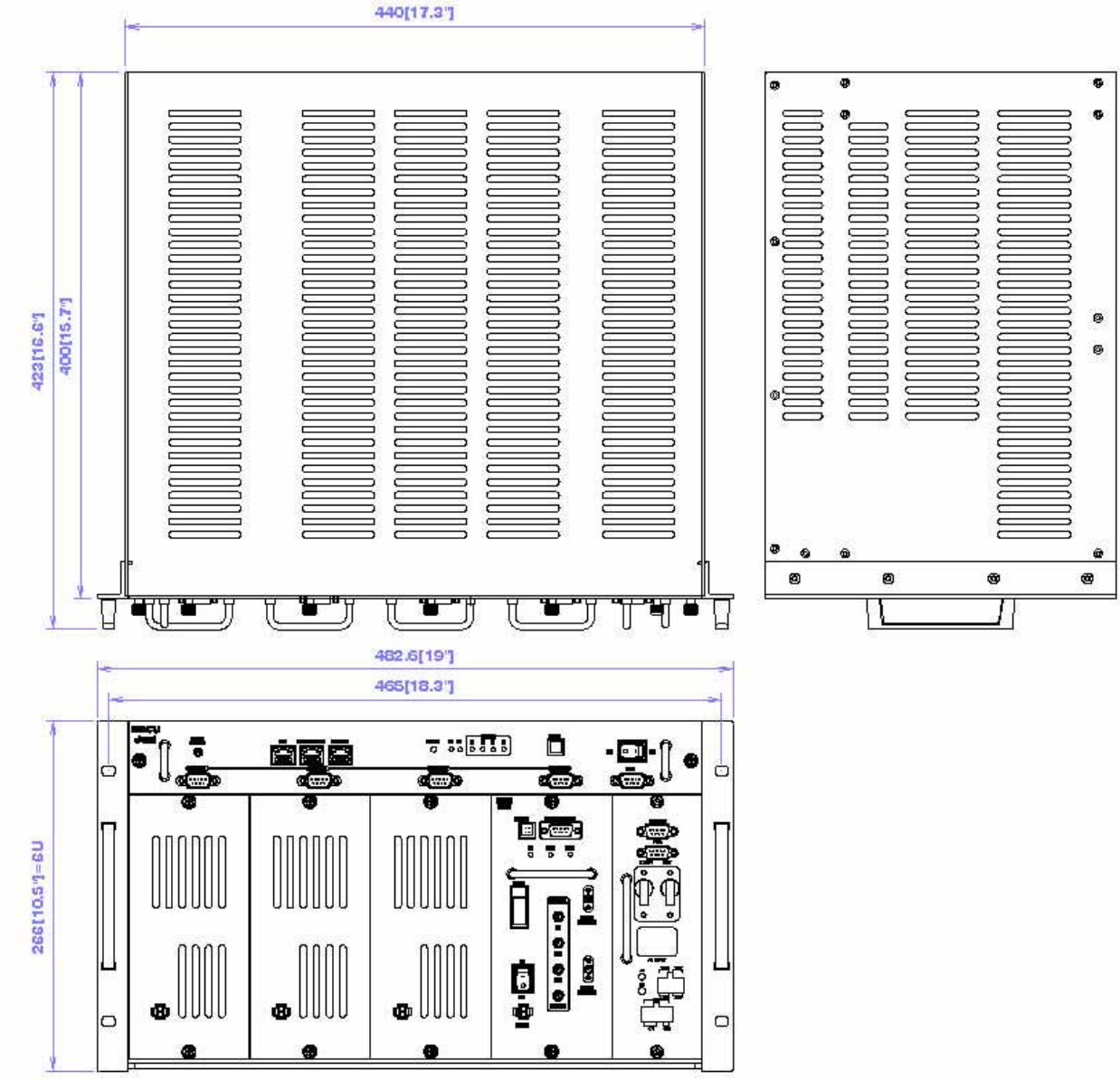
[FIGURE A1.1] DONOR UNIT



[FIGURE A1.2] DONOR UNIT WALL MOUNTING

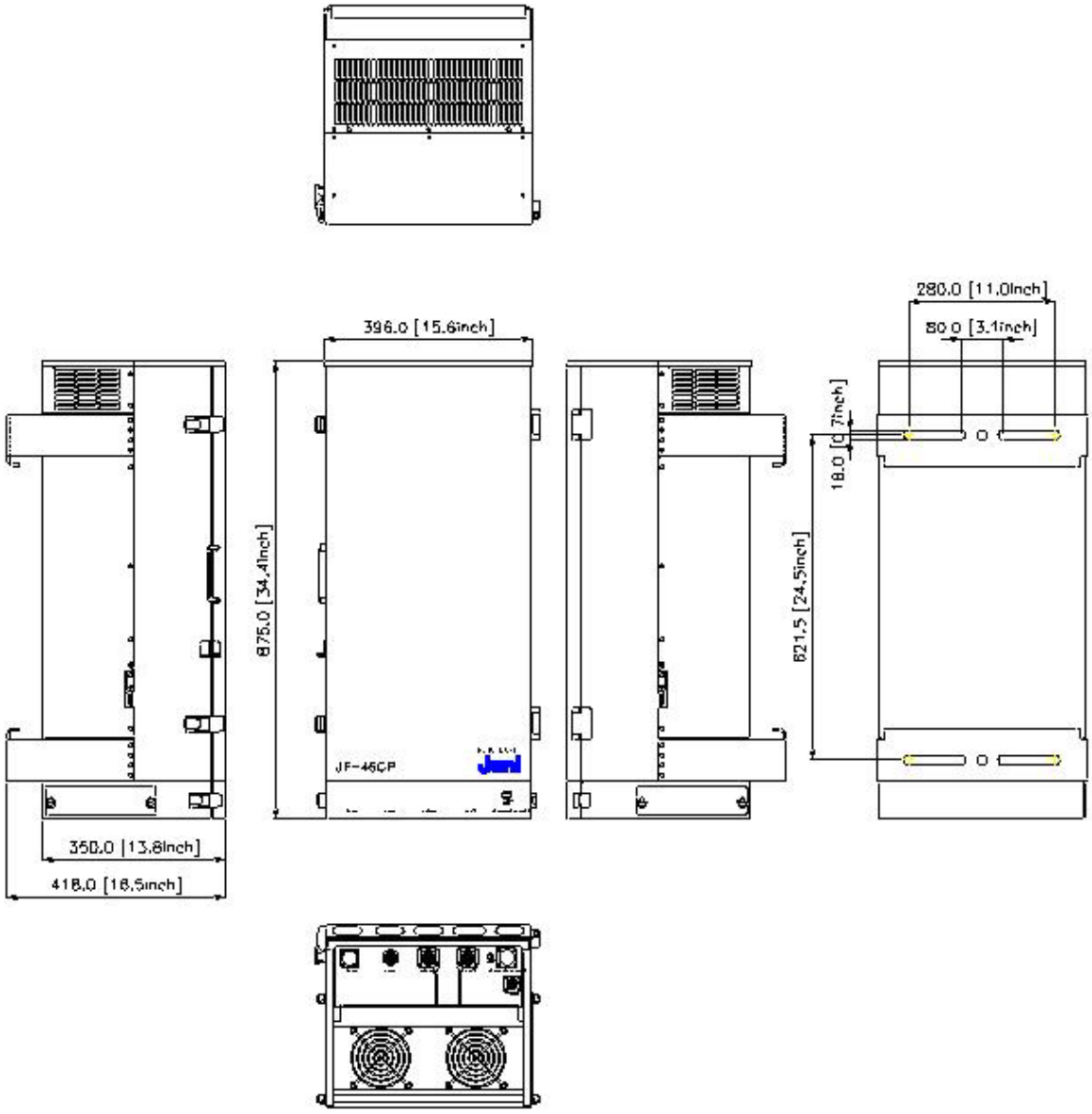


[FIGURE A1.3] DONOR UNIT FRONT VIEW



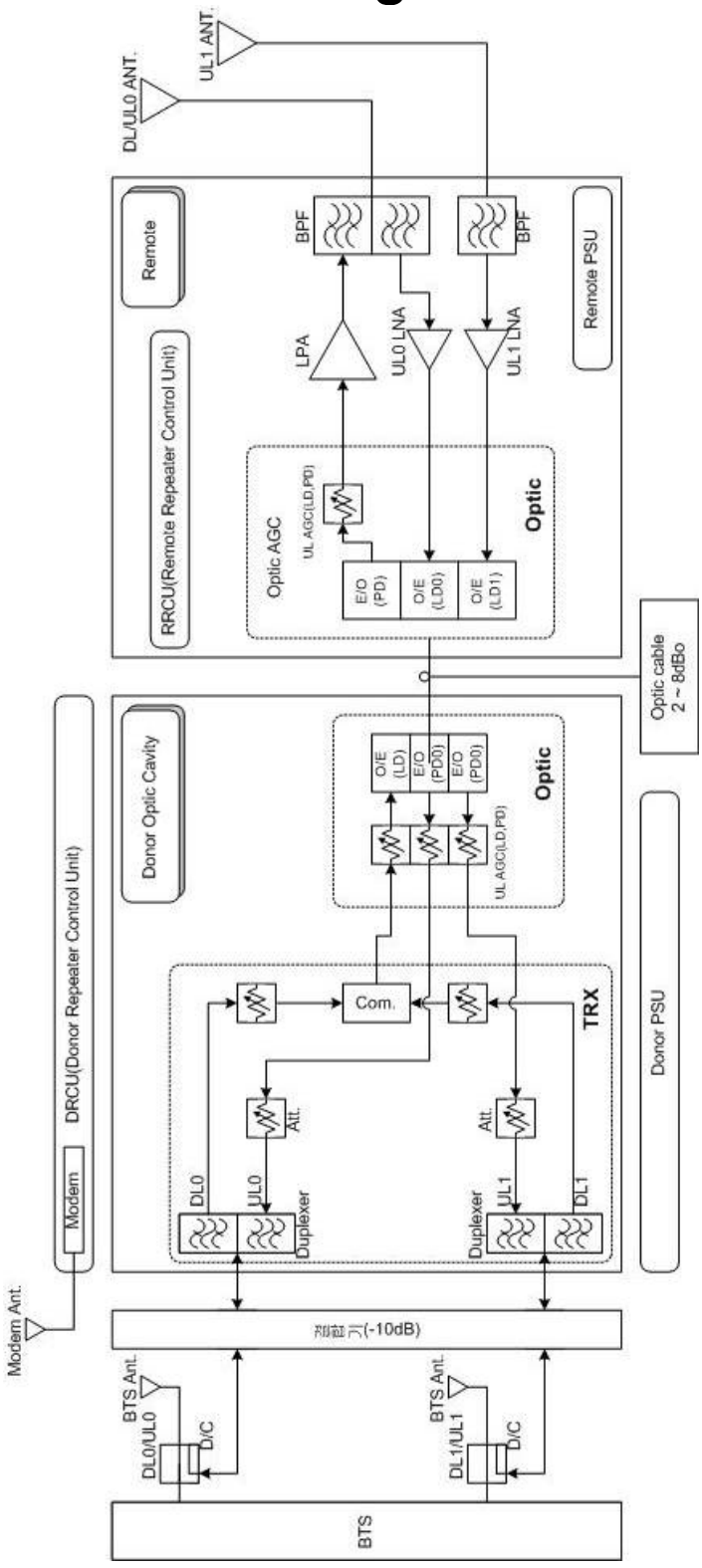
[FIGURE A1.4] DONOR SHELF AND OPTIC MODULE

2. Remote Unit

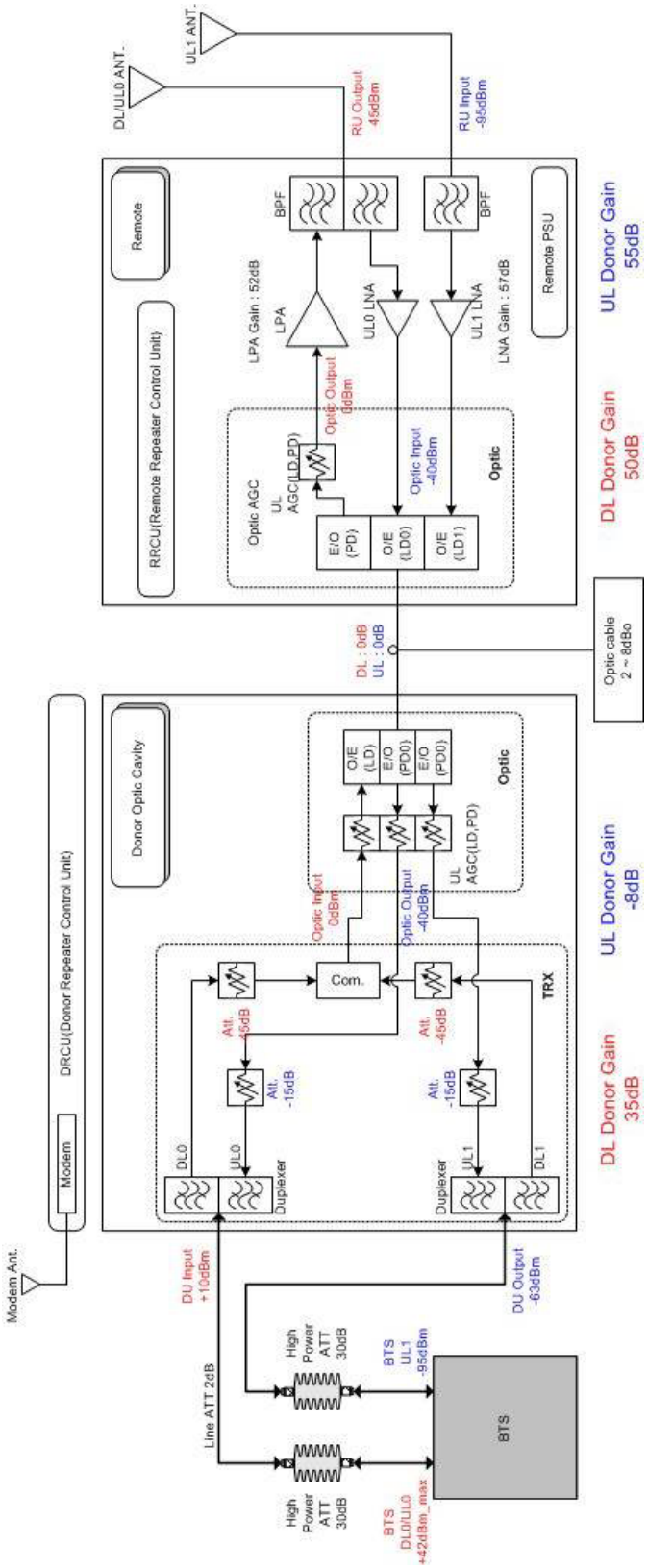


[FIGURE A2.1] REMOTE UNIT WALL MOUNTING

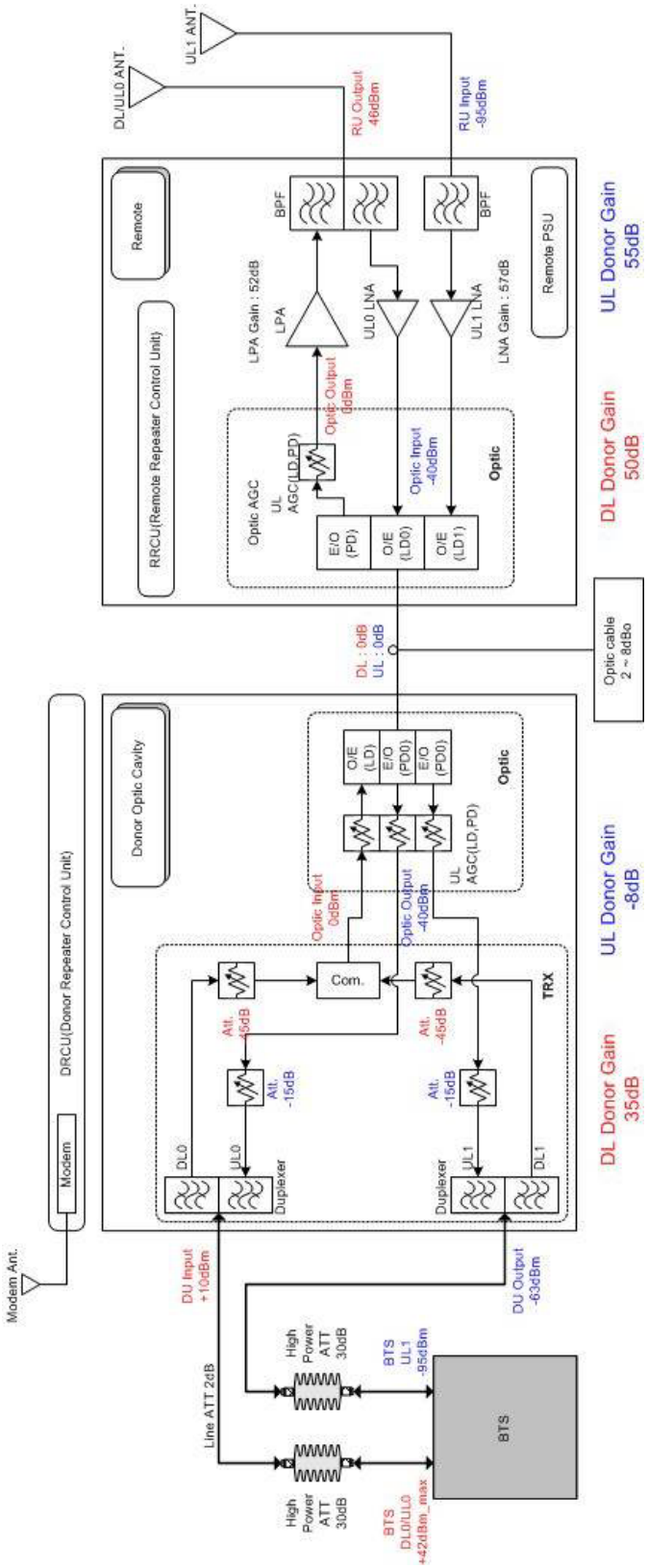
Appendix B. Block Diagram



[FIGURE B1.1] SYSTEM BLOCK DIAGRAM



[FIGURE B1.2] ONE CARRIER TOTAL OUTPUT POWER OF +45DBM



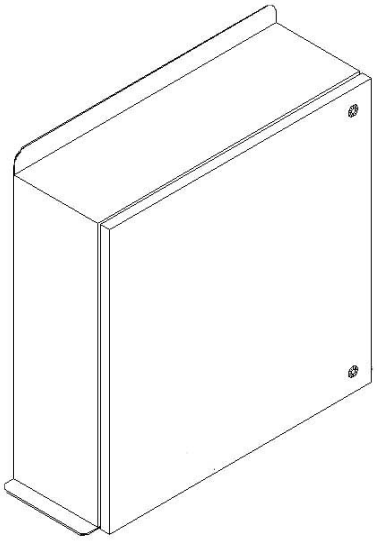
[FIGURE B1.3] TWO CARRIER TOTAL OUTPUT POWER OF +46DBM

Appendix C. Battery Backup

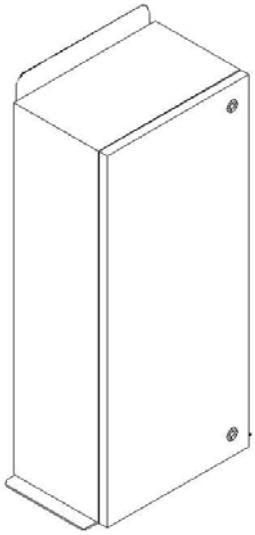
Backup Battery Cabinets for the Juni America 40W Fiber Fed Repeater cabinets are U.L. listed and rated NEMA-3R (constructed to NEMA-4 standards except for the door gasketing for hydrogen venting).

Features:

- Built with 14 gauge steel for durability and support of the batteries.
- Powder coated finish, stock color is light gray (custom colors available).
- Designed to vent hydrogen in the event that the power system over charges the batteries.
- Available with 90 or 180 ampere-hours of sealed lead-acid telecommunication grade batteries (2-hour or 4-hour standby for 30-ampere load).
- Battery warranty is 1 year full replacement, 4 years prorated. 2 year full replacement with optional Advanced Temperature Compensation circuit.
- 50-ampere circuit breaker is located inside cabinet as a safety disconnect. (Optional)
- Batteries are secured in place.
- Power cord connections are inside the cabinet, with provision for any extra length to be coiled inside.
- Completely wired to current JF-46 specifications.
- Supplied with a terminal block for cable connections.
- Sizes:
  - 2-Battery – 13.8” wide, 31.5” high, 12.4” deep
  - 4-Battery – 28" wide, 28" high, and 10" deep.
- Designed to bolt to a floor, wall, or pole.
- Weights:
  2-Battery Cabinet without batteries: 68lbs (30.9kg)
  4-Battery Cabinet without batteries: 72lbs (32.7kg)
  2-Battery Cabinet with 2 batteries: 208lbs (95.5kg)
  4-Battery Cabinet with 4 batteries: 352lbs (160kg)



4-Hour/4-battery



2-Hour/ 2-Battery

Options: ♦ Insulation for outdoor use. ♦ DC powered heater for batteries, with controller (cuts off the heater if batteries are in discharge or warm). ♦ Cabinet locks or security hardware.	♦ Temperature compensation of float voltage independent of the rectifier. (Proprietary Advanced Temperature Compensation circuit) ♦ Temperature compensation extends battery life. ♦ Available in floor and pole mount versions.

Appendix D. Donor Hub Unit and Remote Unit Attenuation Settings Table

Please refer to the table below for the attenuation and gain settings.

Attenuation Settings for JF46 40W Fiber DAS

	Downlink				
	Unit	Value	Value	Unit	Formula
JF46 System Gain	dB	71			
Maximum Carrier Power from BTS	dBm	43.0	20.0	Watts	dBm to Watts = 10^(dBm/10)/1000
Pilot Power Percetage	%	10.0%			
Pilot Power	dBm	33.0	2.0	Watts	dBm = 10*log(Max Watts*Pilot Percentage*1000)
Number of Carriers	Carriers	1.0	0.0	dB (10*logN)	Carriers add by 10*log(N)
Attenuation Kit	dB	37.0			
Additional Cable Loss	dB	0.0			Add additional Cable loss between cable kit and BTS and DHU
Input power per Carrier into DHU - Maximum	dBm	6.0			Max power per carrier - Attunation kit - cable loss
Input power per Carrier into DHU - Pilot	dBm	-4.0			Pilot power per carrier - Attunation kit - cable loss
Input power Composite into DHU - Maximum	dBm	6.0			Max power per carrier - Attunation kit - cable loss + 10*log(n)
Input power Composite into DHU - Pilot	dBm	-4.0			Pilot power per carrier - Attunation kit - cable loss + 10*log(n)
RHU Attenuation	dB	**15.0**			User define, standard is 15dB
RU Attenuation	dB	**16.0**			User define, standard is 16dB
Output power per Carrier at RU - Maximum	dBm	46.0	39.8	Watts	System Gain + Max power per carrier - Donor Att - RU Att
Output power per Carrier at RU - Pilot	dBm	36.0	4.0	Watts	System Gain + Pilot power per carrier - Donor Att - RU Att
Output power Composite at RU - Maximum	dBm	46.0	39.8	Watts	System Gain + Max power per carrier - Donor Att - RU Att + 10*log(n)
Output power Composite at RU - Pilot	dBm	36.0	4.0	Watts	System Gain + Pilot power per carrier - Donor Att - RU Att + 10*log(n)

	Uplink				
	Unit	Value	Value	Unit	Formula
JF46 Uplink System Gain	dB	43			
Attenuation Kit	dB	37.0			
Additional Cable Loss	dB	0.0			Add additional Cable loss between cable kit and BTS and DHU
Uplink Att Setting		**6.0**			UL system gain - Attenuation kit - cable loss

	Attenuation Settings
	User Entry
	Calculated

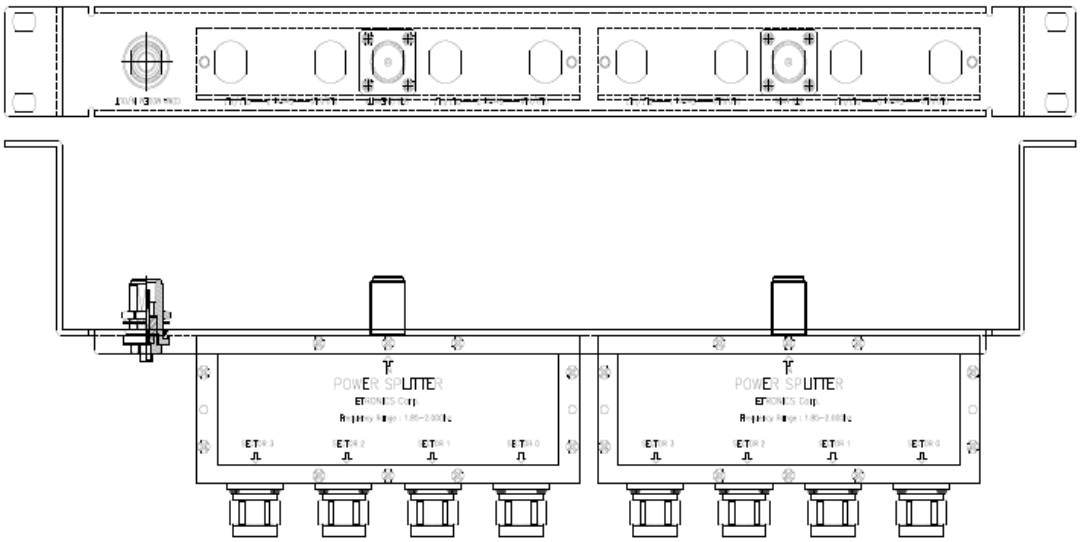
Notes:
Total Gain in Uplink path should be zero (0) dB
Upto 3 EVDO carriers can be used.
Number of carriers is total number of 1xRTT and EVDO
Maximum carrier count is 6 carriers. If more carriers are desired, please contact Juni for guidance.
Gain values are +/- 2dB. Input and output measurements should be made to ensure correct settings.

The calculator above is available from Juni America.

Appendix E. BTS Hotel Rack Installation Procedure

The following procedure is a guide for installing JF-43B Donor Hub Unit on to the rack.

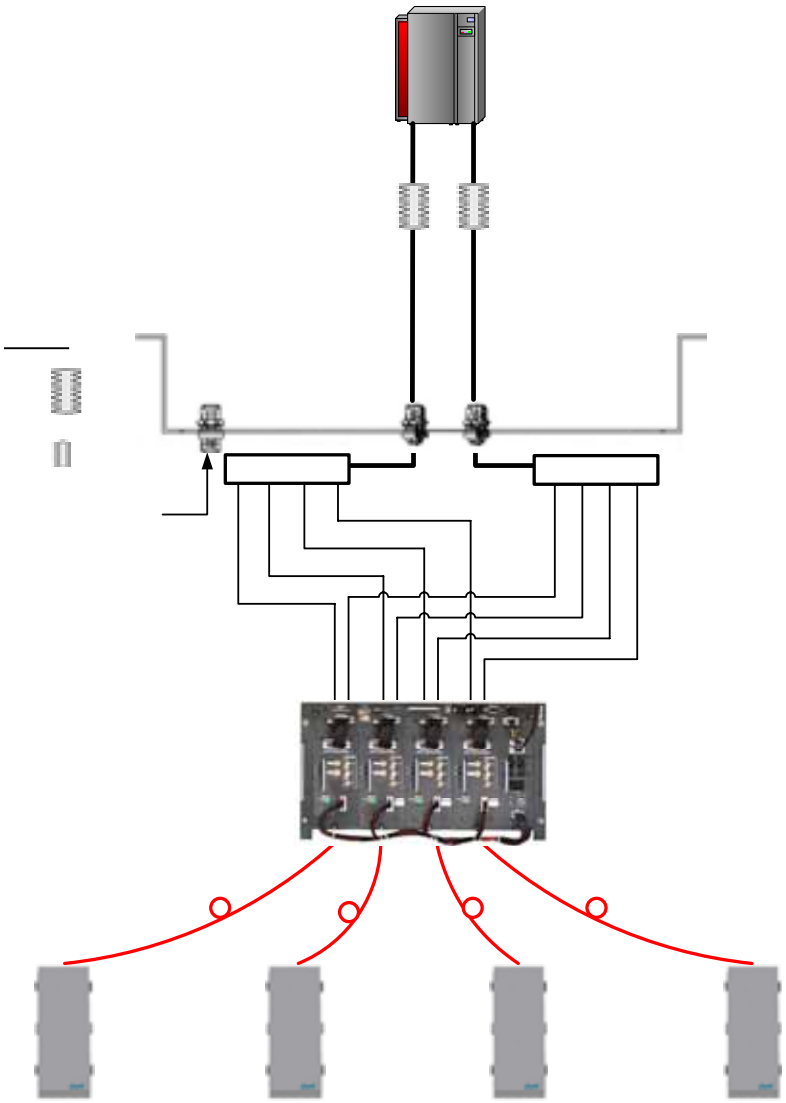
1. The 10.5 in. (6 RU) high Donor Hub Shelf (DHS) is a 19 inch rack mount unit, supports up to 4 Remote Units and mounts to the front of a standard 19 inch rack.
2. The 1.75 in (1 RU) high 4-Way Splitter Panel supports up to 4 Remote Units and mounts to the rear of the rack. This panel is placed above and to the rear of the DHS. Nine RF cables are integral to the Donor RF Connector Panel assembly, and are routed across the top of the DHS to RF connectors on the front panel of the DHS.
3. There is no additional vertical rack space requirement for external duplexers and/or external transmit combiners, since these functions are integral to each Donor Optic Transceiver Module.
4. The 1RU vertical spacing provided by the 4-Way Splitter Panel facilitates airflow above the DHS. There is no other vertical rack space requirement for airflow.
5. Therefore the total rack space height requirement (per 4 Remote Units) is 10.5 + 1.75 in. = 12.25 in. ('7RU).
6. Therefore, a total of 73.5 inches of vertical rack space is required for 6 ea. Donor subsystems [DHS + 4-Way Splitter Panel].
7. Donor Hub Unit (Indoor Configuration) Dimensions: 19 in. rack Wide x 10.43 in. High x. 15.7 in. Deep
8. 4-Way Splitter Panel Dimensions: 19 in. rack Wide x 1.7 in. High x 7 in. Deep.



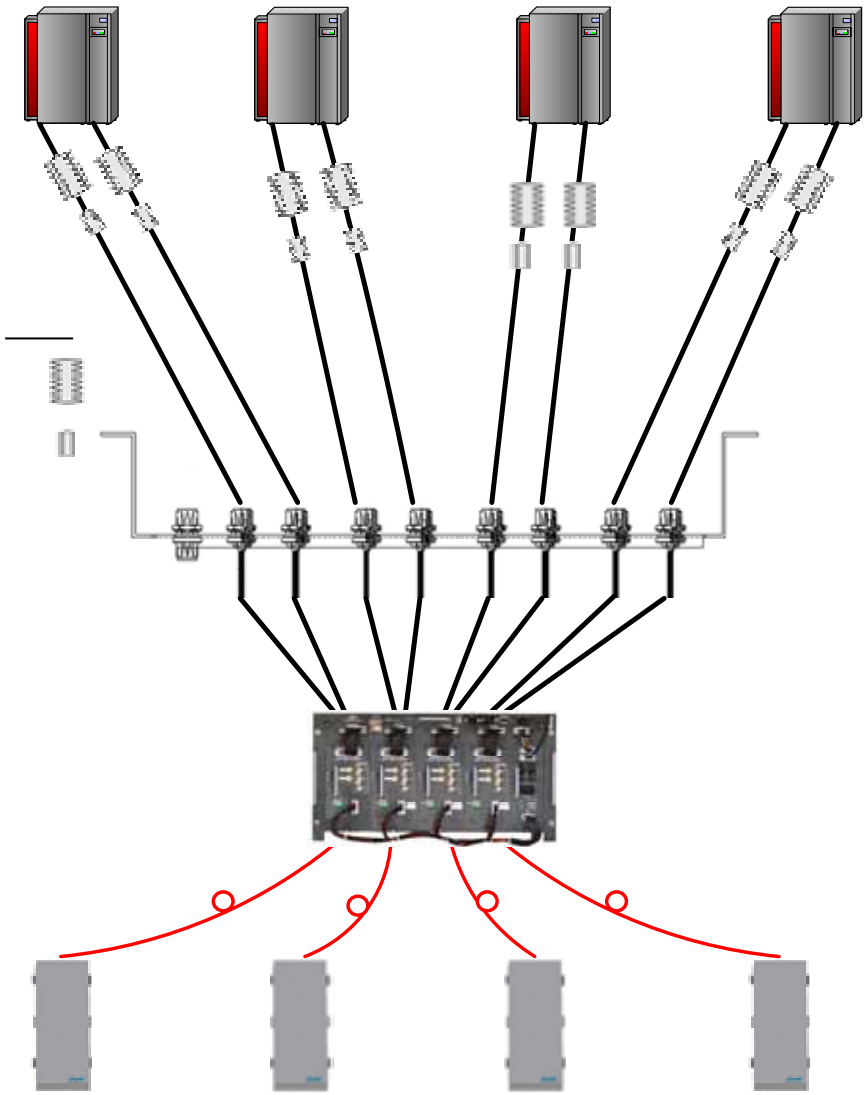
Appendix F. Simulcast and Non-Simulcast Operations

The JF-46 system can be configured and operated in either Simulcast or Non-Simulcast mode.

In Simulcast Mode, one BTS sector feeds multiple Remote Units. Juni offers a Four-Way Splitter for use where one BTS sector feeds up to four Remote Units. It is Juni Model JJAX0100008. The Figure below shows the Four-Way Simulcast configuration. The Four-way Simulcast Connector Panel is intended to mount at the rear of a 19 inch EIA rack, immediately above the associated Donor Hub Unit. RF cables are furnished which connect from the front of the Connector Panel to the various RF connectors on the front of the Donor Hub Unit. The RF connectors which face toward the BTS are recessed.

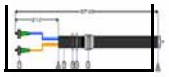
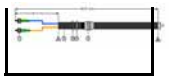


In Non-Simulcast mode, each Remote Unit is fed by one "dedicated BTS sector. The advantage of this approach is higher capacity per Remote Unit, compared to Simulcast mode. Juni offers a Non-Simulcast Connector Panel, Model Number JJAX0100006. The Non-Simulcast Connector Panel is intended to mount at the rear of a 19 inch EIA rack, immediately above the associated Donor Hub Unit. RF cables are furnished which connect from the front of the Connector Panel to the various RF connectors on the front of the Donor Hub Unit. The RF connectors which face toward the BTS are recessed.



Sector 3

Appendix G. Product listing and Item Master List

Image	Name Part Number	Description	Item Master
	**Remote** **PCS "A"** JJFE4600011	JF-46 1900 MHz (Band A) Remote Unit with 115/230 VAC power supply, 1 ea.	0
	**Remote** **PCS "B"** JJFE4600012	JF-46 1900 MHz (Band B) Remote Unit with 115/230 VAC power supply, 1 ea.	0
	**Remote** **PCS "D&E"** JJFE4600013	JF-46 1900 MHz (Band D & E) Remote Unit with 115/230 VAC power supply, 1 ea.	0
	**Optic Module** **for JF46** JJFE4600016	Optic Module for JF-46 Only, (*Can only be used with JF46 Donors & remotes, incompatible with JF43/b)*	*0*
	**Donor Indoor** **+/- 20 to 60VDC** JJFE4600001	JF46 Indoor Donor, +/- 20 to 60VDC, w/o Optic Module	0
	**Donor Outdoor** **115/230 VAC** JJFE4600005	JF46 Outdoor Donor, +115/230 VAC, w/o Optic Module	0
	**Optical Jumper** **2- 200'** JJAX0100014	200 ft. External Optical Dual Fiber Jumpers (2 Jumpers), 1 ea.,	112776
	**Optical Jumper** **1- 200'** JJAX0100015	200 ft. External Optical Fiber Single Jumper Kit (1 Jumper), 1 ea.	112777
	**Optical Jumper** **1- 100'** JJAX0100013	100ft External Optical Fiber Jumper Kit (2 Jumpers)	101835
	HUB Site Kit **DBS SITE** JJAX0100004	DBS Donor Hub Site Accessories Kit	101827
	HUB Site Kit **Universal** JJAX0100005	Universal Donor Hub Site Accessories Kit	101828

	Simulcast KIT 4-WAY JJAX0100008	Panel Mounted 4 way Splitter & Cables	101831
	Simulcast KIT 2-WAY JJAX0100007	2-2 way Splitter & Cables	101830
	Panel Indoor JJAX0100006	Connector Panel & Cables	101829