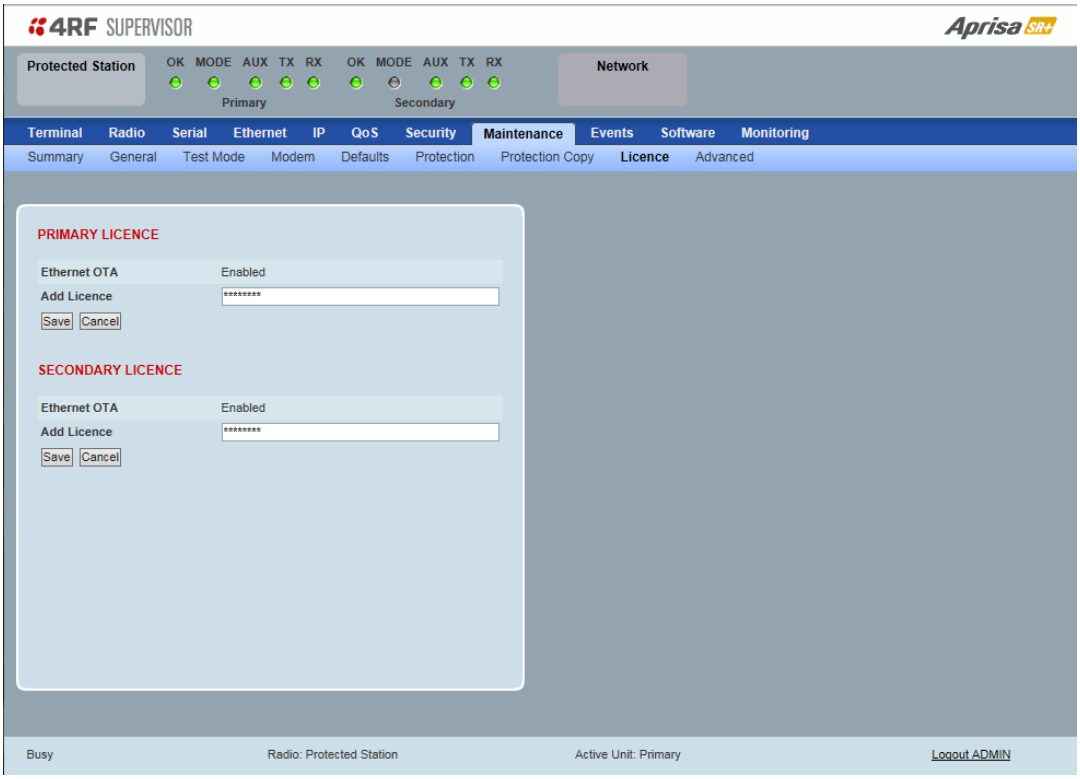
Protected Station: Maintenance > Licence

This page provides the management and control of the Protected Station Maintenance Licence settings.

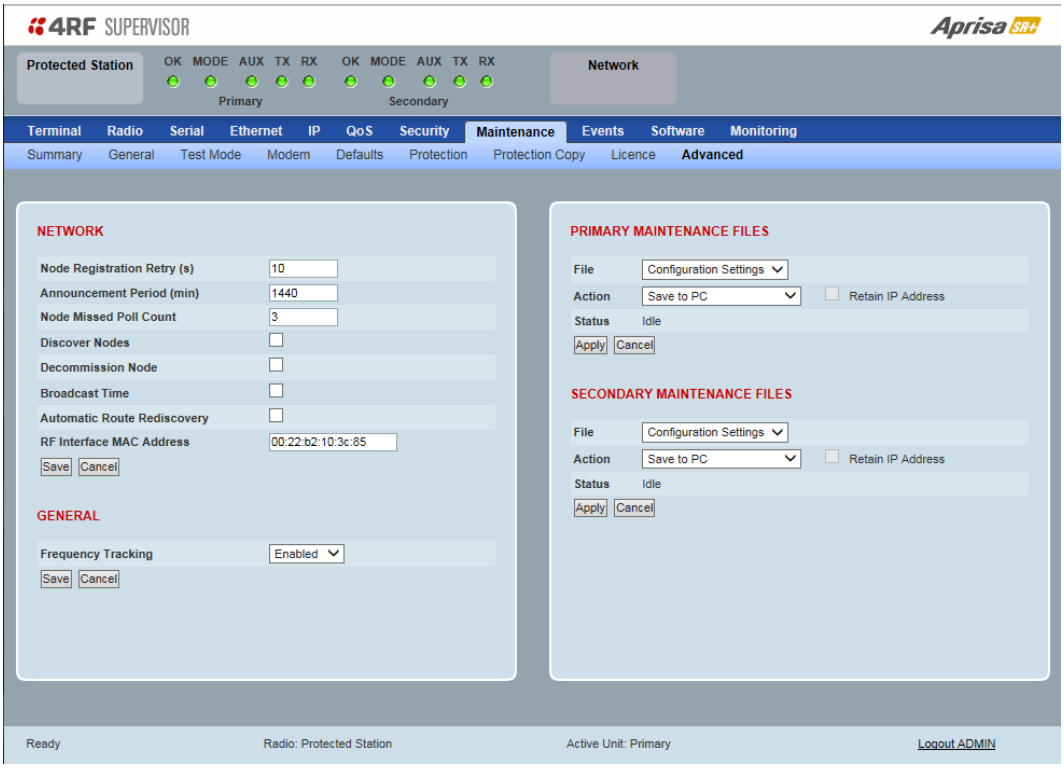


PRIMARY / SECONDARY LICENCE

See ‘Maintenance > Licence’ on page 216 for parameter details.

Protected Station: Maintenance > Advanced

This page provides the management and control of the Protected Station Maintenance Advanced settings.



NETWORK

See ‘Maintenance > Advanced’ on page 217 for parameter details.

RF Interface MAC address

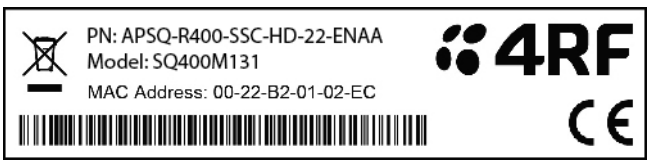
This parameter is only applicable when the radio is part of a Protected Station.

This RF Interface MAC address is used to define the MAC address of the Protection Switch. This address is entered in the factory. Both Protected Station radios read and use this MAC address.

This MAC address entry will only be used by the software if it detects that the factory MAC address set in the internal EPROM of the protected switch is corrupted for some reason, otherwise the software will ignore the MAC address entered by the user.

The RF interface MAC address is used for registration process only. For example, in a remote Protected Station, both radios share the same RF MAC address and a single entry of the remote Protected Station will be presented in network table (Network Status > Network Table).

The Protection Switch RF Interface MAC address is shown on the Protection Switch label:



PRIMARY / SECONDARY CONFIGURATION

See ‘Maintenance > Advanced’ on page 217 for parameter details.

PRIMARY / SECONDARY MAINTENANCE FILES

See ‘Maintenance > Advanced’ on page 217 for parameter details.

Events

The Events menu contains the setup and management of the alarms, alarm events and traps.

Protected Station: Events > Alarm Summary

There are two types of events that can be generated on the Aprisa SR+ radio. These are:

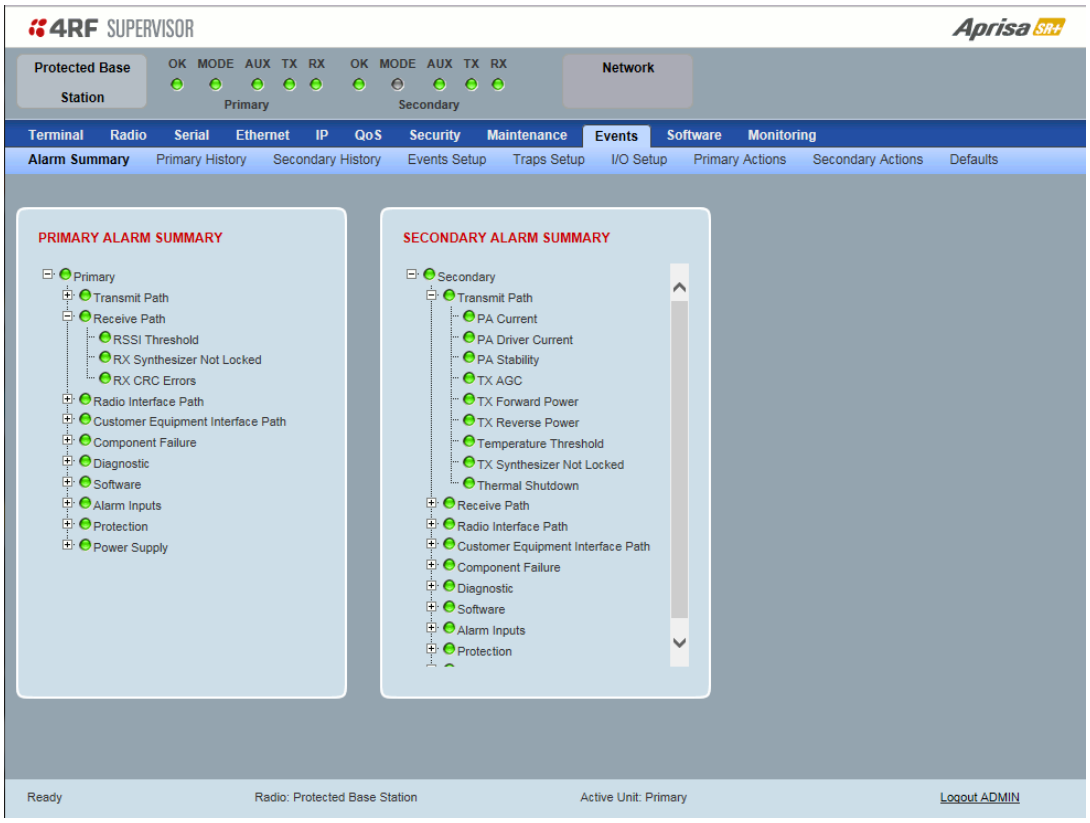
1. Alarm Events

Alarm Events are generated to indicate a problem on the radio.

2. Informational Events

Informational Events are generated to provide information on key activities that are occurring on the radio. These events do not indicate an alarm on the radio and are used to provide information only.

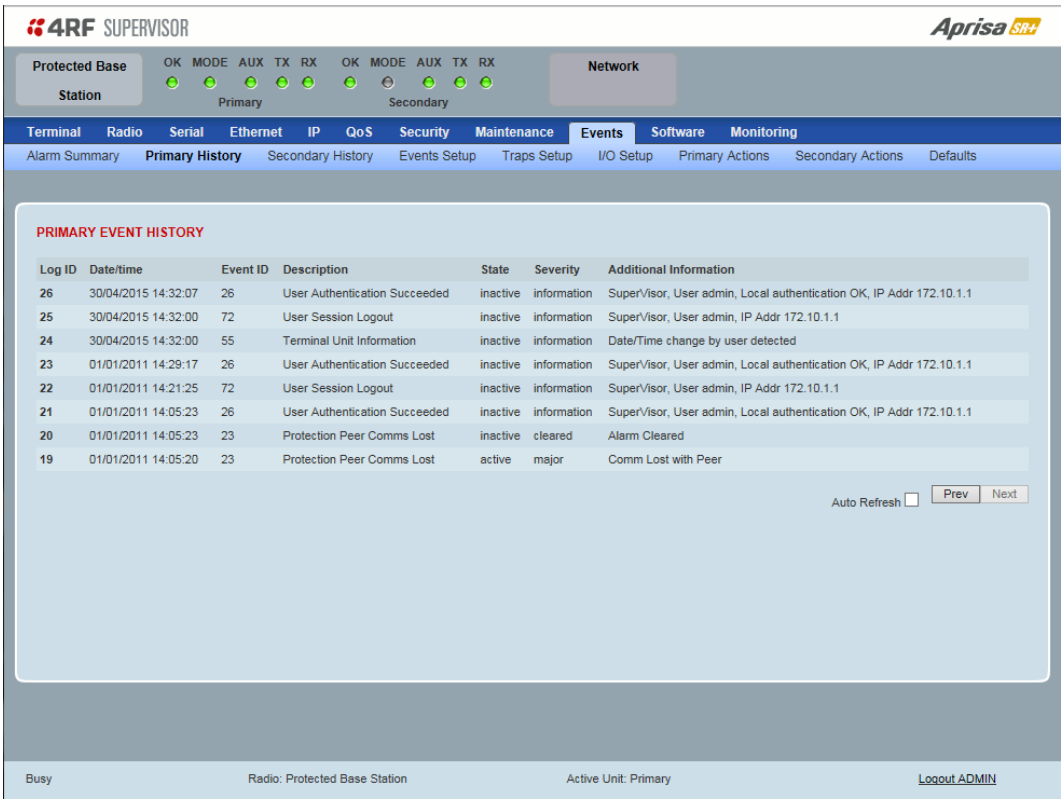
See 'Alarm Types and Sources' on page 368 for a complete list of events.



PRIMARY / SECONDARY ALARM SUMMARY

See 'Events > Alarm Summary' on page 222 for parameter details.

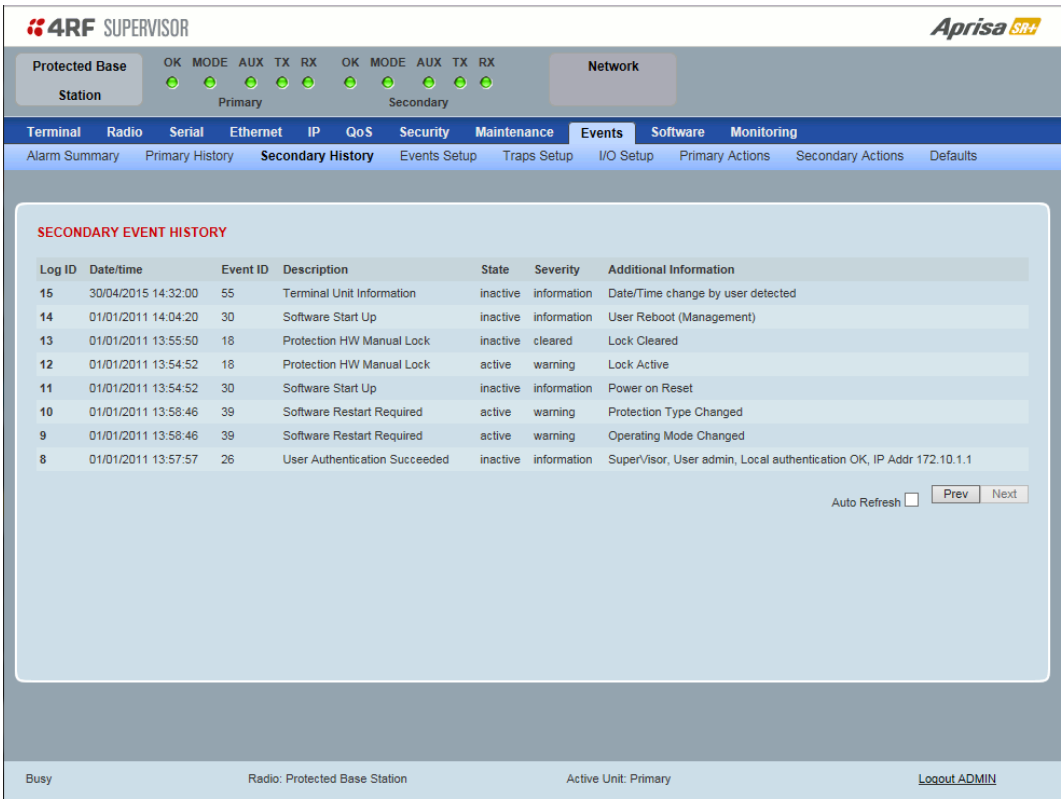
Protected Station: Events > Primary History



PRIMARY EVENT HISTORY

See ‘Events > Event History’ on page 223 for parameter details.

Protected Station: Events > Secondary History



SECONDARY EVENT HISTORY

See ‘Events > Event History’ on page 223 for parameter details.

Software

The Software menu contains the setup and management of the system software including network software distribution and activation on a protected station.

Single Radio Software Upgrade

The radio software can be upgraded on a single radio single Aprisa SR+ radio (see ‘Single Radio Software Upgrade’ on page 362). This process would only be used if the radio was a replacement or a new station in an existing network.

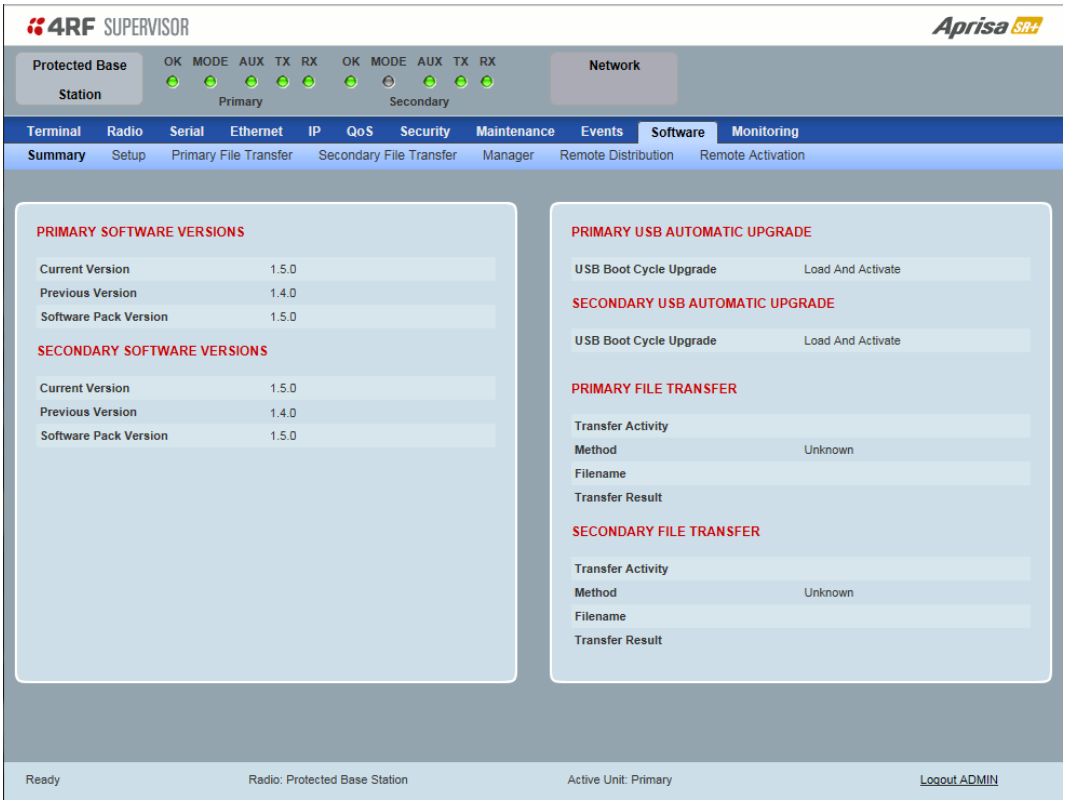
Network Software Upgrade

The radio software can be upgraded on an entire Aprisa SR+ radio network remotely over the radio link (see ‘Network Software Upgrade’ on page 358). This process involves the following steps:

1. Transfer the new software to base station primary radio with ‘Protected Station: Software > Primary File Transfer’.
2. File Transfer the new software to base station secondary radio with ‘Protected Station: Software > Secondary File Transfer’.
3. Using the Software Manual Lock, manually lock all protected remotes to the currently active radio (this is necessary to prevent automatic switching during the distribution and activation process).
4. Distribute the new software to all remote stations with ‘Protected Station: Software > Remote Distribution’. Note: The software pack in the base station active radio is used for distribution.
5. Activate of the new software on remote stations with ‘Protected Station: Software > Remote Activation’.
6. Finally, activate the new software on the base station primary and secondary radios. Note: activating the software will reboot the radio which will reset the Software Manual Lock to Automatic.

Protected Station: Software > Summary

This page provides a summary of the software versions installed on the radio, the setup options and the status of the File Transfers.

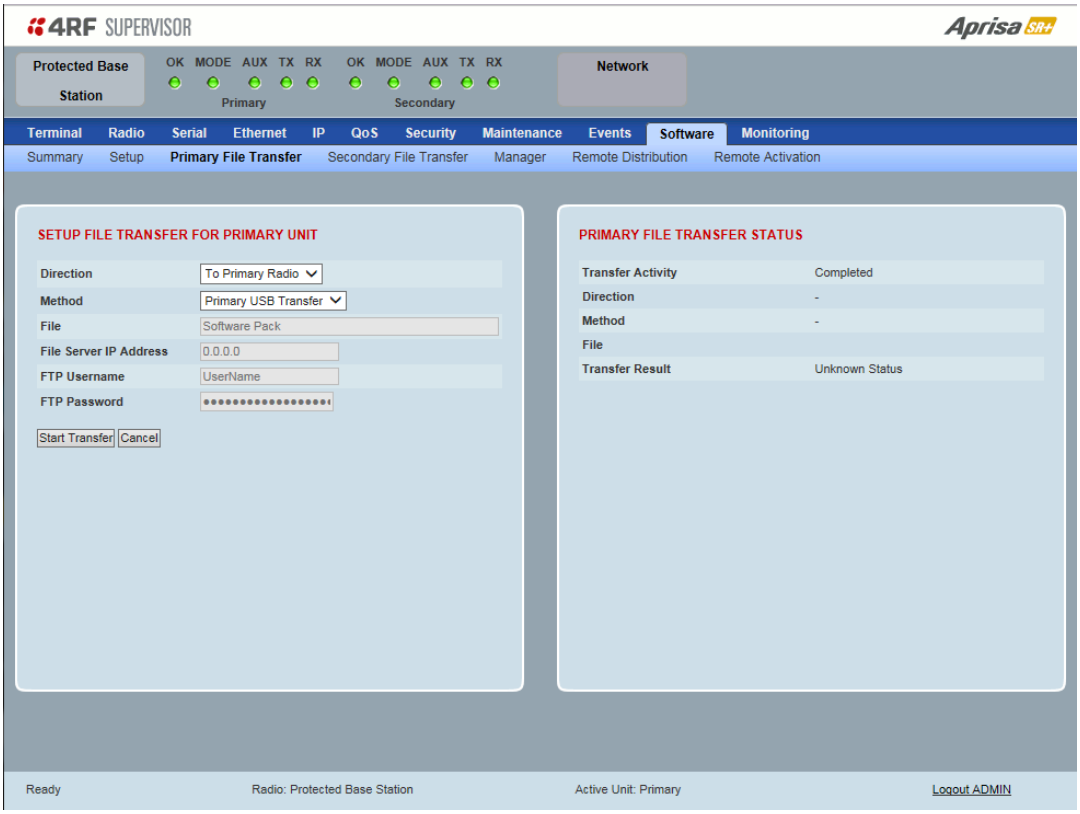


PRIMARY / SECONDARY SOFTWARE VERSIONS

See ‘Protected Station: Software > Primary File Transfer’ and ‘Protected Station: Software > Secondary File Transfer’ for parameter details.

Protected Station: Software > Primary File Transfer

This page provides the mechanism to transfer new software from a file source into the primary radio.



SETUP FILE TRANSFER FOR PRIMARY UNIT

Direction

This parameter sets the direction of file transfer. In this software version, the only choice is 'To Primary Radio'.

Method

This parameter sets the method of file transfer.

Option	Function
Primary USB Transfer	Transfers the software from the USB flash drive to the primary radio.
FTP	Transfers the software from an FTP server to the primary radio.
HTTP	Transfers the software from a PC to the primary radio.
Transfer from Secondary Unit	Transfers the software from the secondary radio to the primary radio.

PRIMARY FILE TRANSFER STATUS

See 'Software > File Transfer' on page 238 for parameter details.

To transfer software into the Aprisa SR+ primary radio:

Primary USB Transfer Method

1. Unzip the software release files in to the root directory of a USB flash drive.
2. Insert the USB flash drive into the primary radio host port .
3. Click on 'Start Transfer'.

FILE TRANSFER STATUS	
Transfer Activity	In Progress
Direction	To This Radio
Method	USB Transfer
File	Software Pack
Transfer Result	In Progress (30%)

4. When the transfer is completed, remove the USB flash drive from the primary radio host port. If the SuperVisor 'USB Boot Upgrade' setting is set to 'Disabled' (see 'USB Boot Upgrade' on page 237), the USB flash drive doesn't need to be removed as the radio won't try to load from it.
5. Go to 'Protected Station: Software > Manager' on page 313 to activate the Software Pack. The radio will reboot automatically.

FTP Method

1. Unzip the software release files in to a temporary directory.
2. Open the FTP server and point it to the temporary directory.
3. Enter the FTP server IP address, Username and password into SuperVisor.
4. Click on 'Start Transfer'.

FILE TRANSFER STATUS	
Transfer Activity	In Progress
Direction	To This Radio
Method	FTP (172.17.10.11)
File	Software Pack
Transfer Result	In Progress (1%)

5. Go to 'Protected Station: Software > Manager' on page 313 to activate the Software Pack. The radio will reboot automatically.

Transfer from Secondary Unit

1. Select Transfer from Secondary Unit.
2. Click on 'Start Transfer'.

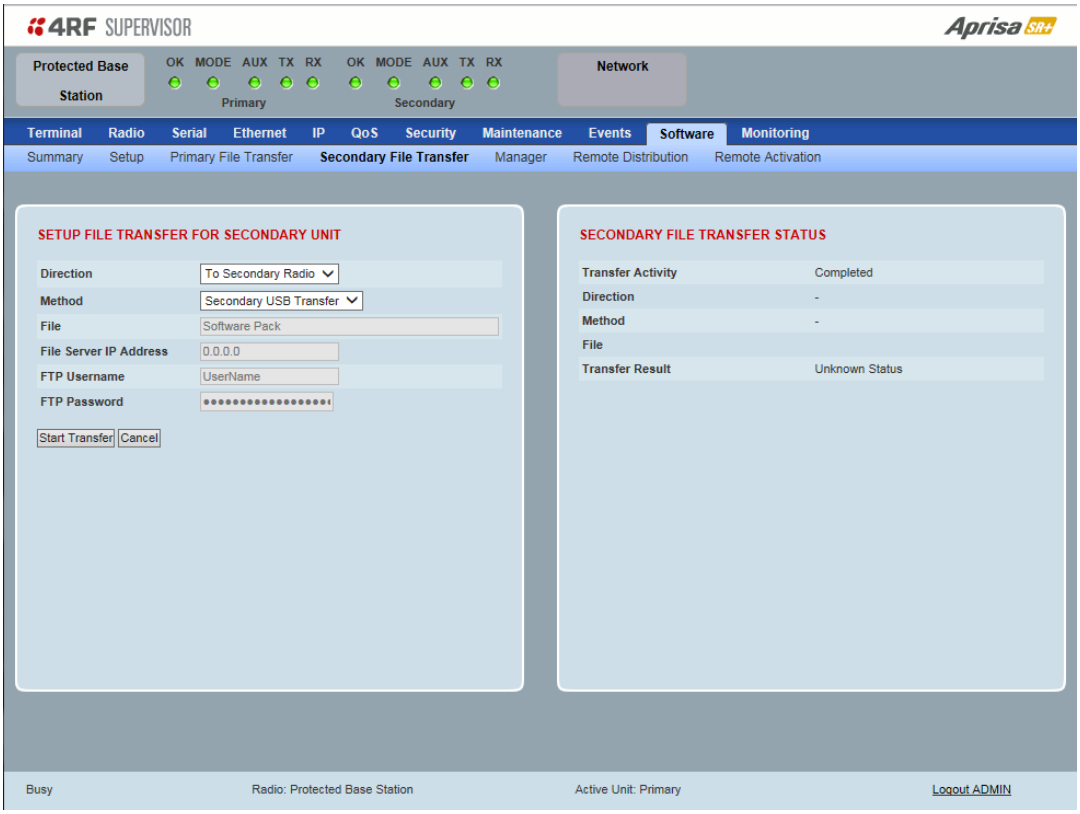
SECONDARY FILE TRANSFER STATUS	
Transfer Activity	In Progress
Direction	To This Radio
Method	Protected Partner Transfer
File	Software Pack
Transfer Result	Starting Transfer

3. Go to 'Protected Station: Software > Manager' on page 313 to activate the Software Pack. The radio will reboot automatically.

If the file transfer fails, check the Event History page (see 'Protected Station: Events > Secondary History' on page 304) for more details of the transfer.

Protected Station: Software > Secondary File Transfer

This page provides the mechanism to transfer new software from a file source into the secondary radio.



SETUP FILE TRANSFER FOR SECONDARY UNIT

Direction

This parameter sets the direction of file transfer. In this software version, the only choice is 'To Secondary Radio'.

Method

This parameter sets the method of file transfer.

Option	Function
Secondary USB Transfer	Transfers the software from the USB flash drive to the secondary radio.
FTP	Transfers the software from an FTP server to the secondary radio.
HTTP	Transfers the software from a PC to the secondary radio.
Transfer from Primary Unit	Transfers the software from the primary radio to the secondary radio.

SECONDARY FILE TRANSFER STATUS

See 'Software > File Transfer' on page 238 for parameter details.

To transfer software into the Aprisa SR+ secondary radio:

Secondary USB Transfer Method

1. Unzip the software release files in to the root directory of a USB flash drive.
2. Insert the USB flash drive into the secondary radio host port .
3. Click on 'Start Transfer'.

FILE TRANSFER STATUS	
Transfer Activity	In Progress
Direction	To This Radio
Method	USB Transfer
File	Software Pack
Transfer Result	In Progress (30%)

4. When the transfer is completed, remove the USB flash drive from the secondary radio host port. If the SuperVisor 'USB Boot Upgrade' setting is set to 'Disabled' (see 'USB Boot Upgrade' on page 237), the USB flash drive doesn't need to be removed as the radio won't try to load from it.
5. Go to 'Protected Station: Software > Manager' on page 313 to activate the Software Pack. The radio will reboot automatically.

FTP Method

1. Unzip the software release files in to a temporary directory.
2. Open the FTP server and point it to the temporary directory.
3. Enter the FTP server IP address, Username and password into SuperVisor.
3. Click on 'Start Transfer'.

FILE TRANSFER STATUS	
Transfer Activity	In Progress
Direction	To This Radio
Method	FTP (172.17.10.11)
File	Software Pack
Transfer Result	In Progress (1%)

4. Go to 'Protected Station: Software > Manager' on page 313 to activate the Software Pack. The radio will reboot automatically.

Transfer from Primary Unit

1. Select Transfer from Primary Unit.
2. Click on 'Start Transfer'.

SECONDARY FILE TRANSFER STATUS	
Transfer Activity	In Progress
Direction	To This Radio
Method	Protected Partner Transfer
File	Software Pack
Transfer Result	Starting Transfer

3. Go to 'Protected Station: Software > Manager' on page 313 to activate the Software Pack. The radio will reboot automatically.

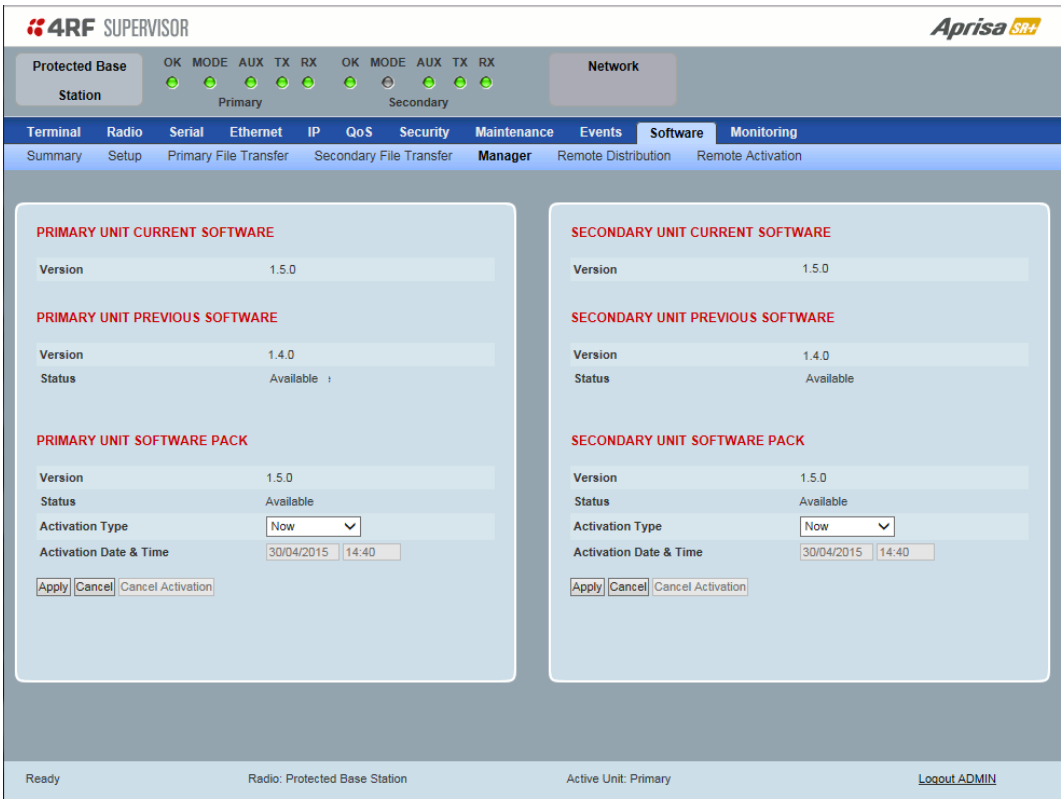
If the file transfer fails, check the Event History page (see 'Protected Station: Events > Primary History' on page 303) for more details of the transfer.

Protected Station: Software > Manager

This page summaries and manages the software versions available in the primary and secondary radios.

The manager is predominantly used to activate new software on single radios. Network activation is performed with 'Protected Station: Software > Remote Activation'.

Both the previous software (if available) and Software Pack versions can be activated on each radio from this page.



PRIMARY / SECONDARY CURRENT SOFTWARE

Version

This parameter displays the software version running on the radio.

PRIMARY / SECONDARY PREVIOUS SOFTWARE

Version

This parameter displays the software version that was running on the radio prior to the current software being activated.

Status

This parameter displays the status of the software version running on the radio.

Option	Function
Active	The software is operating the radio.
Inactive	The software is not operating the radio but could be re-activated if required.

PRIMARY / SECONDARY SOFTWARE PACK

Version

This parameter displays the software pack version available for distribution on base station and activate on all stations.

Status

This parameter displays the status of the software pack version.

Option	Function
Available	On the base station, the software pack is available for distribution. On all stations, the software pack is available for activation.
Activating	The software pack is activating in the radio.
Unavailable	There is no software pack loaded into the radio.

Activate

See ‘Software > Manager’ on page 242 for the activation options.

Protected Station: Software > Remote Distribution

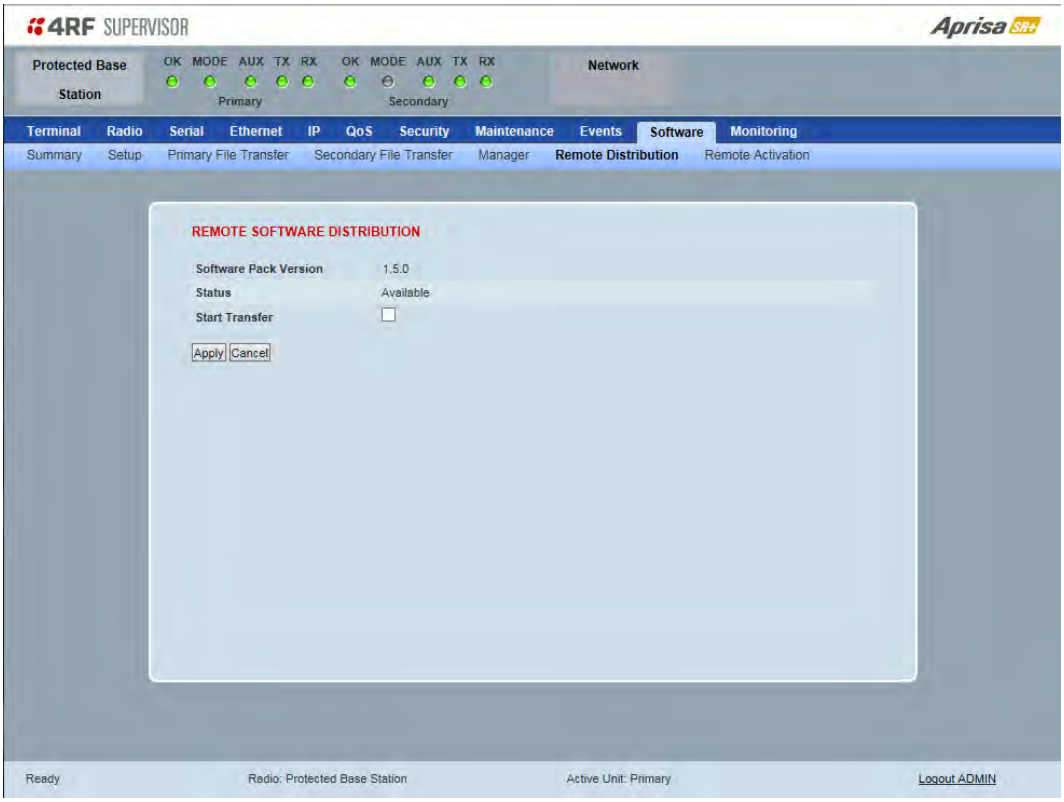
This page provides the mechanism to distribute software to all remote protected stations into the Aprisa SR+ network (network) and then activate it.

The Software Pack loaded into the base station with the file transfer process (see 'Protected Station: Software > Primary File Transfer' on page 307) is distributed via the radio link to all remote stations from the active radio.

The distribution process is monitored from this page.

When all remote stations receive the Software Pack version, the software can be remotely activated on all remote stations.

This page is only available when the radio is configured as a Base Station.



REMOTE SOFTWARE DISTRIBUTION

Software Pack Version

This parameter displays the software pack version available for distribution on base station and activate on all stations.

Status

This parameter displays the status of the software pack version.

If a Software Pack is not available, the status will display 'Unavailable' and the software distribution mechanism will not work.

Start Transfer

This parameter when activated distributes (broadcasts) the new Software Pack to all remote stations in the network.

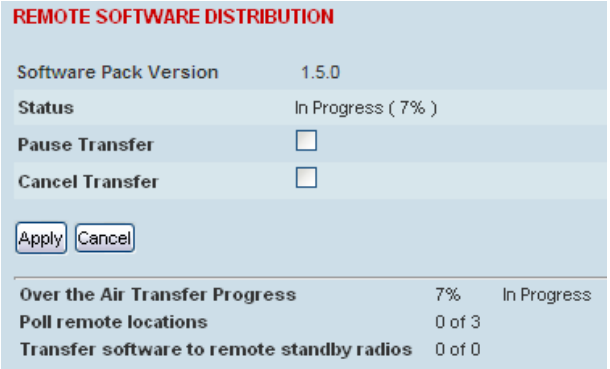
Note: The distribution of software to remote stations does not stop customer traffic from being transferred. However, due to the volume of traffic, the software distribution process may affect customer traffic.

Software distribution traffic is classified as 'management traffic' but does not use the Ethernet management priority setting. Software distribution traffic priority has a fixed priority setting of 'very low'.

To distribute software to remote stations:

This process assumes that a Software Pack has been loaded into the base station with the file transfer process (see 'Protected Station: Software > Primary File Transfer' on page 307).

1. To ensure that the Network Table is up to date, it is recommended running the node discover function (see 'Discover Nodes' on page 218).
2. Click on 'Start Transfer'.



Note: This process could take anywhere between 40 minutes and several hours depending on channel size, Ethernet Management Priority setting and the amount of customer traffic on the network.

Result	Function
Over the Air Transfer Progress	The percentage of the software pack that has been broadcast to the remote radios.
Poll Remote Locations	X is the number of radios polled to determine the number of standby radios. Y is the number of remote radios registered with the base station.
Transfer software to remote standby radios	X is the number of standby radios with the new software version. Y is the number of standby radios requiring the new software version.

3. When the distribution is completed, activate the software with the Remote Software Activation.

Pause Transfer

This parameter when activated, pauses the Over the Air Transfer Process and shows the distribution status. The distribution process will continue from where it was paused with Resume Transfer.

Cancel Transfer

This parameter when activated, cancels the Over the Air Transfer Process immediately.

During the distribution process, it is possible to navigate away from this page and come back to it to check progress. The SuperVisor session will not timeout.

Protected Station: Software > Remote Activation

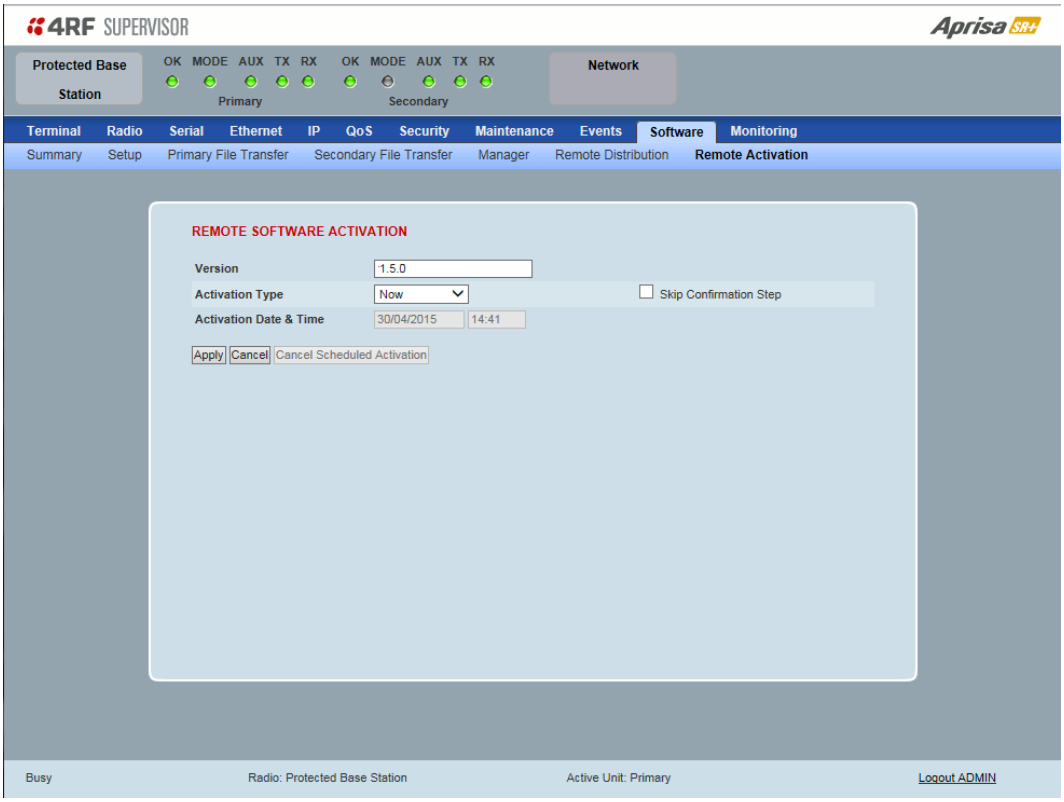
This page provides the mechanism to activate software on all remote protected stations.

The Software Pack has been loaded into the base station with the file transfer process (see 'Protected Station: Software > Primary File Transfer' on page 307) and distributed via the radio link to all remote stations from the active radio.

When all remote stations receive the Software Pack version, the software can be remotely activated on all remote stations.

The activation process is monitored by this page.

This page is only available when the radio is configured as a Base Station.



REMOTE SOFTWARE ACTIVATION

When the software pack version has been distributed to all the remote stations, the software is then activated in all the remote stations with this command. If successful, then activate the software pack in the base station to complete the network upgrade.

Version

This parameter displays the software version for activation. The default version is the software pack version but any valid software version can be entered in the format 'n.n.n'.

Activation Type

This parameter sets when the software pack activation will occur.

Option	Function
Now	Activates the software pack now.
Date & Time	Activates the software pack at the Date & Time set in the following parameter.

Activation Date & Time

This parameter sets the Date & Time when the software pack activation will occur.

This setting can be any future date and 24 hour time.

Skip Confirmation Step

This parameter when enabled skips the confirmation step during the activation process.

Normally, the confirmation step will require use intervention to accept the confirmation which will halt the activation process. Skipping the confirmation will enable the activation process to continue without use intervention.

To activate software in remote stations:

This process assumes that a Software Pack has been loaded into the base station with the file transfer process (see 'Software > File Transfer' on page 238) and that distributed to all remote radios in the network.

Note: Do not navigate SuperVisor away from this page during the activation process (SuperVisor can lose PC focus).

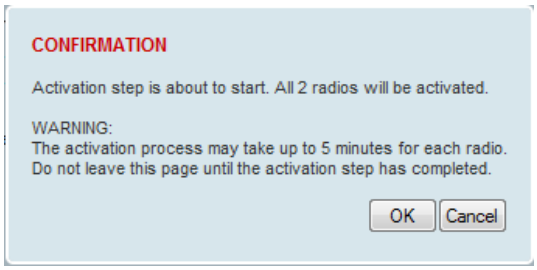
---

1. Enter the Software Pack version (if different from displayed version).
2. See 'Software > Manager' on page 242 for the activation options.

The remote stations will be polled to determine which radios require activation:

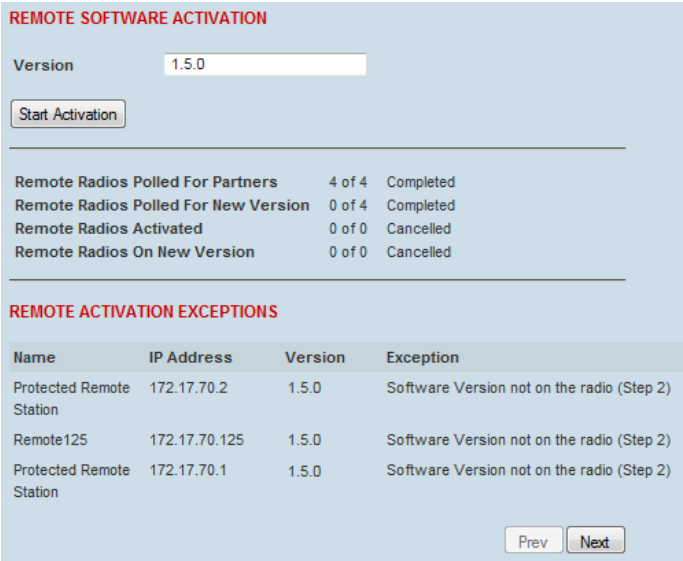
Result	Function (X of Y)
Remote Radios Polled for Partners	X is the number of radios polled to determine the number of protected stations in the network. Y is the number of remote radios registered with the base station.
Remote Radios Polled for New Version	X is the number of radios polled to determine the number of radios that contain the new software version. Y is the number of remote radios registered with the base station.
Remote Radios Activated	X is the number of radios that contain the new software version and have been activated. Y is the number of radios that contain the new software version and can be activated.
Remote Radios On New Version	X is the number of radios that has been successfully activated and now running the new version of software. Y is the number of radios that the activation command was executed on.

When the activation is ready to start:



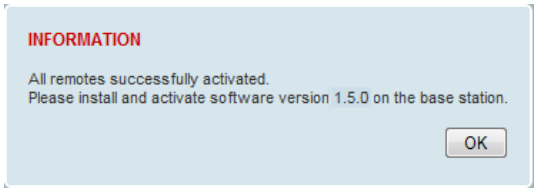
3. Click on 'OK' to start the activation process or Cancel to quit.

The page will display the progress of the activation.



The example shows that during the activation process there were exceptions that may need to be investigated.

When all the remote radios have been activated, the base station radio must now be activated with (see ‘Software > Manager’ on page 242).



4. Click on ‘OK’ to start the activation on the base station.

Command Line Interface

The Aprisa SR+ has a Command Line Interface (CLI) which provides basic product setup and configuration. This can be useful if you need to confirm the radio's IP address, for example.

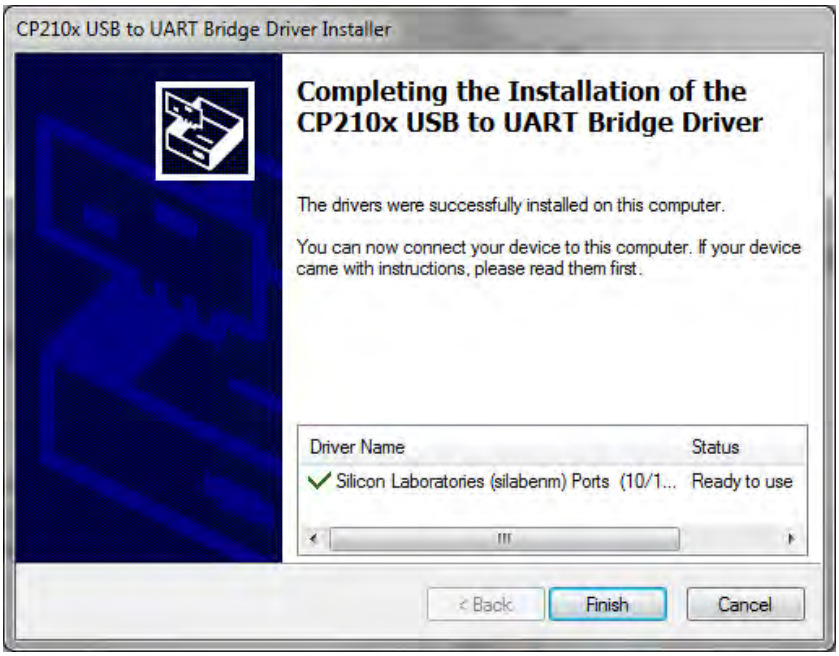
You can password-protect the Command Line Interface to prevent unauthorized users from modifying radio settings.

This interface can be accessed via an Ethernet Port (RJ45), the Management Port (USB micro type B) or the USB host port with a USB converter to RS-232 convertor.

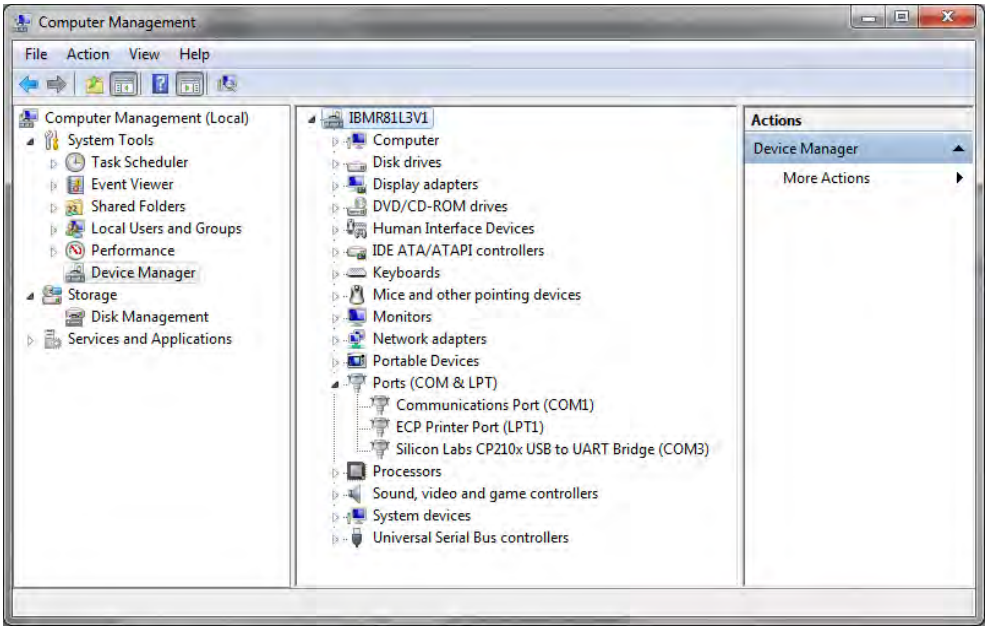
Connecting to the Management Port

A USB Cable USB A to USB micro B, 1m is provided with each radio.

1. Connect the USB A to your computer USB port and the USB micro B to the management port of the Aprisa SR+ (MGMT).
2. Unzip the file 'USB Serial Driver CP210x_VCP_Windows.zip' to a temporary location and install the appropriate driver on your computer. This file is on the Information and setup CD supplied with the radio.



3. Go to your computer device manager (Win 7: Control Panel > Administrative Tools > Computer Management > Device Manager)
4. Click on 'Ports (COM & LPT)'
5. Make a note of the COM port which has been allocated to the 'Silicon Labs CP210x USB to UART Bridge' (COM3 in the example below)



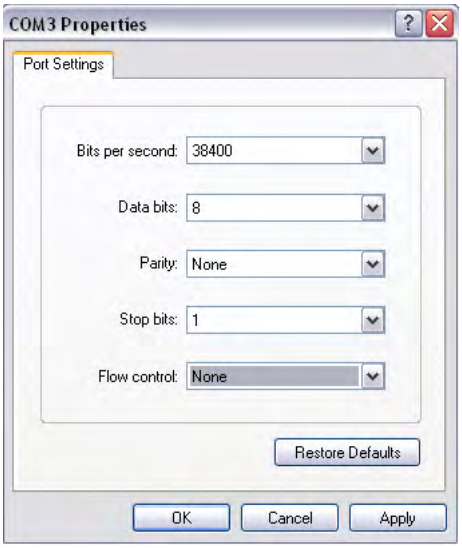
6. Open HyperTerminal or an alternative type of terminal Emulator program e.g. TeraTerm or Putty.

<u>HyperTerminal Example</u>

7. Enter a name for the connection (Aprisa SR+ CLI for example) and click OK.

8. Select the COM port from the Connect Using drop-down box that was allocated to the UART USB.

9. Set the COM port settings as follows:



10. Click OK. The HyperTerminal window will open.
11. Press the Enter key to initiate the session.
12. Login to the Aprisa SR+ CLI with a default Username ‘admin’ and Password ‘admin’.

The Aprisa SR+ CLI menu is shown:

```
Login: admin
Password: *****
CLI user admin last login: 2011/01/01 22:29:34 from 127.0.0.1
>>?
adduser      browser      cd           clear        config
debug        deleteuser   editpasswd   edituser     get
list         logout       ls           nodelqi      pwd
reboot       rohc         set          who
>>
>>
```

CLI Commands

To enter a CLI command:

1. Type the first few characters of the command and hit Tab. This auto completes the command.
2. Enter the command string and enter.

Note: All CLI commands are case sensitive.

The top level CLI command list is displayed by typing a ? at the command prompt.

The following is a list of the top level CLI commands and their usage:

CLI Command	Usage
adduser	adduser [-g <password aging>] [-a <account aging>] [-i <role>] <userName> <userPassword>
browser	browser <state(STR)>
cd	cd <changeMode(STR)>
clear	Clears the screen
config	config userdefault save restore factorydefault restore
debug	set subsystem param(INT) level param(INT) get clear subsystem param(INT) level param(INT) help log dump clear
deleteuser	deleteuser <userName>
editpasswd	editpasswd <oldpassword> <newpassword>
edituser	edituser [-p <password>] [-g <password aging>] [-a <account aging>] [-i]
get	get [-m <mib name>] [-n <module name>] <attribute name> [indexes]
list	list <tablename>
logout	Logs out from the CLI
ls	Displays the next level menu items
pwd	Displays the current working directory
reboot	Reboots the radio
rohc	stats show clear
set	set [-m <mib name>] [-n <module name>] <attribute name> <attribute set value> [indexes]
who	Shows the users currently logged into the radio

Viewing the CLI Terminal Summary

At the command prompt, type:

cd APRISASR-MIB-4RF

MPA APRISASR-MIB-4RF >>ls Terminal

```
>>cd APRISASR-MIB-4RF
MPA APRISASR-MIB-4RF >>ls Terminal
+-------------------------------------------------------+
|S.NO|ATTRIBUTE NAME                |ATTRIBUTE VALUE     |
+-------------------------------------------------------+
|1   |termName                      |Base Station        |
|2   |termLocation                  |Wellington          |
|3   |termContactName               |4RF Limited         |
|4   |termContactDetails            |support@4rf.com     |
|5   |termTimeFormat                |time24h (1)         |
|6   |termDateFormat                |ddmmyyyy (1)        |
|7   |termDateTime                  |2013-9-12,19:22:43.0|
|8   |termEthController1IpAddress   |173.10.10.1         |
|9   |termEthController1SubnetMask  |255.255.0.0         |
|10  |termEthController1Gateway     |0.0.0.0             |
|11  |termRfNwkPanId                |CAFE                |
|12  |termRfNwkRadius               |1                   |
|13  |termInbandManagementEnabled   |true (1)            |
|14  |termInbandManagementTimeoutSec|10                  |
|15  |termRfNwkRepeaterProximity    |noRepeater (0)      |
+-------------------------------------------------------+
```

Changing the Radio IP Address with the CLI

At the command prompt, type ‘set termEthController1IpAddress xxx.xxx.xxx.xxx’

```
+-------------------------------------------------------+
|1   |termName                      |Base Station        |
|2   |termLocation                  |Wellington          |
|3   |termContactName               |4RF Limited         |
|4   |termContactDetails            |support@4rf.com     |
|5   |termTimeFormat                |time24h (1)         |
|6   |termDateFormat                |ddmmyyyy (1)        |
|7   |termDateTime                  |2013-9-12,19:25:19.0|
|8   |termEthController1IpAddress   |173.10.10.1         |
|9   |termEthController1SubnetMask  |255.255.0.0         |
|10  |termEthController1Gateway     |0.0.0.0             |
|11  |termRfNwkPanId                |CAFE                |
|12  |termRfNwkRadius               |1                   |
|13  |termInbandManagementEnabled   |true (1)            |
|14  |termInbandManagementTimeoutSec|10                  |
|15  |termRfNwkRepeaterProximity    |noRepeater (0)      |
+-------------------------------------------------------+

MPA APRISASR-MIB-4RF >>set termEthController1IpAddress 173.10.10.1
termEthController1IpAddress     =       173.10.10.1

MPA APRISASR-MIB-4RF >>
Connected 0:06:07   ANSIW   38400 8-N-1   SCROLL   CAPS   NUM   Capture   Print echo
```

8. In-Service Commissioning

Before You Start

When you have finished installing the hardware, RF and the traffic interface cabling, the system is ready to be commissioned. Commissioning the radio is a simple process and consists of:

1. Powering up the radios.
2. Configuring all radios in the network using SuperVisor.
3. Aligning the antennas.
4. Testing that the links are operating correctly.
5. Connecting up the client or user interfaces.

What You Will Need

- Appropriately qualified commissioning staff at both ends of each link.
- Safety equipment appropriate for the antenna location at both ends of each link.
- Communication equipment, that is, mobile phones or two-way radios.
- SuperVisor software running on an appropriate laptop, computer, or workstation at the base station radio.
- Tools to facilitate loosening and re-tightening the antenna pan and tilt adjusters.
- Predicted receiver input levels and fade margin figures from the radio link budget.

Antenna Alignment

A base station omni-directional collinear antenna has a vertical polarization. The remote station yagi antennas must also have vertical polarization.

Aligning the Antennas

Align the remote station yagi antennas by making small adjustments while monitoring the RSSI. The Aprisa SR+ has a Test Mode which presents a real time visual display of the RSSI on the front panel LEDs. This can be used to adjust the antenna for optimum signal strength (see 'Test Mode' on page 44).

Note: Low gain antennas need less adjustment in elevation as they are simply aimed at the horizon. They should always be panned horizontally to find the peak signal.

---

1. Press and hold the TEST button on the radio LED panel until all the LEDs flash green (about 3 - 5 seconds).

   Note: The time for the LEDs to display the RSSI result is variable, depending on the network traffic, and can be up to 5 seconds. Small antenna adjustments should be made and then wait for the display to refresh.

   The RSSI poll refresh rate can be set with the SuperVisor command 'Transmit Period' (see 'Maintenance > Test Mode' on page 210).

2. Move the antenna through a complete sweep horizontally (pan). Note down the RSSI reading for all the peaks in RSSI that you discover in the pan.
3. Move the antenna to the position corresponding to the maximum RSSI value obtained during the pan. Move the antenna horizontally slightly to each side of this maximum to find the two points where the RSSI drops slightly.
4. Move the antenna halfway between these two points and tighten the clamp.
5. If the antenna has an elevation adjustment, move the antenna through a complete sweep (tilt) vertically. Note down the RSSI reading for all the peaks in RSSI that you discover in the tilt.
6. Move the antenna to the position corresponding to the maximum RSSI value obtained during the tilt. Move the antenna slightly up and then down from the maximum to find the two points where the RSSI drops slightly.
7. Move the antenna halfway between these two points and tighten the clamp.
8. Recheck the pan (steps 2-4) and tighten all the clamps firmly.
9. To exit Test Mode, press and hold the TEST button until all the LEDs flash red (about 3 – 5 seconds).

9. Product Options

Data Interface Ports

The standard Aprisa SR+ provides multiple interface port options for combinations of Ethernet and RS-232 serial for a total of four interface ports i.e. port options of 2E2S, 3E1S or 4E0S, where E=Ethernet, S=Serial port.

The product shown below is the two Ethernet ports plus two RS-232 serial ports.

Interface Port Option	Part Number
4 Ethernet ports and no RS-232 serial ports	APSQ-N400-SSC-HD-40-ENAA
3 Ethernet ports and 1 RS-232 serial port	APSQ-N400-SSC-HD-31-ENAA
2 Ethernet ports and 2 RS-232 serial ports	APSQ-N400-SSC-HD-22-ENAA

Note: The optional serial interface is always available via the USB to serial converter.

Full Duplex Base Station

The Aprisa SR+ supports Full Duplex base / master station hardware. This option works with half duplex repeater / remote radios. The base / master station can transmit while simultaneously receiving from the repeater /remote radios.

Example of a 400 MHz full duplex Aprisa SR+.

Part Number	Part Description
APSQ-N400-SSC-FD-22-ENAA	4RF SR+, BR, 400-470 MHz, SSC, Full Duplex, 2E2S, EN, STD

Protected Station

The Aprisa SR+ Protected Station is fully monitored hot-standby and fully hot-swappable product providing radio and user interface protection for Aprisa SR+ radios. The RF ports and interface ports from the active radio are switched to the standby radio if there is a failure in the active radio.

Option Example

Part Number	Part Description
APSQ-R400-SSC-HD-22-ENAA	4RF SR+, PS, 400-470 MHz, SSC, Half Duplex, 2E2S, EN, STD

The Aprisa SR+ Protected Station is comprised of an Aprisa SR+ Protection Switch and two standard Aprisa SR+ radios mounted in a 2U rack mounting chassis.

All interfaces (RF, data, etc.) are continually monitored on both the active and standby radio to ensure correct operation. The standby radio can be replaced without impacting traffic flow on the active radio.

The Aprisa SR+ radios can be any of the currently available Aprisa SR+ radio frequency bands, channel sizes or interface port options.

The Aprisa SR+ Protected Station can operate as a base station, repeater station or remote station. The protection behaviour and switching criteria between the active and standby radios is identical for the three configurations.

By default, the Aprisa SR+ Protected Station is configured with the left hand radio (A) designated as the primary radio and the right hand radio (B) designated as the secondary radio.

Each radio is configured with its own unique IP and MAC address and the address of the partner radio.

On power-up, the primary radio will assume the active role and the secondary radio will assume the standby role. If, for some reason, only one radio is powered on it will automatically assume the active role.

Both the Aprisa SR+ Protected Station primary radio and secondary radio must be operating on the same software version.

Protected Ports

The protected ports are located on the protected station front panel. Switching occurs between the active radio ports and the standby radio ports based on the switching criteria described below.

The protected ports include:

- Antenna ports ANT/TX and RX (if dual antenna ports used)
- Ethernet ports (depending on interface port option purchased)
- Serial ports (depending on interface port option purchased)

Operation

In hot-standby normal operation, the active radio carries all RS-232 serial and Ethernet traffic over the radio link and the standby radio transmit is on with its transmitter connected to an internal load. Both radios are continually monitored for correct operation including the transmitter and receiver and alarms are raised if an event occurs.

The active radio sends regular 'keep alive' messages to the standby radio to indicate it is operating correctly. In the event of a failure on the active radio, the RF link and user interface traffic is automatically switched to the standby radio.

The failed radio can then be replaced in the field without interrupting user traffic.

Switch Over

The switch-over to the standby radio can be initiated automatically, on fault detection, or manually via the Hardware Manual Lock switch on the Protection Switch or the Software Manual Lock from SuperVisor.

Additionally, it is possible to switch-over the radios remotely without visiting the station site, via the remote control connector on the front of the Protection Switch.

On detection of an alarm fault the switch-over time is less than 0.5 seconds. Some alarms may take up to 30 seconds to be detected depending on the configuration options selected.

The Protection Switch has a switch guard mechanism to prevent protection switch oscillation. If a switch-over has occurred, subsequent switch-over triggers will be blocked if the guard time has not elapsed.

The guard time starts at 20 seconds and doubles each switch-over to a maximum of 320 seconds and halves after a period of two times the last guard time with no protection switch-overs.

Switching Criteria

The Protected Station will switch-over operation from the active to the standby radio if any of the configurable alarm events occur, or if there is a loss of the 'keep alive' signal from the active radio.

It is possible to configure the alarm events which will trigger the switch-over. It is also possible to prevent an alarm event triggering a switch-over through the configuration of blocking criteria.

Any of the following alarm events can be set to trigger or prevent switching from the active radio to the standby radio (see 'Events > Events Setup' on page 224).

PA current	
Tx reverse power	Tx AGC
Temperature threshold	Thermal shutdown
RSSI Threshold	RX Synthesizer Not Locked
Rx CRC errors	RF no receive data
Port 1 Eth no receive data	Port 2 Eth no receive data
Port 1 Eth data receive errors	Port 2 Eth data receive errors
Port 1 Eth data transmit errors	Port 2 Eth data transmit errors
Port 3 Eth no receive data	Port 4 Eth no receive data
Port 3 Eth data receive errors	Port 4 Eth data receive errors
Port 3 Eth data transmit errors	Port 4 Eth data transmit errors
Port 1 Serial Data No RX Data	Port 2 Serial Data RX Data
Port 1 Serial Data RX Errors	Port 2 Serial Data RX Errors
USB Port Serial Data No RX Data	USB Port Serial Data RX Errors
Component failure	Calibration failure
Configuration not supported	Protection Hardware Failure
Alarm Input 1	Alarm Input 2

It will not attempt to switch-over to a standby radio which has power failure.

It will also not switch over to a standby radio with an active alarm event which has been configured as a 'blocking criteria'.

Switch-over will be initiated once either of these conditions is rectified, i.e. power is restored or the alarm is cleared.

Monitored Alarms

The following alarms are monitored by default on the active / standby radio. The monitored alarms are dependent on the Protection Type selected.

Protection Type	All Protection Types	Redundant	Monitored Hot Standby	
Alarm Type	Monitored on Active Radio	Monitored on Standby Radio	Monitored on Standby Radio TX	Monitored on Standby Radio RX
PA Current	☑		☑	
PA Driver Current	☑		☑	
PA Stability	☑		☑	
TX AGC	☑			
TX Forward Power	☑		☑	
TX Reverse Power	☑		☑	
Temperature Threshold	☑	☑	☑	☑
TX Synthesizer Not Locked	☑		☑	
Thermal Shutdown	☑			
RSSI Threshold	☑			☑
RX Synthesizer Not Locked	☑			☑
RX CRC Errors	☑			☑
RF No Receive Data	☑			☑
Port1 ETH No Receive Data	☑			
Port1 ETH Data Receive Errors	☑			
Port1 ETH Data Transmit Errors	☑			
Port2 ETH No Receive Data	☑			
Port2 ETH Data Receive Errors	☑			
Port2 ETH Data Transmit Errors	☑			
Port3 ETH No Receive Data	☑			
Port3 ETH Data Receive Errors	☑			
Port3 ETH Data Transmit Errors	☑			
Port4 ETH No Receive Data	☑			
Port4 ETH Data Receive Errors	☑			
Port4 ETH Data Transmit Errors	☑			
Port1 Serial Data No RX Data	☑			
Port1 Serial Data RX Errors	☑			
Port2 Serial Data No RX Data	☑			
Port2 Serial Data RX Errors	☑			
USB Port Serial Data No RX Data	☑			
USB Port Serial Data No RX Errors	☑			
Component Failure	☑	☑	☑	☑
Protection SW Manual Lock	☑			
Protection HW Manual Lock	☑			

Protection Type	All Protection Types	Redundant	Monitored Hot Standby	
Alarm Type	Monitored on Active Radio	Monitored on Standby Radio	Monitored on Standby Radio TX	Monitored on Standby Radio RX
Modem FEC Disable	☑			
Modem ACM Lock	☑			
Alarm Input 1	☑	☑	☑	☑
Alarm Input 2	☑	☑	☑	☑
Protection Peer Comms Lost	☑			
Protection Hardware Failure	☑			
VDC Power Supply	☑	☑	☑	☑
3.3 Volts Power Supply	☑	☑	☑	☑
5.0 Volts Power Supply	☑	☑	☑	☑
7.2 Volts Power Supply	☑			
15.0 Volts Power Supply	☑	☑	☑	☑

Configuration Management

The Primary and Secondary radios are managed with the embedded web-based management tool, SuperVisor, by using either the Primary or Secondary IP address. Configuration changes in one of the radios will automatically be reflected in the partner radio.

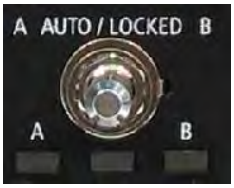
To ensure all remote stations are registered to the correct (active) base station, changes to the Network Table are automatically synchronized from the active radio to the standby radio. The Network Table is only visible on the active radio. This synchronization does not occur if the Hardware Manual Lock is active.

Hardware Manual Lock

The Hardware Manual Lock switch on the Protection Switch provides a manual override of the active / standby radio.

When this lock is activated, the selected radio (A or B) becomes the active radio regardless of the Software Manual Lock and the current switching or block criteria.

When the lock is deactivated (set to the Auto position), the protection will become automatic and switching will be governed by normal switching and blocking criteria.



The state of the switch is indicated by the three LEDs on the Protection Switch:

A LED	B LED	Locked LED	State
Green	Off	Off	Auto - Radio A is active
Off	Green	Off	Auto - Radio B is active
Green	Off	Orange	Manual Lock to radio A
Off	Green	Orange	Manual Lock to radio B

The Protection Switch also has a Software Manual Lock. The Hardware Manual Lock takes precedence over Software Manual Lock if both diagnostic functions are activated i.e. if the Software Manual Lock is set to 'Primary' and the Hardware Manual Lock set to 'Secondary', the system will set the Secondary radio to Active.

When a Hardware Manual Lock is deactivated (set to the Auto position), the Software Manual Lock is re-evaluated and locks set appropriately.

Remote Control

The switch-over to the standby radio can be initiated via the Remote Control connector on the front of the Protection Switch. This control will only operate if the Hardware Manual Lock switch is set to the Auto position.

The inputs are logic inputs with 4700 Ω pullup to +3.3 VDC. They require a pull down to ground to activate the control. The ground potential is available on the connector (see 'Protection Switch Remote Control Connections' on page 367).

L2 / L3 Protection Operation

The Aprisa SR+ Protected Station has selectable L2 Bridge or L3 Router modes, with VLAN, QoS and L2/3/4 address filtering attributes. Each Radio is configured with its own unique IP and MAC address and partner radio address. On switch-over failure, the new active radio sends out a gratuitous ARP to update the MAC learning tables / ARP tables of upstream bridge/router for appropriate traffic flow.

Hot-Swappable

The two Aprisa SR+ radios are mounted on a pull-out tray to making it possible to replace a failed radio without interrupting user traffic.

Antenna and Duplexer Options

Option 1 - single antenna without a duplexer

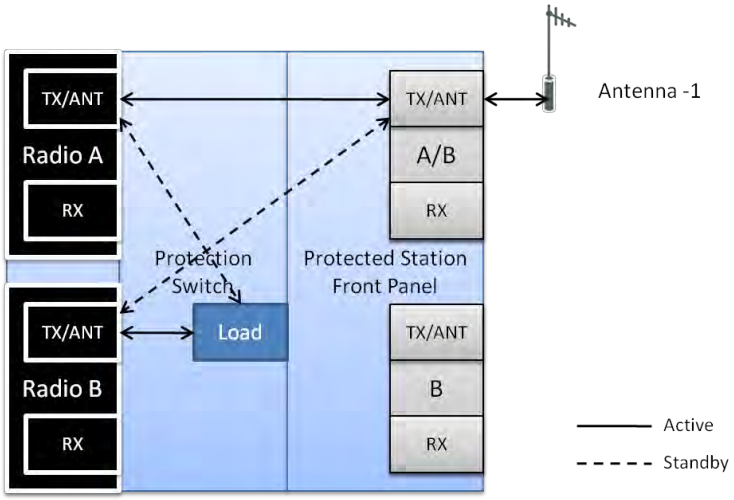
In this configuration, a single antenna is used and connected directly to the Aprisa SR+ Protected Station TX/ANT (A/B side) TNC port on the front panel. In this option Protected Station can operate in:

- Half duplex RF operation only

If single frequency used, standby radio TX is OFF/Mute (as RX/TX on same connector).

If dual frequency used, standby radio TX is ON, transmit to internal load for fault monitoring.

Only the active radio receives the signal (single RX path) from the antenna.



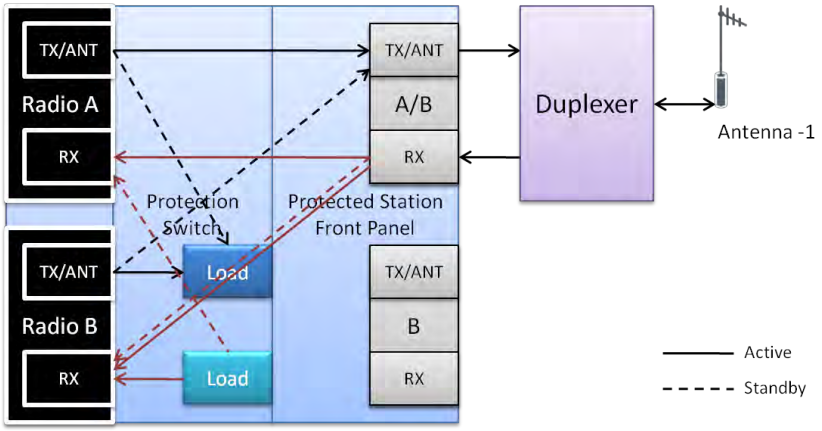
Option 2 - single antenna with a single duplexer

In this configuration, a single antenna is used with a duplexer which is connected to the Aprisa SR+ Protected Station TX/ANT and RX (A/B side) TNC ports on the front panel. In this option, the Protected Station can operate in:

- Half or full duplex RF operation
- Only dual frequency supported, where standby radio TX is ON, transmits to internal load for fault monitoring

When the 'Protection Type' is set to 'monitored hot standby' (Terminal > Operating Mode), the standby radio RX/TX can be fault monitored. This mode has a 4 dB loss in RX sensitivity.

When the 'Protection Type' is set to 'redundant', the standby radio RX/TX will not be fault monitored. This mode has 1 dB loss in RX sensitivity.



Option 3 - dual antenna without a duplexer

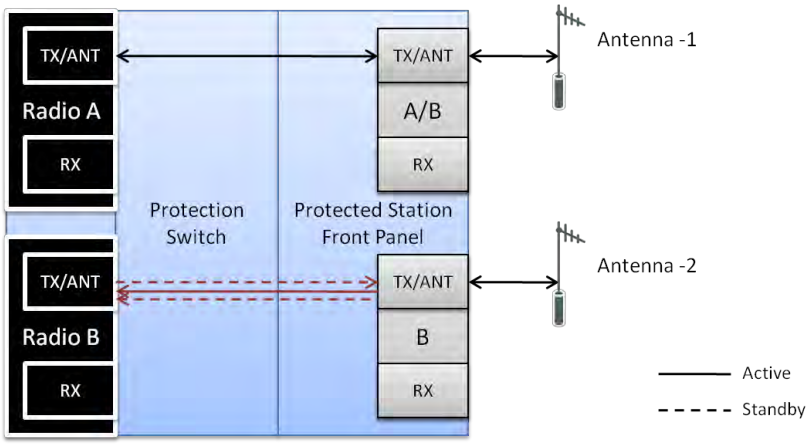
In this configuration, antenna redundancy is supported with dual antennas connected to the Aprisa SR+ Protected Station TX/ANT (A/B side) and TX/ANT (B side) TNC ports on the front panel. In this option, the Protected Station can operate in:

- Half duplex RF operation only

If single frequency used, standby radio RX (TX is off) can't be monitored as it will receive the active TX.

If dual frequency used, and the 'Protection Type' is set to 'monitored hot standby' (Terminal > Operating Mode), the standby radio RX/TX can be fault monitored. This mode has a 1 dB loss in RX sensitivity.

If dual frequency used, and the 'Protection Type' is set to 'redundant', the standby radio RX/TX will not be fault monitored.



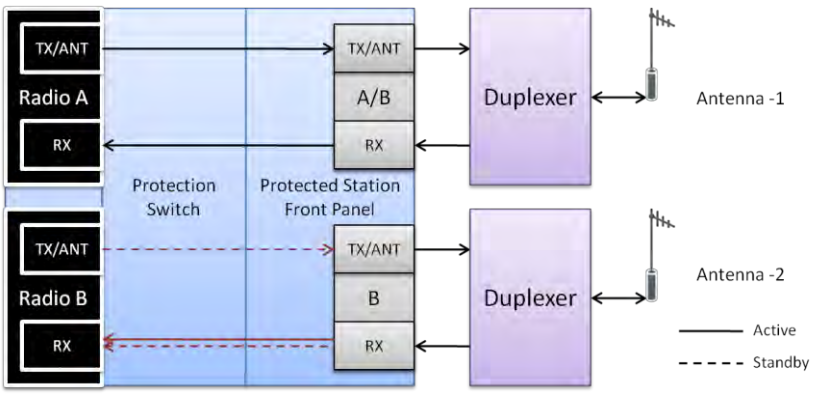
Option 4 - dual antenna with dual duplexers

In this configuration, antenna redundancy is supported with dual antennas connected via dual duplexers to the Aprisa SR+ Protected Station TX/ANT and RX (A/B side) TNC ports and TX/ANT and RX (B side) TNC ports on the front panel. In this option, the Protected Station can operate in:

- Half or full duplex RF operation
- Only dual frequency

When the 'Protection Type' is set to 'monitored hot standby' (Terminal > Operating Mode), the standby radio RX/TX can be fault monitored. This mode has a 1 dB loss in RX sensitivity.

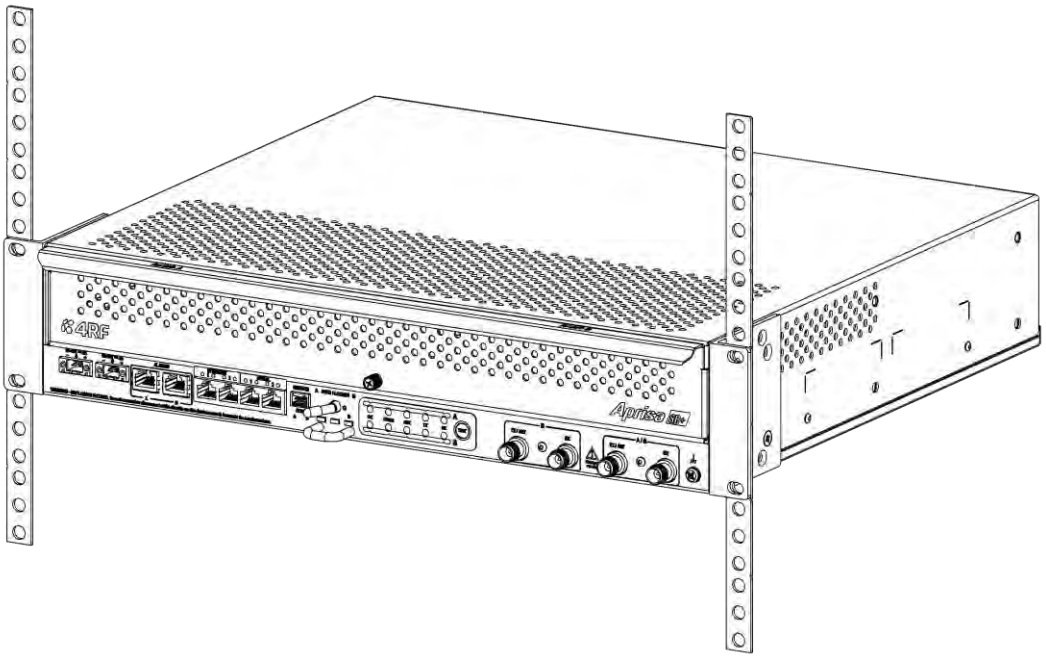
When the 'Protection Type' is set to 'redundant', the standby radio RX/TX will not be fault monitored.



Installation

Mounting

The Aprisa SR+ Protected Station is designed to mount in a standard 19 inch rack.



Cabling

The Aprisa SR+ Protected Station is delivered pre-cabled with power, interface, management and RF cables.

There are two options for the pre-cabled Protected Station (see 'Antenna and Duplexer Options'):

1. Standard Protected Station- suitable for options #1 and #2 (single antenna operation)

Part Number	Part Description
APSQ-R400-SSC-HD-22-ENAA	4RF SR+, PS, 400-470 MHz, SSC, Half Duplex, 2E2S, EN, STD

2. Dual Antenna Protected Station- suitable for options #3 and #4 (dual antenna operation)

Part Number	Part Description
APSQ-R400-SSC-HD-22-ENDA	4RF SR+, PS, 400-470 MHz, SSC, Half Duplex, 2E2S, EN, Dual Ant

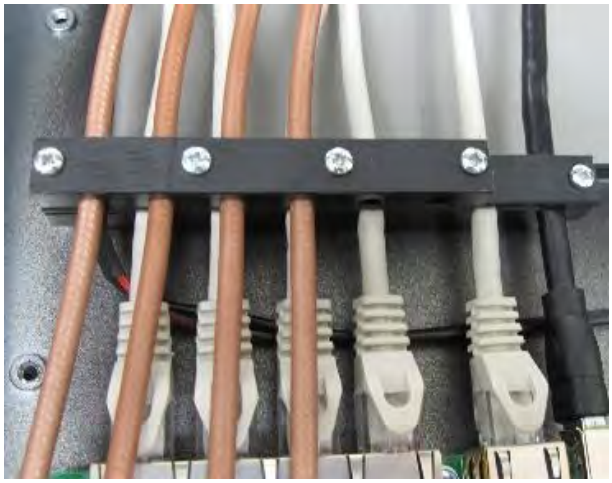
Each option (per ordered part number) is pre-cable configured as the following:

Protected Station Wiring	Internal pre-cabled Protected Station wiring setting	
	Radio / TNC Port	RF Switch Port
Standard Protected Station (single antenna operation)	Radio A TX/ANT	TX/ANTA
	Radio A RX	RXA
	Radio B TX/ANT	TX/ANTB
	Radio B RX	RXB
Dual Antenna Protected Station (dual antenna operation)	Radio A TX/ANT	TX/ANTA
	Radio A RX	RXA
	Radio B TX/ANT	TXB2
	Radio B RX	RXB2

Users can change an existing Protected Station from one option to the other option by following the procedure:

To change a pre-cabled Protected Station from one option to the other option:

1. Disconnect the power supply, antenna/s, interface cables and any other connections
2. Remove the Protected Station shelf from the rack
3. Turn the Protected Station shelf upside down
4. Remove the securing screws and remove the bottom panel
5. Unscrew the four coaxial cable clamp screws
6. Swap the two cables and position them in the appropriate connector ports
7. Refit the coaxial cable clamp and tighten the four clamp screws
8. Refit the bottom panel and tighten the two screws
9. Replace the shelf in the rack

Single Antenna Operation	Dual Antenna Operation
	

Power

The external power source must be connected to both the A and B Molex 2 pin male power connectors located on the protected station front panel. The A power input powers the A radio and the B power input powers the B radio.

The protection switch is powered from the A power input or the B power input (whichever is available).

The maximum combined power consumption is 42 Watts for 10 W transmit peak power.

The Aprisa SR+ Protected station has two DC power options, 13.8 VDC and 48 VDC.

13.8 VDC

The 13.8 VDC nominal external power source can operate over the voltage range of +10.5 to +30 V DC (negative earth).

An example of the 13.8 VDC option part number is:

Part Number	Part Description
APSQ-R400-SSC-HD-22-ENAA	4RF SR+, PS, 400-470 MHz, SSC, Half Duplex, 2E2S, EN, STD

48 VDC

The 48 VDC nominal external power source can operate over the voltage range of 18 to 60 V DC (floating).

An example of the 48 VDC option part number is:

Part Number	Part Description
APSQ-R400-SSC-HD-22-ENAB	4RF SR+, PS, 400-470 MHz, SSC, Half Duplex, 2E2S, EN, 48VDC

Alarms

The protection switch provides access to both the A radio and B radio Alarm Interfaces (see ‘Alarm Interface Connections’ on page 366 for the connector pinout).

Maintenance

Changing the Protected Station IP Addresses

To change the IP address of a Protected Station radio:

1. Change the IP address of either or both the Primary Radio and Secondary radio (see ‘Protected Station: IP > IP Setup’ on page 289). Changes in these parameters are automatically changed in the partner radio.

Creating a Protected Station

When a Protected Station is ordered from 4RF, it will be delivered complete with radios installed, pre-cabled and pre-configured for Redundant operation. The following process will not be required.

This process is to create a protected station from two individual SR+ radios and a new spare Aprisa SR+ Protection Switch. It assumes that the SR+ radios are currently setup for non-protected operation.

1. Set the protection type and partner IP address of the SR+ radio A with SuperVisor 'Terminal > Operating Mode'. Set this radio Protection Unit to primary.
2. Set the protection type and partner IP address of the secondary SR+ radio B with SuperVisor Terminal > Operating Mode'. Set this radio Protection Unit to secondary.
3. Switch off the radios and place the two radios in the new spare Aprisa SR+ Protection Switch.
4. Ensuring that the cables are not crossed over, plug in the interface port cables, the Alarm and Protect port cables and the power connector to both the radios. Secure the power connectors with the two screws.
5. Power on the Protected Station.
6. Connect to either one of the radios via SuperVisor. This will start up SuperVisor in Single Session Management mode.
7. The user can now configure the Protected Station as required.

Replacing a Protected Station Faulty Radio

Replacing a faulty radio in a Protected Station can be achieved without disruption to traffic.

Assuming that the primary radio is active and the secondary radio is faulty and needs replacement:

1. Ensure the replacement radio has the same version of software installed as the primary radio. If necessary, upgrade the software in the replacement radio.
2. Set the RF Interface MAC Address (see ‘Protected Station: Maintenance > Advanced’ on page 300). This MAC address is present on chassis label.
3. Using SuperVisor > Maintenance > Advanced ‘Save Configuration to USB’ and ‘Restore Configuration from USB’ operation, clone the primary radio’s configuration to the replacement radio.
4. Configure the replacement radio as the secondary radio and setup the IP address and other protection parameters (see ‘Terminal > Operating Mode’ on page 94).
5. Set the Hardware Manual Lock switch to make the primary radio active.
6. Unplug the interface port cables, the Alarm and Protect port cables and the power connector from the faulty radio being replaced. The two screws securing the power connector will need to be undone.
7. Carefully remove the faulty radio from the protection switch.
8. Install the replacement radio into the protection switch.
9. Ensuring that the cables are not crossed over, plug in the interface port cables, the Alarm and Protect port cables and the power connector to the replacement radio. Secure the power connector with the two screws.
10. Power on the replacement radio and wait for it to become standby.
11. Set the Hardware Manual Lock switch to the Auto position.

Replacing a Faulty Power Supply

Replacing one of the power supplies can be achieved without disruption to traffic.

If a power supply has failed, the associated radio will have failed which will have caused the protection switch to switch-over to the other radio. It will not have switched back unless the power was restored and another problem occurred which caused a switch-over.

1. If the A power supply is faulty, ensure that the B radio is active (whether it be the primary or secondary radio).

   If the B power supply is faulty, ensure that the A radio is active (whether it be the primary or secondary radio).

2. Replace the faulty power supply.

Replacing a Faulty Protection Switch

Note: Replacing a faulty Protection Switch will disrupt traffic.

Move the radios, the interface cables and the power cables to the replacement Protection Switch.

On both Protected Station radios:

1. Power on the radio and wait for it to become ready.
2. Using SuperVisor > Maintenance > Advanced, enter the RF Interface MAC address shown on the Protection Switch label (see ‘Protected Station: Maintenance > Advanced’ on page 300).
3. Using SuperVisor > Maintenance > Advanced, Decommission the node (see ‘Decommission Node’ on page 218) and then Discover the Nodes (see ‘Discover Nodes’ on page 218).

Ensure that the Hardware Manual Lock switch is set to the Auto position.

The Aprisa SR+ Protected Station is now ready to operate.

Spares

The Aprisa SR+ Protection Switch is available as spare parts for the three radio interface port options:

Part Number	Part Description
APST-XPSW-X22	4RF SR+ Spare, Protection Switch, 2E2S
APST-XPSW-X31	4RF SR+ Spare, Protection Switch, 3E1S
APST-XPSW-X40	4RF SR+ Spare, Protection Switch, 4E0S

Data Driven Protected Station

The Aprisa SR+ Data Driven Protected Station provides radio and RS-232 serial port user interface protection for Aprisa SR+ radios.

Example Part:

Part Number	Part Description
APSQ-D400-SSC-HD-22-ENAA	4RF SR+, PD, 400-470 MHz, SSC, Half Dup, 2E2S, EN, STD

The Aprisa SR+ Data Driven Protected Station shown is comprised of two standard Aprisa SR+ setup as ‘dual antenna port’, ‘half duplex’ radios and two external duplexers mounted on 19" rack mounting shelves.

The Aprisa SR+ radios can be any of the currently available Aprisa SR+ radio frequency band options.

By default, the Aprisa SR+ Data Driven Protected Station is configured with the left hand radio (A) designated as the primary radio and the right hand radio (B) designated as the secondary radio.

Each radio is configured with its own unique IP and MAC address and the address of the partner radio.

On power-up, the primary radio will assume the active role and the secondary radio will assume the standby role. If, for some reason, only one radio is powered on it will automatically assume the active role.

Operation

The active radio is determined explicitly by which radio receives data on its RS-232 serial port input from the interface.

The active radio carries all RS-232 serial traffic over its radio link and the standby radio is unused with its transmitter turned off.

If data is received on the RS-232 serial port interface input of the standby radio, it will immediately become the active radio and the radio which was active will become the standby radio.

Over The Air Compatibility

If the Aprisa SR+ Data Driven Protected Station is to be used in a network of New Aprisa SR radios, the ‘SR Compatible’ option must be enabled (see ‘SR Compatible’ on page 95).

Switch Over

The active radio is determined explicitly by which radio receives data on its RS-232 serial port.

The switching and blocking criteria used for the standard Protected Station do not apply. This means that events and alarms on the unit are not used as switching criteria.

Configuration Management

The Primary and Secondary radios are managed with the embedded web-based management tool, SuperVisor (see 'Managing the Radio' on page 67) by using either the Primary or Secondary IP address. Configuration changes in one of the radios will automatically be reflected in the partner radio.

Changes to the Network Table are automatically synchronized from the active radio to the standby radio but the Network Table is only visible on the active radio.

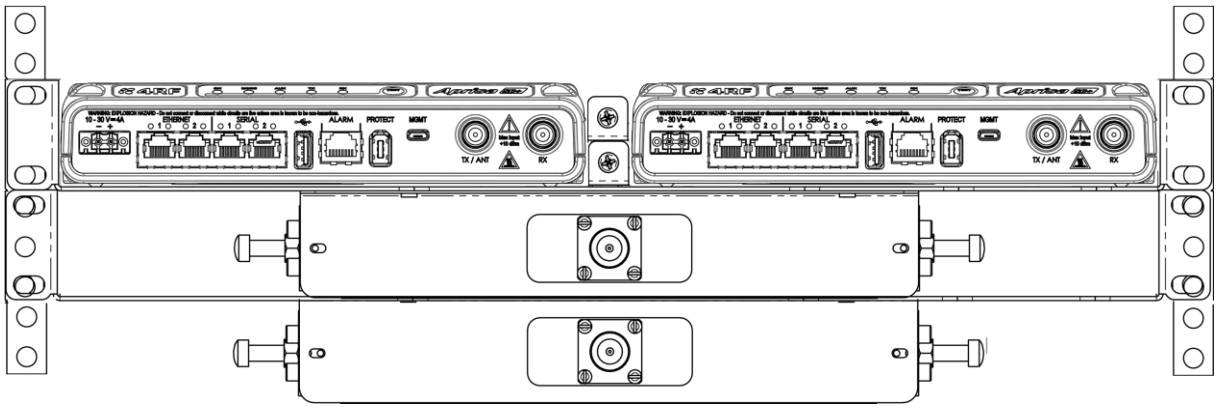
Power

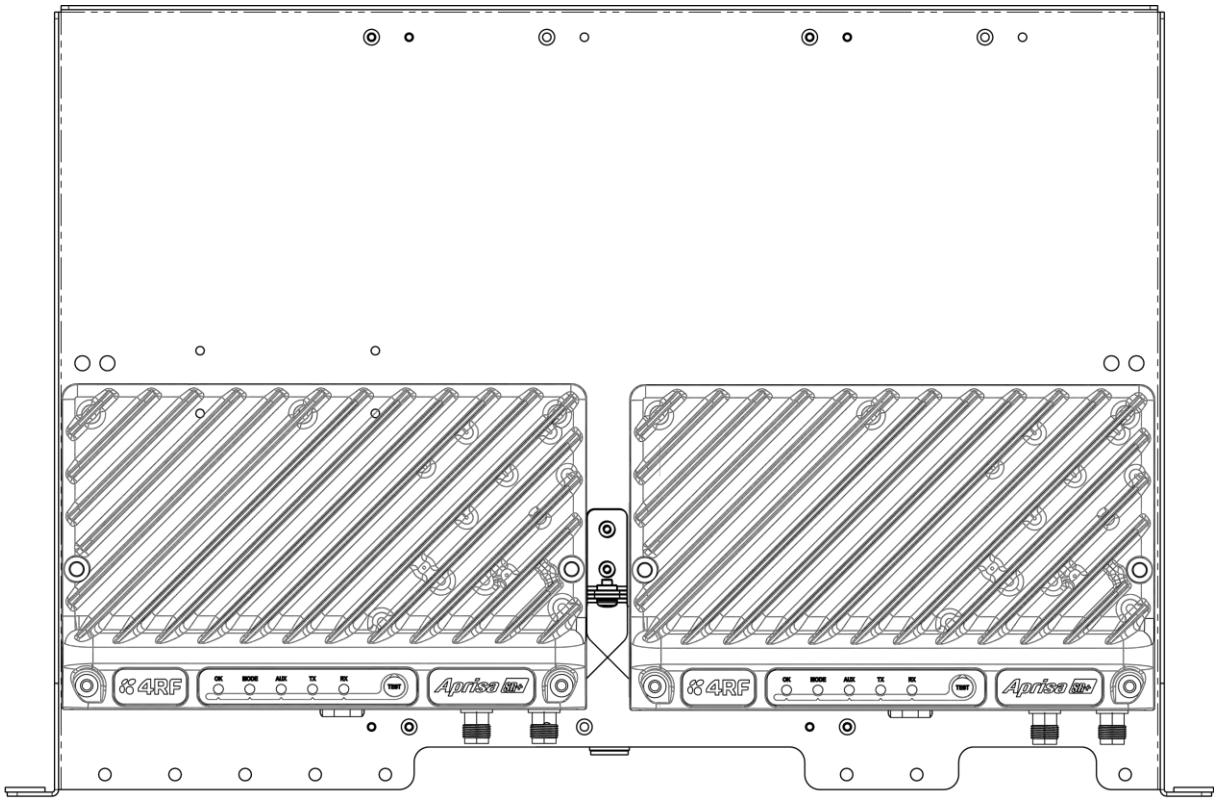
A +10.5 to +30 V DC external power source must be connected to both the A and B Phoenix Contact 2 pin male power connectors. The maximum combined power consumption is 42 Watts for 10 W transmit peak power.

Installation

Mounting

The Aprisa SR+ Data Driven Protected Station is designed to mount in a standard 19” rack on two 1U rack mounting shelves (total of 3RU).





Cabling

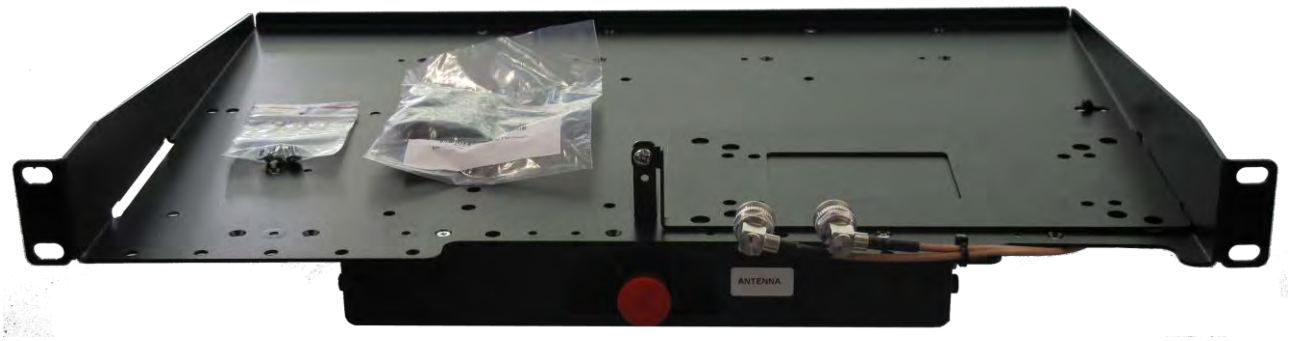
The Aprisa SR+ Data Driven Protected Station is delivered with the radios, duplexers, rack mounting shelves and interconnect cables. The set of interconnect cables is available as a spare part.

Part Number	Part Description
APST-XPSC-ST6	4RF SR+ Spare, Protection Switch Cables, Set Of 6

Duplexer Kits

The Aprisa SR+ product range contains Duplexer Kit accessories for use with Aprisa SR+ radios configured for Single Antenna Dual Port operation.

Radio Duplexer Kits



Example of part number: APSB-KDUP-400-B1-BR

Part Number	Description
APSB-KDUP-135-N0-BR	Aprisa SR+ Duplexer Kit for a SR+ Radio containing: 1x 1U 19" rack front mount shelf with duplexer mounting brackets and screws to mount 1x SR+ radio and 1x duplexer 1x N0 Duplexer 135 MHz, s4.6 MHz, p0.5 MHz 2x TNC to SMA right angle 640mm cables
APSB-KDUP-320-A1-BR	Aprisa SR+ Duplexer Kit for a Aprisa SR+ radio containing: 1x 1U 19" rack front mount shelf with duplexer mounting brackets and screws to mount 1x SR+ radio and 1x duplexer 1x A1 Duplexer 300 MHz, s 5 MHz, p 0.5 MHz 2x TNC to SMA right angle 640mm cables
APSB-KDUP-400-B1-BR	Aprisa SR+ Duplexer Kit for a SR+ Radio containing: 1x 1U 19" rack front mount shelf with duplexer mounting brackets and screws to mount 1x SR+ radio and 1x duplexer 1x B1 Duplexer 400 MHz, s 5 MHz, p 0.5 MHz 2x TNC to SMA right angle 640mm cables
APSB-KDUP-450-M0-BR	Aprisa SR+ Duplexer Kit for a SR+ radio containing: 1x 1U 19" rack front mount shelf with duplexer mounting brackets and screws to mount 1x SR+ radio and 1x duplexer 1x M0 Duplexer 450 MHz, s 5 MHz, p 0.5 MHz 2x TNC to SMA right angle 640mm cables
APSB-KDUP-450-P0-BR	Aprisa SR+ Duplexer Kit for a SR+ radio containing: 1x 1U 19" rack front mount shelf with duplexer mounting brackets and screws to mount 1 or 2 Aprisa SR+ radios and 1 duplexer 1x P0 Duplexer 450 MHz, s 3 MHz, p 0.5 MHz 2x TNC to SMA right angle 640mm cab

Part Number	Description
APSB-KDUP-928-G0-BR	Aprisa SR+ Duplexer Kit for a SR+ radio containing: 1x 1U 19" rack front mount shelf with duplexer mounting brackets and screws to mount 1x SR+ radio and 1x duplexer 1x G0 Duplexer 900 MHz, s 40 MHz, p 7 MHz 2x TNC to SMA right angle 640mm cables
APSB-KDUP-928-G2-BR-MM	Aprisa SR+ Duplexer Kit for a SR+ radio containing: 1x 1U 19" rack mid mount shelf with duplexer mounting brackets and screws to mount 1x SR+ radio and 1x duplexer 1x G2 Duplexer 900 MHz, s 9 MHz, p 1 MHz 2x TNC to SMA right angle 640mm cables
APSB-KDUP-928-G2-BR	Aprisa SR+ Duplexer Kit for a SR+ radio containing: 1x 1U 19" rack front mount shelf with duplexer mounting brackets and screws to mount 1x SR+ radio and 1x duplexer 1x G2 Duplexer 900 MHz, s 9 MHz, p 1 MHz 2x TNC to SMA right angle 640mm cables
APSB-KDUP-928-G3-BR	Aprisa SR+ Duplexer Kit for a SR+ radio containing: 1x 1U 19" rack front mount shelf with duplexer mounting brackets and screws to mount 1x SR+ radio and 1x duplexer 1x G3 Duplexer 900 MHz, s5.5 MHz, p0.5 MHz 2x TNC to SMA right angle 640mm cables
APSB-KDUP-928-G3-BR-MM	Aprisa SR+ Duplexer Kit for a SR+ radio containing: 1x 1U 19" rack mid mount shelf with duplexer mounting brackets and screws to mount 1x SR+ radio and 1x duplexer 1x G3 Duplexer 900 MHz, s5.5 MHz, p0.5 MHz 2x TNC to SMA right angle 640mm cables

Protected Station Duplexer Kits

Example of part number: APSB-KDUP-928-G2-PS

Part Number	Description
APSB-KDUP-135-N0-PS	Aprisa SR+ Duplexer Kit for a SR+ Protected Station containing: 1x N0 Duplexer 135 MHz, s4.6 MHz, p0.5 MHz 2x right angle TNC to SMA right angle 640mm cables Rack front mounted
APSB-KDUP-135-N0-PS-DA	Aprisa SR+ Duplexer Kit for a dual antenna SR+ Protected Station containing: 2x N0 Duplexer 135 MHz, s4.6 MHz, p0.5 MHz 4x right angle TNC to SMA right angle 640mm cables Rack front mounted
APSB-KDUP-320-A1-PS	Aprisa SR+ Duplexer Kit for a Aprisa SR+ Protected Station containing: 1x 1U 19" rack front mount shelf with duplexer mounting brackets and screws 1x A1 Duplexer 300 MHz, s 5 MHz, p 0.5 MHz 2x right angle TNC to SMA right angle 640mm cables
APSB-KDUP-320-A1-PS-DA	Aprisa SR+ Duplexer Kit for a dual antenna Aprisa SR+ Protected Station containing: 1x 1U 19" rack front mount shelf with duplexer mounting brackets and screws 2x A1 Duplexer 300 MHz, s 5 MHz, p 0.5 MHz 4x right angle TNC to SMA right angle 640mm cables
APSB-KDUP-400-B1-PS-DA	Aprisa SR+ Duplexer Kit for a dual antenna SR+ Protected Station containing: 1x 1U 19" rack front mount shelf with duplexer mounting brackets and screws 2x B1 Duplexers 400 MHz, s 5 MHz, p 0.5 MHz 4x right angle TNC to SMA right angle 640mm cables
APSB-KDUP-400-B1-PS	Aprisa SR+ Duplexer Kit for a SR+ Protected Station containing: 1x 1U 19" rack front mount shelf with duplexer mounting brackets and screws 1x B1 Duplexer 400 MHz, s 5 MHz, p 0.5 MHz 2x right angle TNC to SMA right angle 640mm cables

Part Number	Description
APSB-KDUP-450-M0-PS	Aprisa SR+ Duplexer Kit for a SR+ Protected Station containing: 1x 1U 19" rack front mount shelf with duplexer mounting brackets and screws 1x M0 Duplexer 450 MHz, s 5 MHz, p 0.5 MHz 2x right angle TNC to SMA right angle 640mm cables
APSB-KDUP-450-M0-PS-DA	Aprisa SR+ Duplexer Kit for a dual antenna SR+ Protected Station containing: 1x 1U 19" rack front mount shelf with duplexer mounting brackets and screws 2x M0 Duplexer 450 MHz, s 5 MHz, p 0.5 MHz 4x right angle TNC to SMA right angle 640mm cables
APSB-KDUP-450-P0-PS	Aprisa SR+ Duplexer Kit for a SR+ Protected Station containing: 1x 1U 19" rack front mount shelf with duplexer mounting brackets and screws 1x P0 Duplexer 450 MHz, s 3 MHz, p 0.5 MHz 2x right angle TNC to SMA right angle 640mm cables
APSB-KDUP-450-P0-PS-DA	Aprisa SR+ Duplexer Kit for a dual antenna SR+ Protected Station containing: 1x 1U 19" rack front mount shelf with duplexer mounting brackets and screws 2x P0 Duplexer 450 MHz, s 3 MHz, p 0.5 MHz 4x right angle TNC to SMA right angle 640mm cables
APSB-KDUP-928-G0-PS	Aprisa SR+ Duplexer Kit for a SR+ Protected Station containing: 1x 1U 19" rack front mount shelf with duplexer mounting brackets and screws 1x G0 Duplexer 900 MHz, s 40 MHz, p 7 MHz 2x TNC to SMA right angle 590mm cables
APSB-KDUP-928-G2-PS	Aprisa SR+ Duplexer Kit for a SR+ Protected Station containing: 1x 1U 19" rack front mount shelf with duplexer mounting brackets and screws 1x G2 Duplexer 900 MHz, s 9 MHz, p 1 MHz 2x TNC to SMA right angle 590mm cables
APSB-KDUP-928-G2-PS-MM	Aprisa SR+ Duplexer Kit for a SR+ Protected Station containing: 1x 1U 19" rack mid mount shelf with duplexer mounting brackets and screws 1x G2 Duplexer 900 MHz, s 9 MHz, p 1 MHz 2x TNC to SMA right angle 590mm cables
APSB-KDUP-928-G3-PS-MM	Aprisa SR+ Duplexer Kit for a SR+ Protected Station containing: 1x 2U 19" rack mid mount shelf with duplexer mounting brackets and screws 1x G3 Duplexer 900 MHz, s5.5 MHz, p0.5 MHz 2x TNC to SMA right angle 640mm cables
APSB-KDUP-928-G3-PS	Aprisa SR+ Duplexer Kit for a SR+ Protected Station containing: 1x 2U 19" rack front mount shelf with duplexer mounting brackets and screws 1x G3 Duplexer 900 MHz, s5.5 MHz, p0.5 MHz 2x TNC to SMA right angle 640mm cables

USB RS-232 / RS-485 Serial Port

The Aprisa SR+ USB host port is predominantly used for software upgrade and diagnostic reporting. However, it can also be used to provide an additional RS-232 DCE or RS-485 serial port for customer traffic.

This is accomplished with a USB to RS-232 / RS-485 serial converter cable. This plugs into the USB host port connector and can be terminated with the required customer connector.

This additional RS-232 / RS-485serial port is enabled with the SuperVisor mode setting in Serial Port Settings (see 'Serial > Port Setup' on page 124).

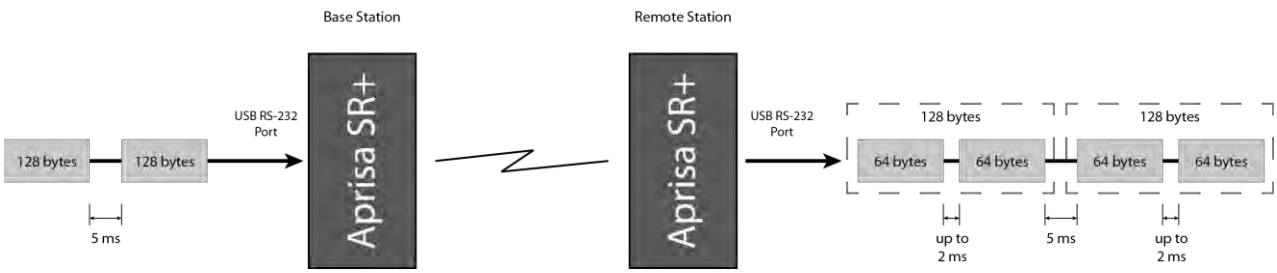
The Aprisa SR+ USB port has driver support for these USB serial converters. Other USB serial converters may not operate correctly.

USB RS-232 / RS-485 operation

The USB serial converter buffers the received data frames into 64 byte blocks separated by a small inter-frame gap.

For the majority of applications, this fragmentation of egress frames is not an issue. However, there are some applications that may be sensitive to the inter-frame gap, therefore, these applications need consideration.

A 5 ms inter-frame is recommended for the applications that are sensitive to inter-frame gap timings.



On a USB RS-232 port, Modbus RTU can operate up to 9600 bit/s with all packet sizes and up to 115200 bit/s if the packet size is less than 64 bytes. The standard RS-232 port is fully compatible with Modbus RTU at all baud rates.

USB RS-232 Cabling Options

The following converter cables are available as Aprisa SR+ accessories to provide the customer interface. The kit contains a USB connector retention clip (see ‘USB Retention Clip’ on page 355).

1. USB Converter to 1.8 metre multi-strand cable 6 wire for termination of customer connector

Part Number	Part Description
APSB-KFCA-USB-23-MS-18	4RF SR+ Acc, Kit, Interface, USB Conv, RS-232, Multi-strand, 1.8m

2. USB converter to RJ45 female kit for USB to RS-232 DCE conversion.

Part Number	Part Description
APSB-KFCA-USB-23-45-MF18	4RF SR+ Acc, Kit, Interface, USB Conv, RS-232, RJ45, Female, 1.8m

3. USB converter to DB9 female kit for USB to RS-232 DCE conversion.

Part Number	Part Description
APSB-KFCA-USB-23-D9-MF18	4RF SR+ Acc, Kit, Interface, USB Conv, RS-232, DB9, Female, 1.8m

USB RS-485 Cabling Options

The following converter cable is available as an Aprisa SR+ accessory to provide the customer interface RS-485 2 wire. The kit contains a USB connector retention clip (see ‘USB Retention Clip’ on page 355).

1. USB Converter to 1.8 metre multi-strand cable 6 wire for termination of customer interface

Part Number	Part Description
APSB-KFCA-USB-48-MS-18	4RF SR+ Acc, Kit, Interface, USB Conv, RS-485, Multi-strand, 1.8m

USB Retention Clip

The USB Retention Clip attaches to the underside of the Aprisa SR+ enclosure adjacent to the USB connector.

To attach the USB Retention Clip:

1. Clean the enclosure surface where the retention clip will attach with an alcohol based cleaner e.g. Isopropanol.
2. Peel off the retention clip protective backing.
3. Stick the clip onto the Aprisa SR+ enclosure ensuring that it aligns to the middle of the radio USB connector.

10. Maintenance

No User-Serviceable Components

There are no user-serviceable components within the radio.

All hardware maintenance must be completed by 4RF or an authorized service centre.

Do not attempt to carry out repairs to any boards or parts.

Return all faulty radios to 4RF or an authorized service centre.

For more information on maintenance and training, please contact 4RF Customer Services at support@4rf.com.

CAUTION: Electro Static Discharge (ESD) can damage or destroy the sensitive electrical components in the radio.

Software Upgrade

A software upgrade can be performed on a single Aprisa SR+ radio or an entire Aprisa SR+ network.

Network Software Upgrade

This process allows customers to upgrade their Aprisa SR+ network from the central base station location without need for visiting remote sites.

The Software Pack is loaded into the base station with the file transfer process (see 'Software > File Transfer' on page 238) and distributed via the radio link to all remote stations.

When all remote stations receive the Software Pack version, the software can be remotely activated on all remote stations.

Non-Protected Network Upgrade Process

This upgrade process is for upgrading the software on an entire Aprisa SR+ network from a non-protected base station. If there are protected remotes in the network, they must be locked to the current active radio.

To upgrade the entire Aprisa SR+ network software:

1. Using File Transfer, load the software pack into the base station (see 'Software > File Transfer' on page 238). The software can be transferred to the radio via an FTP transfer or from a USB flash drive.

   The Aprisa SR+ network file transfer operation is indicated in base station and remote stations by a flashing orange AUX LED.

2. Distribute the software to the entire network of remote radios (see 'Software > Remote Distribution' on page 246). Note that the distribution process over the air will take some time, depending on RF and Transfer rate settings.

   The Aprisa SR+ network software distribution operation is indicated in base station and remote stations by a flashing orange MODE LED.

   Note: The distribution of software to remote stations does not stop customer traffic from being transferred. However, due to the volume of traffic, the software distribution process may affect customer traffic.

   Software distribution traffic is classified as 'management traffic' but does not use the Ethernet management priority setting. Software distribution traffic priority has a fixed priority setting of 'very low'.

3. Activate the software on the entire network of remote radios (see 'Software > Remote Activation' on page 248).

   Note: When the new software activates on the remote radios, all link communication from the base station to the remote will be lost. The base station will attempt to re-establish connectivity to the remote radios for the new version verification but this will fail. However, when the new software activates on the remote radios, the remote radio will reboot automatically and link communication will restore when the base station software is activated.

   When the Remote Activation process gets to the 'Remote Radios On New Version' step, don't wait for this to complete but proceed to step 4.

4. Activate the software on the base station radio (see ‘Software > Manager’ on page 242).
5. When the new software has been activated, remote stations will re-register with the base station. The remote stations software version can verified with ‘Network Status > Network Table’ on page 271.
6. When the base station restarts with the new software, rediscover the nodes (see ‘Discover Nodes’ on page 218).
7. Check that all remote radios are now running on the new software (see ‘Network Status > Network Table’ on page 271).

Note: The following steps will only be necessary if for some reason steps 1-7 did not operate correctly or if software activation is attempted before the distribution process ends or the remote radio was off during steps 1-7 and turns on later. Thus, the following steps will most likely not be required.

---

8. If step 7 shows that not all remote radios are running the latest software version, restore the base / master station to the previous software version (see ‘Software > Manager’ on page 242).
9. Attempt to re-establish connectivity to the remote radios that have failed to upgrade by navigating to and remotely managing the remote radios individually.
10. Navigate to the remote radio history log and review the logs to determine the reason for the failure to activate the new software version.
11. Take appropriate actions to address the reported issue. If connectivity restores with the failed remotes, repeat steps 2-7 if required.

Protected Network Upgrade Process

This upgrade process is for upgrading the software on an entire Aprisa SR+ network from a protected base station. This software upgrade can be achieved without disruption to traffic.

Transferring the new software to the radios

The software can be transferred to the radio via an FTP transfer or from a USB flash drive.

1. Using the Hardware Manual Lock switch (see 'Hardware Manual Lock' on page 335), or the Software Manual Lock (see 'Lock Active To' on page 295), force the secondary radio to active
2. Using File Transfer, load the software pack into the secondary radio (see 'Protected Station: Software > Secondary File Transfer' on page 310).
3. Confirm that the transfer is successful (see 'Protected Station: Software > Manager' on page 313).
4. Using the Hardware Manual Lock switch (see 'Hardware Manual Lock' on page 335), or the Software Manual Lock (see 'Lock Active To' on page 295), force the primary radio to active.
5. Using File Transfer, load the software pack into the primary radio (see 'Protected Station: Software > Primary File Transfer' on page 307).
6. Confirm that the transfer is successful (see 'Protected Station: Software > Manager' on page 313).
7. Distribute the software to the entire network of remote radios (see 'Protected Station: Software > Remote Distribution' on page 315). If there are protected remotes in the network, they must be locked to the current active radio.

   Note that the distribution process over the air will take some time, depending on RF and Transfer rate settings.

Activating the new software on the radios

1. Activate the software on the entire network of remote radios (see 'Protected Station: Software > Remote Activation' on page 318).
2. Monitor the progress of the activation process until the stage where activation of all remote radios has been confirmed.

   When the new software has been activated, remote stations will re-register with the base station. The remote stations software version can verified with 'Network Status > Network Table' on page 271.
3. If the new software version is not over the air compatible with the version currently operating on the radio, there is no need to wait as all link communication from the base station to the remote will be lost so the verification of the new version on the remote radio will fail.
4. Activate the new version software pack of the secondary radio (see 'Protected Station: Software > Manager' on page 313).
5. Immediately after that, activate the new version software pack of the primary radio (see 'Protected Station: Software > Manager' on page 313).

   Note that the activation process will take a few minutes.

Confirm that the new software version is now running on the radios

1. Re-login into the Protection Station and navigate to SuperVisor > Software>Summary.
2. Confirm that the Primary and Secondary radio current software version is now up to date
3. Confirm that the list of remote radios are now running the latest software version with 'Network Status > Network Table' on page 271.
4. When the upgrade process is complete, if the Hardware Manual Lock switch has been used, set it to the Auto position. The software manual lock will release automatically.

Single Radio Software Upgrade

This upgrade process is for upgrading the software on a single Aprisa SR+ radio.

Note: If a radio has been configured for a Protection Type of 'Redundant', and that radio is no longer part of a Protected Station, the Protection Type must be changed to 'None' before the radio software upgrade can be achieved.

File Transfer Method

The Software Pack is loaded into the radio with the file transfer process (see 'Software > File Transfer' on page 238) and activated (see 'Software > Manager' on page 242).

The Aprisa SR+ upgrade operation is indicated by a flashing orange AUX LED.

To upgrade the Aprisa SR+ radio software:

1. Unzip the software release files in to the root directory of a USB flash drive.
2. Insert the USB flash drive into the host port .
3. Using File Transfer, load the software pack into the radio (see 'Software > File Transfer' on page 238).
4. Remove the USB flash drive from the host port .
5. Activate the software on the radio (see 'Software > Manager' on page 242).

USB Boot Upgrade Method

A single Aprisa SR+ radio can also be upgraded simply by plugging a USB flash drive containing the new software into the USB A host port on the Aprisa SR+ front panel and power cycling the radio.

To upgrade the Aprisa SR+ radio software:

1. Unzip the software release files in to the root directory of a USB flash drive.
2. Check that the SuperVisor USB Boot Upgrade setting is set to 'Load and Activate' (see 'Software > Setup' on page 237).
3. Power off the Aprisa SR+ and insert the USB flash drive into the host port .
4. Power on the Aprisa SR+.
5. The software upgrade process is complete when the OK LED flashes green. This can take about 2 minutes.

   The software will have loaded in to the radio current software version.
6. Remove the USB flash drive from the host port .
7. Power cycle the Aprisa SR.

Login to the radio being upgraded and go to SuperVisor 'Software > Manager' on page 242.

The version of the uploaded software will be displayed in the Software Pack 'Version' field and the current software version.

If the upgrade process did not start, the Aprisa SR+ could already be operating on the version of software on the USB flash drive. This will be indicated by flashing OK LED and then the OK, MODE and AUX will light steady green.

If the radio is not operating on the new software (after the power cycle), it could be caused by the SuperVisor 'USB Boot Upgrade' setting set to 'Load Only' (see 'Software > Setup' on page 237).

In this case, go to SuperVisor see 'Software > Manager' on page 242 and tick the Software Pack 'Activate' checkbox and click 'Apply'.

If any Display Panel LED flashes red or is steady red during the upgrade process, it indicates that the upgrade has failed. This could be caused by incorrect files on the USB flash drive or a radio hardware failure.

Software Downgrade

Radio software can also be downgraded if required. This may be required if a new radio is purchased for an existing network which is operating on an earlier software release.

The downgrade process is the same as the upgrade process.

Protected Station Software Upgrade

This upgrade process is for upgrading the software on a single Aprisa SR+ Protected Station.

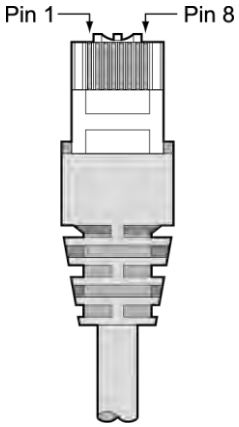
USB Boot Upgrade Method

Assuming the Primary radio is active and the Secondary radio is standby

1. Using the Hardware Manual Lock switch, force the primary radio to active.
2. Insert the USB flash drive with the new software release into the secondary radio host port .
3. Power cycle the secondary radio. The radio will be upgraded with the new software.
4. When the secondary radio upgrade is completed, remove the USB flash drive, power cycle the secondary radio and wait for it to become standby.
5. Using the Hardware Manual Lock switch, force the secondary radio to active.
6. Insert the USB flash drive with the new software release into the primary radio host port .
7. Power cycle the primary radio. The radio will be upgraded with the new software.
8. When the primary radio upgrade is completed, remove the USB flash drive, power cycle the primary radio and wait for it to become standby.
9. When the upgrade process is complete, set the Hardware Manual Lock switch to the Auto position. The secondary radio will remain active and the primary radio will remain standby. To set the primary radio to active, use the hardware lock switch to select the primary radio and wait for it to become active, then set the hardware manual lock switch to the Auto position.

11. Interface Connections

RJ45 Connector Pin Assignments



RJ45 pin numbering

Ethernet Interface Connections

Pin Number	Pin Function	Direction	TIA-568A Wire Colour	TIA-568B Wire Colour
1	Transmit	Output	Green/white	Orange/white
2	Transmit	Output	Green	Orange
3	Receive	Input	Orange/white	Green/white
4	Not used		Blue	Blue
5	Not used		Blue/white	Blue/white
6	Receive	Input	Orange	Green
7	Not used		Brown/white	Brown/white
8	Not used		Brown	Brown

Note: The TIA-568B wiring is the most commonly used and matches the cables we supply.

RJ45 connector LED indicators		
LED	**Status**	**Explanation**
Green	On	Ethernet signal received
Orange	Flashing	Data traffic present on the interface

Note: Do not connect Power over Ethernet (PoE) connections to the Aprisa SR+ Ethernet ports as this will damage the port.

RS-232 Serial Interface Connections

RS-232 Pinout

The Aprisa RS-232 Serial Interface is always configured as a DCE:

RJ45 Pin Number	Pin Function	Direction	TIA-568A Wire Colour	TIA-568B Wire Colour
1	RTS	Input	Green / white	Orange/white
2	DTR / Sleep Mode	Input	Green	Orange
3	TXD	Input	Orange / white	Green/white
4	Ground		Blue	Blue
5	DCD	Output	Blue / white	Blue/white
6	RXD	Output	Orange	Green
7	DSR	Output	Brown / white	Brown/white
8	CTS	Output	Brown	Brown

Note: The TIA-568B wiring is the most commonly used and matches the cables we supply.

RS-232 Customer Cable Wiring

Aprisa RS-232 Interface - DCE			DTE Customer Interface		DCE Customer Interface	
RJ45 Pin Number	Pin Function	Direction	Pin Function	DB9 Male Pinout	Pin Function	DB9 Female Pinout
1	RTS	Input	RTS	7	CTS	8
2	DTR	Input	DTR / Sleep Mode	4	DSR	6
3	TXD	Input	TXD	3	RXD	2
4	Ground		Ground	5	Ground	5
5	DCD	Output	DCD	1		
6	RXD	Output	RXD	2	TXD	3
7	DSR	Output	DSR	6	DTR / Sleep Mode	4
8	CTS	Output	CTS	8	RTS	7

RS-232 RJ45 LED Indicators

LED	Status	Explanation
Green	On	RS-232 device connected
Orange	Flashing	Data present on the interface

Alarm Interface Connections

RJ45 Pin Number	Pin Function	Direction	TIA-568A Wire Colour	TIA-568B Wire Colour
1	Alarm 1 Input / sleep control	Input	Green / white	Orange/white
2	Ground		Green	Orange
3	Alarm 2 Input	Input	Orange / white	Green/white
4	Ground		Blue	Blue
5	Alarm 1 Output	Output	Blue / white	Blue/white
6	Ground		Orange	Green
7	Alarm 2 Output	Output	Brown / white	Brown/white
8	Ground		Brown	Brown

Note: The TIA-568B wiring is the most commonly used and matches the cables we supply.

Protection Switch Remote Control Connections

1 2 3 4

Pin Number	1	2	3	4
Function	A radio active	Ground	B radio active	Ground

12. Alarm Types and Sources

Alarm Types

There are three types of alarm event configuration types:

1. Threshold Type

These alarm events have lower and upper limits. An alarm is raised if current reading is outside the limits.

Note: the limits for PA Current, TX AGC, TX Reverse Power and Thermal shutdown are not user configurable.

2. Error Ratio Type

This is the ratio of bad packets vs total packets in the defined sample duration.

For Serial, it is the ratio of bad characters vs total characters in the duration seconds. An alarm is raised if current error ratio is greater than the configured ratio. The error ratio is configured in 'Upper Limit' field and accepts value between 0 and 1. Monitoring of these events can be disabled by setting the duration parameter to 0.

3. Sample Duration Type

Used for No Receive data events type. An alarm is raised if no data is received in the defined sample duration. Monitoring of these events can be disabled by setting the duration parameter to 0.

See 'Events > Events Setup' on page 224 for setup of alarm thresholds / sample durations etc.

Alarm Events

Transmitter Alarm Events

Event ID	Event Display Text	Default Severity	Configuration Type	Function	Recommended Actions
1	PA Current	critical(1)	Threshold Type	Alarm to indicate that the current drawn by the transmitter power amplifier is outside defined limits.	Check antenna is not open or shorted, check duplexer correctly connected and tuned, if OK replace radio.
61	PA Driver Current	critical(1)	Threshold Type	Alarm to indicate that the current drawn by the transmitter power amplifier driver is outside defined limits.	Check antenna is not open or shorted, check duplexer correctly connected and tuned, if OK replace radio.
62	PA Stability	warning(4)	Threshold Type	Alarm to indicate that the power amplifier is oscillating which may cause corruption of the TX signal	Check antenna is not open or shorted, check duplexer correctly connected and tuned, if OK replace radio.
2	TX AGC	critical(1)	Threshold Type	Alarm to indicate that the variable gain control of the transmitter is outside defined limits.	Check antenna is not open or shorted, check duplexer correctly connected and tuned, if OK replace radio.
3	TX Reverse Power	warning(4)	Threshold Type	Alarm to indicate that the antenna is not connected to the radio	Check antenna is not open or shorted, check duplexer correctly connected and tuned, and confirm VSWR at TX port is less than 2:1. If OK replace radio.
60	TX Forward Power	warning(4)	Threshold Type	Alarm to indicate that the transmitter power is outside the selected TX power setting.	Check antenna is not open or shorted, check duplexer correctly connected and tuned, and confirm VSWR at TX port is less than 2:1. If OK replace radio.
4	Temperature Threshold	warning(4)	Threshold Type	Alarm to indicate that the transmitter temperature is outside defined limits.	Check ambient temperature and for airflow obstructions.
5	TX Synthesizer Not Locked	critical(1)	Threshold Type	Alarm to indicate that the transmitter synthesizer is not locked.	Power off radio and restart. If condition persists replace radio.
31	Thermal Shutdown	critical(1)	Threshold Type	Alarm to indicate that the transmitter has shutdown due to excessively high temperature.	Check ambient temperature and for airflow obstructions.

Receiver Alarm Events

Event ID	Event Display Text	Default Severity	Configuration Type	Function	Recommended Actions
7	RSSI Threshold	warning(4)	Threshold Type	Alarm to indicate that the receiver RSSI reading taken on the last packet received is outside defined limits.	Check antenna is not open or shorted. If the antenna is directional check for off-pointing.
8	RX Synthesizer Not Locked	critical(1)	Not Configurable	Alarm to indicate that the receiver Synthesizer is not locked on the RF received signal.	Power off radio and restart. If condition persists replace radio.
9	RX CRC Errors	warning(4)	Error Ratio Type	Alarm to indicate that the data received on the RF path contains errors at a higher rate than the defined error rate threshold.	Check antenna is not open or shorted. Check duplexer is correctly tuned. If the antenna is directional check for off-pointing. Power off radio and restart. If condition persists replace radio.

Radio Interface Path Alarm Events

Event ID	Event Display Text	Default Severity	Configuration Type	Function	Recommended Actions
34	RF No Receive Data	warning(4)	Sample Duration Type	Alarm to indicate that there is no data received on the RF path in the defined duration period.	Check master is operational. If new deployment check set-up, frequencies, and duplexer (if used). Check antenna is not open or shorted. If the antenna is directional check for off-pointing. Power off radio and restart. If condition persists replace radio.

Modem Alarm Events

Event ID	Event Display Text	Default Severity	Configuration Type	Function	Recommended Actions
68	Modem FEC disable	warning(4)	Not Configurable	Alarm to indicate that FEC has been disabled. This could be a permanent event or a timed event.	Alarm to indicate that FEC has been disabled. This could be a permanent event or a timed event.
70	Modem ACM locked	warning(4)	Not Configurable	Alarm to indicate that the ACM has been locked to a fixed coding and modulation. This could be a permanent event or a timed event.	Alarm to indicate that the ACM has been locked to a fixed coding and modulation. This could be a permanent event or a timed event.

Customer Equipment Interface Path Alarm Events

Event ID	Event Display Text	Default Severity	Configuration Type	Function	Recommended Actions
10	Port 1 Eth No Receive Data	warning(4)	Sample Duration Type	Alarm to indicate that Ethernet port 1 has no received input signal in the defined duration period.	Check Ethernet cable and connector. Check switch port or RTU is active. Check IP and VLAN configuration.
11	Port 1 Eth Data Receive Errors	warning(4)	Error Ratio Type	Alarm to indicate that Ethernet port 1 received input signal contains errors at a higher rate than the defined error rate threshold.	Check Ethernet cable and connector. Check switch port or RTU is active. Check IP and VLAN configuration.
12	Port 1 Eth Data Transmit Errors	warning(4)	Error Ratio Type	Alarm to indicate that Ethernet port 1 transmitted output signal contains errors at a higher rate than the defined error rate threshold.	Check Ethernet cable and connector. Check switch port or RTU is active. Check IP and VLAN configuration.
35	Port 2 Eth No Receive Data	warning(4)	Sample Duration Type	Alarm to indicate that Ethernet port 2 has no received input signal in the defined duration period.	Check Ethernet cable and connector. Check switch port or RTU is active. Check IP and VLAN configuration.
36	Port 2 Eth Data Receive Errors	warning(4)	Error Ratio Type	Alarm to indicate that Ethernet port 2 received input signal contains errors at a higher rate than the defined error rate threshold.	Check Ethernet cable and connector. Check switch port or RTU is active. Check IP and VLAN configuration.
37	Port 2 Eth Data Transmit Errors	warning(4)	Error Ratio Type	Alarm to indicate that Ethernet port 2 transmitted output signal contains errors at a higher rate than the defined error rate threshold.	Check Ethernet cable and connector. Check switch port or RTU is active. Check IP and VLAN configuration.
44	Port 3 Eth No Receive Data	warning(4)	Sample Duration Type	Alarm to indicate that Ethernet port 3 has no received input signal in the defined duration period.	Check Ethernet cable and connector. Check switch port or RTU is active. Check IP and VLAN configuration.

Event ID	Event Display Text	Default Severity	Configuration Type	Function	Recommended Actions
45	Port 3 Eth Data Receive Errors	warning(4)	Error Ratio Type	Alarm to indicate that Ethernet port 3 received input signal contains errors at a higher rate than the defined error rate threshold.	Check Ethernet cable and connector. Check switch port or RTU is active. Check IP and VLAN configuration.
46	Port 3 Eth Data Transmit Errors	warning(4)	Error Ratio Type	Alarm to indicate that Ethernet port 3 transmitted output signal contains errors at a higher rate than the defined error rate threshold.	Check Ethernet cable and connector. Check switch port or RTU is active. Check IP and VLAN configuration.
48	Port 4 Eth No Receive Data	warning(4)	Sample Duration Type	Alarm to indicate that Ethernet port 4 has no received input signal in the defined duration period.	Check Ethernet cable and connector. Check switch port or RTU is active. Check IP and VLAN configuration.
49	Port 4 Eth Data Receive Errors	warning(4)	Error Ratio Type	Alarm to indicate that Ethernet port 4 received input signal contains errors at a higher rate than the defined error rate threshold.	Check Ethernet cable and connector. Check switch port or RTU is active. Check IP and VLAN configuration.
50	Port 4 Eth Data Transmit Errors	warning(4)	Error Ratio Type	Alarm to indicate that Ethernet port 4 transmitted output signal contains errors at a higher rate than the defined error rate threshold.	Check Ethernet cable and connector. Check switch port or RTU is active. Check IP and VLAN configuration.
13	Port 1 Serial Data No Receive Data	warning(4)	Sample Duration Type	Alarm to indicate that the RS-232 port 1 has no received input signal in the defined duration period.	Check serial ports settings, check serial cable and connector.
14	Port 1 Serial Data Receive Errors	warning(4)	Error Ratio Type	Alarm to indicate that the RS-232 port 1 received input signal contains errors at a higher rate than the defined error rate threshold.	Check serial ports settings, check serial cable and connector.
52	Port 2 Serial Data No Receive Data	warning(4)	Sample Duration Type	Alarm to indicate that the RS-232 port 2 has no received input signal in the defined duration period.	Check serial ports settings, check serial cable and connector.
53	Port 2 Serial Data Receive Errors	warning(4)	Error Ratio Type	Alarm to indicate that the RS-232 port 2 received input signal contains errors at a higher rate than the defined error rate threshold.	Check serial ports settings, check serial cable and connector.
63	USB Port Serial Data No Receive Data	warning(4)	Sample Duration Type	Alarm to indicate that the USB port has no received input signal in the defined duration period.	Check serial ports settings, check USB serial cable and adapter, check serial connector.
64	USB Port Serial Data Receive Errors	warning(4)	Error Ratio Type	Alarm to indicate that the USB port received input signal contains errors at a higher rate than the defined error rate threshold.	Check serial ports settings, check USB serial cable and adapter, check serial connector.

Component Failure Alarm Events

Event ID	Event Display Text	Default Severity	Configuration Type	Function	Recommended Actions
16	Component Failure	major(2)	Not Configurable	Alarm to indicate that a hardware component has failed.	Power off and restart radio. If fault persists replace radio.

Hardware Alarm Events

Event ID	Event Display Text	Default Severity	Configuration Type	Function	Recommended Actions
56	VDC Power Supply	warning(4)	Not Configurable	Alarm to indicate that the input power source is outside the operating limits of 10 to 30 VDC	Check DC connection to radio. Replace power supply.
57	3.3 Volts Power Supply	warning(4)	Not Configurable	Alarm to indicate that the 3.3 volt power rail is outside defined limits.	Power off and restart radio. If fault persists replace radio.
58	5.0 Volts Power Supply	warning(4)	Not Configurable	Alarm to indicate that the 5.0 volt power rail is outside defined limits.	Power off and restart radio. If fault persists replace radio.
59	7.2 Volts Power Supply	warning(4)	Not Configurable	Alarm to indicate that the 7.2 volt power rail is outside defined limits.	Power off and restart radio. If fault persists replace radio.
71	15 Volts Power Supply	warning(4)	Not Configurable	Alarm to indicate that the 15 volt power rail is outside defined limits.	Power off and restart radio. If fault persists replace radio.

Software Alarm Events

Event ID	Event Display Text	Default Severity	Configuration Type	Function	Recommended Actions
20	Calibration Failure	major(2)	Not Configurable	Alarm to indicate that the RF calibration has failed.	Power off and restart radio. If fault persists replace radio.
21	Configuration Not Supported	major(2)	Not Configurable	Alarm to indicate that a configuration has entered that is invalid.	Restore previous configuration, remove out of range or invalid parameters, updated software.
32	Network Configuration Warning	warning(4)	Not Configurable	Alarm to indicate a network configuration problem e.g. remote not registered.	Check for invalid parameters. Audit network settings.
73	Radio Network	warning(4)	Not Configurable	Alarm to indicate that there is an alarm in the radio network e.g. a remote radio has not registered or duplicate IP address.	Check for duplicate or invalid parameters. Audit network settings.
39	Software Restart Required	warning(4)	Not Configurable	Alarm to indicate that a configuration has changed that requires a software reboot.	Reboot radio.

Hardware Alarm Input Alarm Events

Event ID	Event Display Text	Default Severity	Configuration Type	Function	Recommended Actions
24	Alarm Input 1	warning(4)	Not Configurable	Alarm to indicate that there is an active alarm on hardware alarm input 1	Action depends on nature of third-party alarm.
25	Alarm Input 2	warning(4)	Not Configurable	Alarm to indicate that there is an active alarm on hardware alarm input 2	Action depends on nature of third-party alarm.

Protected Station Alarm Events

Event ID	Event Display Text	Default Severity	Configuration Type	Function	Recommended Actions
17	Protection Sw Manual Lock	warning(4)	Not Configurable	Alarm to indicate that the Protection Switch Software Manual Lock has been activated.	Information only.
18	Protection Hw Manual Lock	warning(4)	Not Configurable	Alarm to indicate that the Protection Switch Hardware Manual Lock has been activated.	Remember to unlock the Hardware Manual Lock for normal operation
23	Protection Peer Comms Lost	major(2)	Not Configurable	Alarm to indicate that the standby radio has lost communication with the active radio.	Check that the partner radio is powered on and the 'Protect' cable is plugged from the switch to both radios. Check that the radios have been setup for protected operation.
54	Protection Hardware Failure	major(2)	Not Configurable	Alarm to indicate that there is a failure in the protection switch hardware.	Check that the cables are connecting the switch to both radios. Check that the switch and both radios are the same Data interface port options e.g. 2E2S

Informational Events

Event ID	Event Display Text	Default Severity	Function	Recommended Actions
26	User authentication succeeded	information (5)	Event to indicate that a user is successfully authenticated on the radio during login. The information on the user that was successfully authenticated is provided in the eventHistoryInfo object of the Event History Log.	Information No action required unless unexpected
27	User authentication failed	information (5)	Event to indicate that a user has failed to be authenticated on the radio during login. The information on the user that was unsuccessfully authenticated is provided in the eventHistoryInfo object of the Event History Log.	Check for possible intrusion attempt. If unexpected follow cyber incident report procedure.
28	Protection switch failed	information (5)	Event to indicate that a protection switch-over cannot occur for some reason. The reason for the failure to switch is described in the eventHistoryInfo object of the Event History Log.	Investigate reason for switch over and take remedial action.
29	Software System Check	information (5)	Event to indicate that the software has done a system check on the radio. Any information relevant to the cause of the event is provided in the eventHistoryInfo object of the Event History Log.	Information No action required unless unexpected
30	Software Start Up	information (5)	Event to indicate that the radio software has started. Any information relevant to the software start up is provided in the eventHistoryInfo object of the Event History Log.	Information No action required unless unexpected
33	Protection Switch Occurred	information (5)	Event to indicate that a protection switch-over occurs for some reason. The reason for the switch-over is described in the eventHistoryInfo object of the Event History Log.	Investigate reason for switch over and take remedial action.
41	File Transfer Activity	information (5)	Event to indicate that a data file is being transferred to or from the radio.	Information No action required unless unexpected
42	Software Management Activity	information (5)	Event to indicate that software is being distributed to remote radios.	Information No action required unless unexpected
43	Terminal Server TCP Activity	information (5)	Event to indicate TCP packets are being transferred from the terminal server.	Information No action required unless unexpected
55	Terminal Unit Information	information (5)	Event to indicate a miscellaneous activity occurring on the radio	Information no action required unless unexpected.
65	Event Action Activity	information (5)	Event to indicate an event action occurring on the radio	Information No action required unless unexpected
72	User SuperVisor Session Logout	information (5)	Event to indicate that a user has logged out or the user session has timed out	Information No action required unless unexpected

13. Specifications

RF Specifications

Blocking (desensitization), intermodulation, spurious response rejection, and adjacent channel selectivity values determined according to the methods introduced in V1.7.1 of ETSI standards EN 300 113-1.

Frequency Bands

ETSI Compliant

Broadcast Band	Frequency Band	Frequency Tuning Range	Synthesizer Step Size
VHF	135 MHz	135-175 MHz	0.625 kHz
UHF	220 MHz	215-240 MHz	0.625 kHz
UHF	320 MHz	320-400 MHz	6.250 kHz
UHF	400 MHz	400-470 MHz	6.250 kHz
UHF	450 MHz	450-520 MHz	6.250 kHz

FCC Compliant

Broadcast Band	Frequency Band	Frequency Tuning Range	Synthesizer Step Size
VHF	135 MHz	135-175 MHz	0.625 kHz
UHF	220 MHz	215-240 MHz	0.625 kHz
UHF	400 MHz	400-470 MHz	6.250 kHz
UHF	450 MHz	450-520 MHz	6.250 kHz
UHF	700 MHz	757-758 MHz and 787-788 MHz	6.250 kHz
UHF	896 MHz	896-902 MHz (Note 1)	6.250 kHz
UHF	928 MHz	928-960 MHz (Note 1)	6.250 kHz

IC Compliant

Broadcast Band	Frequency Band	Frequency Tuning Range	Synthesizer Step Size
VHF	135 MHz	135-175 MHz	0.625 kHz
UHF	220 MHz	215-240 MHz	0.625 kHz
UHF	220 MHz	215-240 MHz	3.125 kHz
UHF	400 MHz	400-470 MHz	6.250 kHz
UHF	896 MHz	896-902 MHz (Note 1)	6.250 kHz
UHF	928 MHz	928-960 MHz (Note 1)	6.250 kHz

The Frequency Tuning Range is not an indication of the exact frequencies approved by FCC / IC.

Note 1: The receive tuning range is specified. The transmit tuning range is 896 - 960 MHz.

Channel Sizes

ETSI Compliant

ETSI: 135 MHz Band

No Forward Error Correction

Channel Size	Gross Radio Capacity			
	64 QAM	16 QAM	QPSK	4-CPFSK
12.5 kHz	60.0 kbit/s	40.0 kbit/s	20.0 kbit/s	9.6 kbit/s
25 kHz	120.0 kbit/s	80.0 kbit/s	40.0 kbit/s	19.2 kbit/s

Minimum Coded Forward Error Correction

Channel Size	Gross Radio Capacity less FEC			
	64 QAM	16 QAM	QPSK	4-CPFSK
12.5 kHz	52.0 kbit/s	23.1 kbit/s	11.6 kbit/s	8.4 kbit/s
25 kHz	103.9 kbit/s	46.2 kbit/s	23.1 kbit/s	16.7 kbit/s

Maximum Coded Forward Error Correction

Channel Size	Gross Radio Capacity less FEC			
	64 QAM	16 QAM	QPSK	4-CPFSK
12.5 kHz	45.6 kbit/s	17.3 kbit/s	8.7 kbit/s	4.1 kbit/s
25 kHz	91.2 kbit/s	34.6 kbit/s	17.3 kbit/s	8.3 kbit/s

ETSI: 220 / 320 / 400 MHz Bands

No Forward Error Correction

Channel Size	Gross Radio Capacity			
	64 QAM	16 QAM	QPSK	4-CPFSK
12.5 kHz	60.0 kbit/s	40.0 kbit/s	20.0 kbit/s	9.6 kbit/s
20 kHz	84.0 kbit/s	56.0 kbit/s	28.0 kbit/s	9.6 kbit/s
25 kHz	120.0 kbit/s	80.0 kbit/s	40.0 kbit/s	19.2 kbit/s
50 kHz (1)	216.0 kbit/s	144.0 kbit/s	72.0 kbit/s	38.4 kbit/s

Minimum Coded Forward Error Correction

Channel Size	Gross Radio Capacity less FEC			
	64 QAM	16 QAM	QPSK	4-CPFSK
12.5 kHz	52.0 kbit/s	23.1 kbit/s	11.6 kbit/s	8.4 kbit/s
20 kHz	72.7 kbit/s	32.4 kbit/s	16.2 kbit/s	8.4 kbit/s
25 kHz	103.9 kbit/s	46.2 kbit/s	23.1 kbit/s	16.7 kbit/s
50 kHz (1)	187.1 kbit/s	83.2 kbit/s	41.6 kbit/s	33.4 kbit/s

Maximum Coded Forward Error Correction

Channel Size	Gross Radio Capacity less FEC			
	64 QAM	16 QAM	QPSK	4-CPFSK
12.5 kHz	45.6 kbit/s	17.3 kbit/s	8.7 kbit/s	4.1 kbit/s
20 kHz	63.8 kbit/s	24.2 kbit/s	12.1 kbit/s	4.1 kbit/s
25 kHz	91.2 kbit/s	34.6 kbit/s	17.3 kbit/s	8.3 kbit/s
50 kHz (1)	164.2 kbit/s	62.4 kbit/s	31.2 kbit/s	16.5 kbit/s

Note 1: It is the responsibility of the user to check for country regulatory of 50 kHz availability in this frequency band.

ETSI: 450 MHz Band

No Forward Error Correction

Channel Size	Gross Radio Capacity			
	64 QAM	16 QAM	QPSK	4-CPFSK
12.5 kHz	60.0 kbit/s	40.0 kbit/s	20.0 kbit/s	9.6 kbit/s
25 kHz	120.0 kbit/s	80.0 kbit/s	40.0 kbit/s	19.2 kbit/s
50 kHz (1)	216.0 kbit/s	144.0 kbit/s	72.0 kbit/s	38.4 kbit/s

Minimum Coded Forward Error Correction

Channel Size	Gross Radio Capacity less FEC			
	64 QAM	16 QAM	QPSK	4-CPFSK
12.5 kHz	52.0 kbit/s	23.1 kbit/s	11.6 kbit/s	8.4 kbit/s
25 kHz	103.9 kbit/s	46.2 kbit/s	23.1 kbit/s	16.7 kbit/s
50 kHz (1)	187.1 kbit/s	83.2 kbit/s	41.6 kbit/s	33.4 kbit/s

Maximum Coded Forward Error Correction

Channel Size	Gross Radio Capacity less FEC			
	64 QAM	16 QAM	QPSK	4-CPFSK
12.5 kHz	45.6 kbit/s	17.3 kbit/s	8.7 kbit/s	4.1 kbit/s
25 kHz	91.2 kbit/s	34.6 kbit/s	17.3 kbit/s	8.3 kbit/s
50 kHz (1)	164.2 kbit/s	62.4 kbit/s	31.2 kbit/s	16.5 kbit/s

Note 1: It is the responsibility of the user to check for country regulatory of 50 kHz availability in this frequency band.

FCC Compliant

FCC: 135 MHz Band

No Forward Error Correction

Channel Size	Gross Radio Capacity			
	64 QAM	16 QAM	QPSK	4-CPFSK
15 kHz	54.0 kbit/s	36.0 kbit/s	18.0 kbit/s	9.6 kbit/s
30 kHz	96.0 kbit/s	64.0 kbit/s	32.0 kbit/s	19.2 kbit/s

Minimum Coded Forward Error Correction

Channel Size	Gross Radio Capacity less FEC			
	64 QAM	16 QAM	QPSK	4-CPFSK
15 kHz	46.8 kbit/s	20.8 kbit/s	10.4 kbit/s	8.4 kbit/s
30 kHz	83.1 kbit/s	37.0 kbit/s	18.5 kbit/s	16.7 kbit/s

Maximum Coded Forward Error Correction

Channel Size	Gross Radio Capacity less FEC			
	64 QAM	16 QAM	QPSK	4-CPFSK
15 kHz	41.0 kbit/s	15.6 kbit/s	7.8 kbit/s	4.1 kbit/s
30 kHz	73.0 kbit/s	27.7 kbit/s	13.9 kbit/s	8.3 kbit/s

FCC: 220 MHz Band

No Forward Error Correction

Channel Size	Gross Radio Capacity			
	64 QAM	16 QAM	QPSK	4-CPFSK
12.5 kHz	54.0 kbit/s	36.0 kbit/s	18.0 kbit/s	9.6 kbit/s
15 kHz	60.0 kbit/s	40.0 kbit/s	20.0 kbit/s	9.6 kbit/s
25 kHz	96.0 kbit/s	64.0 kbit/s	32.0 kbit/s	19.2 kbit/s
50 kHz	216.0 kbit/s	144.0 kbit/s	72.0 kbit/s	38.4 kbit/s

Minimum Coded Forward Error Correction

Channel Size	Gross Radio Capacity less FEC			
	64 QAM	16 QAM	QPSK	4-CPFSK
12.5 kHz	46.8 kbit/s	20.8 kbit/s	10.4 kbit/s	8.4 kbit/s
15 kHz	52.0 kbit/s	23.1 kbit/s	11.6 kbit/s	8.4 kbit/s
25 kHz	83.1 kbit/s	37.0 kbit/s	18.5 kbit/s	16.7 kbit/s
50 kHz	187.1 kbit/s	83.2 kbit/s	41.6 kbit/s	33.4 kbit/s

Maximum Coded Forward Error Correction

Channel Size	Gross Radio Capacity less FEC			
	64 QAM	16 QAM	QPSK	4-CPFSK
12.5 kHz	41.0 kbit/s	15.6 kbit/s	7.8 kbit/s	4.1 kbit/s
15 kHz	45.6 kbit/s	17.3 kbit/s	8.7 kbit/s	4.1 kbit/s
25 kHz	73.0 kbit/s	27.7 kbit/s	13.9 kbit/s	8.3 kbit/s
50 kHz	164.2 kbit/s	62.4 kbit/s	31.2 kbit/s	16.5 kbit/s

FCC: 400 MHz Band

No Forward Error Correction

Channel Size	Gross Radio Capacity			
	64 QAM	16 QAM	QPSK	4-CPFSK
12.5 kHz	54.0 kbit/s	36.0 kbit/s	18.0 kbit/s	9.6 kbit/s
25 kHz	96.0 kbit/s	64.0 kbit/s	32.0 kbit/s	19.2 kbit/s
50 kHz (1)	216.0 kbit/s	144.0 kbit/s	72.0 kbit/s	38.4 kbit/s

Minimum Coded Forward Error Correction

Channel Size	Gross Radio Capacity less FEC			
	64 QAM	16 QAM	QPSK	4-CPFSK
12.5 kHz	46.8 kbit/s	20.8 kbit/s	10.4 kbit/s	8.4 kbit/s
25 kHz	83.1 kbit/s	37.0 kbit/s	18.5 kbit/s	16.7 kbit/s
50 kHz (1)	187.1 kbit/s	83.2 kbit/s	41.6 kbit/s	33.4 kbit/s

Maximum Coded Forward Error Correction

Channel Size	Gross Radio Capacity less FEC			
	64 QAM	16 QAM	QPSK	4-CPFSK
12.5 kHz	41.0 kbit/s	15.6 kbit/s	7.8 kbit/s	4.1 kbit/s
25 kHz	73.0 kbit/s	27.7 kbit/s	13.9 kbit/s	8.3 kbit/s
50 kHz (1)	164.2 kbit/s	62.4 kbit/s	31.2 kbit/s	16.5 kbit/s

Note 1: It is the responsibility of the user to check for country regulatory of 50 kHz availability in this frequency band.

FCC: 450 MHz Band

No Forward Error Correction

Channel Size	Gross Radio Capacity			
	64 QAM	16 QAM	QPSK	4-CPFSK
12.5 kHz	54.0 kbit/s	36.0 kbit/s	18.0 kbit/s	9.6 kbit/s
25 kHz	96.0 kbit/s	64.0 kbit/s	32.0 kbit/s	19.2 kbit/s

Minimum Coded Forward Error Correction

Channel Size	Gross Radio Capacity less FEC			
	64 QAM	16 QAM	QPSK	4-CPFSK
12.5 kHz	46.8 kbit/s	20.8 kbit/s	10.4 kbit/s	8.4 kbit/s
25 kHz	83.1 kbit/s	37.0 kbit/s	18.5 kbit/s	16.7 kbit/s

Maximum Coded Forward Error Correction

Channel Size	Gross Radio Capacity less FEC			
	64 QAM	16 QAM	QPSK	4-CPFSK
12.5 kHz	41.0 kbit/s	15.6 kbit/s	7.8 kbit/s	4.1 kbit/s
25 kHz	73.0 kbit/s	27.7 kbit/s	13.9 kbit/s	8.3 kbit/s

FCC: 700 MHz Band

No Forward Error Correction

Channel Size	Gross Radio Capacity			
	64 QAM	16 QAM	QPSK	4-CPFSK (2)
25 kHz	120.0 kbit/s	80.0 kbit/s	40.0 kbit/s	19.2 kbit/s
50 kHz	240.0 kbit/s	160.0 kbit/s	80.0 kbit/s	38.4 kbit/s
75 kHz (1)	360.0 kbit/s	240.0 kbit/s	120.0 kbit/s	57.6 kbit/s

Minimum Coded Forward Error Correction

Channel Size	Gross Radio Capacity less FEC			
	64 QAM	16 QAM	QPSK	4-CPFSK (2)
25 kHz	103.9 kbit/s	46.2 kbit/s	23.1 kbit/s	16.7 kbit/s
50 kHz	207.8 kbit/s	92.5 kbit/s	46.2 kbit/s	33.4 kbit/s
75 kHz (1)	311.8 kbit/s	138.7 kbit/s	69.4 kbit/s	50.1 kbit/s

Maximum Coded Forward Error Correction

Channel Size	Gross Radio Capacity less FEC			
	64 QAM	16 QAM	QPSK	4-CPFSK (2)
25 kHz	91.2 kbit/s	34.6 kbit/s	17.3 kbit/s	8.3 kbit/s
50 kHz	182.4 kbit/s	69.3 kbit/s	34.6 kbit/s	16.5 kbit/s
75 kHz (1)	273.6 kbit/s	103.9 kbit/s	52.0 kbit/s	24.8 kbit/s

Note 1: Available in future software release.

Note 2: Please consult 4RF for availability.

FCC: 896 / 928 MHz Bands

No Forward Error Correction

Channel Size	Gross Radio Capacity			
	64 QAM	16 QAM	QPSK	4-CPFSK
12.5 kHz	60.0 kbit/s	40.0 kbit/s	20.0 kbit/s	9.6 kbit/s
25 kHz	96.0 kbit/s	64.0 kbit/s	32.0 kbit/s	19.2 kbit/s
50 kHz	216.0 kbit/s	144.0 kbit/s	72.0 kbit/s	38.4 kbit/s

Minimum Coded Forward Error Correction

Channel Size	Gross Radio Capacity less FEC			
	64 QAM	16 QAM	QPSK	4-CPFSK
12.5 kHz	52.0 kbit/s	23.1 kbit/s	11.6 kbit/s	8.4 kbit/s
25 kHz	83.1 kbit/s	37.0 kbit/s	18.5 kbit/s	16.7 kbit/s
50 kHz	187.1 kbit/s	83.2 kbit/s	41.6 kbit/s	33.4 kbit/s

Maximum Coded Forward Error Correction

Channel Size	Gross Radio Capacity less FEC			
	64 QAM	16 QAM	QPSK	4-CPFSK
12.5 kHz	45.6 kbit/s	17.3 kbit/s	8.7 kbit/s	4.1 kbit/s
25 kHz	73.0 kbit/s	27.7 kbit/s	13.9 kbit/s	8.3 kbit/s
50 kHz	164.2 kbit/s	62.4 kbit/s	31.2 kbit/s	16.5 kbit/s

IC Compliant

IC: 135 MHz Band

No Forward Error Correction

Channel Size	Gross Radio Capacity			
	64 QAM	16 QAM	QPSK	4-CPFSK
15 kHz	54.0 kbit/s	36.0 kbit/s	18.0 kbit/s	9.6 kbit/s
30 kHz	96.0 kbit/s	64.0 kbit/s	32.0 kbit/s	19.2 kbit/s

Minimum Coded Forward Error Correction

Channel Size	Gross Radio Capacity less FEC			
	64 QAM	16 QAM	QPSK	4-CPFSK
15 kHz	46.8 kbit/s	20.8 kbit/s	10.4 kbit/s	8.4 kbit/s
30 kHz	83.1 kbit/s	37.0 kbit/s	18.5 kbit/s	16.7 kbit/s

Maximum Coded Forward Error Correction

Channel Size	Gross Radio Capacity less FEC			
	64 QAM	16 QAM	QPSK	4-CPFSK
15 kHz	41.0 kbit/s	15.6 kbit/s	7.8 kbit/s	4.1 kbit/s
30 kHz	73.0 kbit/s	27.7 kbit/s	13.9 kbit/s	8.3 kbit/s

IC: 220 MHz Band

No Forward Error Correction

Channel Size	Gross Radio Capacity			
	64 QAM	16 QAM	QPSK	4-CPFSK
12.5 kHz	54.0 kbit/s	36.0 kbit/s	18.0 kbit/s	9.6 kbit/s
15 kHz	60.0 kbit/s	40.0 kbit/s	20.0 kbit/s	9.6 kbit/s
25 kHz	96.0 kbit/s	64.0 kbit/s	32.0 kbit/s	19.2 kbit/s
50 kHz	216.0 kbit/s	144.0 kbit/s	72.0 kbit/s	38.4 kbit/s

Minimum Coded Forward Error Correction

Channel Size	Gross Radio Capacity less FEC			
	64 QAM	16 QAM	QPSK	4-CPFSK
12.5 kHz	46.8 kbit/s	20.8 kbit/s	10.4 kbit/s	8.4 kbit/s
15 kHz	52.0 kbit/s	23.1 kbit/s	11.6 kbit/s	8.4 kbit/s
25 kHz	83.1 kbit/s	37.0 kbit/s	18.5 kbit/s	16.7 kbit/s
50 kHz	187.1 kbit/s	83.2 kbit/s	41.6 kbit/s	33.4 kbit/s

Maximum Coded Forward Error Correction

Channel Size	Gross Radio Capacity less FEC			
	64 QAM	16 QAM	QPSK	4-CPFSK
12.5 kHz	41.0 kbit/s	15.6 kbit/s	7.8 kbit/s	4.1 kbit/s
15 kHz	45.6 kbit/s	17.3 kbit/s	8.7 kbit/s	4.1 kbit/s
25 kHz	73.0 kbit/s	27.7 kbit/s	13.9 kbit/s	8.3 kbit/s
50 kHz	164.2 kbit/s	62.4 kbit/s	31.2 kbit/s	16.5 kbit/s

IC: 400 MHz Band

No Forward Error Correction

Channel Size	Gross Radio Capacity			
	64 QAM	16 QAM	QPSK	4-CPFSK
12.5 kHz	54.0 kbit/s	36.0 kbit/s	18.0 kbit/s	9.6 kbit/s
25 kHz	96.0 kbit/s	64.0 kbit/s	32.0 kbit/s	19.2 kbit/s
50 kHz (1)	216.0 kbit/s	144.0 kbit/s	72.0 kbit/s	38.4 kbit/s

Minimum Coded Forward Error Correction

Channel Size	Gross Radio Capacity less FEC			
	64 QAM	16 QAM	QPSK	4-CPFSK
12.5 kHz	46.8 kbit/s	20.8 kbit/s	10.4 kbit/s	8.4 kbit/s
25 kHz	83.1 kbit/s	37.0 kbit/s	18.5 kbit/s	16.7 kbit/s
50 kHz (1)	187.1 kbit/s	83.2 kbit/s	41.6 kbit/s	33.4 kbit/s

Maximum Coded Forward Error Correction

Channel Size	Gross Radio Capacity less FEC			
	64 QAM	16 QAM	QPSK	4-CPFSK
12.5 kHz	41.0 kbit/s	15.6 kbit/s	7.8 kbit/s	4.1 kbit/s
25 kHz	73.0 kbit/s	27.7 kbit/s	13.9 kbit/s	8.3 kbit/s
50 kHz (1)	164.2 kbit/s	62.4 kbit/s	31.2 kbit/s	16.5 kbit/s

Note 1: It is the responsibility of the user to check for country regulatory of 50 kHz availability in this frequency band.

IC: 896 / 928 MHz Bands

No Forward Error Correction

Channel Size	Gross Radio Capacity			
	64 QAM	16 QAM	QPSK	4-CPFSK
12.5 kHz	60.0 kbit/s	40.0 kbit/s	20.0 kbit/s	9.6 kbit/s
25 kHz	96.0 kbit/s	64.0 kbit/s	32.0 kbit/s	19.2 kbit/s
50 kHz	216.0 kbit/s	144.0 kbit/s	72.0 kbit/s	38.4 kbit/s

Minimum Coded Forward Error Correction

Channel Size	Gross Radio Capacity less FEC			
	64 QAM	16 QAM	QPSK	4-CPFSK
12.5 kHz	52.0 kbit/s	23.1 kbit/s	11.6 kbit/s	8.4 kbit/s
25 kHz	83.1 kbit/s	37.0 kbit/s	18.5 kbit/s	16.7 kbit/s
50 kHz	187.1 kbit/s	83.2 kbit/s	41.6 kbit/s	33.4 kbit/s

Maximum Coded Forward Error Correction

Channel Size	Gross Radio Capacity less FEC			
	64 QAM	16 QAM	QPSK	4-CPFSK
12.5 kHz	45.6 kbit/s	17.3 kbit/s	8.7 kbit/s	4.1 kbit/s
25 kHz	73.0 kbit/s	27.7 kbit/s	13.9 kbit/s	8.3 kbit/s
50 kHz	164.2 kbit/s	62.4 kbit/s	31.2 kbit/s	16.5 kbit/s

Receiver

Receiver Sensitivity

			12.5 kHz	25 kHz	50 kHz	75 kHz
BER < 10^{-2}	64 QAM	Max coded FEC	-106 dBm	-102 dBm	-99 dBm	-96 dBm
BER < 10^{-2}	64 QAM	Min coded FEC	-105 dBm	-101 dBm	-98 dBm	-95 dBm
BER < 10^{-2}	64 QAM	No FEC	-103 dBm	-99 dBm	-96 dBm	-93 dBm
BER < 10^{-2}	16 QAM	Max coded FEC	-113 dBm	-110 dBm	-107 dBm	-104 dBm
BER < 10^{-2}	16 QAM	Min coded FEC	-112 dBm	-109 dBm	-106 dBm	-103 dBm
BER < 10^{-2}	16 QAM	No FEC	-109 dBm	-106 dBm	-103 dBm	-100 dBm
BER < 10^{-2}	QPSK	Max coded FEC	-118 dBm	-115 dBm	-112 dBm	-109 dBm
BER < 10^{-2}	QPSK	Min coded FEC	-117 dBm	-114 dBm	-111 dBm	-108 dBm
BER < 10^{-2}	QPSK	No FEC	-115 dBm	-112 dBm	-109 dBm	-106 dBm
BER < 10^{-2}	4-CPFSK	Max coded FEC	NA	NA	NA	NA
BER < 10^{-2}	4-CPFSK	Min coded FEC	-117 dBm	-114 dBm	-111 dBm	-108 dBm
BER < 10^{-2}	4-CPFSK	No FEC	-115 dBm	-112 dBm	-109 dBm	-106 dBm
BER < 10^{-6}	64 QAM	Max coded FEC	-103 dBm	-99 dBm	-96 dBm	-93 dBm
BER < 10^{-6}	64 QAM	Min coded FEC	-101 dBm	-97 dBm	-94 dBm	-91 dBm
BER < 10^{-6}	64 QAM	No FEC	-96 dBm	-92 dBm	-89 dBm	-86 dBm
BER < 10^{-6}	16 QAM	Max coded FEC	-110 dBm	-107 dBm	-104 dBm	-101 dBm
BER < 10^{-6}	16 QAM	Min coded FEC	-108 dBm	-105 dBm	-102 dBm	-99 dBm
BER < 10^{-6}	16 QAM	No FEC	-102 dBm	-99 dBm	-96 dBm	-93 dBm
BER < 10^{-6}	QPSK	Max coded FEC	-115 dBm	-112 dBm	-109 dBm	-106 dBm
BER < 10^{-6}	QPSK	Min coded FEC	-113 dBm	-110 dBm	-107 dBm	-104 dBm
BER < 10^{-6}	QPSK	No FEC	-108 dBm	-105 dBm	-102 dBm	-99 dBm
BER < 10^{-6}	4-CPFSK	Max coded FEC	NA	NA	NA	NA
BER < 10^{-6}	4-CPFSK	Min coded FEC	-113 dBm	-110 dBm	-107 dBm	-104 dBm
BER < 10^{-6}	4-CPFSK	No FEC	-108 dBm	-105 dBm	-102 dBm	-99 dBm

Adjacent Channel Selectivity

		12.5 kHz	25 kHz	50 kHz	75 kHz
Adjacent channel selectivity		> -47 dBm	> -37 dBm	> -37 dBm	> -37 dBm
BER < 10^{-2}	64 QAM	> 43 dB	> 53 dB	> 53 dB	> 53 dB
BER < 10^{-2}	16 QAM	> 43 dB	> 53 dB	> 53 dB	> 53 dB
BER < 10^{-2}	QPSK	> 48 dB	> 58 dB	> 58 dB	> 58 dB
BER < 10^{-2}	4-CPFSK	> 55 dB	> 65 dB	> 65 dB	> 65 dB

Co-Channel Rejection

		12.5 kHz	25 kHz	50 kHz	75 kHz
BER < 10^{-2}	64 QAM	> -23 dB	> -23 dB	> -23 dB	> -23 dB
BER < 10^{-2}	16 QAM	> -19 dB	> -19 dB	> -19 dB	> -19 dB
BER < 10^{-2}	QPSK	> -12 dB	> -12 dB	> -12 dB	> -12 dB
BER < 10^{-2}	4-CPFSK	> -17 dB	> -17 dB	> -17 dB	> -17 dB

Intermodulation Response Rejection

		12.5 kHz	25 kHz	50 kHz	75 kHz
Intermodulation response rejection		> -35 dBm	> -35 dBm	> -35 dBm	> -35 dBm
BER < 10^{-2}	64 QAM	> 55 dB	> 55 dB	> 55 dB	> 55 dB
BER < 10^{-2}	16 QAM	> 55 dB	> 55 dB	> 55 dB	> 55 dB
BER < 10^{-2}	QPSK	> 60 dB	> 60 dB	> 60 dB	> 60 dB
BER < 10^{-2}	4-CPFSK	> 65 dB	> 65 dB	> 65 dB	> 65 dB

Blocking or Desensitization

		12.5 kHz	25 kHz	50 kHz	75 kHz
Blocking or desensitization		> -17 dBm	> -17 dBm	> -17 dBm	> -17 dBm
BER < 10^{-2}	64 QAM	> 73 dB	> 73 dB	> 73 dB	> 73 dB
BER < 10^{-2}	16 QAM	> 73 dB	> 73 dB	> 73 dB	> 73 dB
BER < 10^{-2}	QPSK	> 78 dB	> 78 dB	> 78 dB	> 78 dB
BER < 10^{-2}	4-CPFSK	> 85 dB	> 85 dB	> 85 dB	> 85 dB

Spurious Response Rejection

		12.5 kHz	25 kHz	50 kHz	75 kHz
Spurious response rejection		> -32 dBm	> -32 dBm	> -32 dBm	> -32 dBm
BER < 10^{-2}	64 QAM	> 58 dB	> 58 dB	> 58 dB	> 58 dB
BER < 10^{-2}	16 QAM	> 58 dB	> 58 dB	> 58 dB	> 58 dB
BER < 10^{-2}	QPSK	> 63 dB	> 63 dB	> 63 dB	> 63 dB
BER < 10^{-2}	4-CPFSK	> 70 dB	> 70 dB	> 70 dB	> 70 dB

Receiver Spurious Radiation

	12.5 kHz	25 kHz	50 kHz	75 kHz
Receiver spurious radiation	> -57 dBm	> -57 dBm	> -57 dBm	> -57 dBm

Transmitter

Max peak envelope power (PEP)		12.5 W (+41 dBm)
Average Power output	64 QAM	0.01 to 2.5 W (+10 to +34 dBm, in 1 dB steps)
	16 QAM	0.01 to 3.2 W (+10 to +35 dBm, in 1 dB steps)
	QPSK	0.01 to 5.0 W (+10 to +37 dBm, in 1 dB steps)
	4-CPFSK (Note 1)	0.01 to 10.0 W (+10 to +40 dBm, in 1 dB steps)

Note 1: Please consult 4RF for availability

Note: The Aprisa SR+ transmitter contains power amplifier protection which allows the antenna to be disconnected from the antenna port without product damage.

Adjacent channel power	< - 60 dBc
Transient adjacent channel power	< - 60 dBc
Spurious emissions	< - 37 dBm
Attack time	< 1.5 ms
Release time	< 0.5 ms
Data turnaround time	< 2 ms
Frequency stability	± 1.0 ppm
Frequency aging	< 1 ppm / annum
Emission Designator Suffix	QPSK G1D, QAM D1D

Modem

Forward Error Correction	Variable length concatenated Reed Solomon plus convolutional code
Adaptive Burst Support	Adaptive FEC Adaptive Coding and Modulation

Data Payload Security

Data payload security	CCM* Counter with CBC-MAC
Data encryption	Counter Mode Encryption (CTR) using Advanced Encryption Standard (AES) 128, 192 or 256
Data authentication	Cipher Block Chaining Message Authentication Code (CBC-MAC) using Advanced Encryption Standard (AES) 128, 192 or 256

Interface Specifications

Ethernet Interface

The Aprisa SR+ radio features an integrated 10Base-T/100Base-TX layer-2 Ethernet switch.

To simplify network setup, each port supports auto-negotiation and auto-sensing MDI/MDIX. Operators can select from the following preset modes:

- Auto negotiate
- 10Base-T half or full duplex
- 100Base-TX half or full duplex

The Ethernet ports are IEEE 802.3-compatible. The L2 Bridge (Switch) is IEEE 802.1d/q/p compatible, and supports VLANs and VLAN manipulation of add/remove VLANs.

General	Interface	RJ45 x 2 (Integrated 2-port switch)
	Cabling	CAT-5/6 UTP, supports auto MDIX (Standard Ethernet)
	Maximum line length	100 metres on cat-5 or better
	Bandwidth allocation	The Ethernet capacity maximum is determined by the available radio link capacity.
	Maximum transmission unit	Option setting of 1522 or 1536 octets
	Address table size	1024 MAC addresses
	Ethernet mode	10Base-T or 100Base-TX Full duplex or half duplex (Auto-negotiating and auto-sensing)
Diagnostics	Left Green LED	Off: no Ethernet signal received On: Ethernet signal received
	Right Orange LED	Off: no data present on the interface Flashing: data present on the interface

Note: Do not connect Power over Ethernet (PoE) connections to the Aprisa SR+ Ethernet ports as this will damage the port.

RS-232 Asynchronous Interface

The Aprisa SR+ radio's ITU-T V.24 compliant RS-232 interface is configured as a Cisco® pinout DCE. The interface terminates to a DTE using a straight-through cable or to a DCE with a crossover cable (null modem).

The interface uses two handshaking control lines between the DTE and the DCE.

General	Interface	ITU-T V.24 / EIA/TIA RS-232E
	Interface direction	DCE only
	Maximum line length	10 metres (dependent on baud rate)
Async parameters	Standard mode data bits	7 or 8 bits
	Standard mode parity	Configurable for None, Even or Odd
	Standard mode stop bits	1 or 2 bits
	Interface baud rates	300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600 and 115200 bit/s
Control signals	DCE to DTE	CTS, RTS, DSR, DTR
Diagnostics	Left Green LED	Off: no RS-232 device connected On: RS-232 device connected
	Right Orange LED	Off: no data present on the interface Flashing: data present on the interface

Hardware Alarms Interface

The hardware alarms interface supports two alarm inputs and two alarms outputs.

Alarm Inputs

The alarm connector provides two hardware alarm inputs for alarm transmission to the other radios in the network.

Interface	RJ45 connector
Detector type	Non-isolated ground referenced voltage detector
Detection voltage - on	> +10 VDC
Detection voltage - off	< +4 VDC
Maximum applied input voltage	30 VDC
Maximum input current limit	10 mA

Alarm Outputs

The alarm connector provides two hardware alarm outputs for alarm reception from other radios in the network.

Interface	RJ45 connector
Output type	Non-isolated ground referenced open collector output
Maximum applied voltage	30 VDC
Maximum drive current	100 mA
Overload protection	Thermally resettable fuse

Protect Interface

The Protect interface is used to connect the radios to the protection switch within a Protected Station. It is not a customer interface.

Protection Switch Specifications

RF Insertion Loss	< 0.5 dB (switch and connecting cables)
Remote Control inputs	Logic 4700 ohms pullup to +3.3 VDC

Power Specifications

Power Supply

Aprisa SR+ Radio

Nominal voltage	+13.8 VDC (negative earth)
Absolute input voltage range	+10 to +30 VDC
Maximum power input	35 W
Connector	Molex 2 pin male screw fitting 39526-4002

Aprisa SR+ Protected Station

Power Input	13.8 VDC	48 VDC
Nominal voltage	+13.8 VDC (negative earth)	48 VDC (floating)
Absolute input voltage range	+10 to +30 VDC	18 to 60 VDC
Maximum power input	42 W	
Connector	2x Molex 2 pin male screw fitting 39526-4002	

Aprisa SR+ Migration Master Station

Power Input	13.8 VDC	48 VDC
Nominal voltage	+13.8 VDC (negative earth)	48 VDC (floating)
Absolute input voltage range	+10 to +30 VDC	18 to 60 VDC
Maximum power input	48 W	
Connector	4x Molex 2 pin male screw fitting 39526-4002	

Power Consumption

Note: The radio power consumption is very dependent on transmitter power, the type of traffic and network activity.

Aprisa SR+ Radio

Mode		Power Consumption
Transmit / Receive		< 35 W for 10 W transmit peak power
		< 25.0 W for 1 W transmit power
Receive only	Standard	< 7 W
	Power Optimized	< 3 W in active receive state
		< 2 W in idle receive state < 0.5 W in sleep mode

Aprisa SR+ Protected Station and Aprisa SR+ Data Driven Protected Station

Mode	Power Consumption
Transmit / Receive	< 42 W for 10 W transmit peak power
	< 32.0 W for 1 W transmit power
Receive only	< 15 W

Aprisa SR+ Migration Master Station

Mode	Power Consumption
Transmit / Receive	< 48 W for 10 W transmit peak power
	< 38.0 W for 1 W transmit power
Receive only	< 21 W

Power Dissipation

Aprisa SR+ Radio

Transmit Power	Power Dissipation
10 W transmit power	< 25 W
1 W transmit power	< 24 W

Aprisa SR+ Protected Station and Aprisa SR+ Data Driven Protected Station

Transmit Power	Power Dissipation
10 W transmit power	< 32 W
1 W transmit power	< 31 W

General Specifications

Environmental

Operating temperature range	-40 to +70˚ C (-40 to +158˚ F)
Storage temperature range	-40 to +80˚ C (-40 to +176˚ F)
Operating humidity	Maximum 95% non-condensing
Acoustic noise emission	No audible noise emission

Mechanical

Aprisa SR+ Radio

Dimensions	Width 210 mm (8.27”) Depth 130 mm (5.12”) and 146 mm (5.748”) with TNC connectors Height 41.5 mm (1.63”)
Weight	1.25 kg (2.81 lbs)
Colour	Matt black
Mounting	Wall (2 x M5 screws) Rack shelf (4 x M4 screws) DIN rail bracket

Aprisa SR+ Protected Station

Dimensions	Width 432.6 mm (17”) Depth 372 mm (14.6”) and 388 mm (15.276”) with TNC connectors Height 2U plus external duplexer (if used)
Weight	9.4 kg (22 lbs) (includes the 2 radios)
Colour	Matt black
Mounting	Rack mount (4 x M6 screws)

Aprisa SR+ Migration Master Station

Dimensions	Width 432.6 mm (17”) Depth 372 mm (14.6”) and 388 mm (15.276”) with TNC connectors Height 3U plus external duplexer (if used)
Weight	13.8 kg (31 lbs) (includes the 2 radios)
Colour	Matt black
Mounting	Rack mount (8 x M6 screws)

Compliance

ETSI

Radio	EN 300 113-2
EMI / EMC	EN 301 489-1 and 5
Safety	EN 60950-1:2006 Class 1 division 2 for hazardous locations
Environmental	ETS 300 019 Class 3.4 Ingress Protection IP51

FCC

Radio	47CFR part 24, part 27, part 90 and part 101 Private Land Mobile Radio Services
EMC	47CFR part 15 Radio Frequency Devices, EN 301 489-1 and 5
Safety	EN 60950-1:2006 Class 1 division 2 for hazardous locations
Environmental	ETS 300 019 Class 3.4 Ingress Protection IP51

IC

Radio	RSS-119 / RSS-134
EMC	This Class A digital apparatus complies with Canadian standard ICES-003. Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.
Safety	EN 60950-1:2006 Class 1 division 2 for hazardous locations
Environmental	ETS 300 019 Class 3.4 Ingress Protection IP51

14. Product End Of Life

End-of-Life Recycling Programme (WEEE)

The WEEE Directive concerns the recovery, reuse, and recycling of electronic and electrical equipment. Under the Directive, used equipment must be marked, collected separately, and disposed of properly.

4RF has implemented an end-of-life recycling programme to manage the reuse, recycling, and recovery of waste in an environmentally safe manner using processes that comply with the WEEE Directive (EU Waste Electrical and Electronic Equipment 2002/96/EC).

The WEEE Symbol Explained

This symbol appears on Electrical and Electronic Equipment (EEE) as part of the WEEE (Waste EEE) directive. It means that the EEE may contain hazardous substances and must not be thrown away with municipal or other waste.

WEEE Must Be Collected Separately

You must not dispose of electrical and electronic waste with municipal and other waste. You must separate it from other waste and recycling so that it can be easily collected by the proper regional WEEE collection system in your area.

YOUR ROLE in the Recovery of WEEE

By separately collecting and properly disposing of WEEE, you are helping to reduce the amount of WEEE that enters the waste stream.

One of the aims of the WEEE directive is to divert EEE away from landfill and encourage recycling. Recycling EEE means that valuable resources such as metals and other materials (which require energy to source and manufacture) are not wasted. Also, the pollution associated with accessing new materials and manufacturing new products is reduced.

EEE Waste Impacts the Environment and Health

Electrical and electronic equipment (EEE) contains hazardous substances which have potential effects on the environment and human health. If you want environmental information on the Aprisa SR+ radio, contact us (on page 15).

15. Copyrights

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16. Abbreviations

AES	Advanced Encryption Standard
AGC	Automatic Gain Control
BER	Bit Error Rate
CBC	Cipher Block Chaining
CCM	Counter with CBC-MAC integrity
DCE	Data Communications Equipment
DTE	Data Radio Equipment
EMC	Electro-Magnetic Compatibility
EMI	Electro-Magnetic Interference
ESD	Electro-Static Discharge
ETSI	European Telecommunications Standards Institute
FW	Firmware
HW	Hardware
IF	Intermediate Frequency
IP	Internet Protocol
I/O	Input/Output
ISP	Internet Service Provider
kbit/s	Kilobits per second
kHz	Kilohertz
LAN	Local Area Network
LED	Light Emitting Diode
mA	Milliamps
MAC	Media Access Control
MAC	Message Authentication Code
Mbit/s	Megabits per second
MHz	Megahertz
MIB	Management Information Base
MTBF	Mean Time Between Failures
MTTR	Mean Time To Repair
ms	milliseconds
NMS	Network Management System
PC	Personal Computer
PCA	Printed Circuit Assembly
PLL	Phase Locked Loop
ppm	Parts Per Million
PMR	Public Mobile Radio
RF	Radio Frequency
RoHS	Restriction of Hazardous Substances
RSSI	Received Signal Strength Indication
RX	Receiver
SNMP	Simple Network Management Protocol
SNR	Signal to Noise Ratio
SWR	Standing Wave Ratio
TCP/IP	Transmission Control Protocol/Internet Protocol
TCXO	Temperature Compensated Crystal Oscillator
TFTP	Trivial File Transfer Protocol
TMR	Trunk Mobile Radio
TX	Transmitter
UTP	Unshielded Twisted Pair
VAC	Volts AC
VCO	Voltage Controlled Oscillator
VDC	Volts DC
WEEE	Waste Electrical and Electronic Equipment