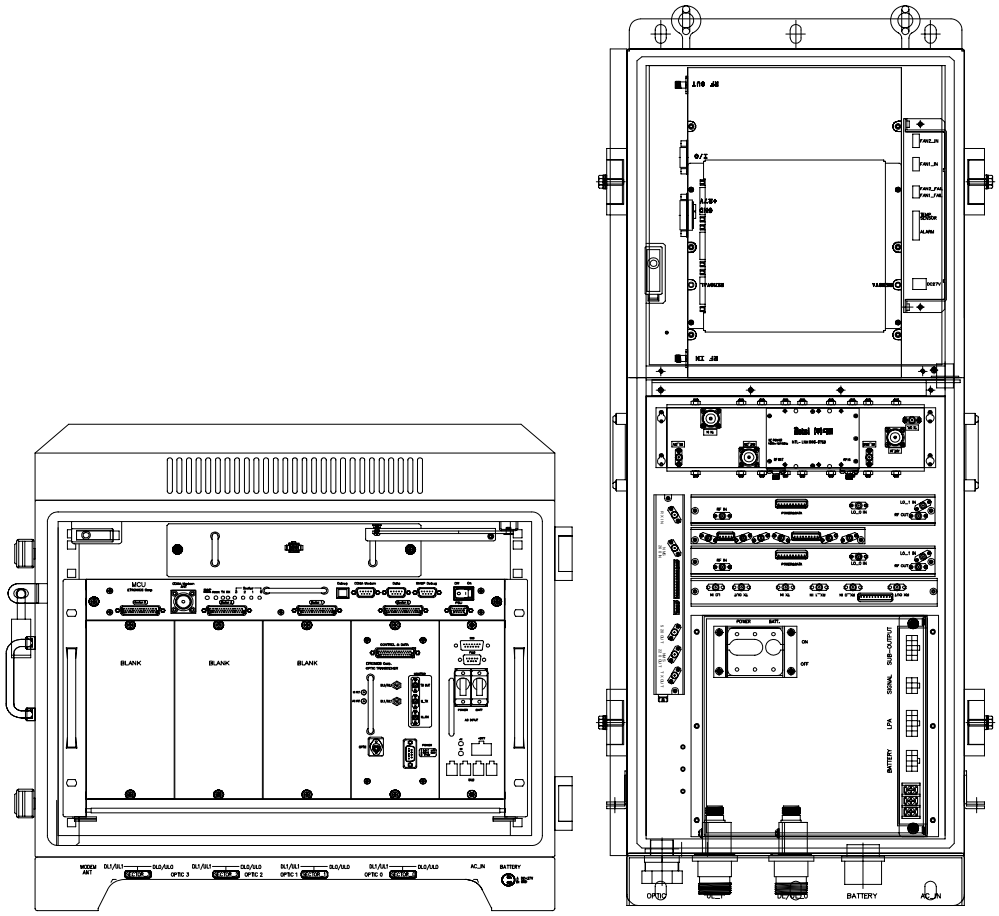
JF43
Fiber Fed Repeater



OPERATIONS MANUAL

Version 1.17
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CONTENTS

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
CATV	Cable TV
CDMA	Code Division Multiple Access
COM	Common
Config	Configuration
DC	Direct Current
DHU	Donor Hub Unit
DL	Downlink
DOC	Donor Optic Cavity
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
HPA	High Power Amplifier
IP	Internet Protocol
JF43	Juni Fiber Repeater 43dBm
LD	Laser Diode
LED	Light Emitting Diode

LMT	Local Management Terminal
LNA	Low Noise Amplifier
LPA	Linear Power Amplifier
LVAC	Low Voltage Alternating Current
MCU	Master Control Unit
MHz	Megahertz
PA	Power Amplifier
PC	Personal Computer
PCS	Personal Communications System
PD	Photo Diode
PSU	Power Supply Unit
REV	Reverse
RF	Radio Frequency
RSM	Remote unit Saw Module
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

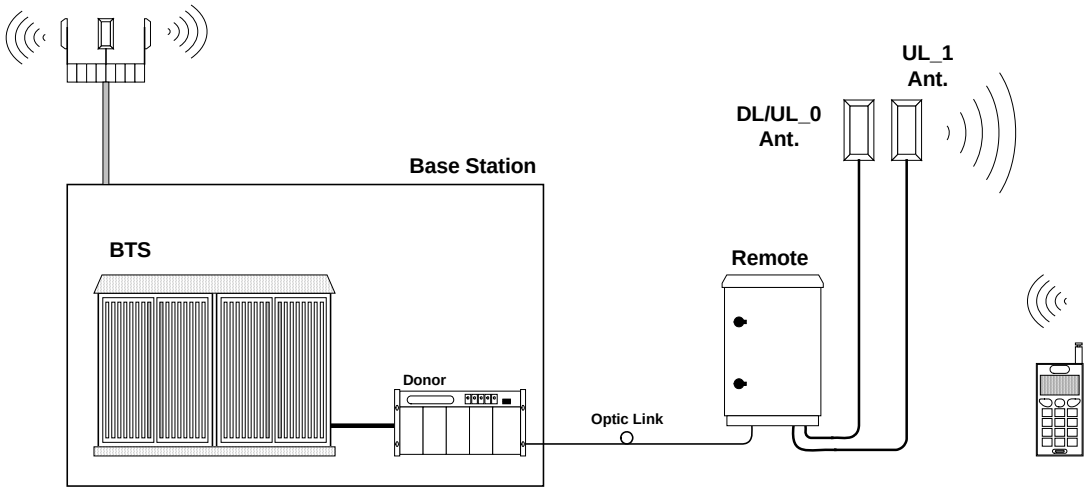
1. Introduction

1.1 Fiber Fed Repeater

The JF43 FFR provides a cost effective solution for cell extension coverage 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 JF43 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.

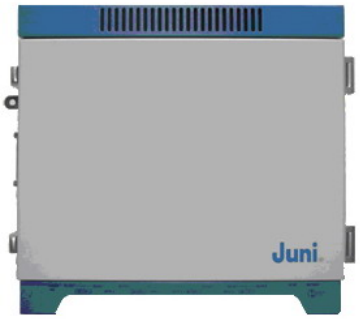
The JF43 FFR provides a high-tech, highly-efficient service system which enables high quality communication at low cost, due to the system's utilization of one optical fiber core between the DHU and RU supporting full duplex transmission of signals for both the DL and UL.



[Figure 1.1] System Configuration

1.2 FFR Components

The JF43 FFR system comprises of two main elements, a DHU and RU.



[Figure 1.2] Donor Hub Unit Enclosure

[Figure 1.3] Remote Unit

The DHU Enclosure includes the following:

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

The RU includes the following:

- Remote Optic Module
- Remote T/Rx Module
- Remote Rx SAW Module
- Control Module
- LPA
- LNA
- Cavity BPF
- Power Supply

1.3 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. The FFR is settable to allow a combination of 85 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.

- Its water and moisture resistant NEMA 4X structure 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 and maintenance and repair is simple. The system provides alarms and information on the repeater gain settings, output level control, HPA 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 (FWD: 1550nm, REV: 1510nm) to be simultaneously transmitted and received through the one optical fiber core.

1.4 Key Features

- Uses only 1 optical fiber core for Tx, Rx0 and Rx1
- 1xEVDO is supported
- 20 watts composite RF output
- Receive diversity is standard and provides up to 6dB 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 LVAC, 55 to 88 VAC
  - ✓ Low voltage AC powering over coax from DHU to RU
  - ✓ Multiple mounting options including; strand, wall, pole, floor/pedestal and encapsulated light pole.
- High performance
- Supports simulcasting of up to 4 RU per sector
  - ✓ 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 Tx output RF ports. Provides Future-Proof BTS interface

1.5 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 50-88VAC. 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 powered by 115VAC. 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.

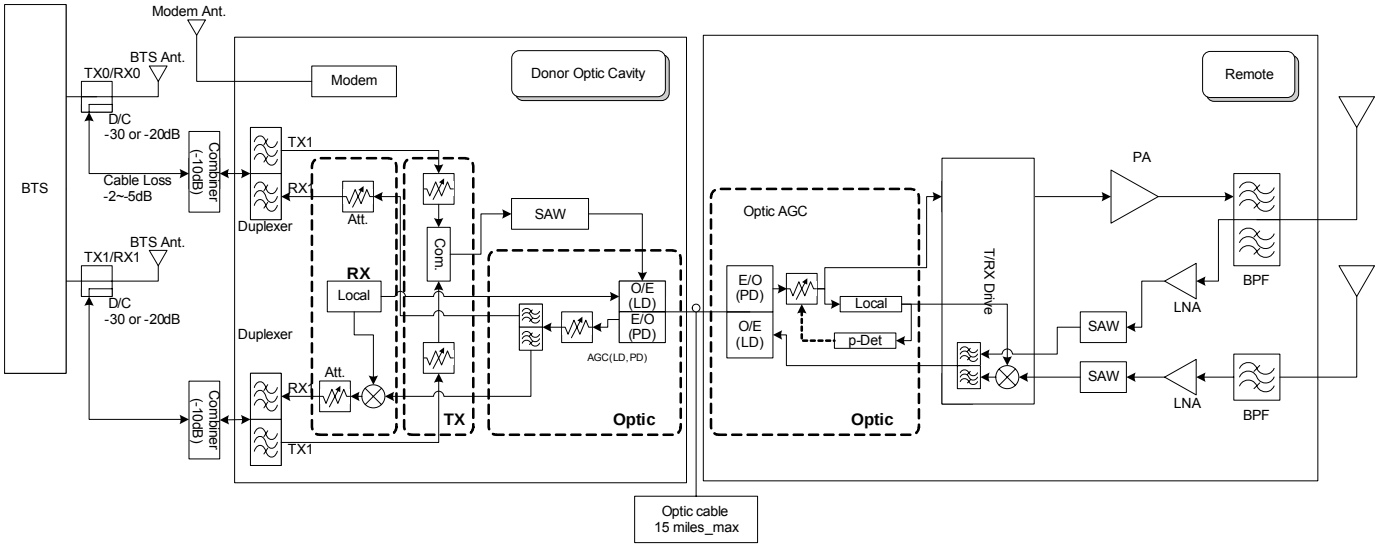
⚠ Always consider and allow sufficient fiber length to permit routing or patch

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).

2. System Description

2.1 FFR System

The JF43 FFR is made up of a main 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 NEMA 4X casing.

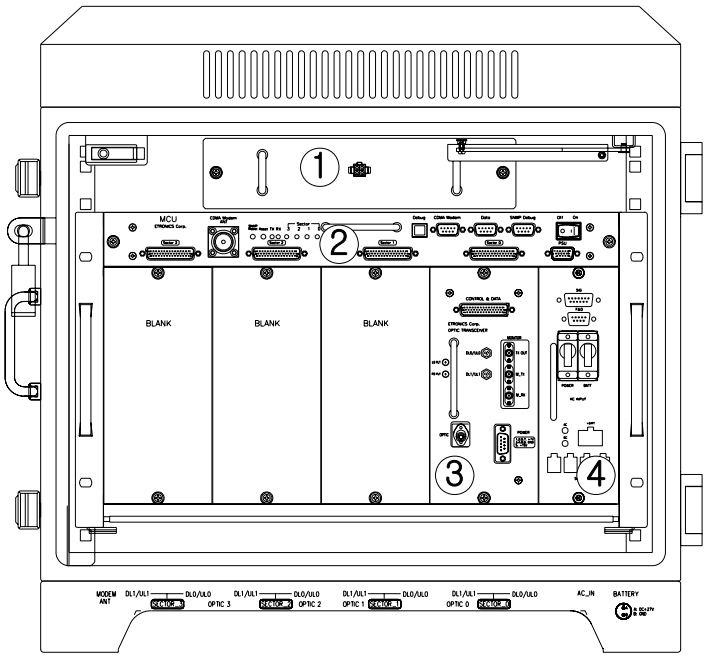


[Figure 2.1] System Block diagram

2.2 Donor Unit

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

2.2.1 Donor Hub Unit Enclosure and Shelf



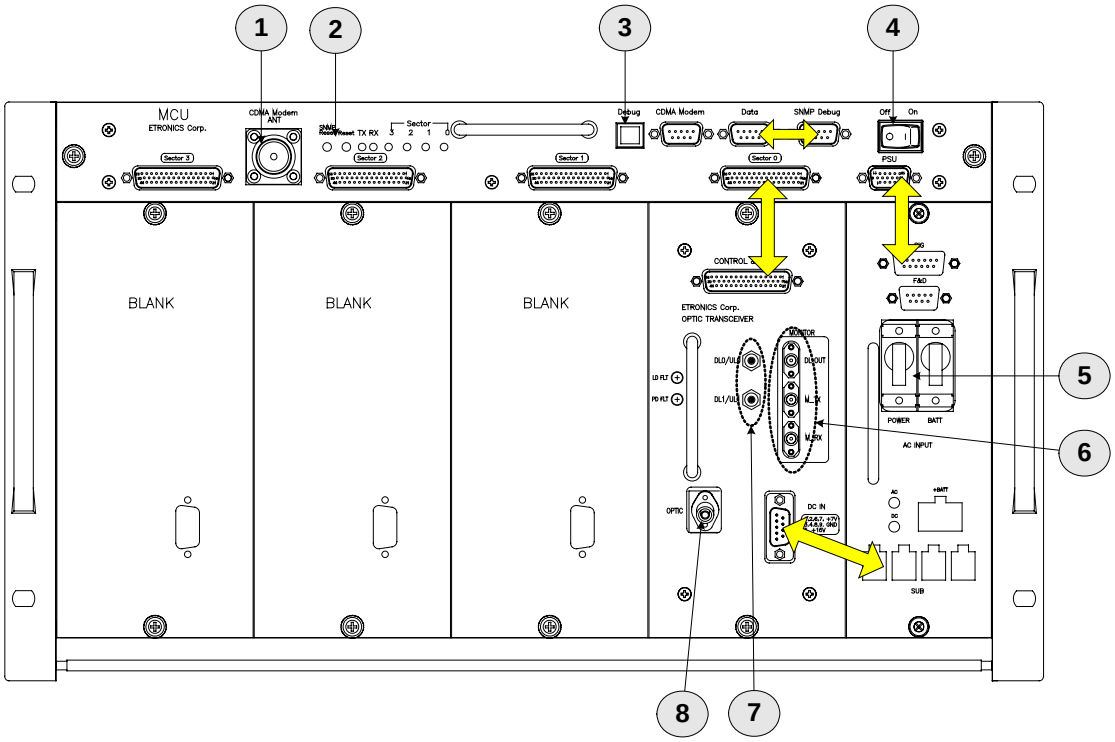
[Figure 2.2] Main Components of the Donor Hub Unit

① FAN: Provides ventilation and disperses heat evenly.

② MCU (Master 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 DOC (Donor Optic Cavity): 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 or 230VAC) into DC+27V, DC+15V, DC +7V and supplies the power to the modules.



[Figure 2.3] Donor Hub Unit Shelf Interface

① CDMA Modem RF Port (Female N-Type): An RF cable connects the CDMA wireless modem port on the MCU to the modem RF port situated on the outside of the enclosure.

② MCU and SNMP reset Key: Hard reset button to restart the MCU and SNMP agent.

③ Debug port: USB port to allow connection to any PC for debugging via the GUI and LMT.

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

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

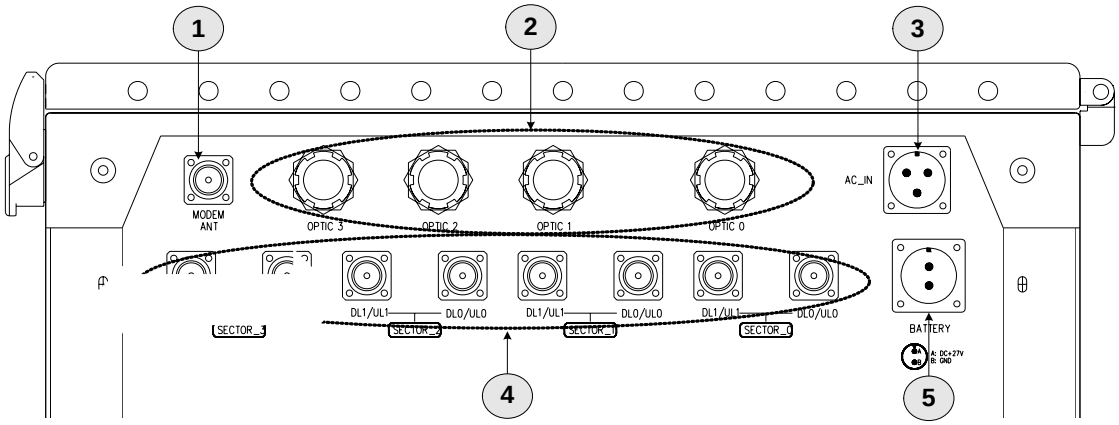
⑥ Monitoring port (Female SMA): Ports used to monitor signals existing within the DHU with a spectrum analyzer or test equipment.

⑦ RF in/out port: RF ports on a single optic transceiver supports only one sector.

This port is connected to the enclosure with RF cables.

⑧ Optic connector: Connector to where the fiber is connected to.

⑨ ⟺: Data and power cable



[Figure 2.4] Donor Hub Unit External Connectors (Bottom View)

① CDMA modem RF port (Female N-Type): External Antenna 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.

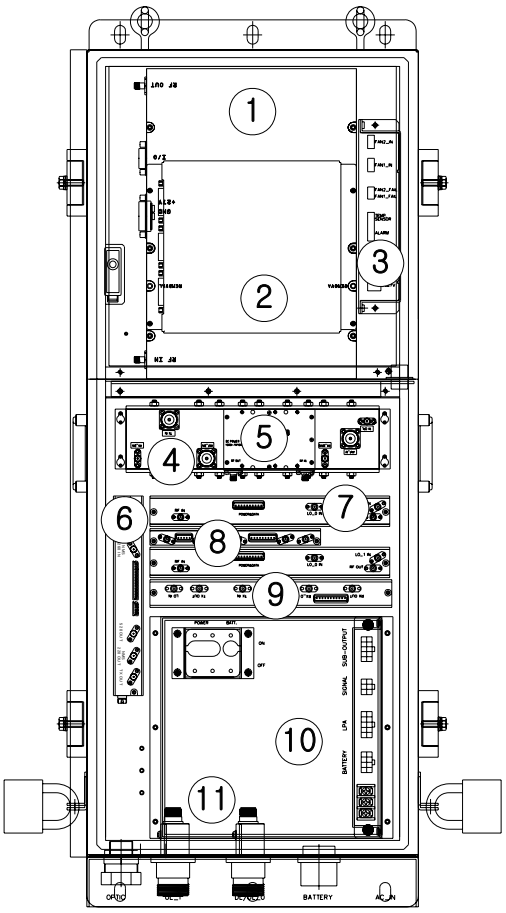
④ RF in/out port (Female N type): Provides connection to the BTS.

⑤ Battery connector (Female weatherproof MS type): Connector for backup batteries units.

2.3 Remote Unit

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

2.3.1 Remote Unit



[Figure 2.5] Main Components of the Remote unit

① **LPA (Linear Power Amplifier):** A 30Watt 6 carrier amplifier which amplifies the signal into high output power for transmitting to the DL antenna. The amplifier is operated by +27VDC and has a 43dB Gain.

② **Control Module:** Used to monitor and control the RU. Also manages the communication with the DHU.

③ **FAN Controller:** Turns the FAN On/Off by detecting the internal temperature of the unit and alerting the Control module (②) the current status of the FAN .

④ **Duplexer & BPF:** Filters out the unwanted signals on the FWD and REV path.

⑤ **Low Noise Amplifier (LNA):** Performs low noise amplification on received signals.

⑥ **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.

⑦ **Remote RX SAW Module:** Uses the SAW Filter to eliminate all unwanted signals from the selected frequency and reduces the interference caused by out of band signals.

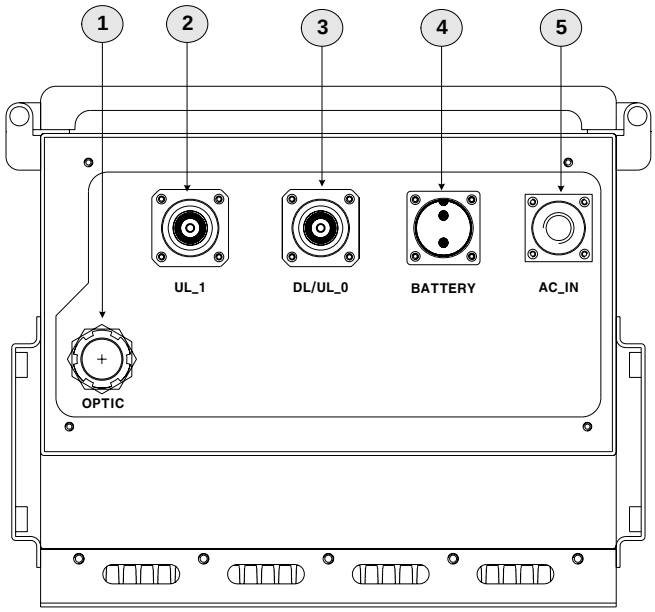
⑧ **Remote Local Module:** Generates and provides the local signal required for RU RX SAW Module (⑦).

⑨ **Remote TX Drive Module:** Amplifies the Forward signal and transmits to the LPA (①), the signal is then amplified once again from the SAW Module(⑦) and transmitted to the Optic Module(⑥). The reverse path performs down conversion of the frequency to 1330 to 1390MHz for diversity functions.

⑩ **Power Supply:** Converts the input power (55 to 88VAC) into DC+27V, DC+15V, DC +7V and supplies this power to the modules.

⑪ **Arrestor:** Protects the system against lightning surges. No external lightning arrestors are required.

2.3.2 Remote Unit Connectors



[Figure 2.6] Connectors located on the bottom of the Remote Unit

① **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.

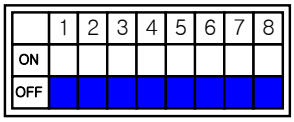
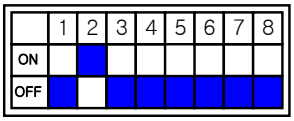
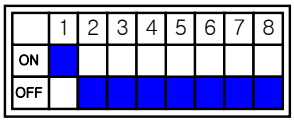
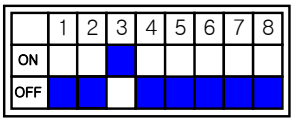
② **UL1 path input port:** Female DIN type Diversity uplink/receive path port to connect a second antenna

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 **Battery connector:** Weatherproof 2 pin MS connector used to connect an external battery backup unit.

⑤ **AC power connector:** Female AC power connector to allow connection for a male Gilbert AC power connector and CATV AC power feeder cable.

2.3.3 Remote Dip Switch Settings

DIP SWITCH	SECTOR	DIP SWITCH	SECTOR
	1		3
	2		4

[Table 2.1] Dip switch on the Control Unit of the Remote unit

The dip switch located on the control unit of the RU is set accordingly to the required sector it must service. A DHU can support a maximum of four remotes which allows the single DHU located at the BTS to service up to four sectors.

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 JF43 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 ~ +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 if there is 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 JF43 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.

- Portable RF spectrum analyzer or RF power meter
- RF Signal generator
- AC/DC voltmeter
- RF adaptors
- External attenuators
- RF test cables
- PC with Local Maintenance Terminal (LMT) software installed
- USB-A to USB-B interface cable
- 99% pure alcohol
- Contraction tubes
- Optical TDR (Time Domain Reflectometer)
- Wireless terminal
- Pencil or pen
- Writing pad

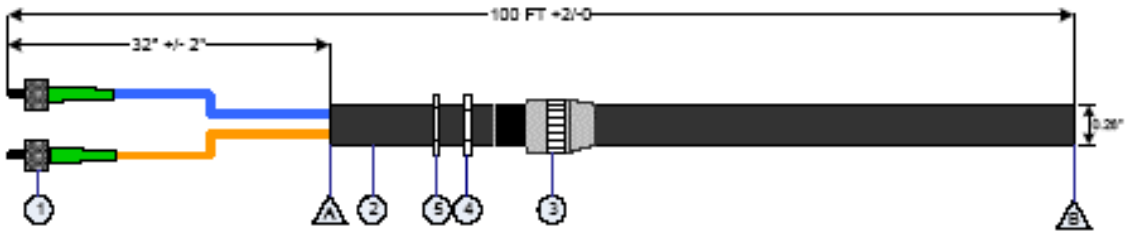
3.5.2 Cautions during Installation

1. 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.
2. 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.

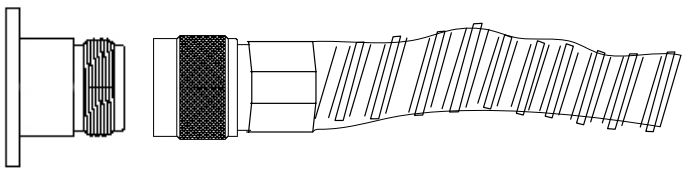


[Figure 3.1] Optical Fiber Jumper Cable

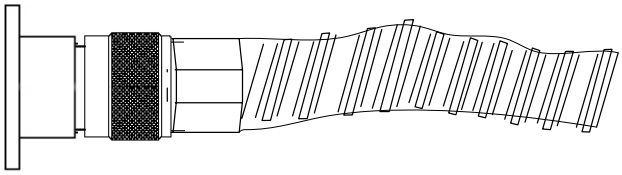
3.5.4 Weatherproofing Connectors

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.

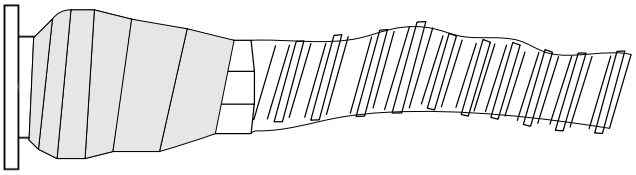


[Figure 3.2] Connect cable to connector



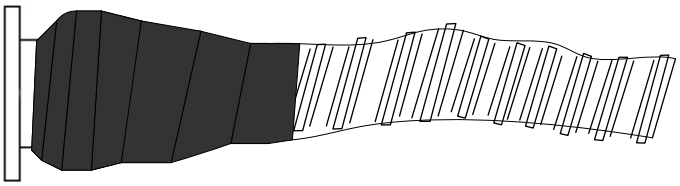
[Figure 3.3] Fasten cable to connector

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 3.4] 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.

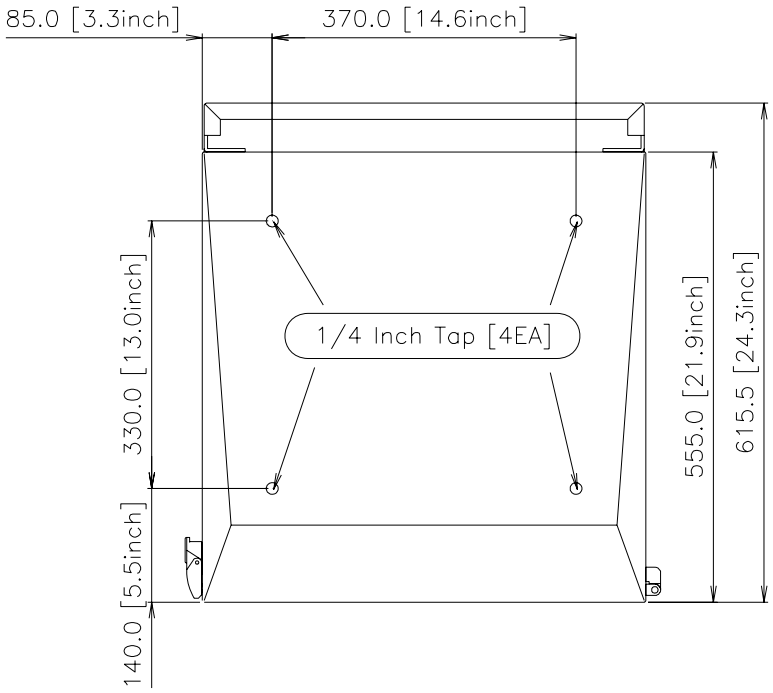


[Figure 3.5] Wrap over Butyl tape with electric tape

3.5.5 Donor Unit Eye Bolts

There are four captive 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.



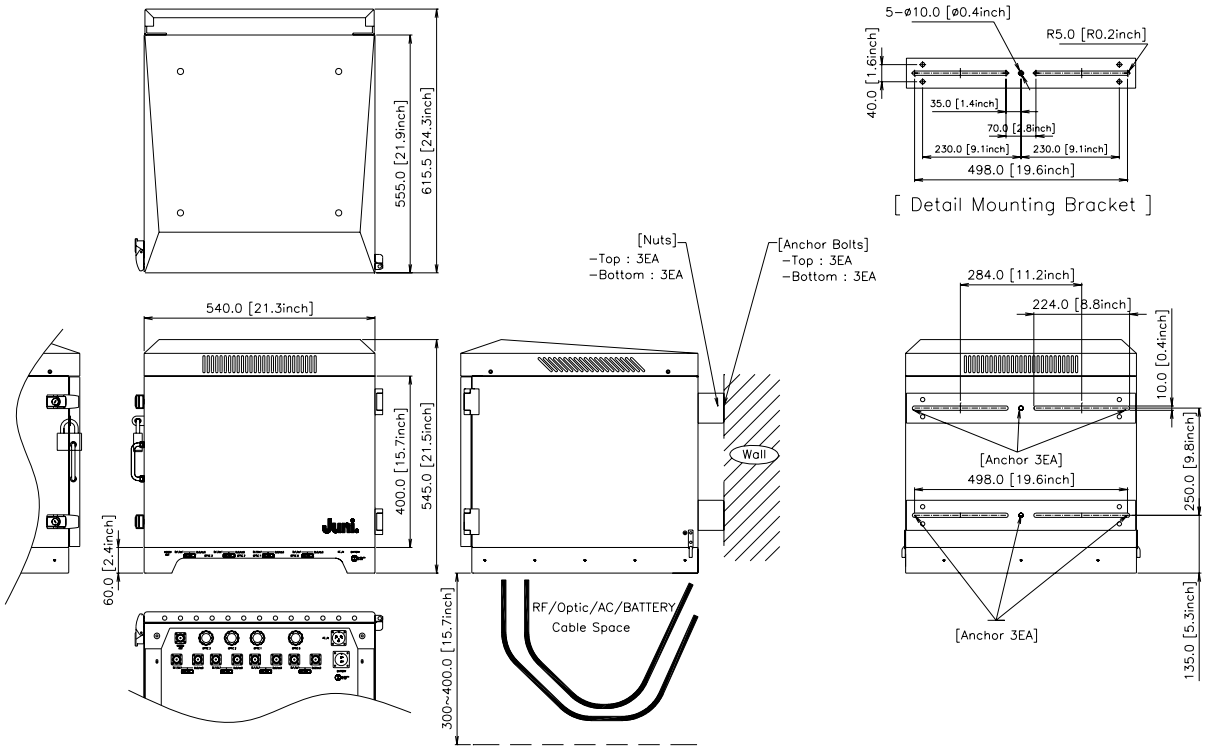
[Figure 3.6] Donor Unit Eye Bolt Patterns

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.



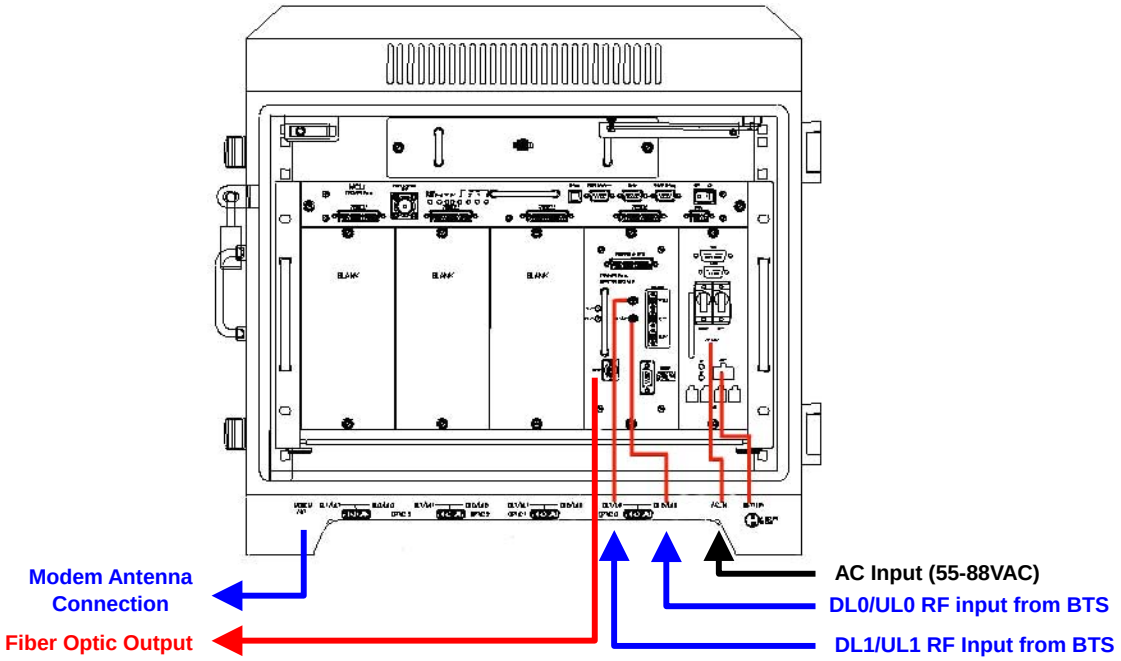
[Figure 3.7] Donor Hub Unit Wall Mounting

3.5.7 Donor Hub Unit Commissioning and Provisioning

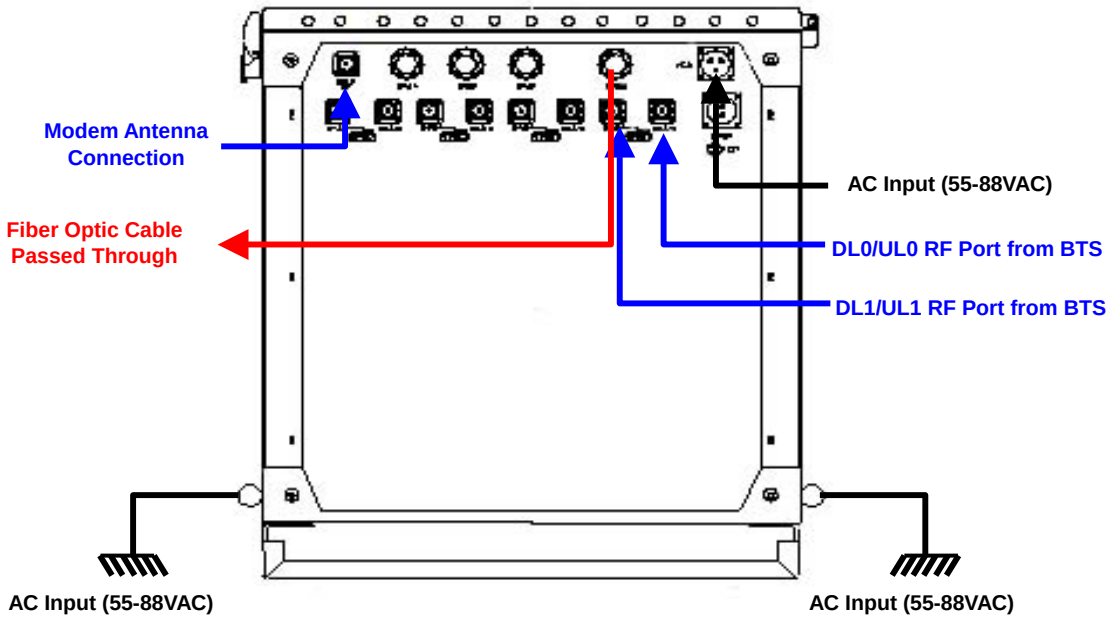
1. Verify that the power is switched OFF.
2. Before any other connections are made, ensure that the ground terminal on the DHU cabinet has been connected to the common ground of the installation site, as described in the previous section.
3. Using a DC voltmeter, verify that the DC voltage level at the power terminals is a nominal ±24 VDC. The DC power provided to the Donor can be either polarity.
4. Connect a customer-supplied power cable to the DHU Enclosure.
5. Connect a customer-supplied AC power cable to the front of the DHU power supply when the DHU enclosure is not used.
6. Connect a customer-supplied Optical Fiber cable to the Optic port of the DHU, inside the Enclosure.
7. Connect a customer supplied modem antenna to the RF modem port on the bottom of the DHU unit.
8. Turn the power on with the main switch located on the PSU and then power on the

MCU.

9. Connect a PC to the MCU's debug port with a USB cable. Load the LMT (Local Maintenance Terminal) software to check the status and settings of the DHU.



[Figure 3.8] Front View Cable connections on the Donor Hub Unit

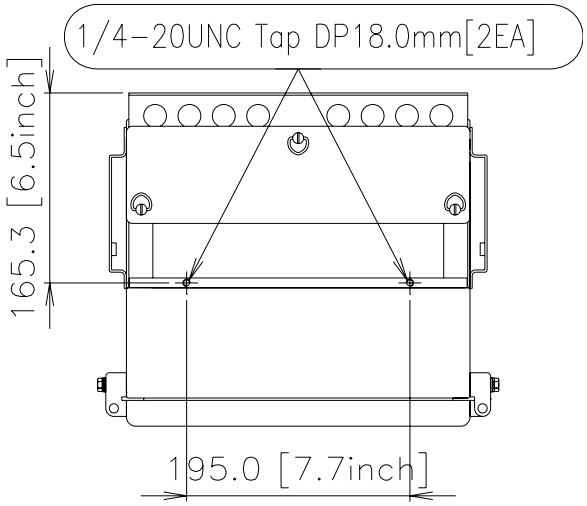


[Figure 3.9] Cable connections on the Donor Hub Unit

3.5.8 Remote Unit Eye Bolts

There are two captive 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 3.10] Remote Unit Eye Bolt Patterns

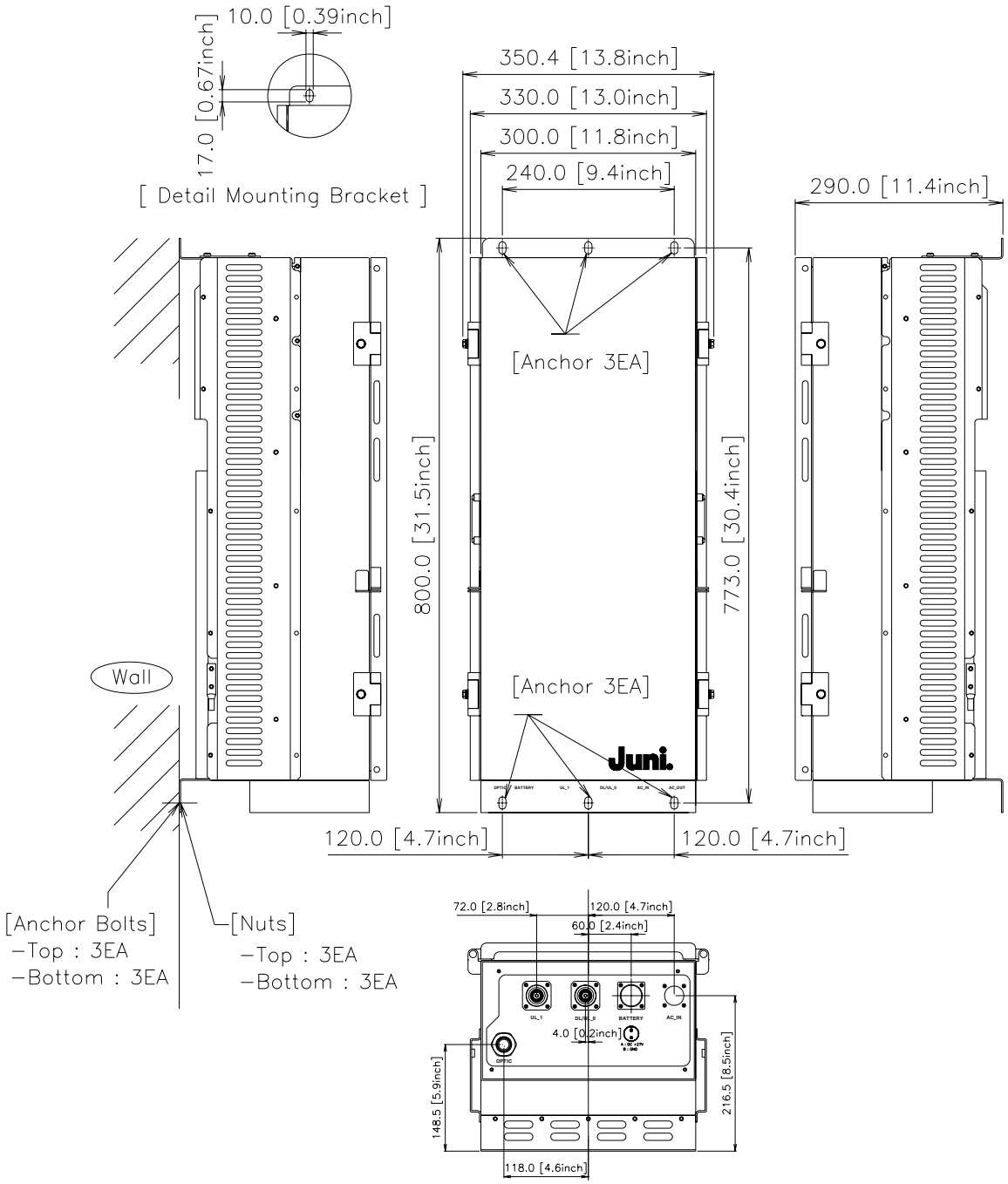
3.5.9 Remote Unit Standard Wall Mount Guide

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.

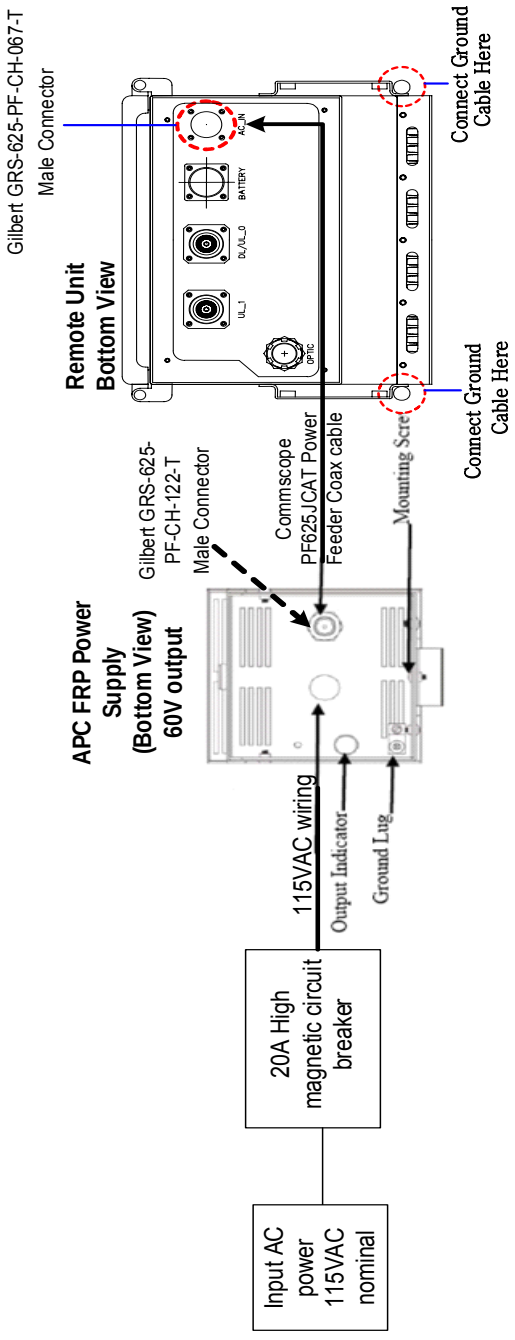


[Figure 3.11] Remote Unit Wall Mounting

3.5.10 LVAC Cables and Connectors Installation Guide

Please refer to Appendix C which contains the cable assembly installation guide from Corning Gilbert on how to prepare and connect the cables and connectors required for the JF-43.

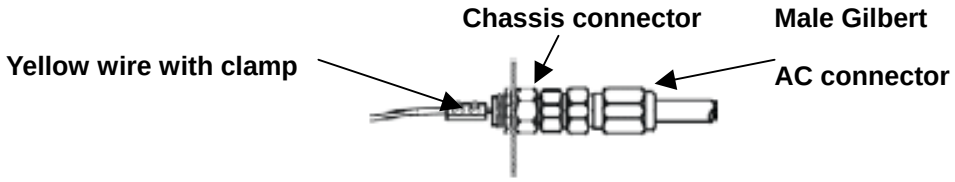
3.5.11 Remote Unit External Powering Configuration (Optional)



[Figure 3.12] Remote Unit External Powering Configuration

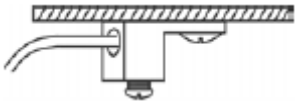
The following procedure is only used when electric power at the site differs to the RU power supply range and results in an external power supply being used. Please follow the procedure below to safely install an external power supply to the RU.

1. Unlock the FRPS enclosure. Let the lid slide down and then pull out at the top. The lid will remain attached to the Power Supply.
2. Check the line power switch of the power supply to ensure that it is OFF.
3. Install a Gilbert male type AC connector into the chassis connector located on the bottom of the Power Supply.
4. Attach the yellow wire with the clamp to the stinger of the male connector. Tighten the setscrew on the lug clamp as shown below.



[Figure 3.13] Steps 3 and 4

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

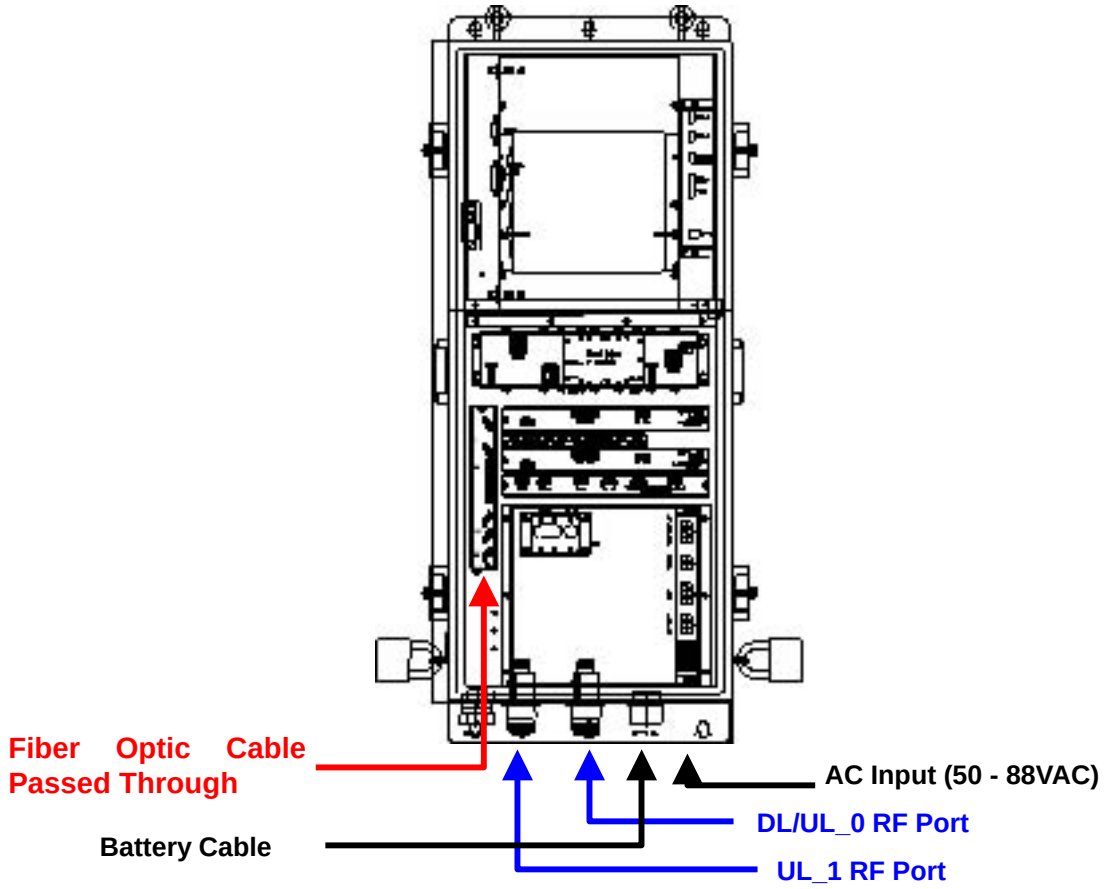


[Figure 3.14] Step 5

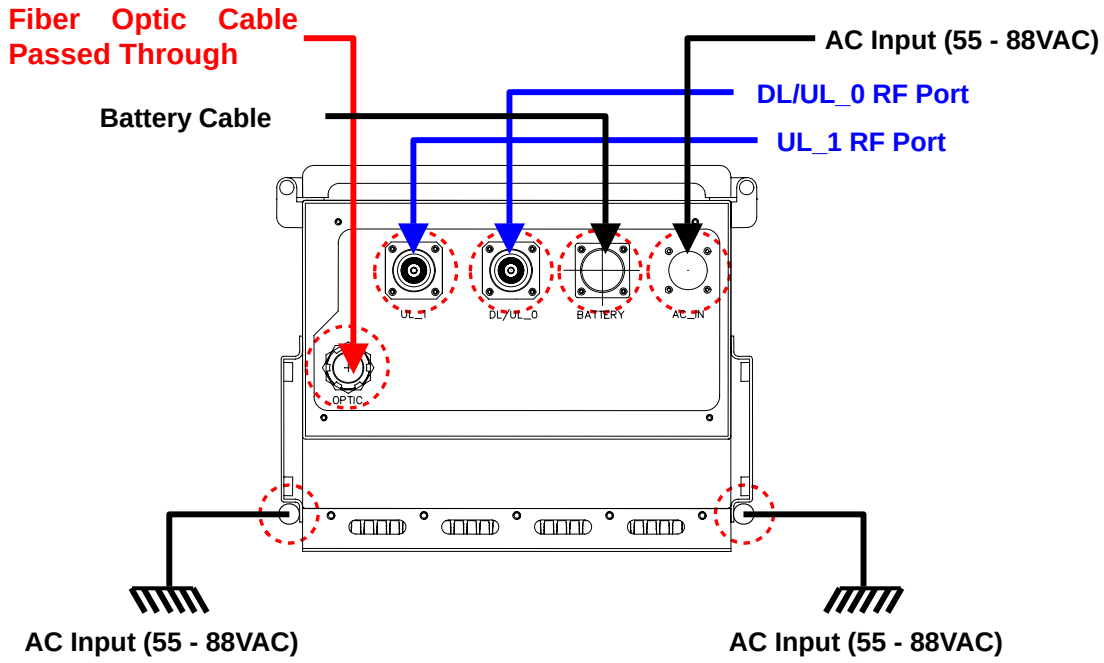
6. Route and attach the ground wire according to local electrical codes.
7. Install an approved 20 amp high magnetic circuit breaker on the input power side of the power supply.
8. Install a conduit into the opening on the bottom and attach line power in accordance with local electrical codes. The barrier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

3.5.12 Remote Unit Commissioning and Provisioning

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 between 110 and 120VAC (for 120VAC powered systems) or between 220 and 240VAC (for 240VAC powered systems)
4. Check that the AC power cable is supplying the correct voltage (55 to 88VAC) 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 5/8 inch CATV 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 USB cable and load the LMT (Local Maintenance Terminal) software to check the status and settings of the RU.
13. Ensure that communication between the RU and DHU is functioning correctly after setting the address with the dip switches on the RSM (Remote Saw Module).
14. Check the downlink signal power waveform and level.
15. Close the door of the RU and weatherproof the connectors and boot.



[Figure 3.15] Cable connections for the remote unit (Top View)



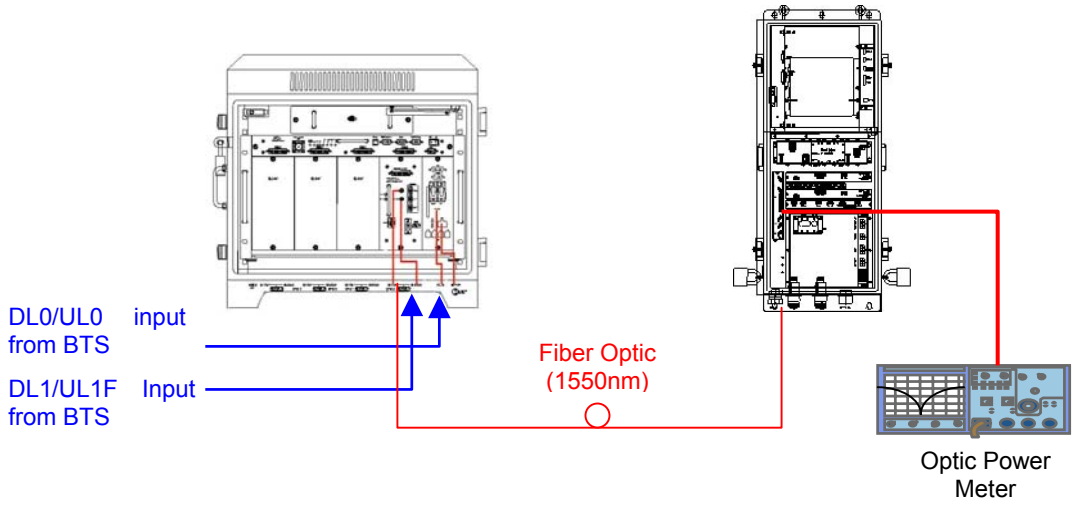
[Figure 3.16] Cable connections for the remote unit (Bottom View)

3.5.13 Operations Tests

This section provides test procedures for the uplink and downlink required to be undertaken in order to set up the JF-43 for optimal service.

3.5.13.1 Optic Cable Loss Test

Connect the system as shown below:



[Figure 3.17] 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 (1550nm) output level. If the optic input level exceeds +6dBm, check the DHU optic module.
2. If the optic loss is larger than –6dBo (on the basis of **1510nm,** optic loss = donor output optic power – remote input optic power) through calculating with measured optic power and if the optic cable length between the DHU and RU is less than 15 miles, check if there is a fault in the PD (Photo Diode) or check the optic cable.
3. If a PD fault has occurred inspect the optic input level and check the optic line. Clean the optic connector and if a fault is still existent, send the repeater back to Juni for repair.

* Reference

a. Optic cable loss is 0.25dB/km at 1510nm, and connection loss is 0.4dB/connector. The total optic deviation of connector is about 1to2dB. (0.4dB ×2 (connector) = about 1dB)

b. At the time of delivery, the Gain is set to be about 38dB (Tx), 20dB (Rx) as a default on the basis of optic cable length being 15 miles.

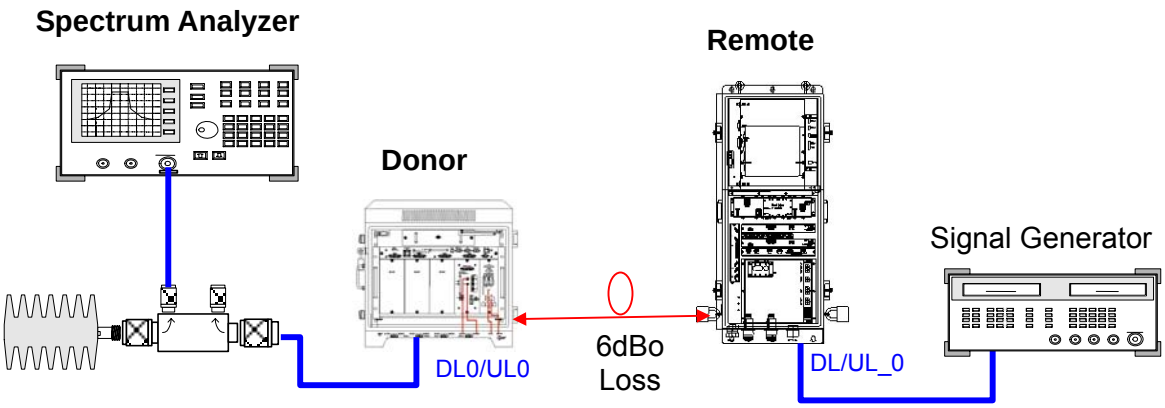
3.5.14 Setup Procedure for DL/UL Path Gain

This section provides test procedures for the uplink and downlink required to be undertaken in order to set up the JF-43 for optimal service.

3.5.14.1 Setup for UL Gain

1. Connect the RF signal generator to the ‘DL/UL_0’ port of the RU.
2. Transmit an input signal of -55dBm to the ‘DL/UL_0’ port using the signal generator.
3. Connect spectrum analyzer to ‘DL/UL_0’ port of the DHU. (Span: 5MHz, amplitude offset = cable loss).

4. Adjust the UL0 Main ATT from the LMT (RF power level with measuring spectrum analyzer) to adjust the reverse output to be -35dBm. (This is to set the reverse gain of the system to 0dB considering the 20dB coupler used to connect to the BTS input.)

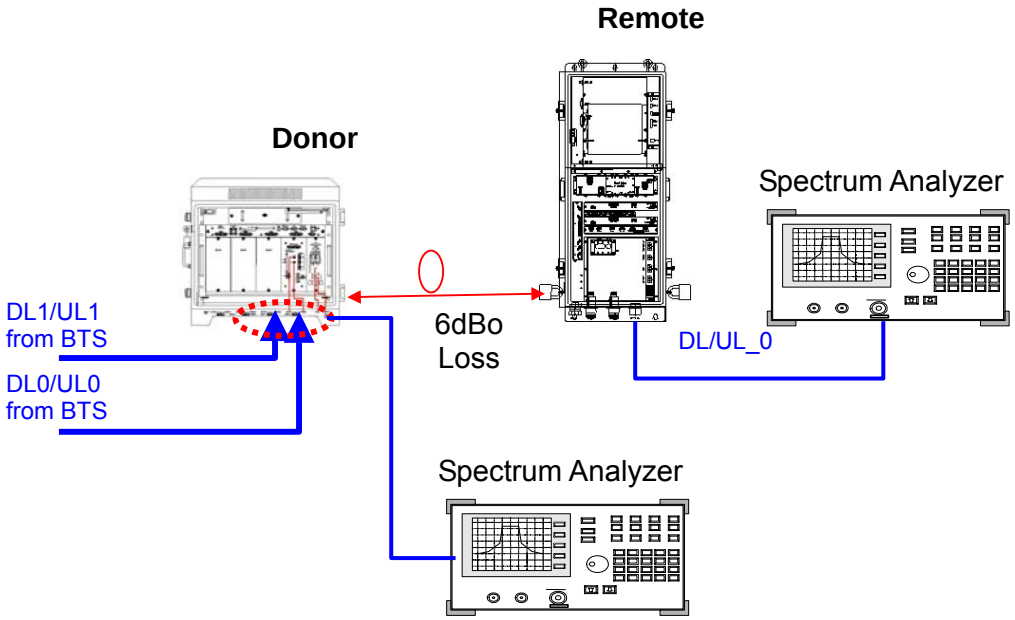


[Figure 3.18] Connection to set up UL gain

3.5.14.2 Setup for DL Gain

1. Check whether the DL input to the DHU is within -3dBm to +7dBm/Total.
2. Set the RU FWD ATT to 25dB.
3. Turn ON the forward LPA.
4. While monitoring the forward output power measurement function of the LMT (Local Maintenance Terminal), adjust the RU forward attenuation to obtain the desired RU forward output level.

Note: The technician responsible for the repeater provisioning should have data for off peak and peak hour traffic for the BTS. It is recommended to set the RU output around 7 to 8dB less than the max output (43dBm) at off peak hours (No traffic) to prevent any over power shutdown.



[Figure 3.19] Connection to set up DL gain

3.5.14.3 Caution Items

- When adjusting the forward gain, start from the minimum gain setting.
- Max. Output Power should not exceed 20W (about +43dBm),
- 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 HPA 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 power has been turned 'OFF'.

4. Dismount the faulty unit from its mounting method.
5. Remount the replacement unit to its position.
6. Connect all cables to the replaced unit.
7. Turn on the power of the replaced unit.
8. For RU replacement, check whether the HPA 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 HPA of the RU.

3.6.2 Optical Module Replacement

1. Turn off the MCU power first.
2. Turn off the DHU power supply.
3. Disconnect al RF connectors, data cables and optical fiber that are connected to the Optic Transceiver.
4. Unscrew the multi-turn fastener located at the top and bottom of the module and pull on the handle to free the optic receiver.
5. Completely remove the module from its slot and place the replacement module back into the same position being careful not to bump the Optic Transceiver.
6. 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.

4. Operation

This section provides guidelines for operating the JF-43 system via GUI interfaces. Information is provided on how to verify all units are operating properly and all performance requirements are satisfied. This process assumes that the units have been installed in accordance with the system design plan.

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 LMT software provided.

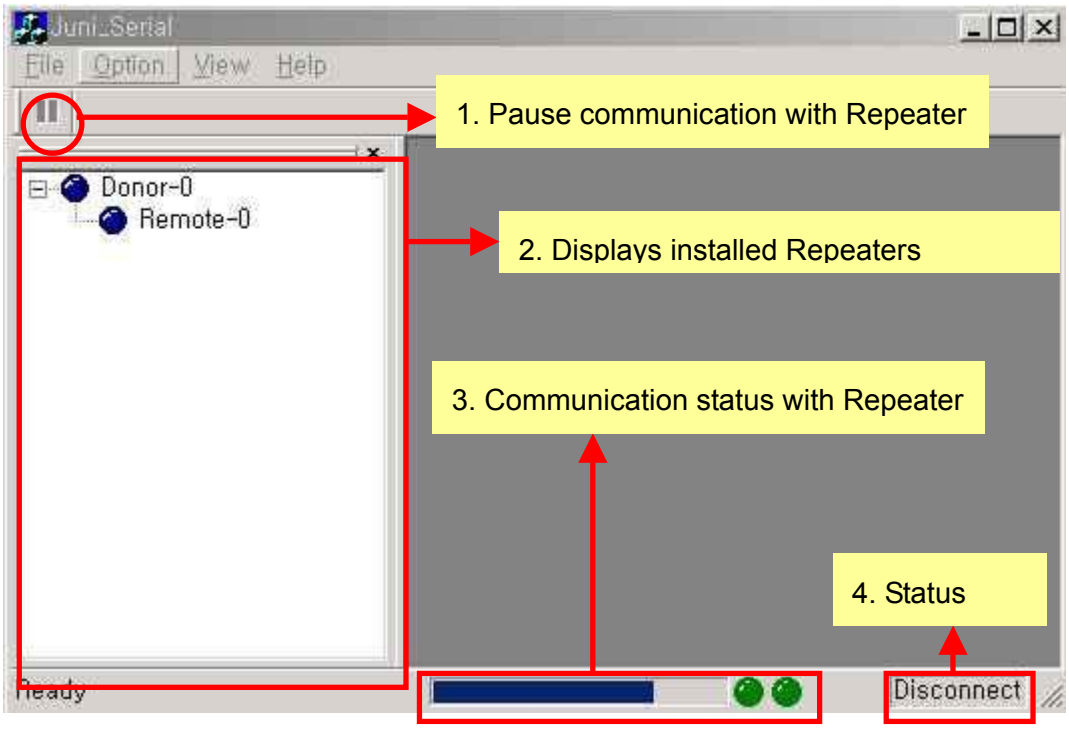
4.2 LMT Operation (Local Maintenance Terminal)

4.2.1 Introduction

The JF43 repeater can be controlled via the LMT (Local Maintenance Terminal) software installed on a computer. This enables the operator to monitor and control the repeater by connecting a PC to the repeater via a linked or wireless communication protocol.

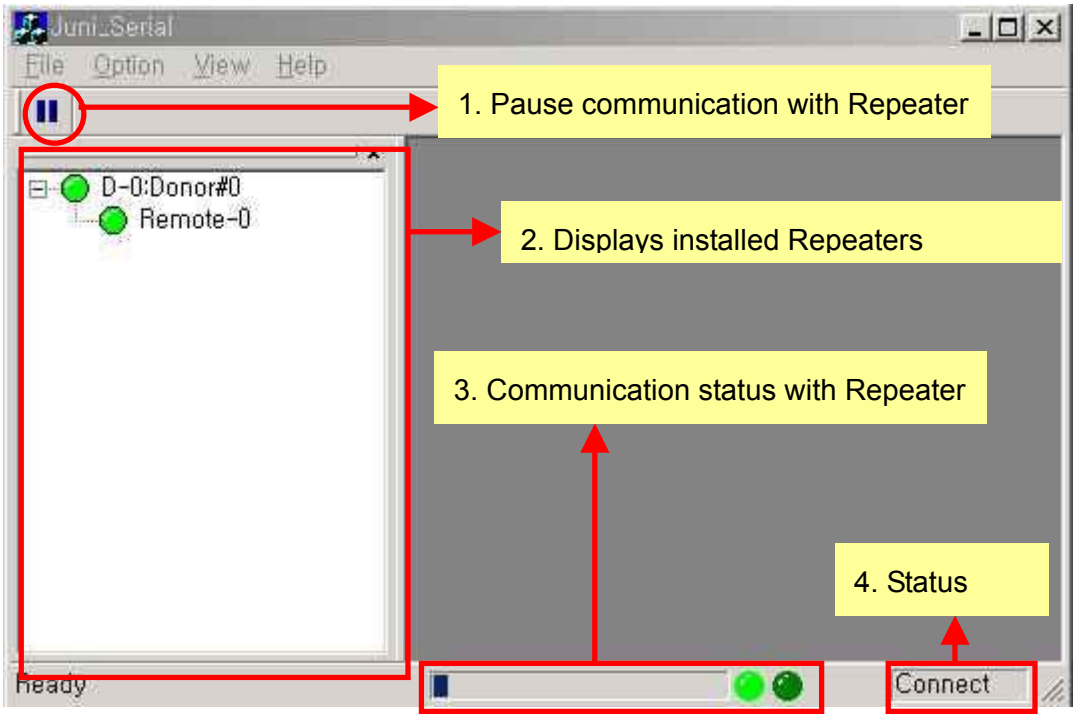
4.2.2 Screen Description

When the Juni_Serial.exe file is started and the program does not detect a connection with the repeater, the following screen is displayed.



[Figure 4.1] LMT Start up Screen - 1

If a connection is made between the repeater and the software running computer, it will display the screen shown below.



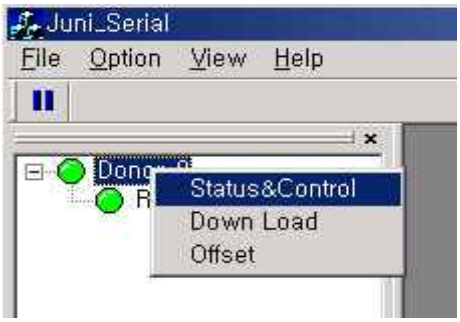
[Figure 4.2] LMT Start up Screen - 2

1) Pause communication with Repeater: This button is used for momentarily disabling and re-enabling communication with the Repeater. Communication with the Repeater is automatically disabled during program startup and Repeater Firmware downloads. When the communication is paused, the icon will be displayed as below, and the LED's on the bottom of the screen will pause its flashing.

[Figure 4.3] Pause Icon

2) Installed Repeaters Display: Displays the Repeaters installed as a hierarchical tree. Information for the items in this tree may be viewed by either double clicking on the content or right-clicking on the mouse and selecting "Status & Control" menu as

illustrated below.



[Figure 4.4] Status & Control

3) Communication status with Repeater: The Progress Bar and LED's display the status of communication with the Repeater at the bottom of the screen.

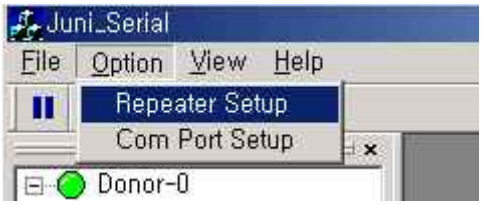
4) Status: Displays “Disconnect” when there is no communication and “Connect” when there is communication between the repeater and the LMT program.

4.2.3 Communication Settings

When the repeater is connected to the computer via USB cable for the first time, it will automatically detect the hardware and run the new hardware wizard. Install the manufacturer supplied driver to enable communication between the repeater and the computer.

4.2.4 Repeater Setup

To configure the repeater settings, click the “Option” menu and select the “Repeater Setup” as shown in Figure 4.5. This will bring up the “Repeater Set up” window as shown in Figure 4.6 below.



[Figure 4.5] Choosing Repeater Setup

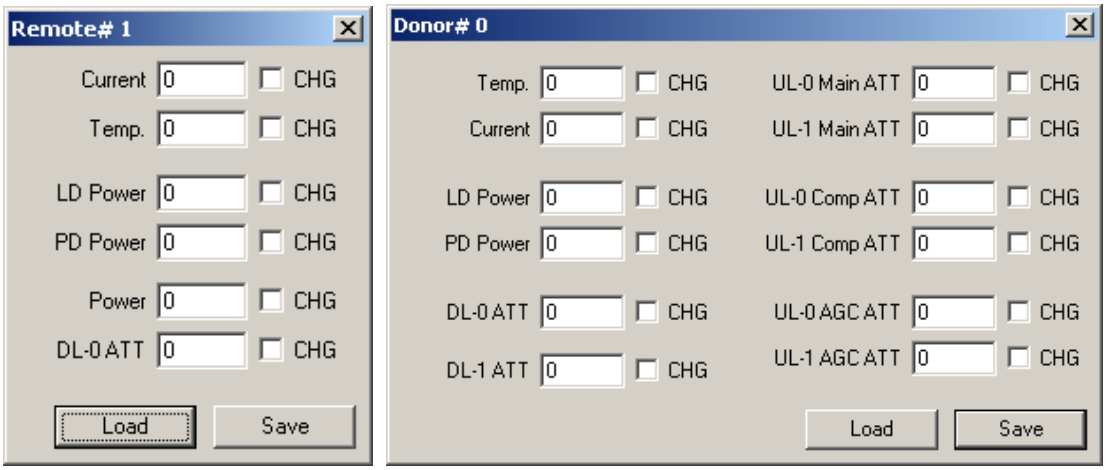
[Figure 4.6] Repeater Setup Window

Click the “Load” button to display the current configuration. To make changes to the current settings, tick the box beside each of the desired items and click “Save” and then “OK”. For initials setting values and instructions, please refer to **section 4.2.6.3.**

4.2.5 Offset Calibration

Since the power level readings can differ to the actual RF power level by up to 1dB, an offset feature exists within the LMT that allows you to calibrate the LMT to synchronize the readings from the RF test equipment.

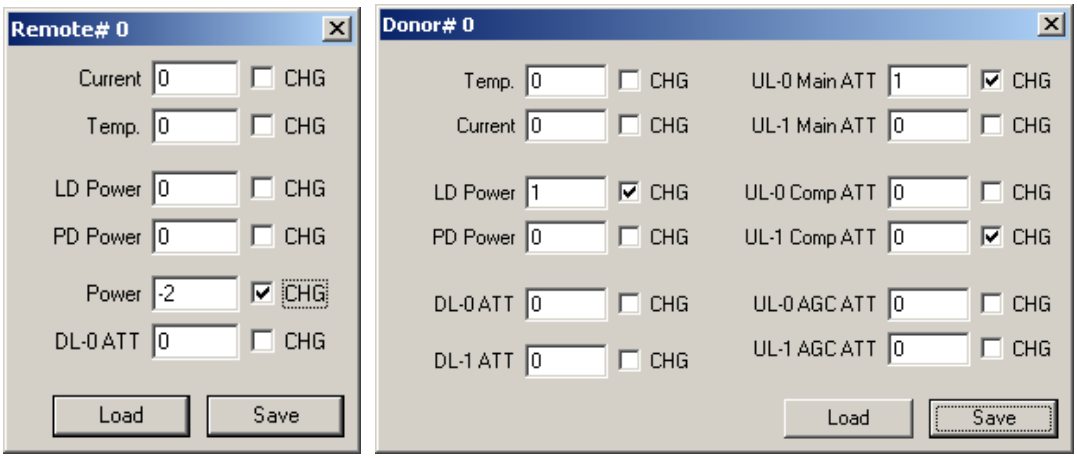
The default offset values for all repeaters are set to 0. To access the offset feature, do as shown in figure 4.4 and select “Offset” to display the window below. The process is the same for both Donor and Remote.



[Figure 4.7] Default Offset Feature Window for Remote and Donor

To set an offset for a particular parameter, first check the CHG box to enable the LMT

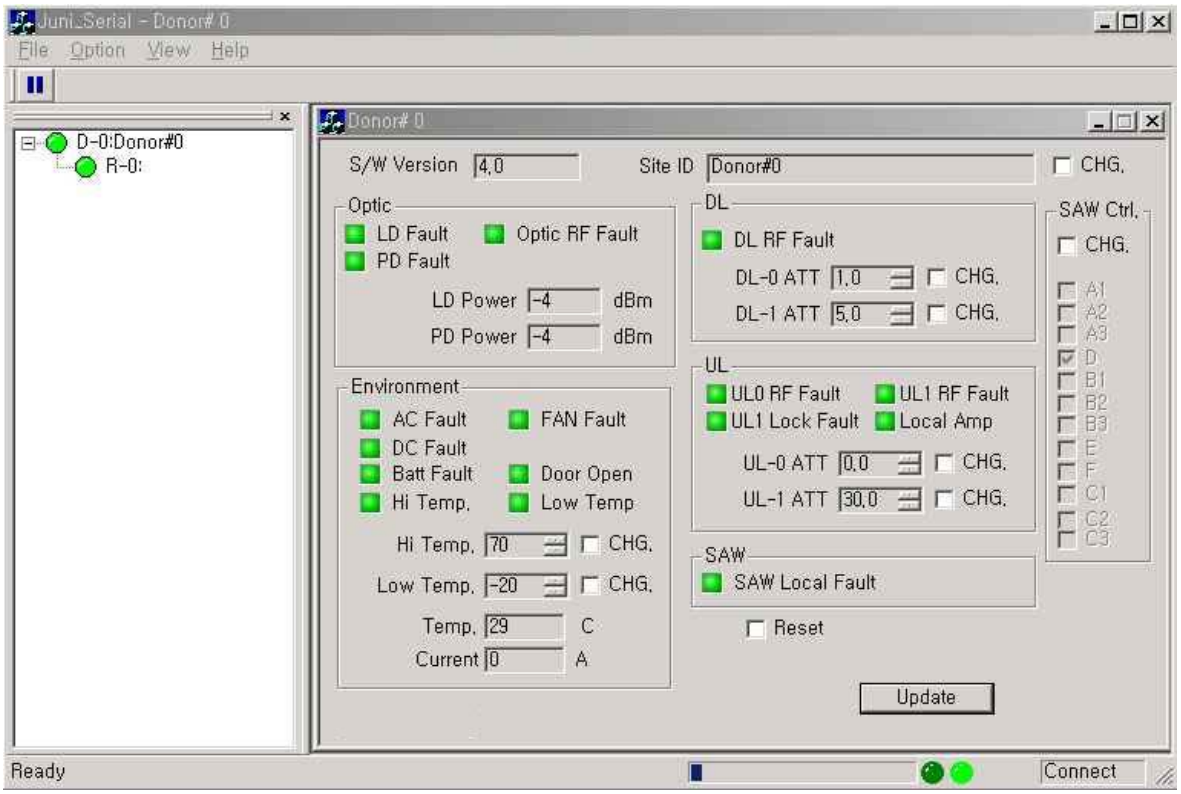
to read and save the settings. Entering a value without check the box will have no effect on the repeater. Once the values have been inputted, press ‘Save’ to save the values and ‘Load’ to load the offset values to the unit. When complete, uncheck the marked boxes and close the offset window.



[Figure 4.8] Offset Calibration

4.2.6 Repeater Status Monitoring and Control

To view the status of installed Repeaters, double click on the desired Repeater in Figure 4.5 to bring up the Control Window. This can also be done by right-clicking on the desired Repeater and selecting the “Status & Control” command as shown in Figure 4.4.



[Figure 4.9] Donor Unit Status Window

4.2.6.1 Donor Unit Window

The system status may be monitored by the color indicated beside each of the alarm contents. Red color denotes a fault/alarm status whereas the Green denotes normal status.

1. S/W Version

Displays the current software version of the Juni_Serial.exe program.

2. Site ID:

Displays the location or the site name of where the repeater is installed. By checking the CHG box, the site ID of the DHU can be renamed and saved.

3. Optic

① LD Fault: Displays the alarm state of the Laser Diode. Generates alarm when the

DHU Laser Diode does not detect any optic output power.

② PD Fault: Displays the alarm state of the Laser Diode. Generates alarm when the DHU Photo Diode does not detect any optic input power.

③ Optic RF Fault: Displays the alarm state of the Amplifier of the Optic module.

④ LD Power: Displays the Laser Diode optic output power.

⑤ PD Power: Displays the Photo Diode optic input power.

4. Environment

① AC Fault: Displays the alarm state of the main input power of the DHU.

② DC Fault: Displays the alarm state of the power supply of the DHU. Generates an alarm when the DHU power supply detects a fault in its circuit.

③ Batt Fault: Displays the alarm state of the Battery of the DHU.

④ Hi Temp: Displays the alarm generated when the detected DHU temperature is higher than the set ⑧ Hi Temp.

⑤ FAN Fault: Displays the alarm state of the Fan of the DHU.

⑥ Door Open: Displays the alarm state of the Door of the DHU.

⑦ Low Temp: Displays the alarm generated when the detected DHU temperature is lower than the set ⑨ Low Temp.

⑧ Hi Temp: Sets/Displays the maximum temperature limit.

⑨ Low Temp: Sets/Displays the minimum temperature limit.

⑩ Temp: Displays the current temperature of the DHU.

⑪ Current: Displays the amount of current consumed by the repeater.

5. DL

① DL RF Fault: Displays the alarm state of the Downlink Amplifier.

② DL-0 ATT: Sets/Displays the Downlink-0 attenuation. Accurately matches the input level of the DHU to the optic module dynamic range input.

③ DL-1 ATT: Sets/Displays the Downlink-1 attenuation. Accurately matches the input level of the DHU to the optic module dynamic range input.

6. UL

① UL0 RF Fault: Displays the alarm state of the Uplink0 Amp.

② UL1 RF Fault: Displays the alarm state of the Uplink1 Amp.

③ UL1 Lock Fault: Displays the alarm state of the Uplink1 Lock.

④ Local Amp: Displays the alarm state of the Local Amplifier.

⑤ UL-0 ATT: Sets/Displays the Uplink-0 attenuation. Attenuator that controls the Uplink0 path gain.

⑥ UL-1 ATT: Sets/Displays the Uplink-1 attenuation. Attenuator that controls the Uplink1 path gain.

7. SAW

① SAW Local Fault: Displays the alarm state of the Downlink SAW Local Lock.

8. Reset

① Uses the software to reset the system.

9. SAW Ctrl

① Displays the selected frequency band for the SAW Filter. Allows control and selection of the 85 different frequency band combinations. Table 4.1 below displays all the possible frequency combinations with Table 4.2 showing the frequency ranges for each of the bands.

	normal 5MHz	normal 15MHz	normal 20MHz	5+5			5+15	15+5
	A1	A	A,D	A1+A2	D+B2	B3+C1	A1+(A3,D,B1)	A+B1
	A2	A2,A3,D	A2,A3,D,B1	A1+A3	D+B3	B3+C2	A2+(D,B1,B2)	(A2,A3,D)+B2
	A3	A3,D,B1	A3,D,B1,B2	A1+D	D+E	E+F	A3+ B	(A3,D,B1)+B3
	D	D,B1,B2	D,B	A1+B1	B1+B2	E+C1	D+(B2,B3,E)	(D,B1,B2)+E
	B1	B	B,E	A2+A3	B1+B3	E+C2	B1+(B3,E,F)	B+F
	B2	B2,B3,E	B2,B3,E,F	A2+D	B1+E	E+C3	B2+(E,F,C1)	(B2,B3,E)+C1
	B3	B3,E,F	B3,E,F,C1	A2+B1	B1+F	F+C1	B3+(F,C1,C2)	(B3,E,F)+C2
	E	E,F,C1	E,F,C1,C2	A2+B2	B2+B3	F+C2	E+C	(E,F,C1)+C3
	F	F,C1,C2	F,C	A3+D	B2+E	F+C3		
	C1	C		A3+B1	B2+F	C1+C2		
	C2			A3+B2	B2+C1	C1+C3		
	C3			A3+B3	B3+E	C2+C3		
				D+B1	B3+F			
	12	10	9	38			8	8
Total Count	85							

[Table 4.1] 85 Possible Frequency Band Combinations

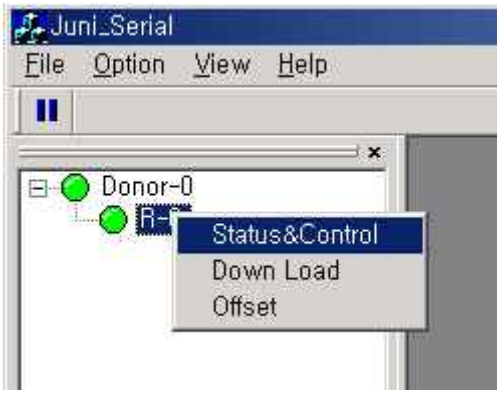
Band	Frequency
A1	1850 to 1855 MHz
A2	1855 to 1860 MHz
A3	1860 to 1865 MHz
D	1865 to 1870 MHz
B1	1870 to 1875 MHz
B2	1875 to 1880 MHz
B3	1880 to 1885 MHz
E	1885 to 1890 MHz
F	1890 to 1895 MHz
C1	1895 to 1900 MHz
C2	1900 to 1905 MHz
C3	1905 to 1910 MHz

[Table 4.2] Frequency band ranges of Table 4

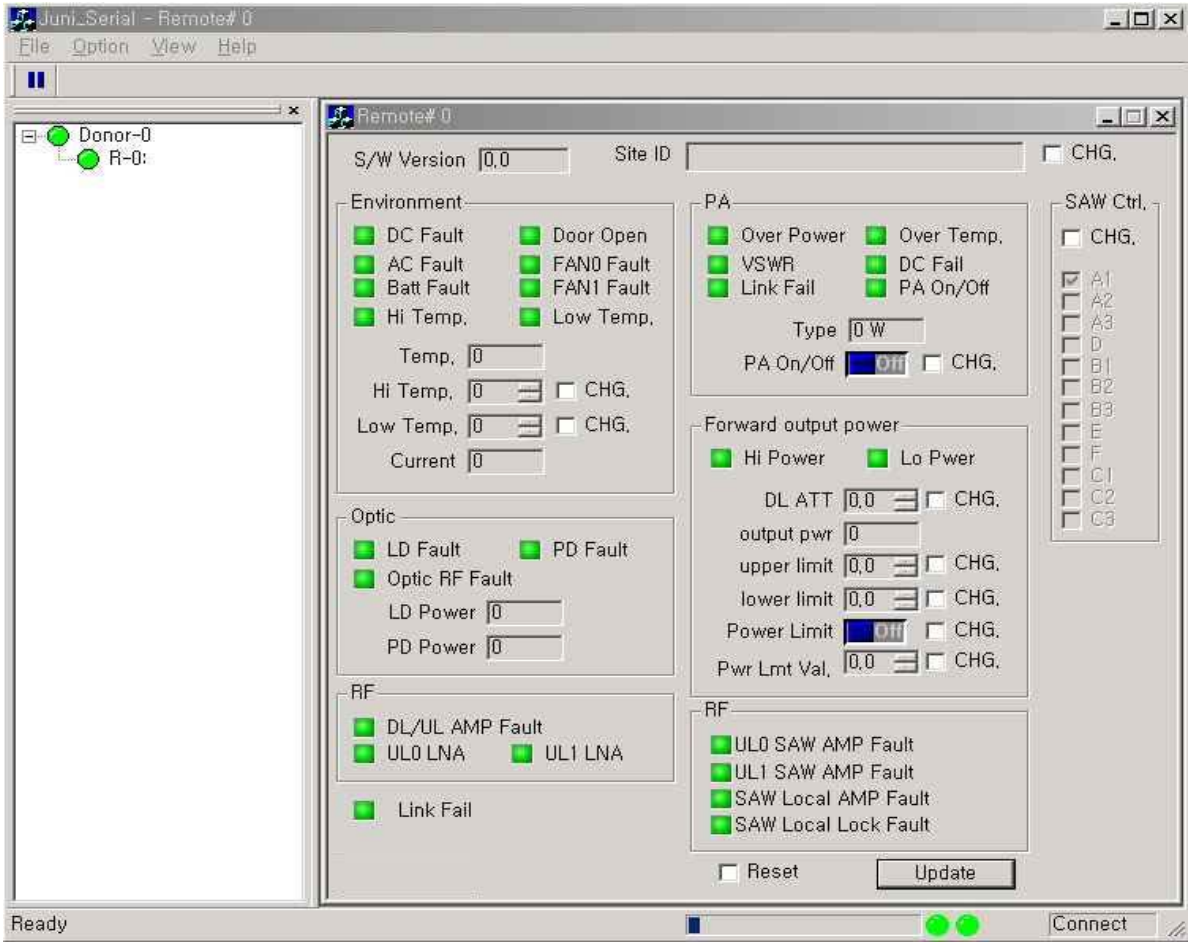
Note: Frequencies C1, C2, C3 are identical to FCC's C3, C4, and C5.

4.2.6.2 Remote Window

To view the Remote-0 status screen displayed in Figure 4.9, right-click on Remote-0 and select “Status & Control” command as illustrated in the Figure 4.8 below.



[Figure 4.10] Remote_0 Select



[Figure 4.11] Remote_0 Status

Similar to the Donor-0 Status window (Figure 4.7), the Remote-0 system status may be monitored by the color indicated beside each of the alarm contents.

Note: only dissimilar items from the Donor-0 status window are outlined below.

1. PA

① Over Power: Displays the Over Power alarm state of the Power Amplifier

② VSWR: Displays the VSWR alarm state of Power Amplifier

③ Link Fail: Displays the alarm state of the Link between RSM and Power Amplifier

④ Over Temp: Displays the Over Temperature alarm state of the Power Amplifier

⑤ DC Fail: Generates alarm when the power supply of the Power Amplifier detects a fault in its circuit

⑥ PA On/Off: Displays the ON/OFF state of the Power Amplifier

⑦ Type: Displays the capacity of the Power Amplifier

⑧ PA On/Off: Controls the ON/OFF function of the Power Amplifier

2. Forward output power

① Hi Power: Displays the High Power alarm status. Alarm generated when the detected temperature of the RU exceeds the set ‘Upper Limit’

② Lo Power: Displays the Low Power alarm status. Alarm generated when the detected temperature of the RU is below the set ‘Lower Limit’

③ DL ATT: Displays the Downlink (Forward) Attenuation. Attenuator that controls the final downlink output

④ Output pwr: Displays the current output power

⑤ Upper limit: Displays the Upper limit output value

⑥ Lower limit: Displays the Lower limit output value

⑦ Power Limit: Controls the On/Off function of the Power Limit

⑧ Pwr Lmt Val.: When the Power Limit is turned “On”, it adjusts the DLATT (Downlink

Attenuation) to maintain the power level to this set value

3. RF

① DL/UL AMP Fault: Displays the alarm state of DL (Downlink) /UL (Uplink) Amplifier

② UL0 LNA: Displays the alarm state of UL0 (Uplink0) Low Noise Amplifier

③ UL1 LNA: Displays the alarm state of UL1 (Uplink1) Lower Noise Amplifier

④ UL0 SAW AMP Fault: Displays the alarm state of UL0 (Uplink0) SAW Amplifier

⑤ UL1 SAW AMP Fault: Displays the alarm state of UL1 (Uplink1) SAW Amplifier

⑥ SAW Local AMP Fault: Displays the alarm state of Remote SAW Local Amplifier

⑦ SAW Local Lock Fault: Displays the alarm state of Remote SAW Local Lock

4. SAW Ctrl

① Displays the selected frequency band for the Remote SAW Filter

4.2.6.3 Repeater Settings Setup

From the Donor-0 Status (Figure 4.7) or the Remote-0 Status (Figure 4.9), click the "CHG" check box next to the desired control items that you wish to change, then modify the values and click the "Update" button to allow the changes to take affect.

To set up the system so that the RU RF output of 20 watts is not exceeded, enter a value of 43dBm into the upper limit. Under certain circumstances where the output power exceeds this value, the AGC function will provide attenuation so as not to damage the unit. The lower power limit can be set as 17dBm.

Please note that the power level readings on the LMT versus the actual RF power can differ by up to 1dB. For this reason the offset feature is included in the LMT.

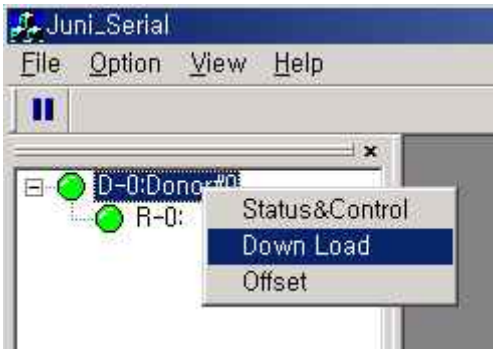
The initial attenuator settings on the LMT should be as follows:

Donor DL0 and DL1 ATT*:** 13 dB ***Donor UL0 and UL1 ATT: 18 dB

Remote DL ATT: 10 dB

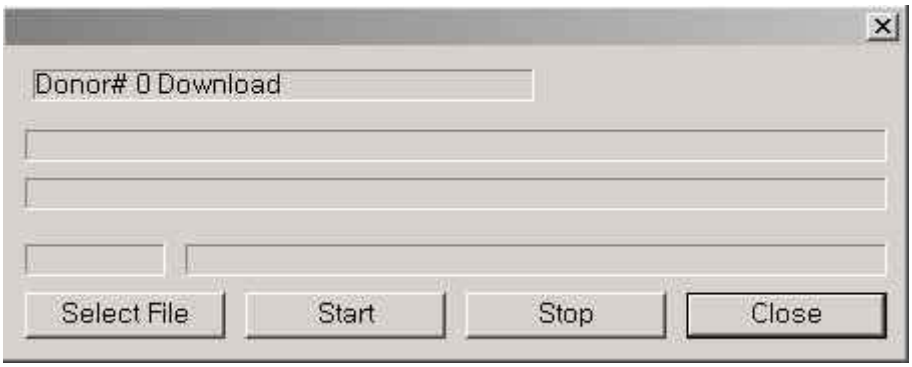
For external attenuator values and internal attenuator settings for DHU BTS power values of +47dBm and +42dBm, please refer to the diagrams in Appendix B.

4.2.7 Repeater Download



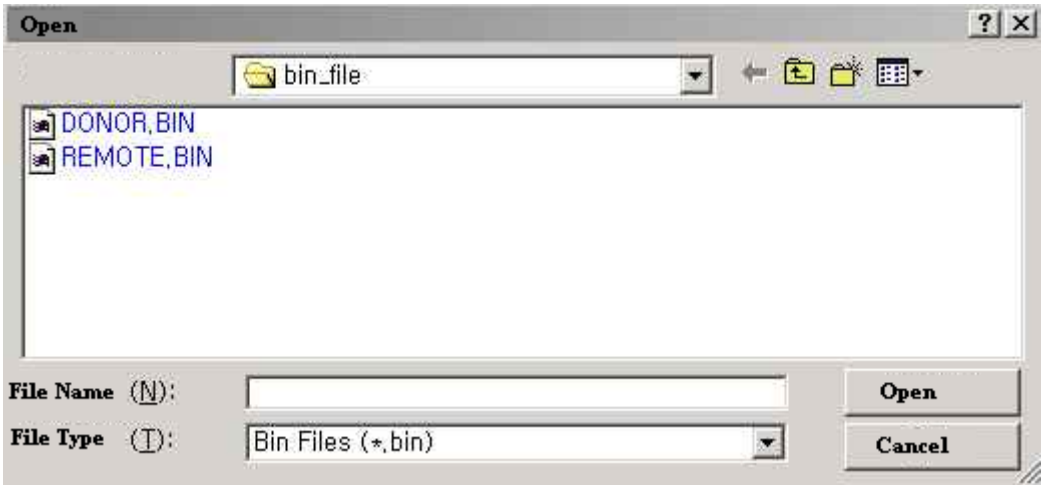
[Figure 4.12] Select "Download"

In order to download a new firmware version to a repeater, right-click the desired repeater and select "Down Load" from the drop down menu as illustrated in Figure 4.10 above. This will generate a new Download window as shown in Figure 4.11 below.



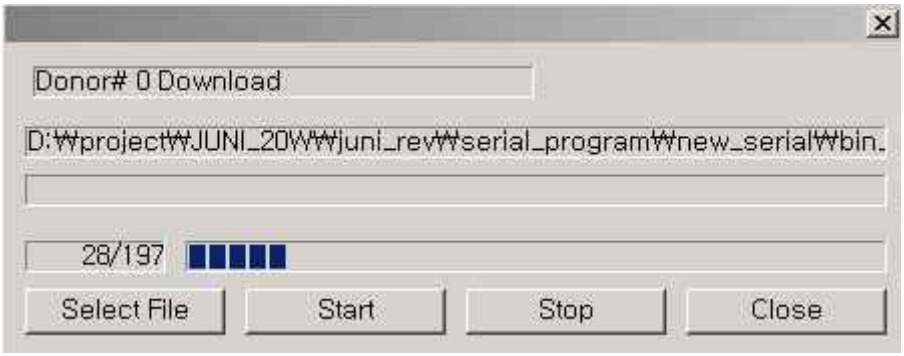
[Figure 4.13] Download Window

Click "Select File" button to display the Open File window as shown in Figure 4.12 below.



[Figure 4.14] Open File Window

Locate the desired file to download and click the “Open” button. Then click the “Start” button as illustrated in Figure 4.13 to initiate the download process. The monitoring of the download progress may be viewed via the Download bar displayed on the download window. If the “Stop” button is pressed during the download process, the program returns to the original program installed prior to the download process.



[Figure 4.15] File downloading

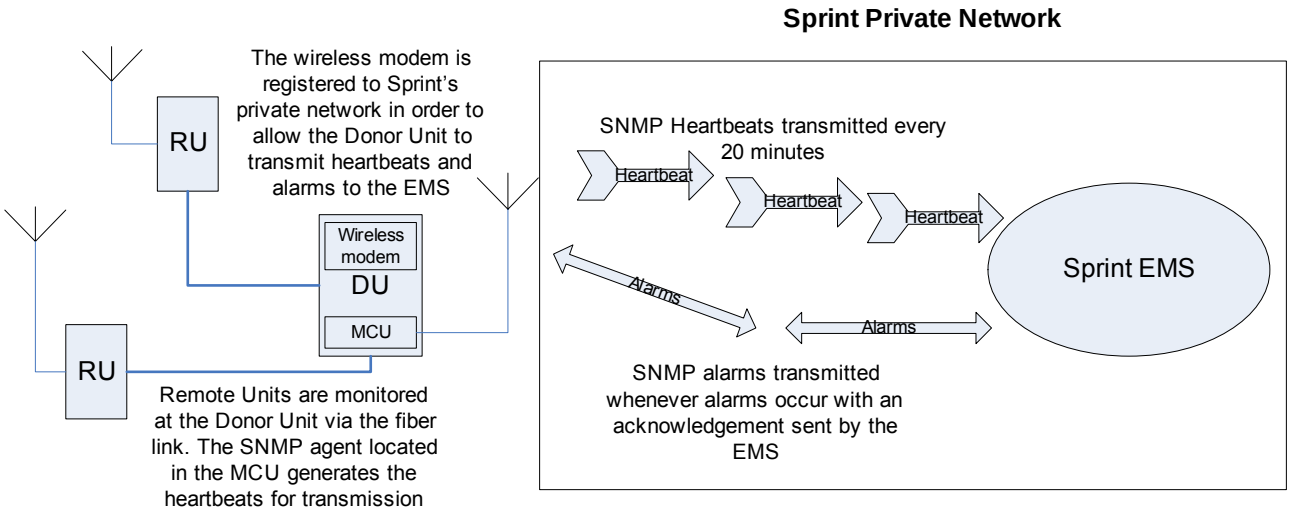
Click the “OK” button at the end of the download as illustrated below in Figure 4.14, to confirm the completion of the download process.

[Figure 4.16] Download Complete Confirmation

4.3 SNMP Operation

4.3.1 Introduction

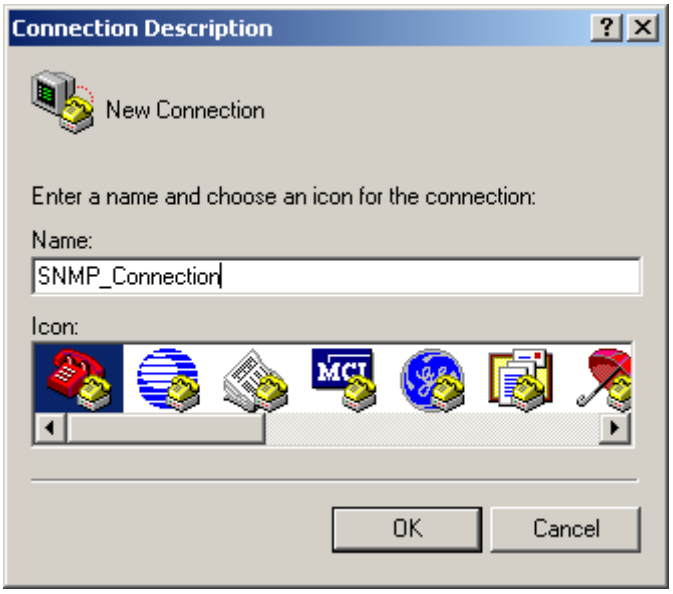
The DHU utilizes a wireless CDMA modem connected to the SNMP agent to transmit SNMP traps and informs to a central Sprint EMS (Element Management Server) on the Sprint private network. The traps, or commonly referred to as a heartbeat, are sent at an interval of every 20 minutes and it a method of notifying 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 which repeater it originates from.



[Figure 4.17] SNMP Operation Overview

4.3.2 Connection Setup for PC to Donor Unit MCU (Master Control Unit)

Connect a RS232C cable from the PC directly to the SNMP debug port on the MCU. Open HyperTerminal in Windows and create a new connection. Enter a session name and press OK.

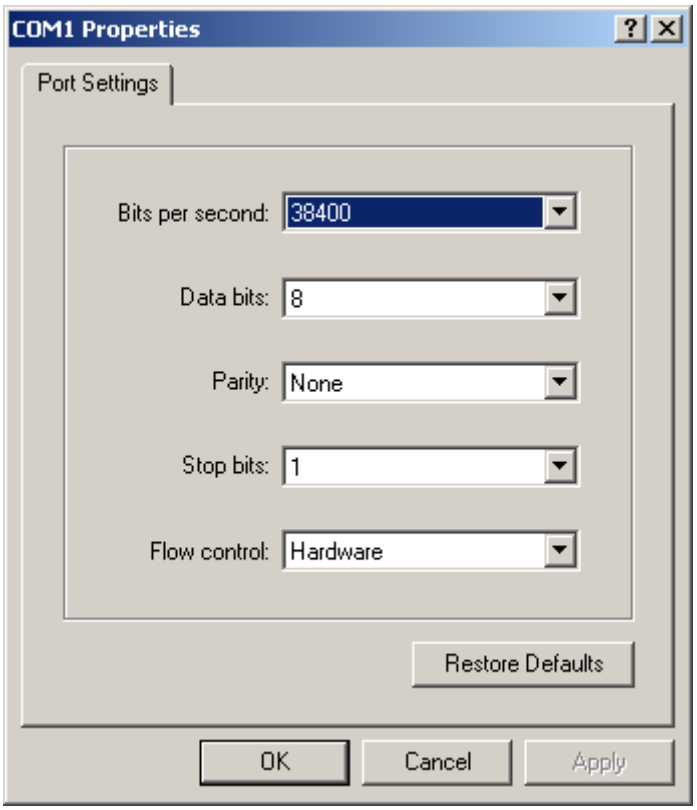


[Figure 4.18] HyperTerminal New Connection

Choose the COM port to which the MCU is connected on the PC and press OK. In this example the modem is connected to COM port 4.

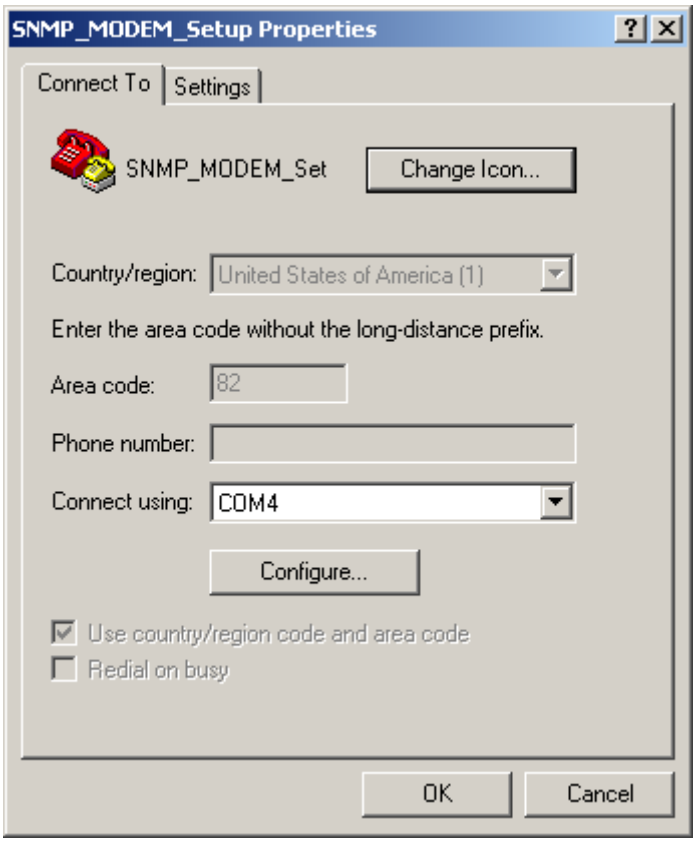
[Figure 4.19] Connection Settings

Choose 38400 Bits Per Second and press OK to enable communication with the MCU.



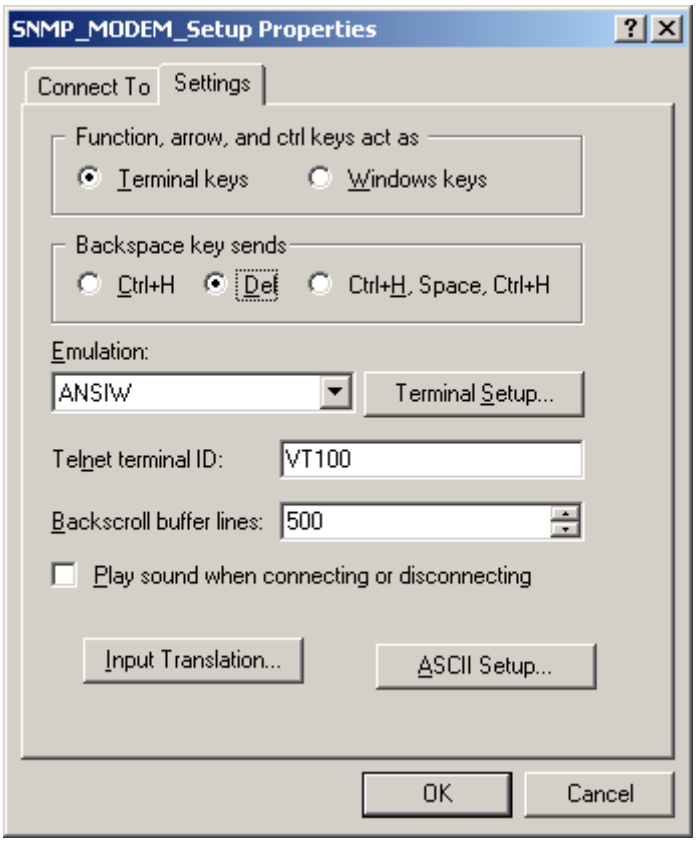
[Figure 4.20] Connection Settings

The session is created and HyperTerminal is now connected to the DHU MCU. Click on File->Properties and on the window select the settings tab.



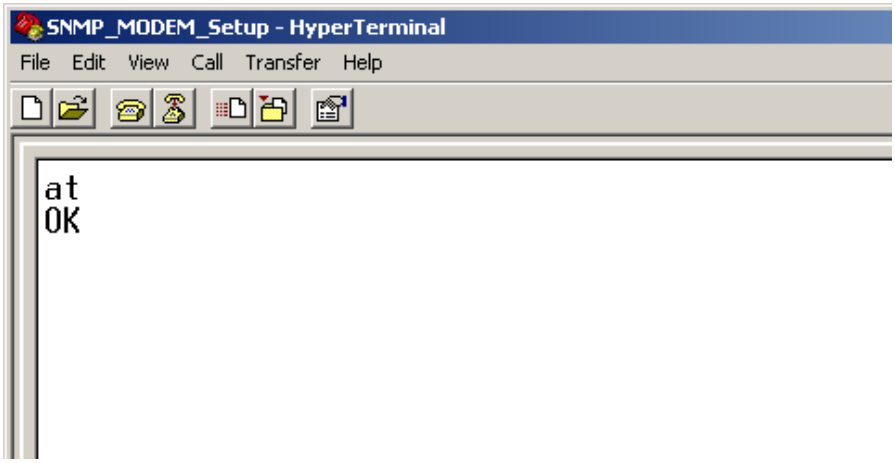
[Figure 4.21] Connection Settings

With the settings tab selected, select ANSIW for the emulation and press OK.



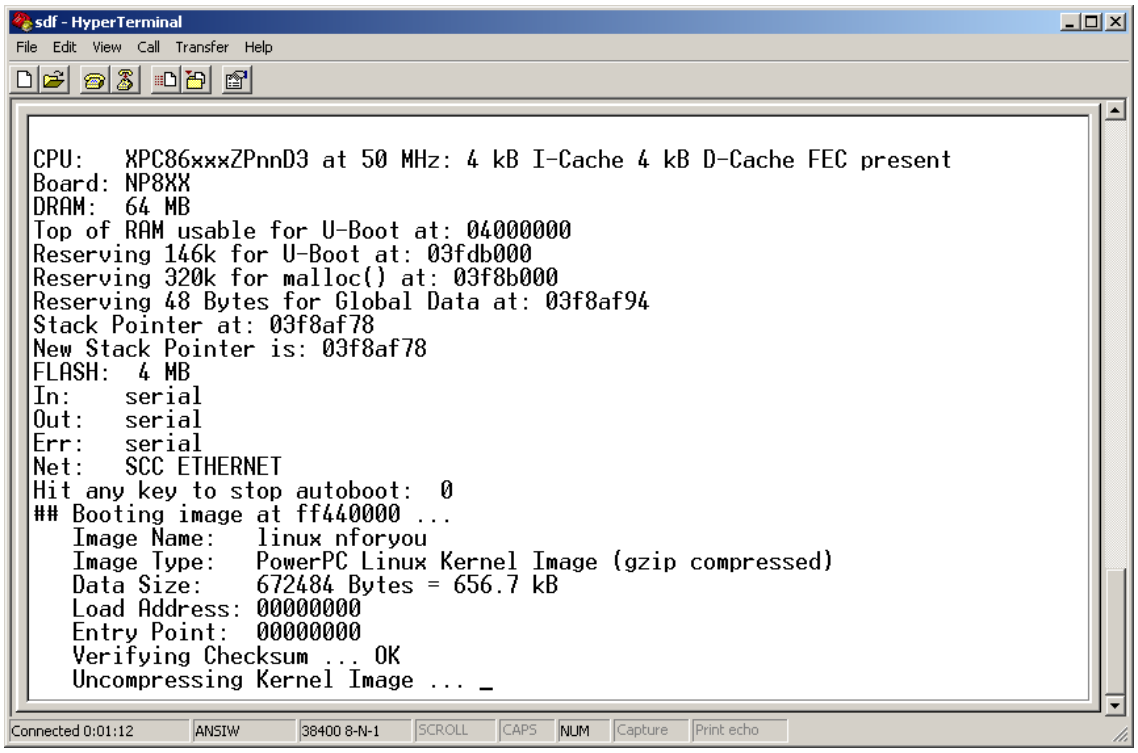
[Figure 4.22] Connection Settings

The session will now allow characters to be typed into the screen in a human readable format. Type “at” or “AT” into the window and an “OK” response should be displayed. This means a direct connection to the MCU has been established and AT commands can now be entered.



[Figure 4.23] Connection Established with Response from Modem

The HyperTerminal should now be ready to accept user input from the keyboard. Once the PC is connected to and can access the MCU, it will display a LINUX command shell such as the figure below.



[Figure 4.24] MCU Start-up Screen Output

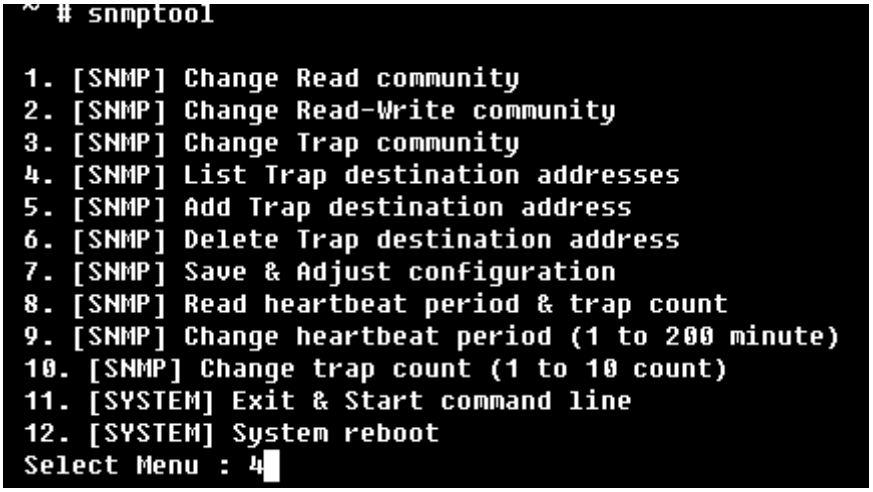
If the screen is blank, press the enter key and a tilde pound (to #) command will be displayed. This means that the MCU is ready to accept input.

Please refer to the next section to view and alter settings on the MCU.

4.3.3 View and Change SNMP Destination IP

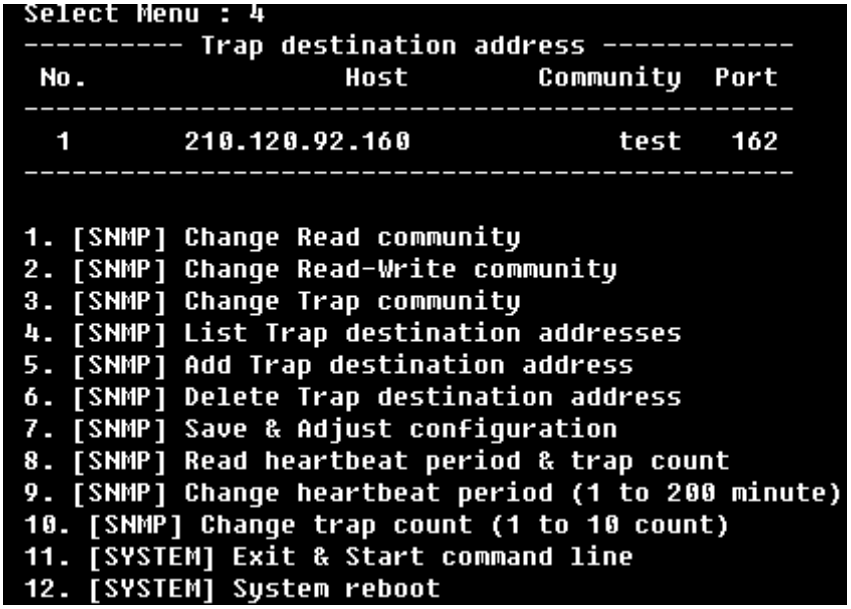
To view and change the SNMP destination IP, the PC should be connected to the MCU via a RS232C cable. With the “to #” command displayed, type in “snmptool” to display the following menu.

Note: Any changes made other than the ones listed below can prevent the SNMP from functioning properly.



[Figure 4.25] SNMP Menu

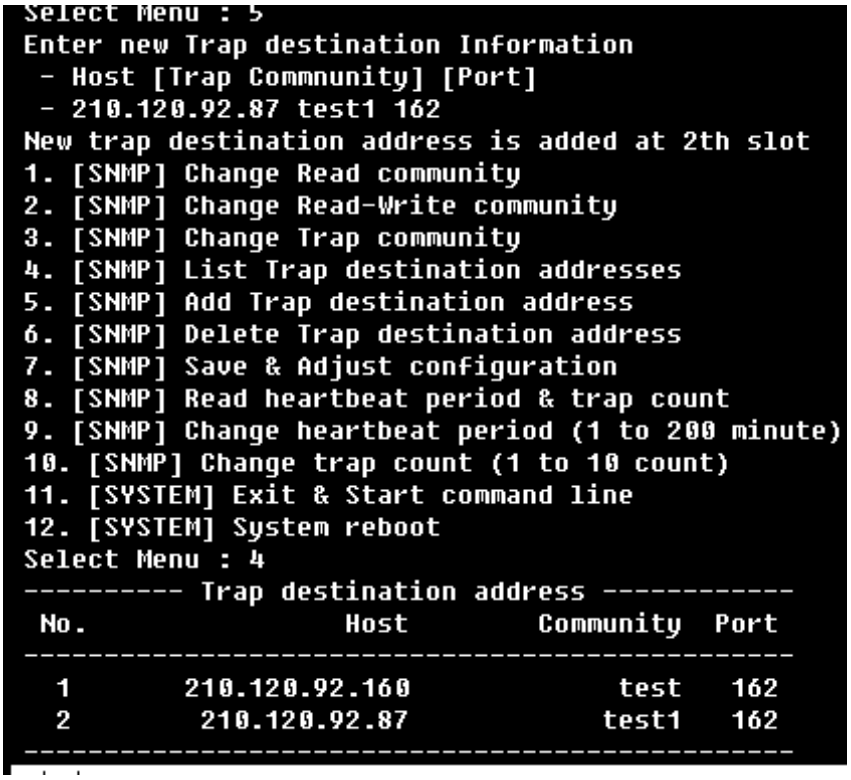
Press 4 and then enter. This will display all the IP addresses to which the traps and informs will be sent.



[Figure 4.26] Display Trap Destination

To enter another or new trap destination address, press 5 at the menu and enter the new IP, community and port separated by a space such as the figure below. To exit

without entering an IP, leave the line blank and enter.



[Figure 4.27] Add Trap Destination

To delete a destination IP, enter 4 to view all the list of IP's and the slot number associated with the IP address. Enter 6 to enter deletion mode and enter the desired slot number.

Once all necessary changes have been made to the IP, press 7 to save and then 11 to return to the normal command prompt.

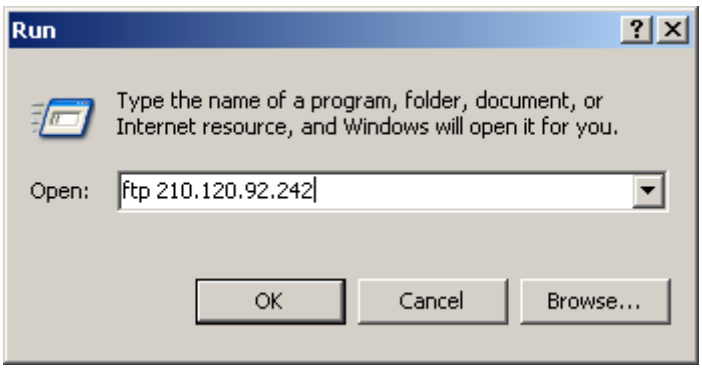
4.3.4 Downloading SNMP History Log

The FFR DHU supports remote downloading of logs via FTP provided the system has been set up accordingly to the previous sections.

Downloading the logs can be done on any computer as long as an internet

connection is available.

Open “Run” in the windows start menu and type in “ftp <IP>”, where <IP> is the IP address assigned to the DHU. An IP of 210.120.92.242 is used as an example in the figure below.



[Figure 4.28] FTP access to Donor Unit

The username and password to log onto the FTP is:

Username: ftp

Password: <blank> (no password required)

To download the logs, enter the following commands in the exact given order.

> lcd c:\

> cd mp202

> get history_log

> get history_snmp_log

> quit

Figure 4.27 shows the response from the FTP server after each command.

```
Connected to 210.120.92.242.
220 Welcome to Stupid-FTPd server.
User (210.120.92.242:(none)): ftp
331 Guest login ok, send your e-mail address as password.
Password:
230 User anonymous logged in.
ftp> lcd c:₩
Local directory now C:₩.
ftp> cd mp202
250 CWD command successful.
ftp> get history_log
200 PORT command successful.
150 Opening BINARY mode data connection for 'history_log' (42836 bytes).
226 Transfer complete.
ftp: 42836 bytes received in 0.04Seconds 1070.90Kbytes/sec.
ftp> get history_snmp_log
200 PORT command successful.
150 Opening BINARY mode data connection for 'history_snmp_log' (26051 bytes).
226 Transfer complete.
ftp: 26051 bytes received in 0.02Seconds 1302.55Kbytes/sec.
ftp> quit
```

[Figure 4.29] FTP Commands

4.3.5 Reading and Understanding the SNMP History Log

Once the log has been downloaded locally to a PC, the information below explains what each line of the log means.

Sync Time: Sync time setting successful..

(Synchronization of SNMP agent and modem clock)

Snmp notification, Check Network successful, 07/18/05 17:05:52

(SNMP agent checks the Network Connection to determine connectivity)

Snmp notification, go to AT-NOK mode, 07/18/05 15:54:50

(Notification by SNMP agent that it is now entering Network Online Mode)

SEND[1:0] HeartBeat Trap, 07/18/05 16:14:56

(Transmission of first heartbeat (count=0) within one hour timeframe)

SEND[1:1] HeartBeat Trap, 07/18/05 16:34:58

(Transmission of second heartbeat (count=1) within one hour timeframe)

SEND[1:2] HeartBeat Trap, 07/18/05 16:55:01

(Transmission of third heartbeat (count=2) within one hour timeframe)

Snmp notification, go to offline mode, 07/18/05 17:05:03

(Notification by SNMP agent that it is now entering Offline Mode)

Snmp notification, go to AT-OK mode, 07/18/05 17:05:40

(Notification by SNMP agent that it is now entering AT Command Mode)

AT+CSQ?

(Command is used to ascertain the received signal strength <rssi> and the channel frame rate error <fer>. 255 Represents an unknown signal quality)

+CSQ: 73, 5, 255

(+CSQ: <rssi>,<fer>)

AT+WIND?

(General mechanism to send unsolicited non-standardized indications to the application)

+WIND: 8

(Indicates that the product is ready to process all AT commands)

Sync Time : Reset Modem H/W

(The modem has retried ten times unsuccessfully to synchronize the SNMP and modem clock. The modem undergoes a hardware reset to retry synchronizing.)

5. System Maintenance

This section explains the JF43 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. All other failed internal components will require Juni engineers to replace and test the units.

5.1 Periodic Maintenance

The JF43 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 NEMA 4X enclosure ensures that the JF43 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 MCU 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 top of the RU.
2. Turn off the fan at the fan controller.
3. To perform maintenance on the fan for the RU, turn the eye bolts at the top of the RU a quarter turn to unlock the fan compartment and then slide it out of the RU. The fan compartment has a draw stud which latches onto a predefined hole to prevent the fan compartment from falling out.
4. Pull out the fan compartment firmly to release the stud from its hole. Do not pull on it too hard as a 24V power cable is directly connected to the fan compartment.
5. 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.
6. 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 JF43 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 optical. 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, RU LED's
- LMT software Graphical User Interface (GUI)

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

The LMT software 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	AC FAULT		**Indicates the status of the main input power**
		Green ☐	The DC power source is on
		Red ☐	The DC power source is off
	DC FAULT		**Indicates the status of the DHU DC power supply**
		Green ☐	The power supply is normal
		Red ☐	The power supply has failed due to faulty circuit or connection
	FAN FAULT		**Indicates the status of the FAN on the DHU**
		Green ☐	The fan is normal
		Red ☐	The fan has failed
	BATT. FAULT		**Indicates the status of the backup battery**
		Green ☐	The battery is functioning normally
		Red ☐	The battery has failed or is not providing power
	DOOR OPEN		**Indicates the status of the door on the DHU**
		Green ☐	The door is closed
		Red ☐	The door is open

	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
	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
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
LOCAL AMP	UL0 RF FAULT	Green ☐ Red ☐	**Indicates the state of the Uplink0 amplifier** The amplifier is functioning normally The amplifier has failed or the RF power output has shutdown

	UL1 RF FAULT	Green ☐ Red ☐	**Indicates the state of the Uplink1 amplifier** The amplifier is functioning normally The amplifier has failed or the RF power output has shutdown
	UL1 LOCK FAULT	Green ☐ Red ☐	**Indicates the state of the Rx Local Oscillator (in the optic module)** The UL1 local oscillator is normal The Rx local oscillator has lost phase lock and may have a frequency error
	LOCAL AMP	Green ☐ Red ☐	**Indicates the state of the local amplifier** The amplifier is functioning normally The amplifier has failed or the RF power output has shutdown
SAW	SAW LOCAL FAULT	Green ☐ Red ☐	**Indicates the state of the downlink SAW local oscillator** The local oscillator is normal The local oscillator (in the SAW Tx module) has lost phase lock and may have a frequency error

[Table 5.1] 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

	FAN0 FAULT	 Green ☐ Red ☐	**Indicates the status of FAN 0 on the RU** The fan is normal The fan has failed
	FAN1 FAULT	 Green ☐ Red ☐	**Indicates the status of FAN 1 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
	DOOR OPEN	 Green ☐ Red ☐	**Indicates the status of the door on the RU** The door is closed The door is open
	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	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
	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
FWD OUTPUT POWER	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
RF	DL/UL AMP FAULT	Green ☐ Red ☐	**Indicates if the uplink or downlink is normal or has failed** The UL/DL amp is normal The UL/DL amp has died or shutdown
	UL0/1 LNA	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
	UL0/1 SAW AMP FAULT	Green ☐ Red ☐	**Indicates the status of the UL0/1 SAW amplifier** The UL0/1 SAW amp is functioning correctly The UL0/1 SAW amp is not functioning correctly. Check the module gain
	SAW LOCAL AMP FAULT	Green ☐ Red ☐	**Indicates the status of the local drive amplifier** The local amplifier is normal The local amplifier is faulty. Check the frequency of the output signal.
	SAW LOCAL LOCK FAULT	Green ☐ Red ☐	**Indicates the status of the local oscillator** The local oscillator is normal The local oscillator (in the SAW module) has lost phase lock and may have a frequency error

[Table 5.2] Remote Unit Alarm Items

5.3 Trouble Shooting for the Donor Unit

Module	Alarm	Possible Reason	Action Required	Action (If problem persists)
Optic	LD	LD Fault	- Change LD	Send back to Juni for Repair
	PD	Bad optic input level	- Inspect optic input level and check the optic line - Clean optic connector - Change the PD module	Send back to Juni for Repair
	Optic RF fault	Optic module AMP Fault	Change the Module	Send back to Juni for Repair
UL	UL0 RF fault	UL0 path AMP Fault	- Check the module gain - Change the Module	Send back to Juni for Repair
	UL1 RF fault	UL1 path AMP Fault	- Check the module gain - Change the module	Send back to Juni for Repair
SAW	Local AMP	UL1 local signal path AMP Fault	- Check the Local signal output level - Change the module	Send back to Juni for Repair
	UL1 rock fault	UL1 local signal Fault	- Check the frequency of output signal - Change the module	Send back to Juni for Repair
	SAW local fault	Local drive AMP fault	- Check local oscillator signal in the SAW module	
Environment	AC fault	AC Voltage Fault	- Check AC voltage - Change PSU	Send back to Juni for Repair
	DC fault	DC Voltage Fault	- Check DC voltage - Check Battery voltage - Change PSU	Send back to Juni for Repair
	BATT fault	When there is no battery	- Check Battery cable - Change PSU	Send back to Juni for Repair
	Fan fault	Fan Fault	- Check Fan - Change Fan	Send back to Juni for Repair
	Door open	Door open	- Check Door - Check the cable of door switch - Change MUC	Send back to Juni for Repair
	Hi temp	When temp is higher than upper limit	- Check temperature and limit - Inspect the reason of temp increase(ex. Fan or over power)	
	Low temp	When temp is lower than lower limit	- Check temperature and limit - Inspect the reason of temp decrease	

[Table 5.3] Donor Unit Trouble Shooting Guide

5.4 Trouble Shooting for the Remote Unit

Module	Alarm	Possible Reason	Action Required	Action (If problem persists)
Optic	LD	LD Fault	Change LD	Send back to Juni for Repair
	PD	Bad optic input level	- Inspect optic input level and check the optic line - Clean optic connector - Change the PD module	Send back to Juni for Repair
	Optic RF fault	Optic module AMP Fault	- Change the Module	Send back to Juni for Repair
RF	DL/UL AMP fault	DL/UL Drive AMP Fault	- Check the module gain - Change the Module	Send back to Juni for Repair
	UL0/1 LNA fault	LNA AMP Fault	- Check the module gain - Change the module	Send back to Juni for Repair
SAW	UL0/1 SAW AMP fault	UL0/1 SAW AMP Fault	- Check the module gain - Change the module	Send back to Juni for Repair
	SAW local lock fault	SAW local signal Fault	- Check the frequency of output signal - Change the module	Send back to Juni for Repair
	SAW local fault	Local drive AMP Fault	- Check local signal level - SAW local signal	
Environment	AC fault	AC Voltage Fault	- Check AC voltage - Change PSU	Send back to Juni for Repair
	DC fault	DC Voltage Fault	- Check DC voltage - Check Battery voltage - Change PSU	Send back to Juni for Repair
	BATT fault	When there is no battery	- Check Battery cable - Change PSU	Send back to Juni for Repair
	Fan fault	Fan Fault	- Check Fan - Change Fan	Send back to Juni for Repair
	Door open	Door open	- Check Door - Check the cable of door switch - Change MCU	Send back to Juni for Repair
	Hi temp	When temp is higher than upper limit	- Check temperature and limit - Inspect the reason of temp increase(ex. Fan or over power)	

	Low temp	When temp is lower than lower limit	- Check temperature and limit - Inspect the reason of temp decrease	
PA	Over Power	Alarm: >46dBm±0.5dB Shutdown: >47dBm±0.5dB	- Check input level - Check output level	
	Over Temp	Alarm: 80to85°C Shutdown: >85°C Auto recovery: <75°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 - Change LPA	Send back to Juni for repair if problem continues
	DC Fail	≤ 19.5V DC or ≥ 30.5V DC	- Check DC power	
	Link Fail	No communication with RSM	- Check Data Cable - Check connector	
	PA on/off	@LPA power off	- Change LPA	Send back to Juni for Repair
Forward Output Power	Hi Power	When output power is higher than upper limit	- Check output power level - Check setting limit	
	Lo Power	When output power is lower than lower limit	- Check output power level - Check setting limit	

[Table 5.4] Remote Unit Trouble Shooting Guide

7. System Maintenance

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

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

Attn: Juni JF-43 Technical Group

9825 Willows Rd NE #100,

Redmond, WA, 98052, USA

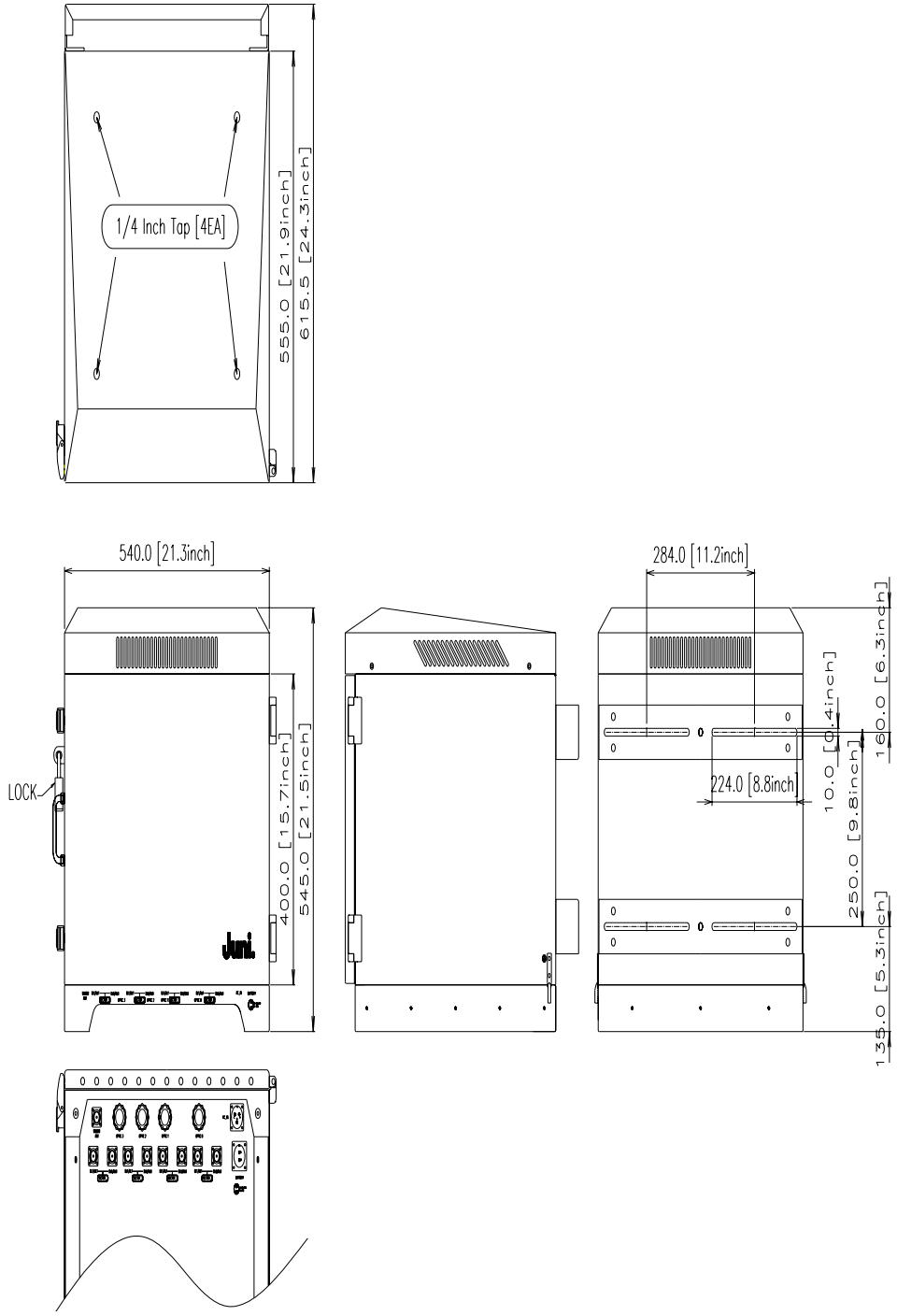
Prior to making a call or request, please have the following pieces of information ready to speed up the help process:

- Repeater serial number
- The repeater Site ID

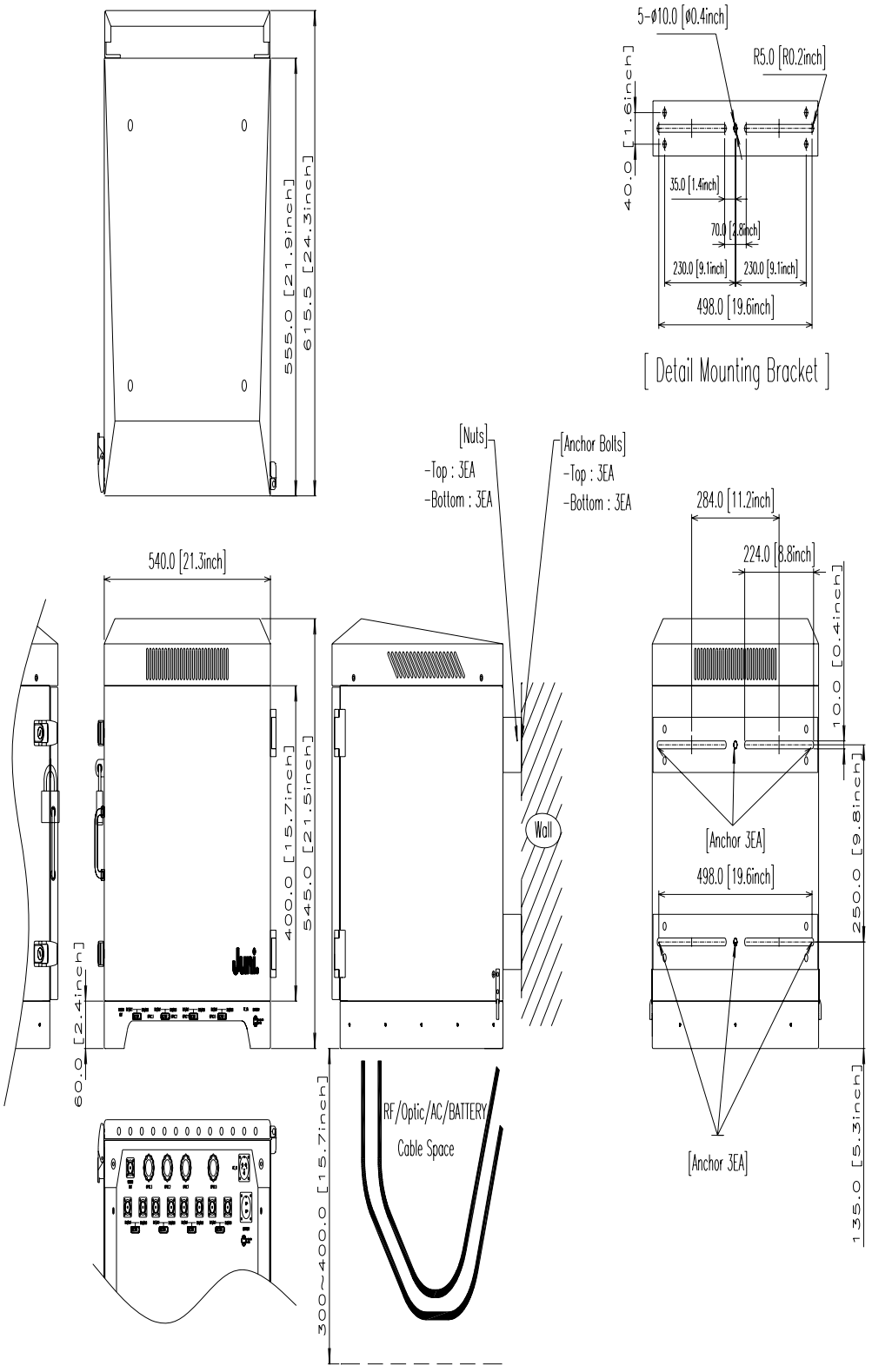
Contents herein are current as of the date of publication. Juni reserves the right to change the contents without prior notice.

Appendix A. JF-43 Mechanics

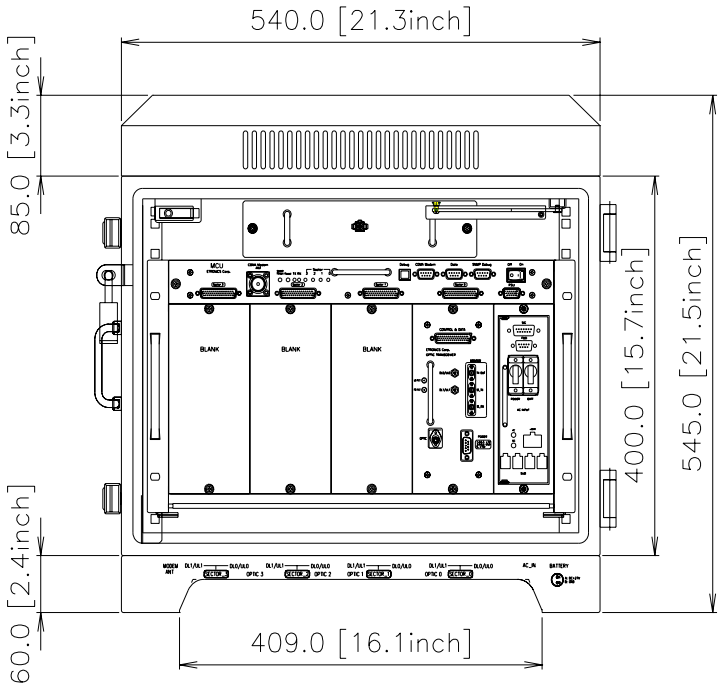
1. Donor Unit



[Figure A1.1] Donor Unit

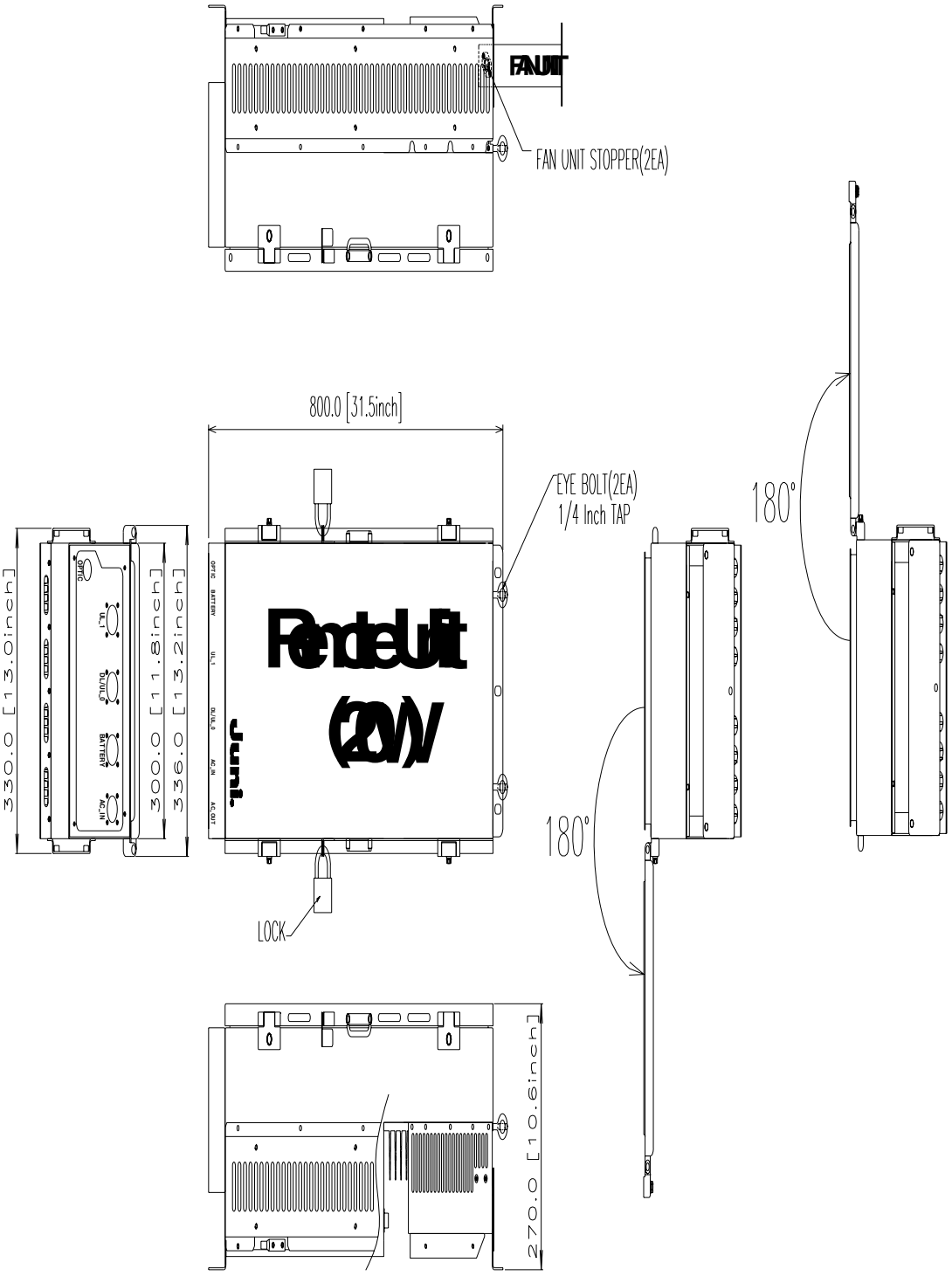


[Figure A1.2] Donor Unit Wall Mounting

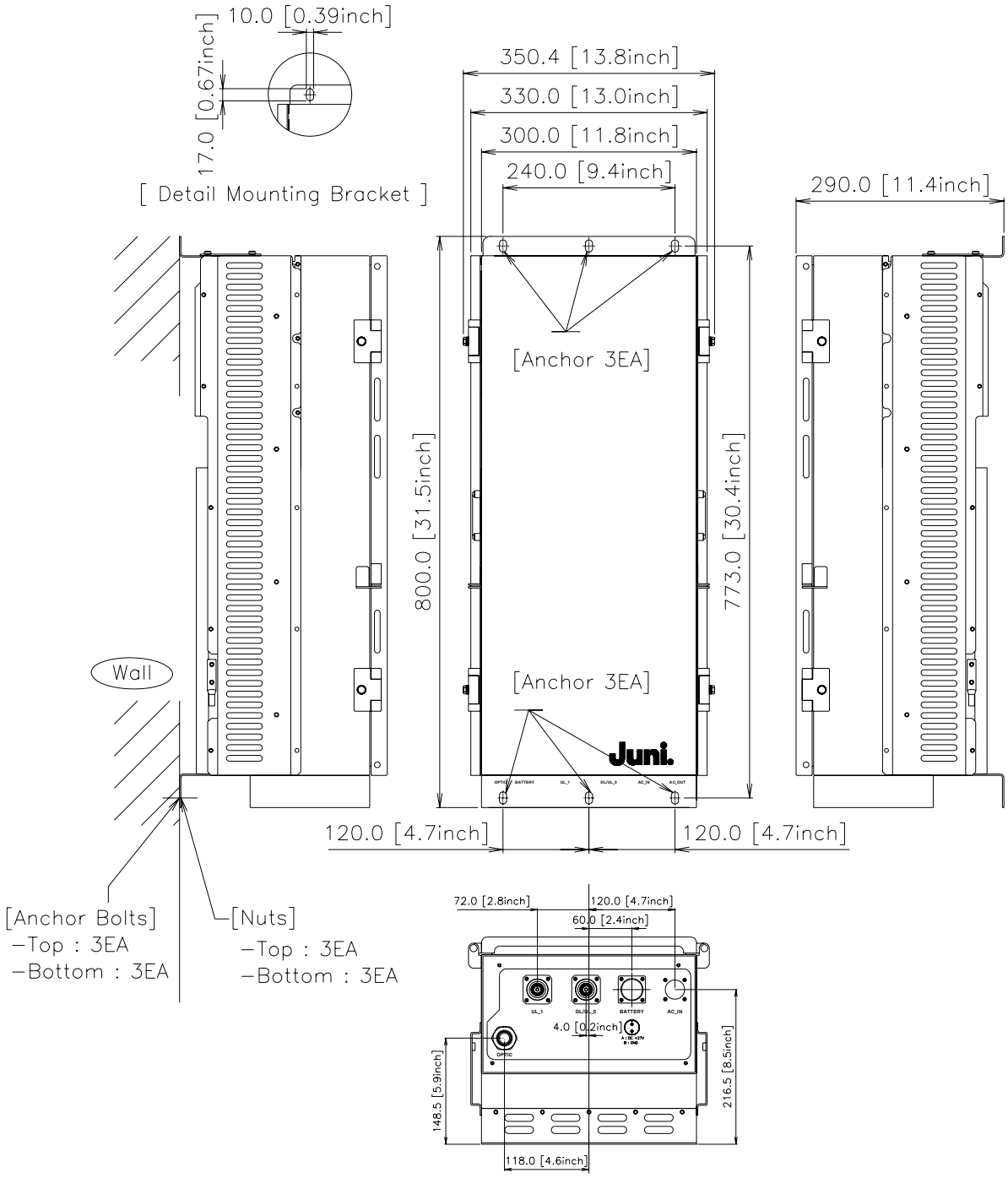


[Figure A1.3] Donor Unit Front View

2. Remote Unit

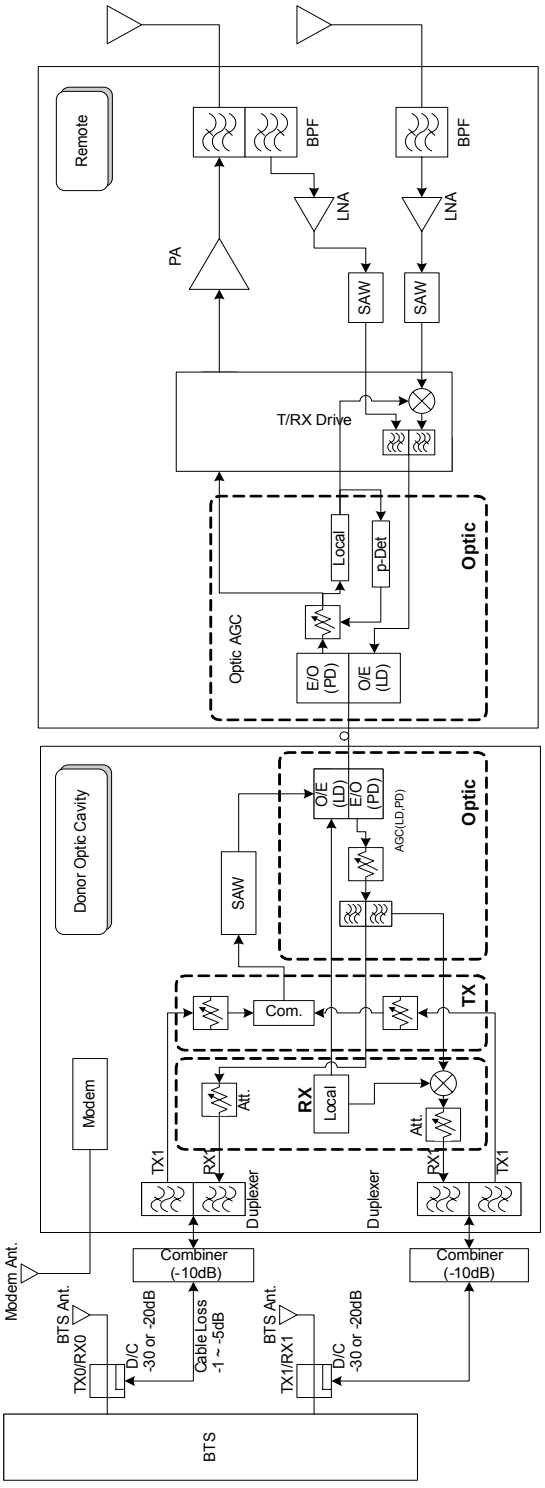


[Figure A2.1] Remote Dimensions

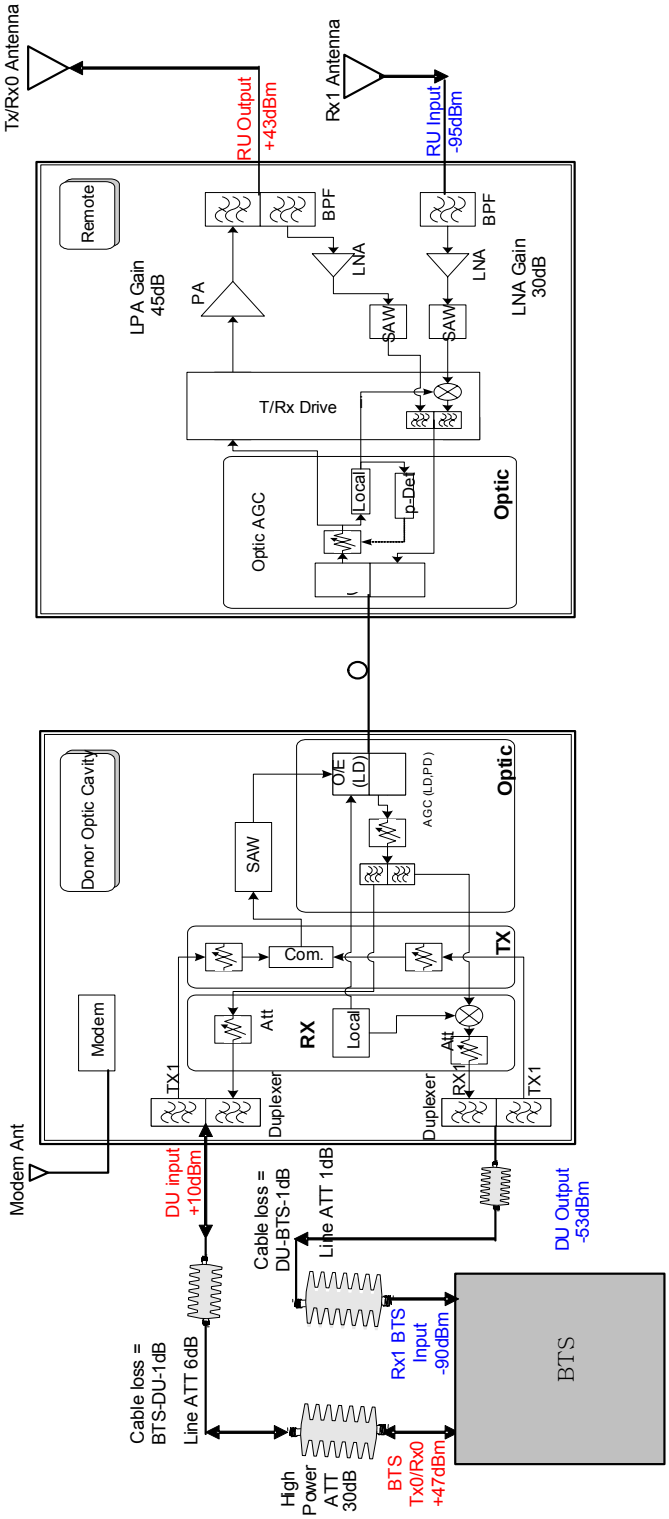


[Figure A2.2] Remote Unit Wall Mounting

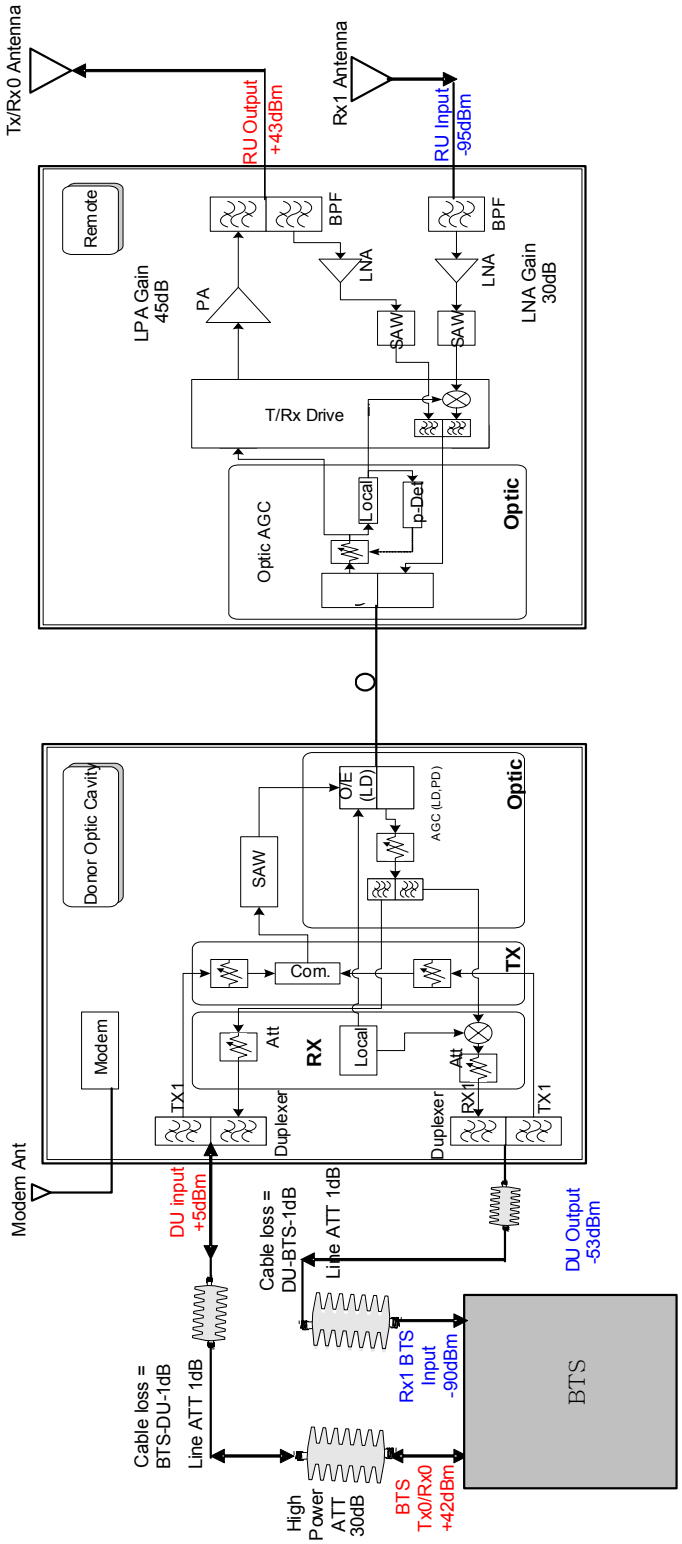
Appendix B. Block Diagram



[Figure B1.1] System Block Diagram



[Figure B1.2] Donor Unit BTS Output Power Value of +47dBm



[Figure B1.3] Donor Unit BTS Output Power Value of +42dBm

Appendix C. LVAC Cables and Connectors Installation Guide (Corning Gilbert)

The installation guide by Corning Gilbert details the process of how to prepare the cable, cut the stinger of the male connector and the assembly of all the cables and connectors. This final cable assembly will power the RU for LVAC applications.