SDR Modular Repeater

USER MANUAL

Version 0.4

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Glossary

The following is a list of abbreviations and terms used throughout this document.

Abbreviation/Term	Definition
AGC	Automatic Gain Control
ALC	Automatic Level Control
AROMS	ADRF' Repeater Operation and Management System
BTS	Base Transceiver Station
CDMA	Code Division Multiple Access
CFE	Compact Front End
CW	Continuous Wave (un-modulated signal)
DAS	Distributed Antenna System
DL	Downlink
Downlink	The path covered from the Base Transceiver Station (BTS) to the subscribers service area via the repeater
HPA	High Power Amplifier
HW	Hardware
IF	Intermediate Frequency
LNA	Low Noise Amplifier
LTE	Long Term Evolution
MS	Mobile Station
PLL	Phased Locked Loop
PS	Power Supply
RF	Radio Frequency
SQE	Signal Quality Estimate
SW	Software
UL	Uplink
Uplink	The path covered from the subscribers service area to the Base Transceiver Station(BTS) via the repeater
VSWR	Voltage Standing Wave Ratio

Released version: 0.4

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Revision History

Version	Author	Description	Date
0.1	Sun Kim	Initial Release	January 18, 2011
0.2	Sun Kim	Revised max gain levels for SMR module	May 10, 2011
0.3	Sun Kim	Revised Band Selection section on the Install Page	July 15, 2011
0.4	Sun Kim	Update illustrations and changes to specifications; added Closeout Package, User Log, and Backup sections	July 19, 2011

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1. SDR Repeater

1.1 Introduction

Four technologies in one body: SDR is an over-the-air repeater system that can incorporate up to four (4) technologies in one body. Current supported technologies are SMR800, SMR900, PCS, and BRS.

1.1.1 Highlights

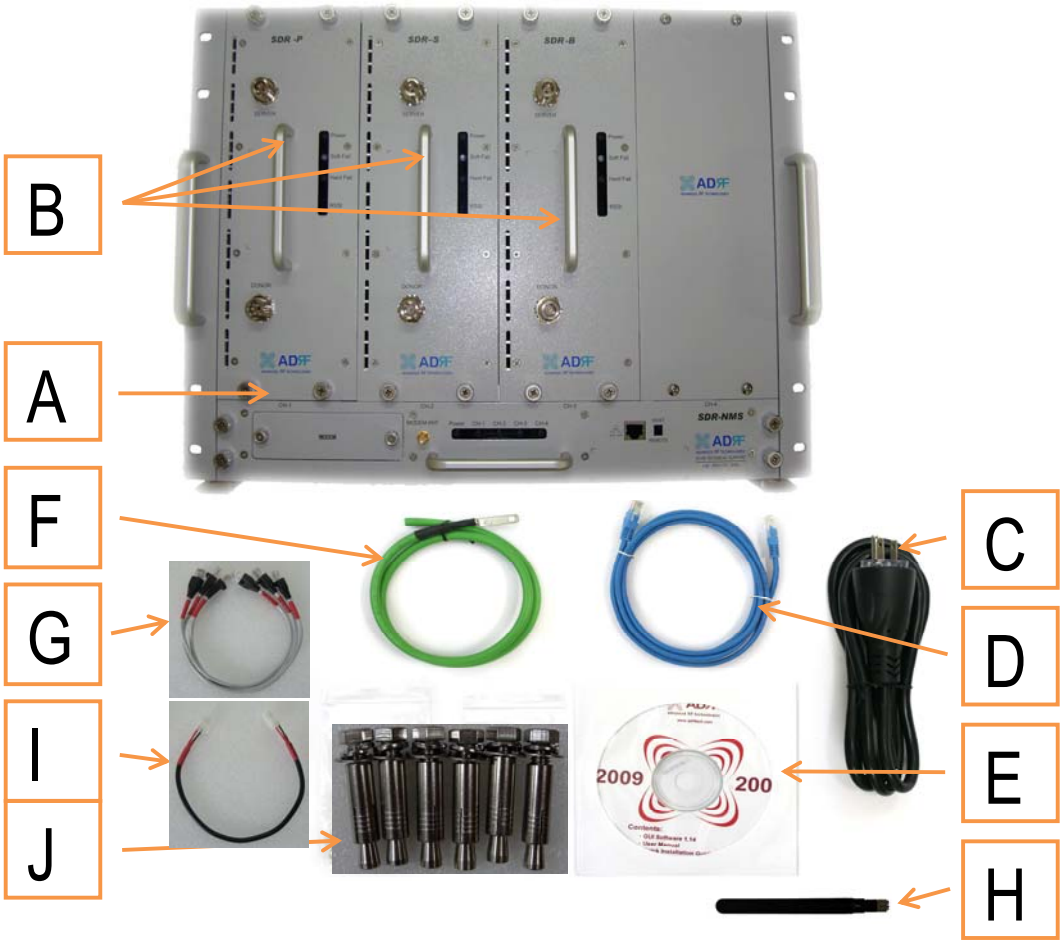
- Supports up to 4 frequency bands simultaneously
    - Covers the SMR800, SMR900, PCS, and BRS, LTE, Cellular, AWS bands
        - [SDR-S]SMR800- Covers 18 MHz
          SMR900- Covers 5 MHz
        - [SDR-P]PCS- Covers 65 MHz
            - 3 independent RF PCS channels, each channel supports 1.25 to 18.75 MHz bandwidth
        - [SDR-B] BRS- Covers 30 MHz
        - [SDR-700]LTE- Covers A+B:12MHz , C:11MHz
        - [SDR-C]Cellular- Covers 25MHz
        - [SDR-A] AWS- Cover 45MHz

- Composite Output Power of 24 or 30 dBm
- 30 dB AGC Range @ 0.5 dB Step
- Adjustable AGC Output Power Level
- Adjustable ALC Level
- Band Selectable via Web-GUI
- Can Support up to 3 Non-Contiguous Bands on the PCS module
- Supports Network Management Monitoring System via SNMP
- Adjustable FA (3 channels)
- Digital filtering
- Incremental Automatic Shutdown/Resumption Time: SDR gradually increases the time span between automatic shutdown and resumption before it permanently shuts itself down
- Versatility and Usability: SDR gives total control to the user. Most of the control parameters, e.g., gain, output power, alarm threshold, etc. can be changed using the Web-GUI so that the user can adjust the system perfectly to the given RF environment
- Web-GUI connectivity via DHCP
- Supports DHCP; No 3rd party GUI software required
- Automated installation

1.1.2 Parts List

Label	Quantity	Description
A	1	SDR Network Management System (NMS)
B	Up to 3*	Optional SDR Modules*
C	1	AC Power Cable
D	1	Ethernet Cable (Crossover)
E	1	Documentation CD**
F	1	Ground Cable
G	3	Channel Data Cable
H	1	Dipole Antenna
I	1	NMS Power Cable
J	6	Anchor Bolt

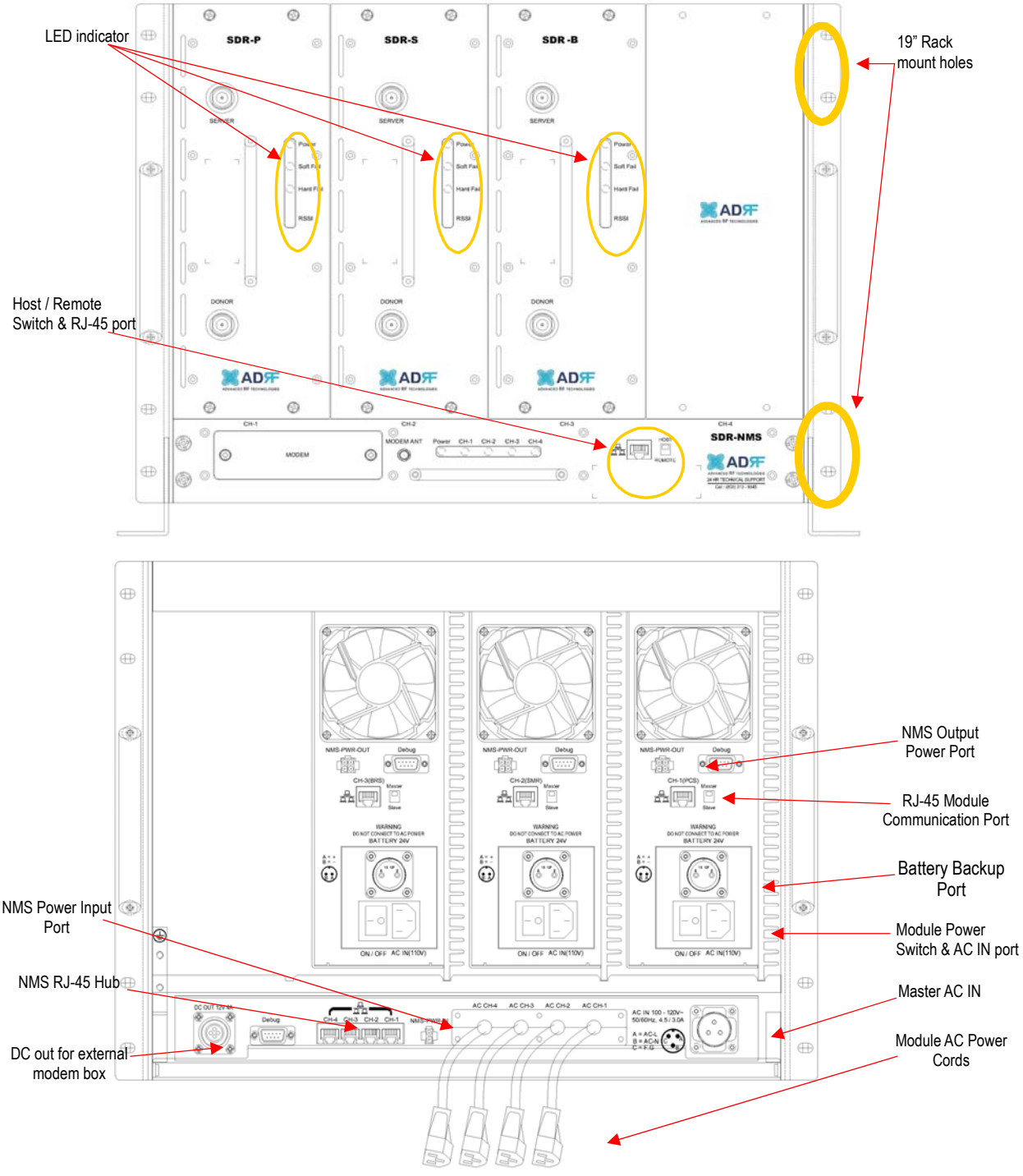
Table 1 – Parts List



** At least 1 module must be present in order to use SDR*
*** CD includes: User Manual, Quick-Start Guide, and Troubleshooting Guide*

Figure A – SDR Repeater Parts List

1.1.3 Repeater Quick View



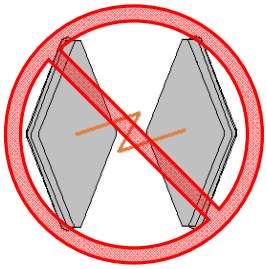
2. Warnings and Hazards

WARNING! ELECTRIC SHOCK

Opening the SDR could result in electric shock and may cause severe injury.

WARNING! EXPOSURE TO RF

Working with the repeater while in operation, may expose the technician to RF electromagnetic fields that exceed FCC rules for human exposure. Visit the FCC website at www.fcc.gov/oet/rfsafety to learn more about the effects of exposure to RF electromagnetic fields.



WARNING! DAMAGE TO REPEATER

Operating the SDR with antennas in very close proximity facing each other could lead to severe damage to the repeater.

RF EXPOSURE & ANTENNA PLACEMENT Guidelines

Actual separation distance is determined upon gain of antenna used.

Please maintain a minimum safe distance of at least 150 cm while operating near the donor and the server antennas. Also, the donor antenna needs to be mounted outdoors on a permanent structure.

WARRANTY

Opening or tampering the SDR will void all warranties.

Lithium Battery: CAUTION. RISK OF EXPLOSION IF BATTERY IS REPLACED BY INCORRECT TYPE. DISPOSE OF USED BATTERIES ACCORDING TO INSTRUCTIONS.

Ethernet Instructions: This equipment is for indoor use only. All cabling should be limited to inside the building.

FCC Part 15 Class A

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their own expense.

CAUTION

Double Pole/Neutral Fusing.

3. SDR Overview

3.1 Switches & Fault Indicators

3.1.1 NMS and Module LED

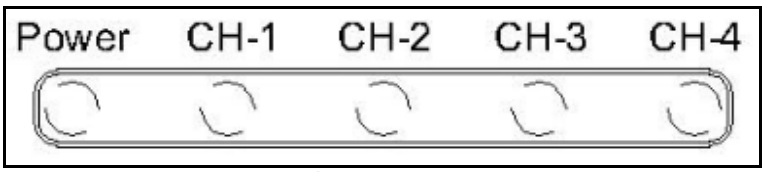


Figure 1: NMS LED

SDR-NMS		Specifications
Power	Solid Green	NMS power is ON
	OFF	NMS is powered OFF
CH-1, CH-2, CH-3, CH-4	Solid Green	Module has communication with NMS
	Solid Red	Module has a communication failure with NMS
	OFF	Module is powered OFF

3.1.2 Module LEDs

SDR has LEDs on the front of the module as shown below in Figure 2.

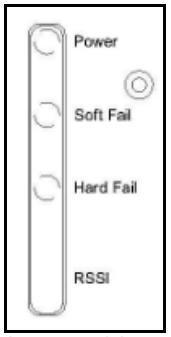


Figure 1: Module LED

SDR-Module		Specifications
Power	Solid Green	Module power is ON
	OFF	Module is powered OFF
Soft Fail	Solid Yellow	Soft Fail alarm exist in the system
	OFF	No Soft Fail alarm are present in the system
Hard Fail	Solid Red	Hard Fail alarm exist in the system
	OFF	No Hard Fail alarms are present in the system
RSSI	Input < -85dBm	Zero (0) bar On
	Input < -75dBm	One (1) bar On
	Input < -65dBm	Two (2) bars On
	Input < -55dBm	Three (3) bars On
	Input < -45dBm	Four (4) bars On
	Input >= -45dBm	Five (5) bars On

3.1.3 Message Board Alarms and Notification

Parameters	Remark
Communication failure	Internal Communication failure
RMF	Field replaceable module failure
RESET	Reset alarm
Heartbeat	Heartbeat
OSC	Oscillation detected
UL RSSI fail	Power at coverage port too high
UL PLL fail	UL Synthesizer failure
H/W fail	Hardware failure
S/W fail	Software failure
UL Emission fail	UL Out-of-band emissions out of spec
DL RSSI fail	Donor Power too high/low
ISO fail	Low isolation
DL PLL fail	DL Synthesizer failure
DL Spur fail	DL Spurious emissions out of spec
Interfere	Interferer power exceeded
Link Fail	Communication error between the module and NMS
Over Temperature	Module is above the normal operating temperature
Under Temperature	Module is below the normal operating temperature
Fan Fail	System has detected an issue with the fan
System Halt	System is in a shutdown state due to a hard fail alarm
DL Signal not detected	DL signal is below the specified level
DL Signal Low	DL signal is below the specified level
Outband overload	System has detected a strong out of band signal
Input overload	In-band incoming signal strength is above max input level
Synthesizer Lock Fail	Issue with internal system amp
DSP Fault	System has detected an issue with the internal DSP chip
DL RF Power	Input + gain does not match the output level (above delta of 6 dB)
Overpower	Output level is above the max output levels
DL Oscillation Alarm	Oscillation has been detected in the system
VSWR	Power is being reflected back to the repeater
AC Fail	Power supply is not operating within specs
DC Fail	Power supply is not operating within specs
Over Current	Power supply is not operating within specs

3.2 Switches and Ports

3.2.1 Power Switch

The AC Power on/off switch is located at the back of each individual module. Each module must be powered on separated. The switch should be powered on after the repeater has been installed properly.

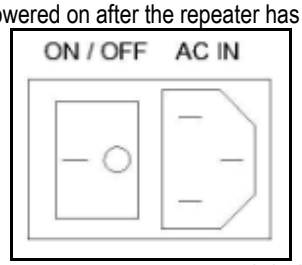


Figure 2: SDR Repeater Power Switch View

3.2.2 Back Up Battery Switch & Battery Port

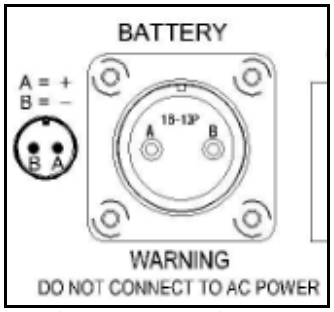


Figure 3: Battery Backup Port

The SDR module can be connected to an ADRF-BBU (ADRF Battery Backup) to provide power during a power failure. If an ADRF-BBU is utilized, connect the ADRF-BBU to the SDR via the external battery port as shown in Figure 4.

(WARNING: The circuit switch on the ADRF-BBU must be set to OFF before connecting the ADRF-BBU to the SDR to prevent damage to the repeater or the ADRF-BBU and personal injury.)

Note: Please contact ADRF Technical Support for assistance if you are unfamiliar with the installation procedure of our battery box.

3.2.3 Ethernet Port and Host/Remote Switch

Ethernet Port

The Ethernet port can be used to communicate directly with the SDR using a RJ-45 crossover cable or can also be used to connect the SDR to an external modem box.

Host/Remote Switch

The Host/Remote Switch allows the user to switch the default Repeater IP, Subnet Mask, and Gateway of the repeater to an alternative setup. These settings can be adjusting by logging into the repeater in HOST mode and configuring the settings under the Modem Box Setting section on the Install Page (section 4.4). Once the settings are set, flipping the switch to the REMOTE position will reboot the repeater with the new alternate settings. *Please note that when the repeater is set to the REMOTE position, DHCP is disabled and the repeater will not automatically assign an IP address to any device that connects directly to the repeater.*

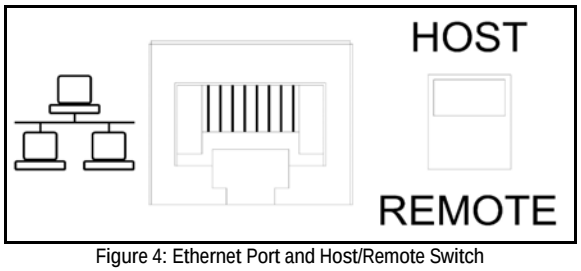


Figure 4: Ethernet Port and Host/Remote Switch

3.2.4 RF Ports

Module RF Ports

Donor and server antennas can be connected directly to the modules or the optional SDR-CHC (channel combiner) can be used to split or combine signals.

Figure 5: RFU RF port

Optional SDR-CHC

An optional channel combiner can be mounted directly above the SDR. The donor portion of the SDR-CHC can be used to split up a combine donor signal into PCS, BRS, and SMR. The server portion of the SDR-CHC can be used to combine the server signals (PCS, BRS, 2.4 GHz WIFI, and SMR) into the Server Sum port. Please contact sales@adrftech.com if you are interested in purchasing the SDR-CHC.

Figure 6: Donor Combiner RF port

3.5 Installation

3.5.1 Wall Mount Procedure

- Verify that the SDR and mounting hole are in good condition
- Remove all SDR modules from the system
- Place the SDR chassis up against the wall so that that module's RF ports face the ceiling
- Mount the SDR chassis to wall use the six (6) mounting hold on the wall mount bracket
- Install the SDR modules into the chassis and secure the module by tightening the four (4) hand screws
- Connect the power and data cables at the bottom on the SDR
- Connect the GND cable
- Connect the Antenna cable
- Connect the Power cable

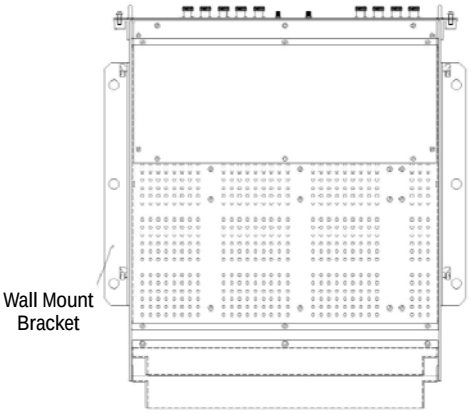


Figure 8: SDR Wall Mount

3.5.2 Rack Mount Procedure

- Verify that the SDR and mounting hole are in good condition
- Remove all SDR modules from the system
- Install the SDR chassis into the 19" rack mount system
- Screw the SDR chassis into the 19" rack mount system using the eight (8) mounting holes
- Install the SDR modules into the chassis and secure the module by tightening the four (4) hand screws
- Connect the power and data cables at the back of the SDR
- Connect the GND cable
- Connect the Antenna cable
- Connect the Power cable

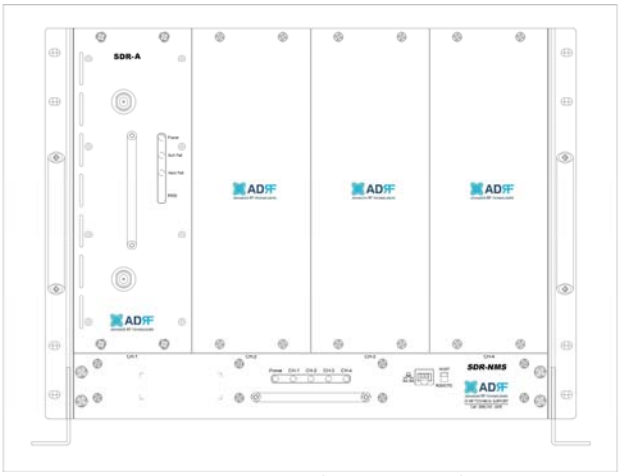


Figure 7: SDR Rack Mount

3.5.3 Grounding

Install the ground cable that has been included in the package at the back of the repeater as show in the figure below.

Figure 8: Ground Cable Connection

3.5.4 Antenna Separation/Isolation

Separation between the antennas is necessary to prevent oscillation. Oscillation occurs when the signal entering the system continually reenters, due to the lack of separation between the donor and server antennas. In other words, the signal is being fed back into the system. This creates a constant amplification of the same signal. As a result, the noise level rises above the signal level.

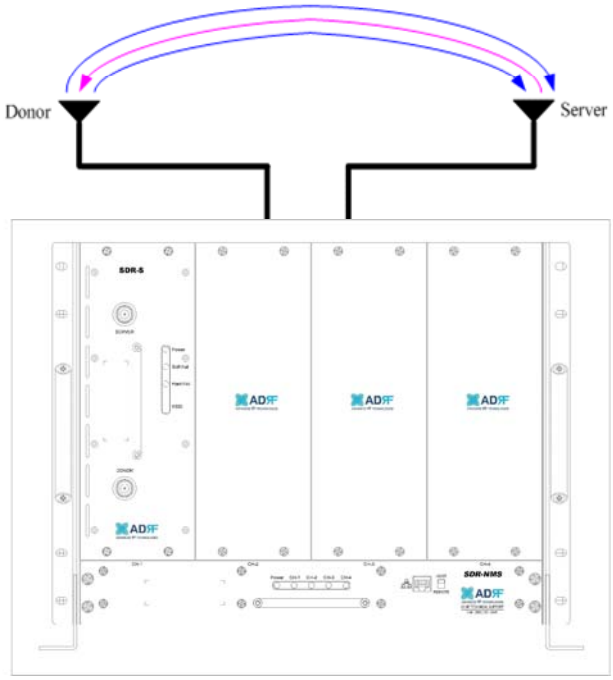


Figure 9: RF Repeater Oscillation

To prevent feedback, the donor and server antennas must be separated by an appropriate distance to provide sufficient isolation. Isolation is attained by separating antennas a sufficient distance so that the output of one antenna does not reach the input of the other. This distance is dependent on the gain of the repeater.

A sufficient isolation value is 13 ~ 15 dB greater than the maximum gain of the repeater. For example, if the gain of the repeater is 50 dB, then an isolation of 63 ~ 65 dB or greater is required. In the same manner, because the SDR has a maximum gain of 90 dB in case of SDR-24, it requires an isolation of at least 103 ~ 105 dB.

3.5.5 Line of Sight

The donor antenna which points towards the base station typically has a narrow beam antenna pattern. As a result, a slight deviation away from the direction of the BTS can lead to less than optimum results. In addition, obstacles between the repeater and the BTS may impair the repeater from obtaining any BTS signal. As a result, the repeater cannot transmit signal to the coverage area. Therefore, a direct line of sight to the BTS for the donor antenna is vital to the function of a repeater. For the same reason, placing the server antenna in direct line of sight of the coverage area is also necessary.

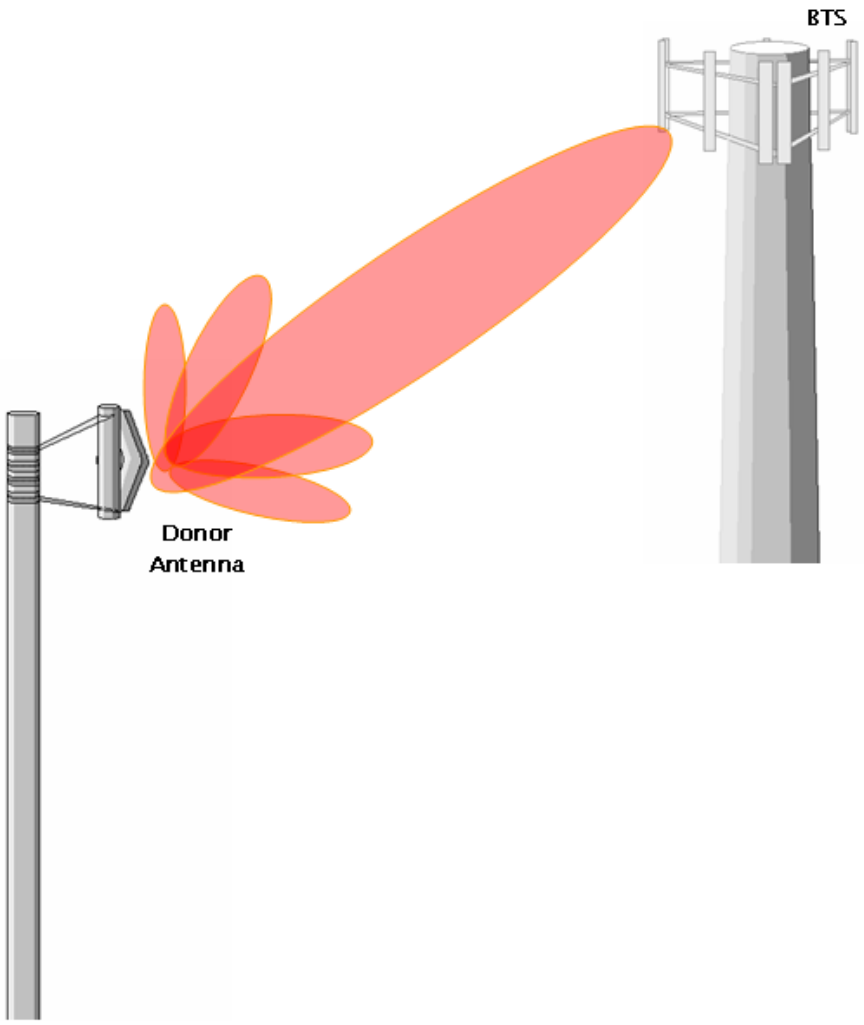


Figure 12 - Direct Line of Sight to the BTS

4. SDR Web-GUI Setup

The Web-GUI allows the user to communicate with the repeater either locally or remotely. To connect to the repeater locally, you will need a laptop with an Ethernet port and a RJ-45 crossover cable. To connect to the repeater remotely, you will need to have an active internet connection and the repeater must have either an internal modem or an Omnibox (ADRF Modem Box) connected to the repeater.

4.1 Repeater/PC Connection Using Web-GUI

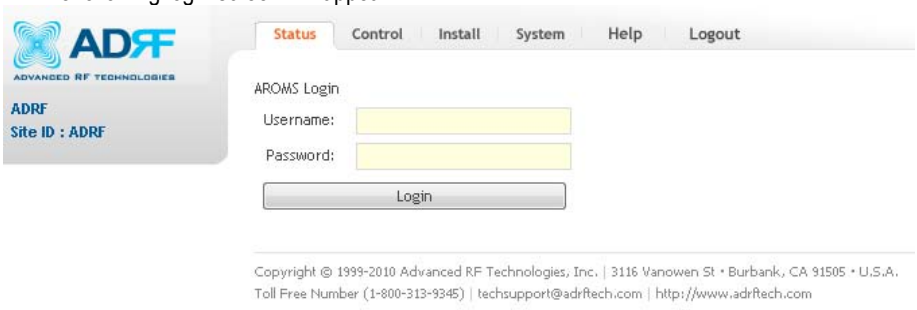
A. Verify that your Local Area Connection is set to Obtain an IP address automatically under the Internet Protocol (TCP/IP) properties
   - If you are connecting to the unit remotely (use of a modem), then skip steps A and B.

B. Connect the RJ-45 crossover cable between the laptop's Ethernet port and the repeater's Ethernet port

C. Launch an Internet Browser

D. Type the following IP address into the address bar of Microsoft Internet Explorer: http://192.168.63.1
   - If you are connecting to the unit remotely, then type the IP address of the modem to connect to the unit

E. The following login screen will appear:

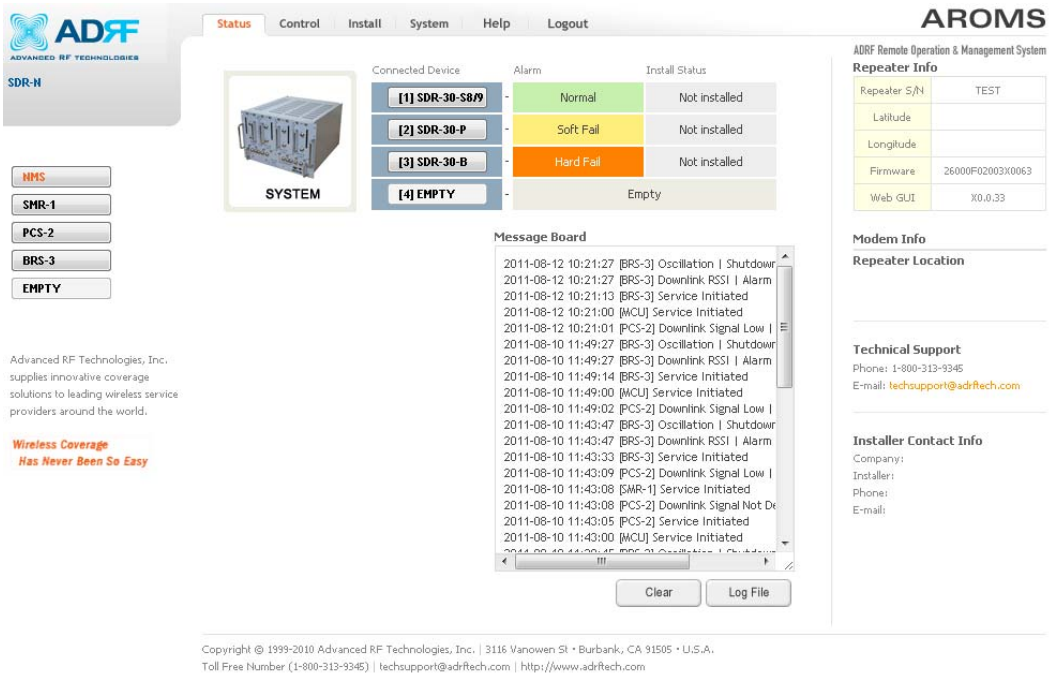


If you are not the Administrator, please type in your assigned username & password which you should have received from the Administrator.

The default username and password for the General User is adrf & adrf, respectively
And the Administrator User is admin & admin, respectively

4.2 Status Tab

4.2.1 Status- NMS



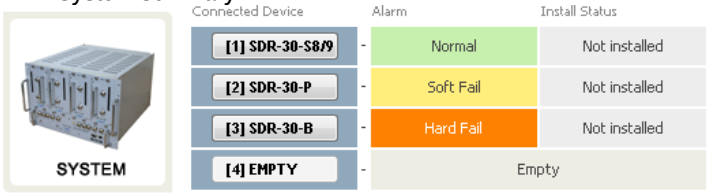
Status- NMS

The NMS Status page provides an overall view of how the system is performing. From the NMS Status page, the user can see if there are any alarms present on any of the modules.

4.2.1.1 Navigation Bar

The navigation bar located on the left hand side of the Web-GUI allows the user to switch between the various modules that are connected to the system.

4.2.1.2 System Summary



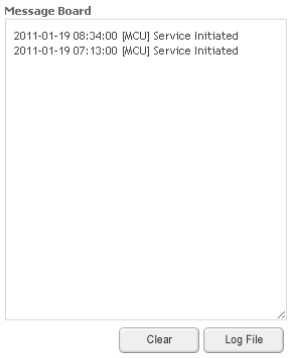
The system summary provide a snapshot of the system is currently performing.

- Connected Device- Displays what modules are connected to the SDR-NMS. Clicking on the buttons in the column will take you to the Status page of that module.
- Alarm- Displays the current alarm status of the individual modules

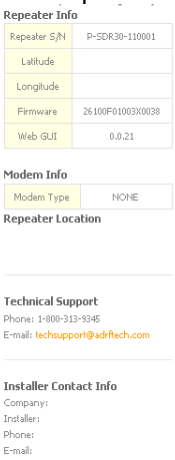
- Install Status- Displays the installation status of the module

4.2.1.3 Message Board

Displays the system events of all connected modules.

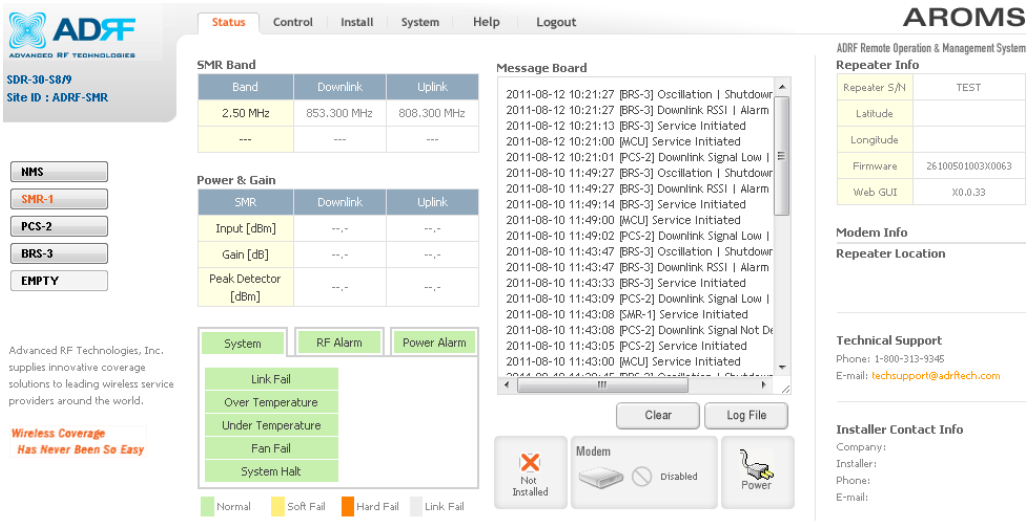


4.2.1.4 Repeater Info / Modem Info / Technical Support / Installer Contact Info

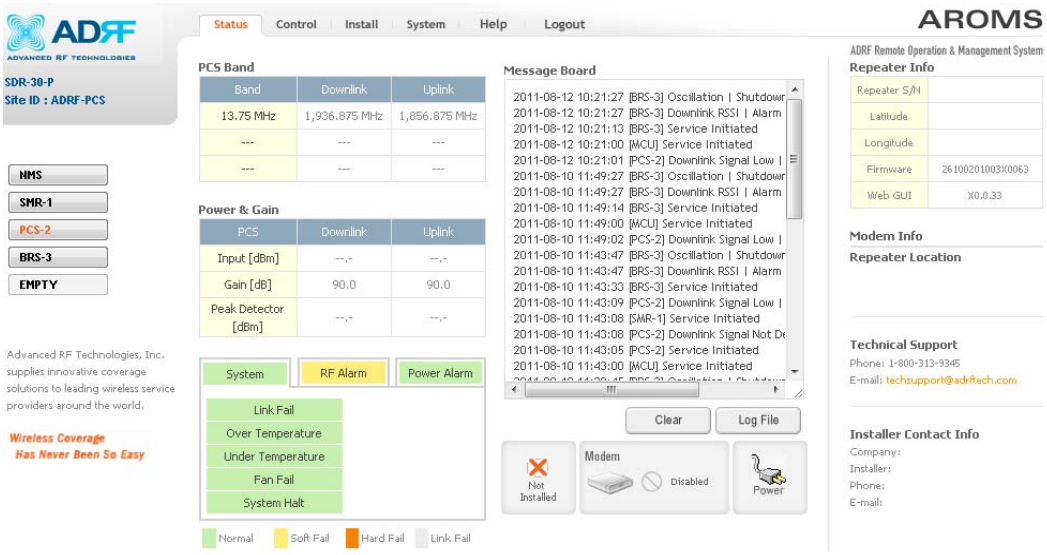


- Repeater Info- Displays the serial number, latitude, longitude, and firmware version of the repeater
- Modem Info- If an internal modem is present, the modem information appears in this section
- Technical Support- Displays ADRF's Technical Support contact information
- Installer Contact Info- Displays the contact information of the installer

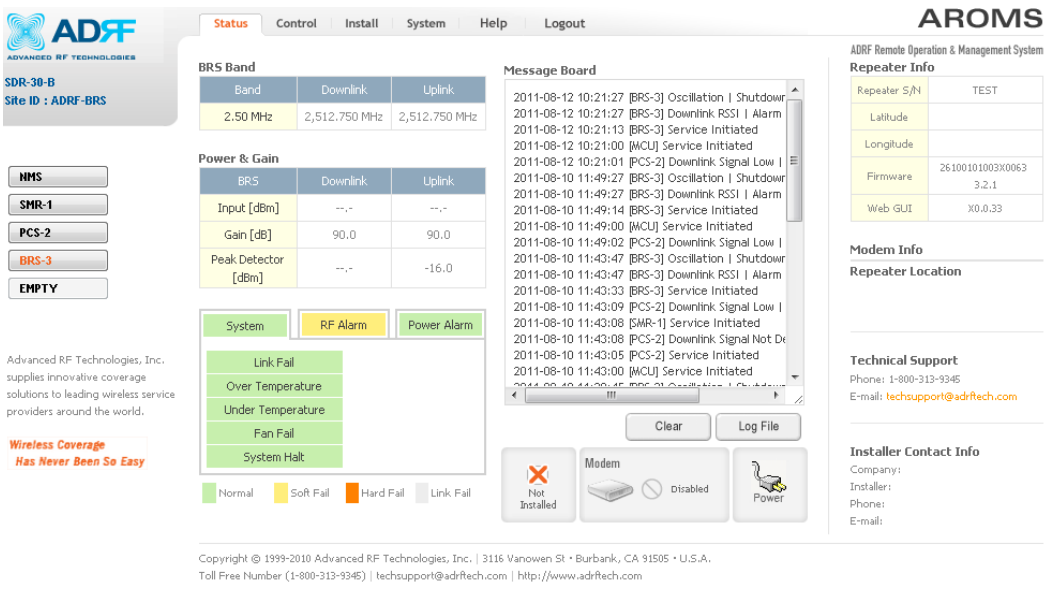
4.2.2 Status- SMR, PCS, BRS



Status- SMR



Status- PCS



Status- BRS

4.2.2.1 Band

This section displays the spectrum and technology that is being used. The band column displays the bandwidth that has been selected. The downlink column displays the center frequency of the selected band. The uplink column displays the center frequency of the selected band.

SMR Band

Band	Downlink	Uplink
1.00 MHz	852.000 MHz	807.000 MHz
1.25 MHz	938.000 MHz	899.000 MHz

PCS Band

Band	Downlink	Uplink
15.00 MHz	1,937.500 MHz	1,857.500 MHz
---	---	---
---	---	---

BRS Band

Band	Downlink	Uplink
2.50 MHz	2,512.750 MHz	2,512.750 MHz

4.2.2.2 Power & Gain

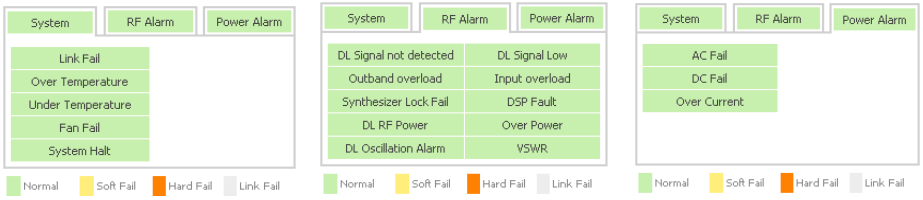
This section displays the Input, Gain, and Output for both downlink and uplink.

Power & Gain

BRS	Downlink	Uplink
Input [dBm]	--.-	--.-
Gain [dB]	90.0	90.0
Peak Detector [dBm]	--.-	-16.0

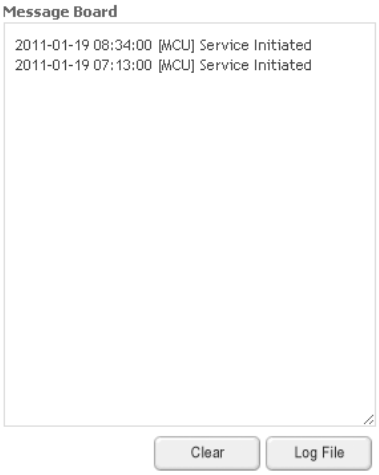
4.2.2.3 Alarm

This section displays the alarm status for system alarms, RF alarms, and Power alarms. If an alarm is present in the system, then the color of the alarm tab will change according to the type of failure.



4.2.2.4 Message Board

Displays the 20 most recent events.



- Clear: Clears the content that is currently being displayed on the Message Board
- Log File: Downloads the system Log File (events and alarms) to your computer

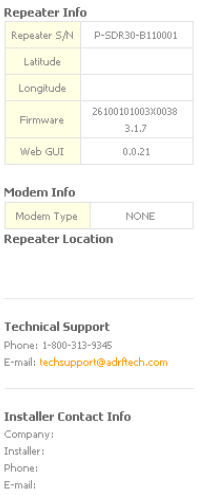
4.2.2.5 Install, Modem, and Power Status

- Installation: Displays whether or not the installation routine has been run (Not Installed or Installed)
- Modem: Displays the status of the modem
  - Disabled- No internal modem is present
  - Not Connected- Internal modem is detected, but no connection to the network has been established
  - Connected- Internal modem is detected and a connection to the network has been established
- Power: Displays the power source that is currently being used

4.2.2.6 Repeater Info / Modem Info / Repeater Location / Technical Support / Installer Contact Info

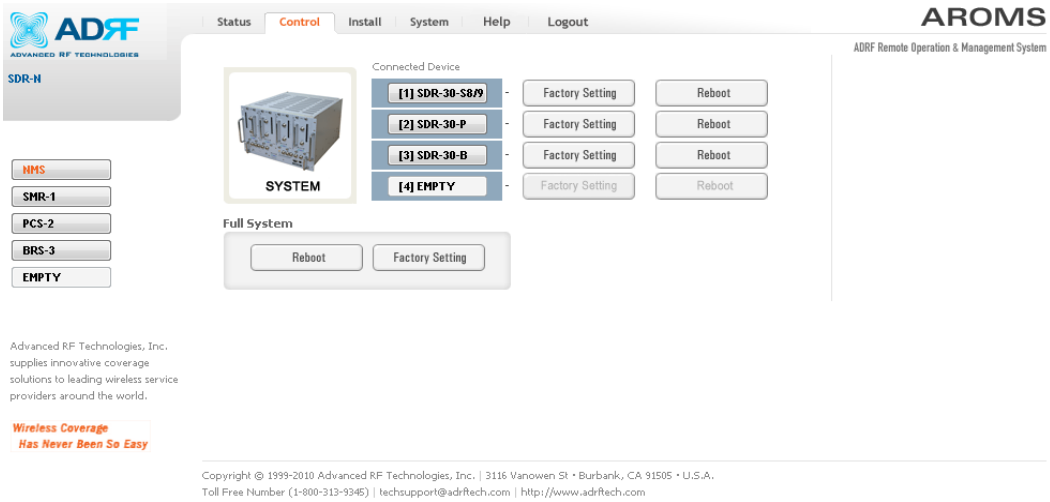
- Repeater Info: Displays the serial number, latitude, longitude, firmware version, Web-GUI version
- Modem Info: Displays the internal modem information (ESN, MDN, IP)
- Repeater Location: Displays the address where the repeater is installed
- Technical Support: Displays ADRF's Technical Support contact information
- Installer Contact Info: Displays the installer's name, phone and e-mail address

Note: Once successfully logged in, the repeater model name and the site/cascade ID will be displayed on the top of all the windows (except for the Main Window).



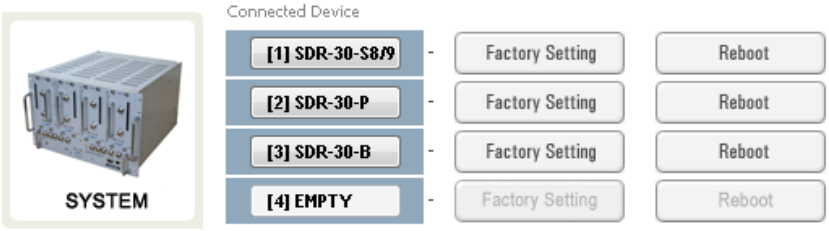
4.3 Control Tab

4.3.1 Control- NMS



Control- NMS

4.3.1.1 Control Summary

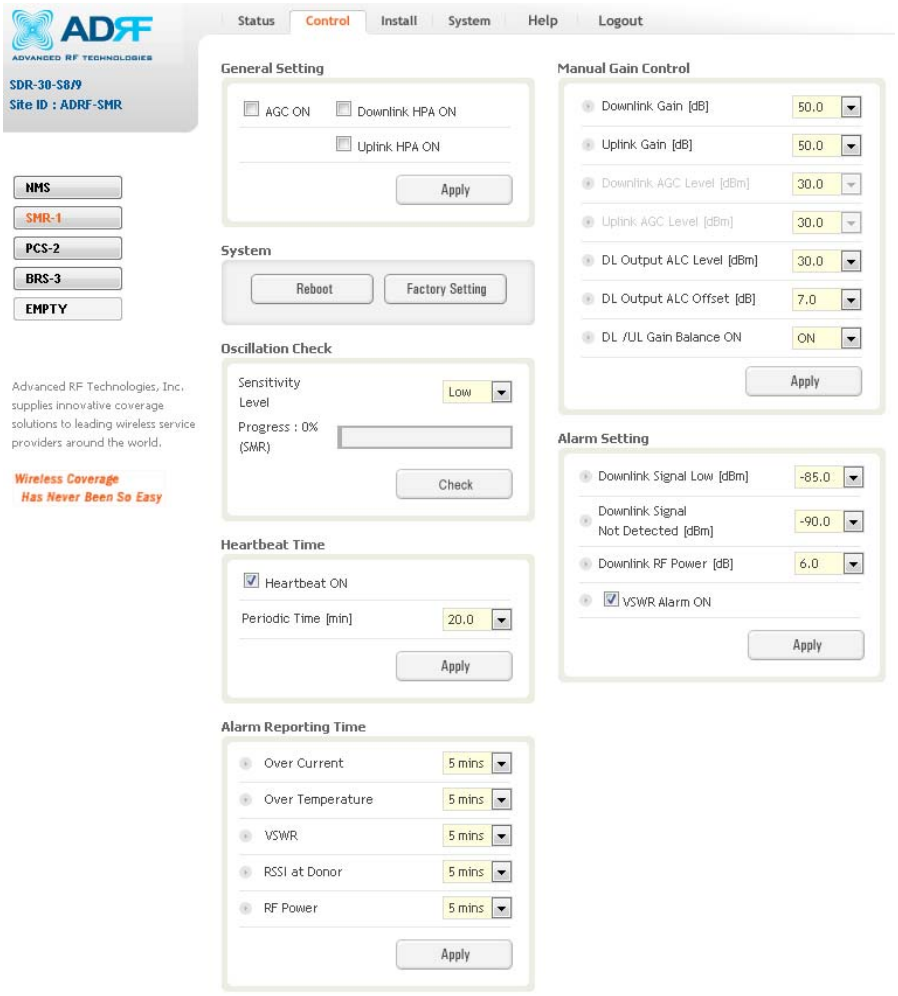


This section allows the user to perform factory settings and reboot one module at a time.

4.3.1.2 Full System

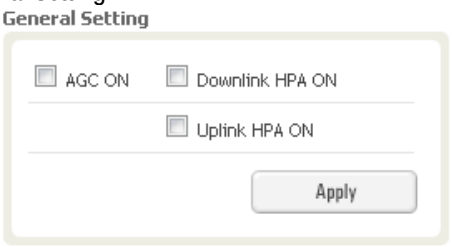
This section allows the user to perform a full system reboot or a full system factory settings.

4.3.2 Control- SMR, PCS, BRS



Control- SMR, PCS, BRS

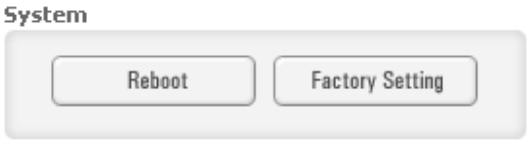
4.3.2.1 General Setting



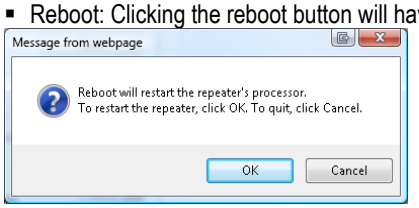
- AGC ON: Enables or disables AGC (Automatic Gain Control)
- Downlink HPA ON: Enables or disables the DL HPA
- Uplink HPA ON: Enables or disabled the UL HPA

To enable any of the settings, click on the checkbox and click the Apply button.

4.3.2.2 System

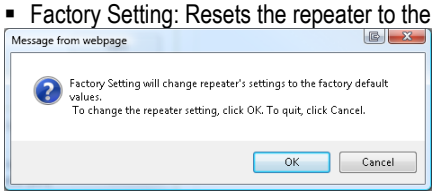


- Reboot: Clicking the reboot button will have the following popup show up:

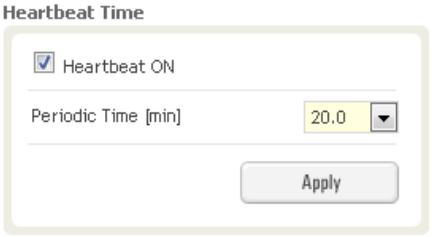


Click OK to reboot the repeater or click Cancel to exit out

- Factory Setting: Resets the repeater to the original factory settings

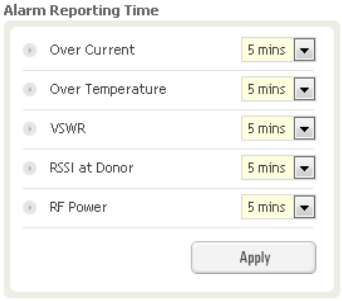


4.3.2.3 Heartbeat Time



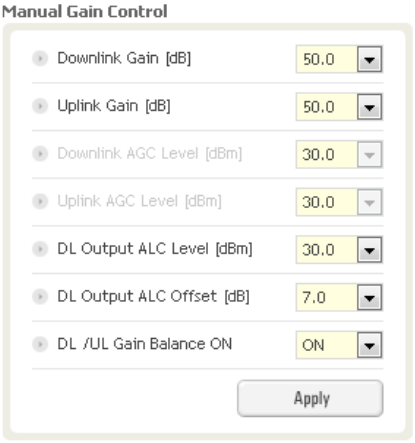
- Allows the user to enable or disable heartbeats from being sent out and also specify the time interval

4.3.2.4 Alarm Reporting Time



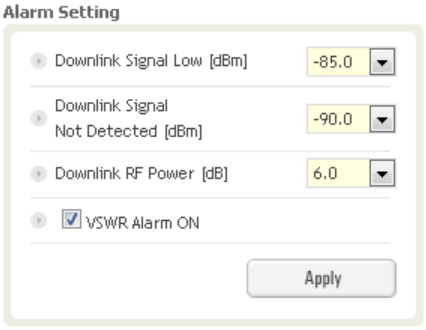
This section allows the user to specify the reporting time of the following alarms; Over Current, Over Temperature, VSWR, RSSI at Donor, and RF Power. If the alarm is set to 5 mins, then the system will send out an SNMP trap only if the alarm is continually present for a 5 minute period. If the alarm clears within this 5 minute period, then the SNMP trap will not be sent out. When the alarm reporting time is set to 0 min, the SNMP trap will be set out immediately once the alarm is triggered. The alarm should be set to 0 min, only when testing the monitoring function. Otherwise, all alarms should be set to 5 mins for normal operation.

4.3.2.5 Manual Gain Control



- Downlink Gain: Allows the DL gain to be adjusted manually when AGC is OFF
- Uplink Gain: Allows the UL gain to be adjusted manually when AGC is OFF
- Downlink AGC Level: Allows the user to set the DL gain when AGC is enabled
- Uplink AGC Level: Allows the user to set the UL gain when AGC is enabled
- DL Output ALC Level: Allows the user to set the Max output level when AGC is OFF
- DL Output ALC Offset: The amount of gain that the system has to work with before raising the gains to match the DL Output ALC Level specified
- DL /UL Gain Balance ON: When enabled, the system will keep the delta value between the Downlink and Uplink gain levels

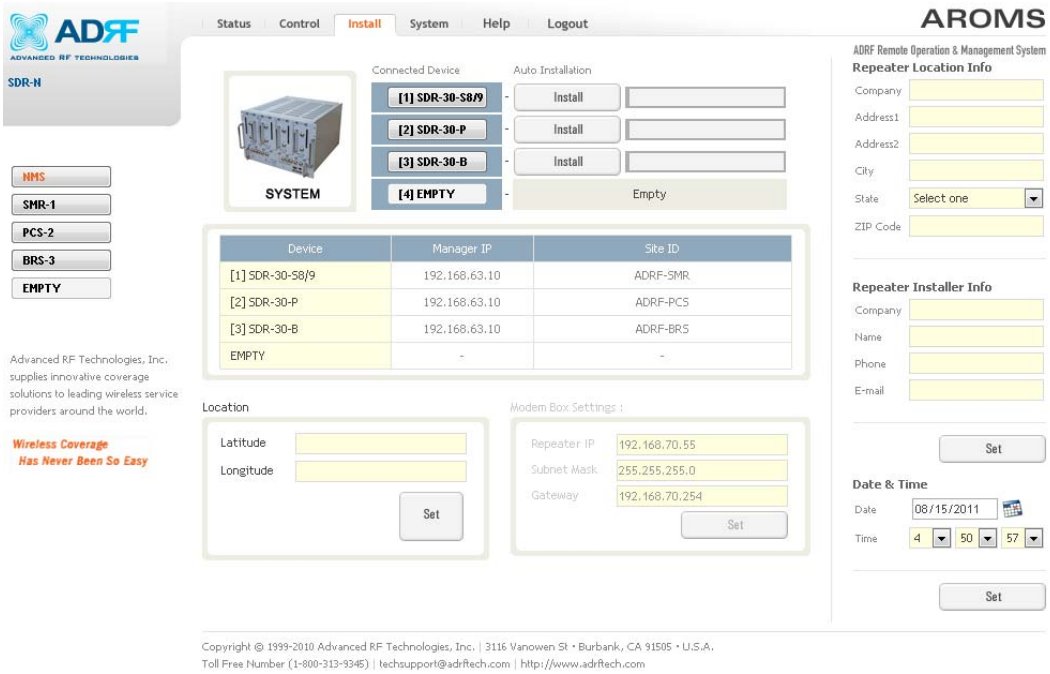
4.3.2.6 Alarm Setting



- Downlink Signal Low: Allows the user to specify the how weak the signal can be before triggering a "Downlink Signal Low" soft-fail alarm
- Downlink Signal Not Detected: Allows the user to specify the how weak the signal can be before triggering a "Downlink Signal Not Detected" soft-fail alarm
- Downlink RF Power: Allows the user to set a maximum deviation value for the downlink RF power
  - For example, if the input signal is -50 dBm and the gain is set to 60 dB, the expected output power should be 10 dBm. If the Downlink RF Power alarm value is set to 6dB, then if the output power is below 4 dBm, then this will trigger a soft-fail alarm
- VSWR Alarm ON: Allow the user to enable/disable the VSWR alarm check

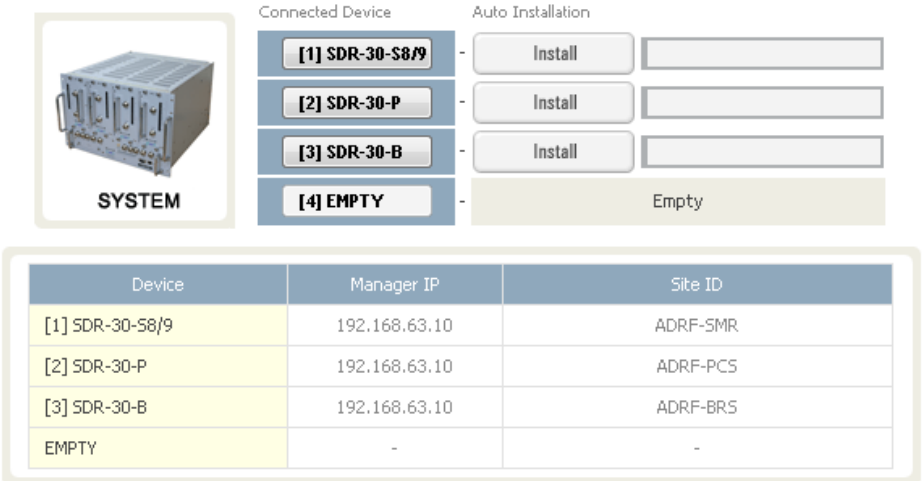
4.4 Install Tab

4.4.1 Install- NMS



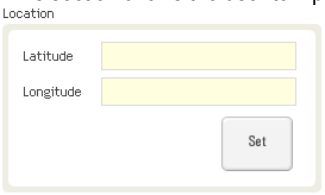
4.4.1.1 Install Summary:

The auto installation routine can be run from this page by clicking on the Install button under the Auto Installation column. This section also displays the Manager IP and Site ID for all the connected SDR modules.



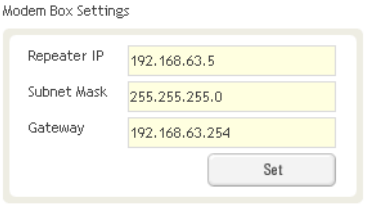
4.4.1.2 Location

This section allows the user to input the latitude and the longitude of the repeater.



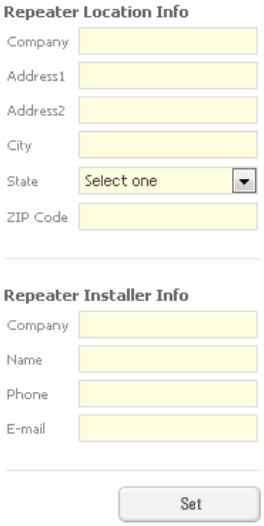
4.4.1.3 Modem Box Settings:

This section allows the user to specify an alternative Repeater IP, Subnet Mask, and Gateway settings. These settings are enabled when the Host/Remote switch is set to the Remote position. When the Host/Remote switch is changed, the repeater will reboot and will result in a temporary loss in coverage.



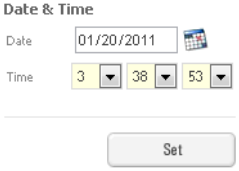
4.4.1.4 Repeater Location Info / Repeater Installer Info

This section allows the user to specify the address of the repeater and also the information of the installer.

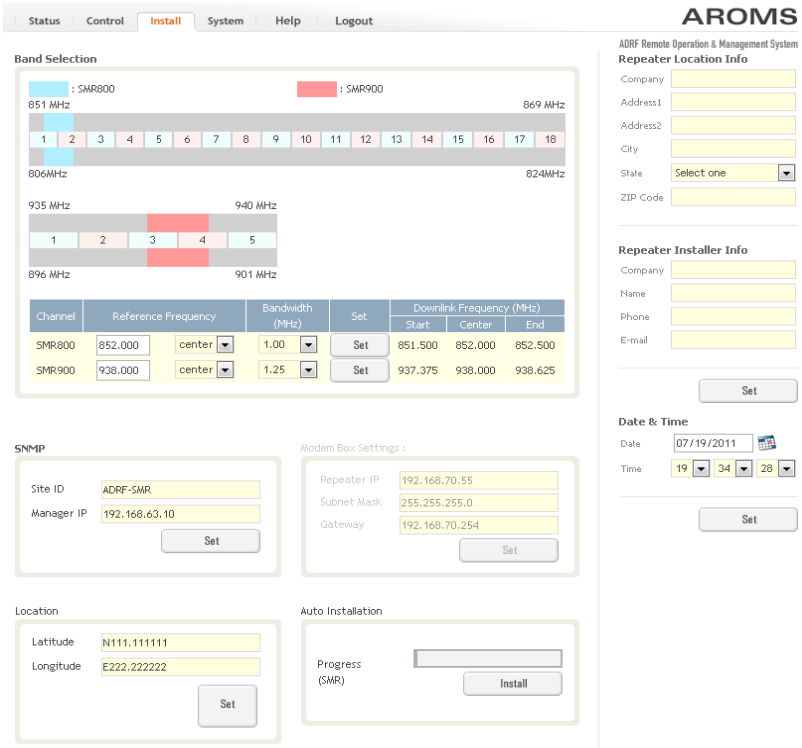


4.4.1.5 Date & Time

This section allows the user to specify the current date and time.

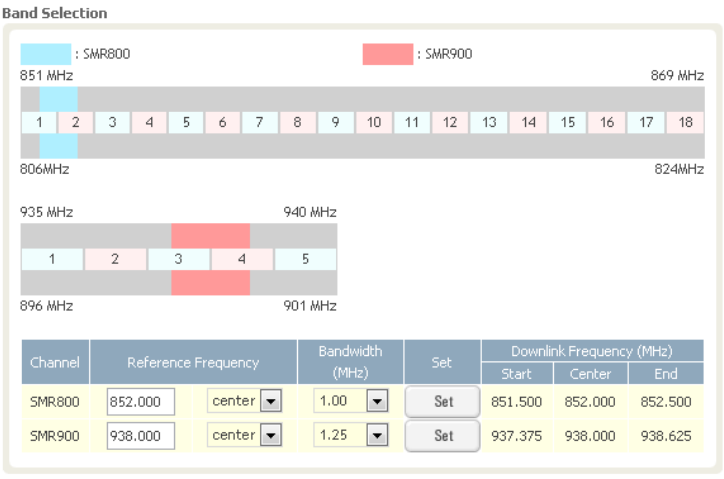


4.4.2 Install- SMR



The SMR Install page allows the user specify the desired frequncies by inputting the Reference Frequency and Bandwidth. The SMR module supports 1 channel on the SMR800 and 1 channel on the SMR900. SMR800 bandwidth selections range from 1.25 to 18 MHz and SMR900 bandwidth selections range from 1.25 to 5 MHz.

4.4.2.1 Install- SMR Band Selection



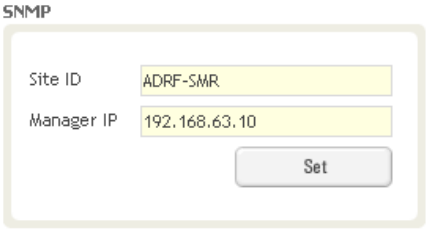
To specify a frequency, input a DL reference frequency and select either start, center, or stop from the dropdown menu. Select the desired bandwidth from the dropdown menu under the Bandwidth column and then click Set.

Start Frequency:
If a start frequency is specifed, then this will be the beginning frequency of the band selection. Adding the bandwidth value that is selected from the Bandwidth column will give you the end frequency of your band selection.

Center Frequency:
Once a center frequncy is specified and a bandwidth is selected, the system will split the bandwidth value in half and then add this to the center frequency to obtain your end frequency and also subtract this value to obtain your start frequency.

Stop Frequency:
If a stop frequency is specified, then this will be the ending frequency of the band selection. Subtracting the bandwidth value that is selected from the Bandwidth column will give you the start frequency of your band selection.

4.4.2.2 Install- SNMP

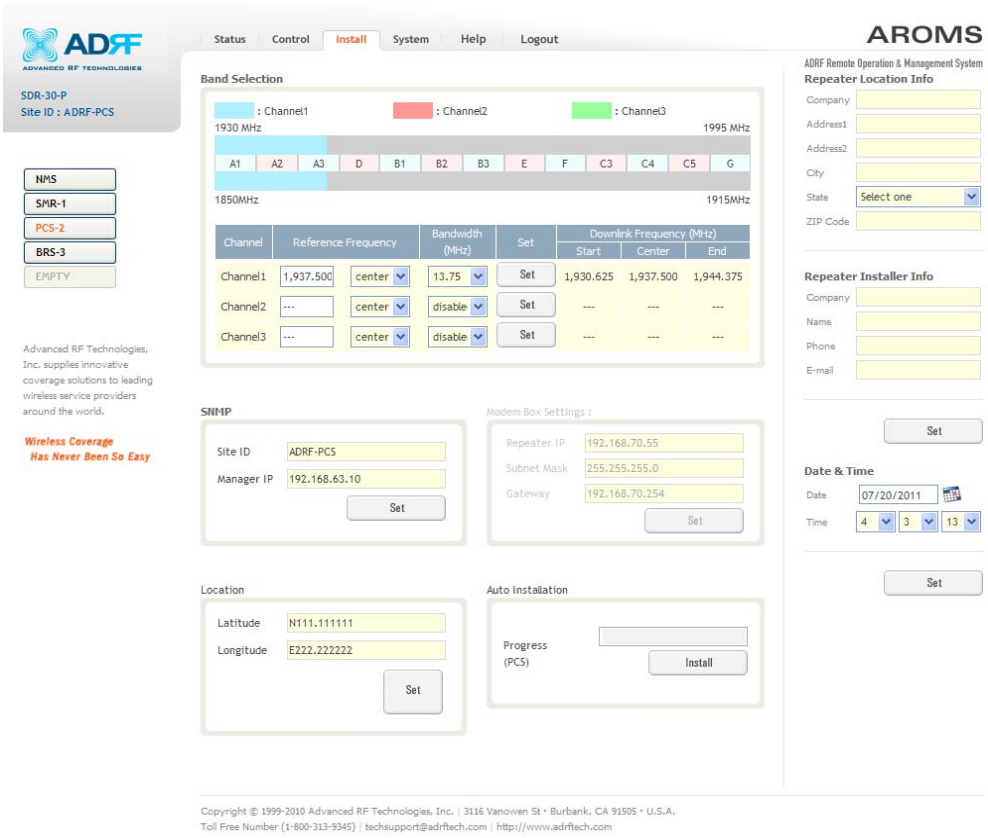


The SNMP section allows you to specify the Site ID and Manager IP. The Site-ID is the code that is used to identify a particular module. The Manager IP field is where the user inputs the IP address of the NOC system that is being used to monitor the SNMP traps.

4.4.2.3 Install- Auto Installation

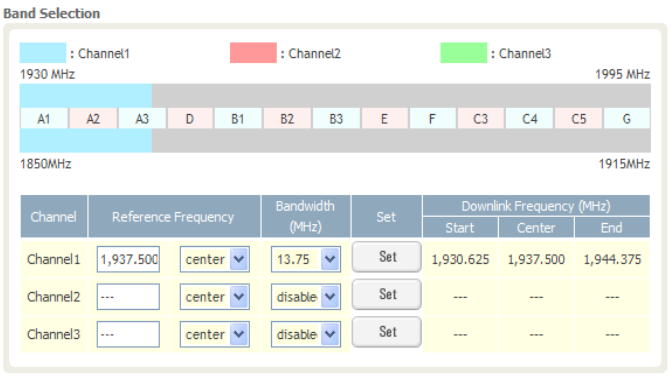
The Auto Installation routine can be run by clicking on the Install button. The Auto Installation routine runs basic system checks for propery functionaility.

4.4.3 Install- PCS



The PCS Install page allows the user specify the desired frequncies by inputting the Reference Frequency and Bandwidth. The PCS module supports up to 3 non-contiguous bands. Bandwidth selection ranges from 1.25 to 18.75 MHz.

4.4.3.1 Install- PCS Band Selection



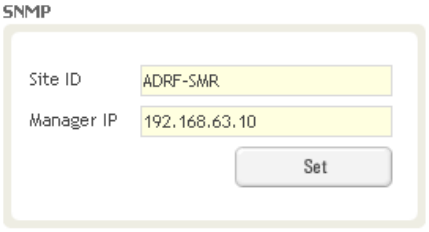
To specify a frequency, input a DL reference frequency and select either start, center, or stop from the dropdown menu. Select the desired bandwidth from the dropdown menu under the Bandwidth column and then click Set.

Start Frequency:
If a start frequency is specifed, then this will be the beginning frequency of the band selection. Adding the bandwidth value that is selected from the Bandwidth column will give you the end frequency of your band selection.

Center Frequency:
Once a center frequncy is specified and a bandwidth is selected, the system will split the bandwidth value in half and then add this to the center frequency to obtain your end frequency and also subtract this value to obtain your start frequency.

Stop Frequency:
If a stop frequency is specified, then this will be the ending frequency of the band selection. Subtracting the bandwidth value that is selected from the Bandwidth column will give you the start frequency of your band selection.

4.4.3.2 Install- SNMP

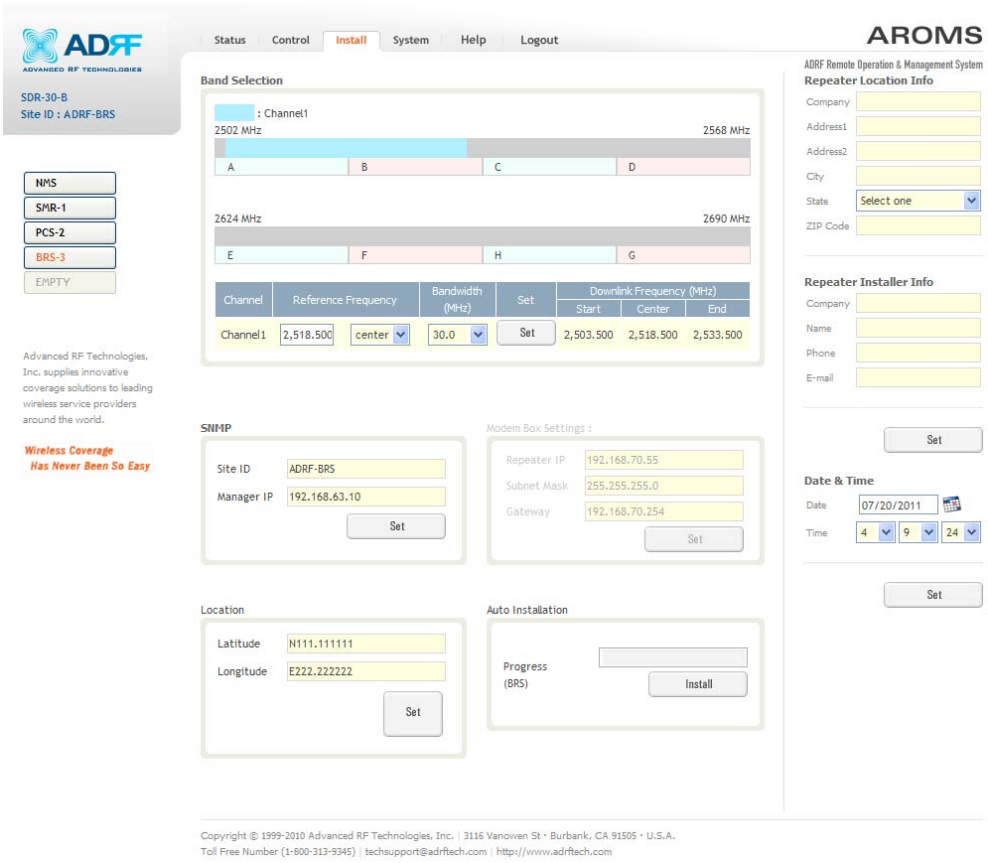


The SNMP section allows you to specify the Site ID and Manager IP. The Site-ID is the code that is used to identify a particular module. The Manager IP field is where the user inputs the IP address of the NOC system that is being used to monitor the SNMP traps.

4.4.3.3 Install- Auto Installation

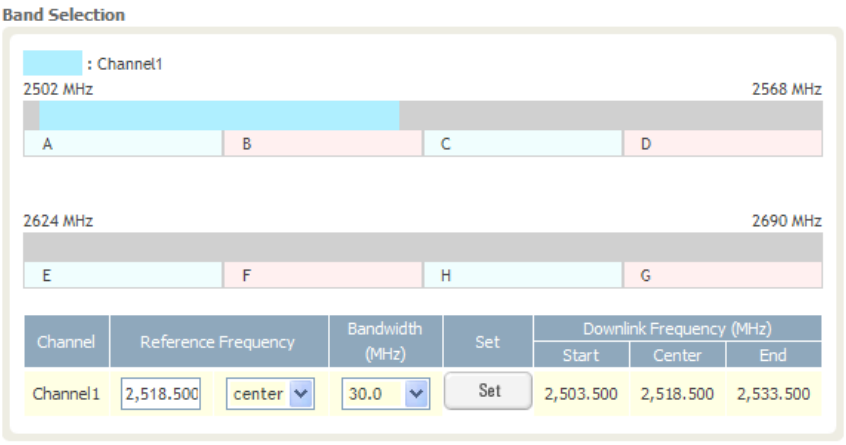
The Auto Installation routine can be run by clicking on the Install button. The Auto Installation routine runs basic system checks for propery functionaility.

4.4.4 Install- BRS



The BRS Install page allows the user to specify the desired frequncies by inputting the Reference Frequency and Bandwidth. The BRS module supports 1 contiguous bands. Bandwidth selection ranges from 2.5 to 30 MHz.

4.4.4.1 Install- BRS Band Selection



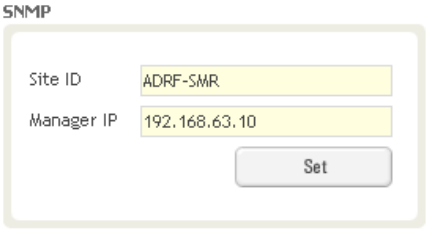
To specify a frequency, input a DL reference frequency and select either start, center, or stop from the dropdown menu. Select the desired bandwidth from the dropdown menu under the Bandwidth column and then click Set.

Start Frequency:
If a start frequency is specifed, then this will be the beginning frequency of the band selection. Adding the bandwidth value that is selected from the Bandwidth column will give you the end frequency of your band selection.

Center Frequency:
Once a center frequncy is specified and a bandwidth is selected, the system will split the bandwidth value in half and then add this to the center frequency to obtain your end frequency and also subtract this value to obtain your start frequency.

Stop Frequency:
If a stop frequency is specified, then this will be the ending frequency of the band selection. Subtracting the bandwidth value that is selected from the Bandwidth column will give you the start frequency of your band selection.

4.4.4.2 Install- SNMP



The SNMP section allows you to specify the Site ID and Manager IP. The Site-ID is the code that is used to identify a particular module. The Manager IP field is where the user inputs the IP address of the NOC system that is being used to monitor the SNMP traps.

4.4.4.3 Install- Auto Installation

The Auto Installation routine can be run by clicking on the Install button. The Auto Installation routine runs basic system checks for propery functionaility.

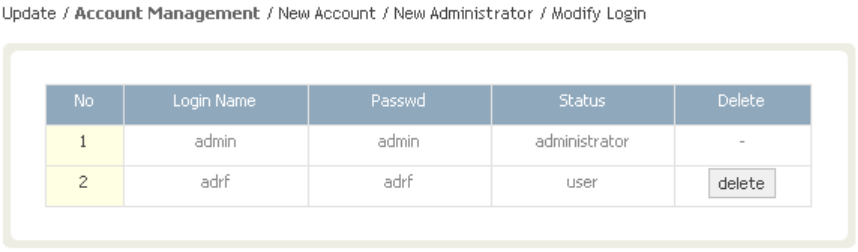
4.5 System

The System tab allows the user to perform firmware updates, upload closeout packages, view any changes to the system, backup existing configuration, and add/remove user accounts, and change the login credentials of the Administrator.

4.5.1 System- Account

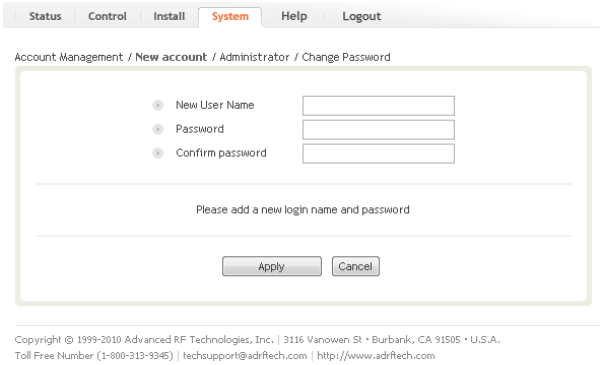
4.5.1.1 System: Account- Account Management

The Account Management section will allow the Administrator to delete any user account. Please note that the Account Management section is only available if you are logged into the system as the Administrator. To delete a user account click on the Account Management link and under the Delete column, click on the delete button.



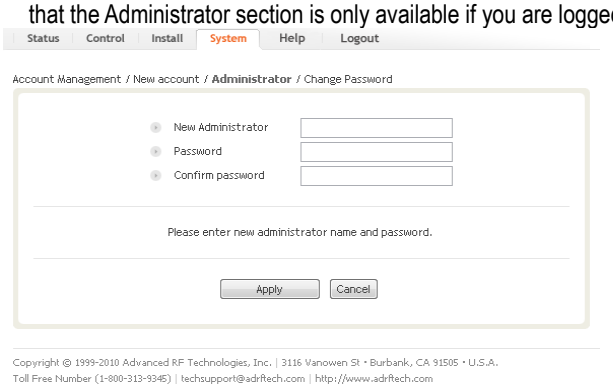
4.5.1.2 System: Account- New Account

The New account section allows the Administrator to create a new user account. Please note that the New account section is only available if you are logged into the system as the Administrator. To create a new user account click on the New account link and fill in the fields highlighted in yellow as shown below.



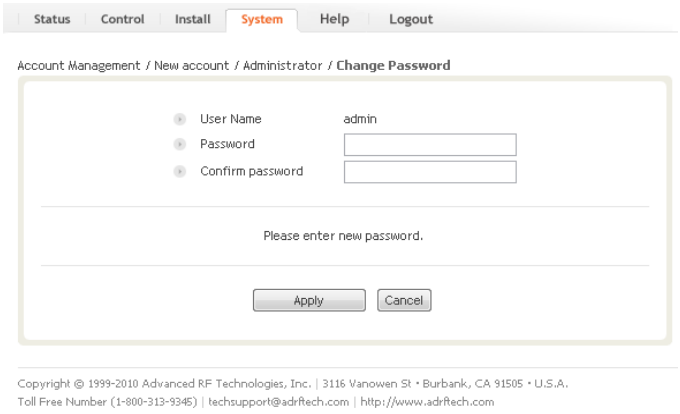
4.5.1.3 System: Account- Administrator

The Administrator section allows the Administrator to create additional Administrator accounts. Please note that the Administrator section is only available if you are logged into the system as the Administrator.



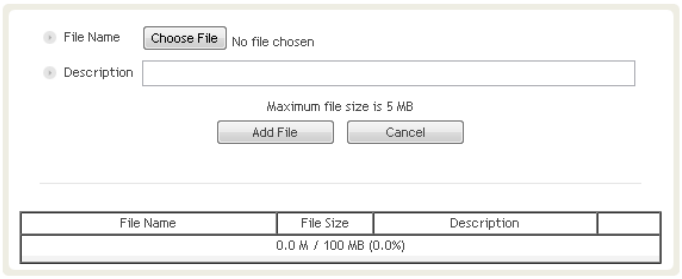
4.5.1.4 System: Account- Change Password

The Change Password section allows the current user who is logged into the system to change their login credentials.

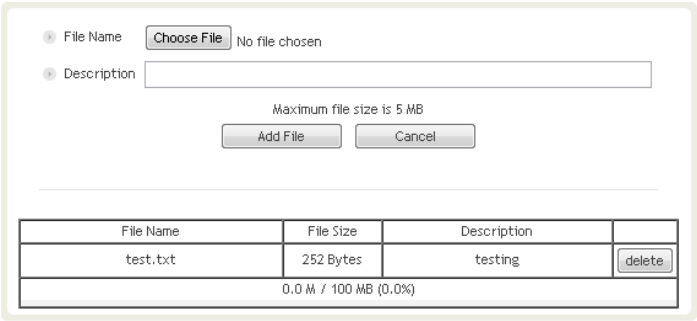


4.5.2 System- Closeout Package

The closeout package section will allow the user to upload documents to the module. The maximum file size for each upload is limited to 5 MB. The total amount of space available for uploading document is 100 MB. Please do not use this section as the primary storage location of your documents. Documents may become unavailable if the system goes down.



To upload documents to the module, click on the “Choose File” or “Browse” button and locate the file that you would like to upload, then enter in a Description of the file being uploaded. Afterwards, click on the “Add File” button to upload the file. Below is what you will see after the file upload. To delete the file, click on the delete button located in the last column.



4.5.3 System- User Log

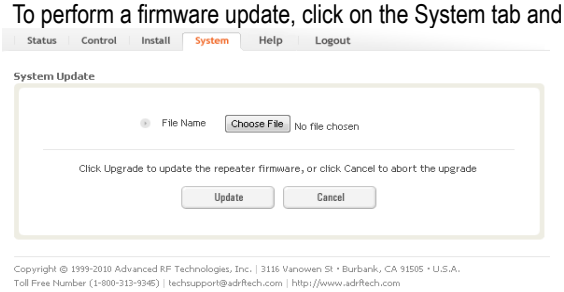
This section displays system events that have taken place. The User Log displays who has made the changes, the time and date of when the event took place, and what changes were made to the system.

User Log

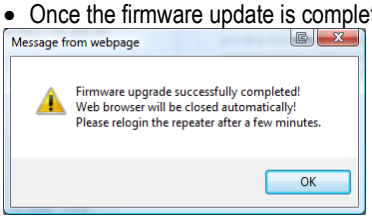
Number	Date	Username	Log Message
1	07/19/2011 20:43:17	admin	Logged-In
2	07/19/2011 19:34:09	admin	Logged-In
3	08/18/2011 13:31:08	adrf	[SMR-1] System Time Change to 7/19/2011 7:19:52
4	08/18/2011 13:21:42	adrf	Logged-In
5	08/18/2011 05:11:57	adrf	Logged-In
6	08/18/2011 01:45:25	admin	[SMR-1] Change Longitude to E222.222222
7	08/18/2011 01:45:25	admin	[SMR-1] Change Latitude to N111.111111
8	08/18/2011 01:43:59	admin	[SMR-1] UL HPA Set On
9	08/18/2011 01:43:59	admin	[SMR-1] DL HPA Set On
10	08/18/2011 01:43:59	admin	[SMR-1] AGC Set On
11	08/18/2011 00:12:06	admin	Logged-In

4.5.4 System: Update

- To perform a firmware update, click on the System tab and the following screen will show up.

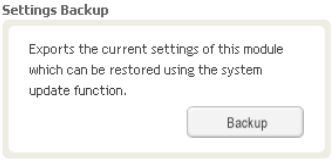


- Click on the Choose File… button and locate the firmware file
- Click on the Upload button to perform the firmware update
- Once the firmware update is complete, the following popup message will appear:



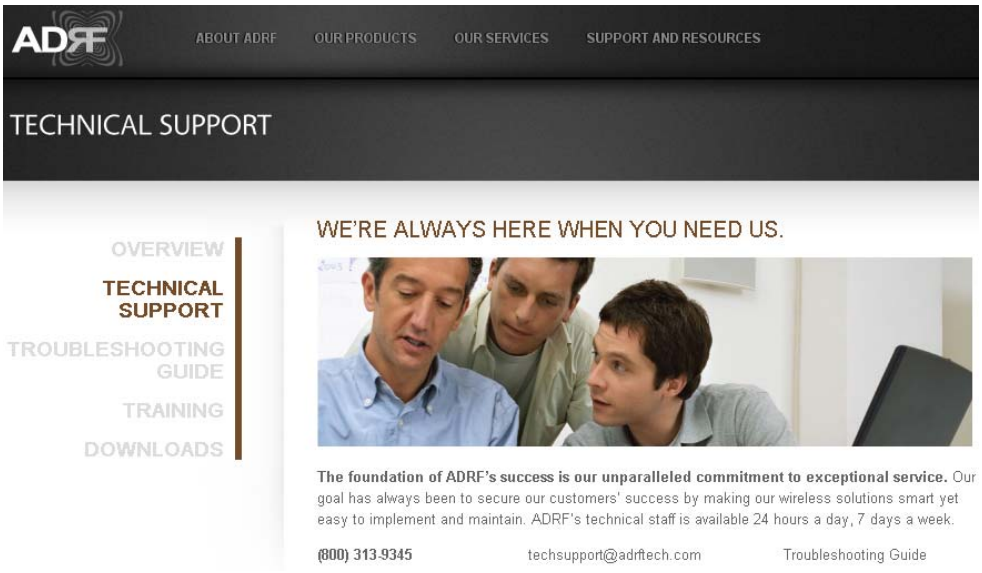
4.5.5 System- Backup

The backup section allows the user to backup the settings on the module. To perform the backup, click on the Backup button and you will be prompted to save the backup file. To restore the settings to the system, perform an update using this file.



4.6 Help

If an internet connection is available, clicking on the Help Tab will redirect the user to our Technical Support page.



4.7 Logout

Clicking the Logout button will log the current user off the system.

5. Maintenance Guide for SDR Repeater

5.1 Periodic Inspection Checklist

a) Check for loose connections between the repeater and antennas. If connections are loose, make sure that all connections are tightly fastened properly.
b) Cables and connectors are in good condition.
c) Ensure that the repeater brackets are in good. condition and that the repeater is securely fastened

5.2 Preventive Measures for Optimal Operation

5.2.1 Recommendations

- Perform the *Periodic Inspection Checklist* quarterly or semi-annually.

5.2.2 Precautions

- Do not operate the repeater with the antennas in extremely close proximity to one another as this may cause damage to the repeater.
- Do not change the parameters unless instructed to do so by an authorized supervisor.
- Do not move the repeater unless instructed to do so by an authorized supervisor.
- Do not detach any cables to the repeater unless repair of respective components is necessary.

6. Warranty and Repair Policy

6.1 General Warranty

The SDR carries a Standard Warranty period of three (3) years unless indicated otherwise on the package or in the acknowledgment of the purchase order.

6.2 Limitations of Warranty

Your exclusive remedy for any defective product is limited to the repair or replacement of the defective product. Advanced RF Technologies, Inc. may elect which remedy or combination of remedies to provide in its sole discretion. Advanced RF Technologies, Inc. shall have a reasonable time after determining that a defective product exists to repair or replace the problem unit. Advanced RF Technologies, Inc. warranty applies to repaired or replaced products for the balance of the applicable period of the original warranty or ninety days from the date of shipment of a repaired or replaced product, whichever is longer.

6.3 Limitation of Damages

The liability for any defective product shall in no event exceed the purchase price for the defective product.

6.4 No Consequential Damages

Advanced RF Technologies, Inc. has no liability for general, consequential, incidental or special damages.

6.5 Additional Limitation on Warranty

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

6.6 Return Material Authorization (RMA)

No product may be returned directly to Advanced RF Technologies, Inc. without first getting an approval from Advanced RF Technologies, Inc. If it is determined that the product may be defective, you will be given an RMA number and instructions in how to return the product. An unauthorized return, i.e., one for which an RMA number has not been issued, will be returned to you at your expense. Authorized returns are to be shipped to the address on the RMA in an approved shipping container. You will be given our courier information. It is suggested that the original box and packaging materials should be kept if an occasion arises where a defective product needs to be shipped back to Advanced RF Technologies, Inc. To request an RMA, please call (800) 313-9345 or send an email to techsupport@adrftech.com.

7. Specifications

7.1 Electrical Specifications

Parameters		Specifications			
		SDR-S (SMR800/900)		SDR-P (PCS)	SDR-B (BRS)
Frequency Range	DL	SMR800	851~869MHz	1930~1995MHz	2502~2690MHz
		SMR900	935~940MHz		
	UL	SMR800	806~824MHz	1850~1915MHz	
		SMR900	896~901MHz		
Frequency Error				≤ ±0.05ppm	≤ ±0.02ppm
Band Selection		0.25MHz Step, Max 18 MHz		1.25MHz Step Max 18.75 MHz (Non-Contiguous 3ch)	2.5MHz Step Max 30 MHz (Continuous 1ch)
Gain Flatness	Full band	≤ ±1.5dB		≤ ±1.5dB	≤ ±1.5dB
	Each band	≤ ±1.5dB		≤ ±1.5dB	≤ ±1.5dB
Gain	Maximum	80dB		90dB	90dB
	Step	0.5dB		0.5dB	0.5dB
	Range	30dB		30dB	30dB
	Tolerance	≤ ±1.0dB		≤ ±1.0dB	≤ ±1.0dB
Composite Output power		24dBm (SDR-24)		24dBm (SDR-24)	24dBm (SDR-24)
		30dBm (SDR-30)		30dBm (SDR-30)	30dBm (SDR-30)
Delay		8us		6us	6us
Roll offs		0.5MHz@ 65dBc		1MHz@ 50dBc	1MHz@ 40dBc 3.5MHz@ 80dBc
Noise Figure(Uplink Only)		6dB@ Max Gain		6dB@ Max Gain	6dB@ Max Gain
VSWR (Input Only)		1.5:1		1.5:1	1.5:1
Sync Detection Level					<-85dBm Typ (Max -90dBm)

Parameters		Specifications			
		SDR-700 (LTE)		SDR-C (CELL)	SDR-A (AWS)
Frequency Range	DL	Upper C	746~757MHz	869~894MHz	2110~2155MHz
		Lower A	728~734MHz		
		Lower B	734~740MHz		
	UL	Upper C	776~787MHz	824~849MHz	1710~1755MHZ
		Lower A	698~704MHz		
		Lower B	704~710MHz		
Frequency Error		≤ ±0.05ppm		≤ ±0.05ppm	≤ ±0.05ppm
Band Selection		0.25MHz Step, Max 12 MHz (Non-Contiguous 2ch)		0.25MHz Step, Max 25 MHz	1.25MHz Step, Max 18.75 MHz (Non-Contiguous 3ch)
Gain Flatness	Full band	≤ ±1.5dB		≤ ±1.5dB	≤ ±1.5dB
	Each band	≤ ±1.5dB		≤ ±1.5dB	≤ ±1.5dB
Gain	Maximum	90dB		90dB	90dB
	Step	0.5dB		0.5dB	0.5dB
	Range	30dB		30dB	30dB

	Tolerance	≤ ±1.0dB	≤ ±1.0dB	≤ ±1.0dB
Composite Output power		24dBm (SDR-24)	24dBm (SDR-24)	24dBm (SDR-24)
		30dBm (SDR-30)	30dBm (SDR-30)	30dBm (SDR-30)
Delay		6.5us	7us	6us
Roll offs		1MHz@ 50dBc	0.5MHz@ 30dBc, 1MHz@ 50dBc	1MHz@ 50dBc
Noise Figure(Uplink Only)		6dB@ Max Gain	6dB@ Max Gain	6dB@ Max Gain
VSWR (Input Only)		1.5:1	1.5:1	1.5:1
EVM		≤ 12.5%	≤ 12.5%	≤ 12.5%

7.2Mechanical Specifications

Parameters		Specifications	Remarks
Size	Module	18.2 x 11.6 x 4.2 in	
	NMS	17.0 x 16.7 x 2.3 in	
	Chassis	19.0 x 19.5 x 14 in	
Weight	Module	21 lbs	
	NMS	7 lbs	
	Chassis	26 lbs	
Connector Type	Input / Output	N Female	
	Sum Port		
	Ethernet	RJ45 Female	
	Frame ground	M5 Screw	
Mount type		Wall mount or 19” rack mount	
Security		Physical Cabinet	

7.3 Power Specifications

Parameters	Specifications	Remarks
AC Power	100~120V AC, 60Hz	
DC Power	-40 ~ -60V DC	Option
	+20 ~ +30V DC	

7.4 Environment Specifications

Parameters	Specifications	Remarks
Operating Temperature	+30 ~ +122°F	
	+0 ~ +50°C	
Relative Humidity	+5 ~ +95%	
Industrial dust	Telcodia GR63-core	

7.5 Warranty & Certificates

Parameters	Specifications	Remarks
MTBF	> 100,000 hours	

Certificates	UL 60950	
	FCC CFR47 part 24	
	FCC CFR47 part 15	
	FCC CFR47 part 90	

Appendix A: Mechanical Drawing

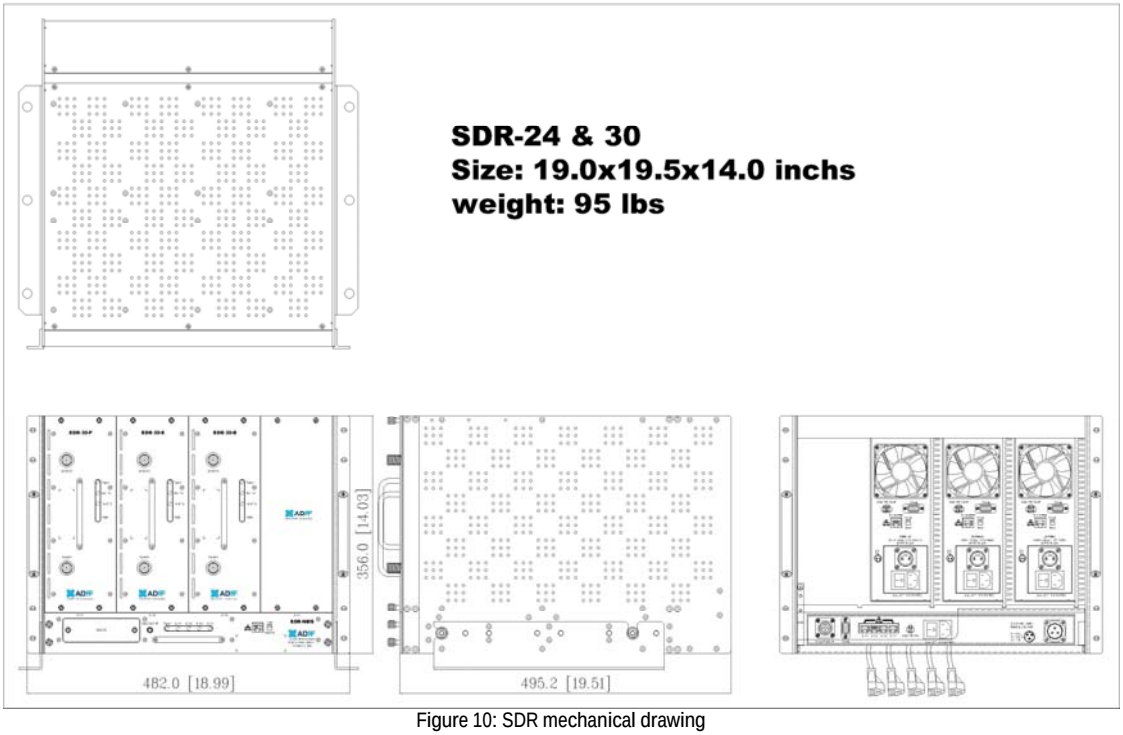


Figure 10: SDR mechanical drawing

Appendix B: Shutdown Retry Logic

The function of the built-in shutdown routine is to protect the repeater from any further damage from a hard-fail that the system may be experiencing.

Within 5 seconds of a hard-fail alarm being detected, the repeater will start the shutdown routine. The repeater will shut down by powering of the HPAs (high-powered amplifiers) for 30 seconds.

After 30 seconds have elapsed, the repeater will power on the HPAs and check to see if the hard-fail alarm still exist. If the hard-fail alarm still exists, then the repeater will shut down for 1 minute (double the time of the previous shutdown time).

After 1 minute has elapsed, the repeater will power on the HPAs and check to see if the hard-fail alarm still exist. If the hard-fail alarm still exists, then the repeater will shut down for 2 minutes (double the time of the previous shutdown time).

The shutdown routine will repeat itself a total of 10 times. If the hard-fail alarm still exists after the 10th retry, then the repeater will turn off its HPAs permanently until a reset is performed or factory set is executed.

MPE Information

	Warning: Exposure to Radio Frequency Radiation The radiated output power of this device is far below the FCC radio frequency exposure limits. Nevertheless, the device should be used in such a manner that the potential for human contact during normal operation is minimized. In order to avoid the possibility of exceeding the FCC radio frequency exposure limits, human proximity to the antenna should not be less than 150cm during normal operation. The gain of the antenna is 16 dBi. The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

IC Warning
This device complies with Industry Canada licence-exempt RSS standard(s).
Operation is subject to the following two conditions: (1) this device may not cause interference, and
(2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence.
L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et
(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi,
même si le brouillage est susceptible d'en compromettre le fonctionnement.