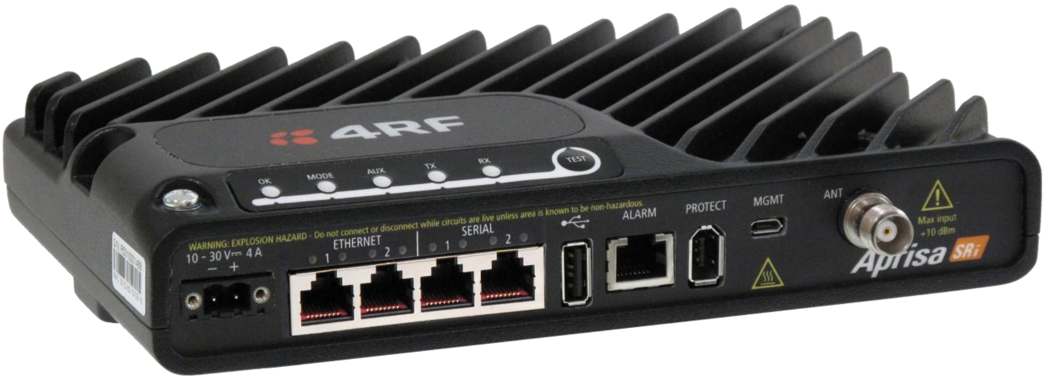
4RF

Aprisa SRi



# User Manual

August 2019

Version 1.1.0a

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## RoHS and WEEE Compliance

The Aprisa SRi is fully compliant with the European Commission's RoHS (Restriction of Certain Hazardous Substances in Electrical and Electronic Equipment) and WEEE (Waste Electrical and Electronic Equipment) environmental directives.

### Restriction of hazardous substances (RoHS)

The RoHS Directive prohibits the sale in the European Union of electronic equipment containing these hazardous substances: lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyls (PBBs), and polybrominated diphenyl ethers (PBDEs).

4RF has worked with its component suppliers to ensure compliance with the RoHS Directive which came into effect on the 1st July 2006.

### 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 instigated a 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).

4RF invites questions from customers and partners on its environmental programmes and compliance with the European Commission's Directives (sales@4RF.com).

# Compliance General

The Aprisa SRi radio predominantly operates within frequency bands that are covered under a class license or general user license which is a license is issued to ‘every person’.

Changes or modifications not approved by the party responsible for compliance could void the user’s authority to operate the equipment.

Equipment authorizations sought by 4RF are based on the Aprisa SRi radio equipment being installed at a fixed restricted access location and operated in point-to-multipoint or point-to-point mode within the environmental profile defined by EN 300 019, Class 3.4. Operation outside these criteria may invalidate the authorizations and / or license conditions.

The term ‘Radio’ with reference to the Aprisa SRi User Manual, is a generic term for one end station of a point-to-multipoint Aprisa SRi network and does not confer any rights to connect to any public network or to operate the equipment within any territory.

## Compliance United States of America FCC

The Aprisa SRi radio is designed to comply with the USA Federal Communications Commission (FCC) specifications as follows:

| | |
|---|---|
| Radio | 47CFR Part 15.247 |
| EMC | 47CFR Part 15 Subpart C Radio Frequency Devices |
| Environmental | EN 300 019, Class 3.4<br>Ingress Protection IP51 |
| Safety | EN 60950-1:2006<br>Class 1 division 2 for hazardous locations |

| **Frequency Band** | **Channel size** | **Power input** | **Authorization** | **FCC ID** |
|---|---|---|---|---|
| 902-928 MHz | 50 kHz | 10-30 VDC | Part 15.247 | UIPSI902M160 |

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

## Compliance Canada ISED

The Aprisa SRi radio is designed to comply with Innovation, Science and Economic Development (ISED) specifications as follows:

| | |
|---|---|
| Radio | RSS-247 |
| EMC | This Class A digital apparatus complies with Canadian standard RSS-Gen. |
| Environmental | EN 300 019, Class 3.4<br>Ingress Protection IP51 |
| Safety | EN 60950-1:2006<br>Class 1 division 2 for hazardous locations |

| **Frequency Band** | **Channel size** | **Power input** | **Authorization** | **ISED** |
|---|---|---|---|---|
| 902-928 MHz | 50 kHz | 10-30 VDC | RSS-247 | 6772A-SI902M160 |

This device complies with Part 15 of the FCC Rules and ISED's licence exempt RSSs. Operation is subject to the following two conditions: (1) This device may not cause interference; and (2) This device must accept any interference, including interference that may cause undesired operation of the device.

Ce dispositif est conforme à la partie 15 des règles de la Federal Communications Commission (FCC) des États Unis et d'Innovation, Sciences et Développement économique Canada (ISED) exempts de licence RSS norme(s). Son fonctionnement est assujetti aux deux conditions suivantes: (1) Ce dispositive nedoit pas provoquer de brouillage préjudiciable, et (2) il doit accepter tout brouillagereçu, y compris le brouillage pouvant entraîner unmauvais fonctionnement.

## Compliance Australia ACMA

The Aprisa SRi radio is designed to comply with Australia ACMA specifications as follows:

| | |
|---|---|
| Radio | Radio Communications (Short Range Devices) Standard 2004 |
| EMC | AS/NZS 4268 |
| Environmental | EN 300 019, Class 3.4<br>Ingress Protection IP51 |
| Safety | EN 60950-1:2006<br>Class 1 division 2 for hazardous locations |

| Frequency Band | Channel size | Power input | Authorization | ACMA |
|---|---|---|---|---|
| 915-928 MHz | 50 kHz | 10-30 VDC | ✓ | Complete |

## Compliance New Zealand RSM

The Aprisa SRi radio is designed to comply with New Zealand RSM specifications as follows:

| | |
|---|---|
| Radio / EMC | AS/NZS 4268 |
| Environmental | EN 300 019, Class 3.4<br>Ingress Protection IP51 |
| Safety | EN 60950-1:2006<br>Class 1 division 2 for hazardous locations |

| Frequency Band | Channel size | Power input | Authorization | RSM |
|---|---|---|---|---|
| 915-928 MHz | 50 kHz | 10-30 VDC | Licence 266324 | Complete |

## Compliance Brazil ANATEL

The Aprisa SRi radio is designed to comply with Brazil ANATEL specifications as follows:

| | |
|---|---|
| Radio / EMC | Resolution No. 680 |
| Environmental | EN 300 019, Class 3.4<br>Ingress Protection IP51 |
| Safety | EN 60950-1:2006<br>Class 1 division 2 for hazardous locations |

| Frequency Band | Channel size | Power input | Authorization | ANATEL |
|---|---|---|---|---|
| 902-907.5 and 915-928 MHz | 50 kHz | 10-30 VDC | | Pending |

## Compliance Mexico IFETEL

The Aprisa SRi radio is designed to comply with the Mexico IFETEL specifications as follows:

| | |
|---|---|
| Radio / EMC | NOM-208-SCFI-2016 |
| Environmental | EN 300 019, Class 3.4<br>Ingress Protection IP51 |
| Safety | EN 60950-1:2006<br>Class 1 division 2 for hazardous locations |

| **Frequency Band** | **Channel size** | **Power input** | **Authorization** | **ID** |
|---|---|---|---|---|
| 902-928 MHz | 50 kHz | 10-30 VDC | | Pending |

## Compliance Hazardous Locations Notice

This product is suitable for use in Class 1, Division 2, Groups A - D hazardous locations or non-hazardous locations. A Nationally Recognized Testing Laboratory (NRTL) listed power supply is required to power the equipment.

The following text is printed on the Aprisa SRi fascia:

WARNING: EXPLOSION HAZARD - Do not connect or disconnect while circuits are live unless area is known to be non-hazardous.

The following text is printed on the Aprisa SRi where the end user is in Canada:

AVERTISSEMENT: RISQUE D'EXPLOSION - Ne pas brancher ou débrancher tant que le circuit est sous tension, à moins qu'il ne s'agisse d'un emplacement non dangereux.

The USB service ports are not to be used unless the area is known to be non-hazardous.

## RF Exposure Warning

**WARNING:**

The installer and / or user of Aprisa SRi radios shall ensure that a separation distance as given in the following table is maintained between the main axis of the terminal's antenna and the body of the user or nearby persons.

Minimum separation distances given are based on the maximum values of the following methodologies:

1. Maximum Permissible Exposure non-occupational limit (B or general public) of 47 CFR 1.1310 and the methodology of FCC's OST/OET Bulletin number 65.
2. Reference levels as given in Annex III, European Directive on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) (1999/519/EC). These distances will ensure indirect compliance with the requirements of EN 50385:2002.

| Frequency (MHz) | Maximum Power (dBm) Note 1 | Maximum Antenna Gain (dBi) | Minimum Separation Distance (m) |
|---|---|---|---|
| 915 | + 26 | 10 dBi | 0.3 |

Note 1: The Peak Envelope Power (PEP) at maximum set power level is 1.0 W ,+30 dBm.

# Contents

# 1. Getting Started

This section is an overview of the steps required to commission an Aprisa SRi radio network in the field:

| **Phase 1:** | **Pre-installation** | |
|---|---|---|
| 1. | Confirm path planning. | Page 66 |
| 2. | Ensure that the site preparation is complete:<br>• Power requirements<br>• Tower requirements<br>• Environmental considerations, for example, temperature control<br>• Mounting space | Page 69 |

| **Phase 2:** | **Installing the radios** | |
|---|---|---|
| 1. | Mount the radio. | Page 72 |
| 2. | Connect earthing to the radio. | Page 71 |
| 3. | Confirm that the:<br>• Antenna is mounted and visually aligned<br>• Feeder cable is connected to the antenna<br>• Feeder connections are tightened to recommended level<br>• Tower earthing is complete | |
| 4. | Install lightning protection. | Page 71 |
| 5. | Connect the coaxial jumper cable between the lightning protection and the radio antenna port. | Page 76 |
| 6. | Connect the power to the radio. | Page 77 |

| Phase 3: | **Establishing the link** | |
|---|---|---|
| 1. | If radio's IP address is not the default IP address (169.254.50.10 with a subnet mask of 255.255.0.0) and you don't know the radio's IP address see 'Command Line Interface' on page 306. | Page 306 |
| 2. | Connect the Ethernet cable between the radio's Ethernet port and the PC. | |
| 3. | Confirm that the PC IP settings are correct for the Ethernet connection:<br>• IP address<br>• Subnet mask<br>• Gateway IP address | Page 83 |
| 4. | Open a web browser and login to the radio. | Page 87 |
| 5. | Set or confirm the RF characteristics:<br>• TX / RX frequency<br>• TX output power<br>• Zone / channel selection | Page 123 |
| 6. | Compare the actual RSSI to the expected RSSI value (from your path planning). | Page 283 |
| 7. | Align the antennas. | Page 315 |
| 8. | Confirm that the radio is operating correctly; the OK, MODE and AUX LEDs are green. | |

# 2. Introduction

## About This Manual

### What It Covers

This user manual describes how to install and configure an Aprisa SRi point-to-multipoint digital radio network.

It specifically documents an Aprisa SRi radio running system software version 1.1.0 .

It is recommended that you read the relevant sections of this manual before installing or operating the radios.

### Who Should Read It

This manual has been written for professional field technicians and engineers who have an appropriate level of training and experience.

### Contact Us

If you experience any difficulty installing or using the Aprisa SRi radio after reading this manual, please contact Customer Support or your local 4RF representative.

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| | |
|---|---|
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| Website | www.4rf.com |
| Telephone | +1 866 232-5647 |

# What’s in the Box

Inside the box you will find:

- One Aprisa SRi radio fitted with a power connector.
- One Aprisa SRi Accessory kit containing the following:

    Aprisa SRi Quick Start Guide
    Management Cable

## Aprisa SRi Accessory Kit

The accessory kit contains the following items:

| | |
|---|---|
| Aprisa SRi Quick Start Guide | <br>4RF<br>Aprisa SRi<br>Quick Start Guide |
| Management Cable<br>USB Cable USB A to USB micro B, 1m | |

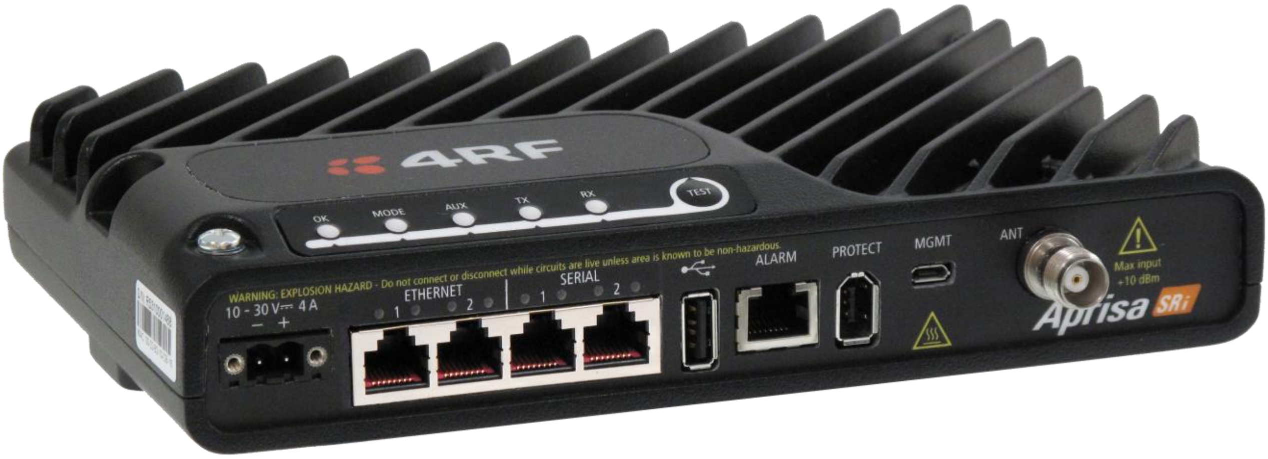
# 3. About the Radio

## The 4RF Aprisa SRi Radio

The 4RF Aprisa SRi is a Point-To-Multipoint (PMP) digital radio providing 915 MHz Industrial Licence Free Spread Spectrum communications.

The radios carry a combination of serial data and Ethernet data between the base station and remote radios.

A single Aprisa SRi is configurable as a Point-To-Multipoint base station or remote radio.


4RF
OK
MODE
AUX
TX
RX
TEST
WARNING: EXPLOSION HAZARD - Do not connect or disconnect while circuits are live unless area is known to be non-hazardous.
10 - 30 V⎓ 4 A
− +
ETHERNET
1
2
SERIAL
1
2
ALARM
PROTECT
MGMT
ANT
Max input +10 dBm
Aprisa SRi

# Product Features

## Functions

- Point-to-Multipoint (PMP) operation
- Unlicensed frequency bands in the frequency range of 902-928 MHz as permitted by the local regulator
- Channel size of 50 kHz
- Half duplex RF Point-To-Multipoint operation
- Jam resistant frequency hopping spread spectrum technology operating where other licence free radios have difficulty in break through
- Full band and reduced non-overlapping zone options allow a tailored approach to interference management for maximum range
- Ethernet data interface and RS-232 / RS-485 asynchronous
- Data encryption and authentication using 128,192 and 256 bit AES and CCM security standards
- Terminal server operation for transporting RS-232 / RS-485 traffic over IP or Ethernet and converting IP packets to a local physical serial port
- Mirrored Bits ® and SLIP support for RS-232
- IEEE 802.1Q VLAN support with single and double VLAN tagged and add/remove VLAN manipulation to adapt to the appropriate RTU / PLCs
- QoS supports using IEEE 802.1p VLAN priority bits to prioritize and handle the VLAN / traffic types
- QoS per port (Ethernet, serial, management)
- L2 / L3 / L4 filtering for security and avoiding narrow band radio network overload
- L3 Gateway Router mode with standard static IP route for simple routing network integration
- L3 Router mode with per Ethernet interface IP address and subnet
- L2 Bridge mode with VLAN aware for standard Industrial LAN integration
- Ethernet and serial payload compression to increase the narrow band radio capacity
- SuperVisor web management support for element and sub-network management
- SuperVisor Extended Network Management (EXM) extending SuperVisor management beyond the single radio network providing configuration and monitoring to other Aprisa SR family products
- SNMPv1/2/3 & encryption MIB supports for 4RF SNMP manager or third party SNMP agent network management
- SNMP context addressing for compressed SNMP access to remote radios
- SNTP for accurate wide radio network time and date
- Transparent to all common SCADA protocols; e.g. Modbus, IEC 60870-5-101/104, DNP3 or similar
- Complies with international standards, including FCC, EMC, safety and environmental standards

# Security

The Aprisa SRi provides security features to implement the key recommendations for industrial control systems. The security provided builds upon the best in class from multiple standards bodies, including:

- IEC/TR 62443 (TC65) 'Industrial Communications Networks – Network and System Security'
- IEC/TS 62351 (TC57) 'Power System Control and Associated Communications – Data and Communication Security'
- FIPS PUB 197, NIST SP 800-38C, IETF RFC3394, RFC3610 and IEEE P1711/P1689/P1685
- FIPS 140-2: Security Requirements for Cryptographic Modules

The security features implemented are:

- Data encryption

  Counter Mode Encryption (CTR) using Advanced Encryption Standard (AES) 128, 192, 256 bit, based on FIPS PUB 197 AES encryption (using Rijndael version 3.0)

- Data authentication

  NIST SP 800-38C Cipher Block Chaining Message Authentication Code (CBC-MAC) based on RFC 3610 using Advanced Encryption Standard (AES)

- Data payload security

  CCM Counter with CBC-MAC integrity (NIST special publication 800-38C)

- Secured management interface protects configuration
- L2 / L3 / L4 Address filtering enables traffic source authorization
- Proprietary physical layer protocol and modified MAC layer protocol based on standardized IEEE 802.15.4
- SNMPv3 with Encryption for NMS secure access
- Secure USB software upgrade
- Key Encryption Key (KEK) based on RFC 3394, for secure Over The Air Re-keying (OTAR) of encryption keys
- User privilege allows the accessibility control of the different radio network users and the user permissions
- RADIUS security for remote user authorization, authentication and accounting
- Secure management access using HTTPS and SNMPv3
- HTTPS certificate uses ECC 256
- Secure remote software upgrade via HTTPS

## Performance

- Typical deployment of 30 remote radios from one base station with a practical limit of a few hundred remote radios
- Low noise receiver
- Forward Error Correction
- Frequency Hopping using non-overlapping zones and channels over the frequency band
- Frequency lock < 100 us not impacting FHSS throughput
- Thermal management for high power over a wide temperature range

## Usability

- Configuration / diagnostics via front panel Management Port USB interface, Ethernet interface
- Built-in webserver SuperVisor with full configuration, diagnostics and monitoring functionality, including remote radio configuration / diagnostics over the radio link
- LED display for on-site diagnostics
- Dedicated alarm port
- Software upgrade and diagnostic reporting via the host port USB flash drive
- Over-the-air software distribution and upgrades
- Simple installation with integrated mounting holes for wall, DIN rail and rack shelf mounting

# Product Overview

## Network Coverage and Capacity

The Aprisa SRi has a typical link range of up to 50 km / 30 miles, however, geographic features, such as hills, mountains, trees and foliage, or other path obstructions, such as buildings, will limit radio coverage. Additionally, geography may reduce network capacity at the edge of the network where errors may occur and require retransmission. However, the Aprisa SRi uses 1 W (+30 dBm) peak output power and Forward Error Correction (FEC) which greatly improves the sensitivity and system gain performance of the radio resulting in less retries and minimal reduction in capacity.

Ultimately, the overall performance of any specific network will be defined by a range of factors including the RF output power, the modulation used and its related receiver sensitivity, interference from other unlicensed radios, the geographic location, the number of remote radios in the base station coverage area and the traffic profile across the network. Effective network design will distribute the total number of remote radios across the available base stations to ensure optimal geographic coverage and network capacity.

One base station can register and operate with up to 500 remote radios.

The practical limit of remote radios that can operate with one base station is determined by a range of factors including the number of services, the packet sizes, the protocols used, the message types and network timeouts.

## Automatic Registration

On start-up, the remote radio listens for the base station and tries to sync with base station frequency hopping before attempting registration. It then transmits a registration message to the base station which responds with a registration response. The base station records the details of all the remote radios active in the network.

If a remote radio cannot register with the base station after multiple attempts within 10 minutes, it will automatically reboot. If remote is not able to register with base station in 5 attempts, then a ‘Network Configuration Warning’ alarm event will be raised indicating that a remote is not registered with the base station.

If a remote radio has registered with the base station but then loses communication, it will automatically reboot within 2 minutes.

## Remote Messaging

There are two message types in the Aprisa SRi network, broadcast messages and unicast messages. Broadcast messages are transmitted by the base station to the remote radios and unicast messages are transmitted by the remote radio to the base station. These messages are commonly referred to as uplink (unicast remote to base) and downlink (broadcast base to remote).

All remotes within the coverage area will receive broadcast messages and pass them on to either the Ethernet or serial interface. The RTU determines if the message is intended for it and will accept it or discard it.

# Architecture

The Aprisa SRi Architecture is based around a layered TCP/IP protocol stack:

- Physical
  Proprietary wireless
  RS-232 and Ethernet interfaces

- Link
  Proprietary wireless (channel access, ARQ, segmentation)
  VLAN aware Ethernet bridge

- Network
  Standard IP
  Proprietary automatic radio routing table population algorithm

- Transport
  TCP, UDP

- Application
  HTTPS web management access through base station with proprietary management application software including management of remote radios over the radio link
  SNMPv1/2/3 for network management application software

## Product Operation

There are three components to the wireless interface: the Physical Layer (PHY), the Data Link Layer (DLL) and the Network Layer. These three layers are required to transport data across the wireless channel in the Point-to-Multipoint (PMP) configuration. The Aprisa SRi DLL is largely based on the 802.15.4 Media Access Control (MAC) layer using a proprietary implementation.

## Physical Layer

The Aprisa SRi PHY uses a one frequency half duplex transmission mode which eliminates the need for a duplexer.

Remote nodes are predominantly in receive mode with only sporadic bursts of transmit data. This reduces power consumption.

The Aprisa SRi is a packet based radio. Data is sent over the wireless channel in discrete packets / frames, separated in time. The PHY demodulates data within these packets with coherent detection.

The Aprisa SRi PHY provides carrier, symbol and frame synchronization predominantly through the use of preambles. This preamble prefixes all packets sent over the wireless channel which enables fast Synchronization.

# Data Link Layer / MAC layer

The Aprisa SRi PHY enables multiple users to be able to share a single wireless channel; however a DLL is required to manage data transport. The two key components to the DLL are channel access and hop by hop transmission.

## Channel Access

The Aprisa SRi radio uses frequency hopping in conjunction with a channel access of Access Request (AR) MAC to maximize the data throughput and performance. With a channel access scheme, the base station controls the communication on the channel.  Remotes ask for access to the channel, and the base station grants access if the channel is not occupied.

### Access Request

This scheme is particularly suited to digital SCADA systems where all data flows through the base station. In this case it is important that the base station has contention-free access as it is involved in every transaction.  The channel access scheme assigns the base station as the channel access arbitrator and therefore inherently it has contention-free access to the channel.  This means that there is no possibility of contention on data originating from the base station.  As all data flows to or from the base station, this significantly improves the robustness of the system.

All data messages are controlled via the AG (access grant) control message and therefore there is no possibility of contention on the actual end user data.  If a remote radio accesses the channel, the only contention risk is on the AR (access request) control message.  These control messages are designed to be as short as possible and therefore the risk of collision of these control messages is significantly reduced. Should collisions occur these are resolved using a random back off and retry mechanism.

As the base station controls all data transactions multiple applications can be effectively handled, including a mixture of polling and report by exception.

## Hop by Hop Transmission

Hop by Hop Transmission is realized in the Aprisa SRi by adding a MAC address header to the packet. For 802.15.4, there are 2 addresses, the source and destination addresses.

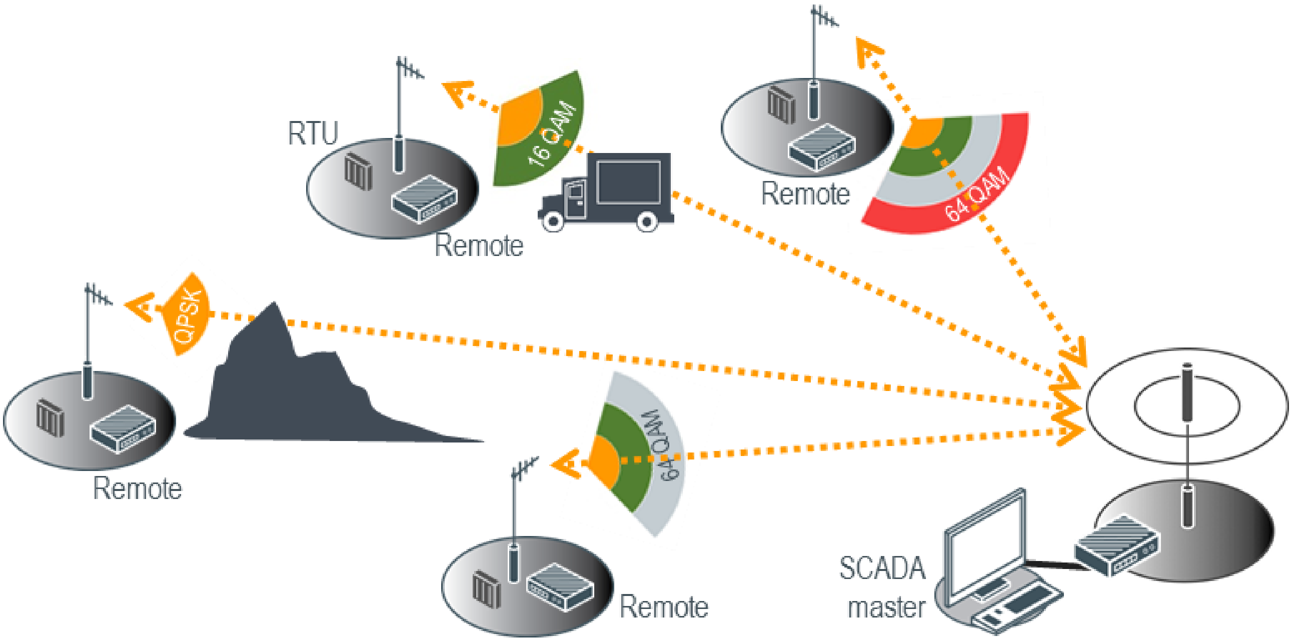
## Adaptive Coding and Modulation

The Aprisa SRi provides Adaptive Coding and Modulation (ACM) which maximizes the use of the RF path to provide the highest radio capacity available.

ACM automatically adjusts the modulation coding and FEC code rate in the remote to base direction of transmission over the defined modulation range based on the signal quality for each individual remote radio.

When the RF path is healthy (no fading), modulation coding is increased and the FEC code rate is decreased to maximize the data capacity.

If the RF path quality degrades, modulation coding is decreased and the FEC code rate is increased for maximum robustness to maintain path connectivity.



## System Gain vs Modulation

This table defines the modulation order based on gross capacity:

| Modulation | Capacity |
|---|---|
| QPSK (Low Gain) | Minimum |
| 16QAM (Low Gain) | ↓ |
| 64QAM (Low Gain) | Maximum |

This table defines the modulation order based on receiver sensitivity:

| Modulation | Coverage |
|---|---|
| QPSK (Low Gain) | Maximum |
| 16QAM (Low Gain) | ↑ |
| 64QAM (Low Gain) | Minimum |

## Zones and Channels

The Aprisa SRi supports:

| Compliance | Number Of Channels per hop zone | Number Of Standard Hop Zones (non-overlapping) | Full Band Single Zone Option |
|---|---|---|---|
| FCC / ISED | 50 | 8 | 400 |
| ACMA / RSM | 25 | 8 | 200 |
| ANATEL | 35 | 8 | 280 |

All zones are enabled by default, but the user can deactivate / active each zone / channel separately. There are exceptions e.g. FCC region, the minimum active channels must be at least 50, which enforced by the radio management.

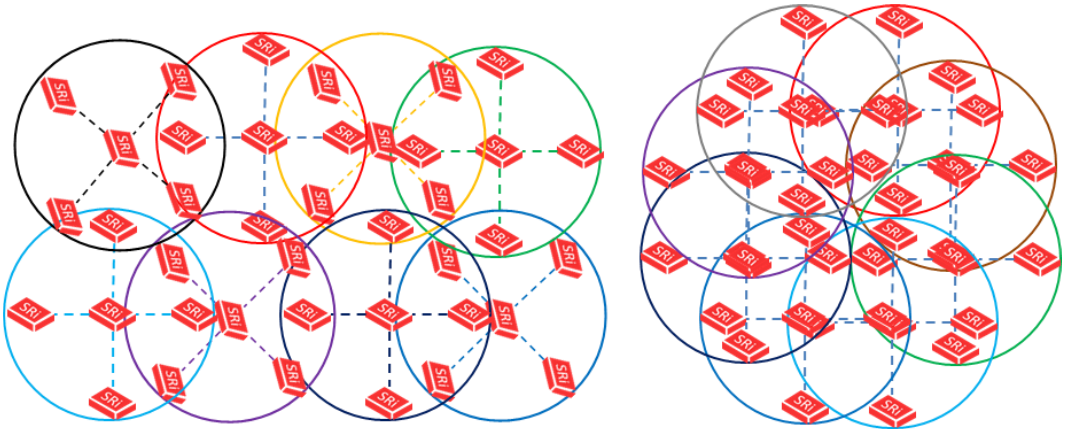
| | FCC | | | ACMA / RSM | | | ANATEL | | |
|---|---|---|---|---|---|---|---|---|---|
| | Frequencies | Channels | Guard Band | Frequencies | Channels | Guard Band | Frequencies | Channels | Guard Band |
| Channel Spacings | 62.5 | | | 62.5 | | | 56.25 | | |
| Zone 1 | 902.5313 | | 0.5 | 915.2813 | | 0.25 | 902.625 | | 0.596875 |
| | 905.5938 | 50 | | 916.7813 | 25 | | 904.5375 | 35 | |
| Zone 2 | 905.6563 | | | 916.8438 | | | 904.5938 | | |
| | 908.7188 | 50 | | 918.3438 | 25 | | 906.5063 | 35 | 0.965625 |
| Zone 3 | 908.7813 | | | 918.4063 | | | 915.6188 | | 0.590625 |
| | 911.8438 | 50 | | 919.9063 | 25 | | 917.5313 | 35 | |
| Zone 4 | 911.9063 | | | 919.9688 | | | 917.5875 | | |
| | 914.9688 | 50 | | 921.4688 | 25 | | 919.5 | 35 | |
| Zone 5 | 915.0313 | | | 921.5313 | | | 919.5563 | | |
| | 918.0938 | 50 | | 923.0313 | 25 | | 921.4688 | 35 | |
| Zone 6 | 918.1563 | | | 923.0938 | | | 921.525 | | |
| | 921.2188 | 50 | | 924.5938 | 25 | | 923.4375 | 35 | |
| Zone 7 | 921.2813 | | | 924.6563 | | | 923.4938 | | |
| | 924.3438 | 50 | | 926.1563 | 25 | | 925.4063 | 35 | |
| Zone 8 | 924.4063 | | | 926.2188 | | | 925.4625 | | |
| | 927.4688 | 50 | 0.5 | 927.7188 | 25 | 0.25 | 927.375 | 35 | 0.596875 |
| Total | | 400 | | | 200 | | | 280 | |
| Zone BW | 3.125 | | | 1.5625 | | | 1.9125 | | |

## Frequency Hopping Synchronization

The base and remote have a pre-arranged pseudo-random channel sequence to follow where pseudo-random channels and sequence pattern are determined per base station ID parameter settings. Up to 8 base stations with overlapping coverage are allowed with minimal interference (see figure below).

For better channel synchronization and performance, remotes inherit zones and black-list channels settings from the base station during registration or when user updates blacklist channels settings on the base station. The radio frequency hopping is done on all active channels (across all zones).

A remote will override its configured channels once it registers and gets updates from base station or when base station changes its channels configuration. At power-on, the Aprisa SRi base station immediately starts hopping and sending packets, ACKs and beacon control packets. When a remote is powered-on or has lost sync with the base station, it picks a random channel from its hop channel set and listens for a beacon with a default of up to 180 seconds (a good link sync on average will be < 10 sec), covering 400 channels. A remote doesn't try to register before it is synchronized with the base station. On idle, a beacon is sent by base station per hop set to keep sync and channel sequence. To avoid miss-synchronization, remote radios are constantly checking for whitelist channel mismatch and in case of a mismatch, the remote will correct the mismatch accordingly.



## Interference Avoidance / Immunity

Aprisa SRi is designed to avoid interference, mainly from other unlicensed radios and deploys a few mechanisms for better interference immunity, to increase performance and maintain robust communication.

Using frequency hopping with 8 zones and a narrower radio channel results in better power density and reduces the chance the channel will be hit with interference.

The noise floor and statistics of each zone and hop set channel is being logged and can be used to find frequencies that have constant interference mainly from other DTS radios. Using this information, the user can navigate in SuperVisor to Radio > Channels and deactivate the noisy zone / channels.

If a beacon isn't received due to frequency interference or being occupied, remotes will automatically move to the next frequency hop before sending an access request (AR). This prevents occupied channels being used with no major impact on throughput.

For reliable link in a noisy environment, remotes will buffer transmitted packets, and perform retries using ARQ mechanism. ARQ (Automatic Repeat reQuest) is a well-known data integrity mechanism used in the Aprisa SRi as it adds a layer of interference recovery on top of the powerful Aprisa FEC (Forward Error Correction). Some frequencies may be subject to more interference than others so if packet retries are enabled in the Aprisa SRi and interference on a specific frequency overwhelms the FEC, then any missing packets are automatically retransmitted on another frequency. Packet retries for uplink and downlink direction will work as follows;

In uplink direction:

Packet retries will continue until the packets TTL time expires, or packet has been re sent per 'Remote to Base Packet' parameter settings retries times (if 0 no retries will be made). Remote radios will check the next downlink ack flag in the beacon or data packet to determine if retransmission is required (if the remote 'unicast packet' is set to auto, the retries parameter is received by the remote from base during registration).

In downlink direction:

Downlink packet retries are used for unicast packets. Retries will continue until the packets TTL time expires, or packet has been re sent 'Unicast Packet' parameter settings retries times (if 0 no retries will be made). The base radio will check the next uplink ack flag from the remote radio to determine if retransmission is required.

To ensure the integrity of some broadcast packets (e.g. OTA firmware upgrade), they would automatically be sent per 'Broadcast Packet' parameter settings times.

## Two Base Stations Using the Same Antenna

Two Aprisa SRi base stations can be used with the same antenna (overlapping coverage). This can be done with the G5 tuned duplexer (see ‘Duplexer Kits’ on page 317).

The antenna will be connected to the two base stations via the duplexer. Base station 1 is configured to zones 1 and 2 and base station 2 is configured to zones 7 and 8. Remotes will be configured as per the base station they are associated with.

Note: this cannot be used with ACMA / RSM radios.

## Repeater Station

To create a back to back repeater station, two additional radios are used. One is the remote radio and the other is the base station, both connected via a G5 tuned duplexer to the same antenna i.e. similar to the two base stations using the same antenna as described above.

The remote radio configured for zones 1 and 2 while the base station radio is configured for zones 7 and 8. This requires the near end base station to also be configured for zones 1 and 2 and the far end remote radio configured for zones 7 and 8.

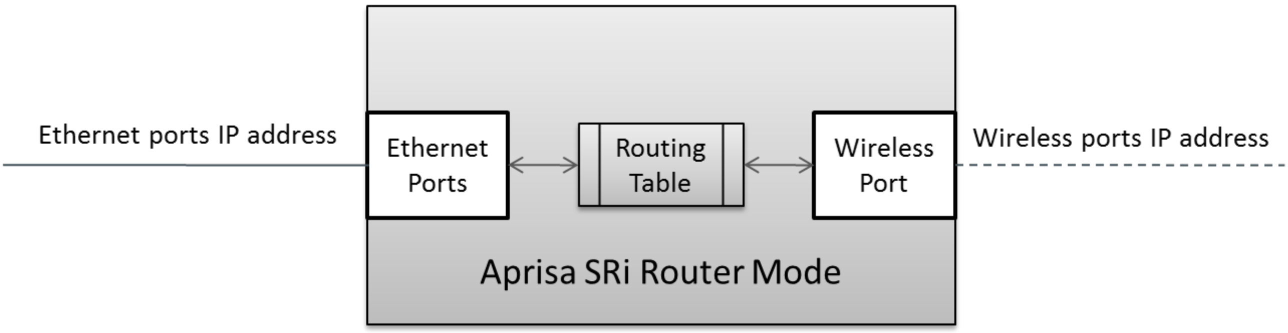
# Network Layer

## Packet Routing

Aprisa SRi is a standard static IP router which routes and forwards IP packet based on standard IP address and routing table decisions.

Aprisa SRi router mode (see figure below), enables the routing of IP packets within the Aprisa SRi wireless network and in and out to the external router / IP RTUs devices connected to the Aprisa SRi wired Ethernet ports.

Within the Aprisa SRi Router mode, each incoming Ethernet packet on the Ethernet port is stripped from its Ethernet header to reveal the IP packet and to route the IP packet based on its routing table. If the destination IP address is one of the RTUs, the packet is then forwarded to the wireless ports and broadcasted as a PMP wireless packet to all the remote radios. The appropriate remote then routes the IP packet and forwards it based on its routing table to the appropriate Ethernet port, encapsulating the appropriate next hop MAC header and forwarding it to the RTU. The RTU can then interpret and process the IP data and communication is established between the RTU and the initiating communication device.



## Static IP Router

The Aprisa SRi works in the point-to-multipoint (PMP) network as a standard static IP router with the Ethernet and wireless / radio as interfaces and serial ports using terminal server as a virtual interface.

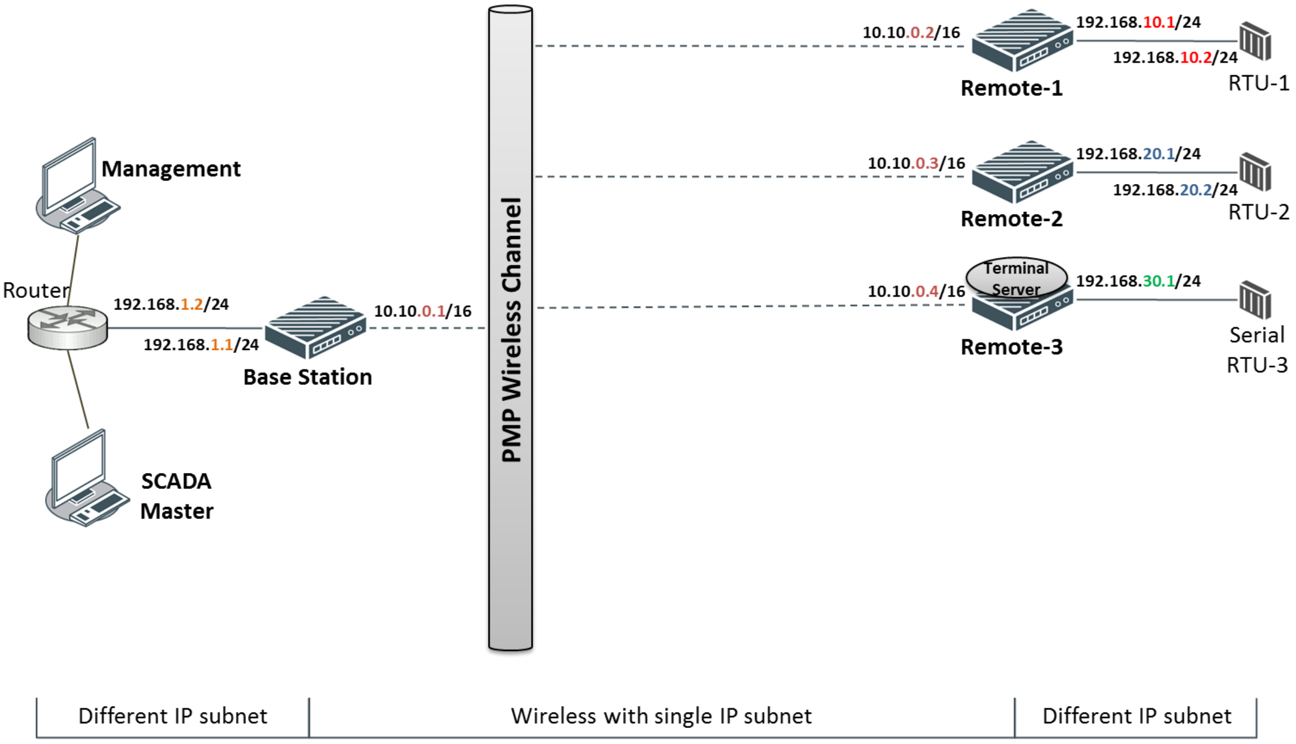
The Aprisa SRi static router is semi-automated operation, where the routing table is automatically created in the base station and populated with routes to all remote radios in the network during the registration process and vice versa, where the routing table is automatically created in remote radios and populated with routes to base station during the registration process. Updates occur when remote is disconnected from network for any reason, with the routing table updated in a controlled fashion.

Also, in decommission operation, the base station routing tables are completely flushed allowing an automatic rebuild. This avoids the user manually inserting / removing of multiple static routes to build / change the routes in the network which might be tedious and introduce significant human error. The Aprisa SRi works as a static IP router without using any routing protocol and therefore does not have the overhead of a routing protocol for better utilization of the narrow bandwidth network.

In addition to the semi-automated routes, the user can manually add / remove routes in the routing table for the radio interface, Ethernet Interface and for routers which are connected to the radio network.

The Aprisa SRi base station is used as a gateway to other networks. Thus, a configurable IP address default gateway can be set using a static route in the routing table with a destination IP address of the destination network address. It is recommended to use a real network IP address (actual device IP) for the gateway and not 0.0.0.0.

The Aprisa SRi sub-netting rules distinguish between the wireless interface and the remote Ethernet interface where RTUs are connected. The entire wireless network is set on a single IP subnet, while each Aprisa SRi remote's Ethernet interface is set to a different subnet network. In this way, the user can easily distinguish between the remote radios subnet IP addresses.



## The Radio Network as a Gateway Router

The Aprisa SRi point-to-multipoint radio network can be considered as a gateway router where the 'network Ethernet interface' on each radio in the network is the 'router port'.

The routing table for all directly attached devices to the Aprisa SRi network, at the Base or the Remote radios is automatically built, and no static routes are required to be entered for those device routes.

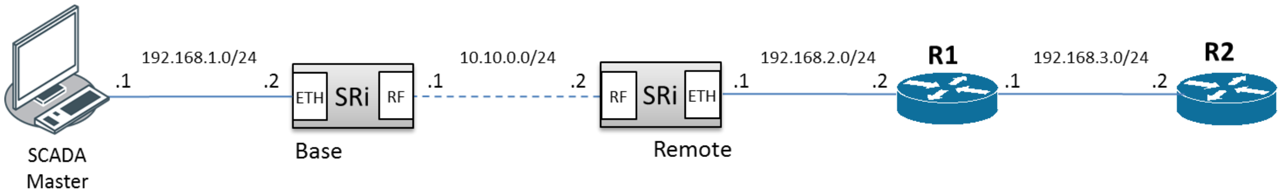
The 'Radio interface IP address' is used internally for the radio network and automatic routes. It is not used when setting static routes or default gateways.

Static route IP addresses or the default gateway should use the 'network Ethernet interface' IP address.

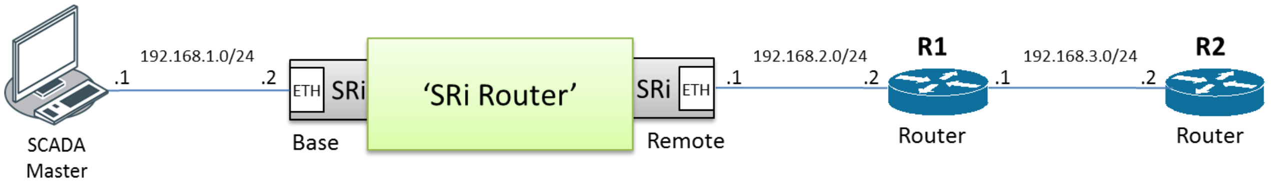
External network routers should be set with a high metric for the SRi path, to prevent route updates being sent over the radio network.

### The Radio Network as a Router – Example

The purpose of this example is to determine the static route setting for router R2 in the base station and remote radio in the following network.



Since the Aprisa SRi network should be considered as a router where the network Ethernet interface is the 'router port', the network configuration for setting the static routes or the default gateway IP addresses is described in the follow figure:



Thus, the static route setting for router R2 at the Aprisa SRi base station and remote radio will be:

| Destination Address | Destination Mask | Gateway Address | Static Route Setting at ? |
|---|---|---|---|
| 192.168.3.0 | 255.255.255.0 | 192.168.2.1 | Base station |
| 192.168.3.0 | 255.255.255.0 | 192.168.2.2 | Remote radio |

**Note:** The radio network (base station and remote radios) will automatically build routes to the attached device e.g. SCADA Master station or attached router e.g. router R1 so static routes are not required for these devices.

## Advanced Gateway Router Mode (AGRM) and Advanced Router Mode (ARM)

The Advanced Gateway Router Mode (AGRM) or Advanced Router Mode (ARM) are enabled when either Router or a Gateway Router modes are selected and the Advanced checkbox is ticked (see 'Terminal > Operating Mode' on page 110).

Advanced Gateway Router mode (AGRM) or Advanced Router mode (ARM) act like a true router between the Ethernet ports and the RF interface port where the next hop is either an Ethernet port or an RF port (in the non-advanced option the next hop is the Ethernet interface of the next hop radio and the RF interface are for internal use). This means that the RF Interface of the radio also becomes a public interface, so the user should be able to use this interface just like any other Ethernet interface.

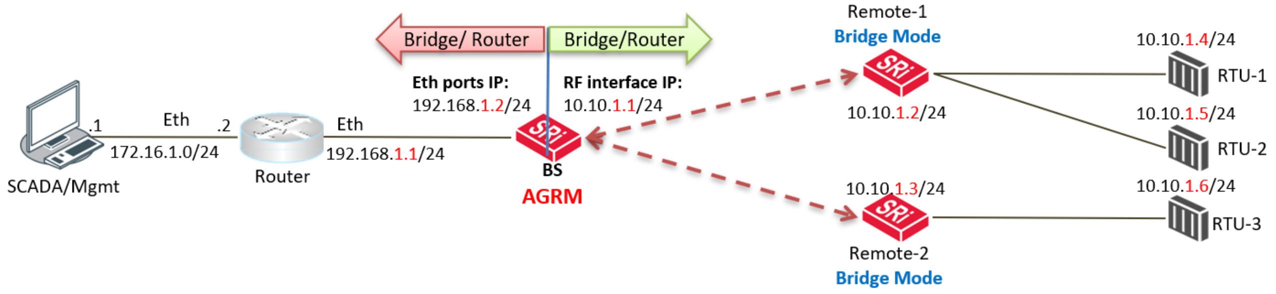
In AGRM, all Ethernet ports have the same IP address and subnet and in ARM, each Ethernet interface has a different IP address and subnet. In addition, the advanced option supports a new mix between AGRM / ARM and Bridge Mode in a radio network. The following mix of [Base Station] - [Remote] networks are supported:

- **AGRM / ARM - Bridge network** i.e. base station AGRM / ARM and remote radios in Bridge mode.
- **Bridge - AGRM / ARM network** i.e. base station in Bridge mode and remote radios are in AGRM / ARM, where each node in the network can act as independent router without depending on other nodes in the network.
- **Bridge - Mix [AGRM / ARM and Bridge] network** i.e. base station in Bridge mode and remotes are a mix of Bridge and AGRM / ARM.
- **AGRM / ARM - Mix [AGRM / ARM and Bridge] network** i.e. base station in AGRM / ARM and remotes are a mix of Bridge and AGRM / ARM.
- **AGRM / ARM - AGRM / ARM network** i.e. base station in AGRM / ARM and remote radios are also in AGRM / ARM.

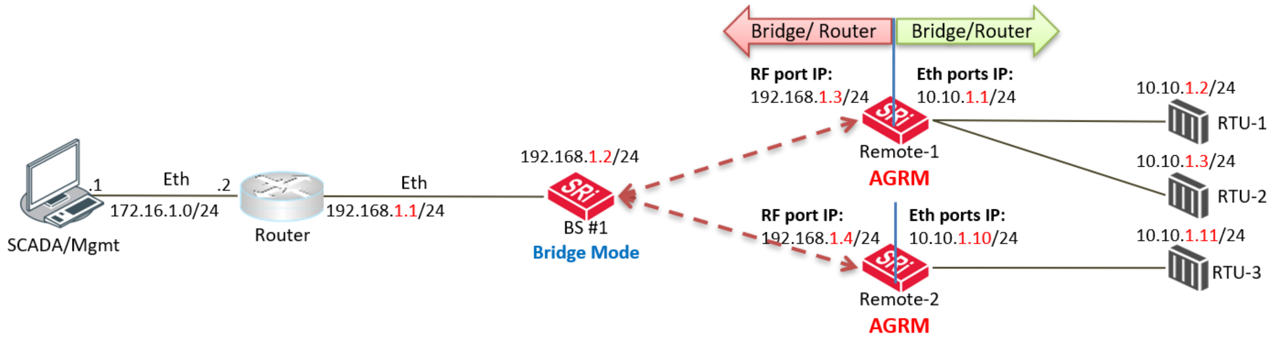
The last option is a fully routed network where it is recommended to use the standard router modes to benefit from the radio port auto IP assignment and auto static route build for all associated devices connected to the radio network.

**Note:** A mix between advanced router modes and standard router modes in the network is prohibited and will raise a 'network configuration warning' alarm. If a user wants to build a full routed network, use the standard router modes for the base station, remote radios.

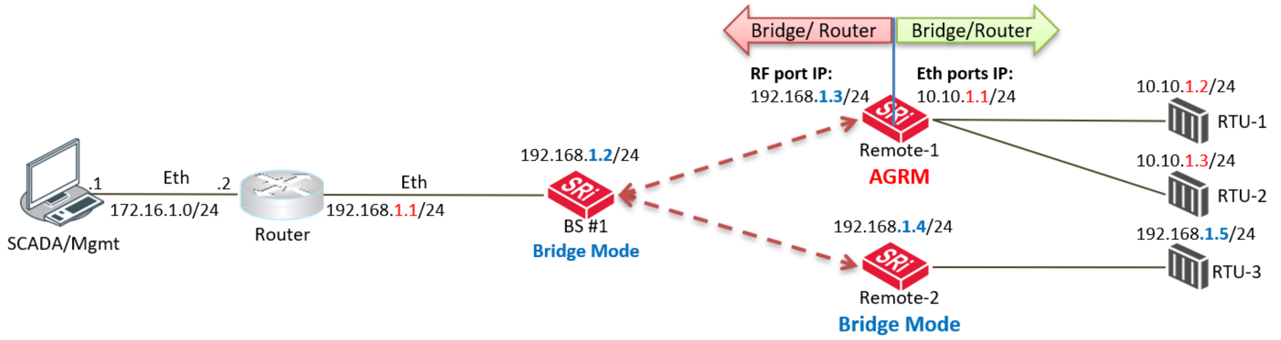
The following figures are examples of the currently supported networks as described above.



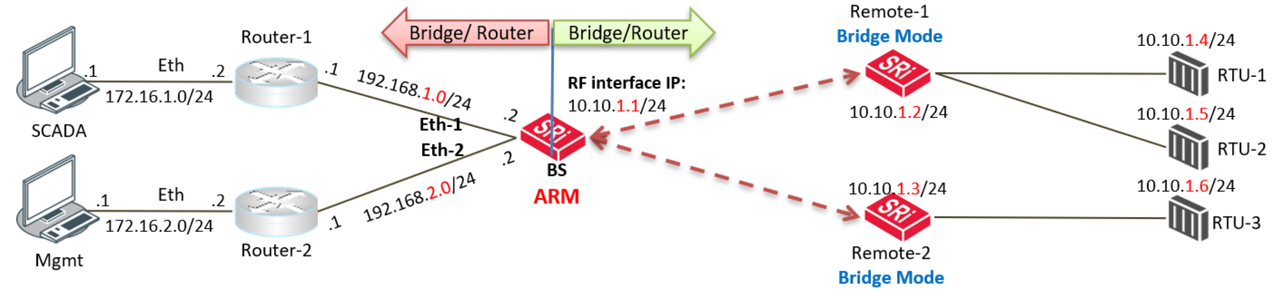
The above figure describes a mixed radio mode network (AGRM-Bridge) where base station is in Advanced Gateway Router Mode (AGRM) and the remote radios are in bridge mode (where the base station is AGRM / ARM and all remotes must be in the same bridge mode). RTUs must set their default gateway to 10.10.1.1 which is RF IP Address of base station to reach the SCADA master.



The above figure describes a mixed radio mode network (Bridge-AGRM) where the base station is in Bridge Mode and remote radios are in AGRM. To reach RTU-3 (10.10.1.11), the external router must use a next hop gateway of 192.168.1.4 which is RF Interface address of Remote-2.



The above figure describes a mixed radio mode network (Bridge-Mix [AGRM and Bridge]) where the base station is in Bridge Mode and remote radios are a mix of AGRM and Bridge mode. To reach RTU-2 (10.10.1.3), the external router must use a next hop gateway of 192.168.1.3 which is RF Interface address of Remote-1. To reach RTU-3 (192.168.1.5), the external router can send the traffic directly on the bridge subnet 192.168.1.x/24 network.



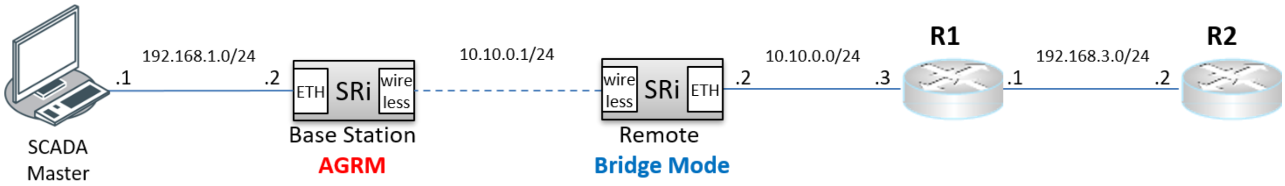
The above figure describes a mixed radio mode network (ARM-Bridge) where base station is in Advanced Router Mode (ARM) and remote radios are in bridge mode. It's the same case as the AGRM-Bridge network above, but each Ethernet interface has a different IP address and subnet at the ARM base station.

The following functions supported in AGRM / ARM is the differences between Advanced Router Mode options (AGRM / ARM) and standard Router Mode options Gateway Router Mode (GRM) / Router Mode (RM), such as AGRM vs GRM and/or ARM vs RM:

- The radio interface IP Address (RF IP Address) is associated with Ethernet MAC Address so it can be addressed like any other Ethernet Interface. The radio interface IP address will ARP respond to ARP request with his MAC address.
- The radio interface IP address can be used for radio management functions such as SNMP, ICMP and SNTP.
- External routers can use radio interface IP address as next hop / default gateway.
- The radio Interface IP address can be used as the ‘Local IP Address’ in terminal server.
- Auto assignment of radio interface IP address is done in a routed network of Router Mode (RM) and Gateway Router Mode (GRM) but not in AGRM / ARM. In AGRM / ARM the radio interface IP address is manually configured.
- Changes to the radio Interface IP address will be included in the remote registration or re-registration with base station, respectively.
- AGRM / ARM allows a mix with Bridge mode, so a AGRM / ARM-Bridge or Bridge-AGRM / ARM or a Bridge-Mix [AGRM / ARM and Bridge] network can be created. A network configuration warning alarm will be raised on base station if this condition is not met.
- The ARP table will report a radio interface IP address if any address is learned on this interface.

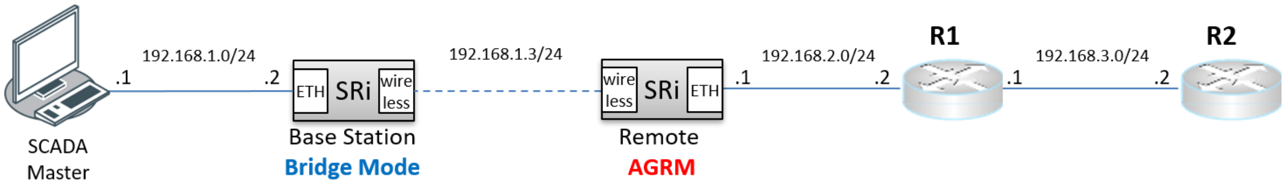
## Advanced Gateway Router (AGRM) or Advanced Router Mode (ARM) Static Route – Example

The purpose of this example is to determine the static route setting for router R2 in the base station and remote radio in the following AGRM-Bridge, Bridge-AGRM networks.



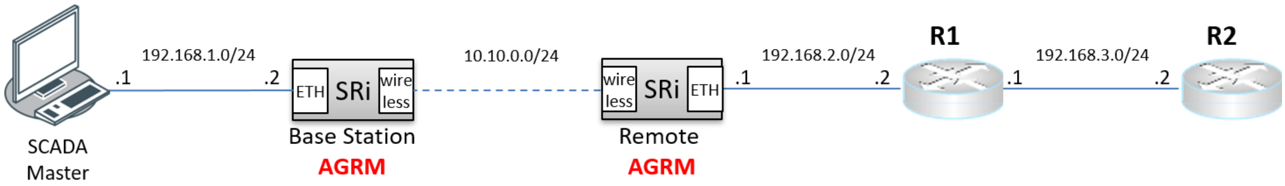
In the above figure, the static route setting for router R2 at the base radio AGRM will be:

| Destination Address | Destination Mask | Gateway Address |
|---|---|---|
| 192.168.3.0 | 255.255.255.0 | 10.10.0.3 |



In the above figure, the static route setting for router R2 at the remote radio AGRM will be:

| Destination Address | Destination Mask | Gateway Address |
|---|---|---|
| 192.168.3.0 | 255.255.255.0 | 192.168.2.2 |



In the above figure, the static route setting for router R2 at the Base Station AGRM will be:

| Destination Address | Destination Mask | Gateway Address |
|---|---|---|
| 192.168.3.0 | 255.255.255.0 | 10.10.0.2 |

**Note:** In AGRM / ARM - AGRM / ARM network scenario, automatic route build of the radio network is currently not supported. Auto route build for the associated devices to the radio network (i.e. next hop devices) is only supported in the standard router modes where the base station, and remote radios are all in standard router modes.

## Static IP Router – Human Error Free

To ensure correct operation, the Aprisa SRi router base station alerts when one (or more) of the devices is not configured for router mode or a duplicated IP is detected when manually added.

When the user changes the base station IP address / subnet, the base station sends an ARP unsolicited announcement message and the remote radios auto-update their routing table accordingly. This also allows the router that is connected to the base station to update its next hop IP address and its routing table.

When the user changes the remote radio IP address / subnet, a re-registration process in the base station then auto-updates its routing table accordingly.

## Terminal Server - Transition to Converged Ethernet / IP Network

Customers that are transitioning their SCADA network to an Ethernet / IP SCADA network, can simultaneously operate their legacy serial RTUs, not as a separate serial network to the new Ethernet / IP network, but as part of the Ethernet / IP network, by using the terminal server feature.

The Aprisa SRi terminal server is an application running in the radio that encapsulates serial traffic into Ethernet / IP traffic. For SCADA networks, this enables the use of both serial and Ethernet / IP RTUs within an Ethernet / IP based SCADA network.

## Network Address Translation (NAT) Router

The NAT functions are only available in Advanced Gateway Router Mode (AGRM) or Advanced Router Mode (ARM). Configuring NAT on the standard router modes will raise a ‘configuration not supported’ alarm.

The current implementation of One-to-One NAT and Port Forwarding NAPT supports network configurations of AGRM / ARM mode, such as AGRM / ARM – Bridge (or mix of Bridge and AGRM / ARM), Bridge - AGRM / ARM, Bridge - Mix [AGRM / ARM and Bridge] and AGRM / ARM – AGRM / ARM networks (where in AGRM / ARM – AGRM /ARM network, either base station or remote radios can be NAT enabled, not both). It is recommended reading the section about AGRM / ARM above before reading this section. The NAT is enabled in IP > NAT’ on page 169.

Network Address Translation (NAT) is a method of remapping external (public) IP addresses into other local/internal (private) IP addresses and vice versa; providing transparent routing to end users/hosts via the AGRM / ARM router.

In One-to-One NAT, IP addresses in the IP address space are mapped (translated) from external / public interface IP address into other local / private interface IP address space (and vice-versa) via the AGRM / ARM router, where One-to-One IP addresses are translated (including recalculating affected fields of the header, like IP header checksum or higher-level checksum).

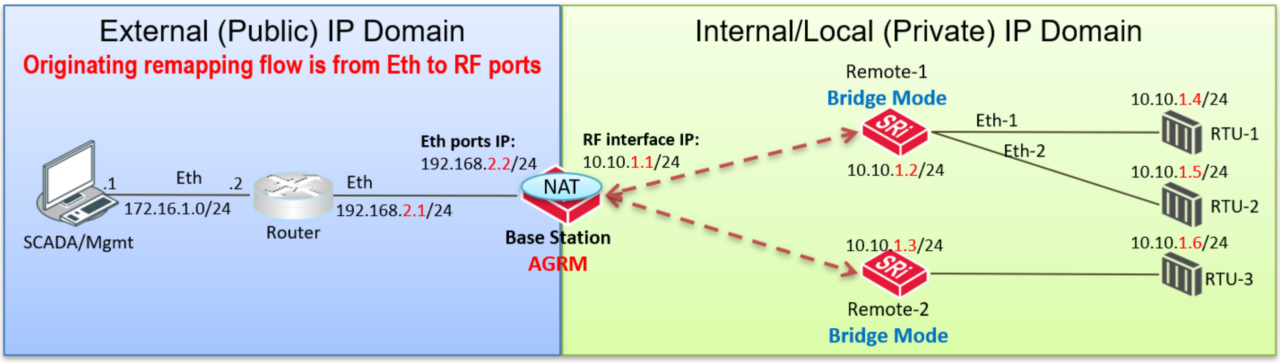
The advantage of NAT is to allow preservation of the multiple local (private) IP addresses, even if the external (public) IP addresses change. Another advantage is the security function of NAT where private / internal IP addresses are ‘hidden’ from the external / public IP domain behind the NAT. Also, private / internal IP addresses can be reused in different NAT routers in the radio network.

In order to easily explain the NAT function, the following terminology is used:

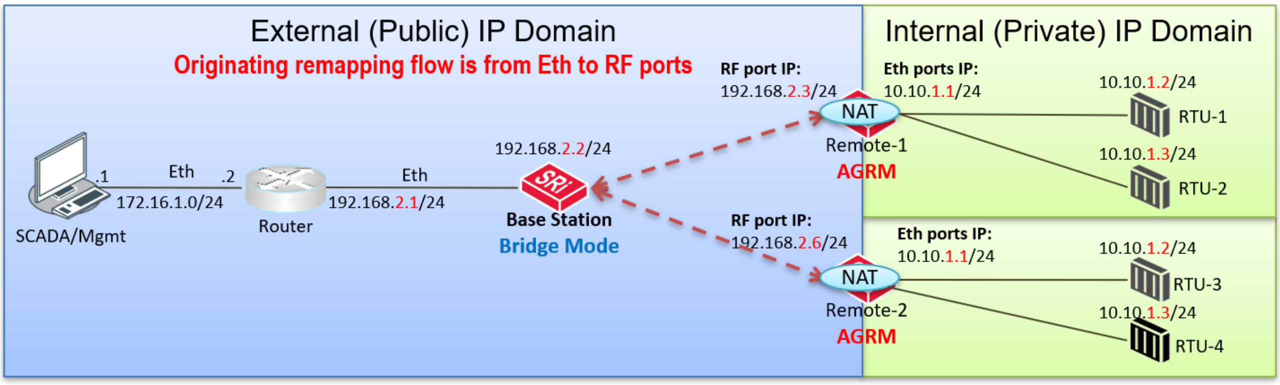
- **Session** – an IP / TCP / UDP service (identified by IP address and/or TCP / UDP port (or ICMP query ID))
- **Public (external) / Private (internal / local) IP domain** – the public / external and private / local IP network domains is used to define the NAT gating function and the inbound and outbound session NAT translation process based on NAT Address Map Table (AMP). The external / local notations used for IP address and TCP / UDP ports are as follow:
  - **Eth: eIP:ePort** – represents the external domain Ethernet port, IP address and TCP/UDP port.
  - **Eth: iIP:iPort** – represents the internal/local domain Ethernet port, IP address and TCP/UDP port.
- **Inbound / Outbound** – session originating from external to local network domain will be considered as inbound session. Session originating from internal / local to external network domain will be considered as outbound traffic. Outbound session only may for example represent report by exception. Inbound and Outbound session may for example represent poll / response.

### Public (External) and Private (Internal/Local) IP Domains

The following figure describes the Public (external) and Private (internal/local) IP domains in AGRM / ARM-Bridge network. The NAT IP domains splits at the NAT function enabled device, the AGRM base station.



The following figure describes the Public (external) / Private (internal) IP domains in Bridge-AGRM / ARM network. The NAT IP domains splits at the NAT function enabled device, the AGRM remote radios.



### One-to-One NAT Description

One-to-One NAT method is based on the remapping of external / public IP address space (e.g. radio IP space) into another internal / private IP space (e.g. RTUs IP space) and vice versa, by modifying the IP address. UDP / TCP ports will preserve their source / destination port numbers. NAT IP address translation function is performed before routing for inbound packets and after routing for outbound packets. NAT can translate and handle TCP, UDP, ICMP query, IP fragments and FTP packet types.

One-to-One NAT is translating inbound session packets per public interface and based on NAT Address Map Table (Address Map Table), supporting max 20 entries. Outbound session packets are translated based on the reverse table of Address Map Table. The user can configure the public port and Address Map Table in 'IP > NAT' page. NAT is translating inbound packets (IP address) originating in public network domain and destined for devices in private network domain. Outbound NAT translation refers to packets originated in private network and destined for devices in public network. Inbound or outbound packets will be dropped if it does not match any translation criteria defined for the appropriate public interface and Address Map Table configuration.

Monitoring the NAT translation sessions is available in 'Monitoring > NAT' with max 250 entries in NAT session table. Entries with a max idle time will be aged in favor of a new entry if the limit is reached. Entries are automatically removed after a period of inactivity as configured at 'IP > NAT > Settings TAB' in 'Session Idle Timeout'. NAT packet statistics of inbound and outbound sessions are also reported in the NAT session table per session basis.

NAT alarms are supported for any invalid configuration settings, including improper translation entries, invalid timeout, along with any incompatibilities with other feature settings will cause a ‘configuration not supported’ alarm.

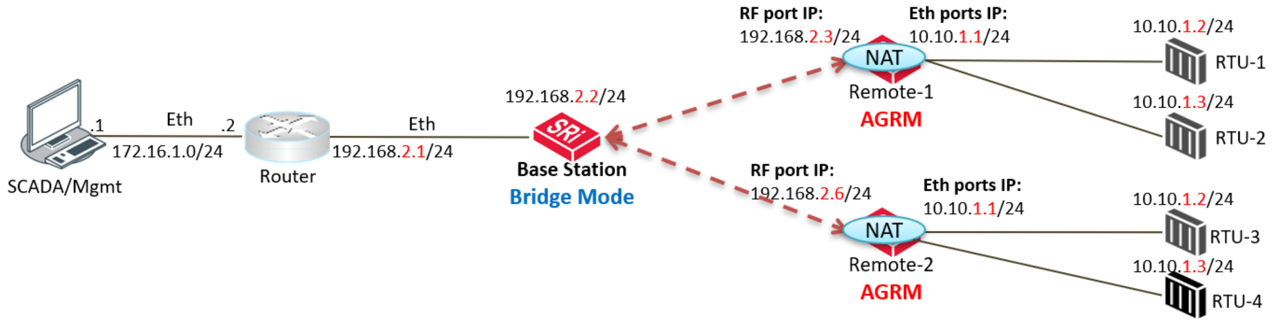
As shown in the figure of Bridge-AGRM network above, IP addresses used in one NAT internal domain can be reused by any other NAT internal domain. In the example figure above, RTUs connected to AGRM remote-1 and remote-2 reusing the same IP addresses space i.e. in this case all RTUs can have the same IP addresses space per remote radio.

NAT router radio will respond to inbound ARP requests for IP addresses in public range as define in Address Map Table with the MAC address of the public interface. Outbound ARP request for private IP range will ARP respond with MAC address of the NAT radio private/local interface.

In a protected station, all NAT configurations are shared between both the active and standby radios. The standby radio will not perform any NAT translation and routing. After a protection switch-over, NAT session table will be aged. For smooth protection switching and continuous traffic flow, the protected station automatically supports MAC address cloning for both active and standby radios NAT public interface (the cloned MAC address is presented in ‘RF Mac Address’ field (see ‘Maintenance > Advanced’ on page 243).

### One-to-One NAT Operation

The following figure describes an example of a radio network with One-to-One NAT configured at remotes in AGRM mode including the user configuration of NAT Address Map Table and expected session table (a detailed in / outbound session is shown for clarity of explanation, where NAT session table in SuperVisor will show a session in one line which will include inbound / outbound transactions, session duration, statistics, etc).



| NAT Address Map Table - [Remote-1, Public Interface: RF Port] | | | | | |
|---|---|---|---|---|---|
| Order | Match To… | | | Translate To… | Active |
| | Public Dest IP Address Start | Public Dest IP Address End | Protocol | Private Dest IP Address Start | |
| 1 | 192.168.2.4 | 192.168.2.5 | Any | 10.10.1.2 | ✓ |

| NAT Address Map Table - [Remote-2, Public Interface: RF Port ] | | | | | |
|---|---|---|---|---|---|
| Order | Match To… | | | Translate To… | Active |
| | Public Dest IP Address Start | Public Dest IP Address End | Protocol | Private Dest IP Address Start | |
| 1 | 192.168.2.7 | 192.168.2.8 | Any | 10.10.1.2 | ✓ |

| NAT Session Table - [Remote-1] | | | | | | | |
|---|---|---|---|---|---|---|---|
| ID | In/Out bound | Public IP Src Addr | Public IP Dest Addr | Protocol | Private IP Src Addr | Private IP Dest Addr | Comments |
| 1 | In | 172.16.1.1 | 192.168.2.3 | Any | N/A | N/A | Management > Remote1 |
| 2 | In | 172.16.1.1 | 192.168.2.4 | Any | 172.16.1.1 | 10.10.1.2 | SCADA Master > RTU-1 |
| 3 | Out | 192.168.2.4 | 172.16.1.1 | Any | 10.10.1.2 | 172.16.1.1 | RTU-1 > SCADA Master |
| 4 | In | 172.16.1.1 | 192.168.2.5 | Any | 172.16.1.1 | 10.10.1.3 | SCADA Master > RTU-2 |
| 5 | Out | 192.168.2.5 | 172.16.1.1 | Any | 10.10.1.3 | 172.16.1.1 | RTU-2 > SCADA Master |

The configured NAT Address Map Table of remote-1 shows that NAT will translate public interface RF port IP address range 192.168.2.4 - 5 to private IP address range 10.10.1.2 – 3. NAT Address Map Table of remote-2 shows reuse of the same private IP address range where NAT will translate public IP address range 192.168.2.7 - 8 to private IP address range 10.10.1.2 – 3.

The NAT session table of remote-1 session ID #1 shows that the public interface RF port address can’t be used in the NAT function or in NAT Address Map Table configuration as it is reserved for the radio access (e.g. management access, etc). This line is just for explanation purposes as in SuperVisor it will not be shown in NAT session table since no NAT translation is made as it’s not part of the Address Map Table configuration table.

Session ID #2 and #3 shows the inbound and outbound session translation when the SCADA master accesses RTU-1 and vice versa. From the SCADA master perspective, RTU-1 public address is 192.168.2.4 (as it doesn’t know the real address 10.10.1.2 of RTU-1 which is ‘hidden’ behind the NAT). As explained above, SuperVisor will not show session ID #2 and #3 in one line as these inbound / outbound transactions are considered as one session.

NAT translates the inbound session public RF port destination IP 192.168.2.4 to 10.10.1.2 on Eth port, the real private IP destination of RTU-1. The source address of SCADA master 172.16.1.1 remains unchanged during the inbound NAT translation as shown in session ID#2.

Outbound session #3 shows the response of RTU-1 to SCADA master and NAT translation of Eth port private source address 10.10.1.2 to 192.168.2.4 on RF port public source address. The destination address of SCADA master 172.16.1.1 remains unchanged during the outbound NAT translation.

## Port Forwarding NAT (NAPT) Description

Port Forwarding NAT method is based on the remapping (translating) of an external / public TCP/UDP port of a single public IP addresses (e.g. BS radio Eth port-1 IP address) into multiple internal / private IP space (e.g. remote and RTUs IP address space) and vice versa, by translating public TCP/UDP ports space to the private IP space. The NAT translation function is performed before routing for inbound packets and after routing for outbound packets. NAT can translate and handle TCP, UDP, ICMP query, IP fragments and FTP packet types.

Port Forwarding NAT translates inbound session packets per public interface based on the NAT Address Map Table supporting max 20 entries. Outbound session packets are translated based on the reverse of the Address Map Table based on dynamic table entries created whenever a session is not configured in the Address Map Table (no dynamic session is allowed on inbound session). The user can configure the public port and Address Map Table in 'IP > NAT' page. NAT translates inbound packets (IP address) originating in public network domain and destined for devices in private network domain. Outbound NAT translation refers to packets originating in a private network and destined for devices in a public network. Inbound packets will be dropped if they don't match any translation criteria defined for the appropriate public interface and Address Map Table configuration.

Monitoring the NAT translation sessions is available in 'Monitoring > NAT' with max 250 entries in NAT session table. Entries with a max idle time will be aged in favour of a new entry if the limit is reached. Entries are automatically removed after a period of inactivity as configured at 'IP > NAT > Settings TAB' in 'Session Idle Timeout'. NAT packet statistics of inbound and outbound sessions are also reported in the NAT session table on a per session basis.

NAT alarms are supported for any invalid configuration settings, including improper translation entries, invalid timeout, along with any incompatibilities with other feature settings which will cause a 'configuration not supported' alarm.

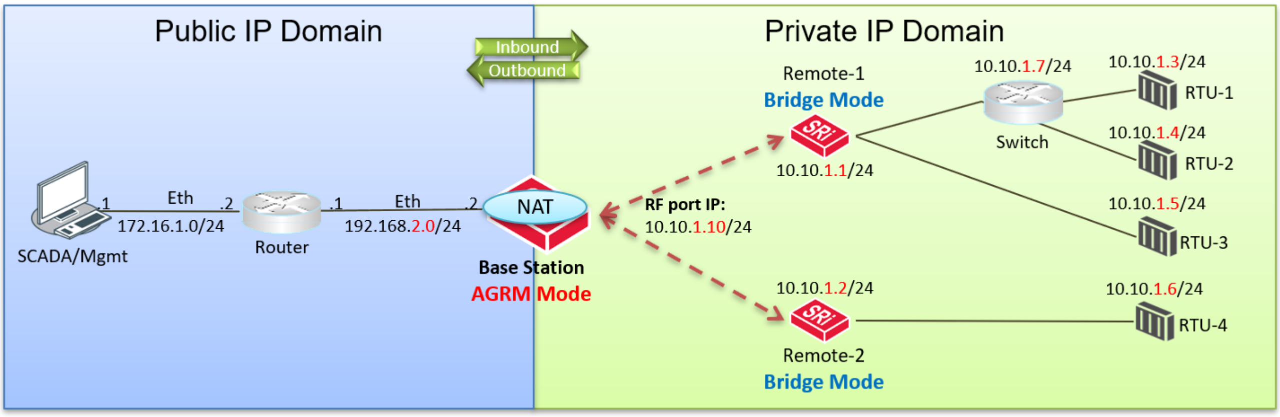
IP addresses used in one NAT internal domain can be reused by any other NAT internal domain.

A NAT router radio will respond to inbound ARP requests for IP addresses in public range as defined in the Address Map Table with the MAC address of the public interface. An outbound ARP request for a private IP range will respond with the MAC address of the NAT radio private/local interface.

In a protected station, all NAT configurations are shared between both the active and standby radios. The standby radio will not perform any NAT translation and routing. After a protection switch-over, the NAT session table will be aged. For smooth protection switching and continuous traffic flow, the public interface MAC address will be used.

## Port Forwarding NAT (NAPT) Operation

The following figure describes an example of Port Forwarding used for security, hiding the private IP address from the public interface network and it can be used to preserve private IP address even if public IP network subnet might change, reducing operational risk and expense. In this example, Port Forwarding NAT is configured at the Base Station in AGRM mode including the user configuration of NAT Address Map Table and expected session table (a detailed in / outbound session is shown for clarity of explanation, where NAT session table in SuperVisor will show a session in one line which will include inbound / outbound transactions, session duration, statistics, etc).



| NAT Address Map Table - [Base Station, Public Interface: Eth-1] | | | | | | | |
|---|---|---|---|---|---|---|---|
| Order ID | Match To… | | | | Translate To… | | Active |
| | Public Dest IP Address Start | Public Dest Port Start | Public Dest Port End | Protocol | Private Dest IP Address Start | Private Dest Port | |
| 1 | 192.168.2.2 | 8081 | 8087 | Any | 10.10.1.1 | 80 | ✓ |
| 2 | 192.168.2.2 | 10003 | 10006 | Any | 10.10.1.3 | 502 | ✓ |
| 3 | 192.168.2.2 | 101 | 107 | ICMP | 10.10.1.1 | 200 | ✓ |

| NAT Session Table - [Base Station, Eth-1] | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ID | In Out bound | Public IP Src Addr | Public IP Dest Addr | Public Src Port | Public Dst Port | Protocol | Private IP Src Addr | Private IP Dest Addr | Private Src Port | Private Dst Port | Comments |
| 1 | In | 172.16.1.1 | 192.168.2.2 | PPP | 80 | Any | N/A | N/A | N/A | N/A | Management > Base |
| 2 | In | 172.16.1.1 | 192.168.2.2 | XYZ | 8081 | Any | 172.16.1.1 | 10.10.1.1 | XYZ | 80 | Management > Remote-1 |
| 3 | Out | 192.168.2.2 | 172.16.1.1 | 8081 | XYZ | Any | 10.10.1.1 | 172.16.1.1 | 80 | XYZ | Remote-1 > Management |
| 4 | In | 172.16.1.1 | 192.168.2.2 | XXX | 10003 | Any | 172.16.1.1 | 10.10.1.3 | XXX | 502 | SCADA > RTU-1 (Modbus) |
| 5 | Out | 192.168.2.2 | 172.16.1.1 | 10003 | XXX | Any | 10.10.1.3 | 172.16.1.1 | 502 | XXX | RTU-1 (Modbus) > SCADA |
| 6 | In | 172.16.1.1 | 192.168.2.2 | FFF | 20000 | Any | N/A | N/A | N/A | N/A | To Base CPU (and drop) |
| 7 | Out | 192.168.2.2 | 172.16.1.1 | 10003 | RRR | Any | 10.10.1.3 | 172.16.1.1 | 502 | RRR | RBE RTU-1 > SCADA |
| 8 | Out | 192.168.2.2 | 172.16.1.1 | NNN | 23 | Any | 10.10.1.3 | 172.16.1.1 | ZZZ | 23 | RTU-1 (Telnet) > SCADA |
| 9 | In | 172.16.1.1 | 192.168.2.2 | 23 | NNN | Any | 172.16.1.1 | 10.10.1.3 | 23 | ZZZ | To Base CPU (and drop) |
| 10 | In | 172.16.1.1 | 192.168.2.2 | N/A | 102 | ICMP | 172.16.1.1 | 10.10.1.1 | N/A | 200 | Ping (Req.) > Remote-2 |
| 11 | Out | 192.168.2.2 | 172.16.1.1 | 102 | N/A | ICMP | 10.10.1.1 | 172.16.1.1 | 200 | N/A | Remote-2 > Ping (Resp.) |

The configured NAT Address Map Table of the Base Station shows that Port Forwarding NAT will translate;

NAT Address Map Table Line 1 configuration will translate public interface Eth-1 IP address 192.168.2.2 port range 8081 - 8087 to private IP address range 10.10.1.1 – 7 and port 80.

NAT Address Map Table Line 2 configuration will translate public IP address 192.168.2.2 port range 10,003 – 10,006 to private IP address range 10.10.1.3 – 6 and port 502 (Modbus).

NAT Address Map Table Line 3 configuration will translate ping messages public IP address 192.168.2.2 ping query ID 101 – 107 to private IP address range 10.10.1.1 – 7 and ping query ID 200.

The NAT session table of Base Station session ID #1 shows that the public interface Eth-1 IP address and TCP/UDP port 80 can't be used in the NAT function or in NAT Address Map Table configuration as it is reserved for the radio access (e.g. management access, etc). This line is just for explanation purposes as in SuperVisor it will not be shown in NAT session table since no NAT translation is made and it's not part of the Address Map Table configuration table.

Session ID #2 and #3 shows the inbound and outbound session translation when the Management accesses remote-1 using HTTP (port 80) and vice versa. From the Management perspective, remote-1 public address is 192.168.2.2 and port 8081 (as it doesn't know the real address 10.10.1.1 which is 'hidden' behind the NAT). As explained above, SuperVisor will not show session ID #2 and #3 in separate lines as these inbound / outbound transactions are considered as one session.

Session ID #4 and #5, are the same as sessions ID #2 and #3 and supported by NAT Address Map Table configuration ID #2.

Session ID #6 shows that an inbound session will drop packets if the session configuration is not supported in the NAT Address Map Table, or there is no outbound session initiated that can support a response of an inbound session (even if not in Address Map Table).

Session ID #7 and #8 are session initiated outbound sessions like RTU-1 RBE (Report by Exception) and Telnet session initiated from RTU-1, respectively. Initiated outbound sessions will be either translated per reverse Address Map Table configuration and if no configuration rule exists, then it will be built dynamically by the NAT function to later support a response from inbound session. Inbound session ID #9 is an example of a response to initiated outbound session ID #8, which is a dynamically created NAT translation table/session.

Session ID #10 and #11, are the same as sessions ID #2 and #3 and supported by NAT Address Map Table configuration ID #3, but this rule is set for ICMP ping. Instead of TCP/UDP port, NAT uses the ping query ID for translation. To run a ping across port forwarding NAT, user can use the hrPing.exe utility (run as admin) that can control the ping query ID value. Standard Windows ping command doesn't have the capability to control the ping query ID value.

## Bridge Mode with VLAN Aware

### Ethernet VLAN Bridge / Switch Overview

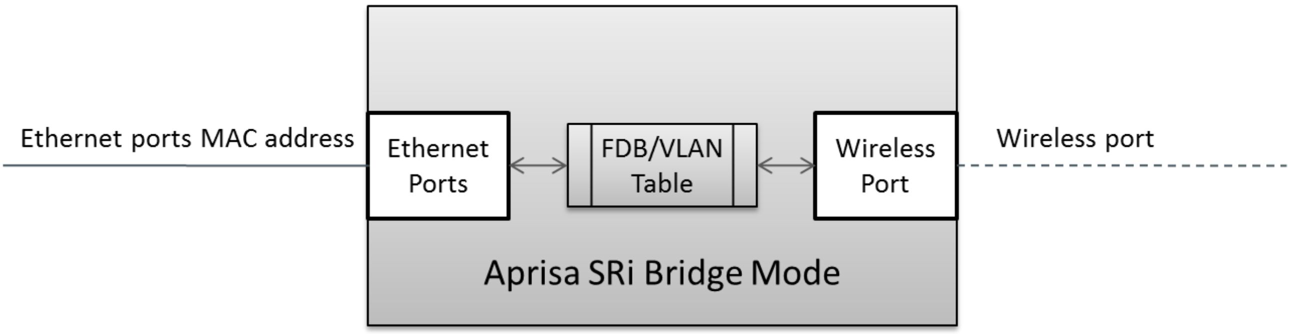
The Aprisa SRi in Bridge mode of operation is a standard Ethernet Bridge based on IEEE 802.1d or VLAN Bridge based on IEEE 802.1q/p which forward / switch Ethernet packet based on standard MAC addresses and VLANs using FDB (forwarding database) table decisions. VLAN is short for Virtual LAN and is a virtual separate network, within its own broadcast domain, but across the same physical network.

VLANs offer several important benefits such as improved network performance, increased security and simplified network management.

The Aprisa SRi Bridge mode (see figure below), is the default mode of operation and it enables the switching / bridging of Ethernet VLAN tagged or untagged packets within the Aprisa SRi wireless network and in and out to the external Industrial LAN network and RTUs devices connected to the Aprisa SRi wired Ethernet ports or serial ports through the terminal server function.

Within the Aprisa SRi Bridge mode, each incoming Ethernet packet is inspected for the destination MAC address (and VLAN) and looks up its FDB table for information on where to send the specific Ethernet frame. If the FDB table doesn't contain the specific MAC address, it will flood the Ethernet frame out to all ports in the broadcast domain and when using VLAN, the broadcast domain is narrowed to the specific VLAN used in the packet (i.e. broadcast will be done only to the ports which configured with that specific VLAN).

The FDB table is used to store the MAC addresses that have been learnt and the ports associated with that MAC address. If the destination MAC address is one of the RTUs, the packet is then forwarded to the wireless ports and broadcast as a PMP wireless packet to all the remote radios. The appropriate remote then switches the Ethernet packet and forwards it based on its FDB table (based on the MAC or VLAN & MAC) to the appropriate Ethernet port to the RTU. The RTU can then interpret and process the Ethernet / IP data and communication is established between the RTU and the initiating communication device.



# VLAN Bridge Mode Description

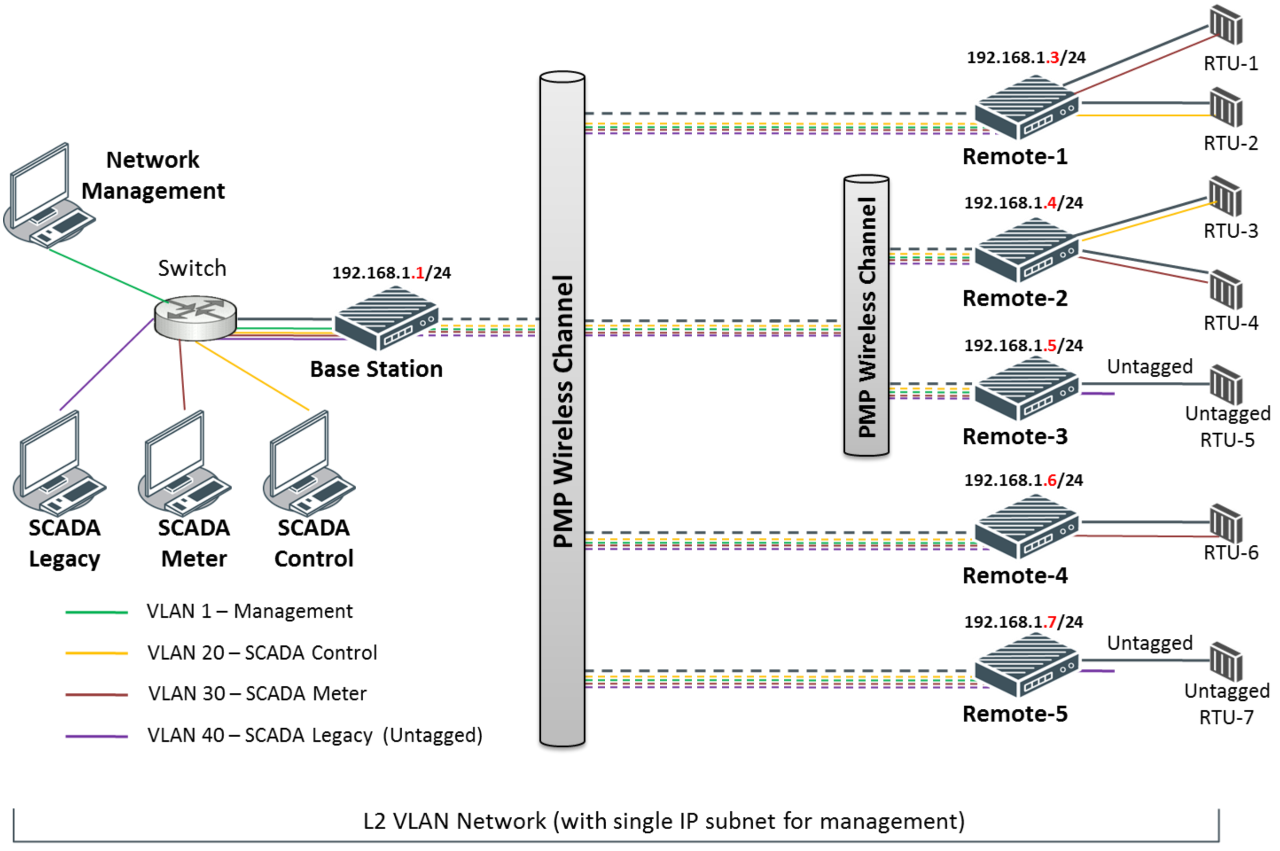
## General – Aprisa SRi VLAN Bridge

The Aprisa SRi works in a point-to-multipoint (PMP) network as a standard VLAN bridge with the Ethernet and wireless / radio as interfaces and serial ports using terminal server as a virtual interface.

The Aprisa SRi is a standard IEEE 802.1q VLAN bridge, where the FDB table is created by the bridge learning / aging process. New MACs are learnt and the FDB table updated. Unused MACs are aged out and flushed automatically after aging period.

VLANs are statically configured by the user on the ports where a Virtual LAN is required across the radio network. An example of VLAN isolation of traffic type is shown in the figure below, where RTUs #1, 4 and 6 together with SCADA meter master form a Virtual LAN which is isolated from the other devices, even though they are on the same physical network. VLAN management can be used to manage with external NMS all the Aprisa SRi devices on the radio network and is automatically created with a VLAN ID = 1 default value. The VLAN ID can be changed by the user later on.

Each device in the Aprisa SRi bridge is identified by its own IP address, as shown in the figure.



## VLANs – Single, Double and Trunk VLAN ports

The Aprisa SRi supports single VLAN (CVLAN), double VLAN (SVLAN) and trunk VLAN.

A single VLAN can be used to segregate traffic type.

A double VLAN can be used to distinguish between Aprisa SRi sub-networks (remotes), where the outer SVLAN is used to identify the sub-network and the CVLAN is used to identify the traffic type. In this case, a double tagged VLAN will be forwarded across the Industrial LAN network and switched based on the SVLAN to the appropriate Aprisa SRi sub-network. When packet enters the Aprisa SRi network, the SVLAN will be stripped off (removed) and the forwarding will be done based on the CVLAN, so only a single VLAN will pass through over the radio network and double VLAN will be valid on the borders of the radio network.

Trunk VLAN is also supported by the Aprisa SRi where the user can configure multiple VLANs on a specific Ethernet port, creating a trunk VLAN port. For example, in the above figure, a single trunk VLAN port is created between the switch and the Aprisa SRi base station, carrying VLAN ID #1, 20, 30 and 40.

## VLAN Manipulation – Add / Remove VLAN Tags

In order to support double VLAN and different device types connected to the Aprisa SRi e.g. switches, RTUs, etc, which can be VLAN tagged or untagged / plain Ethernet devices, add / remove VLAN manipulation is required.

In an Aprisa SRi VLAN tagged network, a remote Aprisa SRi connected to a plain RTU without VLAN support, will remove (strip-off) the VLAN tag from the packet before sending it to the RTU. On the other direction, when the RTU is sending an untagged packet, the Aprisa SRi will add (append) an appropriate user pre-configure VLAN tag before sending it over the air to the base station. This is shown in the above figure on untagged RTU #5 and 7.

## QoS using VLAN

VLANs carry 3 priority bits (PCP field) in the VLAN tag allowing prioritization of VLAN tagged traffic types with 8 levels of priority (where 7 is the highest priority and 0 is the lowest priority). The Aprisa SRi supports QoS (Quality of Service) where the priority bits in the VLAN tagged frame are evaluated and mapped to four priority levels and four queues supported by the Aprisa SRi radio. Packets in the queues are then scheduled out in a strict priority fashion for transmission over-the-air as per the priority level from high to low.

# Avoiding Narrow Band Radio Traffic Overloading

The Aprisa SRi supports mechanisms to prevent narrowband radio network overload:

1. L3/L4 Filtering

The L3 filtering can be used to block undesired traffic from being transferred on the narrow band channel, occupying the channel and risking the SCADA critical traffic. L3/4 filtering has the ability to block a known IP address and applications using TCP/IP or UDP/IP protocols with multiple filtering rules. The L3 (/L4) filter can block/forward (discard/process) a specific IP address and a range of IP addresses. Each IP addressing filtering rule set can also be set to filter a L4 TCP or UDP port/s which in most cases relates to specific applications as per IANA official and unofficial well-known ports. For example, filter and block E-mail SMTP or TFTP protocol as undesired traffic over the SCADA network. The user can block a specific or range of IP port addresses, examples SMTP (Simple Mail Transfer Protocol) TCP port 25 or TFTP (Simple Trivial File Transfer Protocol) UDP port 69.

2. L2 Address Filtering

L2 Filtering (Bridge Mode) provides the ability to filter radio link traffic based on specified Layer 2 MAC addresses. Destination MAC (DA) addresses and a Source MAC (SA) addresses and protocol type (ARP, VLAN, IPv4, IPv6 or Any type) that meet the filtering criteria will be transmitted over the radio link. Traffic that does not meet the filtering criteria will not be transmitted over the radio link.

3. L2 Port VLANs Ingress Filtering and QoS

Double VLAN (Bridge Mode)

Double VLAN is used to distinguish/segregate between different radio sub-networks (remotes). Traffic with double VLANs which are not destined to a specific sub-network will be discarded on the ingress of the radio sub-network, avoiding the overload of the radio sub-network.

Single VLAN (Bridge Mode)

Single VLAN is used to distinguish/segregate between different traffic types assigned by the user in its industrial corporate LAN. In order to avoid the overload of the radio network, traffic with single VLANs which are not destined to a specific radio network will be discarded on the Ethernet ingress port of the radio network. All single VLANs which set and are eligible will be transmitted over the radio link.

QoS using 802.1p priority bits (Bridge Mode)

The priority bits can be used in the VLAN tagged frames to prioritized critical mission SCADA traffic and ensure SCADA traffic transmission relative to any other unimportant traffic. In this case, traffic based on VLAN priority (priority 0 to 7) enters one of the four priority queues of the Aprisa SRi (Very High, High, Medium and Low). Traffic leaves the queues (to the radio network) from highest priority to lowest in a strict priority fashion.

4. Ethernet port QoS

The Aprisa SRi supports ‘Ethernet Per Port Prioritization’. Each Ethernet port can be assigned a priority and traffic shall be prioritized accordingly. This is quite useful in networks where customers do not use VLANs or cannot use 802.1p prioritization.

5. Ethernet Data and Management Priority and Background Bulk Data Transfer Rate

Alternatively, to VLAN priority, users can control the Ethernet traffic priority (vs serial), management priority and rate in order to control the traffic load of the radio network, where important and high priority data (SCADA) will pass-through first assuring SCADA network operation. The user can set the use of the Ethernet Data Priority, which controls the priority of the Ethernet customer traffic relative to the serial customer traffic and can be set to one of the four queues. The Ethernet Management Priority controls the priority of the Ethernet management traffic relative to Ethernet customer traffic and can be set to one of the four queues. The Background Bulk Data Transfer Rate sets the data transfer rate (high, medium, low) for large amounts of management data.

6. Ethernet Packet Time to Live

Another aspect of avoiding overload radio network is the Ethernet packet TTL, which is used to prevent old, redundant packets being transmitted through the radio network. This sets the time an Ethernet packet is allowed to live in the system before being dropped if it cannot be transmitted over the air.

7. Payload Compression

Aprisa SRi supports payload compression. A Lempel–Ziv (LZ) algorithm is used to efficiently compress up to 50% traffic with high percentage of repetitive strings. Both serial and Ethernet / IP payload traffic are compressed.

# Interfaces

## Antenna Interface

- 1 x TNC, 50 ohm, female connector

## Ethernet Interface

- 2 ports 10/100 base-T Ethernet layer 2 switch using RJ45

  Used for Ethernet user traffic and radio sub-network management.

## RS-232 / RS-485 Interface

- 2 ports RS-232 asynchronous ports using RJ45 connectors
- Optional 1x RS-232 or RS-485 asynchronous port using USB host port with USB to RS-232 or USB to RS-485 converters

## USB Interfaces

- 1 x Management port using USB micro type B connector

  Used for product configuration with the Command Line Interface (CLI).
- 1 x Host port using USB standard type A connector

  Used for software upgrade, diagnostic reporting and configuration save / restore.

## Protect Interface

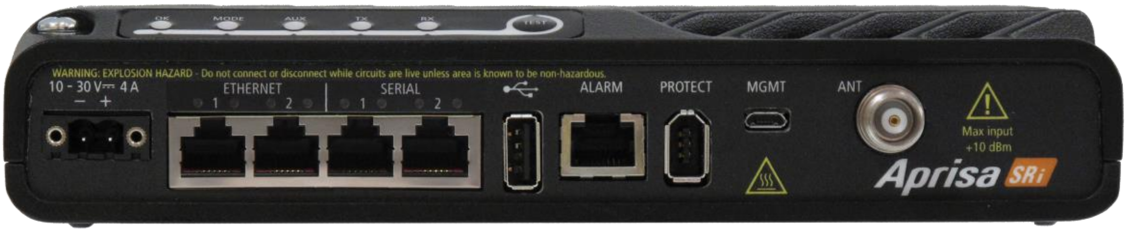
- 1x Protect interface port

  Not applicable for the Aprisa SRi radio.

## Alarms Interface

- 1x Alarm port using RJ45 connector
  Used to provide 2 x hardware alarm inputs and 2 x hardware alarm outputs

# Front Panel Connections

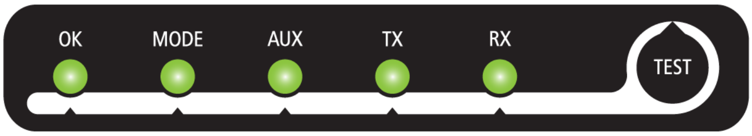

OK
MODE
AUX
TX
RX
TEST
WARNING: EXPLOSION HAZARD - Do not connect or disconnect while circuits are live unless area is known to be non-hazardous.
10 - 30 V⎓ 4 A
− +
ETHERNET
1 2
SERIAL
1 2
ALARM
PROTECT
MGMT
ANT
Max input +10 dBm
Aprisa SRi

All connections to the radio are made on the front panel. The functions of the connectors are (from left to right):

| Designator | Description |
|---|---|
| 10 - 30 VDC; 3A | +10 to +30 VDC (negative ground) DC power input using Molex 2 pin male screw fitting connector.<br>AC/DC and DC/DC power supplies are available as accessories. See 'External Power Supplies' on page 77. |
| ETHERNET 1 & 2 | Integrated 10Base-T/100Base-TX layer-3 Ethernet switch using RJ45 connectors.<br>Used for Ethernet user traffic and product management.<br>See 'Ethernet > Port Setup' on page 147. |
| SERIAL 1 | One port of RS-232 serial using RJ45 connector.<br>Used for RS-232 asynchronous user traffic.<br>See 'Serial > Port Setup' on page 130. |
|  | Host Port using a USB standard type A connector.<br>Used for software upgrade and diagnostic reporting and optional: 1x RS-232 asynchronous port with USB to RS-232 converter.<br>See 'Software Upgrade' on page 323 and 'Maintenance > General' on page 231. |
| ALARM | Alarm Port using a RJ45 connector.<br>Used for two alarm inputs and two alarm outputs.<br>See 'Hardware Alarms Interface' on page 346. |
| MGMT | Management Port using a USB micro type B connector.<br>Used to access the radio Command Line Interface (CLI).<br>See 'Connecting to the CLI via the Management Port' on page 306 |
| PROTECT | Protect port. Not used for the SRi. |
| *ANT* | TNC, 50 ohm, female connector for connection of antenna feeder cable for half duplex RF operation.<br>See 'Coaxial Feeder Cables' on page 69. |

# LED Display Panel

The Aprisa SRi has an LED Display panel which provides on-site alarms / diagnostics without the need for PC.



The LEDs indicate the following conditions:

| | OK | MODE | AUX | TX | RX |
|---|---|---|---|---|---|
| Flashing Red | | *Radio has not registered* | | | |
| Solid Red | *Alarm present with severity Critical, Major and Minor* | | | *TX path fail* | *RX path fail* |
| Flashing Orange | | *Diagnostics Function Active*<br>*OTA software distribution* | *Management traffic on the USB MGMT port* | | |
| Solid Orange | *Alarm present with Warning Severity* | | *Device detect on the USB host port (momentary)* | | |
| Flashing Green | *Software Upgrade Successful* | | *Tx / Rx Data on the USB host port* | *RF path TX is active* | *RF path RX is active* |
| Solid Green | *Power on and functions OK and no alarms* | *Processor Block is OK* | *USB interface OK* | *Tx path OK* | *Rx path OK* |

| LED Colour | Severity |
|---|---|
| Green | No alarm – information only |
| Orange | Warning alarm |
| Red | Critical, major or minor alarm |

## Single Radio Software Upgrade

During a radio software upgrade, the LEDs indicate the following conditions:

- Software upgrade started - the OK LED flashes orange
- Software upgrade progress indicated by running AUX to MODE LEDs
- Software upgrade completed successfully - the OK LED flashes green
- Software upgrade failed - any LED flashing red during the upgrade

## Network Software Upgrade

During a network software upgrade, the MODE LED flashes orange on the base station and all remote radios.

## Test Mode

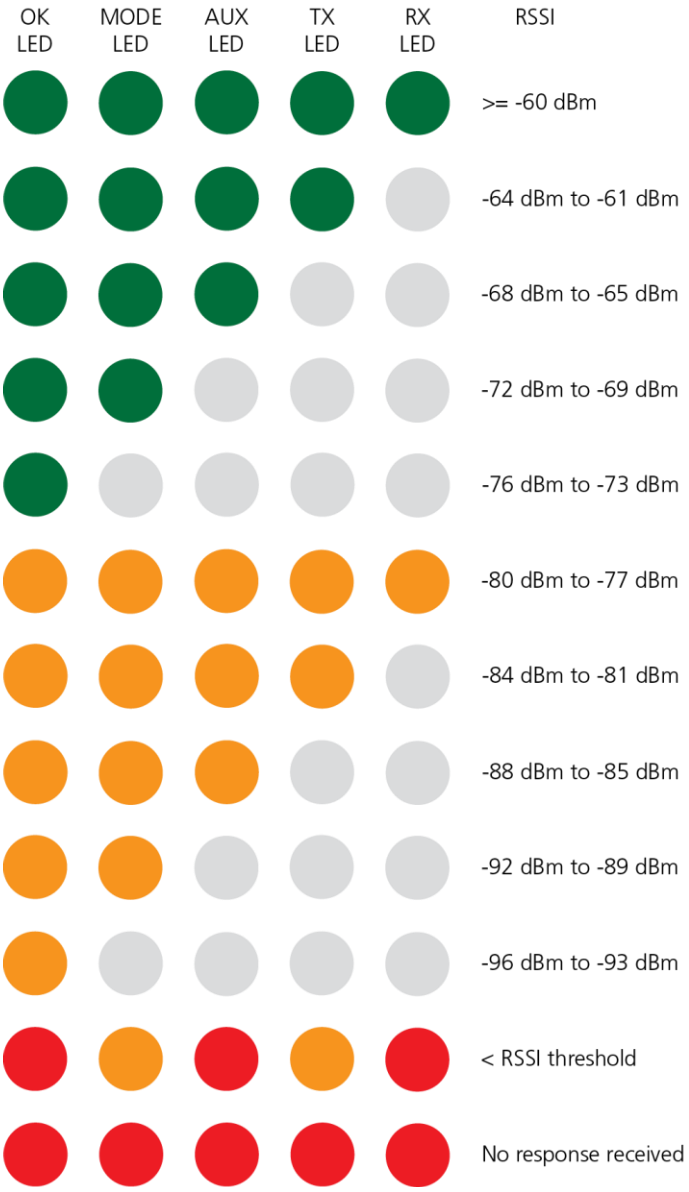
Remote radios have a Test Mode which presents a real time visual display of the RSSI on the LED Display panel. This can be used to adjust the antenna for optimum signal strength.

To enter Test Mode, press and hold the TEST button on the radio LED panel until all the LEDs flash green (about 3 - 5 seconds). The response time is variable and can be up to 5 seconds.

To exit Test Mode, press and hold the TEST button until all the LEDs flash red (about 3 – 5 seconds).

**Note:** Test Mode traffic has a low priority but could affect customer traffic depending on the relative priorities setup.

The RSSI result is displayed on the LED Display panel as a combination of LED states:



| OK LED | MODE LED | AUX LED | TX LED | RX LED | RSSI |
|---|---|---|---|---|---|
| 🟢 | 🟢 | 🟢 | 🟢 | 🟢 | >= -60 dBm |
| 🟢 | 🟢 | 🟢 | 🟢 | ⚪ | -64 dBm to -61 dBm |
| 🟢 | 🟢 | 🟢 | ⚪ | ⚪ | -68 dBm to -65 dBm |
| 🟢 | 🟢 | ⚪ | ⚪ | ⚪ | -72 dBm to -69 dBm |
| 🟢 | ⚪ | ⚪ | ⚪ | ⚪ | -76 dBm to -73 dBm |
| 🟠 | 🟠 | 🟠 | 🟠 | 🟠 | -80 dBm to -77 dBm |
| 🟠 | 🟠 | 🟠 | 🟠 | ⚪ | -84 dBm to -81 dBm |
| 🟠 | 🟠 | 🟠 | ⚪ | ⚪ | -88 dBm to -85 dBm |
| 🟠 | 🟠 | ⚪ | ⚪ | ⚪ | -92 dBm to -89 dBm |
| 🟠 | ⚪ | ⚪ | ⚪ | ⚪ | -96 dBm to -93 dBm |
| 🔴 | 🟠 | 🔴 | 🟠 | 🔴 | < RSSI threshold |
| 🔴 | 🔴 | 🔴 | 🔴 | 🔴 | No response received |

## Network Management

The Aprisa SRi contains an embedded web server application (SuperVisor) to enable element management with any major web browser (such as Mozilla Firefox or Microsoft® Internet Explorer).

SuperVisor enables operators to configure and manage the Aprisa SRi base station radio and remote radios over the radio link.

The key features of SuperVisor are:

- Full element management, configuration and diagnostics
- Manage the entire network from the Base Station (remote management of elements)
- Managed network software distribution and upgrades
- Performance and alarm monitoring of the entire network, including RSSI, alarm states, time-stamped events, etc.
- View and set standard radio configuration parameters including frequencies, transmit power, channel access, serial, Ethernet port settings
- Set and view security parameters
- User management
- Operates over a secure HTTPS session on the access connection to the base station

SuperVisor, when connected to the base station radio allows management of all radios in the network. The Network Table displays a list of all the registered remote radios for the base station and provides management access to each of the remote radios (see ‘Network Status > Network Table’ on page 297).

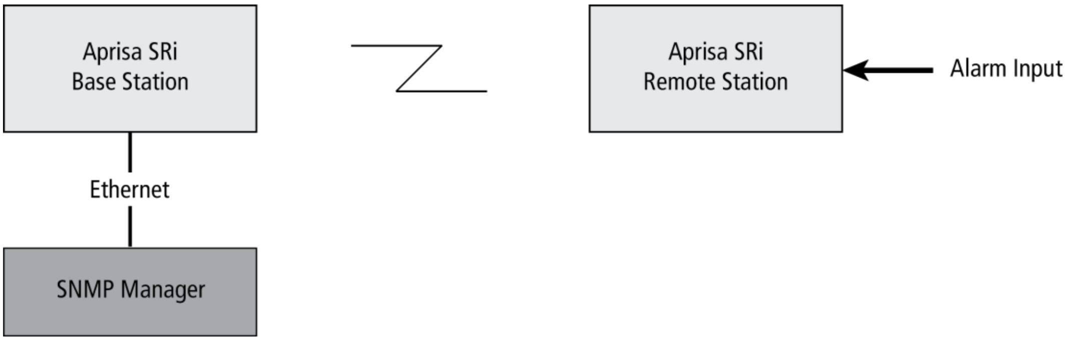
# Hardware Alarm Inputs / Outputs

The Aprisa SRi provides two hardware alarm inputs to generate alarm events in the network and two hardware alarm outputs to receive alarm events from the network.

The hardware alarm inputs and outputs are part of the event system. All alarm events can be viewed in SuperVisor event history log (see 'Events > Event History' on page 246). These include the alarm events generated by the hardware alarm inputs.

## Alarm Input to SNMP Trap

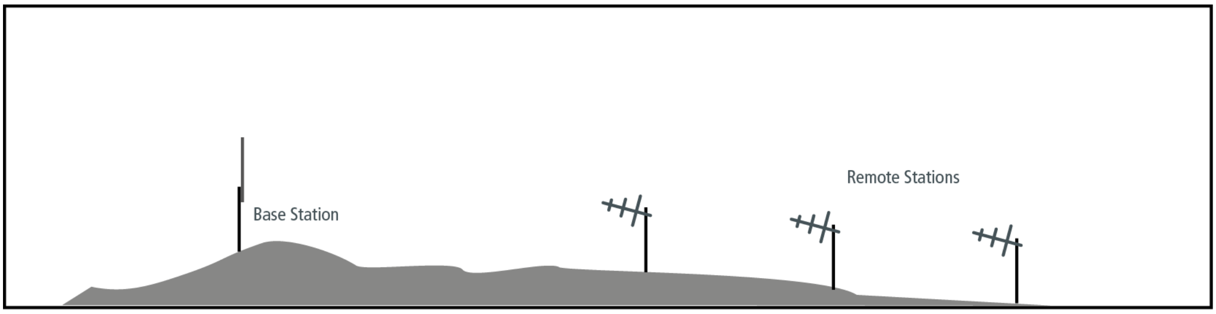
An alarm event from an Aprisa SRi hardware alarm input can be sent over the air to any SNMP Manager using SNMP traps.



# 4. Implementing the Network

## Network Topologies

### Point-to-Multipoint Network



## Initial Network Deployment

### Install the Base Station

**To install the base station in your network:**

1. Install the base station radio (see ‘Installing the Radio’ on page 72).
2. Set the radio Network ID to a unique ID in your entire network (see ‘Terminal > Device’ on page 102).
3. Set the radio operating mode to ‘base station’ (see ‘Terminal > Operating Mode’ on page 110).
4. Set the radio IP address (see ‘IP > IP Setup > Bridge / Gateway Router Modes’ on page 159).
5. Set the radio zones / channels.
6. Set the radio security settings (see ‘Security > Setup’ on page 202).

### Installing the Remote radios

**To install the remote radios in your network:**

1. Install the remote radio (see ‘Installing the Radio’ on page 72).
2. Set the radio Network ID to the same ID as the other stations in the network (see ‘Terminal > Device’ on page 102).
3. Set the radio operating mode to ‘remote radio’ (see ‘Terminal > Operating Mode’ on page 110).
4. Set the radio IP address (see ‘IP > IP Setup > Bridge / Gateway Router Modes’ on page 159).
5. Set the radio zones / channels to be compatible with the base station.
6. Set the radio security settings to the same as the base station (see ‘Security > Setup’ on page 202).

The base station will automatically allocate a node address to the new remote radio.

# Network Changes

## Adding a Remote radio

**To add a remote radio to your network:**

1. Install the remote radio (see ‘Installing the Radio’ on page 72).
2. Set the radio Network ID to the same ID as the other stations in the network (see ‘Terminal > Device’ on page 102).
3. Set the radio IP address (see ‘IP > IP Setup > Bridge / Gateway Router Modes’ on page 159).).
4. Set the radio zones / channels to be compatible with the base station.
5. Set the radio operating mode to ‘remote radio’ (see ‘Terminal > Operating Mode’ on page 110).

The base station will automatically allocate a node address to the new remote radio.

**To remove a remote radio from your network:**

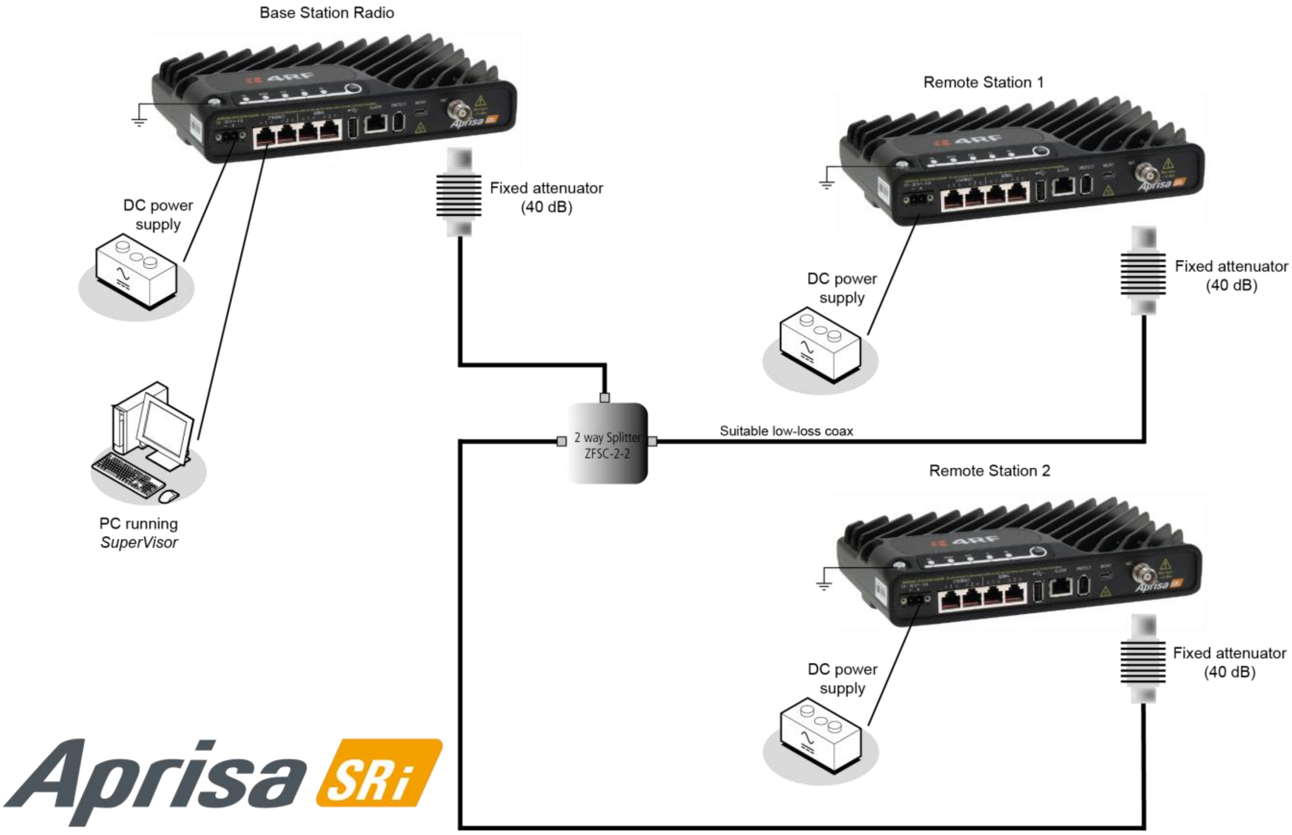
1. Turn the power off on the remote radio you wish to remove. This is the only action that is required.

**Note**: The remote radio will continue to show in the Network Table list.

# 5. Preparation

## Bench Setup

Before installing the links in the field, it is recommended that you bench-test the links. A suggested setup for basic bench testing is shown below:



**When setting up the equipment for bench testing, note the following:**

Earthing

Each radio should be earthed at all times. The radio earth point should be connected to a protection earth.

Attenuators

In a bench setup, there should be 60 - 80 dB at up to 1 GHz of 50 ohm coaxial attenuation, capable of handling the transmit power of +26 dBm (0.4 W) between the radios’ antenna connectors.

Splitter

If more than two radios are required in your bench setup, a multi-way splitter is required. The diagram shows a two way splitter. This splitter should be 50 ohm coaxial up to 1 GHz and capable of handling the transmit power of +26 dBm (0.4 W).

Cables

Use double-screened coaxial cable that is suitable for use up to 1 GHz at ≈ 1 metre.

**CAUTION:** Do not apply signals greater than +10 dBm to the antenna connection as they can damage the receiver.

# Compliance Considerations

The Aprisa SRi is a professional radio product and as such must be installed by a suitably trained and qualified installer who is aware of the local regulatory requirements existing at the time of installation and is capable of ensuring that the regulations are adhered to.

The maximum Equivalent Isotropic Radiated Power (EIRP) permitted from the Aprisa SRi is regulated and must not exceed the limits provided in the following table. To meet this regulatory requirement; knowledge of the antenna gain and feeder cable loss must be known before setting the transmitter output power.

| **Regulatory Requirement** | **Frequency Range** | **Maximum EIRP**[1] | **SRi Equivalent Maximum Average Power (*$R_{dBm}$*)** |
|---|---|---|---|
| USA, FCC Part 15.247 | 902 MHz to 928 MHz | +36 dBm PEP | +32 dBm |
| Canada, ISED RSS-247 | 902 MHz to 928 MHz | +36 dBm PEP | +32 dBm |
| Australia, ACMA AS/NZS 4268 | 915 MHz to 928 MHz | +30 dBm | +30 dBm |
| New Zealand, General User Radio Licence for Short Range Devices | 915 MHz to 928 MHz | +30 dBm | +30 dBm |
| New Zealand, General User Radio Licence for Short Range Devices | 920 MHz to 928 MHz | +36 dBm | +36 dBm |
| Brazil, Act No. 14.448, of December 4, 2017 | 902 MHz to 907.5 MHz & 915 MHz to 928 MHz | +36 dBm PEP | +30 dBm |
| Mexico, NOM-208-SCFI-2016 | 902 MHz to 928 MHz | +36 dBm PEP | +30 dBm |

[1] These are correct at the time of printing. The installer must ensure that the installation complies with the regulatory requirements at the time of installation.

The Aprisa SRi has a maximum mean output power of +26 dBm into a 50 ohm antenna which equates to a maximum peak power of +30 dBm PEP. To determine the maximum power to be set on the Aprisa SRi, the following installation parameters must be known:

1. Aprisa SRi equivalent average power for maximum permitted EIRP (specified in dBm) $R_{dBm}$
2. Antenna isotropic gain (specified in dBi) $G_{dBi}$
3. Feeder coax loss between Aprisa SRi and antenna (specified in dB/m) $L_{dB/m}$
4. Length of feeder coax between Aprisa SRi and antenna (specified in metres) $d_m$

From these the above information, the power setting of the Aprisa SRi ($P_{dBm}$) can be calculated to ensure operation within the regulatory requirements using the formula:

$$P_{dBm} = R_{dBm} + \left(d_m \times L_{dB/m}\right) - G_{dBi}$$

Antenna gain information can be obtained from the Antenna manufacturer and is either expressed in terms of dBi, referenced to an isotropic radiator, or dBd, referenced to a dipole.

If the gain is expressed in dBd, it can be converted to dBi by adding 2.15 dB to the gain value.

The following is an example of transmitter power calculations:

| Antenna Type and Gain | Feeder Coax Length and Loss | Regulatory Limit | Maximum SRi Power Setting |
|---|---|---|---|
| Yagi, 11 dBi | 10 m of ½” Heliax @ 0.11 dB/m gives 1.1 dB loss | +36 dBm PEP | 22 dBm |
| Panel, 12 dBi | 33 m of RG214 @ 0.22 dB/m gives 7.3 dB loss | +30 dBm | 25 dBm |
| Dipole, 3.5 dBi | 3 m of RG214 @ 0.22 dB/m gives 0.66 dB loss | +30 dBm | 26 dBm |
| Grid, 18 dBi | 15 m of ½” Heliax @ 0.11 dB/m gives 1.65 dB loss | +30 dBm | 13 dBm |

## Canada

This radio transmitter Aprisa SRi ISED: 6772A-SI902M160 has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

## Mexico

La operación de este equipo está sujeta a las siguientes dos condiciones:

(1) es posible que este equipo o dispositivo no cause interferencia perjudicial y

(2) este equipo o dispositivo debe aceptar cualquier interferencia, incluyendo la que pueda causar su operación no deseada.

Este equipo ha sido diseñado para operar con las antenas que enseguida se enlistan y para una ganancia máxima de antena de 6 dBi.

El uso con este equipo de antenas no incluidas en esta lista o que tengan una ganancia mayor que 6 dBi quedan prohibidas. La impedancia requerida de la antena es de 50 ohms.

# Path Planning

The following factors should be considered to achieve optimum path planning:

- Antenna Selection and Siting
- Coaxial Cable Selection
- Linking System Plan

## Antenna Selection and Siting

Selecting and siting antennas are important considerations in your system design. The antenna choice for the site is determined primarily by the frequency of operation and the gain required to establish reliable links.

### Base Station

The predominant antenna for a base station is an omni-directional collinear gain antenna.

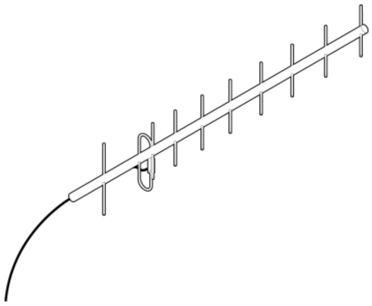
#### Omni Directional Collinear Antennas

| | **Factor** | **Explanation** |
|---|---|---|
| | Gain | Varies with size (5 dBi to 11 dBi typical) |
| | Wind loading | Minimal |
| | Tower aperture required | Minimal |
| | Size | Range from 2 m to 3 m length |
| | Polarization | Vertical |

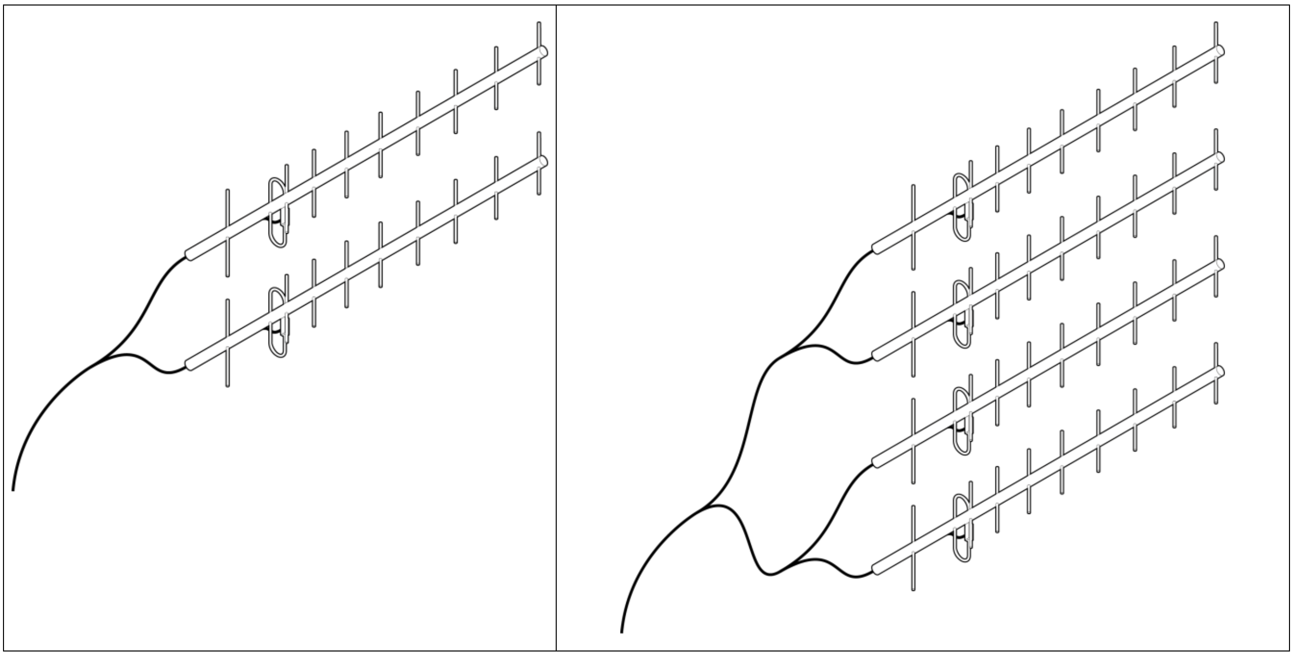
## Remote radio

There are two main types of directional antenna that are commonly used for remote radios, Yagi and corner reflector antennas.

### Yagi Antennas

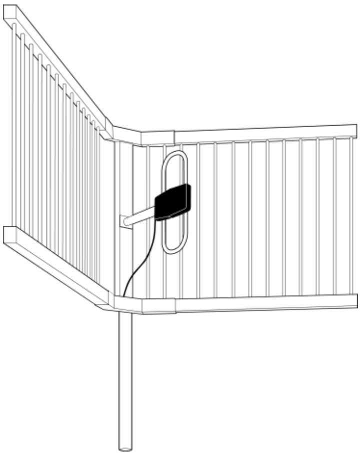
|  | Factor | Explanation |
|---|---|---|
| | Gain | Varies with size (typically 11 dBi to 16 dBi) |
| | Stackable gain increase | 2 Yagi antennas (+ 2.8 dB)<br>4 Yagi antennas (+ 5.6 dB) |
| | Size | Range from 0.6 m to 3 m in length |
| | Front to back ratio | Low (typically 18 to 20 dB) |

It is possible to increase the gain of a Yagi antenna installation by placing two or more of them in a stack. The relative position of the antennas is critical.



Example of stacked antennas

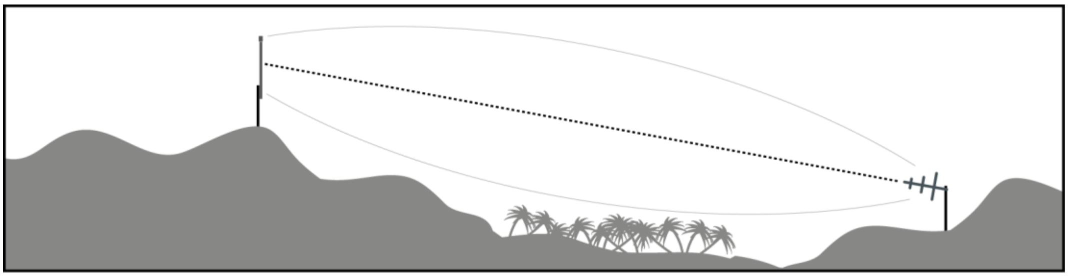
## Corner Reflector Antennas

|  | Factor | Explanation |
|---|---|---|
| | Gain | Typically 12 dBi |
| | Size | Range from 0.36 m to 0.75 m in length |
| | Front to back ratio | High (typically 30 dB) |
| | Beamwidth | Broad (up to 60°) |

## Antenna Siting

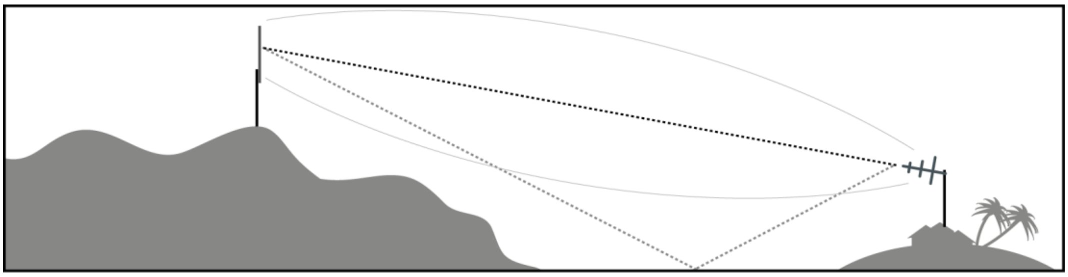
When siting antennas, consider the following points:

A site with a clear line of sight to the remote radio is recommended. Pay particular attention to trees, buildings, and other obstructions close to the antenna site.



Example of a clear line-of-sight path

Any large flat areas that reflect RF energy along the link path, for instance, water, could cause multipath fading. If the link path crosses a feature that is likely to cause RF reflections, shield the antenna from the reflected signals by positioning it on the far side of the roof of the equipment shelter or other structure.



Example of a mid-path reflection path

The antenna site should be as far as possible from other potential sources of RF interference such as electrical equipment, power lines and roads. The antenna site should be as close as possible to the equipment shelter.

Wide angle and zoom photographs taken at the proposed antenna location (looking down the proposed path), can be useful when considering the best mounting positions.

## Coaxial Feeder Cables

To ensure maximum performance, it is recommended that you use good quality low-loss coaxial cable for all feeder runs. When selecting a coaxial cable consider the following:

| Factor | Effect |
|---|---|
| Attenuation | Short cables and larger diameter cables have less attenuation |
| Cost | Smaller diameter cables are cheaper |
| Ease of installation | Easier with smaller diameter cables or short cables |

For installations requiring long feeder cable runs, use the RFI AVA5 50, RFI LDF4 50A or RFI CNT-400 feeder cable or equivalent:

| Part Number | Part Description | Specification |
|---|---|---|
| RFI AVA5 50 | Feeder Cable, 7/8", HELIAX, Low loss | 7/8" foam dielectric. Standard Jacket<br>Outer conductor corrugated copper, inner conductor copper-clad aluminum<br>Bending radius of 250 mm min<br>Attenuation of 3.7 dB / 100m @ 900 MHz |
| RFI LDF4 50A | Feeder cable, 1/2", HELIAX, Low Loss | 1/2" foam dielectric. Standard Jacket<br>Outer conductor corrugated copper, inner conductor copper-clad aluminum<br>Bending radius of 125 mm min<br>Attenuation of 7.0 dB / 100m @ 900 MHz |
| RFI CNT 400 | Feeder, CNT-400, 10.8mm, Double Shielded Solid Polyethylene | Low loss 0.4’ (10.8 mm) feeder cable<br>UV protected black Polyethylene, bonded AL tape outer conductor<br>Bending radius of 30 mm min<br>Attenuation of 12.8 dB / 100m @ 900 MHz |

For installations requiring short feeder cable runs, use the RFI 8223 feeder cable or equivalent:

| Part Number | Part Description | Specification |
|---|---|---|
| RFI 8223 | Feeder, RG 223 5.4mm d, Double Shielded Solid Polyethylene | Bending radius of 20 mm min<br>Attenuation of 45.6 dB / 100m @ 900 MHz |

When running cables:

Run coaxial feeder cable from the installation to the antenna, ensuring you leave enough extra cable at each end to allow drip loops to be formed.

Terminate and ground the feeder cables in accordance with the manufacturers’ instructions. Bond the outer conductor of the coaxial feeder cables to the base of the tower mast.

## Linking System Plan

All of the above factors combine in any proposed installation to create a Linking System Plan. The Linking System Plan predicts how well the radios will perform after it is installed.

Use the outputs of the Linking System Plan during commissioning to confirm the radios have been installed correctly and that it will provide reliable service.

# Site Requirements

## Power Supply

Ensure a suitable power supply is available for powering the radio.

The nominal input voltage for a radio is +13.8 VDC (negative earth) with an input voltage range of +10 to +30 VDC. The maximum power input is 25 W.

**WARNING:**

Before connecting power to the radio, ensure that the radio is grounded via the negative terminal of the DC power connection.

## Equipment Cooling

If the Aprisa SRi is operated in an environment where the ambient temperature exceeds 50°C, the Aprisa SRi convection air flow over the heat sinks must be considered.

The environmental operating conditions are as follows:

| | |
|---|---|
| Operating temperature | -40 to +70° C (-40 to +158° F) |
| Storage temperature | -40 to +85° C (-40 to +185° F) |
| Humidity | Maximum 95% non-condensing |

**WARNING:**

If the Aprisa SRi is operated in an environment where the ambient temperature exceeds 50°C, the Aprisa SRi must be installed within a restricted access location to prevent human contact with the enclosure heat sink.

**WARNING:**

The Aprisa SRi can be operated in an environment where the ambient temperature exceeds 50°C. The heat sink will be a hot surface - do not touch.

# Earthing and Lightning Protection

**WARNING:**

Lightning can easily damage electronic equipment.

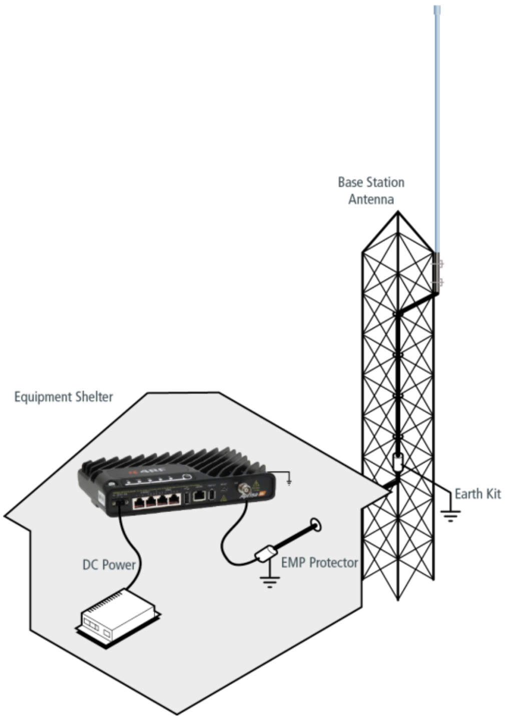
To avoid this risk, install primary lightning protection devices on any interfaces that are reticulated in the local cable network.

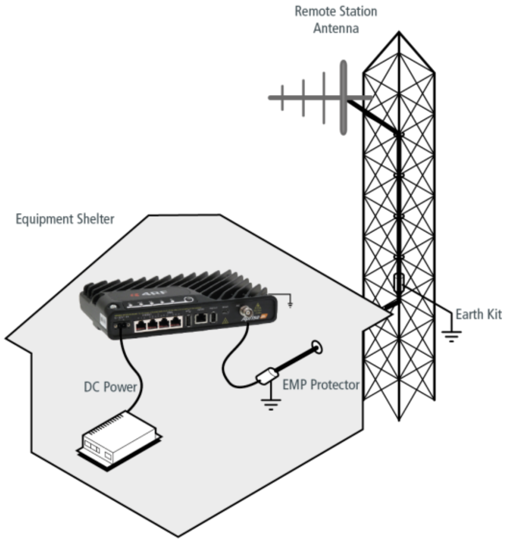
You should also install a coaxial surge suppressor on the radio antenna port.

## Feeder Earthing

Earth the antenna tower, feeders and lightning protection devices in accordance with the appropriate local and national standards. The diagram below shows the minimum requirements.

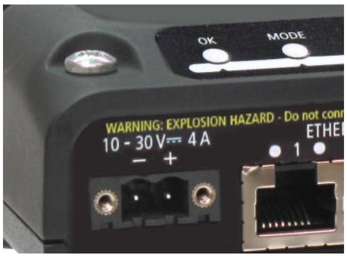
Use grounding kits as specified or supplied by the coaxial cable manufacturer to properly ground or bond the cable outer.





## Radio Earthing

The Aprisa SRi has an earth connection point on the top left of the enclosure. M4 8mm pan pozi machine screws and M4 lock washers are supplied fitted to the radio. These screws can be used to earth the enclosure to a protection earth.



# 6. Installing the Radio

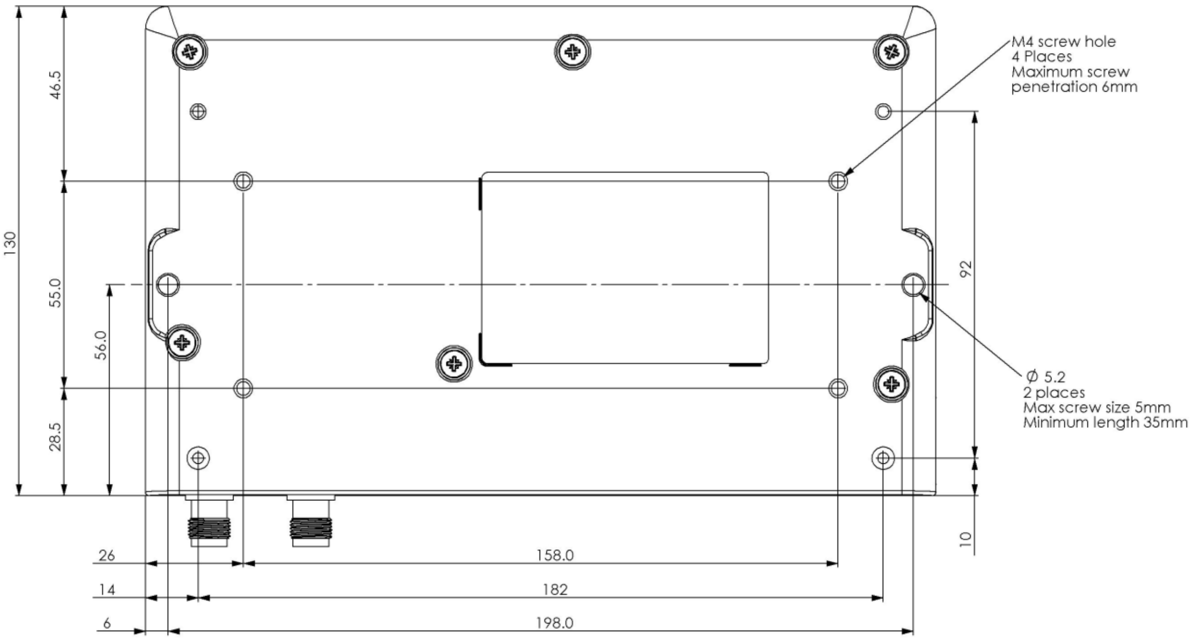
**CAUTION:**

You must comply with the safety precautions in this manual or on the product itself.

4RF does not assume any liability for failure to comply with these precautions.

## Mounting

The Aprisa SRi has four threaded holes (M4) in the enclosure base and two holes (5.2 mm) through the enclosure for mounting.



Mounting options include:

- DIN rail mounting with the Aprisa SRi DIN Rail Mounting Bracket
- Rack shelf mounting
- Wall mounting
- Outdoor enclosure mounting

**WARNING:**

If the Aprisa SRi is operated in an environment where the ambient temperature exceeds 50°C, the Aprisa SRi must be installed within a restricted access location to prevent human contact with the enclosure heatsink.

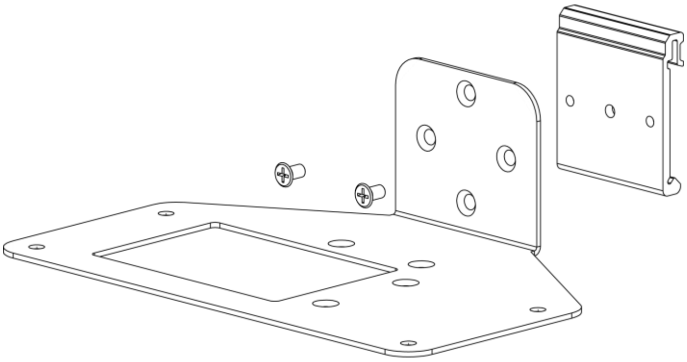
## Required Tools

No special tools are needed to install the radio.

# DIN Rail Mounting

The Aprisa SRi has an optional accessory part to enable the mounting on a standard DIN rail:

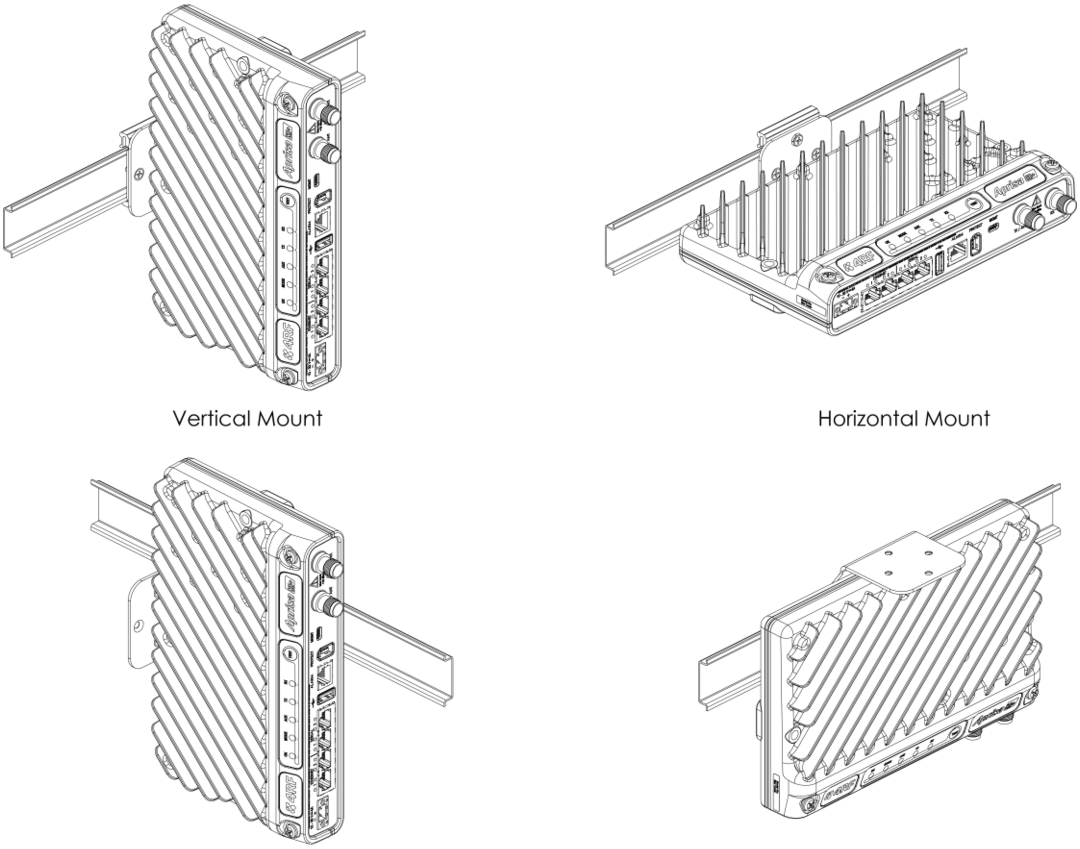
| Part Number | Part Description |
|---|---|
| APSB-MBRK-DIN | 4RF SR+ Acc, Mounting, Bracket, DIN Rail |



The Aprisa SRi is mounted into the DIN rail mounting bracket using the four M4 threaded holes in the Aprisa SRi enclosure base. Four 8 mm M4 pan pozi machine screws are supplied with the bracket.

The Aprisa SRi DIN rail mounting bracket can be mounted in four positions on a horizontal DIN rail:

- Vertical Mount (vertical enclosure perpendicular to the mount)
- Horizontal Mount (horizontal enclosure perpendicular to the mount)
- Flat Vertical Mount (vertical enclosure parallel to the mount)
- Flat Horizontal Mount (horizontal enclosure parallel to the mount)



Vertical Mount

Horizontal Mount

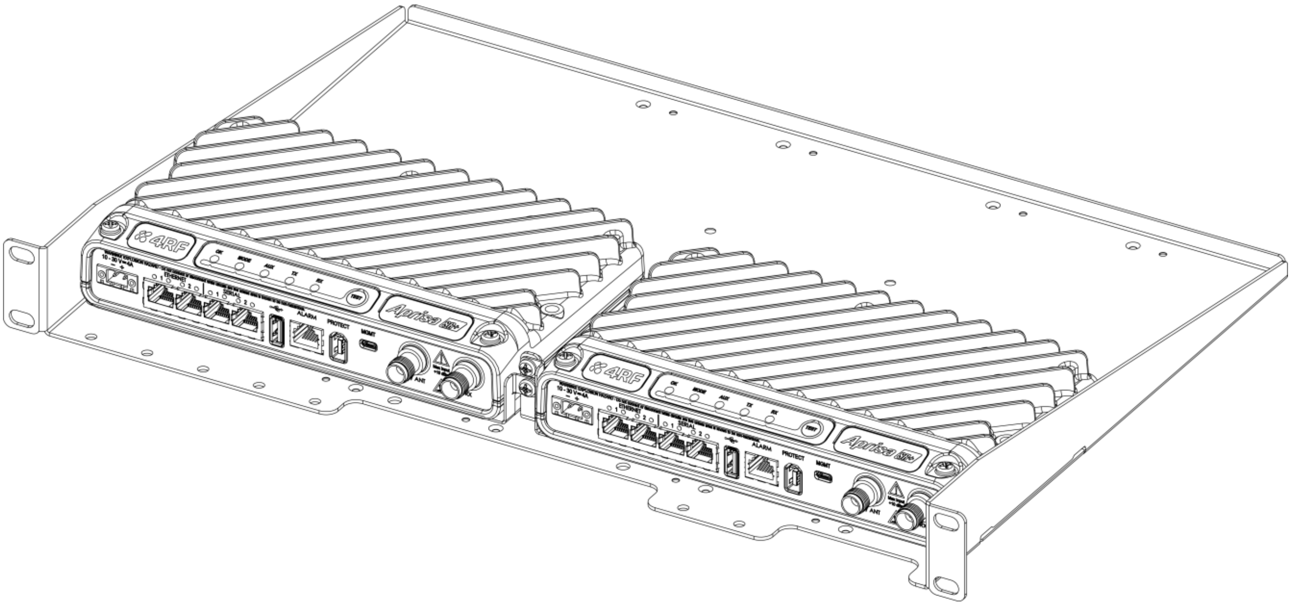
Flat Vertical Mount

Flat Horizontal Mount

## Rack Shelf Mounting

The Aprisa SRi can be mounted on a rack mount shelf using the four M4 threaded holes in the Aprisa SRi enclosure base. The following picture shows Aprisa SRi mounted on a 1 RU rack mounted shelf.

| Part Number | Part Description |
|---|---|
| APSB-MR19-X1U | 4RF SR+ Acc, Mounting, 19" Rack Mount Shelf, 1U |

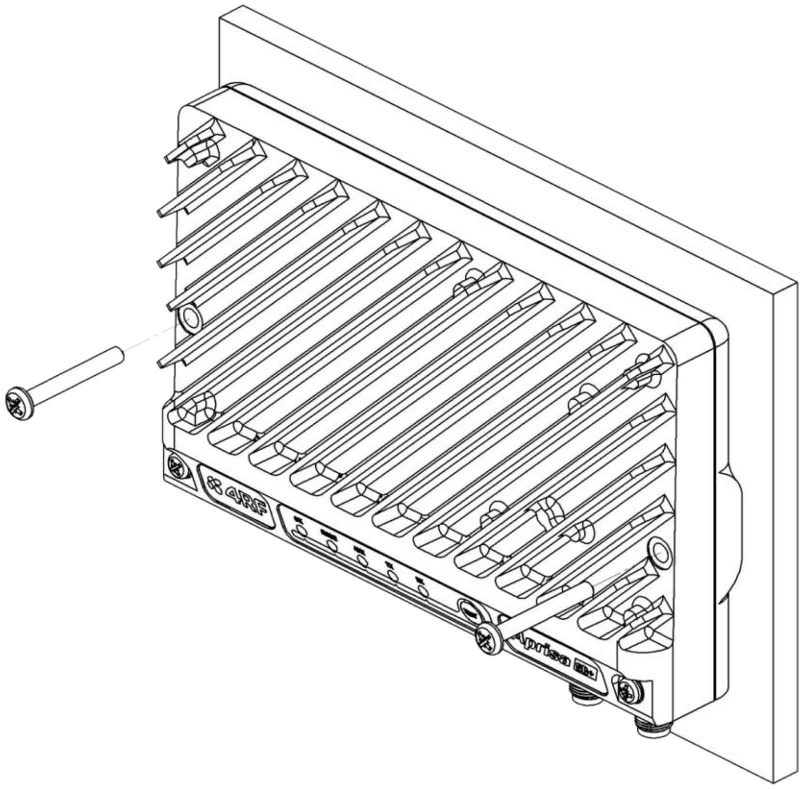


**WARNING:**

If the Aprisa SRi is operated in an environment where the ambient temperature exceeds 50°C, the Aprisa SRi convection air flow over the heat sinks must be considered.

## Wall Mounting

The Aprisa SRi can be mounted on a wall using the two holes through the enclosure (5.2 mm diameter). Typically, M5 screws longer than 35 mm would be used.



# Installing the Antenna and Feeder Cable

Carefully mount the antenna following the antenna manufacturers' instructions. Run feeder cable from the antenna to the radio location.

Lightning protection must be incorporated into the antenna system (see 'Earthing and Lightning Protection' on page 71).

**WARNING:**

When the link is operating, there is RF energy radiated from the antenna.
Do not stand in front of the antenna while the radio is operating (see the 'RF Exposure Warning' on page 3).

Fit the appropriate male or female connector (usually N-type) to the antenna feeder at the antenna end. Carefully follow the connector manufacturers' instructions.

Securely attach the feeder cable to the mast and cable trays using cable ties or cable hangers. Follow the cable manufacturer's recommendations about the use of feeder clips, and their recommended spacing.

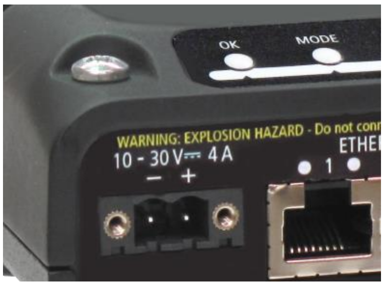
Connect the antenna and feeder cable. Weatherproof the connection with a boot, tape or other approved method.

The Aprisa SRi antenna connection is a TNC female connector so the feeder / jumper must be fitted with a TNC male connector.

If a jumper is used between the feeder and the radio, connect a coaxial surge suppressor or similar lightning protector between the feeder and jumper cables (or at the point where the cable enters the equipment shelter). Connect the feeder cable to the antenna port on the radio.

Earth the case of the lightning protector to the site Lightning Protection Earth.

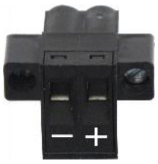
The Aprisa SRi has an earth connection point on the top left of the enclosure. M4 8mm pan pozi machine screws and M4 lock washers are supplied fitted to the radio. These screws can be used to earth the enclosure to a protection earth.



# Connecting the Power Supply

The nominal input voltage for a radio is +13.8 VDC (negative earth) with an input voltage range of +10 to +30 VDC. The maximum power input is 25 W.

The power connector required is a Molex 2 pin female screw fitting part. This connector is supplied fitted to the radio.



The negative supply of the Aprisa SRi power connection is internally connected to the Aprisa SRi enclosure. Power must be supplied from a Negative Earthed power supply.

Wire your power source to power connector and plug the connector into the radio. The connector screws can be fastened to secure the connector.

Spare Molex 2 pin female power connectors can be ordered from 4RF:

| Part Number | Part Description |
|---|---|
| APST-CML2-FEM-01 | 4RF SR+ Spare, Connector, Molex 2 pin, Female, 1 item |

Turn your power source on:

- All the radio LEDs will flash orange for one second and then the OK, MODE and AUX LEDs will light green, the TX and RX LEDs will flash red.
- The Aprisa SRi radio is ready to operate
- The TX and RX LEDs will be green (steady or flashing) when the radio is registered with the network.

If the LEDs fail to light, carefully check the supply polarity. If the power supply connections have been accidentally reversed, internal fuses will have blown to protect the unit.

Spare fuses are contained within the radio, see ‘Spare Fuses’ on page 321 for instructions on how to locate and replace the fuses.

## External Power Supplies

The following external power supplies are available from 4RF as accessories:

| Part Number | Part Description |
|---|---|
| APSB-P230-030-24-TS | 4RF SR+ Acc, PSU, 230 VAC, 30W, 24 VDC, -10 to +60C |
| APSB-P230-048-24-TE | 4RF SR+ Acc, PSU, 230 VAC, 48W, 24 VDC, -20 to +75C |
| APSB-P230-060-24-TS | 4RF SR+ Acc, PSU, 230 VAC, 60W, 24 VDC, -10 to +60C |
| APSB-P48D-050-24-TA | 4RF SR+ Acc, PSU, 48 VDC, 50W, 24 VDC, 0 to +50C |

# 7. Managing the Radio

## SuperVisor

The Aprisa SRi contains an embedded web server application (SuperVisor) to enable element management with any major web browser (such as Mozilla Firefox or Microsoft® Internet Explorer).

SuperVisor enables operators to configure and manage the Aprisa SRi base station radio and remote radios over the radio link.

The key features of SuperVisor are:

- Full element management, configuration and diagnostics
- Manage the entire network from the Base Station (remote management of elements)
- Managed network software distribution and upgrades
- Performance and alarm monitoring of the entire network, including alarm states, time-stamped events, etc.
- View and set standard radio configuration parameters including frequencies, transmit power, channel access, serial, Ethernet port settings
- Set and view security parameters
- User management
- Operates over a secure HTTPS session on the access connection to the base station

## PC Requirements for SuperVisor

SuperVisor requires the following minimum PC requirements:

| Browser | Operating System | Processor | RAM |
|---|---|---|---|
| Internet Explorer 9<br>Does not support config file upload from PC | MS-Windows Vista<br>Service Pack 2 | 1 GHz processor | 2 GB Ram |
| Internet Explorer 10<br>(recommended minimum browser) | MS-Windows 7<br>Service Pack 1 | 1 GHz processor | 2 GB Ram |
| Internet Explorer 11 | MS-Windows 8.1 | 1 GHz processor | 2 GB Ram |
| Mozilla Firefox (MS-Windows) | MS-Windows XP<br>Service Pack 2 | 1 GHz processor, Pentium 4 and above | 1 GB Ram |
| Mozilla Firefox (Linux) | Gnome desktop 2.18 and above | 1 GHz processor, Pentium 4 and above | 1 GB Ram |
| Mozilla Firefox (Apple Mac)<br>(4RF does not support retina displays) | Mac OS X 10.6 | 1 GHz processor, Pentium 4 and above | 1 GB Ram |

**Note 1:** 4RF does not support Windows 10 Edge, Google Chrome, Opera or Apple Safari browsers but when they have been used, they have worked correctly.

# Connecting to SuperVisor

The predominant management connection to the Aprisa SRi radio is with an Ethernet interface using standard IP networking. There should be only one Ethernet connection from the base station to the management network.

The Aprisa SRi has a factory default IP address of 169.254.50.10 with a subnet mask of 255.255.0.0. This is an IPv4 Link Local (RFC3927) address which simplifies the connection to a PC.

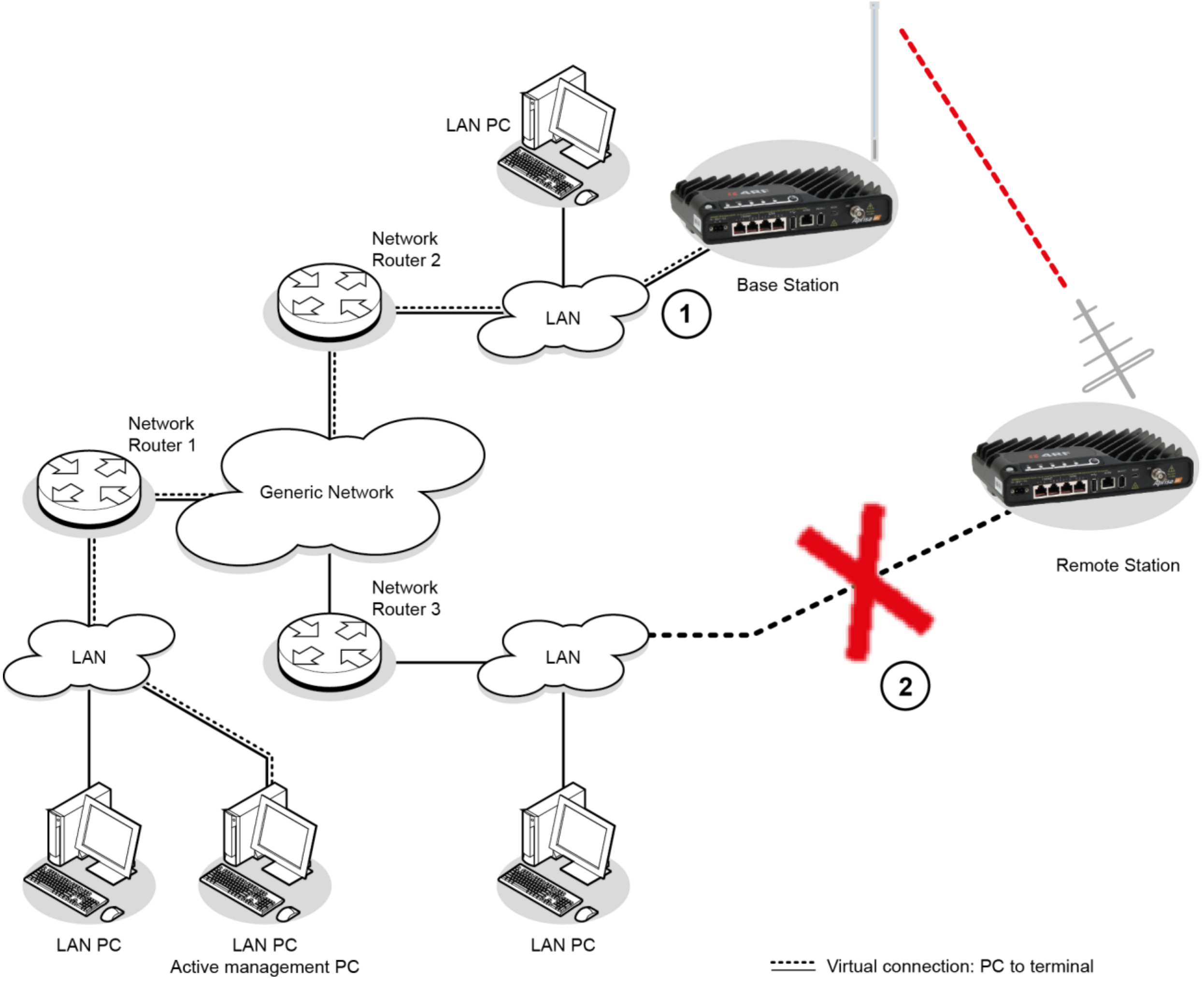
Each radio in the network must be set up with a unique IP address on the same subnet.

**To change the Aprisa SRi IP address:**

1. Set up your PC for a compatible IP address e.g. 169.254.50.1 with a subnet mask of 255.255.0.0.
2. Connect your PC network port to one of the Aprisa SRi Ethernet ports.
3. Open a browser and enter http://169.254.50.10.
4. Login to the radio with the default Username ‘admin’ and Password ‘admin’.
5. Change the IP address to conform to the network plan in use.

## Management PC Connection

The active management PC must only have one connection to the network as shown by path ①. There should not be any alternate path that the active management PC can use via an alternate router or alternate LAN that would allow the management traffic to be looped as shown by path ②.



When logging into a network, it is important to understand the relationship between the Local Radio and the Remote Radios.

The Local Radio is the radio that your IP network is physically connected to.

If the Local Radio is a base station, SuperVisor manages the base station and all the remote radios in the network.

If the Local Radio is a remote radio, SuperVisor only manages the remote radio logged into.

If the user is at the remote radio and connects SuperVisor directly to the remote radio via their computer, all relevant features are still available. This includes the ability to monitor the 'Last received packet RSSI. If ICMP is enabled on the base station, the user will also be able to ping the base station to confirm the connectivity.

## PC Settings for SuperVisor

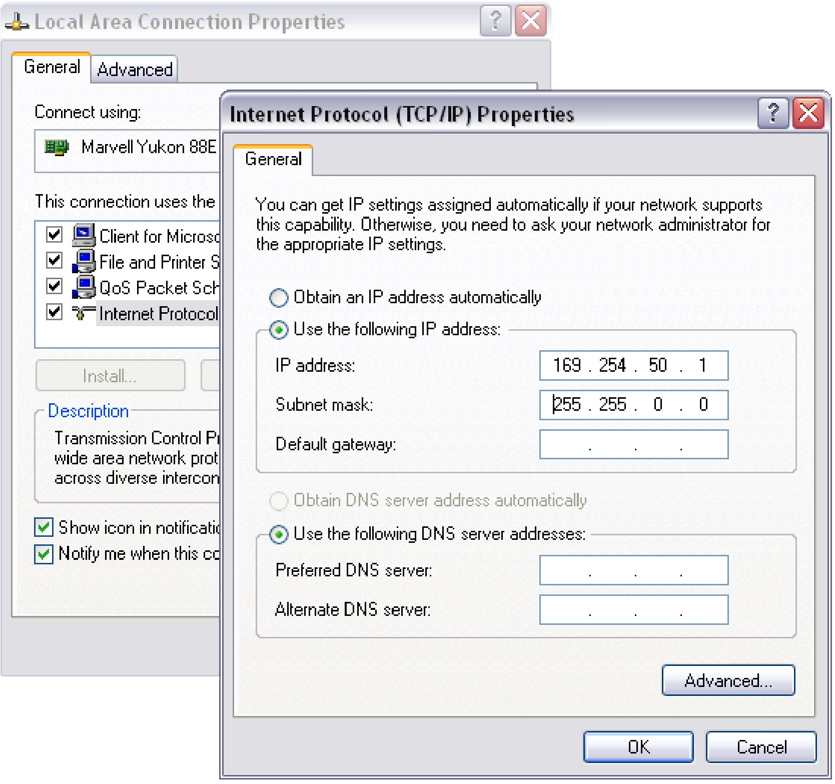
**To change the PC IP address:**

If your PC has previously been used for other applications, you may need to change the IP address and the subnet mask settings. You will require Administrator rights on your PC to change these.

Windows XP example:

1. Open the ‘Control Panel’.
2. Open ‘Network Connections’ and right click on the ‘Local Area Connection’ and select ‘Properties’.
3. Click on the ‘General’ tab.
4. Click on ‘Internet Protocol (TCP/IP)’ and click on properties.
5. Enter the IP address and the subnet mask (example as shown).
6. Click ‘OK’ then close the Control Panel.

If the radio is on a different subnet from the network the PC is on, set the PC default gateway address to the network gateway address which is the address of the router used to connect the subnets (for details, consult your network administrator).



Local Area Connection Properties

General | Advanced

Connect using:

Marvell Yukon 88E

This connection uses the

☑ Client for Microso

☑ File and Printer S

☑ QoS Packet Sch

☑ Internet Protocol

Install...

Description

Transmission Control P
wide area network prot
across diverse intercon

☑ Show icon in notificati

☑ Notify me when this co

Internet Protocol (TCP/IP) Properties

General

You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

○ Obtain an IP address automatically

● Use the following IP address:

IP address: 169 . 254 . 50 . 1

Subnet mask: 255 . 255 . 0 . 0

Default gateway: . . .

○ Obtain DNS server address automatically

● Use the following DNS server addresses:

Preferred DNS server: . . .

Alternate DNS server: . . .

Advanced...

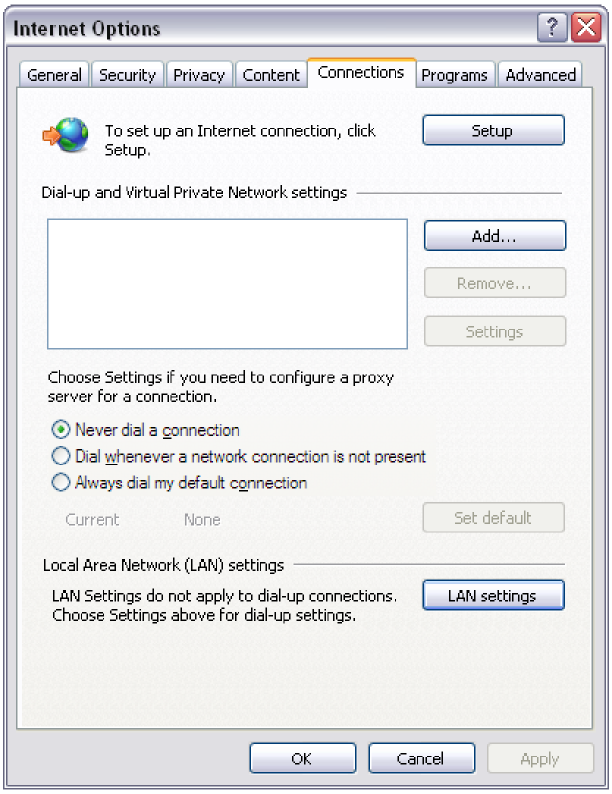
OK | Cancel

**To change the PC connection type:**

If your PC has previously been used with Dial-up connections, you may need to change your PC Internet Connection setting to ‘Never dial a connection’.

Windows Internet Explorer 8 example:

1. Open Internet Explorer.
2. Open the menu item Tools > Internet Options and click on the ‘Connections’ tab.
3. Click the ‘Never dial a connection’ option.



Internet Options

To set up an Internet connection, click Setup.

Dial-up and Virtual Private Network settings

Choose Settings if you need to configure a proxy server for a connection.

● Never dial a connection

○ Dial whenever a network connection is not present

○ Always dial my default connection

Current None

Local Area Network (LAN) settings

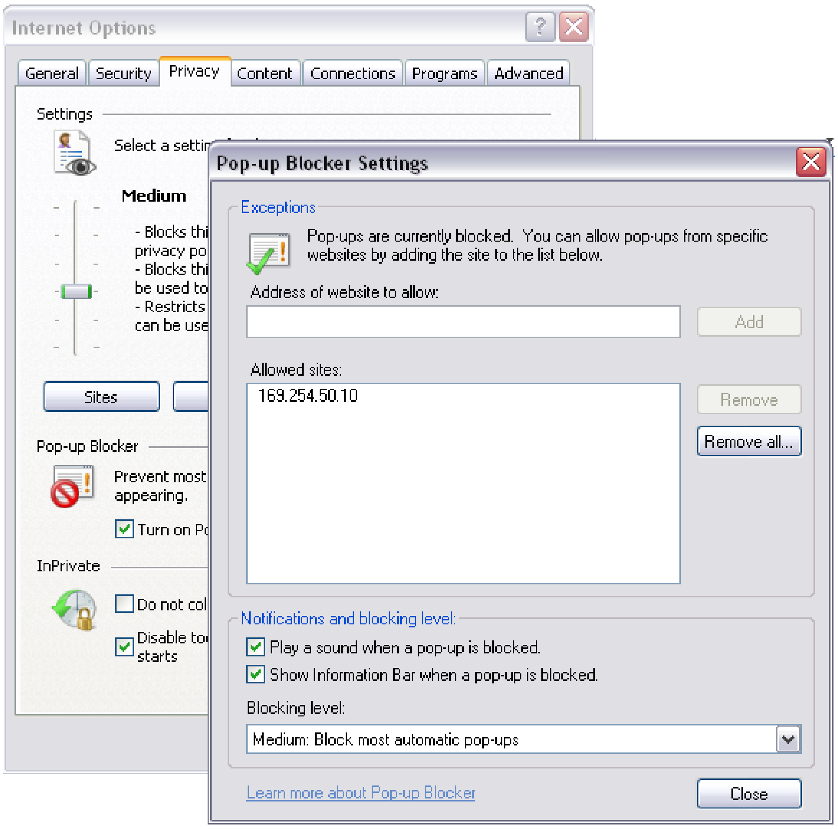
LAN Settings do not apply to dial-up connections. Choose Settings above for dial-up settings.

### To change the PC pop-up status:

Some functions within SuperVisor require Pop-ups enabled e.g. saving a MIB

Windows Internet Explorer 8 example:

1. Open Internet Explorer.
2. Open the menu item Tools > Internet Options and click on the ‘Privacy’ tab.
3. Click on ‘Pop-up Blocker Settings’.
4. Set the ‘Address of Web site to allow’ to the radio address or set the ‘Blocking Level’ to ‘Low: Allow Pop-ups from secure sites’ and close the window.



Pop-ups are currently blocked. You can allow pop-ups from specific websites by adding the site to the list below.

Address of website to allow:

Allowed sites: 169.254.50.10

☑ Play a sound when a pop-up is blocked.

☑ Show Information Bar when a pop-up is blocked.

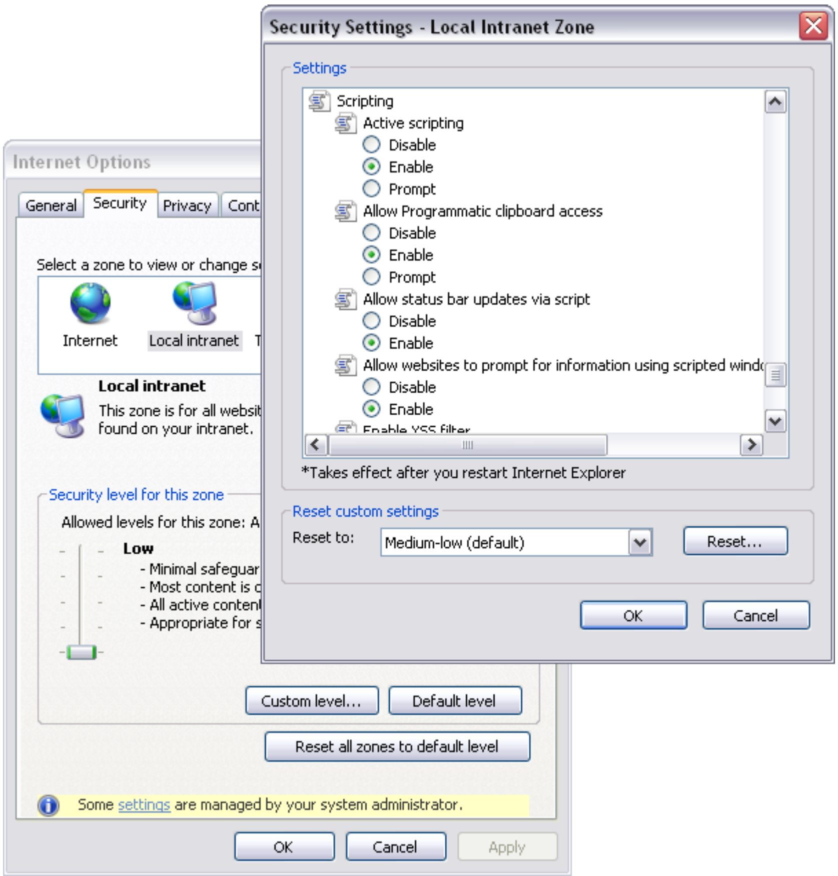
Blocking level: Medium: Block most automatic pop-ups

**To enable JavaScript in the web browser:**

Some functions within SuperVisor require JavaScript in the web browser to be enabled.

Windows Internet Explorer 8 example:

1. Open Internet Explorer.
2. Open the menu item Tools > Internet Options and click on the ‘Security’ tab.
3. Click on ‘Local Intranet’.
4. Click on ‘Custom Level’.
5. Scroll down until you see section labeled ‘Scripting’.
6. Under ‘Active Scripting’, select ‘Enable’.



Security Settings - Local Intranet Zone

Settings

Scripting
- Active scripting
  - ○ Disable
  - ● Enable
  - ○ Prompt
- Allow Programmatic clipboard access
  - ○ Disable
  - ● Enable
  - ○ Prompt
- Allow status bar updates via script
  - ○ Disable
  - ● Enable
- Allow websites to prompt for information using scripted windo
  - ○ Disable
  - ● Enable
- Enable XSS filter

*Takes effect after you restart Internet Explorer

Reset custom settings

Reset to: Medium-low (default)

Internet Options

Select a zone to view or change s

Local intranet

This zone is for all websit
found on your intranet.

Security level for this zone

Allowed levels for this zone: A

Low
- Minimal safeguar
- Most content is c
- All active conten
- Appropriate for s

Some settings are managed by your system administrator.

## Login to SuperVisor

The maximum number of concurrent users that can be logged into a radio is 6.

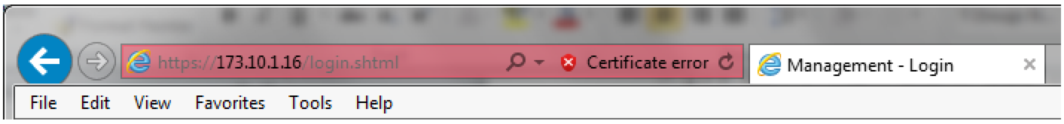
If SuperVisor is inactive for a period defined by the Inactivity Timeout option (see 'Maintenance > General' on page 231), the radio will automatically logout the user.

**To login to SuperVisor:**

1. Open your web browser and enter the IP address of the radio.

If you haven't assigned an IP address to the radio, use the factory default IP address of 169.254.50.10 with a subnet mask of 255.255.0.0.

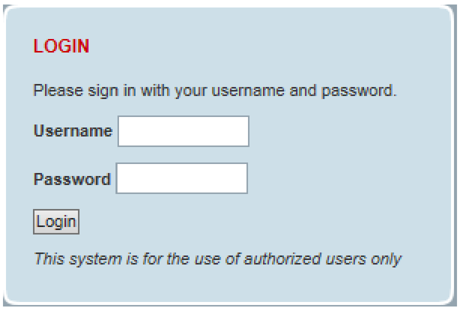
If you don't know the IP address of the radio, you can determine it using the Command Line Interface (see 'Command Line Interface' on page 306).



**Note**: The Aprisa SRi has a randomly generated unique self-signed ECC256 security certificate which may cause the browser to prompt a certificate warning. It is safe to ignore the warning and continue. The valid certificate is 'Issued By: 4RF-APRISA' which can be viewed in the browser.

2. Login with the Username and Password assigned to you.

If unique usernames and passwords have not yet been configured, use the default username 'admin' and password 'admin'.


LOGIN

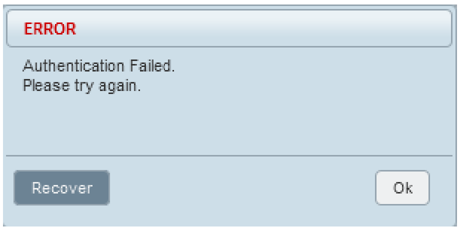
Please sign in with your username and password.

Username

Password

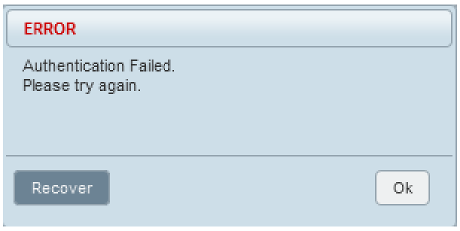
*This system is for the use of authorized users only*

If the login fails, the pop-up will be displayed.


ERROR

Authentication Failed.
Please try again.

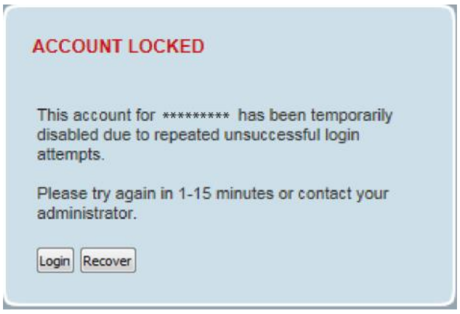
SuperVisor will display a warning popup upon multiple consecutive failed login attempts on the same account.



ERROR

Authentication Failed.
Please try again.

SuperVisor has login protection options which provide protection against unsuccessful login retries (see Security > Users 'Login Protection Mode' on page 211). If login protection is active and a login attempt failed due to temporary lockout of the account (Level 1 or Level 2 lockout), SuperVisor will display an 'Account Locked' message.



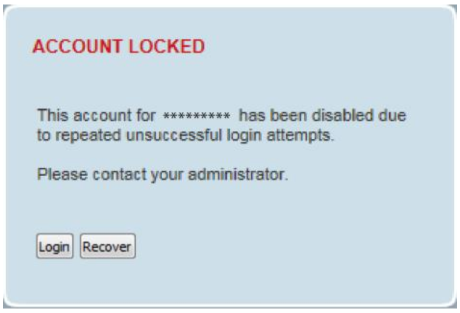
ACCOUNT LOCKED

This account for ********* has been temporarily disabled due to repeated unsuccessful login attempts.

Please try again in 1-15 minutes or contact your administrator.

Login

If a login attempt failed due to permanent lockout of the account (continued failed login attempts even after levels 1 and 2 lockout periods), SuperVisor will display an 'Account Locked' message.



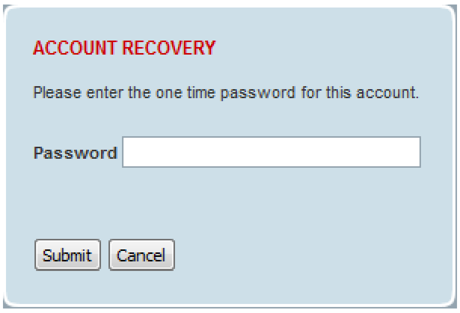
ACCOUNT LOCKED

This account for ********* has been disabled due to repeated unsuccessful login attempts.

Please contact your administrator.

Recover

If a login attempt failed due to permanent lockout of the account or the Admin password is unknown, click the ‘Recover’ button to start the recovery process.

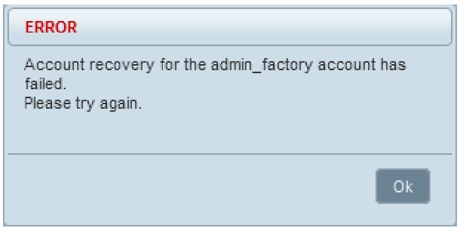


ACCOUNT RECOVERY

Please enter the one time password for this account.

Password

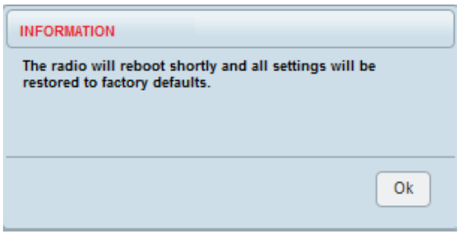
If the user account is not an ADMIN account, or if the account does not have an associated ‘Standard OPT’ password entered (see ‘One-time Password Recovery’ on page 217), SuperVisor will display an error message.



ERROR

Account recovery for the admin_factory account has failed.
Please try again.

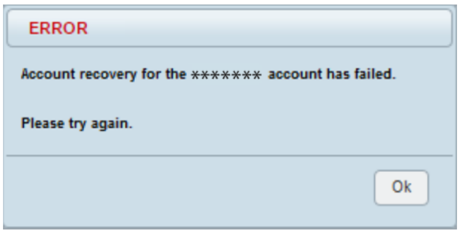
If a factory password was verified successfully during the account recover process, SuperVisor will display a message indicating that the radio will be reset to factory defaults and rebooted.



INFORMATION

The radio will reboot shortly and all settings will be restored to factory defaults.

If the submitted password for the account recovery process was invalid, SuperVisor will display a message indicating that the recovery process has failed.

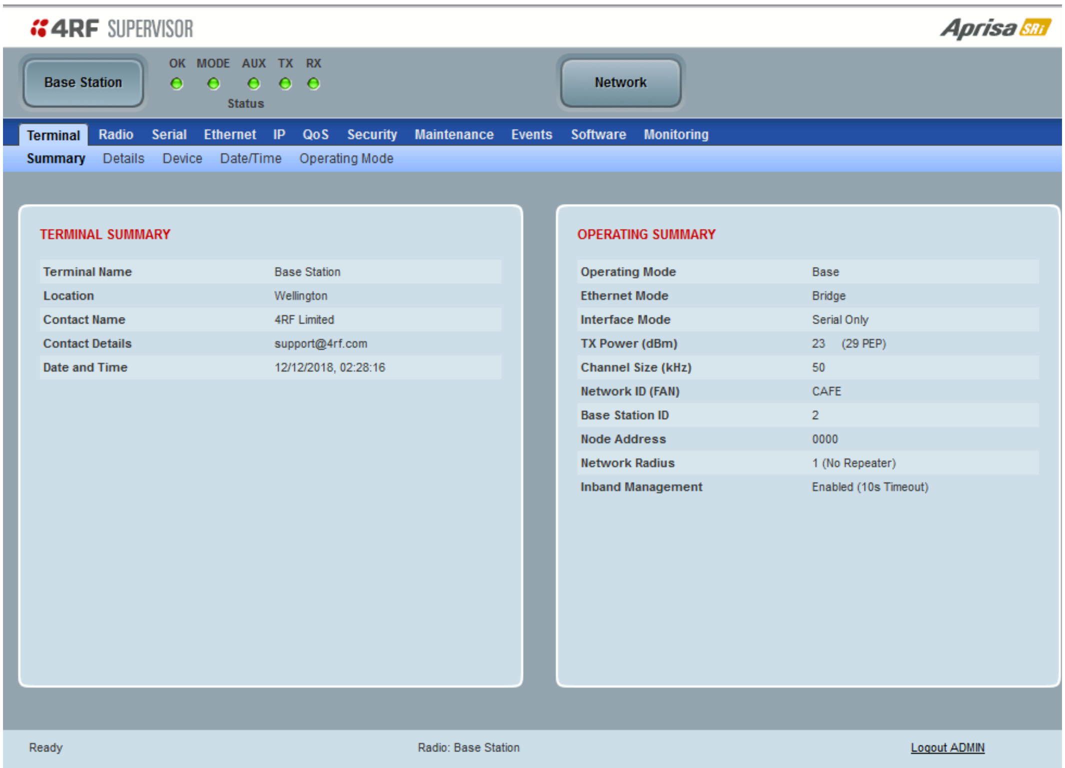


ERROR

Account recovery for the ******* account has failed.

Please try again.

If the login is successful, the opening Terminal > Summary page will be displayed.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary Details Device Date/Time Operating Mode

TERMINAL SUMMARY

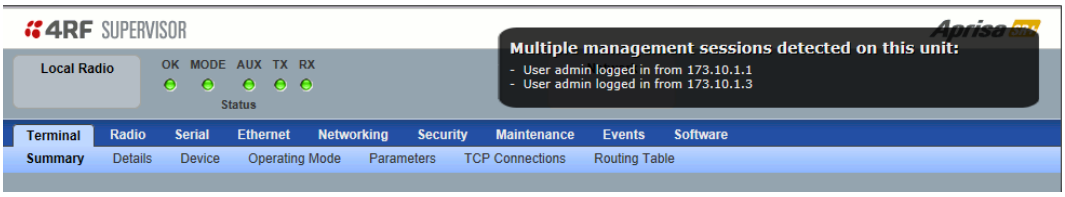
| | |
|---|---|
| Terminal Name | Base Station |
| Location | Wellington |
| Contact Name | 4RF Limited |
| Contact Details | support@4rf.com |
| Date and Time | 12/12/2018, 02:28:16 |

OPERATING SUMMARY

| | |
|---|---|
| Operating Mode | Base |
| Ethernet Mode | Bridge |
| Interface Mode | Serial Only |
| TX Power (dBm) | 23 (29 PEP) |
| Channel Size (kHz) | 50 |
| Network ID (FAN) | CAFE |
| Base Station ID | 2 |
| Node Address | 0000 |
| Network Radius | 1 (No Repeater) |
| Inband Management | Enabled (10s Timeout) |

Ready Radio: Base Station Logout ADMIN

If there is more than one user logged into the same radio, the Multiple Management Sessions popup will show the usernames and IP addresses of the users. This popup message will display until 5 seconds after the cursor is moved. The event log will also record the users logged into the radio or logged out the radio.


4RF SUPERVISOR
Aprisa SRi
Local Radio
OK MODE AUX TX RX
Status
Terminal Radio Serial Ethernet Networking Security Maintenance Events Software
Summary Details Device Operating Mode Parameters TCP Connections Routing Table

Multiple management sessions detected on this unit:

- User admin logged in from 173.10.1.1
- User admin logged in from 173.10.1.3

## Logout of SuperVisor

As the maximum number of concurrent users that can be logged into a radio is 6, not logging out correctly can restrict access to the radio until after the timeout period (30 minutes).

Logging out from a radio will logout all users logged in with the same username.

If the SuperVisor window is closed without logging out, the radio will automatically log the user out after a timeout period of 3 minutes.

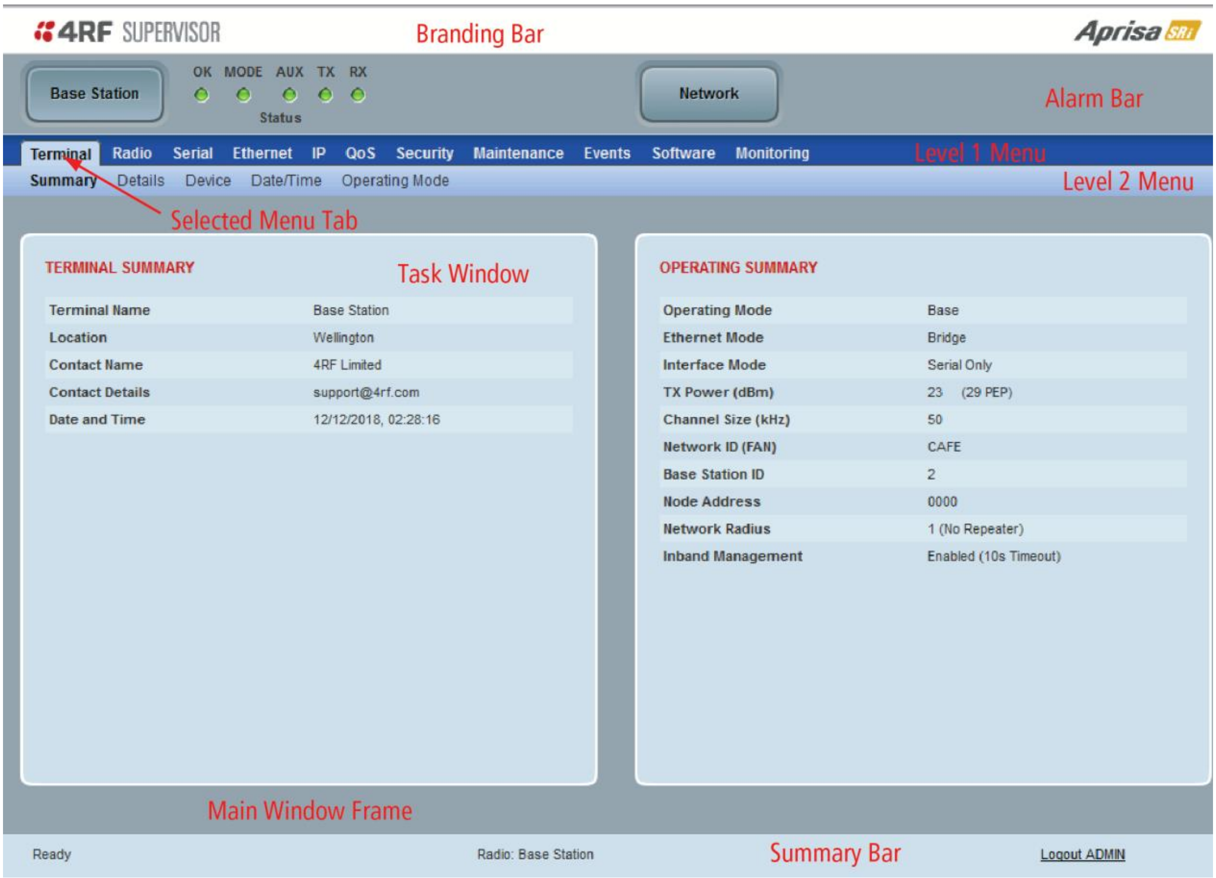
**To logout of SuperVisor:**

Click on the ‘Logout’ button on the Summary Bar.

# SuperVisor Page Layout

## Standard Radio

The following shows the components of the SuperVisor page layout for a standard radio:



TERMINAL SUMMARY

| | |
|---|---|
| Terminal Name | Base Station |
| Location | Wellington |
| Contact Name | 4RF Limited |
| Contact Details | support@4rf.com |
| Date and Time | 12/12/2018, 02:28:16 |

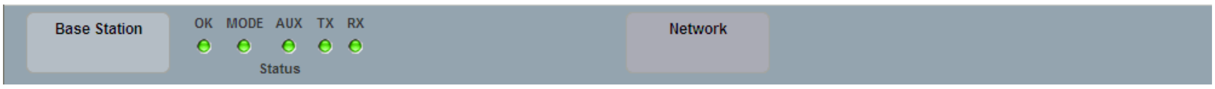
OPERATING SUMMARY

| | |
|---|---|
| Operating Mode | Base |
| Ethernet Mode | Bridge |
| Interface Mode | Serial Only |
| TX Power (dBm) | 23 (29 PEP) |
| Channel Size (kHz) | 50 |
| Network ID (FAN) | CAFE |
| Base Station ID | 2 |
| Node Address | 0000 |
| Network Radius | 1 (No Repeater) |
| Inband Management | Enabled (10s Timeout) |

## SuperVisor Branding Bar

The branding bar at the top of the SuperVisor frame shows the branding of SuperVisor on the left and the product branding on the right.

## SuperVisor Alarm Bar



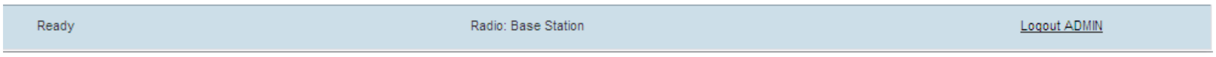
The alarm bar shows the name of the radio terminal that SuperVisor is logged into (the local radio) on the left.

If the local radio is a base station, the page shows the name of the current remote radio (the remote radio) on the right. SuperVisor will manage all the remote radios in the network.

If the local radio is a remote radio, the page shows the name of the remote radio on the left. The right side of the Alarm Bar will be blank.

The LED alarm indicators reflect the status of the front panel LEDs on the radio.

## SuperVisor Summary Bar



The summary bar at the bottom of the page shows:

| Position | Function |
|---|---|
| Left | Busy - SuperVisor is busy retrieving data from the radio that SuperVisor is logged into.<br>Ready - SuperVisor is ready to manage the radio. |
| Middle | Displays the name of the radio terminal that SuperVisor is currently managing. |
| Right | The access level logged into SuperVisor. This label also doubles as the SuperVisor logout button. |

# SuperVisor Extended Network Management (EXM)

Extended Network Management (EXM) extends SuperVisor management beyond the single radio network providing configuration and monitoring to other Aprisa SR family products down the RF path from the radio logged into. All radios that are then managed from one login become part of the extended network radio list.

A typical use of this new feature is where an Aprisa SRi radio network is connected to the 'tail end' of an Aprisa SR+ radio network where the Aprisa SRi base station is cable connected to the Ethernet port of an Aprisa SR+ remote radio. The connection between the Network Operations Centre (NOC) to the Aprisa SRi base station would be via the Over-The-Air path of the Aprisa SR+ base station's network.

## Benefits Of EXM

Some of the benefits that will be seen from this enhancement include:

- Ability to use SuperVisor to manage any 4RF compatible radio units via the 'closest radio station'
- A user can now simply establish a local connection with the closest radio and navigate to manage another radio down the RF path from the radio logged into.
- Ability to use SuperVisor to perform 'inverse remote management' – i.e. to manage the base station from any of its remote radios
- When on site at a remote location, the user can now login to the remote radio and navigate to manage its base station
- A user can now add any IP connectable radio to a SuperVisor session and utilize the Network Status monitoring feature to monitor radios network wide
- SuperVisor can be left running long term on the 'Network Status > Summary' page to have a summarized status view of the whole monitored network

The EXM feature will not be suitable for customers who use Port forwarding NAT configuration or One to One NAT in their existing setup.

## Extended Network Management (EXM) Setup

1. Enable Network Extension Mode on all radios required in the extended network radio list including the radio logged into, the remote radio being used to extend management, the destination base station and any remote radios off that base station requiring management. See ‘Security > Setup’ on page 202 for the Network Extension Mode setting.

2. Ensure that the Network ID is the same on all radios in the extended network radio list (see ‘Network ID’ on page 105).

3. Ensure that the Key Encryption Key Type, Key Encryption Key Size and the Key Encryption Key are the same on all radios in the extended network radio list (see ‘Security > Setup’ on page 202).

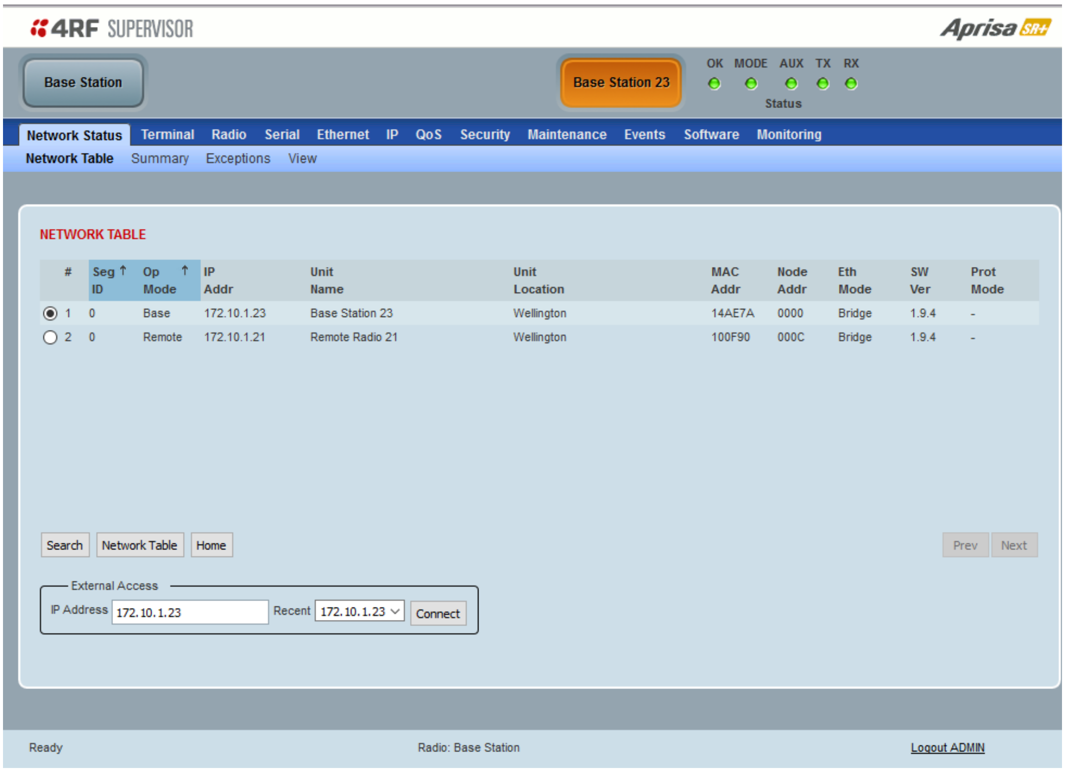
4. Click on the Network button on SuperVisor Alarm Bar (see ‘Network Status > Network Table’ on page 297).

5. In the External Access box, enter the IP address of the external radio and click the Connect button.

If this connection is successful:

- The Network Button will show the name of the radio connected to
- The LEDs next to the Network button will display the status of the radio connected to
- Clicking any top level menu after the connection is established will open the page for the radio connected to

The Network Table shows the radio connected to. To see the complete Network Table of the radio connected to, click the Network Table button.



NETWORK TABLE

| | # | Seg ↑ ID | Op ↑ Mode | IP Addr | Unit Name | Unit Location | MAC Addr | Node Addr | Eth Mode | SW Ver | Prot Mode |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | 1 | 0 | Base | 172.10.1.23 | Base Station 23 | Wellington | 14AE7A | 0000 | Bridge | 1.9.4 | - |
| ○ | 2 | 0 | Remote | 172.10.1.21 | Remote Radio 21 | Wellington | 100F90 | 000C | Bridge | 1.9.4 | - |

External Access
IP Address 172.10.1.23 Recent 172.10.1.23 Connect

Ready Radio: Base Station Logout ADMIN

## SuperVisor Menu

The following is a list of SuperVisor top level menu items:

| **Local Terminal** | **Network** |
|---|---|
| | Network Table |
| Terminal | Summary |
| Radio | Exceptions |
| Serial | View |
| Ethernet | |
| IP | |
| QoS | |
| Security | |
| Maintenance | |
| Events | |
| Software | |
| Monitoring | |

### SuperVisor Parameter Settings

Changes to parameters settings have no effect until the 'Save' button is clicked.

Click the 'Save' button to apply the changes or 'Cancel' button to restore the current value.

## SuperVisor Menu Access

The SuperVisor menu has varying access levels dependent on the login User Privileges.

The following is a list of all possible SuperVisor menu items versus user privileges:

*Terminal Settings Menu Items*

| Menu Item | View | Technician | Engineer | Admin |
|---|---|---|---|---|
| Terminal > Summary | Read-Only | Read-Only | Read-Only | Read-Only |
| Terminal > Details | Read-Only | Read-Only | Read-Only | Read-Only |
| Terminal > Device | No Access | Read-Write | Read-Write | Read-Write |
| Terminal > Date / Time | Read-Only | Read-Only | Read-Only | Read-Only |
| Terminal > Operating Mode | No Access | Read-Write | Read-Write | Read-Write |
| Radio > Radio Summary | Read-Only | Read-Only | Read-Only | Read-Only |
| Radio > Channel Summary | Read-Only | Read-Only | Read-Only | Read-Only |
| Radio > Zone Summary | Read-Only | Read-Only | Read-Only | Read-Only |
| Radio > Radio Setup | No Access | Read-Write | Read-Write | Read-Write |
| Radio > Channel Setup | No Access | Read-Write | Read-Write | Read-Write |
| Radio > Zone Setup | No Access | Read-Write | Read-Write | Read-Write |
| Radio > Advanced Setup | No Access | Read-Write | Read-Write | Read-Write |
| Serial > Summary | Read-Only | Read-Only | Read-Only | Read-Only |
| Serial > Port Setup | No Access | Read-Write | Read-Write | Read-Write |
| Ethernet > Summary | Read-Only | Read-Only | Read-Only | Read-Only |
| Ethernet > Port Setup | No Access | Read-Write | Read-Write | Read-Write |
| Ethernet > L2 Filtering | No Access | No Access | Read-Write | Read-Write |
| Ethernet > VLAN | No Access | No Access | Read-Write | Read-Write |
| IP > IP Summary | Read-Only | Read-Only | Read-Only | Read-Only |
| IP > Terminal Server Summary | Read-Only | Read-Only | Read-Only | Read-Only |
| IP > IP Setup | No Access | Read-Write | Read-Write | Read-Write |
| IP > Terminal Server Setup | No Access | Read-Write | Read-Write | Read-Write |
| IP > L3 Filtering | No Access | No Access | Read-Write | Read-Write |
| IP > IP Routes | No Access | No Access | Read-Write | Read-Write |
| IP > NAT | No Access | No Access | Read-Write | Read-Write |
| QoS > Summary | Read-Only | Read-Only | Read-Only | Read-Only |
| QoS > Traffic Priority | No Access | No Access | Read-Write | Read-Write |
| QoS > Traffic Classification | No Access | No Access | Read-Write | Read-Write |
| Security > Summary | Read-Only | Read-Only | Read-Only | Read-Only |
| Security > Setup | No Access | No Access | Read-Write | Read-Write |
| Security > Users | No Access | No Access | No Access | Read-Write |
| Security > RADIUS | No Access | No Access | No Access | Read-Write |
| Security > SNMP | No Access | No Access | No Access | Read-Write |
| Security > Manager | No Access | No Access | Read-Write | Read-Write |
| Security > Distribution | No Access | No Access | Read-Write | Read-Write |
| Maintenance > Summary | Read-Only | Read-Only | Read-Only | Read-Only |

| Menu Item | View | Technician | Engineer | Admin |
|---|---|---|---|---|
| Maintenance > General | No Access | Read-Write | Read-Write | Read-Write |
| Maintenance > Modem | No Access | Read-Write | Read-Write | Read-Write |
| Maintenance > Defaults | No Access | No Access | No Access | Read-Write |
| Maintenance > Licence | No Access | No Access | Read-Write | Read-Write |
| Maintenance > Files | No Access | No Access | Read-Write | Read-Write |
| Maintenance > Advanced | No Access | No Access | Read-Write | Read-Write |
| Events > Alarm Summary | Read-Only | Read-Only | Read-Only | Read-Only |
| Events > Event History | Read-Only | Read-Only | Read-Only | Read-Only |
| Events > Events Setup | No Access | No Access | Read-Write | Read-Write |
| Events > Traps Setup | No Access | No Access | Read-Write | Read-Write |
| Events > Alarm I/O Setup | Read-Only | Read-Only | Read-Write | Read-Write |
| Events > Event Action Setup | No Access | No Access | Read-Write | Read-Write |
| Events > Defaults | No Access | No Access | Read-Write | Read-Write |
| Software > Summary | Read-Only | Read-Only | Read-Only | Read-Only |
| Software > Setup | No Access | No Access | Read-Write | Read-Write |
| Software > File Transfer | No Access | No Access | Read-Write | Read-Write |
| Software > Manager | No Access | No Access | Read-Write | Read-Write |
| Software > Remote Distribution | No Access | No Access | Read-Write | Read-Write |
| Software > Remote Activation | No Access | No Access | Read-Write | Read-Write |
| Monitoring > Terminal | Read-Only | Read-Only | Read-Only | Read-Only |
| Monitoring > Serial | Read-Only | Read-Only | Read-Only | Read-Only |
| Monitoring > Ethernet | Read-Only | Read-Only | Read-Only | Read-Only |
| Monitoring > Radio | Read-Only | Read-Only | Read-Only | Read-Only |
| Monitoring > Interface | Read-Only | Read-Only | Read-Only | Read-Only |
| Monitoring > User Selected | Read-Only | Read-Only | Read-Only | Read-Only |
| Monitoring > TCP Connections | Read-Only | Read-Only | Read-Only | Read-Only |
| Monitoring > Routing Table | Read-Only | Read-Only | Read-Only | Read-Only |
| Monitoring > Address Tables | Read-Only | Read-Only | Read-Only | Read-Only |
| Monitoring > NAT | Read-Only | Read-Only | Read-Only | Read-Only |

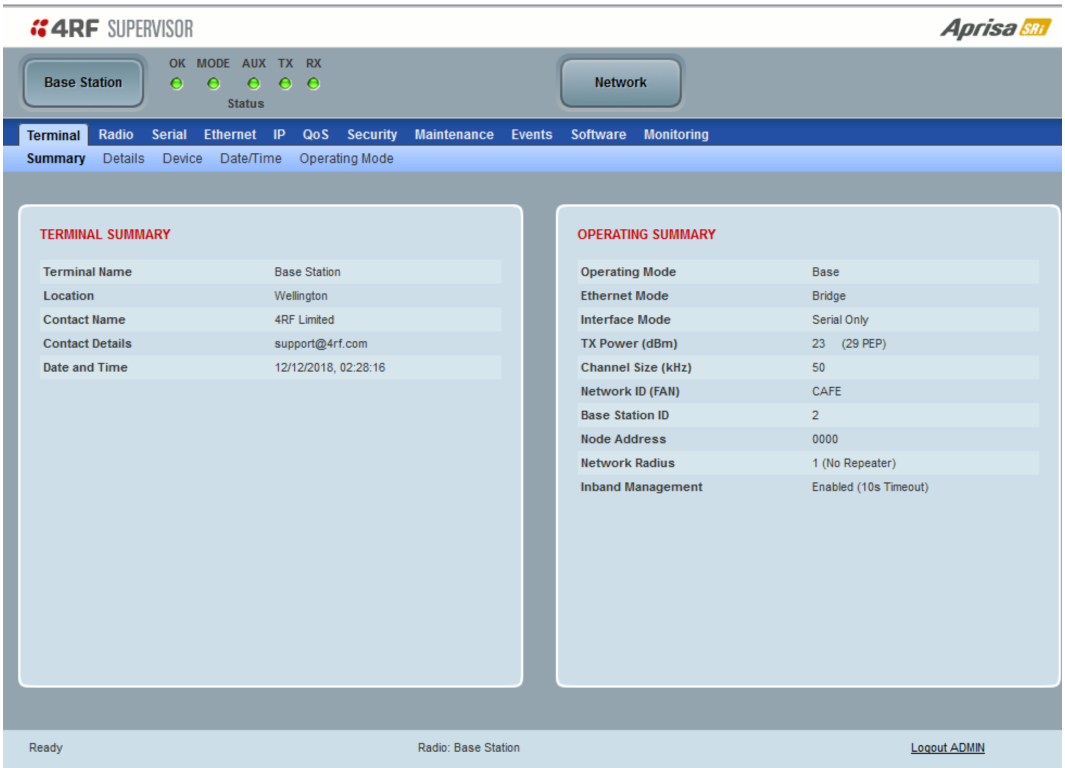
*Network Settings Menu Items*

| Menu Item | View | Technician | Engineer | Admin |
|---|---|---|---|---|
| Network Table | Read-Only | Read-Only | Read-Only | Read-Only |
| Summary | Read-Only | Read-Only | Read-Only | Read-Only |
| Exceptions | Read-Only | Read-Only | Read-Only | Read-Only |
| View | Read-Only | Read-Only | Read-Only | Read-Only |

# SuperVisor

## Terminal

### Terminal > Summary


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary Details Device Date/Time Operating Mode
Ready
Radio: Base Station
Logout ADMIN

TERMINAL SUMMARY

| | |
|---|---|
| Terminal Name | Base Station |
| Location | Wellington |
| Contact Name | 4RF Limited |
| Contact Details | support@4rf.com |
| Date and Time | 12/12/2018, 02:28:16 |

OPERATING SUMMARY

| | |
|---|---|
| Operating Mode | Base |
| Ethernet Mode | Bridge |
| Interface Mode | Serial Only |
| TX Power (dBm) | 23 (29 PEP) |
| Channel Size (kHz) | 50 |
| Network ID (FAN) | CAFE |
| Base Station ID | 2 |
| Node Address | 0000 |
| Network Radius | 1 (No Repeater) |
| Inband Management | Enabled (10s Timeout) |

#### TERMINAL SUMMARY

This page displays the current settings for the Terminal parameters. See ‘Terminal > Details’ on page 100, ‘Terminal > Device’ on page 102 and ‘Terminal > Operating Mode’ on page 110 for setting details.

#### OPERATING SUMMARY

*Operating Mode*

This parameter displays the current Operating Mode i.e. if the radio is operating as a base station or remote radio and the network operating mode of Bridge Mode or Router Mode.

*Interface Mode*

This parameter displays the Interfaces available for traffic on the radio such as Ethernet and Serial. For Ethernet availability on the radio see ‘Maintenance > Licence’ on page 237.

*TX Power (dBm)*

This parameter displays the current Transmit Power in dBm.

*Channel Size (kHz)*

This parameter displays the current Channel Size in kHz.

*Network ID*

This parameter is the network ID of this base station node and its remote radios in the network. The entry is four hex chars (not case sensitive).

*Base Station ID*

This parameter identifies the base station. All radios operating to the base station in the same network must use the same Base Station ID setting.

It is especially important to set different values for each network when two or more networks using the same frequencies are operating with some overlapping coverage. The entry is an integer from 1 to 8.

*Node Address*

The Node Address of the base station is 0000.

If the Node Address shown is FFFE, this radio is a remote radio but has not been registered with the base station.

The base station will automatically allocate a Node Address to all its registered remote radios. This address can be between 000B to 01FE.

*Network Radius*

This parameter indicates a Network Repeaters Proximity setting of ‘No Repeater’ or ‘Base-Repeater’. Not applicable for the Aprisa SRi.

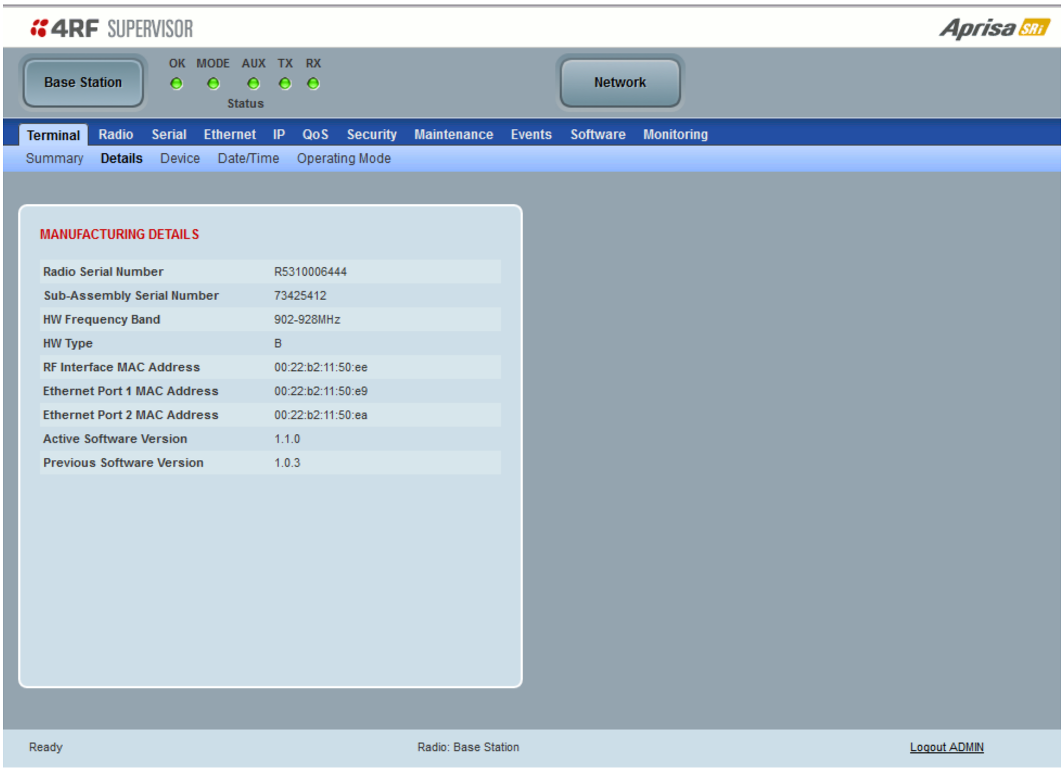
*Inband Management*

This parameter displays the status of the Inband Management option.

*Inband Management Timeout (sec)*

This parameter displays the number of seconds that the base station waits for a response from a remote radio before aborting the Inband Management request.

## Terminal > Details


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary Details Device Date/Time Operating Mode
Ready
Radio: Base Station
Logout ADMIN

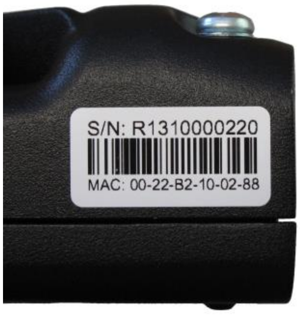
MANUFACTURING DETAILS

| | |
|---|---|
| Radio Serial Number | R5310006444 |
| Sub-Assembly Serial Number | 73425412 |
| HW Frequency Band | 902-928MHz |
| HW Type | B |
| RF Interface MAC Address | 00:22:b2:11:50:ee |
| Ethernet Port 1 MAC Address | 00:22:b2:11:50:e9 |
| Ethernet Port 2 MAC Address | 00:22:b2:11:50:ea |
| Active Software Version | 1.1.0 |
| Previous Software Version | 1.0.3 |

### MANUFACTURING DETAILS

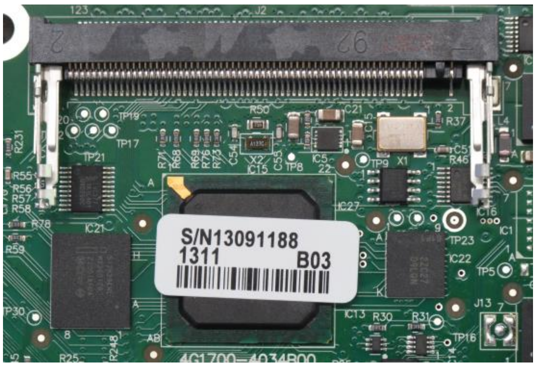
*Radio Serial Number*

This parameter displays the Serial Number of the radio (shown on the enclosure label).



*Sub-Assembly Serial Number*

This parameter displays the Serial Number of the printed circuit board assembly (shown on the PCB label).



*HW Frequency Band*

This parameter displays the hardware radio frequency operating range.

*HW Type*

This parameter displays the hardware board assembly type.

*Radio MAC Address*

This parameter displays the MAC address of the radio (the management Ethernet MAC address).

*Active Software Version*

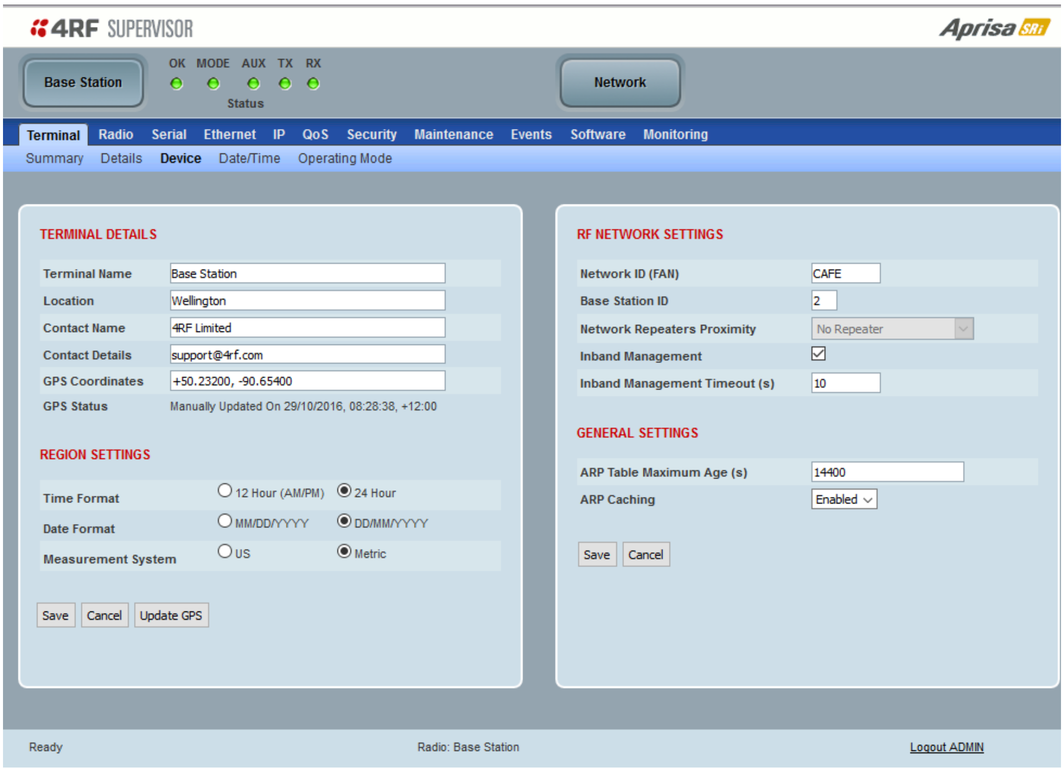
This parameter displays the version of the software currently operating the radio.

*Previous Software Version*

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

A new radio from the factory will display ‘None’ for the Previous SW Version.

## Terminal > Device


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary Details Device Date/Time Operating Mode

TERMINAL DETAILS

| | |
|---|---|
| Terminal Name | Base Station |
| Location | Wellington |
| Contact Name | 4RF Limited |
| Contact Details | support@4rf.com |
| GPS Coordinates | +50.23200, -90.65400 |
| GPS Status | Manually Updated On 29/10/2016, 08:28:38, +12:00 |

REGION SETTINGS

| | | |
|---|---|---|
| Time Format | ○ 12 Hour (AM/PM) | ● 24 Hour |
| Date Format | ○ MM/DD/YYYY | ● DD/MM/YYYY |
| Measurement System | ○ US | ● Metric |

Save Cancel Update GPS

RF NETWORK SETTINGS

| | |
|---|---|
| Network ID (FAN) | CAFE |
| Base Station ID | 2 |
| Network Repeaters Proximity | No Repeater |
| Inband Management | ☑ |
| Inband Management Timeout (s) | 10 |

GENERAL SETTINGS

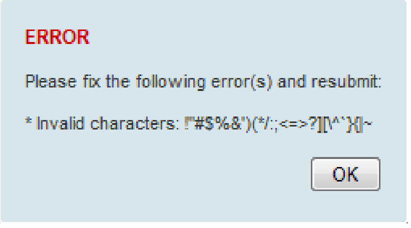
| | |
|---|---|
| ARP Table Maximum Age (s) | 14400 |
| ARP Caching | Enabled |

Save Cancel

Ready Radio: Base Station Logout ADMIN

## TERMINAL DETAILS

The data entry in the next four fields can be up to 40 characters but cannot contain invalid characters. A popup warns of the invalid characters:


ERROR

Please fix the following error(s) and resubmit:

* Invalid characters: !"#$%&')(*/:;<=>?][\^`}{|~

1. Enter the Terminal Name.
2. Enter the Location of the radio.
3. Enter a Contact Name. The default value is ‘4RF Limited’.
4. Enter the Contact Details. The default value is ‘support@4RF.com’.

### *GPS Coordinates*

This parameter sets the GPS Coordinates for the radio location. It can be manually entered and saved or if the radio is fitted with a GPS Receiver, it can be set by clicking on the Update GPS button. The entry is two values of latitude and longitude comma delimited;

- The Latitude value must be a decimal number anywhere from -90 to 90
- The Longitude value must be a decimal number anywhere from -180 to 180

*GPS Status*

This field displays the status of the GPS Receiver if enabled (see ‘

GPS Receiver' on page 145).

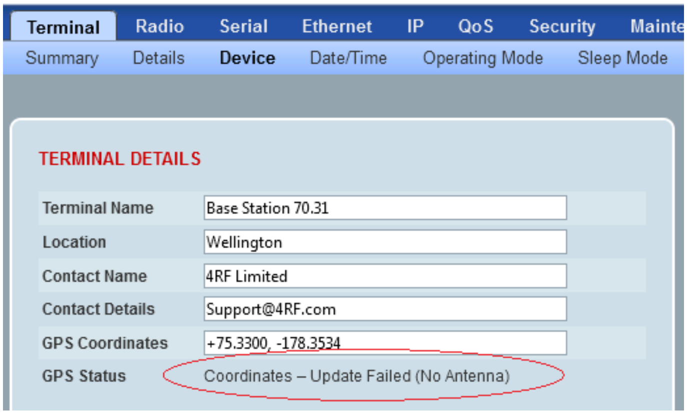
The GPS Horizontal Dilution Of Precision (HDOP) information provides a GPS signal quality rating;

| DOP Value | Rating | Description |
|---|---|---|
| < 1 | Ideal | Highest possible confidence level to be used for applications demanding the highest possible precision at all times. |
| 1-2 | Excellent | At this confidence level, positional measurements are considered accurate enough to meet all but the most sensitive applications. |
| 2-5 | Good | Represents a level that marks the minimum appropriate for making business decisions. Positional measurements could be used to make reliable in-route navigation suggestions to the user. |
| 5-10 | Moderate | Positional measurements could be used for calculations, but the fix quality could still be improved. A more open view of the sky is recommended. |
| 10-20 | Fair | Represents a low confidence level. Positional measurements should be discarded or used only to indicate a very rough estimate of the current location. |
| >20 | Poor | At this level, measurements are inaccurate by as much as 300 meters with a 6-meter accurate device (50 DOP × 6 meters) and should be discarded. |

## Controls

The Update GPS button updates the GPS Coordinates field from the installed USB GPS Receiver.

If the GPS Receiver is enabled but is not operating or not receiving a valid GPS signal, the GPS Status will show 'Update Failed'.



TERMINAL DETAILS

| | |
|---|---|
| Terminal Name | Base Station 70.31 |
| Location | Wellington |
| Contact Name | 4RF Limited |
| Contact Details | Support@4RF.com |
| GPS Coordinates | +75.3300, -178.3534 |
| GPS Status | Coordinates – Update Failed (No Antenna) |

## REGION SETTINGS

### *Time Format*

This parameter sets the time format for all time based results.

The default setting is 24 Hours.

### *Date Format*

This parameter sets the date format for date based results.

The default setting is DD/MM/YYYY.

### *Measurement System*

This parameter sets the unit type for parameters like temperature readings.

The default setting is Metric.

## RF NETWORK DETAILS

### *Network ID*

This parameter sets the network ID of this base station node and its remote radios in the network. The entry is four hexadecimal chars (not case sensitive).

The default setting is CAFE.

### *Base Station ID*

This parameter identifies the base station. All radios operating to the base station in the same network must use the same Base Station ID setting.

It is especially important to set different values for each network when two or more networks using the same frequencies are operating with some overlapping coverage. The entry is an integer from 1 to 8.

### *Network Repeaters Proximity*

This parameter is set in remote radios to indicate the use of peer to peer connections between remotes via the base station. All remote radios in the network must be set the same. This is not applicable for the Aprisa SRi radios.

| Option | Function |
|---|---|
| No Repeater | Use when regular PMP network operation is required. |
| Base Repeater | Use when there is a base-repeater in the network and support of peer to peer connections between remotes via the base station is required. |

The Network Repeaters Proximity options are dependent on the Terminal Operating Mode.

| Operating Mode | Network Repeaters Proximity | Operation |
|---|---|---|
| Base | No Repeater | Regular PMP network operation |
| Base-Repeater | Base-Repeater | If remotes are configured with Network Repeaters Proximity = Base-repeater, then the network will support peer to peer connections between remotes via the base station |
| Remote | No Repeater | This option shall be configured when base station Operating Mode = Base |
| Remote | Base-Repeater | This option shall be configured when base station Operating Mode = Base-Repeater to support peer to peer connections between remotes via the base station |

### *Inband Management*

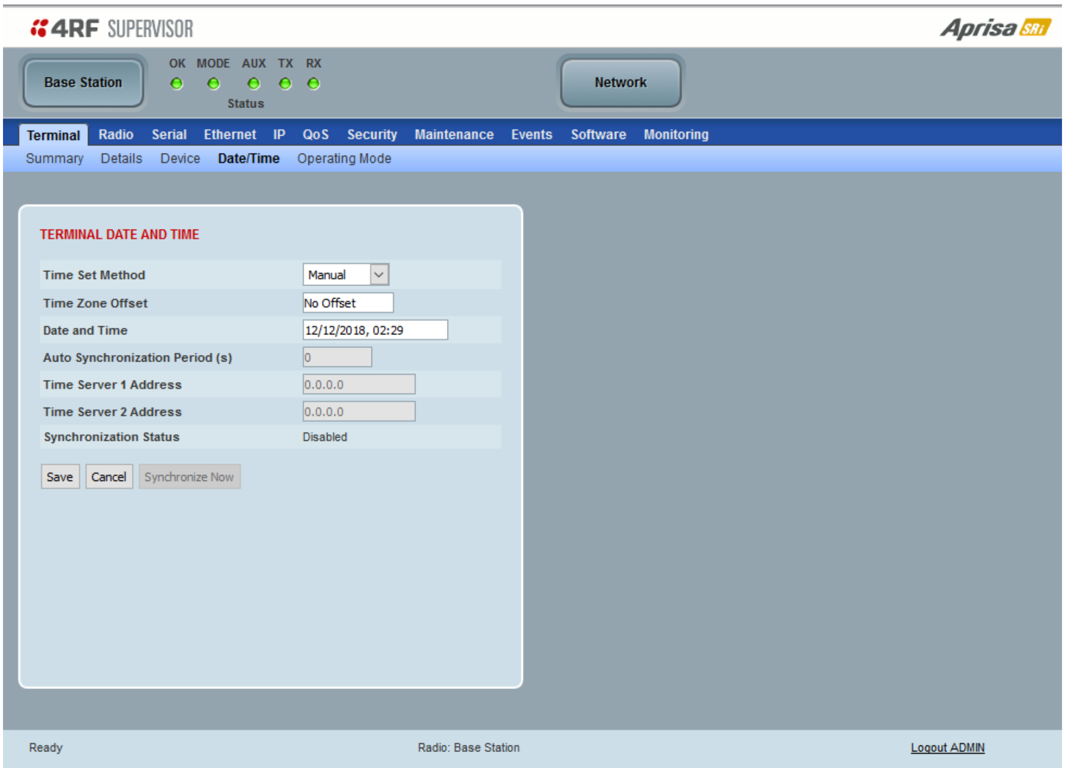
This parameter sets the Inband Management option.

If the Inband Management option is enabled, SuperVisor operating on a base station can also manage all the remote radios in the network.

### *Inband Management Timeout (sec)*

This parameter sets the Inband Management timeout period. This determines the time the base station waits for a response from a remote before aborting the Inband Management request. The default setting is 10 seconds.

## Terminal > Date / Time


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary Details Device Date/Time Operating Mode
Save
Cancel
Synchronize Now
Ready
Radio: Base Station
Logout ADMIN

TERMINAL DATE AND TIME

| | |
|---|---|
| Time Set Method | Manual |
| Time Zone Offset | No Offset |
| Date and Time | 12/12/2018, 02:29 |
| Auto Synchronization Period (s) | 0 |
| Time Server 1 Address | 0.0.0.0 |
| Time Server 2 Address | 0.0.0.0 |
| Synchronization Status | Disabled |

### TERMINAL DATE AND TIME

Sets the radio Date and Time. This information is controlled from a software clock.

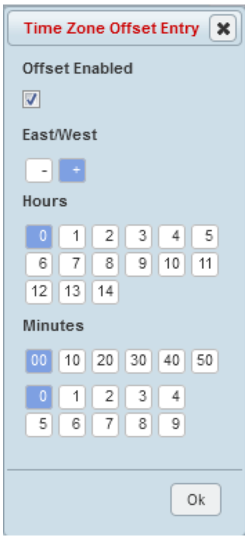
#### *Time Set Method*

This parameter sets the method for setting the Date and Time. The default setting is Manual.

| Option | Function |
|---|---|
| Manual | Manual entry of Date and Time |
| SNTP | Date and Time Synchronization feature allows a radio to synchronize its date and time from an SNTP server.<br>Using the SNTP feature will ensure that all radios in the network has the same date and time required for accurate network diagnostics.<br>Configure SNTP on the base station which then sends the date and time to all the remote radios. It can be configured on a remote radio if required but not on all remotes as SNTP requests could overload the network.<br>For high availability time/date synchronization, SNTP can be synchronized from two SNTP servers for server backup. |

*Time Zone Offset*

The Time Zone Offset is the number of hours / minutes offset from UTC time. The default setting is ‘No Offset’. Clicking the Time Zone Offset field brings up a pop-up to enter the offset.



Time Zone Offset Entry

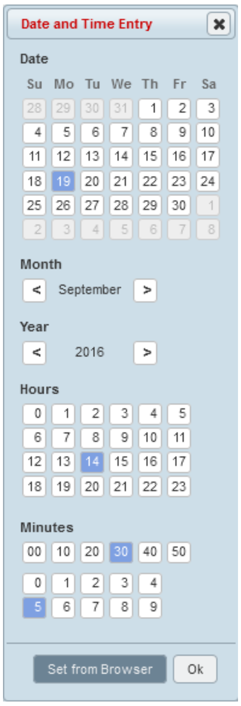
Offset Enabled

☑

After selecting the offset, review the current date and time before saving the changes.

*Date and Time*

This sets the radio Date and Time. Clicking the Date and Time field brings up a pop-up to enter the date and time.



The 'Set from Browser' button sets the date and time directly from the browser date and time.

If the Set from Browser button is used and the offset for the browser and the radio are different, then SuperVisor will adjust the time displayed in the text box to be the local time for the radio e.g. clicking 5pm in Sydney (+10:00) will put 3 pm in the text box for a Perth based radio (+08:00).

*Auto Synchronization Period (s)*

This parameter sets the number of seconds between the end of the last SNTP server synchronization and the next SNTP server synchronization attempt. The minimum period is 60 seconds. A period of 0 seconds will disable SNTP server synchronization attempts.

The base station sends a broadcast message to the remote radios to synchronize the radio date and time at a rate controlled by the Announcement Period (see page 243).

*Time Server 1 Address*

This parameter sets the IP address of the first priority SNTP server. If the synchronization is successful to this server, Time Server 2 Address will not be used.

*Time Server 2 Address*

This parameter sets the IP address of the second priority SNTP server. If the synchronization fails using the SNTP server on Time Server 1 Address, synchronization will be attempted to the SNTP server on this address.

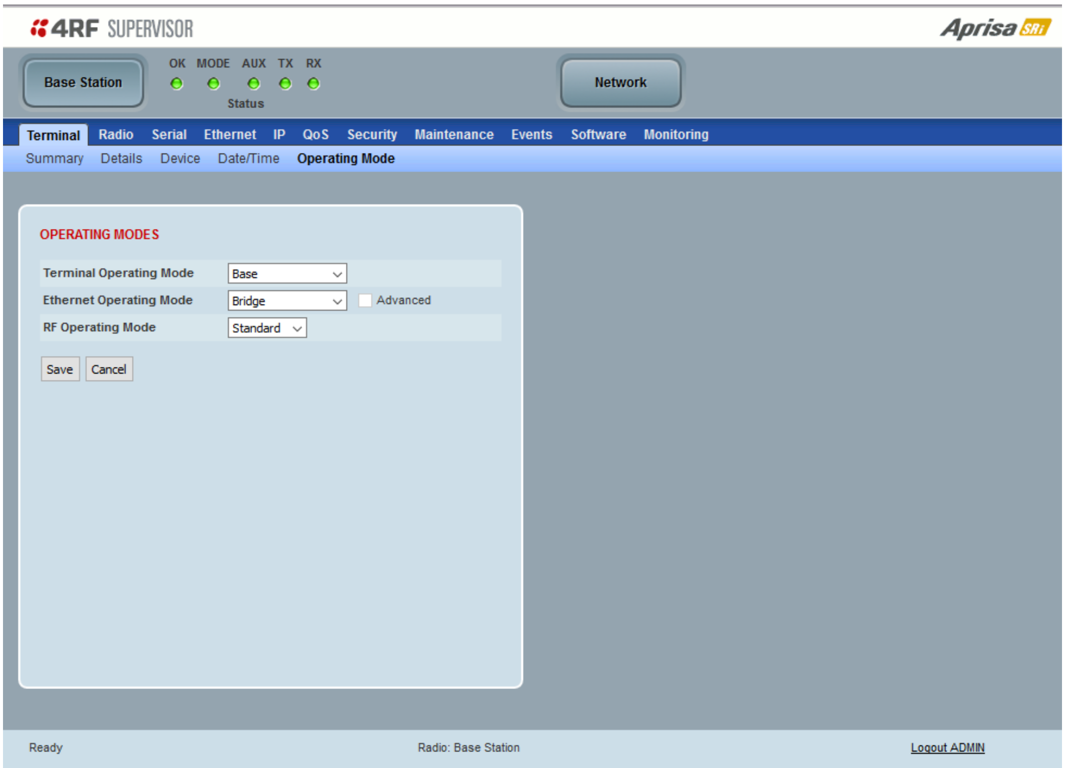
*Synchronization Status*

This field shows the status of the current synchronization or the result of the last synchronization.

*Synchronize Now*

This Synchronize Now button provides manual Synchronization.

## Terminal > Operating Mode


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary Details Device Date/Time Operating Mode
Save Cancel
Ready
Radio: Base Station
Logout ADMIN

OPERATING MODES

Terminal Operating Mode: Base

Ethernet Operating Mode: Bridge ☐ Advanced

RF Operating Mode: Standard

### OPERATING MODES

*Terminal Operating Mode*

The default setting is Remote.

| Option | Function |
|---|---|
| Base | The base station manages all traffic activity between itself and remotes. It is the center-point of the network where in most cases will be connected to a SCADA master. |
| Base Repeater | The base-repeater has the same function as the base station but used when peer to peer connections between remotes is required via the base station. Not applicable for the Aprisa SRi radio. |
| Remote | The remote in most cases is used as the end-point of the SCADA network connected to an RTU or PLC device for SCADA network control and monitoring. |

*Ethernet Operating Mode*

The Ethernet Operating Mode defines how Ethernet / IP traffic is processed in the radio. The default setting is Bridge.

| Option | Function |
|---|---|
| Bridge | Bridge mode inspects each incoming Ethernet frame source and destination MAC addresses to determine if the frame is forwarded over the radio link or discarded. |
| Gateway Router | Gateway Router mode inspects each incoming IP source and destination IP addresses to determine if the packet is forwarded over the radio link or discarded. In this mode, all Ethernet interfaces have the same IP address and subnet. |
| Router | Router mode inspects each incoming IP source and destination IP addresses to determine if the packet is forwarded over the radio link or discarded. In this mode, each Ethernet interface has a different IP address and subnet. |

*Advanced*

Enabled for Gateway Router and Router modes only. The default setting is unticked.

To enable Advanced routing, select the operating mode; Router or Gateway Router and tick the Advanced checkbox.

Advanced Gateway Router mode (AGRM) or Advanced Router mode (ARM) act like a true router between the Ethernet ports and RF interface port where the next hop is one of these ports. This means that the RF interface is a public interface exposed to the user with IP and MAC address like the Ethernet interface.

In AGRM mode, all Ethernet interfaces have the same IP address and subnet.

In ARM mode, each Ethernet interface has a different IP address and subnet.

See ‘Advanced Gateway Router Mode (AGRM) and Advanced Router Mode (ARM)’ on page 36 for a detailed explanation of advanced router modes.

Note 1: The Network Address Translation feature works only in Advanced Router or Advanced Gateway Router operating mode (see ‘IP > NAT’ on page 169).

*RF Operating Mode*

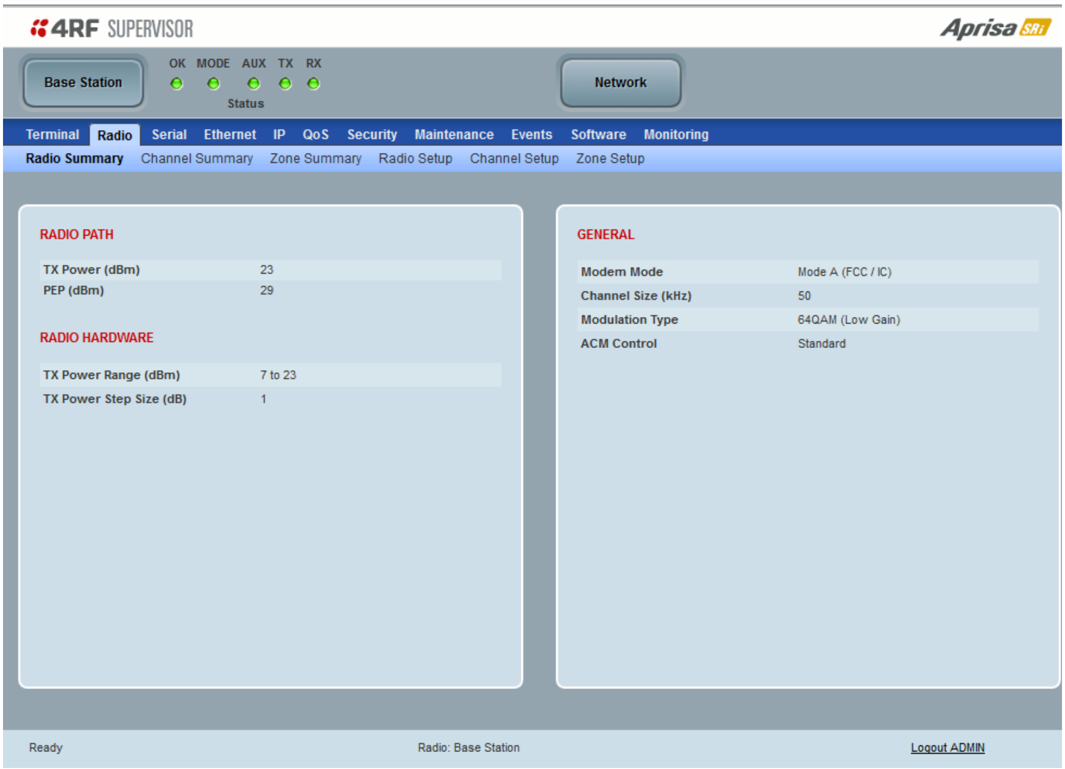
The RF Operating Mode defines the operation of the RF over-the-air. The default setting is Standard.

| Option | Function |
|---|---|
| Standard | The radio operates normally. |
| Disabled | Disables all RF over-the-air communications from the RF port and turns off the transmitter and receiver to save power.<br>This enables a radio to be used as a Terminal Server without RF. |

# Radio

## Radio > Radio Summary

This page displays the current settings for the Radio parameters.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Radio Summary Channel Summary Zone Summary Radio Setup Channel Setup Zone Setup

RADIO PATH

| | |
|---|---|
| TX Power (dBm) | 23 |
| PEP (dBm) | 29 |

RADIO HARDWARE

| | |
|---|---|
| TX Power Range (dBm) | 7 to 23 |
| TX Power Step Size (dB) | 1 |

GENERAL

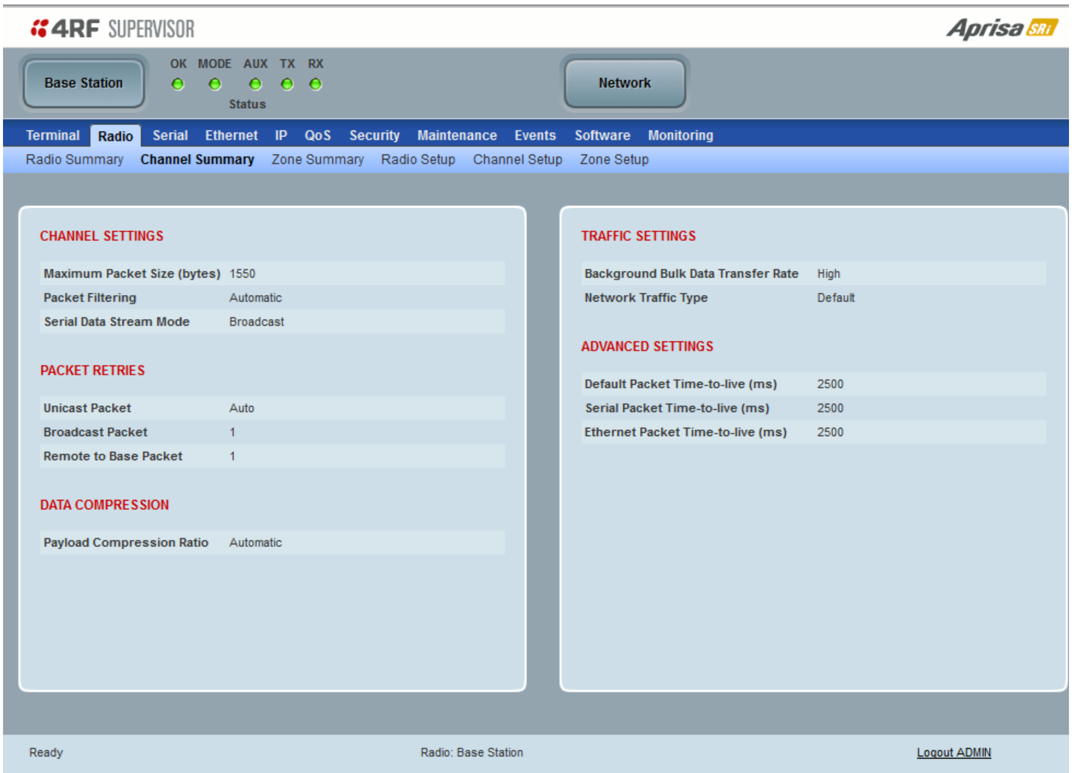
| | |
|---|---|
| Modem Mode | Mode A (FCC / IC) |
| Channel Size (kHz) | 50 |
| Modulation Type | 64QAM (Low Gain) |
| ACM Control | Standard |

Ready
Radio: Base Station
Logout ADMIN

See ‘Radio > Radio Setup’ and ‘Radio > Channel Setup’ for setting details.

## Radio > Channel Summary

This page displays the current settings for the Channel parameters.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Radio Summary Channel Summary Zone Summary Radio Setup Channel Setup Zone Setup
Ready
Radio: Base Station
Logout ADMIN

CHANNEL SETTINGS

| | |
|---|---|
| Maximum Packet Size (bytes) | 1550 |
| Packet Filtering | Automatic |
| Serial Data Stream Mode | Broadcast |

PACKET RETRIES

| | |
|---|---|
| Unicast Packet | Auto |
| Broadcast Packet | 1 |
| Remote to Base Packet | 1 |

DATA COMPRESSION

| | |
|---|---|
| Payload Compression Ratio | Automatic |

TRAFFIC SETTINGS

| | |
|---|---|
| Background Bulk Data Transfer Rate | High |
| Network Traffic Type | Default |

ADVANCED SETTINGS

| | |
|---|---|
| Default Packet Time-to-live (ms) | 2500 |
| Serial Packet Time-to-live (ms) | 2500 |
| Ethernet Packet Time-to-live (ms) | 2500 |

See ‘Radio > Channel Setup’ for setting details.

### DATA COMPRESSION

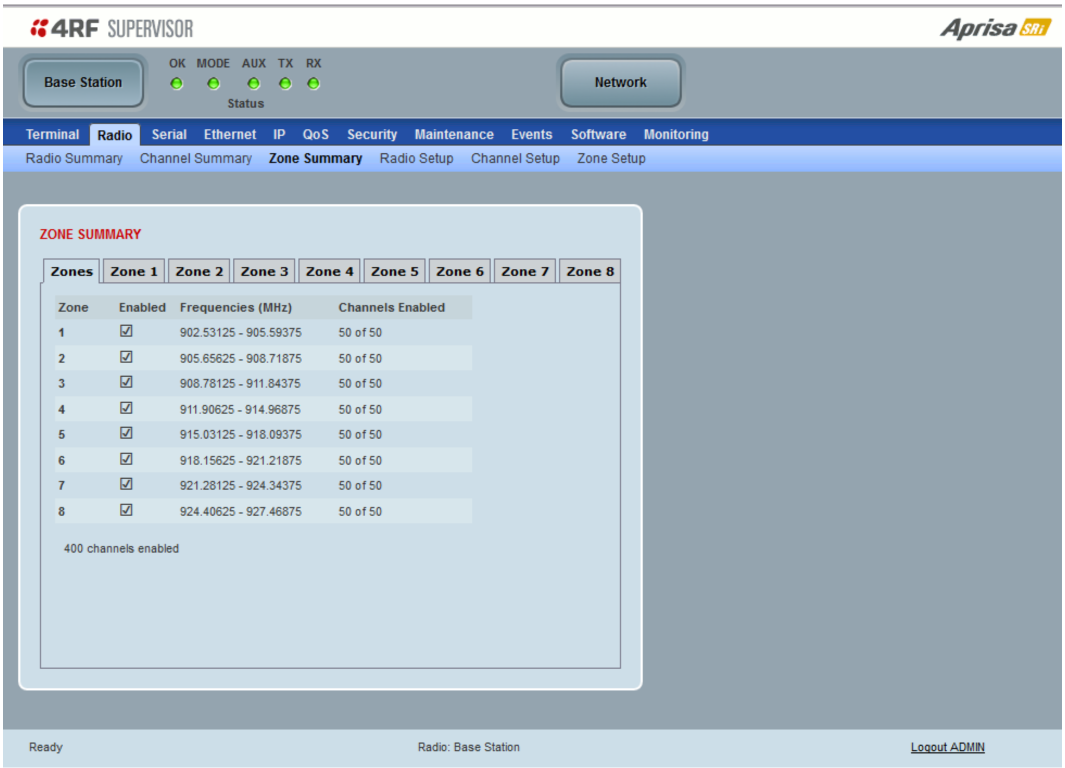
*Payload Compression Ratio*

The payload is compressed using level 3 QuickLZ data compression. Payload Compression is automatic and cannot be turned off by SuperVisor.

Compression is not attempted on data that is already compressed e.g. jpg files.

## Radio > Zone Summary

This page displays the current settings for the Zones.



4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Radio Summary Channel Summary Zone Summary Radio Setup Channel Setup Zone Setup

ZONE SUMMARY

Zones Zone 1 Zone 2 Zone 3 Zone 4 Zone 5 Zone 6 Zone 7 Zone 8

| Zone | Enabled | Frequencies (MHz) | Channels Enabled |
|---|---|---|---|
| 1 | ☑ | 902.53125 - 905.59375 | 50 of 50 |
| 2 | ☑ | 905.65625 - 908.71875 | 50 of 50 |
| 3 | ☑ | 908.78125 - 911.84375 | 50 of 50 |
| 4 | ☑ | 911.90625 - 914.96875 | 50 of 50 |
| 5 | ☑ | 915.03125 - 918.09375 | 50 of 50 |
| 6 | ☑ | 918.15625 - 921.21875 | 50 of 50 |
| 7 | ☑ | 921.28125 - 924.34375 | 50 of 50 |
| 8 | ☑ | 924.40625 - 927.46875 | 50 of 50 |

400 channels enabled

Ready

Radio: Base Station

See ‘Radio > Channel Setup’ for setting details.

### ZONE SUMMARY

*Zone*

The zone number defined in the regulatory specification. The maximum number of standard hop zones is 8.

*Enabled*

Displays the hop zones enabled.

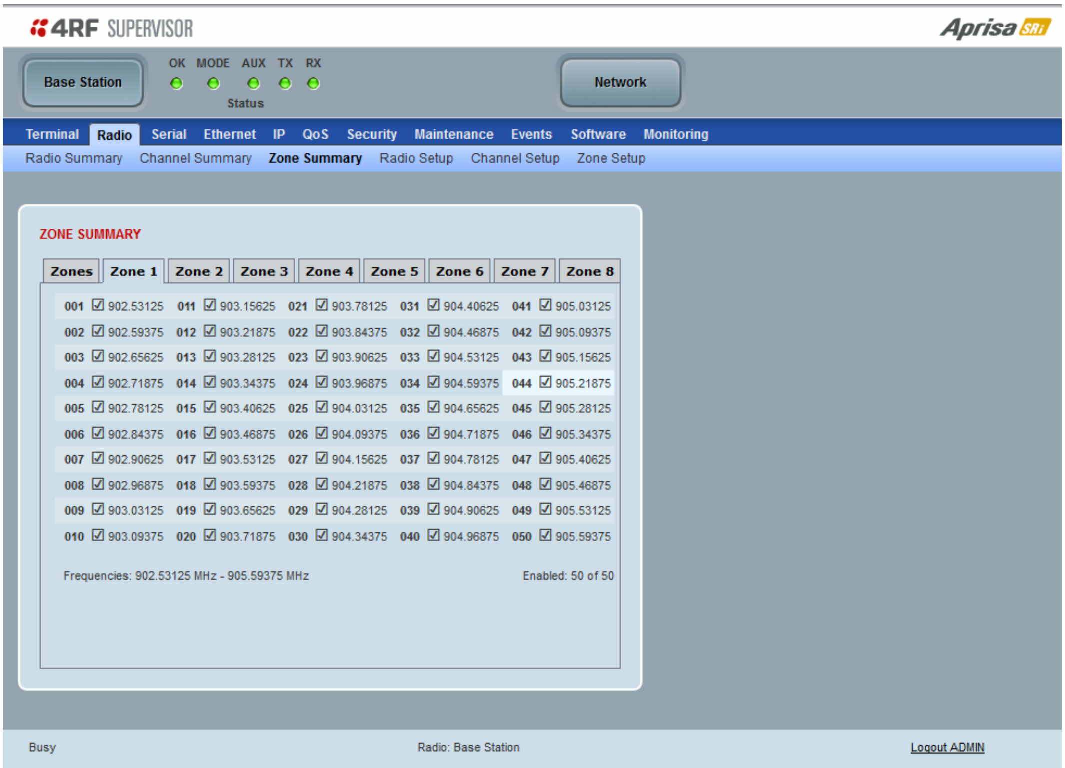
*Frequencies*

Displays the zone frequencies defined for the zone hop number.

*Channels Enabled*

Displays the number of channels selected in the zone.

The Zone Summary > Zones shows the channels enabled per zone hop 1 to 8.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Radio Summary Channel Summary Zone Summary Radio Setup Channel Setup Zone Setup
Zones Zone 1 Zone 2 Zone 3 Zone 4 Zone 5 Zone 6 Zone 7 Zone 8
Busy
Radio: Base Station
Logout ADMIN

ZONE SUMMARY

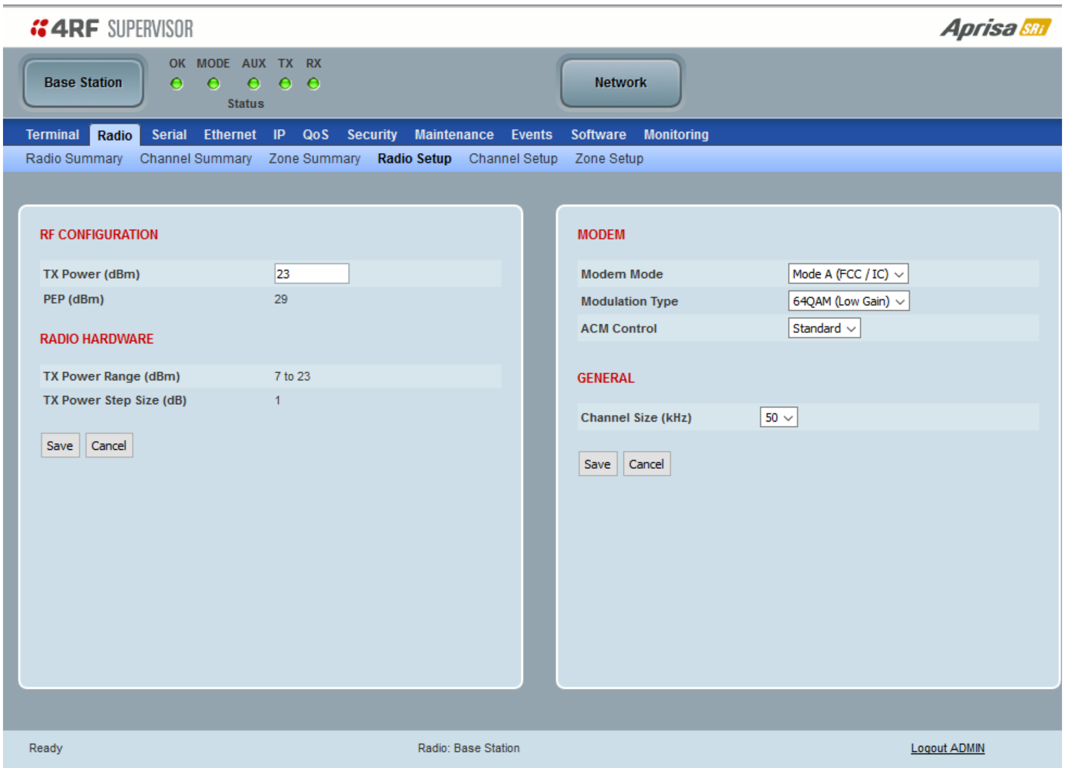
| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 001 | ☑ | 902.53125 | 011 | ☑ | 903.15625 | 021 | ☑ | 903.78125 | 031 | ☑ | 904.40625 | 041 | ☑ | 905.03125 |
| 002 | ☑ | 902.59375 | 012 | ☑ | 903.21875 | 022 | ☑ | 903.84375 | 032 | ☑ | 904.46875 | 042 | ☑ | 905.09375 |
| 003 | ☑ | 902.65625 | 013 | ☑ | 903.28125 | 023 | ☑ | 903.90625 | 033 | ☑ | 904.53125 | 043 | ☑ | 905.15625 |
| 004 | ☑ | 902.71875 | 014 | ☑ | 903.34375 | 024 | ☑ | 903.96875 | 034 | ☑ | 904.59375 | 044 | ☑ | 905.21875 |
| 005 | ☑ | 902.78125 | 015 | ☑ | 903.40625 | 025 | ☑ | 904.03125 | 035 | ☑ | 904.65625 | 045 | ☑ | 905.28125 |
| 006 | ☑ | 902.84375 | 016 | ☑ | 903.46875 | 026 | ☑ | 904.09375 | 036 | ☑ | 904.71875 | 046 | ☑ | 905.34375 |
| 007 | ☑ | 902.90625 | 017 | ☑ | 903.53125 | 027 | ☑ | 904.15625 | 037 | ☑ | 904.78125 | 047 | ☑ | 905.40625 |
| 008 | ☑ | 902.96875 | 018 | ☑ | 903.59375 | 028 | ☑ | 904.21875 | 038 | ☑ | 904.84375 | 048 | ☑ | 905.46875 |
| 009 | ☑ | 903.03125 | 019 | ☑ | 903.65625 | 029 | ☑ | 904.28125 | 039 | ☑ | 904.90625 | 049 | ☑ | 905.53125 |
| 010 | ☑ | 903.09375 | 020 | ☑ | 903.71875 | 030 | ☑ | 904.34375 | 040 | ☑ | 904.96875 | 050 | ☑ | 905.59375 |

Frequencies: 902.53125 MHz - 905.59375 MHz

Enabled: 50 of 50

## Radio > Radio Setup

Transmit frequency, maximum transmit power and channel size would normally be defined by a local regulatory body.



RF CONFIGURATION

| | |
|---|---|
| TX Power (dBm) | 23 |
| PEP (dBm) | 29 |

RADIO HARDWARE

| | |
|---|---|
| TX Power Range (dBm) | 7 to 23 |
| TX Power Step Size (dB) | 1 |

MODEM

| | |
|---|---|
| Modem Mode | Mode A (FCC / IC) |
| Modulation Type | 64QAM (Low Gain) |
| ACM Control | Standard |

GENERAL

| | |
|---|---|
| Channel Size (kHz) | 50 |

Ready    Radio: Base Station    Logout ADMIN

### RF CONFIGURATION

*TX Power*

The transmitter power is the power measured at the antenna output port when transmitting. The transmitter power has a direct impact on the radio power consumption. The default setting is +26 dBm.

The maximum permitted transmitter power may be limited by the EIRP requirements. See ‘Compliance Considerations’ on page 64 for details.

If TX Power setting is higher than the high limit or lower than the low limit for the current modulation, an Informational Event (55 Terminal Unit Information) will be raised to notify the user that transmit power has been changed. This only applies to fixed modulation (not ACM).

The Peak Envelope Power (PEP) is calculated based on current configured TX power settings and modulation:

| | |
|---|---|
| QPSK | PEP = TX Power Setting + 4 dBm |
| 16 QAM | PEP = TX Power Setting + 6 dBm |
| 64 QAM | PEP = TX Power Setting + 7 dBm |

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

## RADIO HARDWARE

The radio hardware displays the radio TX Power specifications.

## MODEM

### *Modem Mode*

This parameter sets the Modem Mode in the radio. The Modem Mode option list is dependent on the radio Hardware Variant (defined by the part number option ordered).

| Option | Frequency Range | Part Number Option |
|---|---|---|
| Mode A (FCC / ISED) | 902-928 MHz | C1 |
| Mode B (ACMA / RSM) | 915-928 MHz | C2 |
| Mode C (ANATEL) | 902-907.5 and 915-928 MHz | C3 |

### *Modulation Type*

The remote to base direction of transmission is always fixed i.e. not adaptive.

This parameter sets the fixed TX Modulation Type for the base to remote direction.

| Option | Function |
|---|---|
| QPSK (Low Gain) | Sets the modulation to QPSK |
| 16QAM (Low Gain) | Sets the modulation to 16 QAM |
| 64QAM (Low Gain) | Sets the modulation to 64 QAM |

The default setting is QPSK (Low Gain).

The base station radio TX modulation will be set based on the worse case (RSSI) path profile scenario of all the radios in one hop distance from the base station radio.

### *ACM Control (base station)*

This parameter enables / disables Adaptive Code Modulation for the remote to base direction of transmission (upstream).

When ACM is enabled, the base station sends a modulation type recommendation to each remote radio based on the signal quality for each individual remote radio.

| Option | Function |
|---|---|
| Disabled | Disables Adaptive Code Modulation for the upstream.<br>The base station does not send a modulation type recommendation to any remote radio. |
| Standard | Enables Adaptive Code Modulation for the upstream.<br>The ACM will be selected based on the link quality. |

The default setting is Standard.

*ACM Control (remote radio)*

These settings are only used if the Modulation Type is set to Adaptive and only apply to the remote to base direction of transmission (upstream).

The remote to base direction of transmission can be adaptive modulation or fixed modulation.

This parameter sets the TX Modulation Type for the remote radio.

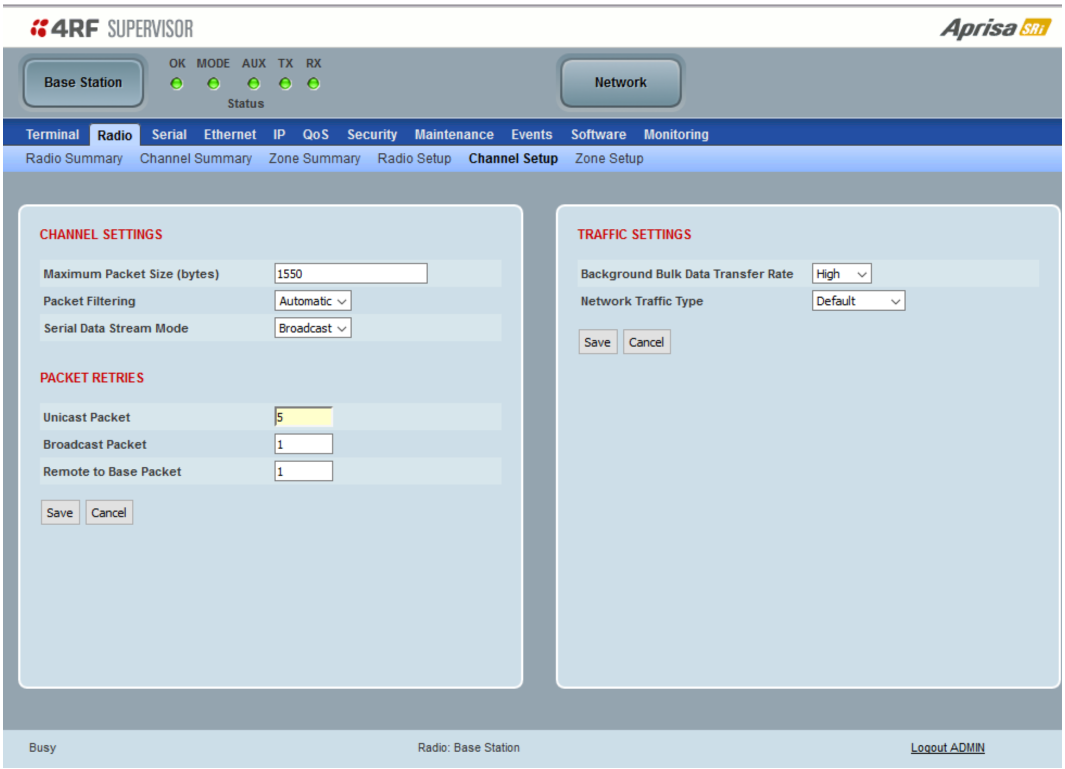
| Option | Function |
|---|---|
| Adaptive | Sets the modulation type to Adaptive Code Modulation.<br>The remote radio receives the modulation type recommendation from the base and adjusts the modulation in the remote to base direction of transmission (upstream). |
| QPSK (Low Gain) | Sets the modulation to QPSK. |
| 16QAM (Low Gain) | Sets the modulation to 16 QAM. |
| 64QAM (Low Gain) | Sets the modulation to 64 QAM. |

### GENERAL

*Channel Size (kHz)*

This parameter sets the Channel Size for the radio (see ‘Channel Sizes’ on page 339 for Radio Capacities). The default setting is 50 kHz.

## Radio > Channel Setup


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Radio Summary Channel Summary Zone Summary Radio Setup Channel Setup Zone Setup
Save
Cancel
Busy
Radio: Base Station
Logout ADMIN

CHANNEL SETTINGS

| | |
|---|---|
| Maximum Packet Size (bytes) | 1550 |
| Packet Filtering | Automatic |
| Serial Data Stream Mode | Broadcast |

PACKET RETRIES

| | |
|---|---|
| Unicast Packet | 5 |
| Broadcast Packet | 1 |
| Remote to Base Packet | 1 |

TRAFFIC SETTINGS

| | |
|---|---|
| Background Bulk Data Transfer Rate | High |
| Network Traffic Type | Default |

## CHANNEL SETTINGS

### *Maximum Packet Size (Bytes)*

This parameter sets the maximum over-the-air packet size in bytes. A smaller maximum Packet Size is beneficial when many remote radios are trying to access the channel, and smaller high priority packets must not be delayed by larger low priority packets sent by other radios. The default setting is 1550 bytes.

This packet size includes the wireless protocol header and security payload (0 to 16 bytes). The length of the security header depends on the level of security selected.

When the security setting is 0, the maximum user data transfer over-the-air is 1516 bytes.

When encryption is enabled, the entire packet of user data (payload) is encrypted. If authentication is being used, the security frame will be added (up to 16 bytes). The wireless protocol header is then added which is proprietary to the Aprisa SRi. This is not encrypted.

*Packet Filtering*

Each Aprisa SRi radio can filter packets not destined for itself. The Packet Filtering parameter controls this functionality.

In an Aprisa SRi network, all communication from remote radios is destined for the base station in the Aprisa SRi network communication protocol.

| Option | Function |
|---|---|
| Disabled | Every packet received by the radio will be forwarded to the relevant interface. |
| Automatic | The radio will filter (discard) packets not destined for itself according to the Aprisa SRi traffic protocols |

The default setting is Automatic.

**Note:** The Aprisa SRi network is transparent to the protocol being transmitted; therefore the Packet Filtering parameter is based on the Aprisa SRi addressing and network protocols, not the user (SCADA, etc.) traffic protocols.

*Serial Data Stream Mode*

This parameter controls the traffic flow in the radio serial ports.

| Option | Function |
|---|---|
| Broadcast | Serial port traffic from the network is broadcast on all serial ports on this radio. This will include the RS-232 port derived from the USB port. |
| Segregate | Serial port traffic from the network from a specific port number is directed to the respective serial port only (see Segregated Port Directions). |

The default setting is Broadcast.

## PACKET RETRIES

The larger the number of retries, the greater the chance the packet will be delivered but reduces overall packet throughput.

### *Unicast Packet*

Sets the number of unicast packet retries for the radio.

Base Station

The base station unicast packet retries sets the number of retries for a packet sent to remote radios. The default value is 5.

Remote Radios

The remote radio unicast packet sets the number of retries for a packet sent to the base station. The default value is Auto.

If the Auto is ticked, remote radios will use the Remote To Base Packet retries setting sent from the base station

If the Auto is unticked, remote radios will use the unicast packet retries set on the remote radio

### *Broadcast Packet*

The base station broadcast packet retries sets the number of broadcast packet retries for packets sent to all remote radios. The default value is 1.

### *Remote To Base Packet*

Sets all remote radio unicast packet retries setting if the remote radio unicast packet Auto is ticked. The default value is 5.

## TRAFFIC SETTINGS

### *Background Bulk Data Transfer Rate*

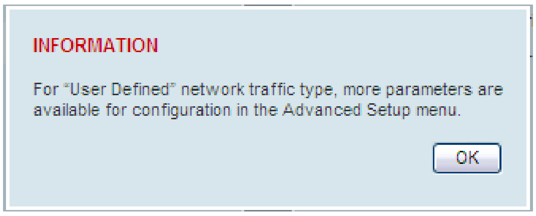
This parameter sets the data transfer rate for large amounts of management data.

| Option | Function |
|---|---|
| High | Utilizes more of the available capacity for large amounts of management data. Highest impact on user traffic. |
| Medium | Utilizes a moderate of the available capacity for large amounts of management data. Medium impact on user traffic. |
| Low | Utilizes a minimal of the available capacity for large amounts of management data. Lowest impact on user traffic. |

The default setting is high.

### *Network Traffic Type*

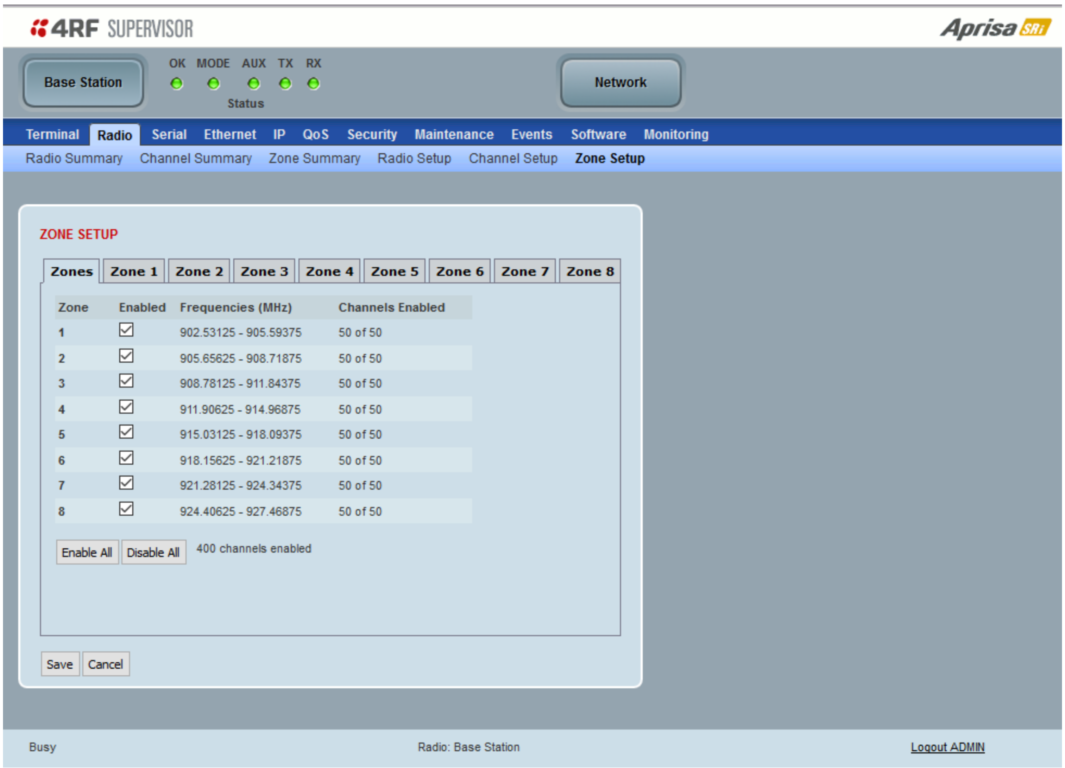
This parameter optimizes the channel settings for the predominant traffic type.

| Option | Function |
|---|---|
| User Defined | Allows the user to define the channel settings (see ‘Radio > Advanced Setup’ on page 126).<br><br>INFORMATION<br>For "User Defined" network traffic type, more parameters are available for configuration in the Advanced Setup menu.<br>OK |
| Serial Only | Optimizes the channel settings for the predominantly serial traffic. |
| Ethernet Only | Optimizes the channel settings for the predominantly Ethernet traffic. |
| Mixed | Optimizes the channel settings for a mix of Ethernet and serial traffic. |

The default setting is Mixed.

## Radio > Zone Setup

This page configures the Zone / Channel settings.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Radio Summary Channel Summary Zone Summary Radio Setup Channel Setup Zone Setup
Zones Zone 1 Zone 2 Zone 3 Zone 4 Zone 5 Zone 6 Zone 7 Zone 8
Enable All
Disable All
Save
Cancel
Logout ADMIN

ZONE SETUP

| Zone | Enabled | Frequencies (MHz) | Channels Enabled |
|---|---|---|---|
| 1 | ☑ | 902.53125 - 905.59375 | 50 of 50 |
| 2 | ☑ | 905.65625 - 908.71875 | 50 of 50 |
| 3 | ☑ | 908.78125 - 911.84375 | 50 of 50 |
| 4 | ☑ | 911.90625 - 914.96875 | 50 of 50 |
| 5 | ☑ | 915.03125 - 918.09375 | 50 of 50 |
| 6 | ☑ | 918.15625 - 921.21875 | 50 of 50 |
| 7 | ☑ | 921.28125 - 924.34375 | 50 of 50 |
| 8 | ☑ | 924.40625 - 927.46875 | 50 of 50 |

400 channels enabled

Busy

Radio: Base Station

## ZONE SETUP

Specific channels within the selected zone hop can be disabled if there is a known transmission within the channel that may cause interference to the operation of this network. The minimum number of enabled channels is 50.

On a remote radio the configured channels are only used to initiate communication with the base station. A remote can only connect with a base station if there is some overlap between configured channels on the base and the radio.

When a remote radio registers with the base station, the remote radio will automatically configure to use the zone channel list distributed by the base station. The zone channels displayed on the remote radio will continue to display the radio channels initially enabled (not the zone channel list distributed by the base station).

### *Zone*

The zone number from 1 to 8.

### *Enabled*

Enables / disables the entire hop zone of channels. If a channel is selected in a zone that is disabled, the zone will be enabled when the channel selection is saved. The default is all zones enabled.

*Frequencies*

The zone frequencies are pre-defined in the Aprisa SRi for the zone number. The zone frequencies are spaced at the hop frequency of 62.5 kHz.

*Channels Enabled*

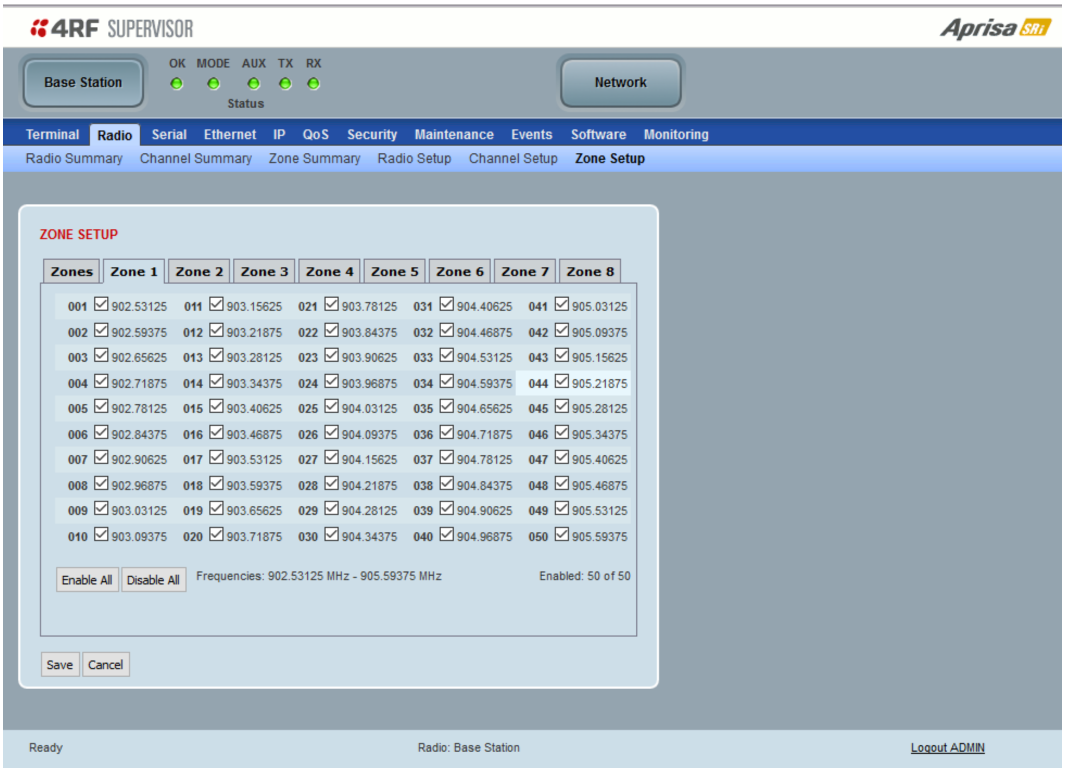
Displays the number of channels selected in the zone.

## Controls

The Enable All button enables all zones and all channels in each zone.

The Disable All button disables all zones and all channels in each zone.

The Zone Setup > Zones 1 to 8 setup the channels per zone hop.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Radio Summary Channel Summary Zone Summary Radio Setup Channel Setup Zone Setup
Zones Zone 1 Zone 2 Zone 3 Zone 4 Zone 5 Zone 6 Zone 7 Zone 8
Enable All
Disable All
Save
Cancel
Logout ADMIN

ZONE SETUP

|  |  |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|
| 001 | ☑ 902.53125 | 011 | ☑ 903.15625 | 021 | ☑ 903.78125 | 031 | ☑ 904.40625 | 041 | ☑ 905.03125 |
| 002 | ☑ 902.59375 | 012 | ☑ 903.21875 | 022 | ☑ 903.84375 | 032 | ☑ 904.46875 | 042 | ☑ 905.09375 |
| 003 | ☑ 902.65625 | 013 | ☑ 903.28125 | 023 | ☑ 903.90625 | 033 | ☑ 904.53125 | 043 | ☑ 905.15625 |
| 004 | ☑ 902.71875 | 014 | ☑ 903.34375 | 024 | ☑ 903.96875 | 034 | ☑ 904.59375 | 044 | ☑ 905.21875 |
| 005 | ☑ 902.78125 | 015 | ☑ 903.40625 | 025 | ☑ 904.03125 | 035 | ☑ 904.65625 | 045 | ☑ 905.28125 |
| 006 | ☑ 902.84375 | 016 | ☑ 903.46875 | 026 | ☑ 904.09375 | 036 | ☑ 904.71875 | 046 | ☑ 905.34375 |
| 007 | ☑ 902.90625 | 017 | ☑ 903.53125 | 027 | ☑ 904.15625 | 037 | ☑ 904.78125 | 047 | ☑ 905.40625 |
| 008 | ☑ 902.96875 | 018 | ☑ 903.59375 | 028 | ☑ 904.21875 | 038 | ☑ 904.84375 | 048 | ☑ 905.46875 |
| 009 | ☑ 903.03125 | 019 | ☑ 903.65625 | 029 | ☑ 904.28125 | 039 | ☑ 904.90625 | 049 | ☑ 905.53125 |
| 010 | ☑ 903.09375 | 020 | ☑ 903.71875 | 030 | ☑ 904.34375 | 040 | ☑ 904.96875 | 050 | ☑ 905.59375 |

Frequencies: 902.53125 MHz - 905.59375 MHz

Enabled: 50 of 50

Ready

Radio: Base Station

## ZONE SETUP

Specific channels within the selected zone hop can be disabled if there is a known transmission within the channel that may cause interference to the operation of this network. The minimum number of enabled channels is 50.

Initially, remote radio channels are enabled to allow communication with the base station.

When a remote radio registers with the base station, the remote radio will automatically configure to use the zone channel list distributed by the base station. The zone channels displayed on the remote radio will continue to display the radio channels initially enabled (not the zone channel list distributed by the base station).

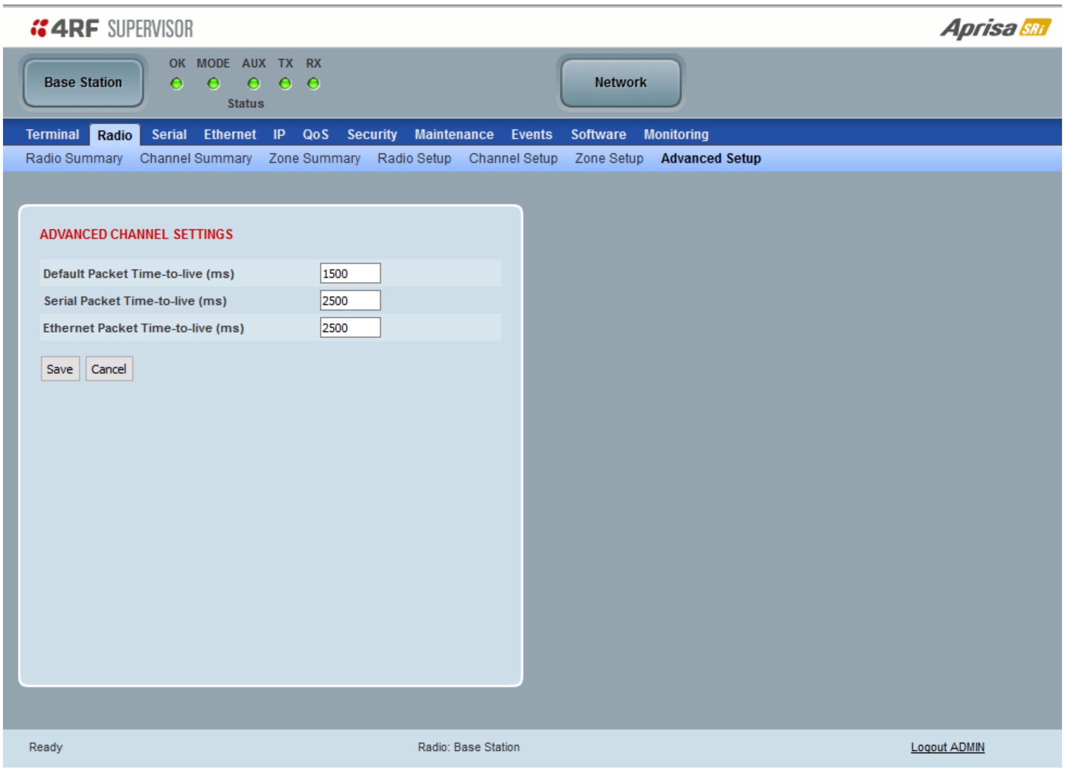
### Controls

The Enable All button enables all channels in the zone.

The disable All button disables all channels in the zone.

## Radio > Advanced Setup

This page is only visible when the Channel Setup > Network Traffic Type is set to User Defined.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Radio Summary Channel Summary Zone Summary Radio Setup Channel Setup Zone Setup Advanced Setup
Save Cancel
Ready
Radio: Base Station
Logout ADMIN

ADVANCED CHANNEL SETTINGS

| | |
|---|---|
| Default Packet Time-to-live (ms) | 1500 |
| Serial Packet Time-to-live (ms) | 2500 |
| Ethernet Packet Time-to-live (ms) | 2500 |

### ADVANCED CHANNEL SETTINGS

*Default Packet Time to Live (ms)*

This parameter sets the default time a packet is allowed to live in the system before being dropped if it cannot be transmitted over the air. It is used to prevent old, redundant packets being transmitted through the Aprisa SRi network. The default setting is 1500 ms.

In the case of serial poll SCADA networks such as MODBUS and IEC 60870.50.101, it is important to ensure the replies from the RTU are in the correct sequence and are not timed out replies from Master requests. If the TTL value is too long, the SCADA master will detect sequence errors.

It is recommended to use a TTL which is half the serial SCADA timeout. This is commonly called the ‘scan timeout’ or ‘link layer time out’ or ‘retry timeout’.

When using TCP protocols, a TTL of 1500 ms is recommended because a TCP re-transmission usually occurs after approximately 3 seconds.

In SCADA networks which use both serial and Ethernet, it is recommended that the TTL is set to half the serial SCADA timeout for serial remotes, and 1500 ms for Ethernet (TCP) remotes. For example, if the serial SCADA timeout is 1000 ms, a remote radio which is connected to the serial RTU should be set to 500 ms, a remote radio which is connected to an Ethernet (TCP) RTU should have a 1500 ms timeout.

In this case, the base station TTL should be set to 1500 ms as well; or whichever is the longer TTL of serial or Ethernet.

*Serial Packet Time to Live (ms)*

This parameter sets the time a serial packet is allowed to live in the system before being dropped if it cannot be transmitted over the air. The default setting is 800 ms.

*Ethernet Packet Time to Live (ms)*

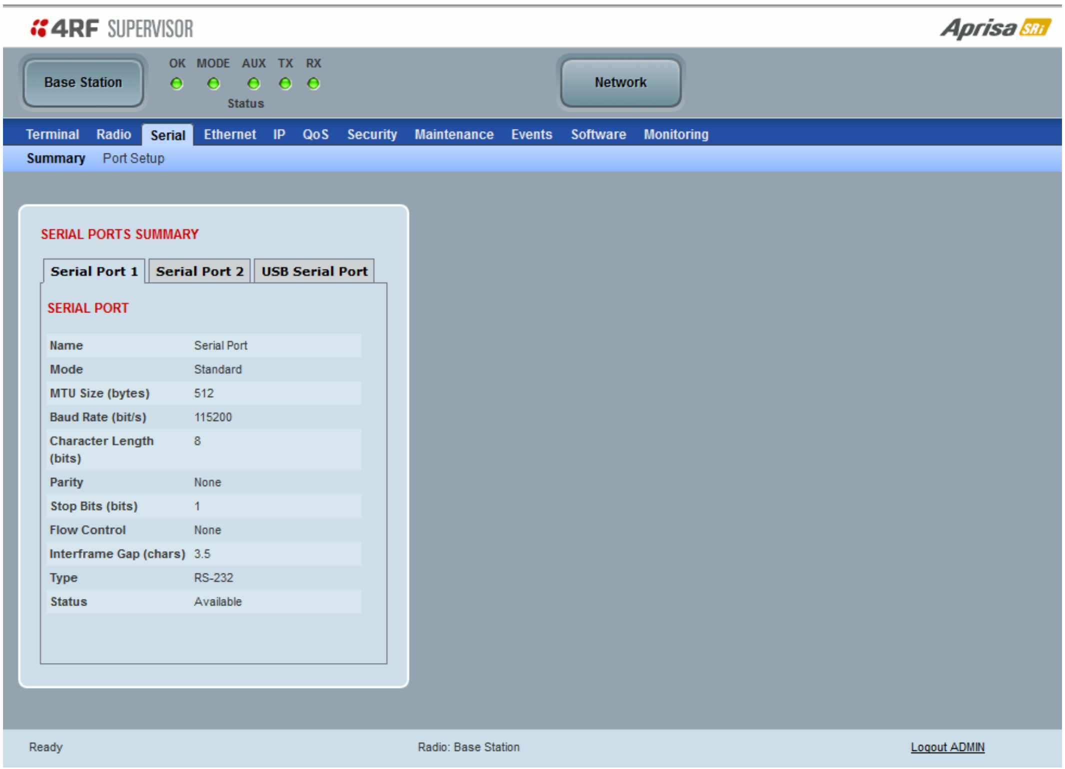
This parameter sets the time an Ethernet packet is allowed to live in the system before being dropped if it cannot be transmitted over the air. The default setting is 600 ms.

# Serial

## Serial > Summary

### RS-232 Hardware Ports

This page displays the current settings for the serial port parameters.



SERIAL PORTS SUMMARY

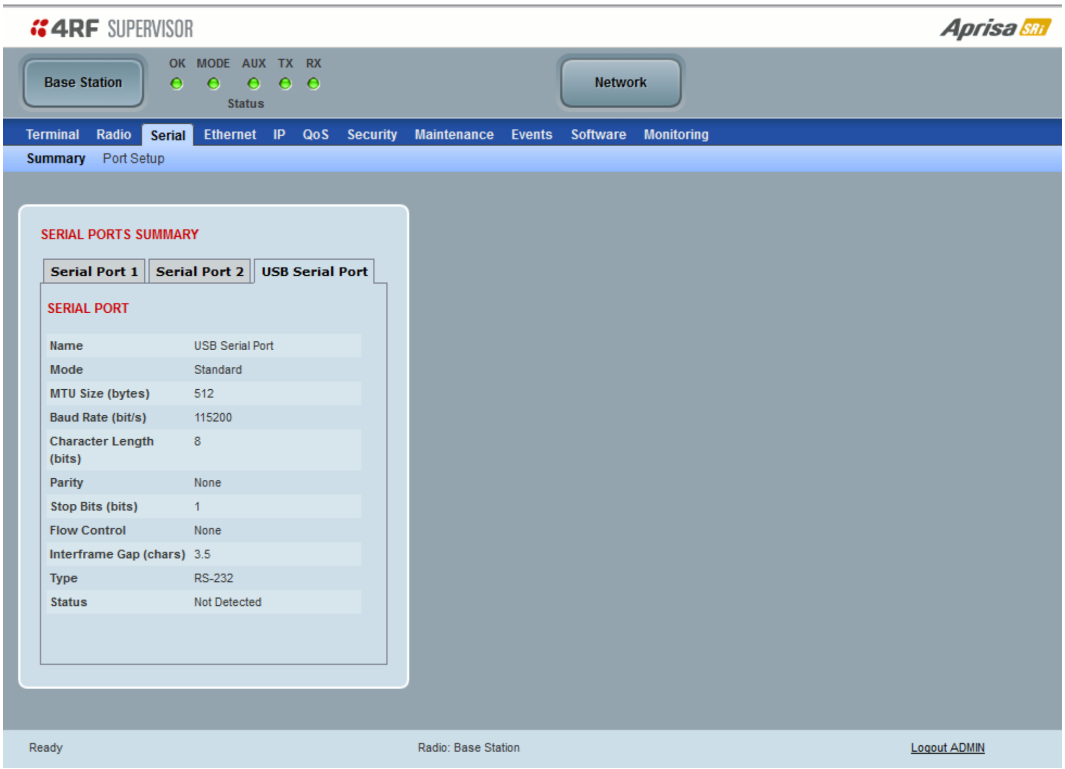
SERIAL PORT

| | |
|---|---|
| Name | Serial Port |
| Mode | Standard |
| MTU Size (bytes) | 512 |
| Baud Rate (bit/s) | 115200 |
| Character Length (bits) | 8 |
| Parity | None |
| Stop Bits (bits) | 1 |
| Flow Control | None |
| Interframe Gap (chars) | 3.5 |
| Type | RS-232 |
| Status | Available |

See ‘Serial > Port Setup’ on page 130 for configuration options.

*USB Serial Ports*

This page displays the current settings for the USB serial port parameters.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary Port Setup
Serial Port 1 Serial Port 2 USB Serial Port
Ready
Radio: Base Station
Logout ADMIN

SERIAL PORTS SUMMARY

SERIAL PORT

| | |
|---|---|
| Name | USB Serial Port |
| Mode | Standard |
| MTU Size (bytes) | 512 |
| Baud Rate (bit/s) | 115200 |
| Character Length (bits) | 8 |
| Parity | None |
| Stop Bits (bits) | 1 |
| Flow Control | None |
| Interframe Gap (chars) | 3.5 |
| Type | RS-232 |
| Status | Not Detected |

*Type*

This parameter displays the Serial Port interface type.

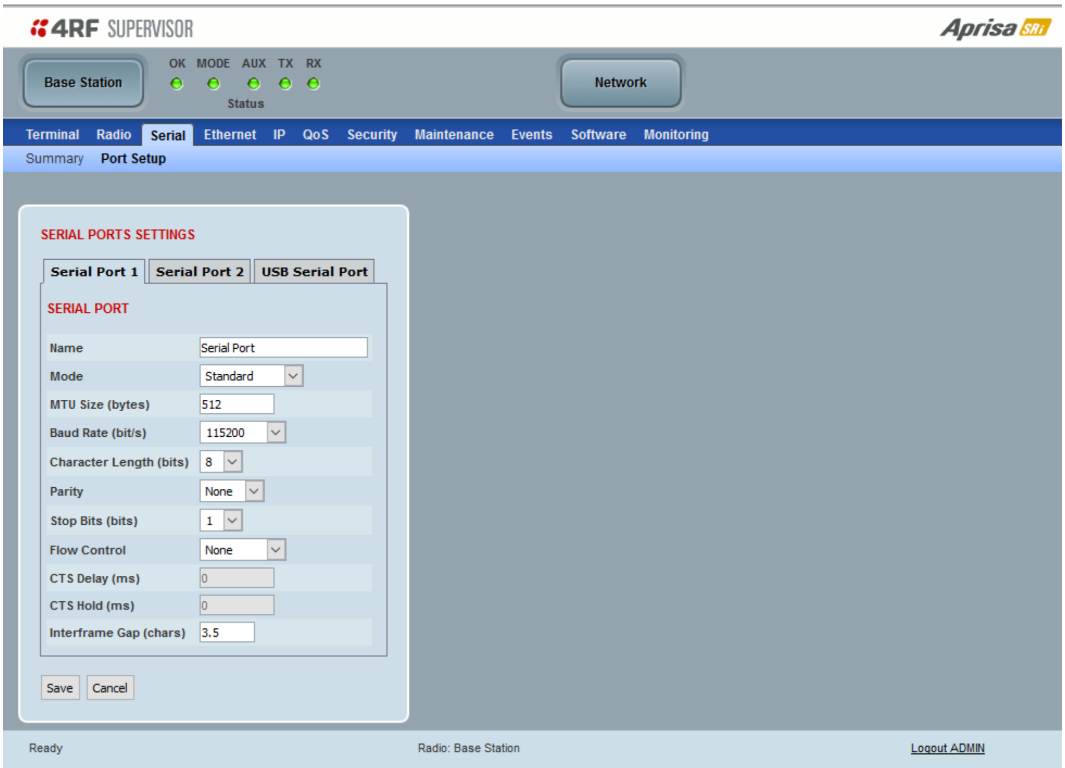
If the Name is USB Serial Port:

| Option | Function |
|---|---|
| RS-232 | Indicates that a USB to RS-232 serial converter is plugged into the radio. |
| RS-485 | Indicates that a USB to RS-485 serial converter is plugged into the radio. |

## Serial > Port Setup

### RS-232 Hardware Ports

This page provides the setup for the serial port settings.



SERIAL PORTS SETTINGS

SERIAL PORT

| | |
|---|---|
| Name | Serial Port |
| Mode | Standard |
| MTU Size (bytes) | 512 |
| Baud Rate (bit/s) | 115200 |
| Character Length (bits) | 8 |
| Parity | None |
| Stop Bits (bits) | 1 |
| Flow Control | None |
| CTS Delay (ms) | 0 |
| CTS Hold (ms) | 0 |
| Interframe Gap (chars) | 3.5 |

### SERIAL PORTS SETTINGS

*Name*

This parameter sets the port name which can be up to 32 characters.

| Option | Function |
|---|---|
| Serial Port | This is for the standard RS-232 serial ports provided with the RJ45 connectors. |
| USB Serial Port | This is the optional RS-232 / RS-485 serial port provided with the USB host port connector with a USB to RS-232 / RS-485 RJ45 converter cable (see ‘USB Serial Ports’ on page 318). |

*Mode*

This parameter defines the mode of operation of the serial port. The default setting is Standard.

| Option | Function |
|---|---|
| Disabled | The serial port is not required. |
| Standard | The serial port is communicating with serial ports on other stations. |
| Mirrored Bits ® | Mirrored Bits® is a serial communications protocol used to exchange internal logic status messages directly between relays and devices used in line protection, remote control and monitoring, relay remote tripping, sectionalizing and other such applications. The protocol is often described as a relay-to-relay communications technology. |
| Terminal Server | A base station Ethernet port can communicate with both Ethernet ports and serial ports on remote radios.<br>RS-232 traffic is encapsulated in IP packets (see 'Serial > Port Setup' Terminal Server on page 138). |
| SLIP | IP packets are encapsulated over RS-232 interface port (see 'Serial > Port Setup' Serial Line Interface Protocol (SLIP)' on page 141). |

*MTU Size (bytes)*

This parameter sets the size of the packet in bytes received before it is transmitted if an inter-frame gap is not detected. The default setting is 512 bytes.

*Baud Rate (bit/s)*

This parameter sets the baud rate to 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600 or 115200 bit/s. The default setting is 115200 bit/s.

*Character Length (bits)*

This parameter sets the character length to 7 or 8 bits. The default setting is 8 bits.

*Parity*

This parameter sets the parity to Even, Odd or None. The default setting is None.

*Stop Bits (bits)*

This parameter sets the number of stop bits to 1 or 2 bits. The default setting is 1 bit.

*Flow Control*

This parameter sets the flow control of the serial port. The default setting is Disabled.

| Option | Function |
|---|---|
| None | The Aprisa SRi radio port (DCE) CTS is in a permanent ON (+ve) state.<br>This does not go to OFF if the radio link fails. |
| CTS-RTS | CTS / RTS hardware flow control between the DTE and the Aprisa SRi radio port (DCE) is enabled.<br>If the Aprisa SRi buffer is full, the CTS goes OFF.<br>In the case of radio link failure, the signal goes to OFF (-ve) state. |

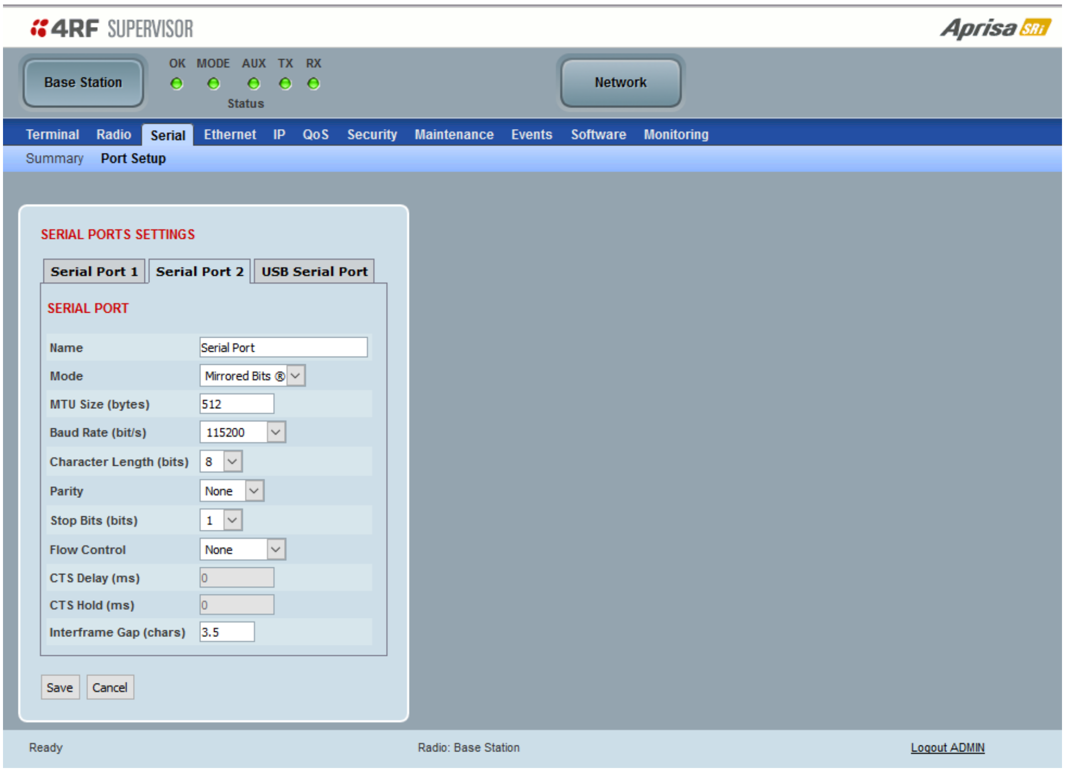
In terminal server mode, the serial packet is no different from an Ethernet packet and travels through various packet queues before being transmitted over the air. Thus, the serial flow control has no affect in terminal server mode.

*Inter-Frame Gap (chars)*

This parameter defines the gap between successive serial data frames. It is used to delimit the serial data to define the end of a packet. The Inter-Frame Gap limits are 0 to 20 chars in steps of 0.1 char. The default setting is 3.5 chars.

## Mirrored Bits®

This menu item is only applicable if the serial port has an operating mode of Mirrored Bits.



SERIAL PORTS SETTINGS

SERIAL PORT

| | |
|---|---|
| Name | Serial Port |
| Mode | Mirrored Bits ® |
| MTU Size (bytes) | 512 |
| Baud Rate (bit/s) | 115200 |
| Character Length (bits) | 8 |
| Parity | None |
| Stop Bits (bits) | 1 |
| Flow Control | None |
| CTS Delay (ms) | 0 |
| CTS Hold (ms) | 0 |
| Interframe Gap (chars) | 3.5 |

### Introduction

Mirrored Bits® is a serial communications protocol used to exchange internal logic status messages directly between relays and devices used in line protection, remote control and monitoring, relay remote tripping, sectionalizing and other such applications.

The protocol relies on near constant transmission of status bytes between the devices. It can only tolerate small delays between receipts of packets.

The protocol provides alarms states to monitor and report on radio channel performance. If a receiving device does not receive a status packet within a predefined time then it asserts an ‘instantaneous channel monitor’ error (ROK), this error clears as soon as the next status packet is received.

There are two more significant errors RBAD (ROK dropout for settable time) and CBAD (long term channel unavailability exceeding a settable threshold) that will be asserted if more extensive delays occur or the communications channel is lost.

The trigger or time period for asserting ROK varies between devices. Typically, the ROK error state is asserted if a receiving device does not receive a packet for a period > than 3 x the period taken to transmit a packet.

When optimizing for Mirrored Bits® operation, the target is to present a radio channel that does not result in ROK triggers occurring. Individual networks may be tolerant to occasional ROK alarms states if configured to make use of the more significant alarms.

## Optimization

The Aprisa SRi provides a Half Duplex radio channel with variable latency. Error free transport of the protocol can be achieved through specific serial traffic configuration settings, which are dependent on the radio RF configuration, Mirrored Bits® devices and network characteristics.

Under some scenarios limited Ethernet transport may be supported without impacting Mirrored Bits® operation. If the network can tolerate occasional ROK errors Ethernet support may be increased. The level of impact on Mirrored Bits® is related to radio settings and the specifics of the Ethernet traffic including size and frequency of the Ethernet packets.

When attempting to configure the radios to support new devices or varying network requirements a standard configuration is used for the radios and the following two key serial data parameters are adjusted:

- Inter-Frame Gap (IFG) – used to detect new packets on the serial input to the radio
- Maximum Transmission Unit (MTU) – used to define the over the air (OTA) packet size

To date, 4RF has lab tested and confirmed operation with the follow SEL Mirrored Bits® devices. Contact 4RF for preferred configuration:

- 2411 PAC (Programmable Automation Controller)
- 2505 series remote I/O modules
- 321 series relays

4RF is working with customers to confirm support for other devices as they are identified. The remainder of this document details the configuration settings and general process to optimize the radio to support additional devices, in addition to listing expected latencies under different configurations.

## General Configuration

The configurations and process are aligned with a 2505 series remote I/O module device with serial baud rate of 9600. As a ‘fast’ Mirrored Bits® device it is considered a good start point for optimization.  For other baud rates please refer to the table in Initial Setup for Mirrored Bits® Support on page 136 for initial MTU and IFG settings.

The following are the recommended RF configurations and serial data configuration settings and to optimize the performance over Aprisa SRi radios.

Recommended RF configurations are:

- Radio > Channel Setup > Serial Data Stream Mode to ‘Segregate’
- Radio > Channel Setup > Network Traffic Type to ‘Serial Only’
- Radio > Radio Setup > Modulation – 64QAM (low gain)

### Serial data port variable parameters

Two key serial port parameters will be adjusted during optimization. The following initial values have been determined as a suitable for the SEL 2505 device which is the fastest device 4RF has lab tested. It is a suitable start point to carry out optimization for other devices.

Inter-Frame Gap – initially set to 0.2

- IFG is dependent on serial line baud rate only
- The Mirrored Bits® protocol is essentially timed to a base clock, the slower the baud rate the longer the period to transmit a packet resulting in less time between packets
- A low baud rate is ideal as it increase the time period before a ROK error will occur as this is dependent on serial packet transmission time
- The minimum baud rate currently proven to provide reliable communications is 9600 bit, with this rate an IFG of 0.2 is required to be used
- With the 2505 device the IFG increases with increases in serial baud rate, while easier to detect gaps the ROK error period is reduced

MTU – initially set to 32 bytes

- Dependent on serial line baud rate, channel size, modulation, security settings, intended traffic mix and all other settings that influence OTA speed and capacity available for external traffic
- MTU affects latency, if a large MTU then the radio will ‘wait’ for the number of bytes before sending the packet OTA
- Ideally a low MTU will be used – the minimum needs to support the various settings above and intended mix of traffic
- MTU can be changed in steps of +/- 8 when trying different configurations
- Refer table in section 5 for start point of MTU based on channel size, modulation and serial baud rate, this assumes the general radio settings as above
- Increase by 8 for new devices or in attempt to support some Ethernet or other services

## Initial Setup for Mirrored Bits® Support

The MTU can be adjusted up or down in steps of 8 bytes

- Increase by 8 bytes if Mirrored Bits® is not running without alarms or ROK assertions
- Decrease by 8 bytes if Mirrored Bits® is running error free, the target is to find the smallest MTU for reliable transport

If reliable Mirrored Bits® communications cannot be achieved after increasing the MTU by 10 steps or 80 bytes, then the following CLI commands can be used to extract low level packet information from the radio.

This information can be forwarded to 4RF to determine what is occurring and identify alternate configurations.

- Configure Radio / Mirrored Bits® equipment for 9600 baud rate.
- Connect Mirrored Bits® equipment to one of the serial ports and start traffic.
- Ensure no management traffic or other services are connected to the Ethernet or Serial ports.
- Login to the radio CLI as ‘admin’ and execute ‘debug set 2 5’ -> there will be continuous scrolling information.
- Screen capture one page of the scrolling information to send to 4RF.
- Remove serial cable and execute ‘debug clear 2 5’ via the CLI to clear the debug routine, alternatively reboot the radio.
- Note if the serial baud rate intended to be used is not 9600 then repeat for each different rate and clearly identify the screen prints by baud rate before forwarding to 4RF.

Note there are additional low level configurations which can improve performance. 4RF will detail these if required based on the information received.

## Additional Setup for Improved Latency or Additional Services

Once reliable Mirrored Bits® communications has been achieved, experimentation can be undertaken to reduce latencies or provide support for additional services such as Ethernet based SCADA polling.

Increasing the MTU will impact latency for each packet (refer to table in section 4). A point may be reached where the gaps between individual packets are too high and the Mirrored Bits® ROK or other alarms will assert.

Increasing the MTU allows some ‘space’ in each packet for additional data from the second serial port or the Ethernet ports.

Support for Ethernet is highly dependent on the size and frequency of packets being sent. A level of trial and error is required. At the slower OTA data rates, support may be limited however with higher OTA data rates some services may be supported (such as polling).

It should be noted that if the Mirrored Bits® devices or network manager can accept occasional ROK assertions then there is more flexibility for other services.

## Baud rate and Latency Table

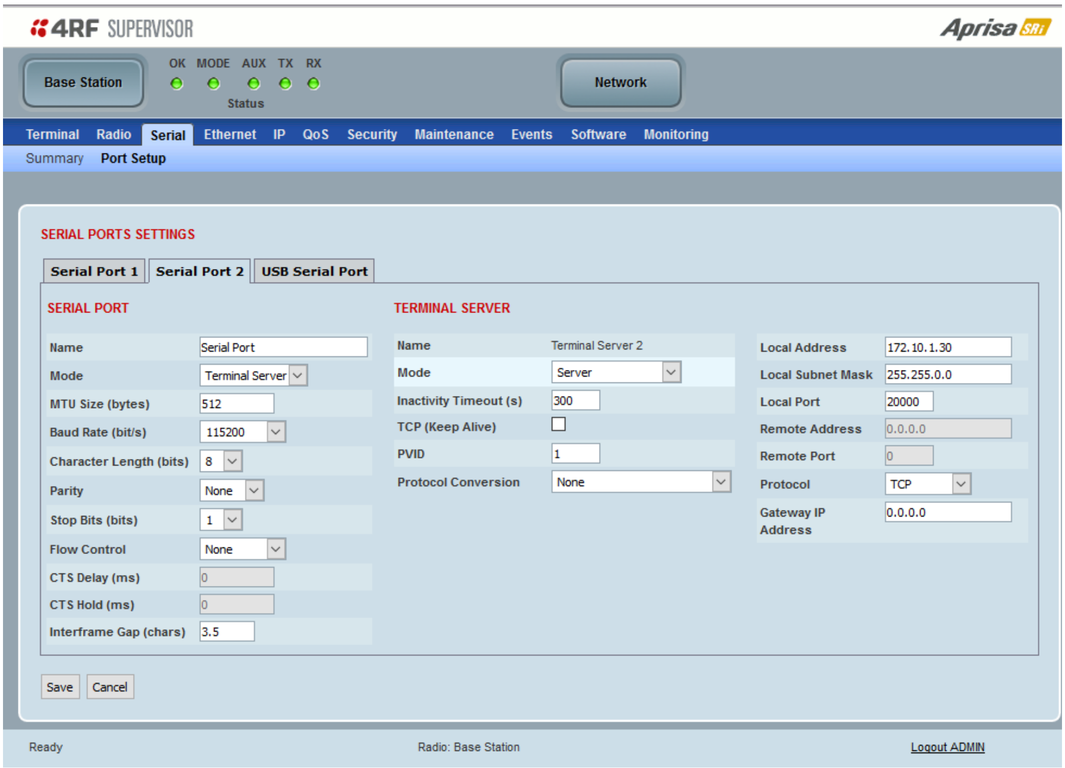
The following table lists the optimized MTU and IFG and resulting latency for the SEL 2505 device, one of the faster devices available so serves as an ideal starting point when introducing new devices. It is recommended that initial testing is carried out with one step size higher (8) on MTU.

| Serial Baud Rate | Modulation | Channel Size | Minimum MTU Size | IFG<br>SEL 2505 | One Way Latency (ms) |
|---|---|---|---|---|---|
| 9600 | 64 QAM Low | 50 | 8 | 0.2 | 20.0 |
| 9600 | 16 QAM Low | 50 | 16 | 0.2 | - |
| 9600 | QPSK Low | 50 | 24 | 0.2 | 42.5 |
| | | | | | |
| 19200 | 64 QAM Low | 50 | 16 | 0.5 | 25.0 |
| 19200 | 16 QAM Low | 50 | 24 | 0.5 | - |
| 19200 | QPSK Low | 50 | 24 | 0.5 | - |
| | | | | | |
| 38400 | 64 QAM Low | 50 | 24 | 3 | 40.0 |
| 38400 | 16 QAM Low | 50 | 24 | 3 | - |
| 38400 | QPSK Low | 50 | 40 | 3 | 62.5 |

## Terminal Server

This menu item is only applicable if the serial port has an operating mode of Terminal Server.

The Terminal Server operating mode provides encapsulation of serial data from a local serial port into an IP packet (over TCP or UDP). This function is typically used for connecting a legacy serial RTU at a remote radio to an Ethernet SCADA server.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary Port Setup
Serial Port 1 Serial Port 2 USB Serial Port
Save Cancel
Logout ADMIN

SERIAL PORTS SETTINGS

SERIAL PORT

| | |
|---|---|
| Name | Serial Port |
| Mode | Terminal Server |
| MTU Size (bytes) | 512 |
| Baud Rate (bit/s) | 115200 |
| Character Length (bits) | 8 |
| Parity | None |
| Stop Bits (bits) | 1 |
| Flow Control | None |
| CTS Delay (ms) | 0 |
| CTS Hold (ms) | 0 |
| Interframe Gap (chars) | 3.5 |

TERMINAL SERVER

| | |
|---|---|
| Name | Terminal Server 2 |
| Mode | Server |
| Inactivity Timeout (s) | 300 |
| TCP (Keep Alive) | □ |
| PVID | 1 |
| Protocol Conversion | None |

| | |
|---|---|
| Local Address | 172.10.1.30 |
| Local Subnet Mask | 255.255.0.0 |
| Local Port | 20000 |
| Remote Address | 0.0.0.0 |
| Remote Port | 0 |
| Protocol | TCP |
| Gateway IP Address | 0.0.0.0 |

Ready

Radio: Base Station

### *Mode*

This parameter defines the mode of operation of the terminal server connection. The default setting is Client and Server.

| Option | Function |
|---|---|
| Client | The radio will attempt to establish a TCP connection with the specified remote unit. Generally, this setting is for the base station with an Ethernet connection to the SCADA master. |
| Server | The radio will listen for a TCP connection on the specified local port. Generally, this setting is for the remote radio with a serial connection to the RTU.<br>Data received from any client shall be forwarded to the associated serial port while data received from that serial port shall be forwarded to every client with an open TCP connection.<br>If no existing TCP connections exist, all data received from the associated serial port shall be discarded. |
| Client and Server | The radio will listen for a TCP connection on the specified local port and if necessary, establish a TCP connection with the specified remote unit. Generally, this setting is used for the remote radio, but it should be used carefully as two connections might be established with the base station.<br>Data received from any client shall be forwarded to the associated serial port while data received from that serial port shall be forwarded to every client with an open TCP connection. |

*Inactivity Timeout (seconds)*

This specifies the duration (in seconds) to automatically terminate the connection with the remote TCP server if no data has been received from either the remote TCP server or its associated serial port for the duration of the configured inactivity time.

*TCP Keep Alive*

A TCP keep alive is a message sent by one device to another to check that the link between the two is operating, or to prevent the link from being broken.

If the TCP keep alive is enabled, the radio will be notified if the TCP connection fails.

If the TCP keep alive is disabled, the radio relies on the Inactivity Timeout to detect a TCP connection failure. The default setting is disabled.

**Note:** An active TCP keep alive will generate a small amount of extra network traffic.

*PVID*

This parameter sets the PVID (port VLAN ID) for each of the terminal servers on the radio.

*Protocol Conversion*

This parameter defines the mode of operation of the terminal server connection. The default setting is None.

| Option | Function |
|---|---|
| None | No terminal server Protocol Conversion |
| Modbus TCP to Modbus RTU | The radio provides a gateway between Modbus TCP to Modbus RTU. |
| Modbus TCP to Modbus ASCII | The radio provides a gateway between Modbus TCP to Modbus ASCII. |

*Local Address*

This parameter sets the serial Terminal Server local IP address.

<u>Bridge Mode</u>

The local IP address can be the same as the radio's configured IP address or the Virtual IP address for protected stations. If it is not the above, then it must be an IP address from a network different from the radio's network.

Note that the Terminal Server local IP address settings can be the same for other terminal servers in the radio.

<u>Router Mode</u>

The local IP address must be the same as port 1 (management IP address) of the radio’s configured port IP addresses or the Virtual IP address for protected stations.

<u>Gateway Router Mode</u>

The local IP address must be the same as the radio's configured IP address or the Virtual IP address for protected stations.

*Local Port*

This parameter sets the TCP or UDP port number of the local serial port.

The valid port number range is less than or equal to 49151 but with exclusions of 0, 20, 21, 23, 80, 161, 162, 443, 5445, 6445, 9930 or 9931. The default setting is 20000.

The user is responsible for ensuring that there is no conflict on the network.

*Remote Address*

This parameter sets the IP address of the server connected to the radio Ethernet port. When the remote address / port is configured as 0.0.0.0/0, each outgoing UDP packet will be sent to the source address of the last received UDP packet.

*Remote Port*

This parameter sets the port number of the server used in TCP client, TCP client server or UDP modes. The default setting is 0.

*Protocol*

This parameter sets the L4 TCP/IP or UDP/IP protocol used for terminal server operation. The default setting is TCP.

*Gateway IP Address*

This Terminal Server parameter sets the Gateway IP address of a router in the network that serves as the forwarding router to other networks when no other route specification matches the destination IP address of a packet.

This is useful when default gateway IP address of the radio and the Terminal Server Gateway IP Address are on different IP subnet networks.

When all radios are in router mode (GRM / RM) or advanced router mode (AGRM / ARM), the default gateway IP address of the radio and Gateway IP Address of the Terminal Server are the same, leaving the Gateway IP Address on the default value of 0.0.0.0 will serve the purpose. Only when the radio and Terminal Server are with different IP subnets and are connected to different router gateway IP addresses, the default value shall be set to the appropriate gateway IP address.

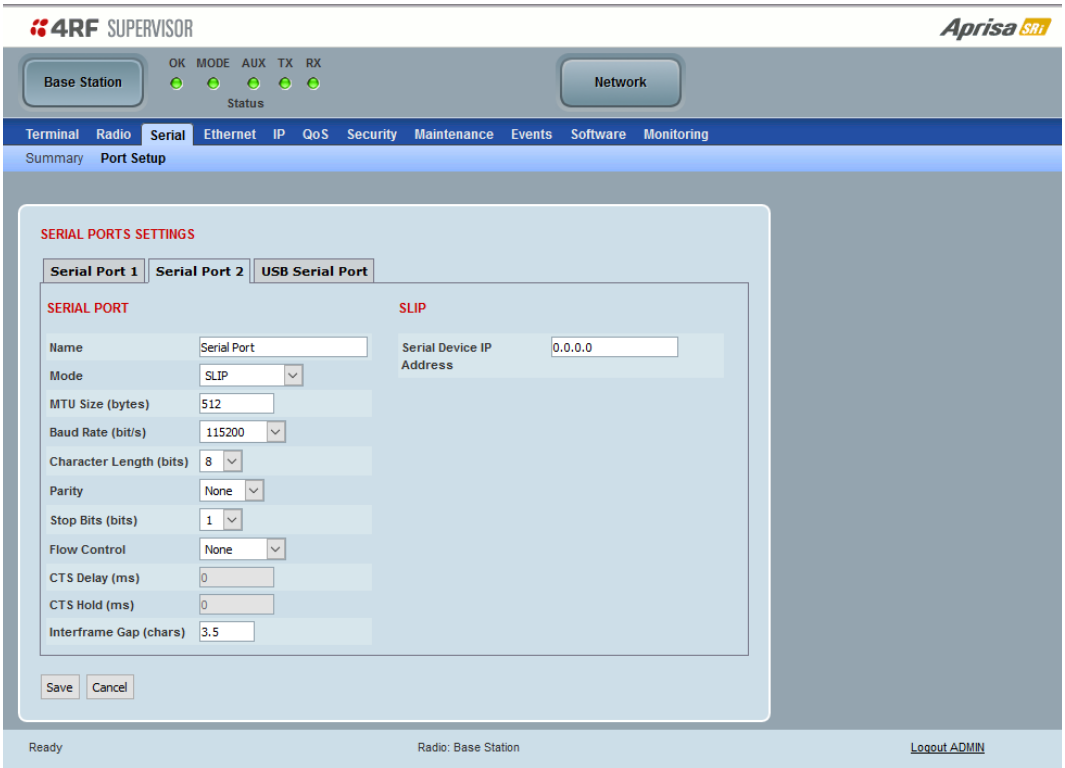
## Serial Line Interface Protocol (SLIP)

This menu item is only applicable if the serial port has an operating mode of SLIP.

The SLIP operating mode provides IP packet encapsulation over RS-232 serial interface as per the SLIP protocol RFC 1055.

A SLIP serial interface contains the IP address of the serially connected RTU as per the RTU/PLC SLIP protocol. The SLIP interfaces on the remote radios can be part of the bridge network and can coexist and operate with a mix of Ethernet interfaces, serial SLIP and terminal server interfaces.

As the RTU/PLC serial SLIP interface doesn't support MAC addresses, a remote radio SLIP interface uses a proxy ARP function that returns its own MAC address for ARP requests based on the IP address of the RTU/PLC SLIP interface.



SERIAL PORTS SETTINGS

SERIAL PORT

| | |
|---|---|
| Name | Serial Port |
| Mode | SLIP |
| MTU Size (bytes) | 512 |
| Baud Rate (bit/s) | 115200 |
| Character Length (bits) | 8 |
| Parity | None |
| Stop Bits (bits) | 1 |
| Flow Control | None |
| CTS Delay (ms) | 0 |
| CTS Hold (ms) | 0 |
| Interframe Gap (chars) | 3.5 |

SLIP

| | |
|---|---|
| Serial Device IP Address | 0.0.0.0 |

Ready

Radio: Base Station

### *Serial Device IP Address*

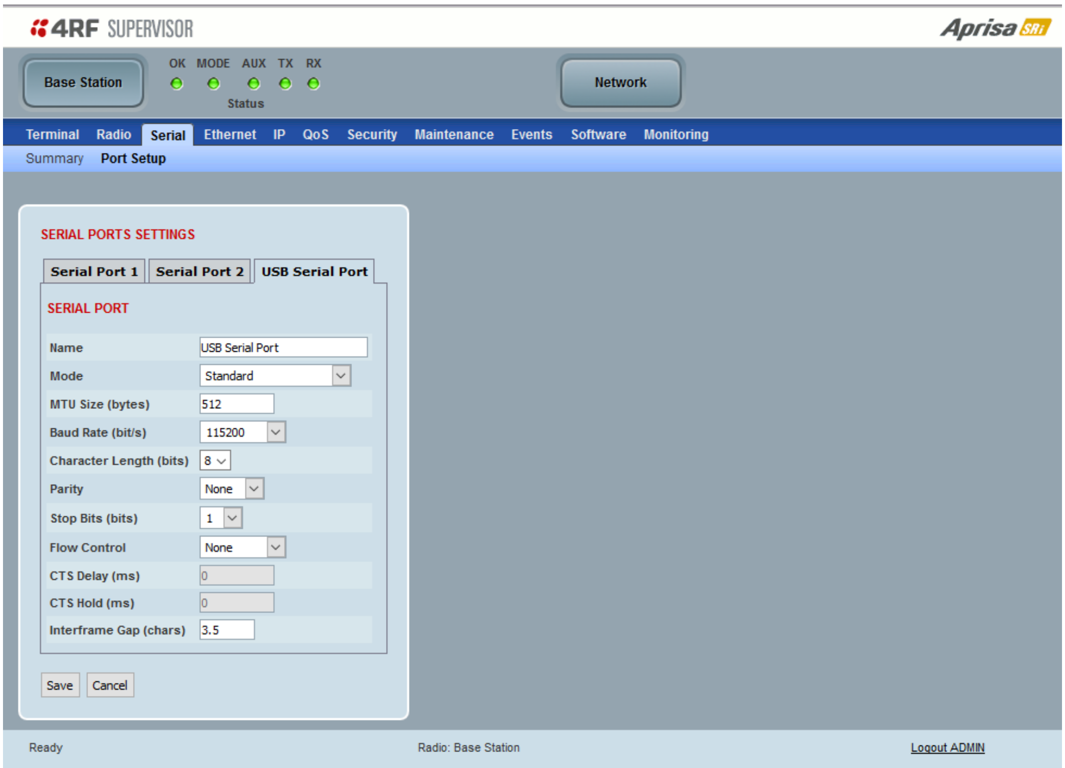
This parameter sets the IP address of the RTU connected on the configured serial port.

### *Baud Rate (bit/s)*

This parameter sets the baud rate to 1200, 2400, 4800, 9600, 19200, 38400, 57600 or 115200 bit/s. The default setting is 115200 bit/s. The minimum supported baud rate is 1200 bit/s as SLIP will not work on baud rates below 1200.

### *USB Serial Ports*

This page provides the setup for the USB serial port settings.



SERIAL PORTS SETTINGS

SERIAL PORT

| | |
|---|---|
| Name | USB Serial Port |
| Mode | Standard |
| MTU Size (bytes) | 512 |
| Baud Rate (bit/s) | 115200 |
| Character Length (bits) | 8 |
| Parity | None |
| Stop Bits (bits) | 1 |
| Flow Control | None |
| CTS Delay (ms) | 0 |
| CTS Hold (ms) | 0 |
| Interframe Gap (chars) | 3.5 |

## SERIAL PORTS SETTINGS

### *Mode*

This parameter defines the mode of operation of the serial port. The default setting is Disabled.

| Option | Function |
|---|---|
| Disabled | The serial port is not required. |
| Standard | The serial port is communicating with serial ports on other stations. |
| Terminal Server | A base station Ethernet port can communicate with both Ethernet ports and serial ports on remote radios.<br>RS-232 traffic is encapsulated in IP packets (see ‘Serial > Port Setup’ Terminal Server on page 138). |
| CLI Management | The USB host port is used to access the radio Command Line Interface (CLI). A USB converter to RS-232 convertor will be required to connect to a PC. |
| GPS Receiver - NMEA0183 | Set if a GPS receiver device is plugged into the radio USB port (see ‘ GPS Receiver’ on page 145). |

*MTU Size (bytes)*

This parameter sets the size of the packet in bytes received before it is transmitted if an inter-frame gap is not detected. Setting a smaller MTU may reduce latency, but this should only be done with streaming mode or else if serial protocol is known to allow gaps at the receiver. The default setting is 512 bytes.

*Baud Rate (bit/s)*

This parameter sets the baud rate to 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600 or 115200 bit/s. The default setting is 9600 bit/s.

*Character Length (bits)*

This parameter sets the character length to 7 or 8 bits. The default setting is 8 bits.

*Parity*

This parameter sets the parity to Even, Odd or None. The default setting is None.

*Stop Bits (bits)*

This parameter sets the number of stop bits to 1 or 2 bits. The default setting is 1 bit.

*Flow Control*

This parameter sets the flow control of the serial port. The default setting is Disabled.

| Option | Function |
|---|---|
| None | The Aprisa SRi radio port (DCE) CTS is in a permanent ON (+ve) state. |
| CTS-RTS | CTS / RTS hardware flow control between the DTE and the Aprisa SRi radio port (DCE) is enabled.<br>If the Aprisa SRi buffer is full the CTS goes OFF, otherwise CTS is ON. |
| CTS-Keying | CTS Keying is needed when working with devices that require to be keyed before sending data;<br>• Driving legacy modems that use the CTS signal as a key-up signal.<br>• Driving RS485 serial links, where the CTS signal is used as a Tx enable |

*CTS Delay ms*

In CTS-Keying mode, this parameter sets the period the between the CTS being set and data being transmitted. The default setting is 0 ms.

*CTS Hold Duration ms*

In CTS-Keying mode, this parameter sets the the period the between the end of the data and CTS being cleared. The default setting is 0 ms.

*Inter-Frame Gap (chars)*

This parameter defines the gap between successive serial data frames. It is used to delimit the serial data to define the end of a packet.

Smaller values give better serial latency, however if this value is too small then packets may be incorrectly split and serial speed may be much slower. If this value is too large serial packets may be incorrectly joined together.

The Inter-Frame Gap limits are 0 to 9999 chars in steps of 0.1 char. The default setting is 3.5 chars.

An alarm event indicates if the value is set larger than the maximum for the serial mode selected.

## GPS Receiver

This menu item is only applicable if a GPS Receiver device is plugged into the radio USB port.

The radio USB port supports NMEA 0183 - a combined electrical and data specification for communication between electronics systems and GPS receivers.

The currently supported GPS Receiver devices are;

| | Part Number | Part Description |
|---|---|---|
| 1 | FTD FT X GPS | GPS Receiver, 1575 MHz, USB, Dongle |
| 2 | INV EZ GPS | GPS Receiver, 1575 MHz, USB, SMA |
| | PCT GNSS HR26PM | Antenna, Patch, 1565-1610 MHz, GNSS Freq Filter, SMA |

*MTU Size (bytes)*

This parameter is not required for GPS Receiver device.

*Baud Rate (bit/s)*

Set to 4800 bit/s for both supported GPS Receiver devices above.

*Character Length (bits)*

Set to 8 bits.

*Parity*

Set to None.

*Stop Bits (bits)*

Set to 1 bit.

*Flow Control*

Set to Disabled.

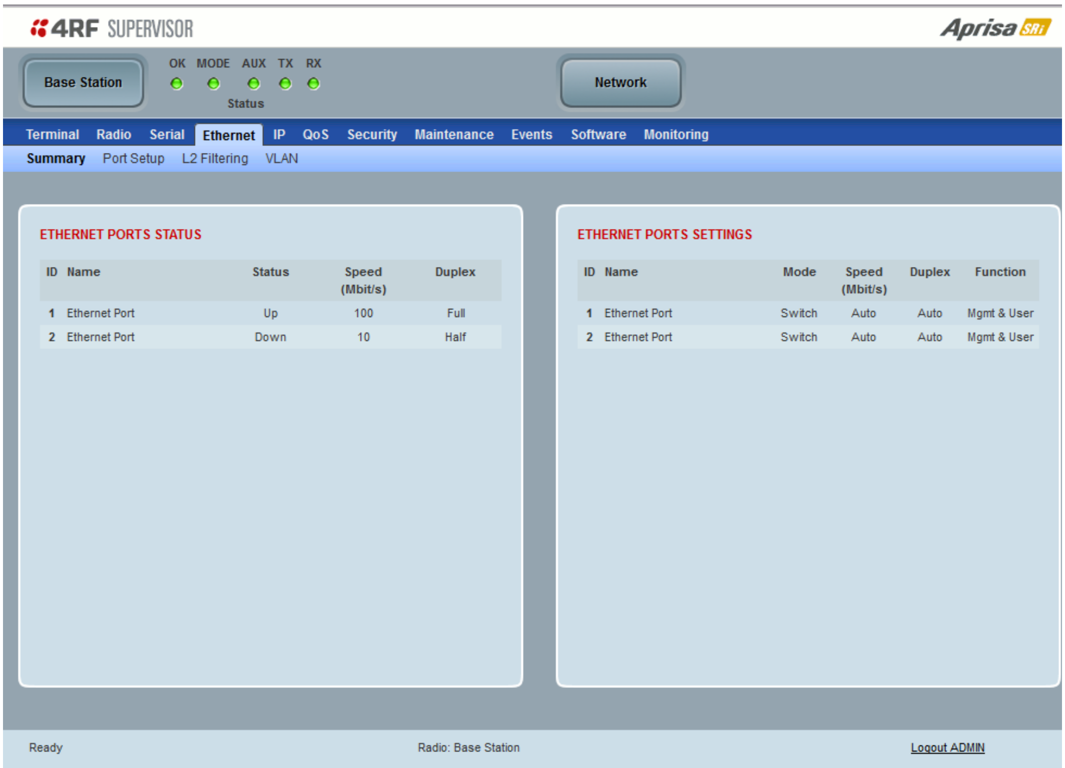
*Inter-Frame Gap (chars)*

This parameter is not required for GPS Receiver device.

# Ethernet

## Ethernet > Summary

This page displays the current settings for the Ethernet port parameters and the status of the ports.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary Port Setup L2 Filtering VLAN
Ready
Radio: Base Station
Logout ADMIN

ETHERNET PORTS STATUS

| ID | Name | Status | Speed (Mbit/s) | Duplex |
|---|---|---|---|---|
| 1 | Ethernet Port | Up | 100 | Full |
| 2 | Ethernet Port | Down | 10 | Half |

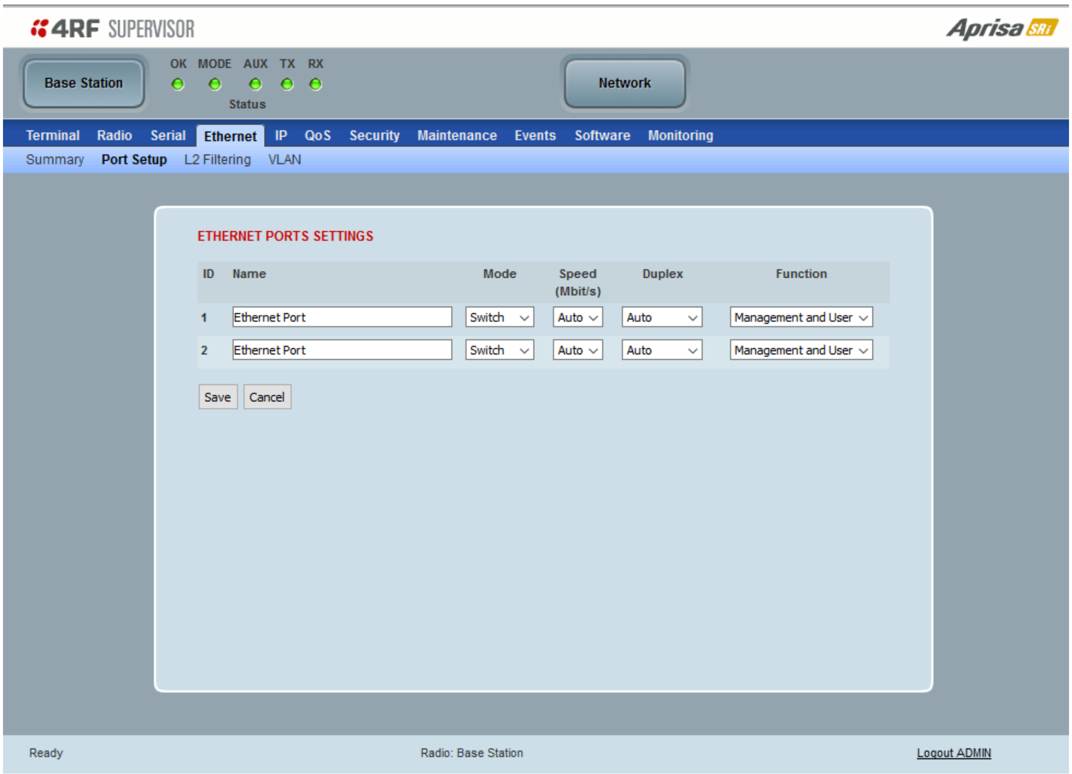
ETHERNET PORTS SETTINGS

| ID | Name | Mode | Speed (Mbit/s) | Duplex | Function |
|---|---|---|---|---|---|
| 1 | Ethernet Port | Switch | Auto | Auto | Mgmt & User |
| 2 | Ethernet Port | Switch | Auto | Auto | Mgmt & User |

See ‘Ethernet > Port Setup’ for configuration options.

## Ethernet > Port Setup

This page provides the setup for the Ethernet ports settings.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary Port Setup L2 Filtering VLAN
Save Cancel
Ready
Radio: Base Station
Logout ADMIN

ETHERNET PORTS SETTINGS

| ID | Name | Mode | Speed (Mbit/s) | Duplex | Function |
|---|---|---|---|---|---|
| 1 | Ethernet Port | Switch | Auto | Auto | Management and User |
| 2 | Ethernet Port | Switch | Auto | Auto | Management and User |

### ETHERNET PORT SETTINGS

*Mode*

This parameter controls the Ethernet traffic flow. The default setting is Standard.

| Option | Function |
|---|---|
| Standard | Enables Ethernet data communication over the radio link but Ethernet traffic is not switched locally between the two Ethernet ports. |
| Switch | Ethernet traffic is switched locally between the two Ethernet ports and communicated over the radio link |
| Disabled | Disables all Ethernet data communications. |

*Speed (Mbit/s)*

This parameter controls the traffic rate of the Ethernet port. The default setting is Auto.

| Option | Function |
|---|---|
| Auto | Provides auto selection of Ethernet Port Speed 10/100 Mbit/s |
| 10 | The Ethernet Port Speed is manually set to 10 Mbit/s |
| 100 | The Ethernet Port Speed is manually set to 100 Mbit/s |

*Duplex*

This parameter controls the transmission mode of the Ethernet port. The default setting is Auto.

| Option | Function |
|---|---|
| Auto | Provides auto selection of Ethernet Port duplex setting. |
| Half Duplex | The Ethernet Port is manually set to Half Duplex. |
| Full Duplex | The Ethernet Port is manually set to Full Duplex. |

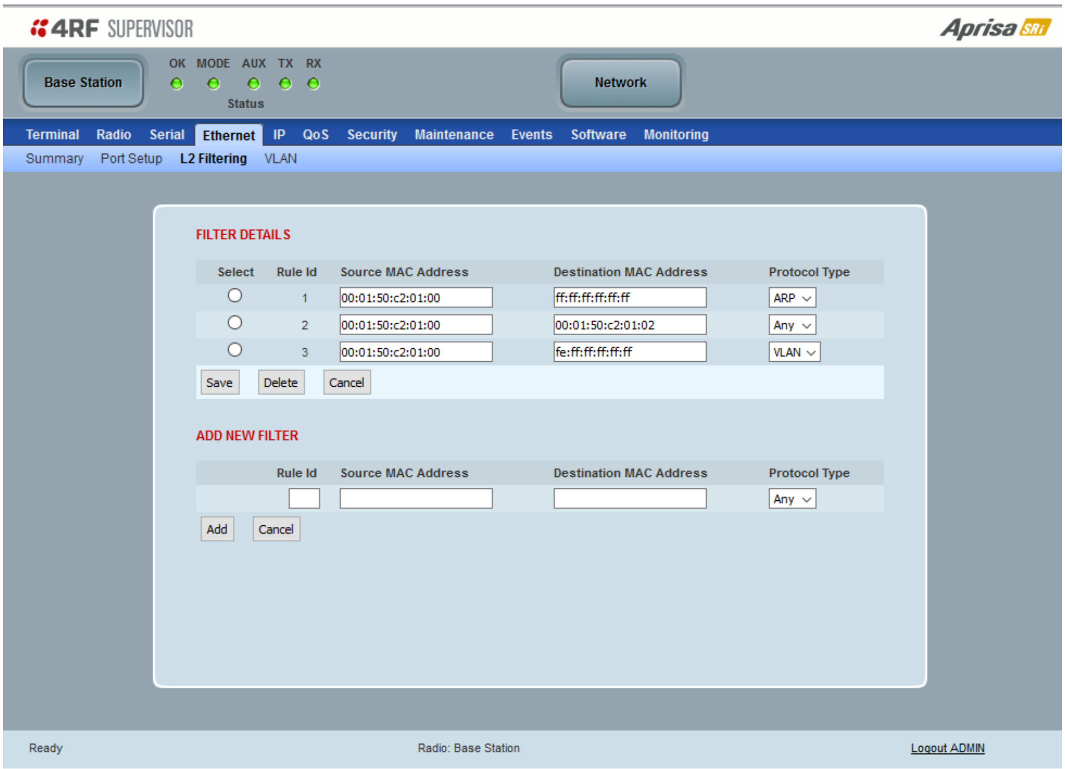
*Function*

This parameter controls the use for the Ethernet port. The default setting is Management and User.

| Option | Function |
|---|---|
| Management Only | The Ethernet port is only used for management of the network. |
| Management and User | The Ethernet port is used for management of the network and User traffic over the radio link. |
| User Only | The Ethernet port is only used for User traffic over the radio link. |

## Ethernet > L2 Filtering

This page is only available if the Ethernet traffic option has been licensed (see ‘Maintenance > Licence’ on page 237).


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary Port Setup L2 Filtering VLAN

FILTER DETAILS

| Select | Rule Id | Source MAC Address | Destination MAC Address | Protocol Type |
|---|---|---|---|---|
| ○ | 1 | 00:01:50:c2:01:00 | ff:ff:ff:ff:ff:ff | ARP |
| ○ | 2 | 00:01:50:c2:01:00 | 00:01:50:c2:01:02 | Any |
| ○ | 3 | 00:01:50:c2:01:00 | fe:ff:ff:ff:ff:ff | VLAN |

ADD NEW FILTER

| Rule Id | Source MAC Address | Destination MAC Address | Protocol Type |
|---|---|---|---|
|  |  |  | Any |

### FILTER DETAILS

L2 Filtering provides the ability to filter (white list) radio link user traffic based on specified Layer 2 MAC addresses.

User traffic originating from specified Source MAC Addresses destined for specified Destination MAC Addresses that meets the protocol type criteria will be transmitted over the radio link.

User traffic that does not meet the filtering criteria will not be transmitted over the radio link.

Management traffic to the radio will never be blocked.

#### *Source MAC Address*

This parameter sets the filter to the Source MAC address of the packet in the format ‘hh:hh:hh:hh:hh:hh’.

If the Source MAC Address is set to ‘FF:FF:FF:FF:FF:FF’, traffic will be accepted from any source MAC address.

#### *Destination MAC Address*

This parameter sets the filter to the Destination MAC address of the packet in the format ‘hh:hh:hh:hh:hh:hh’.

If the Destination MAC Address is set to ‘FF:FF:FF:FF:FF:FF’, traffic will be delivered to any destination MAC address.

*Protocol Type*

This parameter sets the EtherType accepted ARP, VLAN, IPv4, IPv6 or Any type.

Example:

In the screen shot, the rules are configured in the base station which controls the Ethernet traffic to the radio link.

Traffic from an external device with the Source MAC address 00:01:50:c2:01:00 is forwarded over the radio link if it meets the criteria. All other traffic will be blocked.

- Rule 1 If the Protocol Type is ARP going to any destination MAC address or
- Rule 2 If the Protocol Type is Any and the destination MAC address is 01:00:50:c2:01:02 or
- Rule 3 If the Protocol Type is VLAN tagged packets going to any unicast destination MAC address.

*Special L2 Filtering Rules:*

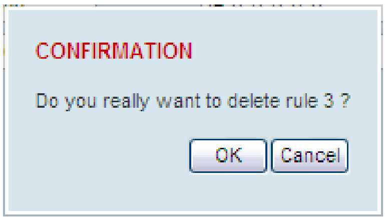
Unicast Only Traffic

This L2 filtering allows for Unicast only traffic and drop broadcast and multicast traffic. This filtering is achieved by adding the two rules:

| Rule | Source MAC Address | Destination MAC Address | Protocol Type |
|---|---|---|---|
| Allow ARPS | FF:FF:FF:FF:FF:FF | FF:FF:FF:FF:FF:FF | ARP |
| Allow Unicasts from Any source | FF:FF:FF:FF:FF:FF | **FE**:FF:FF:FF:FF:FF | Any |

**To delete a L2 Filter:**

1. Click on an existing rule 'Select'.
2. Click on Delete.



CONFIRMATION

Do you really want to delete rule 3 ?

3. Click on OK.

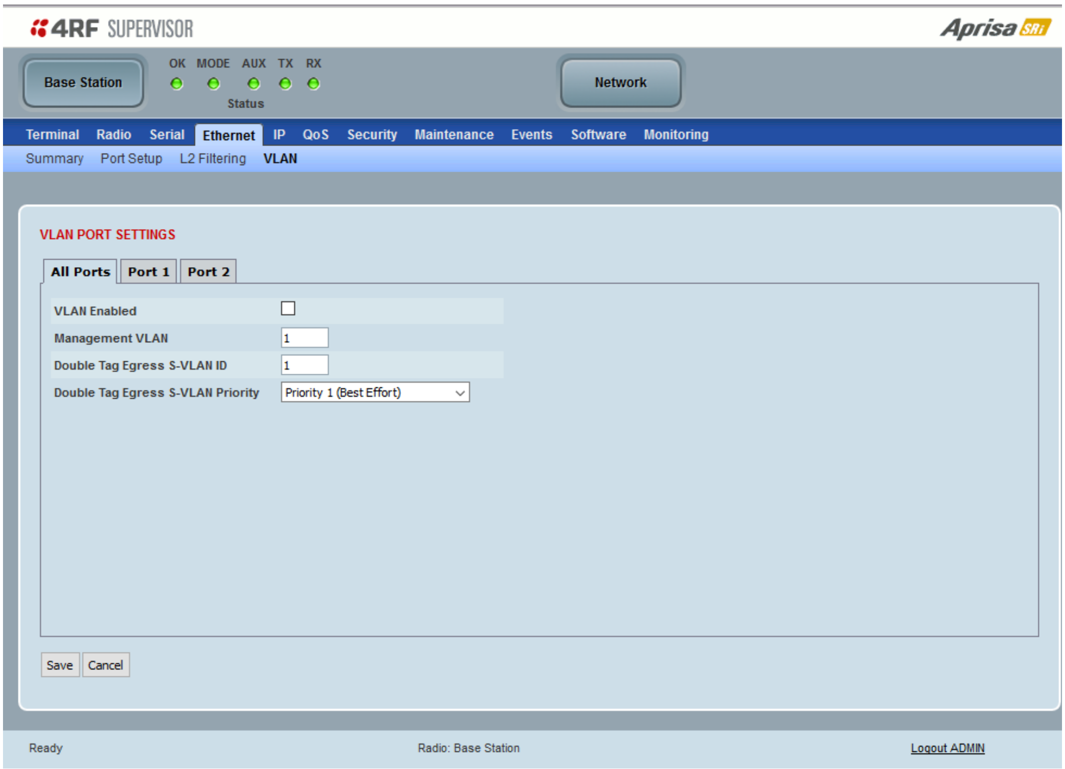
ADD NEW FILTER

**To add a L2 Filter:**

1. Enter the Rule ID number. This is a unique rule number between 1 and 25.
2. Enter the Source MAC address of the packet or 'FF:FF:FF:FF:FF:FF' to accept traffic from any MAC address.
3. Enter the Destination MAC address of the packet or 'FF:FF:FF:FF:FF:FF' to deliver traffic to any MAC address.
4. Select the Protocol Type to ARP, VLAN, IPv4, IPv6 or Any type.
5. Click on Add.

## Ethernet > VLAN

This page is only available if the Ethernet traffic option has been licensed (see ‘Maintenance > Licence’ on page 237).



VLAN PORT SETTINGS

| | |
|---|---|
| VLAN Enabled | ☐ |
| Management VLAN | 1 |
| Double Tag Egress S-VLAN ID | 1 |
| Double Tag Egress S-VLAN Priority | Priority 1 (Best Effort) |

### VLAN PORT SETTINGS – All Ports

This page specifies the parameters that relate to all Ethernet ports when working in Bridge Mode. Three parameters are global parameters for the Ethernet Bridge; enable / disable VLANs, Management VLAN ID and the Double VLAN ID(S-VLAN) and the priority bit. These parameters can't be defined per port and are globally defined for the Ethernet Bridge.

*VLAN Enabled*

This parameter sets if VLAN operation is required on the network. If it is enabled on the base station, it must also be enabled on the remote radios. The default is disabled.

*Management VLAN*

This parameter sets the VLAN ID for management traffic only. The value can be between 1 and 4094. The default is 1.

*Double Tag Egress S-VLAN ID*

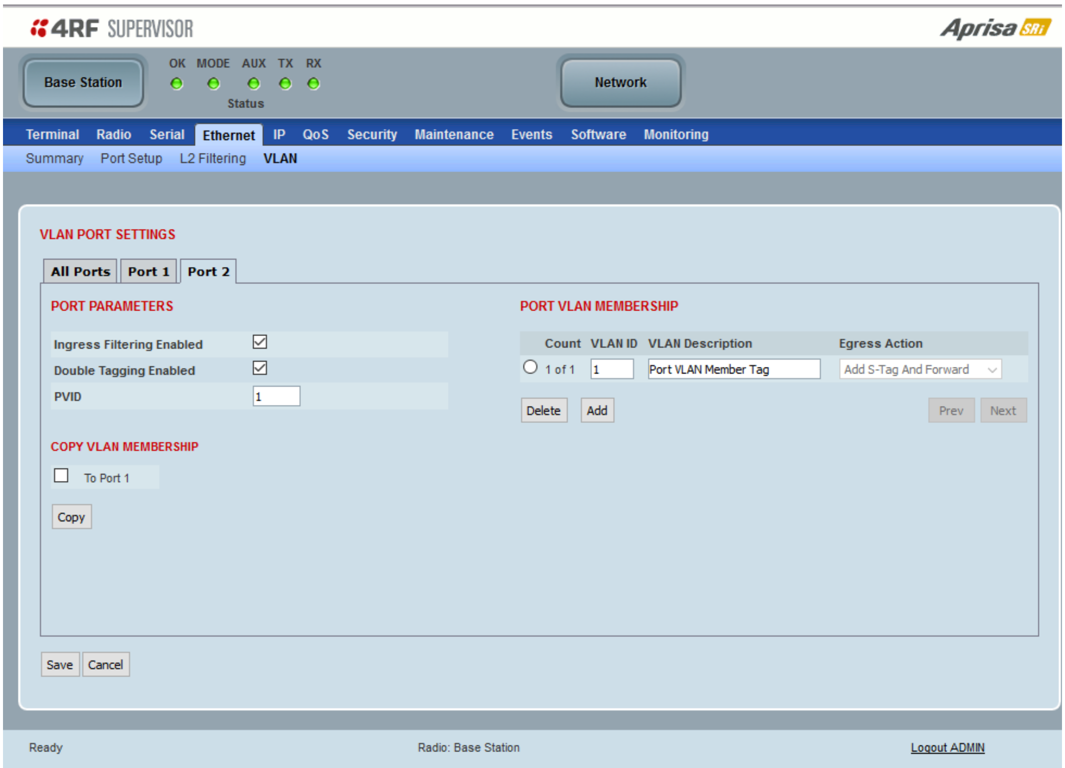
This parameter sets the S-VLAN ID (outer tag) in the egress direction. The value can be between 1 and 4094. The default is 1.

*Double Tag Egress S-VLAN Priority*

This parameter sets the S-VLAN egress traffic priority. The default is Priority 1 (Best Effort).

| **Option** | **Egress Priority Classification** | **High / Low Priority** |
|---|---|---|
| Priority 0 Background | 0 | Lowest Priority |
| Priority 1 (Best Effort) | 1 | ↓ |
| Priority 2 (Excellent Effort) | 2 | |
| Priority 3 (Critical Applications) | 3 | |
| Priority 4 (Video) | 4 | |
| Priority 5 (Voice) | 5 | |
| Priority 6 (Internetwork Control) | 6 | |
| Priority 7 (Network Control) | 7 | Highest Priority |

VLAN PORT SETTINGS – Port 2


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary Port Setup L2 Filtering VLAN

VLAN PORT SETTINGS

All Ports | Port 1 | Port 2

PORT PARAMETERS

| | |
|---|---|
| Ingress Filtering Enabled | ☑ |
| Double Tagging Enabled | ☑ |
| PVID | 1 |

COPY VLAN MEMBERSHIP

□ To Port 1

Copy

PORT VLAN MEMBERSHIP

| | Count | VLAN ID | VLAN Description | Egress Action |
|---|---|---|---|---|
| ○ | 1 of 1 | 1 | Port VLAN Member Tag | Add S-Tag And Forward |

Delete Add Prev Next

Save Cancel

Ready Radio: Base Station Logout ADMIN

## PORT PARAMETERS

### *Ingress Filtering Enabled*

This parameter enables ingress filtering. When enabled, if ingress VLAN ID is not included in its member set (inner tagged), the frame will be discarded.

If the Ingress Filtering is disabled, the Aprisa SRi supports 'Admit All Frames' so that all frames tagged, untagged and priority-tagged-frames are allowed to pass through the Ethernet ports. The default is disabled.

### *Double Tagging Enabled*

This parameter enables double tagging on this specific port. When enabled, if the ingress traffic is double tagged, the Aprisa SRi will check and validate that the S-VLAN ID matches the S-VLAN defined in 'Double Tag Egress S-VLAN ID' in the 'all ports' tab. If there is a match, the packet will be forwarded into the Bridge and the S-VLAN outer tag will be removed, thus the radio network will only forward a single VLAN. If there isn't a matching S-VLAN, the packet will be discarded. On egress, the outer tag (S-VLAN) is appended with the 'Double Tag Egress S-VLAN ID' defined in the 'all ports' tab (see page 151). The default is disabled.

If double tagging is enabled on the port, incoming frames should always be double tagged.

- If the incoming frame is untagged, then the PVID (port VLAN ID) is used and forwarded with the Port Ingress priority provided the PVID is configured in the Port VLAN Membership of any of the Ethernet ports. If not, the frames are dropped.
- If the incoming frame is single tagged, then PVID is used and forwarded with the Port Ingress priority provided the PVID is configured in the Port VLAN Membership of any of the Ethernet ports. If not the frames are dropped.

If double tagging is disabled on the port, incoming frames should always be single tagged, untagged or priority-tagged frames.

Double tagged frames are simply forwarded treating them as if they were single tagged frames. At the egress of the Ethernet port, such frames are forwarded only if the S-VLAN ID of that frame is a member of the Port VLAN Membership.

#### *PVID (Port VLAN ID)*

This parameter sets the frame VLAN ID when the ingress frame is untagged (e.g. when in 'port VLAN membership' the 'egress action' is set to 'untagged and forward') or priority-tagged (VLAN=0). The value can be between 1 and 4094. The default is 1.

**Note:** The Port VLAN Membership must contain the PVID. If the Port VLAN Membership does not contain the PVID, untagged or priority-tagged frames will be discarded.

### COPY VLAN MEMBERSHIP

#### *To Port*

This parameter when set copies the port VLAN Membership settings to the other ports.

### PORT VLAN MEMBERSHIP

#### *VLAN ID*

This parameter sets the VLAN ID of the port for a maximum 64 active VLANs. The value can be between 1 and 4094. The default is 1.

#### *VLAN Description*

This parameter is a freeform field used to identify the VLAN. It can be up to a maximum of 32 characters.

*Egress Action*

This parameter sets the action taken on the frame on egress from the Ethernet port. The default is Untag and forward.

| Option | Function |
|---|---|
| Untag and forward | Removes the tagged information and forwards the frame. On Ingress, the VLAN tag will be added to the PVID tag. |
| Forward | Forwards the tagged frame as it is on egress.<br>On Ingress, traffic is expected to include the VLAN tag with a member VLAN ID, otherwise the packet will be dropped. |

## Controls

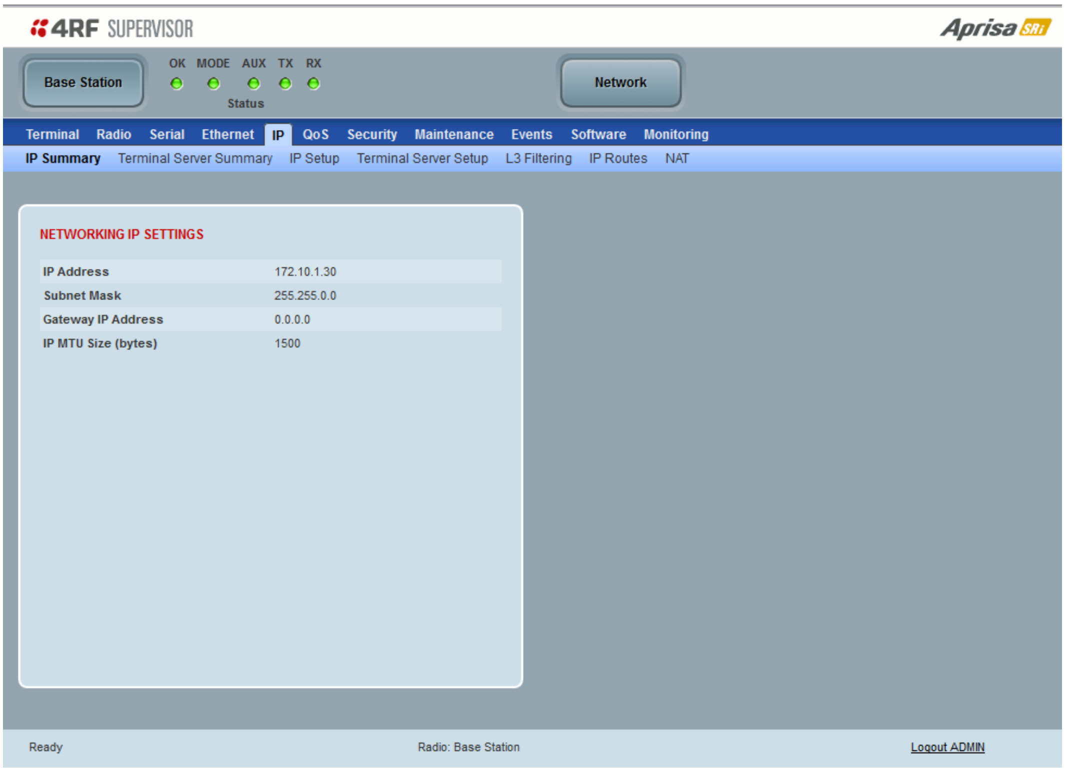
The Add button adds the selected entry.

The Delete button deletes the selected entry.

# IP

## IP > IP Summary > Bridge / Gateway Router Modes

This page displays the current settings for the Networking IP Settings for an Ethernet Operating Mode of ‘Bridge’ or ‘Gateway Router’.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
IP Summary Terminal Server Summary IP Setup Terminal Server Setup L3 Filtering IP Routes NAT
Ready
Radio: Base Station
Logout ADMIN

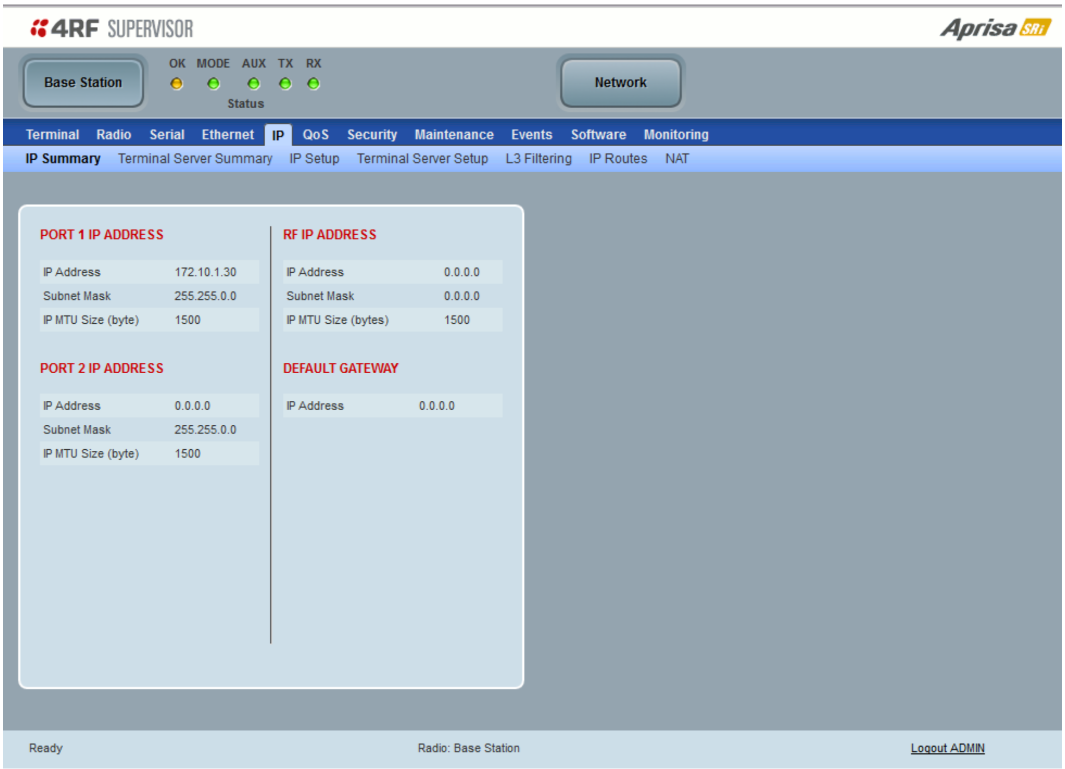
NETWORKING IP SETTINGS

| | |
|---|---|
| IP Address | 172.10.1.30 |
| Subnet Mask | 255.255.0.0 |
| Gateway IP Address | 0.0.0.0 |
| IP MTU Size (bytes) | 1500 |

See ‘IP > IP Setup > Bridge / Gateway Router Modes’ on page 159 for configuration options.

## IP > IP Summary > Router Mode

This page displays the current settings for the Networking IP Settings for an Ethernet Operating Mode of ‘Router’.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
IP Summary Terminal Server Summary IP Setup Terminal Server Setup L3 Filtering IP Routes NAT
Ready
Radio: Base Station
Logout ADMIN

PORT 1 IP ADDRESS

| | |
|---|---|
| IP Address | 172.10.1.30 |
| Subnet Mask | 255.255.0.0 |
| IP MTU Size (byte) | 1500 |

PORT 2 IP ADDRESS

| | |
|---|---|
| IP Address | 0.0.0.0 |
| Subnet Mask | 255.255.0.0 |
| IP MTU Size (byte) | 1500 |

RF IP ADDRESS

| | |
|---|---|
| IP Address | 0.0.0.0 |
| Subnet Mask | 0.0.0.0 |
| IP MTU Size (bytes) | 1500 |

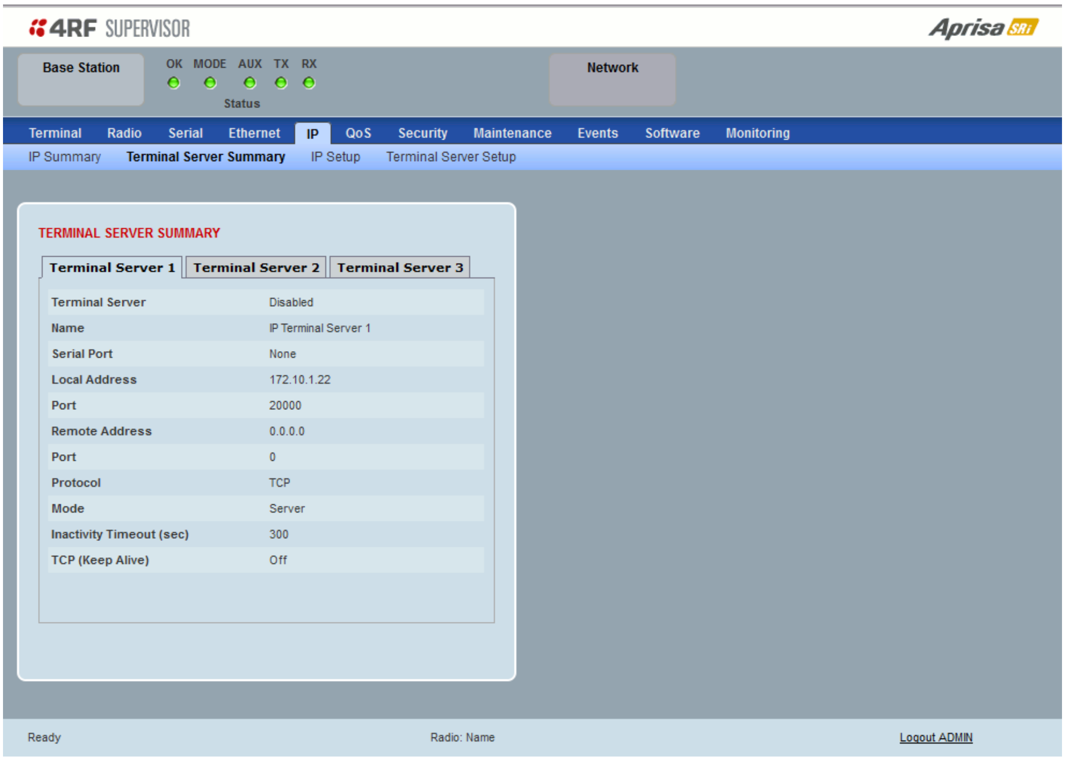
DEFAULT GATEWAY

| | |
|---|---|
| IP Address | 0.0.0.0 |

See ‘IP > IP Setup > Router Mode’ on page 160 for configuration options.

## IP > IP Terminal Server Summary

This page provides the setup for the IP Settings for an Ethernet Operating Mode of ‘Bridge’ or ‘Gateway Router’.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
IP Summary Terminal Server Summary IP Setup Terminal Server Setup
Terminal Server 1 Terminal Server 2 Terminal Server 3
Ready
Radio: Name
Logout ADMIN

TERMINAL SERVER SUMMARY

| | |
|---|---|
| Terminal Server | Disabled |
| Name | IP Terminal Server 1 |
| Serial Port | None |
| Local Address | 172.10.1.22 |
| Port | 20000 |
| Remote Address | 0.0.0.0 |
| Port | 0 |
| Protocol | TCP |
| Mode | Server |
| Inactivity Timeout (sec) | 300 |
| TCP (Keep Alive) | Off |

### TERMINAL SERVER SUMMARY

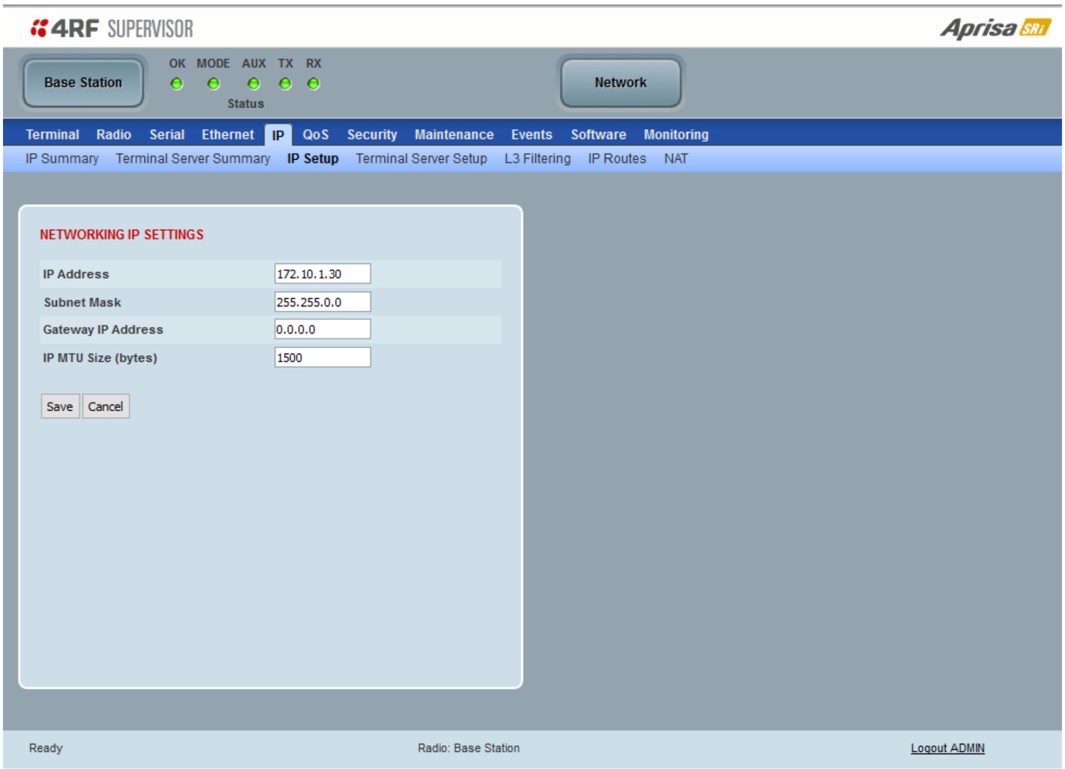
IP Terminal Server converts local incoming IP packets to a local physical serial port and to OTA serial packets.

This function is typically used on a base / master station to convert traffic to serial OTA for transmission to all remote radios

See ‘IP > IP Terminal Server Setup’ for configuration options.

## IP > IP Setup > Bridge / Gateway Router Modes

This page provides the setup for the IP Settings for an Ethernet Operating Mode of ‘Bridge’ or ‘Gateway Router’.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
IP Summary Terminal Server Summary IP Setup Terminal Server Setup L3 Filtering IP Routes NAT
Save Cancel
Ready
Radio: Base Station
Logout ADMIN

NETWORKING IP SETTINGS

| | |
|---|---|
| IP Address | 172.10.1.30 |
| Subnet Mask | 255.255.0.0 |
| Gateway IP Address | 0.0.0.0 |
| IP MTU Size (bytes) | 1500 |

### NETWORKING IP SETTINGS

*IP Address*

Set the static IP Address of the radio (Management and Ethernet ports) assigned by your site network administrator using the standard format xxx.xxx.xxx.xxx. This IP address is used both in Bridge mode and in Router mode. The default IP address is in the range 169.254.50.10.

*Subnet Mask*

Set the Subnet Mask of the radio (Management and Ethernet ports) using the standard format xxx.xxx.xxx.xxx. The default subnet mask is 255.255.0.0 (/16).

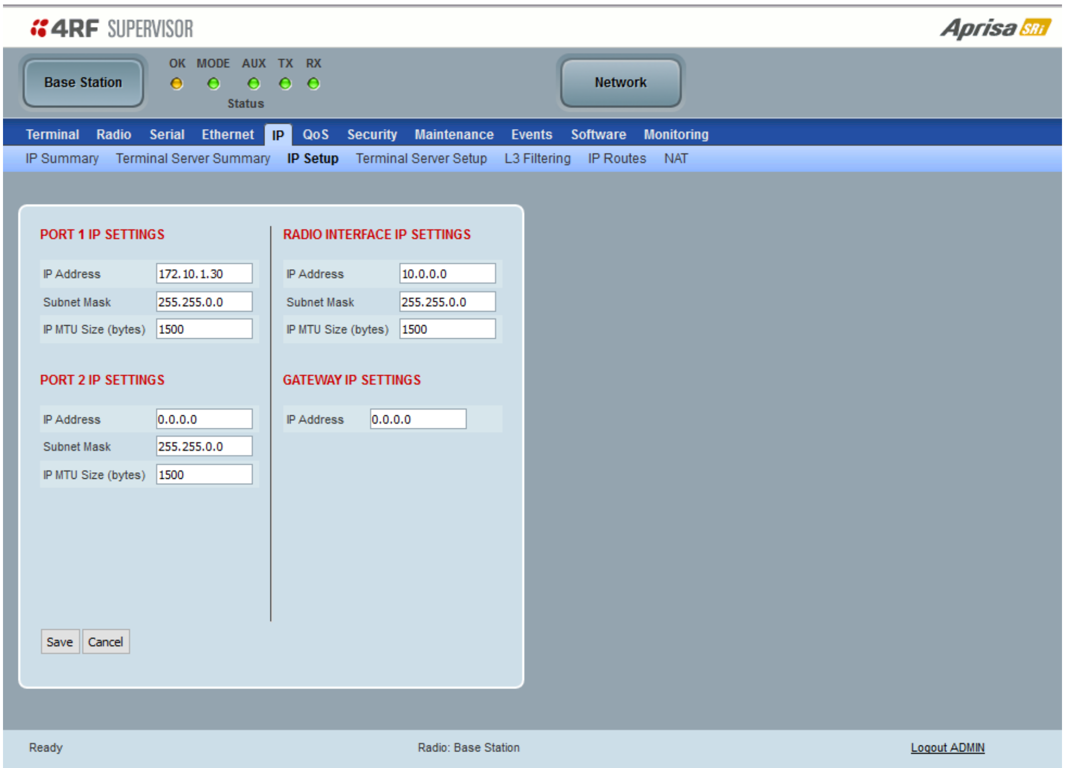
*Gateway*

Set the Gateway address of the radio, if required, using the standard format xxx.xxx.xxx.

A default gateway is the node on the network that traffic is directed to when an IP address does not match any other routes in the routing table. It can be the IP address of the router or PC connected to the base station. The default gateway commonly connects the internal radio network and the outside network. The default Gateway is 0.0.0.0.

## IP > IP Setup > Router Mode

This page provides the setup for the IP Settings for and Ethernet Operating Mode of ‘Router’.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
IP Summary Terminal Server Summary IP Setup Terminal Server Setup L3 Filtering IP Routes NAT
Save
Cancel
Ready
Radio: Base Station
Logout ADMIN

PORT 1 IP SETTINGS

| | |
|---|---|
| IP Address | 172.10.1.30 |
| Subnet Mask | 255.255.0.0 |
| IP MTU Size (bytes) | 1500 |

PORT 2 IP SETTINGS

| | |
|---|---|
| IP Address | 0.0.0.0 |
| Subnet Mask | 255.255.0.0 |
| IP MTU Size (bytes) | 1500 |

RADIO INTERFACE IP SETTINGS

| | |
|---|---|
| IP Address | 10.0.0.0 |
| Subnet Mask | 255.255.0.0 |
| IP MTU Size (bytes) | 1500 |

GATEWAY IP SETTINGS

| | |
|---|---|
| IP Address | 0.0.0.0 |

### PORT SETTINGS

*IP Address*

Set the static IP Address of the radio Ethernet port (n) assigned by your site network administrator using the standard format xxx.xxx.xxx.xxx. This IP address is used for this Ethernet port Router mode.

*Subnet Mask*

Set the Subnet Mask of the of the radio Ethernet port (n) using the standard format xxx.xxx.xxx.xxx. The default subnet mask is 255.255.0.0 (/16).

*Gateway*

Set the Gateway address of the radio Ethernet port (n), if required, using the standard format xxx.xxx.xxx.

A default gateway is the node on the network that traffic is directed to when an IP address does not match any other routes in the routing table. It can be the IP address of the router or PC connected to the base station. The default gateway commonly connects the internal radio network and the outside network. The default Gateway is 0.0.0.0.

## RADIO INTERFACE IP SETTINGS

The RF interface IP address is the address that traffic is routed to for transport over the radio link. This IP address is only used when Router Mode is selected i.e. not used in Bridge Mode.

*Radio Interface IP Address*

Set the IP Address of the RF interface using the standard format xxx.xxx.xxx.xxx. The default IP address is in the range 10.0.0.0.

*Radio Interface Subnet Mask*

Set the Subnet Mask of the RF interface using the standard format xxx.xxx.xxx.xxx. The default subnet mask is 255.255.0.0 (/16).

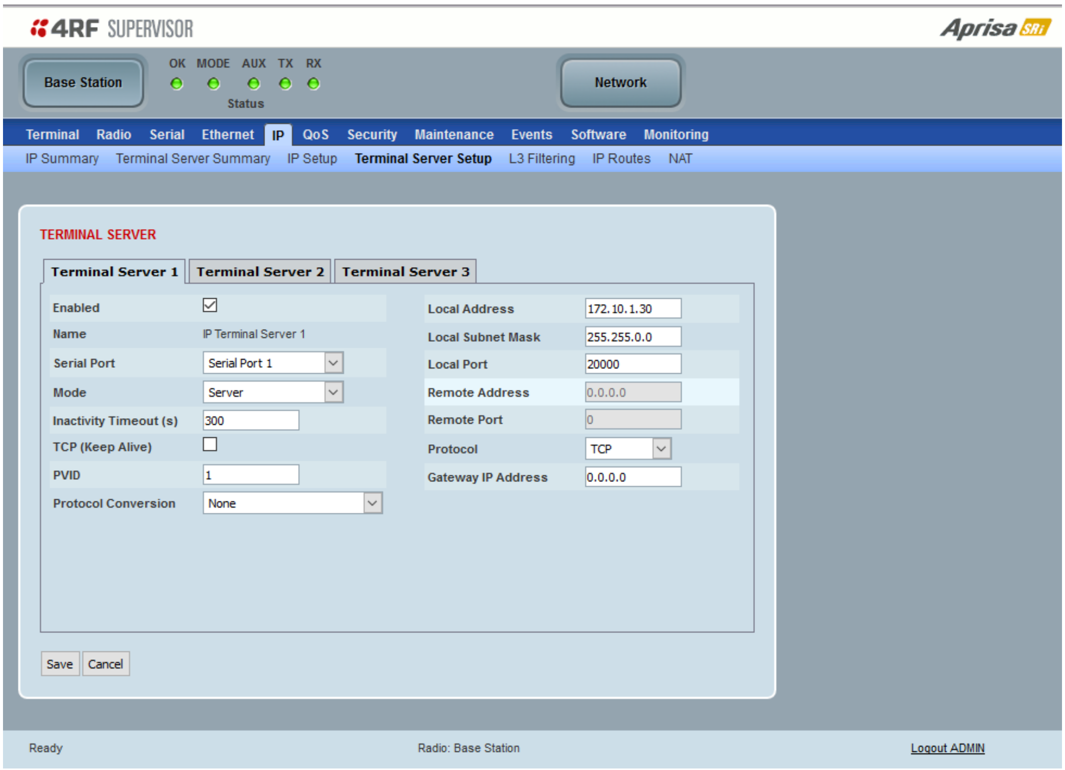
**Note 1:** If the base station RF interface IP address is a network IP address, and if the remote radio is also using a network IP address within the same subnet or different subnet, then the base radio will assign an automatic RF interface IP address from its own subnet.

When the base radio has a host specific RF interface IP address, then all the remotes must have a host specific RF interface IP address from the same subnet.

**Note 2:** When a remote radio is configured for Router Mode and the base radio is changed from Bridge Mode to Router Mode and the RF interface IP address is set to AUTO IP configuration (at least the last octet of the RF interface IP address is zero), it is mandatory to configure the network topology by using the ‘Decommission Node’ and ‘Discover Nodes’ (see ‘Maintenance > Advanced’ on page 243).

## IP > IP Terminal Server Setup

This page provides the setup for the IP Settings for an Ethernet Operating Mode of ‘Bridge’ or ‘Gateway Router’.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
IP Summary Terminal Server Summary IP Setup Terminal Server Setup L3 Filtering IP Routes NAT
Terminal Server 1 Terminal Server 2 Terminal Server 3
Save Cancel
Ready
Radio: Base Station
Logout ADMIN

TERMINAL SERVER

| | | | |
|---|---|---|---|
| Enabled | ☑ | Local Address | 172.10.1.30 |
| Name | IP Terminal Server 1 | Local Subnet Mask | 255.255.0.0 |
| Serial Port | Serial Port 1 | Local Port | 20000 |
| Mode | Server | Remote Address | 0.0.0.0 |
| Inactivity Timeout (s) | 300 | Remote Port | 0 |
| TCP (Keep Alive) | ☐ | Protocol | TCP |
| PVID | 1 | Gateway IP Address | 0.0.0.0 |
| Protocol Conversion | None | | |

### TERMINAL SERVER

*Enabled*

This parameter enables IP terminal server.

IP Terminal Server converts local incoming IP packets to a local physical serial port and to OTA serial packets as well. This function is typically used on a base / master station to convert traffic to serial OTA for transmission to all remote radios.

*Name*

This parameter displays the IP terminal server port name.

*Serial Port*

This parameter selects the serial port to use IP terminal server.

| Option | Function |
|---|---|
| Serial Port | This is the normal RS-232 serial ports provided with the RJ45 connector. |
| USB Serial Port | This is the optional RS-232 / RS-485 serial port provided with the USB host port connector with a USB to RS-232 / RS-485 RJ45 converter cable (see ‘USB Serial Ports’ on page 318). |

*Local Address*

This parameter displays the IP address of this radio.

*Local Port*

This parameter sets the TCP or UDP port number of the local serial port.

The valid port number range is greater than or equal to 1024 and less than or equal to 49151 but with exclusions of 0, 5445, 6445, 9930 or 9931. The default setting is 20000.

*Remote Address*

This parameter sets the IP address of the server connected to the radio Ethernet port.

*Remote Port*

This parameter sets the TCP or UDP port number of the server connected to the radio Ethernet port. The default setting is 0.

*Protocol*

This parameter sets the L4 TCP/IP or UDP/IP protocol used for terminal server operation. The default setting is TCP.

*Mode*

This parameter defines the mode of operation of the terminal server connection. The default setting is Client and Server.

| Option | Function |
|---|---|
| Client | The radio will attempt to establish a TCP connection with the specified remote unit. Generally, this setting is for the base station with an Ethernet connection to the SCADA master. |
| Server | The radio will listen for a TCP connection on the specified local port. Generally, this setting is for the remote radio with a serial connection to the RTU.<br>Data received from any client shall be forwarded to the associated serial port while data received from that serial port shall be forwarded to every client with an open TCP connection.<br>If no existing TCP connections exist, all data received from the associated serial port shall be discarded. |
| Client and Server | The radio will listen for a TCP connection on the specified local port and if necessary, establish a TCP connection with the specified remote unit. Generally, this setting is used for the remote radio but it should be used carefully as two connections might be established with the base station.<br>Data received from any client shall be forwarded to the associated serial port while data received from that serial port shall be forwarded to every client with an open TCP connection. |

*Inactivity Timeout (seconds)*

This specifies the duration (in seconds) to automatically terminate the connection with the remote TCP server if no data has been received from either the remote TCP server or its associated serial port for the duration of the configured inactivity time.

*TCP Keep Alive*

A TCP keep alive is a message sent by one device to another to check that the link between the two is operating, or to prevent the link from being broken.

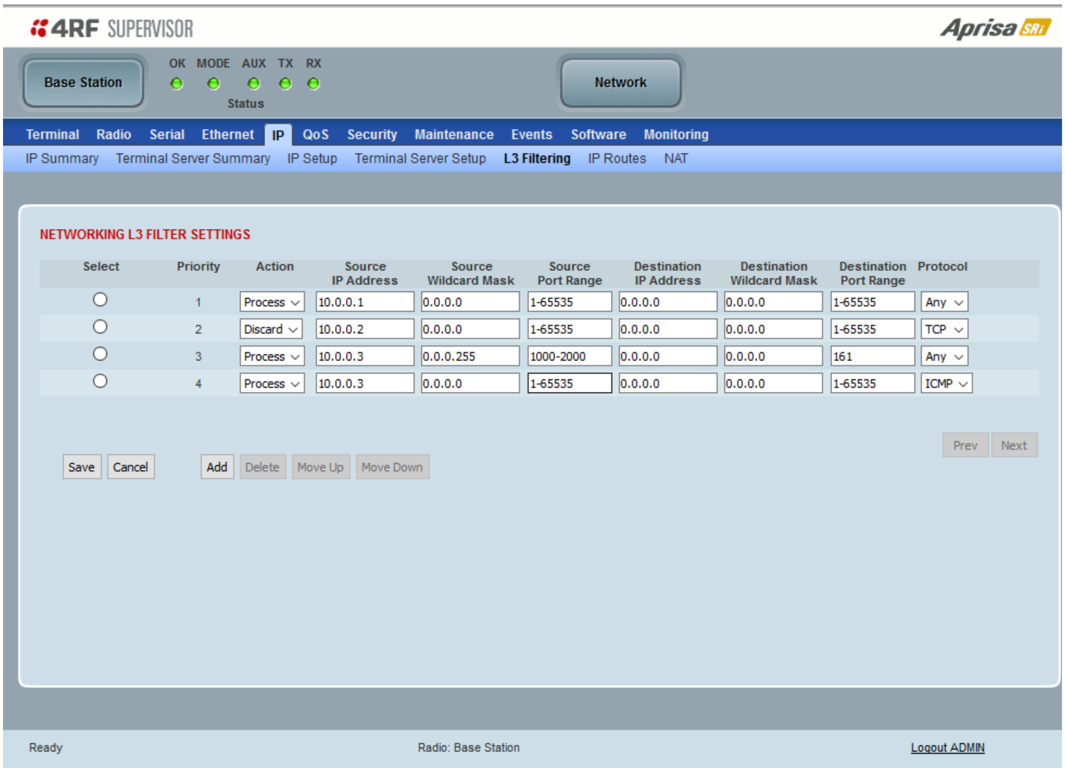
If the TCP keep alive is enabled, the radio will be notified if the TCP connection fails.

If the TCP keep alive is disabled, the radio relies on the Inactivity Timeout to detect a TCP connection failure. The default setting is disabled.

**Note:** An active TCP keep alive will generate a small amount of extra network traffic.

## IP > L3 Filtering

This page is only available if the Ethernet traffic option has been licensed (see ‘Maintenance > Licence’ on page 237) and Router Mode selected. The filter operates in either Bridge Mode or Router Mode (see 'Terminal > Operating Mode’ on page 110).


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
IP Summary Terminal Server Summary IP Setup Terminal Server Setup L3 Filtering IP Routes NAT

NETWORKING L3 FILTER SETTINGS

| Select | Priority | Action | Source IP Address | Source Wildcard Mask | Source Port Range | Destination IP Address | Destination Wildcard Mask | Destination Port Range | Protocol |
|---|---|---|---|---|---|---|---|---|---|
| ○ | 1 | Process | 10.0.0.1 | 0.0.0.0 | 1-65535 | 0.0.0.0 | 0.0.0.0 | 1-65535 | Any |
| ○ | 2 | Discard | 10.0.0.2 | 0.0.0.0 | 1-65535 | 0.0.0.0 | 0.0.0.0 | 1-65535 | TCP |
| ○ | 3 | Process | 10.0.0.3 | 0.0.0.255 | 1000-2000 | 0.0.0.0 | 0.0.0.0 | 161 | Any |
| ○ | 4 | Process | 10.0.0.3 | 0.0.0.0 | 1-65535 | 0.0.0.0 | 0.0.0.0 | 1-65535 | ICMP |

### NETWORKING L3 FILTER SETTINGS

L3 Filtering provides the ability to evaluate traffic and take specific action based on the filter criteria.

This filtering can also be used for L4 TCP / UDP port filtering which in most cases relates to specific applications as per IANA official and unofficial well-known ports.

Entering a * into any to field will automatically enter the wildcard values when the data is saved.

*Priority*

This parameter shows the priority order in which the filters are processed.

*Action*

This parameter defines the action taken on the packet when it meets the filter criteria.

| Option | Function |
|---|---|
| Process | Processes the packet if it meets the filter criteria |
| Discard | Discards the packet if it meets the filter criteria |

*Source IP Address*

If the source IP address is set to 0.0.0.0, any source IP address will meet the filter criteria.

### *Source Wildcard Mask*

This parameter defines the mask applied to the source IP address. 0 means that it must be a match.

If the source wildcard mask is set to 0.0.0.0, the complete source IP address will be evaluated for the filter criteria.

If the source wildcard mask is set to 0.0.255.255, the first 2 octets of the source IP address will be evaluated for the filter criteria.

If the source wildcard mask is set to 255.255.255.255, none of the source IP address will be evaluated for the filter criteria.

Note: The source wildcard mask operation is the inverse of subnet mask operation

### *Source Port Range*

This parameter defines the port or port range for the source. To specify a range, insert a dash between the ports e.g. 1000-2000. If the source port range is set to 1-65535, traffic from any source port will meet the filter criteria.

### *Destination IP Address*

This parameter defines the destination IP address of the filter. If the destination IP address is set to 0.0.0.0, any destination IP address will meet the filter criteria.

### *Destination Wildcard Mask*

This parameter defines the mask applied to the destination IP address. 0 means that it must be a match.

If the destination wildcard mask is set to 0.0.0.0, the complete destination IP address will be evaluated for the filter criteria.

If the destination wildcard mask is set to 0.0.255.255, the first 2 octets of the destination IP address will be evaluated for the filter criteria.

If the destination wildcard mask is set to 255.255.255.255, none of the destination IP address will be evaluated for the filter criteria.

Note: The destination wildcard mask operation is the inverse of subnet mask operation

### *Destination Port Range*

This parameter defines the port or port range for the destination. To specify a range, insert a dash between the ports e.g. 1000-2000. If the destination port range is set to 1-65535, traffic to any destination port will meet the filter criteria.

### *Protocol*

This parameter defines the Ethernet packet type that will meet the filter criteria.

## Controls

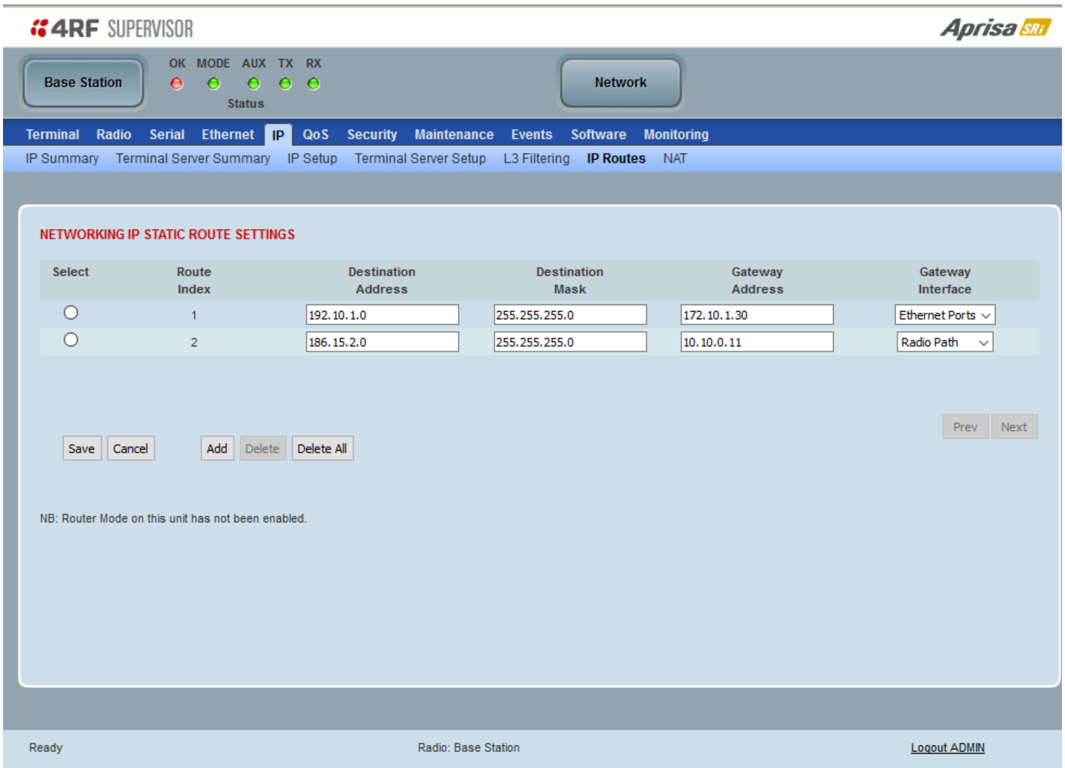
The Delete button deletes the selected entry.

The Move Up button moves the selected entry above the entry above it increasing its process priority.

The Move Down button moves the selected entry below the entry above it reducing its process priority.

## IP > IP Routes

This page is only available if the Ethernet traffic option has been licensed (see ‘Maintenance > Licence’ on page 237) and Router Mode selected. It is not valid for Bridge Mode (see 'Terminal > Operating Mode’ on page 110).


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
IP Summary Terminal Server Summary IP Setup Terminal Server Setup L3 Filtering IP Routes NAT
Prev Next
Save Cancel Add Delete Delete All

NETWORKING IP STATIC ROUTE SETTINGS

| Select | Route Index | Destination Address | Destination Mask | Gateway Address | Gateway Interface |
|---|---|---|---|---|---|
| ○ | 1 | 192.10.1.0 | 255.255.255.0 | 172.10.1.30 | Ethernet Ports |
| ○ | 2 | 186.15.2.0 | 255.255.255.0 | 10.10.0.11 | Radio Path |

NB: Router Mode on this unit has not been enabled.

Ready    Radio: Base Station    Logout ADMIN

### NETWORKING IP STATIC ROUTE SETTINGS

Static routing provides the ability to evaluate traffic to determine if packets are forwarded over the radio link or discarded based on the route criteria.

*Route Index*

This parameter shows the route index.

*Destination Address*

This parameter defines the destination IP address of the route criteria.

*Destination Mask*

This parameter defines the subnet mask applied to the Destination IP Address. 255 means that it must be a match.

If the destination subnet mask is set to 255.255.255.255, all octets of the Destination IP Address will be evaluated for the route criteria.

If the destination subnet mask is set to 255.255. 0.0, the first 2 octets of the Destination IP Address will be evaluated for the route criteria.

*Gateway Address*

This parameter sets the gateway address where packets will be forwarded to.

- If the gateway interface is set to Ethernet Ports, the gateway address is the IP address of the device connected to the Ethernet port.
- If the gateway interface is set to Radio Path, the gateway address is the IP address of the remote radio.

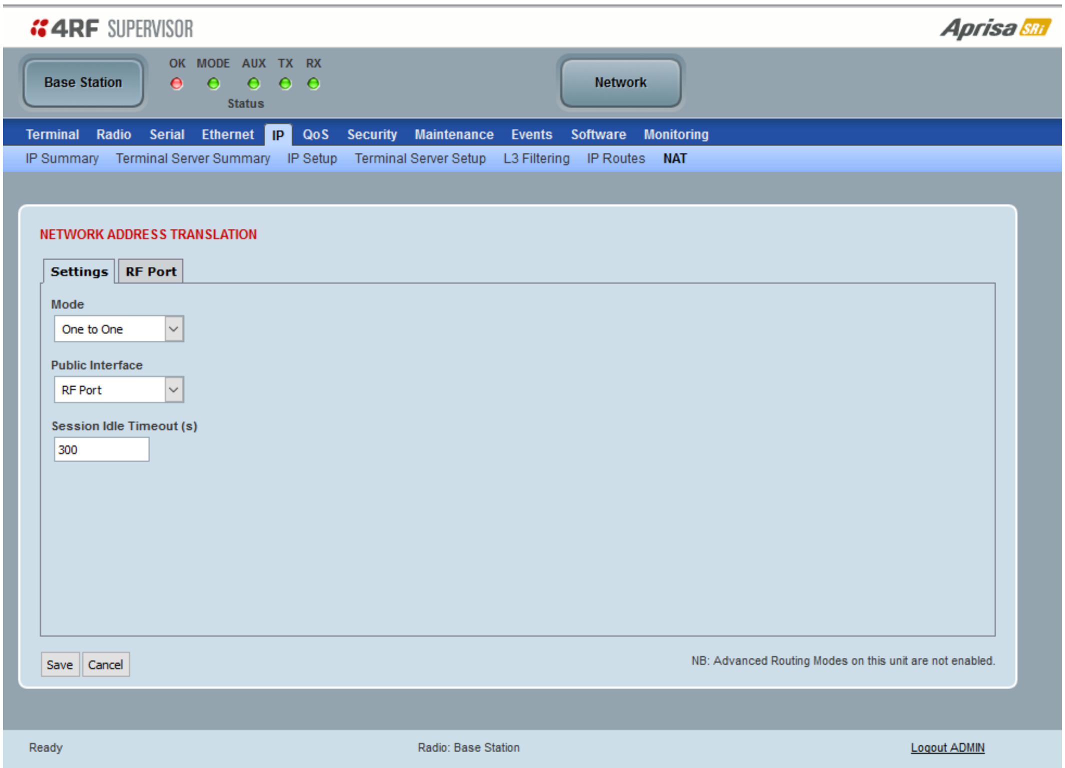
*Gateway Interface*

This parameter sets the destination interface.

| **Option** | **Function** |
|---|---|
| Ethernet Ports | Packets are forwarded to the Ethernet interface port. |
| Radio Path | Packets are forwarded to the RF Interface radio path. |

## IP > NAT

This page is only available if the Ethernet traffic option has been licensed (see ‘Maintenance > Licence’ on page 237) and Router Mode selected. It is not valid for Bridge Mode (see 'Terminal > Operating Mode’ on page 110).


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
IP Summary Terminal Server Summary IP Setup Terminal Server Setup L3 Filtering IP Routes NAT
Settings
RF Port
Save
Cancel
Ready
Radio: Base Station
Logout ADMIN

NETWORK ADDRESS TRANSLATION

Mode: One to One

Public Interface: RF Port

Session Idle Timeout (s): 300

NB: Advanced Routing Modes on this unit are not enabled.

### NETWORK ADDRESS TRANSLATION

*Mode*

| Option | Function |
|---|---|
| Disabled | No Network Address Translation |
| One to One | NAT mapping (translating) of public interface IP address space into another private interfaces IP address space and vice versa via AGRM/ARM router. |
| Port Forwarding | NAT mapping (translating) of public TCP/UDP port (or ICMP query ID) of a single public IP addresses into multiple private IP address space and vice versa via AGRM/ARM router. |

## One To One

The One-to-One Network Address Translation (NAT) remaps one public interface IP address space into another private interface IP address space and vice versa by modifying the IP network address information in IP datagram packet headers.

The NAT function is only available in Advanced Gateway Router Mode (AGRM) or Advanced Router Mode (ARM).

The current implementation of One-to-One NAT supports network configurations supported in AGRM / ARM mode, such as AGRM / ARM-Bridge, Bridge-AGRM / ARM and Bridge-Mix [AGRM / ARM and Bridge]  i.e. other network configuration options are not supported by NAT, such as AGRM / ARM-AGRM / ARM network). For more detailed information about NAT see section ‘Network Address Translation (NAT) Router’ on page 41.

### *Public Interface*

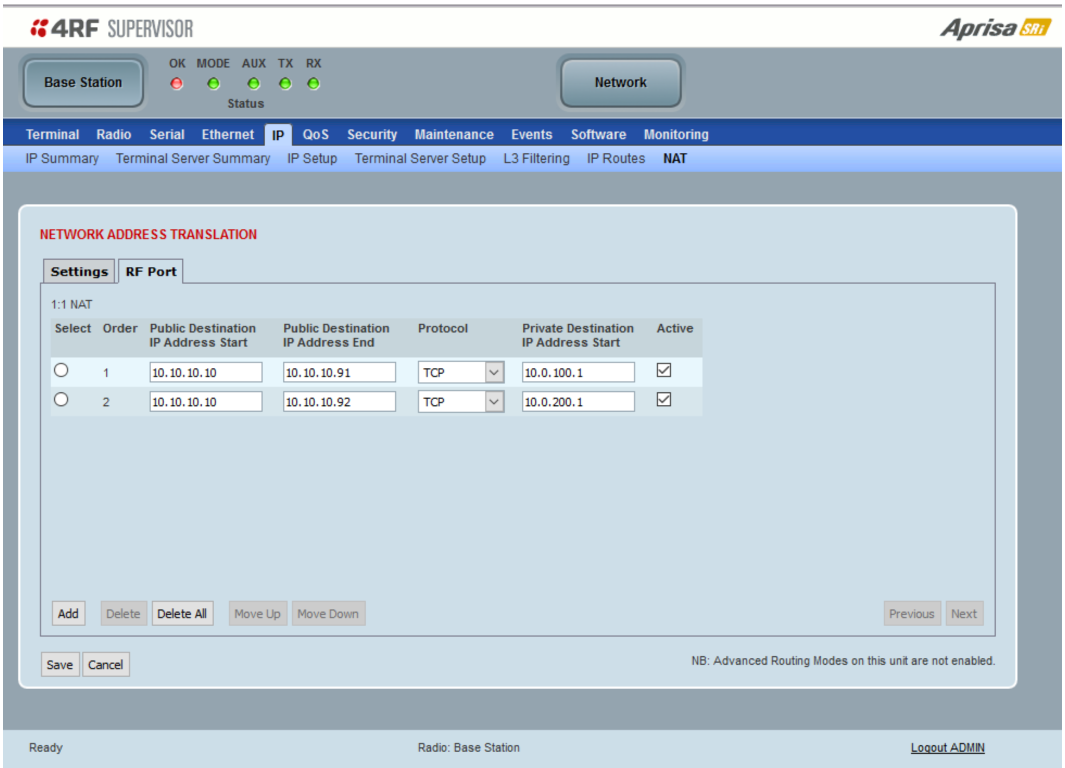
This parameter sets the Global external / public interface.

| Option | Function |
|---|---|
| Radio Port | The public interface for NAT is the radio port. |
| Ethernet Port (n) | The public interface for NAT is Ethernet port n. |

### *Session Idle Timeout*

This time defines the NAT session period in the NAT session table. The session will be automatically removed once the idle timer expires. The Time is common for ‘ANY’ protocol. This timer will be reset to 0 in session table when a matching packet hits the NAT rule.

One To One > RF Port


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
IP Summary Terminal Server Summary IP Setup Terminal Server Setup L3 Filtering IP Routes NAT
Add Delete Delete All Move Up Move Down Previous Next
Save Cancel
Ready
Radio: Base Station
Logout ADMIN

NETWORK ADDRESS TRANSLATION

Settings | RF Port

1:1 NAT

| Select | Order | Public Destination IP Address Start | Public Destination IP Address End | Protocol | Private Destination IP Address Start | Active |
|---|---|---|---|---|---|---|
| ○ | 1 | 10.10.10.10 | 10.10.10.91 | TCP | 10.0.100.1 | ☑ |
| ○ | 2 | 10.10.10.10 | 10.10.10.92 | TCP | 10.0.200.1 | ☑ |

NB: Advanced Routing Modes on this unit are not enabled.

The RF Port configures the inbound NAT translation rules (public to private interface translation direction) for the selected public interface which in this case is the RF port. NAT will perform the IP address translation on the inbound direction whenever there is a matching rule in the public IP address and protocol fields translating it to the private IP address. Outbound NAT translation function (private to public interface translation direction) will perform the IP address translation whenever there is a matching rule in the private IP address and protocol fields translating it to the public IP address.

*Public Destination IP Address Start*

The start of the public destination IP address range.

*Public Destination IP Address End*

The end of the public destination IP address range.

*Protocol*

The matching protocol where NAT should perform the IP address translation function. Supports ICMP, TCP, UDP or Any (Any means one among the list; ICMP, TCP, UDP).

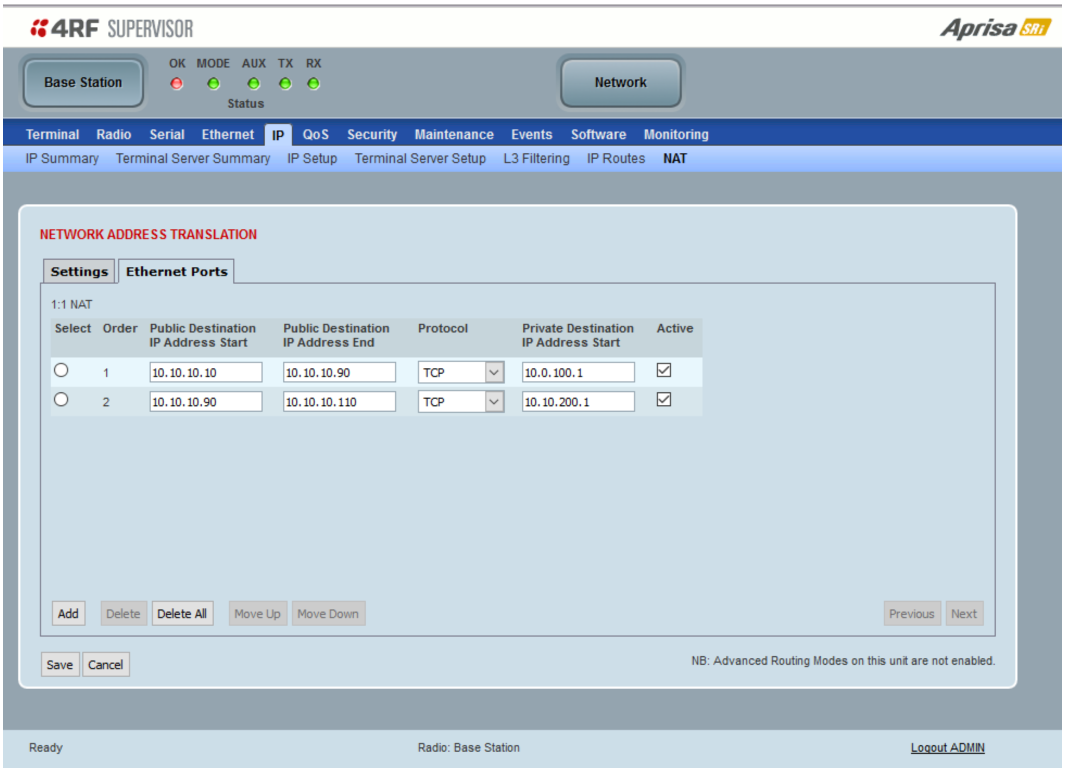
*Private Destination IP Address Start*

This is the start of the Private Destination IP address range. The end of the private destination IP address is automatically calculated from the start and end of public destination IP address range.

*Active*

If checked the rule becomes active, if unchecked the rule is inactive.

One To One > Ethernet Ports


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
IP Summary Terminal Server Summary IP Setup Terminal Server Setup L3 Filtering IP Routes NAT
Settings
Ethernet Ports
Add Delete Delete All Move Up Move Down Previous Next
Save Cancel
Logout ADMIN

NETWORK ADDRESS TRANSLATION

1:1 NAT

| Select | Order | Public Destination IP Address Start | Public Destination IP Address End | Protocol | Private Destination IP Address Start | Active |
|---|---|---|---|---|---|---|
| ○ | 1 | 10.10.10.10 | 10.10.10.90 | TCP | 10.0.100.1 | ☑ |
| ○ | 2 | 10.10.10.90 | 10.10.10.110 | TCP | 10.10.200.1 | ☑ |

NB: Advanced Routing Modes on this unit are not enabled.

Ready    Radio: Base Station

The Ethernet Ports configures the inbound NAT translation rules (public to private interface translation direction) for the selected public interface which in this case is the Ethernet port. NAT will perform the IP address translation on the inbound direction whenever there is a matching rule in the public IP address and protocol fields translating it to the private IP address. Outbound NAT translation function (private to public interface translation direction) will perform the IP address translation whenever there is a matching rule in the private IP address and protocol fields translating it to the public IP address.

*Public Destination IP Address Start*

The start of the public destination IP address range.

*Public Destination IP Address End*

The end of the public destination IP address range.

*Protocol*

The matching protocol where NAT should perform the IP address translation function. Supports ICMP, TCP, UDP or Any (Any means one among the list; ICMP, TCP, UDP).

*Private Destination IP Address Start*

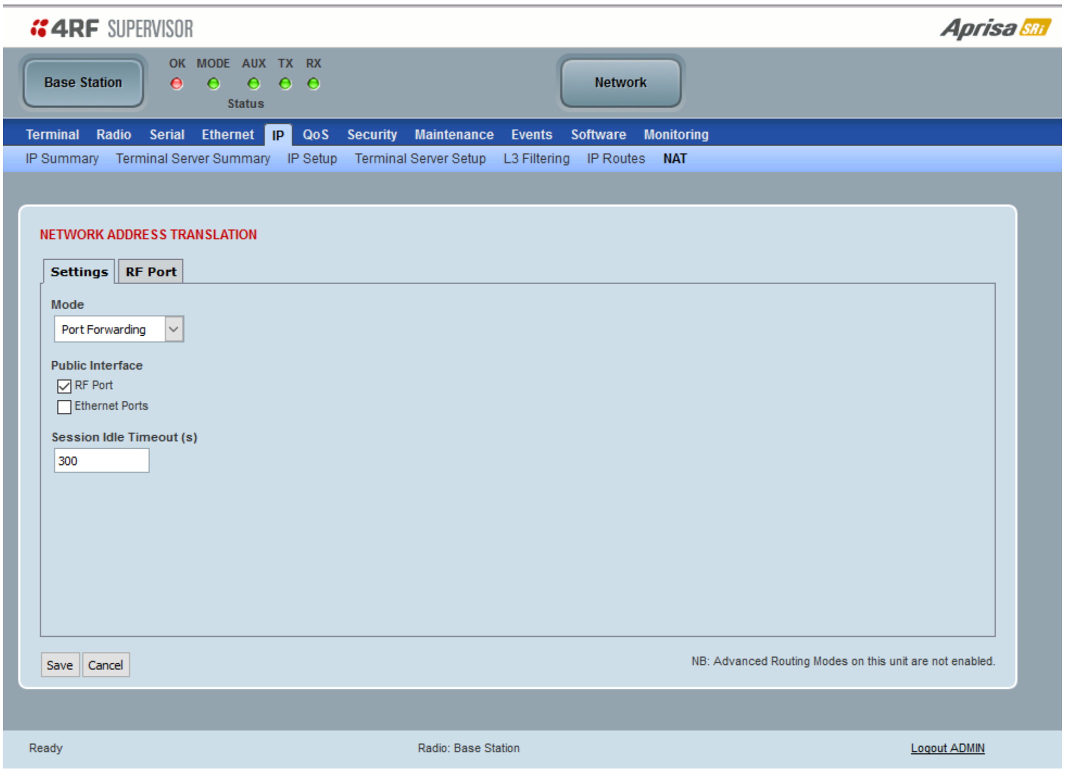
This is the start of the Private Destination IP address range. The end of the private destination IP address is automatically calculated from the start and end of public destination IP address range.

*Active*

If checked the rule becomes active, if unchecked the rule is inactive.

## Port Forwarding

Port Forwarding NAT (NAPT) remaps the public TCP/UDP port (or ICMP query ID) of a single public IP address into multiple private IP address spaces and vice versa via AGRM/ARM router.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
IP Summary Terminal Server Summary IP Setup Terminal Server Setup L3 Filtering IP Routes NAT
Settings
RF Port
Save
Cancel
Logout ADMIN

NETWORK ADDRESS TRANSLATION

Mode: Port Forwarding

Public Interface
☑ RF Port
□ Ethernet Ports

Session Idle Timeout (s): 300

NB: Advanced Routing Modes on this unit are not enabled.

Ready

Radio: Base Station

### *Public Interface*

This parameter sets the Global external /public interface. The page varies depending on the router mode ARM and AGRM.

The table below shows the public interface options for ARM router (as shown in the screenshot above for 2E2S radio). In ARM, each Ethernet interface can be set with a different public IP address, thus a multiple Ethernet port can be used as a public interface. This is useful for example when radio is connected via two Ethernet ports to two different networks with different subnets for protection or for different services e.g. SCADA service and management service.

| Option | Function |
|---|---|
| Radio Port | The public interface for NAT is the radio port. |
| Ethernet Port 1 | The public interface for NAT is a Ethernet port 1. |
| Ethernet Port 2 | The public interface for NAT is a Ethernet port 2. |

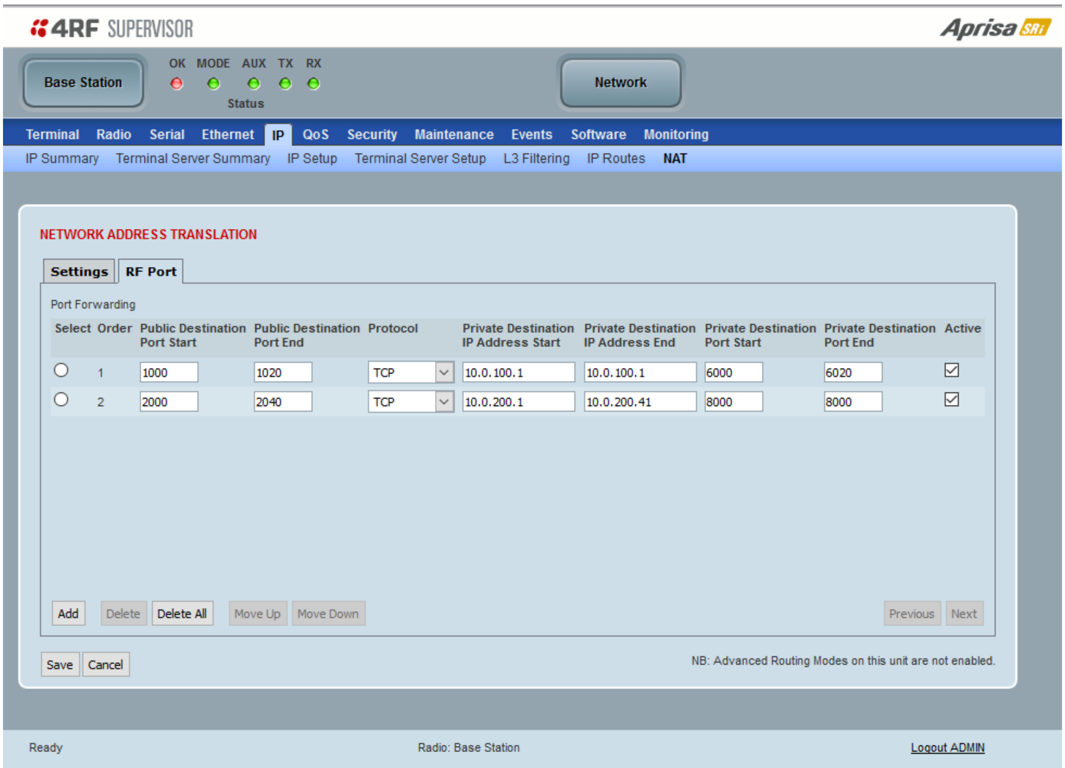
The table below shows the public interface options for a AGRM router, since in AGRM all Ethernet interfaces can be set with only a single public IP address.

| Option | Function |
|---|---|
| Radio Port | The public interface for NAT is the radio port. |
| Ethernet Ports | The public interface for NAT is a Ethernet port. |

*Session Idle Timeout*

This time defines the NAT session period in the NAT session table. The session will be automatically removed once the idle timer expires. The Time is common for ‘ANY’ protocol. This timer will be reset to 0 in session table when a matching packet hits the NAT rule.

Port Forwarding > RF Port


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
IP Summary Terminal Server Summary IP Setup Terminal Server Setup L3 Filtering IP Routes NAT

NETWORK ADDRESS TRANSLATION

Settings | RF Port

Port Forwarding

| Select | Order | Public Destination Port Start | Public Destination Port End | Protocol | Private Destination IP Address Start | Private Destination IP Address End | Private Destination Port Start | Private Destination Port End | Active |
|---|---|---|---|---|---|---|---|---|---|
| ○ | 1 | 1000 | 1020 | TCP | 10.0.100.1 | 10.0.100.1 | 6000 | 6020 | ☑ |
| ○ | 2 | 2000 | 2040 | TCP | 10.0.200.1 | 10.0.200.41 | 8000 | 8000 | ☑ |

NB: Advanced Routing Modes on this unit are not enabled.

When the RF Port is selected as the public interface, then the inbound NAT session is from the radio RF port to the Ethernet private network side of the network (public to private interface), commonly used in remotes. NAT will perform the translation on the inbound direction whenever there is a matching rule in the public TCPU/UDP port, the single IP address of RF port and protocol fields translating it to the multiple private IP address space.

Outbound NAT translation function (private to public interface translation direction) will perform the IP address translation whenever there is a matching rule in the TCP/UDP port and private IP address and protocol fields or a dynamic rule is created translating it to the single public IP address and TCP/UDP port.

*Public Destination Port Start*

The start of the public destination port range between 0 to 65535.

*Public Destination Port End*

The end of the public destination port range between 0 to 65535.

*Protocol*

The matching protocol where NAT should perform the IP address translation function. Supports ICMP, TCP, UDP or Any (Any means one among the list; ICMP, TCP, UDP).

*Private Destination IP Address Start*

This is the start of the Private Destination IP address range.

*Private Destination IP Address End*

This is the end of the Private Destination IP address range.

*Private Destination Port Start*

The start of the private destination port range between 0 to 65535.

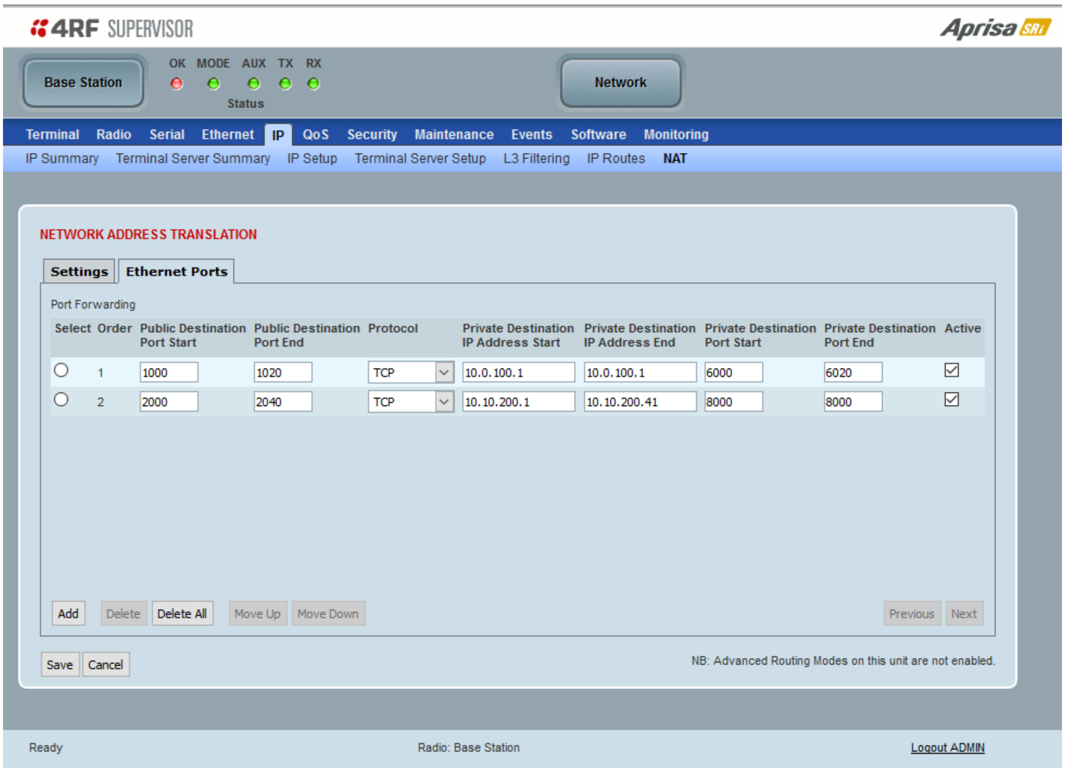
*Private Destination Port End*

The end of the private destination port range between 0 to 65535.

*Active*

If checked the rule becomes active, if unchecked the rule is inactive.

Port Forwarding > Ethernet Ports


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
IP Summary Terminal Server Summary IP Setup Terminal Server Setup L3 Filtering IP Routes NAT
Settings
Ethernet Ports
Add
Delete
Delete All
Move Up
Move Down
Previous
Next
Save
Cancel
Logout ADMIN

NETWORK ADDRESS TRANSLATION

Port Forwarding

| Select | Order | Public Destination Port Start | Public Destination Port End | Protocol | Private Destination IP Address Start | Private Destination IP Address End | Private Destination Port Start | Private Destination Port End | Active |
|---|---|---|---|---|---|---|---|---|---|
| ○ | 1 | 1000 | 1020 | TCP | 10.0.100.1 | 10.0.100.1 | 6000 | 6020 | ☑ |
| ○ | 2 | 2000 | 2040 | TCP | 10.10.200.1 | 10.10.200.41 | 8000 | 8000 | ☑ |

NB: Advanced Routing Modes on this unit are not enabled.

Ready

Radio: Base Station

When the Ethernet Port is selected as the public interface, then the inbound NAT session is from the Ethernet port to the RF port private network side of the network (public to private interface), commonly used in Base station. NAT will perform the translation on the inbound direction whenever there is a matching rule in the public TCPU/UDP port, the single IP address of the Ethernet port and protocol fields translating it to the multiple private IP address space.

Outbound NAT translation function (private to public interface translation direction) will perform the IP address translation whenever there is a matching rule in the TCP/UDP port and private IP address and protocol fields or a dynamic rule is created translating it to the single public IP address and TCP/UDP port.

*Public Destination Port Start*

The start of the public destination port range between 0 to 65535.

*Public Destination Port End*

The end of the public destination port range between 0 to 65535.

*Protocol*

The matching protocol where NAT should perform the IP address translation function. Supports ICMP, TCP, UDP or Any (Any means one among the list; ICMP, TCP, UDP).

*Private Destination IP Address Start*

This is the start of the Private Destination IP address range.

*Private Destination IP Address End*

This is the end of the Private Destination IP address range.

*Private Destination Port Start*

The start of the private destination port range between 0 to 65535.

*Private Destination Port End*

The end of the private destination port range between 0 to 65535.

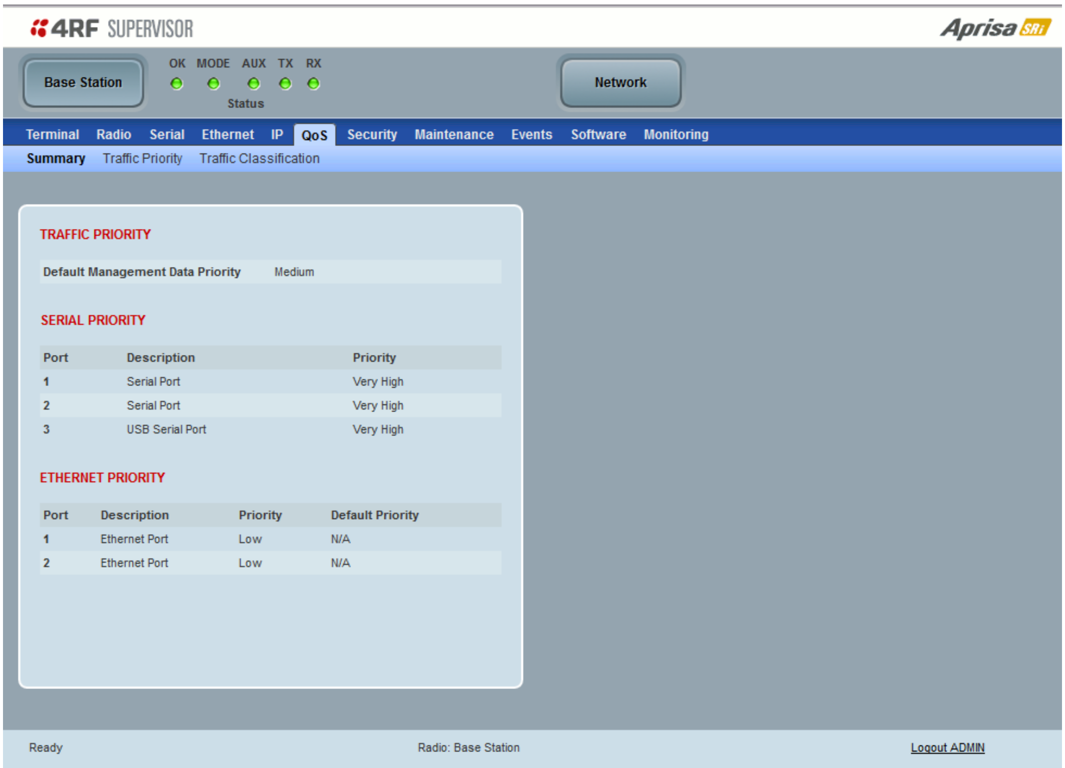
*Active*

If checked the rule becomes active, if unchecked the rule is inactive.

# QoS

## QoS > Summary

This page provides a summary of the QoS Settings.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary Traffic Priority Traffic Classification

TRAFFIC PRIORITY

| | |
|---|---|
| Default Management Data Priority | Medium |

SERIAL PRIORITY

| Port | Description | Priority |
|---|---|---|
| 1 | Serial Port | Very High |
| 2 | Serial Port | Very High |
| 3 | USB Serial Port | Very High |

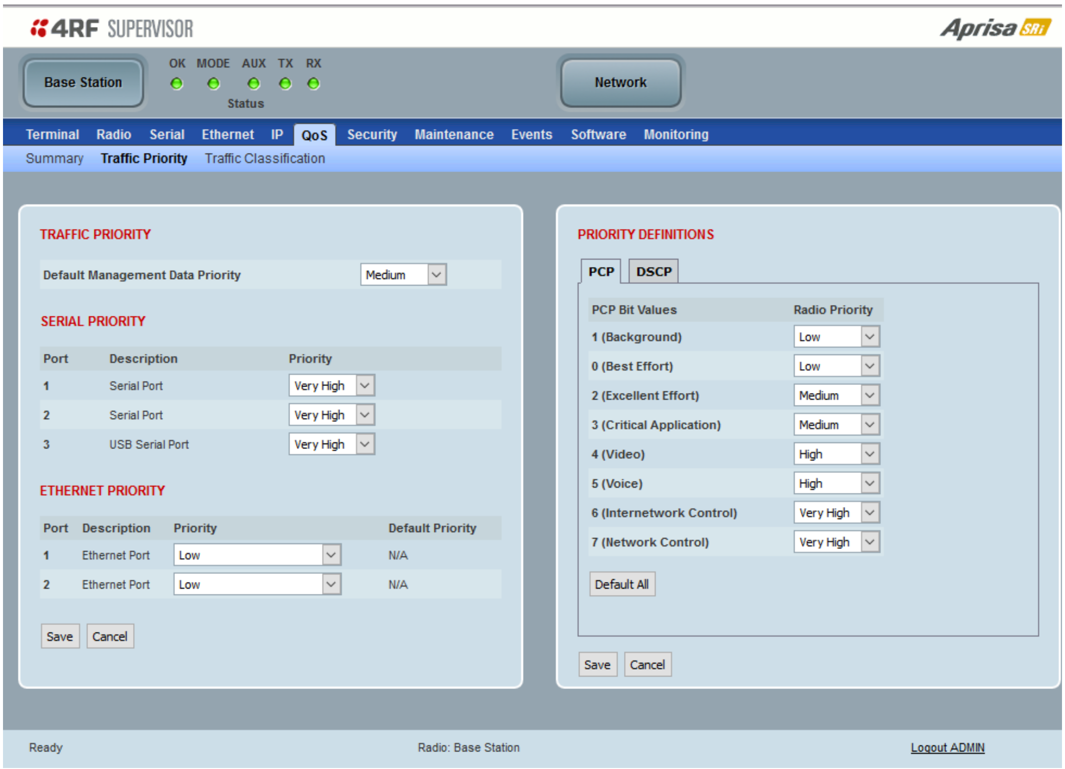
ETHERNET PRIORITY

| Port | Description | Priority | Default Priority |
|---|---|---|---|
| 1 | Ethernet Port | Low | N/A |
| 2 | Ethernet Port | Low | N/A |

Ready
Radio: Base Station
Logout ADMIN

See ‘QoS > Traffic Priority’ and ‘QoS > Traffic Classification’ for configuration options.

## QoS > Traffic Priority



TRAFFIC PRIORITY

| | |
|---|---|
| Default Management Data Priority | Medium |

SERIAL PRIORITY

| Port | Description | Priority |
|---|---|---|
| 1 | Serial Port | Very High |
| 2 | Serial Port | Very High |
| 3 | USB Serial Port | Very High |

ETHERNET PRIORITY

| Port | Description | Priority | Default Priority |
|---|---|---|---|
| 1 | Ethernet Port | Low | N/A |
| 2 | Ethernet Port | Low | N/A |

PRIORITY DEFINITIONS

PCP DSCP

| PCP Bit Values | Radio Priority |
|---|---|
| 1 (Background) | Low |
| 0 (Best Effort) | Low |
| 2 (Excellent Effort) | Medium |
| 3 (Critical Application) | Medium |
| 4 (Video) | High |
| 5 (Voice) | High |
| 6 (Internetwork Control) | Very High |
| 7 (Network Control) | Very High |

### TRAFFIC PRIORITY

*Default Management Data Priority*

The Default Management Data Priority controls the priority of the Ethernet management traffic relative to Ethernet customer traffic. It can be set to Very High, High, Medium and Low. The default setting is Medium.

### SERIAL PRIORITY

This parameter controls the per port priority of the serial customer traffic relative to the Ethernet customer traffic. If equal priority is required to Ethernet traffic, this setting must be the same as the Ethernet Data Priority setting.

The serial data priority can be set to Very High, High, Medium and Low. The default setting is Low.

A queuing system is used to prioritize traffic from the serial and Ethernet interfaces for over the air transmission. A weighting may be given to each data type and this is used to schedule the next transmission over the air e.g. if there are pending data packets in multiple buffers but serial data has a higher weighting it will be transmitted first. The serial buffer is 20 serial packets (1 packet can be up to 512 bytes).

There are four priority queues in the Aprisa SR: Very High, High, Medium and Low. Data is added to one of these queues depending on the priority setting. Data leaves the queues from highest priority to lowest: the Very High queue is emptied first, followed by High then Medium and finally Low.

### ETHERNET PRIORITY

This parameter controls the per port priority of the Ethernet customer traffic relative to the serial customer traffic. If equal priority is required to serial traffic, this setting must be the same as the Serial Data Priority setting.

The Ethernet Priority enables users to set the priority of Ethernet port ingress frames. The priority for each port can be:

| Priority | Description |
|---|---|
| Low | All port frames are set to low priority |
| Medium | All port frames are set to medium priority |
| High | All port frames are set to high priority |
| Very High | All port frames are set to very high priority |
| From Tagged Frame (PCP) | All port frames are set to PCP priority bits (VLAN priority) in VLAN tagged frames or priority tag (VLAN 0) frames.<br>To enable, see ‘PCP (Priority Code Point)’ on page 182. |
| From Packet (DSCP) | All port frames are set to DSCP priority bits in an IP packet (DSCP in IPv4 TOS field).<br>To enable, see ‘DSCP (Differentiated Services Code Point)’ on page 184. |

The default setting is Low.

A queuing system is used to prioritize customer traffic from the serial and Ethernet interfaces for over the air transmission. A weighting may be given to each data type and this is used to schedule the next transmission over the air e.g. if there are pending data packets in multiple buffers but serial data has a higher weighting it will be transmitted first. The Ethernet buffer is 10 Ethernet packets (1 packet can be up to Ethernet MTU, 1536 bytes).

There are four priority queues in the Aprisa SRi: Very High, High, Medium and Low. Data is added to one of these queues depending on the priority setting. Data leaves the queues from highest priority to lowest: the Very High queue is emptied first, followed by High then Medium and finally Low.

#### Default Priority

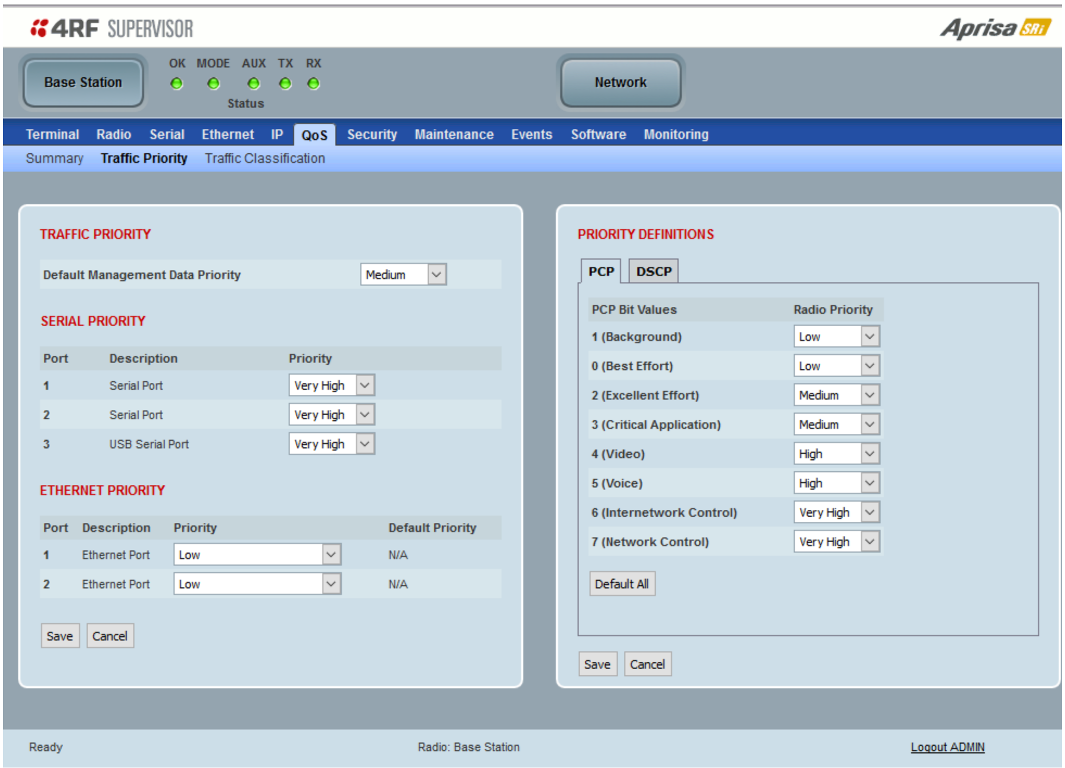
When the priority of an Ethernet port uses the PCP bits (VLAN priority) values the ‘Default Priority’ option is enabled, allowing the priority of untagged VLAN frames to be set.

When the priority of an Ethernet port uses the DSCP priority (in IPv4 TOS field) values the ‘Default Priority’ option is enabled, allowing the priority of ARP frames to be set.

*PRIORITY DEFINITIONS*

*PCP (Priority Code Point)*

These settings provide priority translation / mapping between the external radio LAN VLAN priority network and the radio internal VLAN priority network, using the VLAN tagged PCP (Priority Code Point) priority field in the Ethernet/VLAN frame.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary Traffic Priority Traffic Classification

TRAFFIC PRIORITY

Default Management Data Priority: Medium

SERIAL PRIORITY

| Port | Description | Priority |
|---|---|---|
| 1 | Serial Port | Very High |
| 2 | Serial Port | Very High |
| 3 | USB Serial Port | Very High |

ETHERNET PRIORITY

| Port | Description | Priority | Default Priority |
|---|---|---|---|
| 1 | Ethernet Port | Low | N/A |
| 2 | Ethernet Port | Low | N/A |

PRIORITY DEFINITIONS

| PCP Bit Values | Radio Priority |
|---|---|
| 1 (Background) | Low |
| 0 (Best Effort) | Low |
| 2 (Excellent Effort) | Medium |
| 3 (Critical Application) | Medium |
| 4 (Video) | High |
| 5 (Voice) | High |
| 6 (Internetwork Control) | Very High |
| 7 (Network Control) | Very High |

The IEEE 802.1Q specification defines a standards-based mechanism for providing VLAN tagging and class of service (CoS) across Ethernet networks. This is accomplished through an additional VLAN tag, which carries VLAN tag ID and frame prioritization information (PCP field), inserted within the header of a Layer 2 Ethernet frame.

Priority Code Point (PCP) is a 3-bit field that indicates the frame priority level (or CoS). The operation of the PCP field is defined within the IEEE 802.1p standard, which is an extension of 802.1Q. The standard establishes eight levels of priority, referred to as CoS values, where CoS 7 ('111' in PCP filed) is the highest priority and CoS 0 ('000') is the lowest priority.

The radio in bridge mode used the PCP value in the VLAN tag to prioritize packets and provide the appropriate QoS treatment per traffic type. The radio implements 4 priority queuing techniques that base its QoS on the VLAN priority (PCP). Based on VLAN priority bits, traffic can be put into a particular Class of Service (CoS) queue. Packets with higher CoS will always serve first for OTA transfer and on ingress/egress Ethernet ports.

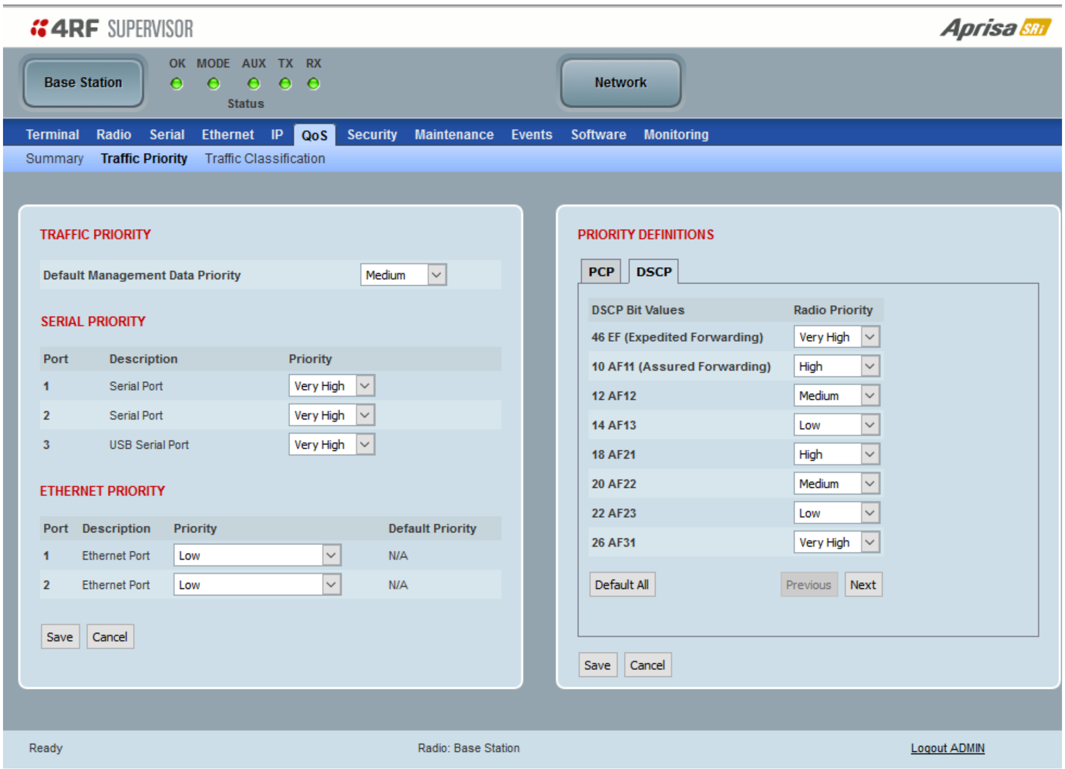
The 'PCP priority definition' tab is used to map ingress VLAN packet with PCP priority to the radio internal CoS (priority). Since, in most of the cases the radio VLAN network is connected to the corporate VLAN networks, the network administrator might like to have a different VLAN priority scheme of the radio network CoS. For example, management traffic in the multi-gigabit corporate VLAN network might be prioritize with priority 7 (highest priority) and SCADA traffic with priority 5, but in the narrow bandwidth radio network, SCADA traffic will be map to radio very high CoS / priority (i.e. set PCP 5 = Very high) and management traffic might will be map to radio medium CoS / priority (i.e. set PCP 7 = medium) in order to serve first the mission-critical SCADA traffic over the radio network.

This is done by mapping the external radio network VLAN priority to the internal radio CoS / priority using the ‘PCP priority definition’ tab. The radio support 4 queues, thus at maximum an 8 -> 4 VLAN priority / CoS mapping is done.

Default mapping of ingress packet VLAN priority to radio CoS / priority shown in the ‘PCP priority definition’ tab.

*DSCP (Differentiated Services Code Point)*

These settings provide translation / mapping between the external radio IP priority network and the radio internal IP priority network, using the DSCP (DiffServ Code Point) priority field in the IP packet header.



TRAFFIC PRIORITY

| | |
|---|---|
| Default Management Data Priority | Medium |

SERIAL PRIORITY

| Port | Description | Priority |
|---|---|---|
| 1 | Serial Port | Very High |
| 2 | Serial Port | Very High |
| 3 | USB Serial Port | Very High |

ETHERNET PRIORITY

| Port | Description | Priority | Default Priority |
|---|---|---|---|
| 1 | Ethernet Port | Low | N/A |
| 2 | Ethernet Port | Low | N/A |

PRIORITY DEFINITIONS

| DSCP Bit Values | Radio Priority |
|---|---|
| 46 EF (Expedited Forwarding) | Very High |
| 10 AF11 (Assured Forwarding) | High |
| 12 AF12 | Medium |
| 14 AF13 | Low |
| 18 AF21 | High |
| 20 AF22 | Medium |
| 22 AF23 | Low |
| 26 AF31 | Very High |

Differentiated Services (DiffServ) is a new model in which traffic is treated by routers with relative priorities based on the IPv4 type of services (ToS) field. DSCP (DiffServ Code Point) standard defined in RFC 2474 and RFC 2475. DiffServ increases the number of definable priority levels by reallocating bits of an IP packet for priority marking.

The DiffServ architecture defines the DiffServ (DS) field, which supersedes the ToS field in IPv4 to make per-hop behaviour (PHB) decisions about packet classification and traffic scheduling functions. The six most significant bits of the DiffServ field (in the IPv4 TOS field) is called as the DSCP. The standardized DiffServ field of the packet is marked with a value so that the packet receives a particular routing/forwarding treatment or PHB, at each router node. Using DSCP packet classification, traffic can be partition into multiple priority levels.

The radio in router mode uses the DSCP value in the IP header to select a PHB behaviour for the packet and provide the appropriate QoS treatment. The radio implements 4 priority queuing techniques that base its PHB on the DSCP in the IP header of a packet. Based on DSCP, traffic can be put into a particular priority / CoS (Class of Service) queue. Packets with higher CoS will always serve first for OTA transfer and on ingress / egress Ethernet ports.

The 'DSCP priority definition' tab is used to map ingress IP packet with DSCP priority to the radio internal priority / CoS. Since, in most of the cases the radio routed network is connected to the corporate routed networks, the network administrator might like to have a different routed network priority scheme of the radio network, for example management traffic in the multi-gigabit corporate routed network might be prioritize with DSCP EF (expedite forwarding) code (DSCP highest priority), and SCADA traffic with DSCP AF11 (assured forwarding) code (high priority), but in the narrow bandwidth radio network, SCADA traffic will be map to radio very high CoS / priority (i.e. set AF11 = Very high) and management traffic might map to radio low CoS / priority (i.e. set EF = Low)  in order to serve first the mission-critical SCADA traffic over the radio network.

This is done by mapping the external radio network DSCP priority to the internal radio CoS / priority levels using the 'DSCP priority definition' tab. The radio support four queues, thus at maximum a 64 -> 4 CoS / priority mapping is done.

Default mapping of ingress packet DSCP priority to radio CoS shown in the 'DSCP priority definition' tab. The radio maps all 64 DSCP values. The user can configure most common used 21 DSCP codes and the rest are mapped by default to low CoS / priority.

## QoS > Traffic Classification

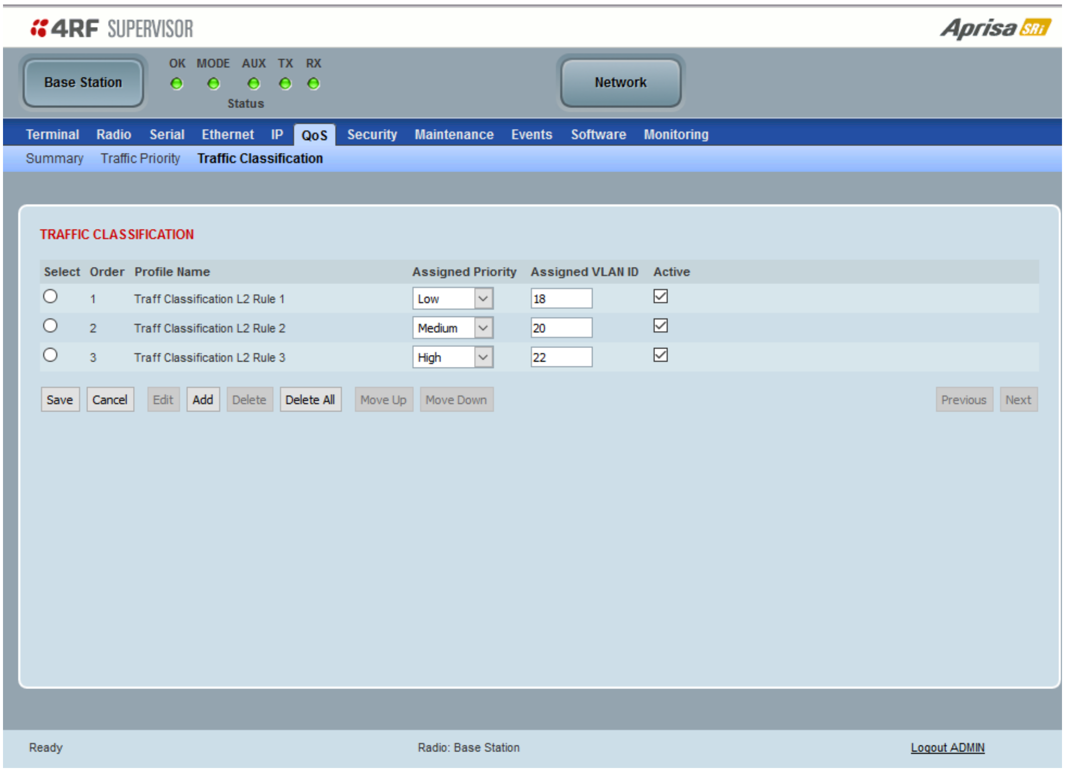
These settings provide multiple traffic classification profiles based on classification rules. Profiles for a specific traffic type, protocol or application can be assigned to a particular VLAN and CoS / priority in bridge mode or to CoS / priority in router mode to provide the appropriate QoS treatment.

For example SCADA traffic, management traffic, FTP traffic, can each have its own profile build with a set of classification rules. A profile can be build using multiple classification rules based on ports, Ethernet, IP, TCP / UDP headers fields (i.e. L1/2/3/4 header fields) such as: Ethernet port #1, VLAN ID, VLAN priority, IP DSCP Priority, MAC/IP address, TCP / UDP port fields to identify and classify the specific traffic type. When an ingress packet matches the profile L2/3/4 header fields settings, the packet is assigned to a particular VLAN and CoS / priority in bridge mode or to CoS / priority in router mode to provide the appropriate QoS treatment.

The radio supports four CoS / priority queues: very high, high, medium and low. These queues are connected to a strict priority scheduler which dispatches packets from the queues out to the egress port by always serving first the ‘very high’ priority queue, whenever there is a packet in this queue. When the highest priority queue empties, the scheduler will serve the next high priority queues and so on. So when SCADA traffic is assigned to a ‘Very high’ priority, it will always served first and send over-the-air (OTA) whenever SCADA traffic enters to the radio, giving it the highest priority over other traffic type.

These settings are different for Bridge Mode and Router Mode.

## Bridge Mode Traffic Classification Settings


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary Traffic Priority Traffic Classification
Save Cancel Edit Add Delete Delete All Move Up Move Down Previous Next
Ready
Radio: Base Station
Logout ADMIN

TRAFFIC CLASSIFICATION

| Select | Order | Profile Name | Assigned Priority | Assigned VLAN ID | Active |
|---|---|---|---|---|---|
| ○ | 1 | Traff Classification L2 Rule 1 | Low | 18 | ☑ |
| ○ | 2 | Traff Classification L2 Rule 2 | Medium | 20 | ☑ |
| ○ | 3 | Traff Classification L2 Rule 3 | High | 22 | ☑ |

### TRAFFIC CLASSIFICATION

VLAN bridge mode traffic classification settings provide mapping / assigning of profiles (set by rules to match a specific traffic type) to a VLAN ID and VLAN CoS / priority. The profile which is used to match to a specific traffic type will be identified in the radio network by its associated VLAN ID and VLAN CoS / priority to provide the appropriate QoS treatment. CoS / Priority can be set to very high, high, medium, low priority.

*Profile name*

A free form field to enter the profile name with a maximum of 32 chars.

*Assigned Priority*

Traffic packets that match the applied profile rules will be assigned to the selected 'assigned priority' setting of Very High, High, Medium and Low. This field cannot be set to Don't Care.

This applies profile rule mapping to the VLAN CoS / Priority with the appropriate internal radio assigned priority setting of Very High, High, Medium and Low.

*Assigned VLAN ID*

Traffic packets that match the applied profile rules will be assigned to the selected ‘assigned VLAN ID’ setting of VLAN ID in the range of 0 to 4095.

A VLAN ID of an ingress packet matching the classification rule (see ‘VLAN ID’ rule in next page) shall be changed to the ‘assigned VLAN ID’ setting, if below conditions are met:

1. The VLAN ID of Ingress packet is same as PVID of the ingress port.
2. Packet is received untagged at the port

If the VLAN ID of the tagged ingress packet is not the same as the PVID of the ingress port, then it shall not be changed and the ‘assigned VLAN ID’ setting is ignored i.e. ingress VLANs will pass-through unchanged.

If ‘assigned VLAN ID’ value is set in the ‘port VLAN membership’ under Ethernet > VLAN (port x tab), then this VLAN will be available for ingress and egress on the Ethernet and RF ports, otherwise this VLAN will only be available in one direction on the egress RF port.

For example, if the base station Ethernet port 1 ‘assigned VLAN ID’ = 100 (VLAN-100) and it is also defined in the ‘port VLAN membership’ under Ethernet > VLAN (port 1 tab) and the remote sends a packet to the base with a VLAN of 100, this packet will be egress out to Ethernet port 1 (tagged or untagged based on the ‘egress action’ definition). If the VLAN-100 wasn’t set in the ‘port VLAN membership’, then the base station will drop a packet from the remote.

This setting parameter can be ‘Don’t Care’ (Assigned VLAN ID = 0) which means that the VLAN ID of ingress frame will never be modified.

*Active*

Activates or deactivates the profile rule.

## Controls

The Save button saves all profiles to the radio.

The Cancel button removes all changes since the last save or first view of the page if there has not been any saves. This button will un-select all the Select radio buttons.

The Edit button will show the next screen for the selected profile where the profile can be configured. This button will be disabled unless a profile is selected.

The Add button adds a new profile,

- If no profile was selected then the new profile is added to the end of the list,
- If a profile is selected the new profile is added after that profile.

The Delete button will delete the selected profile. The button will be disabled unless a profile has been selected.

The Delete All button will delete all the profiles. A pop-up will ask if the action is correct. If the answer is yes, then all profiles are deleted in SuperVisor. The Save button must be pressed to delete all the profiles in the radio.

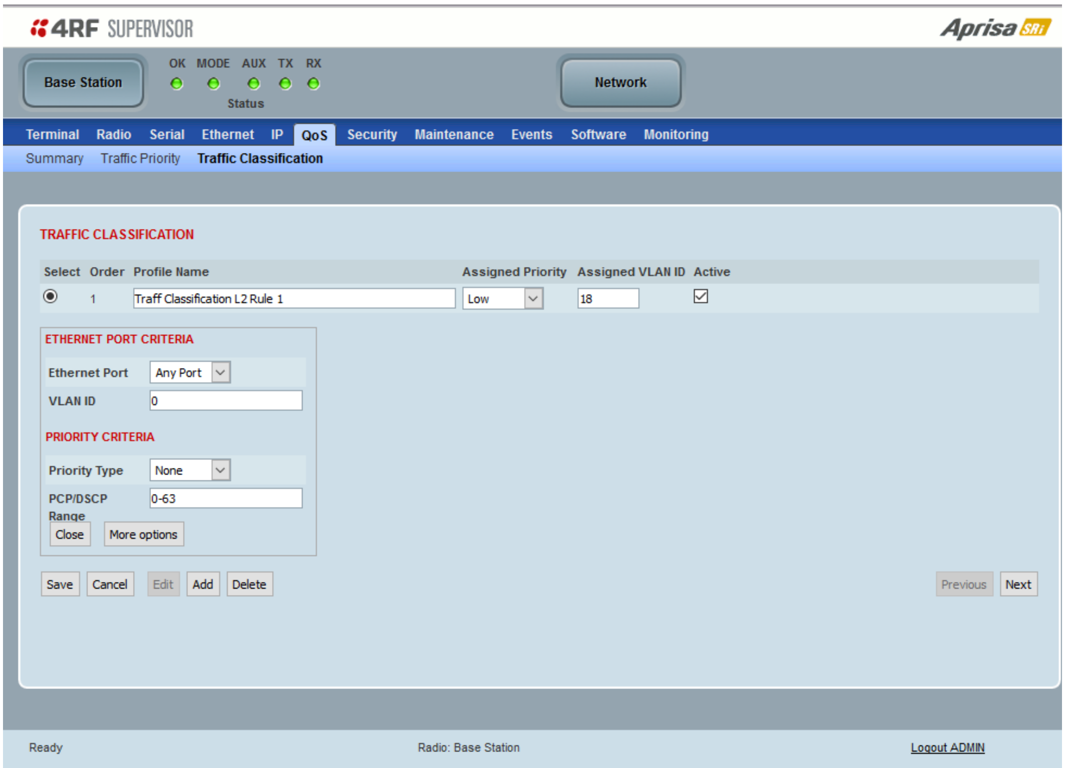
The Move up button will move the selected profile up one in the order of profiles

The Move Down button will move the selected profile down one in the order of profiles

The Previous button displays the previous page in the list of profiles. A pop up will be displayed if any profile has been modified and not saved, preventing the previous page being displayed.

The Next button will display the next page in the list of profiles.

To edit a traffic classification, select the profile and click on the Edit button


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary Traffic Priority Traffic Classification
Save Cancel Edit Add Delete
Previous Next
Close More options
Ready
Radio: Base Station
Logout ADMIN

TRAFFIC CLASSIFICATION

| Select | Order | Profile Name | Assigned Priority | Assigned VLAN ID | Active |
|---|---|---|---|---|---|
| ● | 1 | Traff Classification L2 Rule 1 | Low | 18 | ☑ |

ETHERNET PORT CRITERIA

| | |
|---|---|
| Ethernet Port | Any Port |
| VLAN ID | 0 |

PRIORITY CRITERIA

| | |
|---|---|
| Priority Type | None |
| PCP/DSCP Range | 0-63 |

## ETHERNET PORT CRITERIA

### *Ethernet Port*

Set the layer 1 Ethernet port number or all Ethernet ports in the selected profile classification rule.

### *VLAN ID*

Sets the layer 2 packet Ethernet header VLAD ID field in the selected profile classification rule. Valid values are between 0 and 4095. This VLAN ID should be enabled in the system for using this parameter during classification.

Enable this VLAN in the network by setting the same VLAN ID value in PVID (port VLAN ID) and in the PORT VLAN MEMBERSHIP under ‘VLAN PORT SETTINGS – Port ’ on page 153. If the VLAN ID is set to zero, all VLAN IDs will meet the criteria.

## PRIORITY CRITERIA

### *Priority Type*

Set the layer 2 Ethernet or layer 3 IP packet header priority type fields in the selected profile classification rules.

| Priority Type | Description |
|---|---|
| None | Do not use any layer 2 / 3 Ethernet or IP header priority fields in the selected profile classification rules. |
| PCP | Use the layer 2 Ethernet header priority field of PCP (Priority Code Point) VLAN priority bits (per IEEE 802.1p/q) in the selected profile classification rules. |
| DSCP | Use the layer 3 IP header TOS field used as DSCP (Differentiated Services Code Point per RFC 2474 and RFC 2475) priority bit in the selected profile classification rules. |

### *PCP / DSCP Range*

As per the ‘priority type’ selection, this parameter sets the PCP priority value/s or DSCP priority value/s fields in the selected profile classification rule. The value can be set to a single priority or a single range (no multiple ranges are allowed), for example, the PCP selected priority value can be 7 or a range of priority values like 4-7.

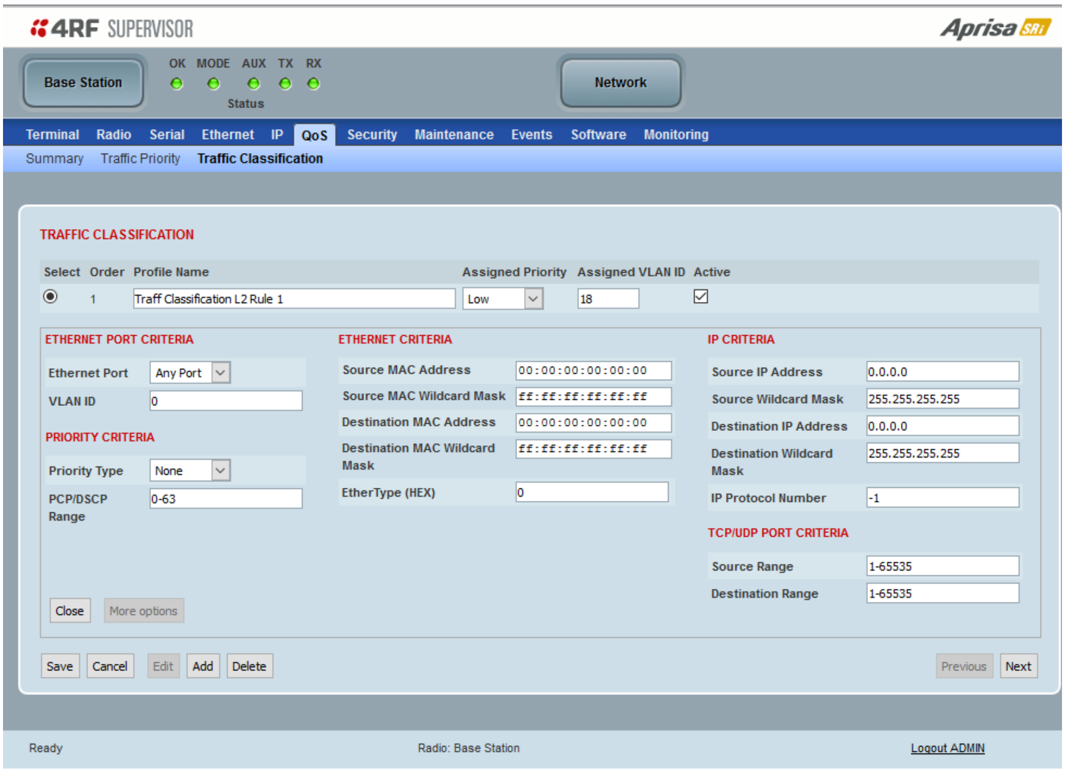
The following table shows the layer 2 packet VLAN tag header PCP priority field values

| PCP Value (Decimal) | PCP Priority | Priority Level |
|---|---|---|
| 7 | Priority [7] | Highest |
| 6 | Priority [6] | ↓ |
| 5 | Priority [5] | |
| 4 | Priority [4] | |
| 3 | Priority [3] | |
| 2 | Priority [2] | |
| 1 | Priority [1] | |
| 0 | Priority [0] | Lowest |

The following table shows the layer 3 packet IP header DSCP priority field values

| DSCP Value (Decimal) | DSCP Priority |
|---|---|
| 46 | EF (Expedited Forwarding) |
| 10 | AF11 (Assured Forwarding) |
| 12 | AF12 |
| 14 | AF13 |
| 18 | AF21 |
| 20 | AF22 |
| 22 | AF23 |
| 26 | AF31 |
| 28 | AF32 |
| 30 | AF33 |
| 34 | AF41 |
| 36 | AF42 |
| 38 | AF43 |
| 0 | CS0/Best Effort (BE) |
| 8 | CS1 (Class Selector ) |
| 16 | CS2 |
| 24 | CS3 |
| 32 | CS4 |
| 40 | CS5 |
| 48 | CS6 |
| 56 | CS7 |

Click on More Options if more Layer 2/3/4 (Ethernet / IP / TCP or UDP) packet header fields are required for the selected profile classification rule. This page describes all the possible fields that can be used for the classification rules in bridge mode.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary Traffic Priority Traffic Classification
Close
More options
Save Cancel Edit Add Delete
Previous Next
Ready
Radio: Base Station
Logout ADMIN

TRAFFIC CLASSIFICATION

| Select | Order | Profile Name | Assigned Priority | Assigned VLAN ID | Active |
|---|---|---|---|---|---|
| ● | 1 | Traff Classification L2 Rule 1 | Low | 18 | ☑ |

ETHERNET PORT CRITERIA

| | |
|---|---|
| Ethernet Port | Any Port |
| VLAN ID | 0 |

PRIORITY CRITERIA

| | |
|---|---|
| Priority Type | None |
| PCP/DSCP Range | 0-63 |

ETHERNET CRITERIA

| | |
|---|---|
| Source MAC Address | 00:00:00:00:00:00 |
| Source MAC Wildcard Mask | ff:ff:ff:ff:ff:ff |
| Destination MAC Address | 00:00:00:00:00:00 |
| Destination MAC Wildcard Mask | ff:ff:ff:ff:ff:ff |
| EtherType (HEX) | 0 |

IP CRITERIA

| | |
|---|---|
| Source IP Address | 0.0.0.0 |
| Source Wildcard Mask | 255.255.255.255 |
| Destination IP Address | 0.0.0.0 |
| Destination Wildcard Mask | 255.255.255.255 |
| IP Protocol Number | -1 |

TCP/UDP PORT CRITERIA

| | |
|---|---|
| Source Range | 1-65535 |
| Destination Range | 1-65535 |

## ETHERNET CRITERIA

### *Source MAC Address*

This parameter sets the Layer 2 Ethernet packet header Source MAC Address field in the selected profile classification rule in the format of 'hh:hh:hh:hh:hh:hh'.

### *Source MAC Wildcard Mask*

This parameter sets the wildcard mask of the 'Source MAC Address'. If the Source MAC Address is set to 'FF:FF:FF:FF:FF:FF', all source MAC addresses will meet the criteria.

### *Destination MAC Address*

This parameter sets the Layer 2 Ethernet packet header Destination MAC Address field in the selected profile classification rule in the format of 'hh:hh:hh:hh:hh:hh'.

### *Destination MAC Wildcard Mask*

This parameter sets the wildcard mask of the 'Destination MAC Address'. If the Destination MAC Address is set to 'FF:FF:FF:FF:FF:FF', all destination MAC addresses will meet the criteria.

*EtherType (Hex)*

This parameter sets the Layer 2 Ethernet packet header EtherType field in the selected profile classification rule. EtherType is a 16 bit (two octets) field in an Ethernet frame. It is used to indicate which protocol is encapsulated in the payload of an Ethernet Frame.

EtherType Examples:

| Protocol | EtherType Value (Hexadecimal) |
|---|---|
| IPv4 | 0800 |
| ARP | 0806 |
| IPv6 | 86DD |
| VLAN | 8100 |

## IP CRITERIA

*Source IP Address*

This parameter sets the Layer 3 IP packet header Source IP Address field in the selected profile classification rule. This parameter is written in the standard IPv4 format of 'xxx.xxx.xxx.xxx'.

*Source IP Wildcard Mask*

This parameter sets the wildcard mask applied to the 'Source IP Address'. This parameter is written in the standard IPv4 format of 'xxx.xxx.xxx.xxx'.

0 means that it must be a match. If the wildcard mask is set to 0.0.0.0, the complete Source IP Address will be evaluated for the classification rule.

If the wildcard mask is set to 0.0.255.255, the first 2 octets of the Source IP Address will be evaluated for the classification rule.

If the wildcard mask is set to 255.255.255.255, none of the Source IP Address will be evaluated for the classification rule.

Note: The wildcard mask operation is the inverse of subnet mask operation

*Destination IP Address*

This parameter sets the Layer 3 IP packet header Destination IP Address field in the selected profile classification rule. This parameter is written in the standard IPv4 format of 'xxx.xxx.xxx.xxx'.

*Destination IP Wildcard Mask*

This parameter sets the wildcard mask applied to the 'Destination IP Address'. This parameter is written in the standard IPv4 format of 'xxx.xxx.xxx.xxx'.

0 means that it must be a match. If the wildcard mask is set to 0.0.0.0, the complete Destination IP Address will be evaluated for the classification rule.

If the wildcard mask is set to 0.0.255.255, the first 2 octets of the Destination IP Address will be evaluated for the classification rule.

If the wildcard mask is set to 255.255.255.255, none of the Destination IP Address will be evaluated for the classification rule.

Note: The wildcard mask operation is the inverse of subnet mask operation

*IP Protocol Number*

This parameter sets the Layer 3 IP packet header ‘Protocol’ field in the selected profile classification rule. This field defines the protocol used in the data portion of the IP datagram.

Protocol number Examples:

| Protocol | Protocol value (decimal) |
|---|---|
| ICMP | 1 |
| TCP | 6 |
| UDP | 17 |

## TCP / UDP PORT CRITERIA

*Source Range*

This parameter sets the Layer 4 TCP / UDP packet header Source Port or Source Port range field in the selected profile classification rule. To specify a range, insert a dash between the ports e.g. 1000-2000. If the source port range is set to 1-65535, traffic from any source port will meet the criteria.

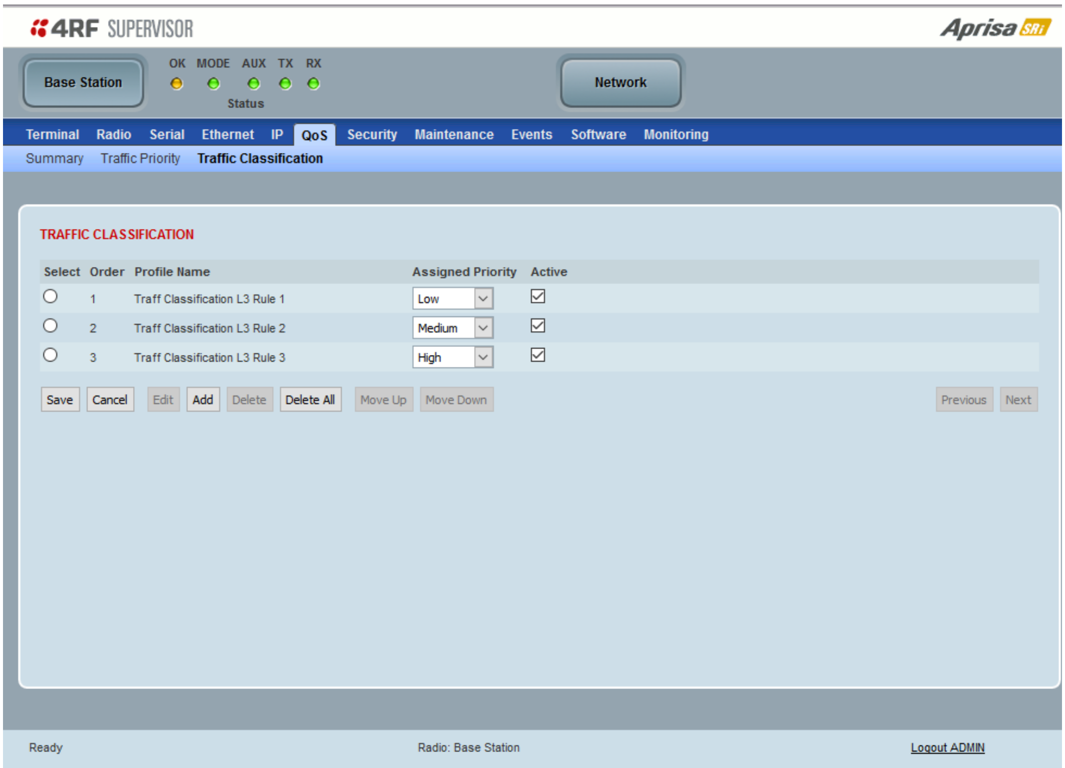
*Destination Range*

This parameter sets the Layer 4 TCP / UDP packet header Destination Port or Destination Port range field in the selected profile classification rules. To specify a range, insert a dash between the ports e.g. 1000-2000. If the source port range is set to 1-65535, traffic from any source port will meet the criteria.

Examples for TCP / UDP Port Numbers:

| Protocol | TCP / UDP Port # (decimal) |
|---|---|
| Modbus | 502 |
| IEC 60870-5-104 | 2,404 |
| DNP 3 | 20,000 |
| SNMP | 161 |
| SNMP TRAP | 162 |

## Router Mode Traffic Classification Settings


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary Traffic Priority Traffic Classification
Save Cancel Edit Add Delete Delete All Move Up Move Down Previous Next
Ready
Radio: Base Station
Logout ADMIN

TRAFFIC CLASSIFICATION

| Select | Order | Profile Name | Assigned Priority | Active |
|---|---|---|---|---|
| ○ | 1 | Traff Classification L3 Rule 1 | Low | ☑ |
| ○ | 2 | Traff Classification L3 Rule 2 | Medium | ☑ |
| ○ | 3 | Traff Classification L3 Rule 3 | High | ☑ |

*TRAFFIC CLASSIFICATION*

Router Mode traffic classification settings provide mapping / assigning of profiles (set by rules to match a specific traffic type) to a CoS / priority. The profile which is used to match to a specific traffic type will be identified in the radio network by its associated CoS / priority to provide the appropriate QoS treatment. CoS / Priority can be set to very high, high, medium, low priority.

*Profile name*

A free form field to enter the profile name with a maximum of 32 chars.

*Assigned Priority*

Traffic packets that match the applied profile rules will be assigned to the selected ‘assigned priority’ setting of Very High, High, Medium and Low. This field cannot be set to Don’t Care.

*Active*

Activated or deactivate the profile rule.

## Controls

The Save button saves all profiles to the radio.

The Cancel button removes all changes since the last save or first view of the page if there has not been any saves. This button will un-select all the Select radio buttons.

The Edit button will show the next screen for the selected profile where the profile can be configured. This button will be disabled unless a profile is selected.

The Add button adds a new profile,

- If no profile was selected then the new profile is added to the end of the list,
- If a profile is selected the new profile is added after that profile.

The Delete button will delete the selected profile. The button will be disabled unless a profile has been selected.

The Delete All button will delete all the profiles. A pop-up will ask if the action is correct. If the answer is yes, then all profiles are deleted in SuperVisor. The Save button must be pressed to delete all the profiles in the radio.

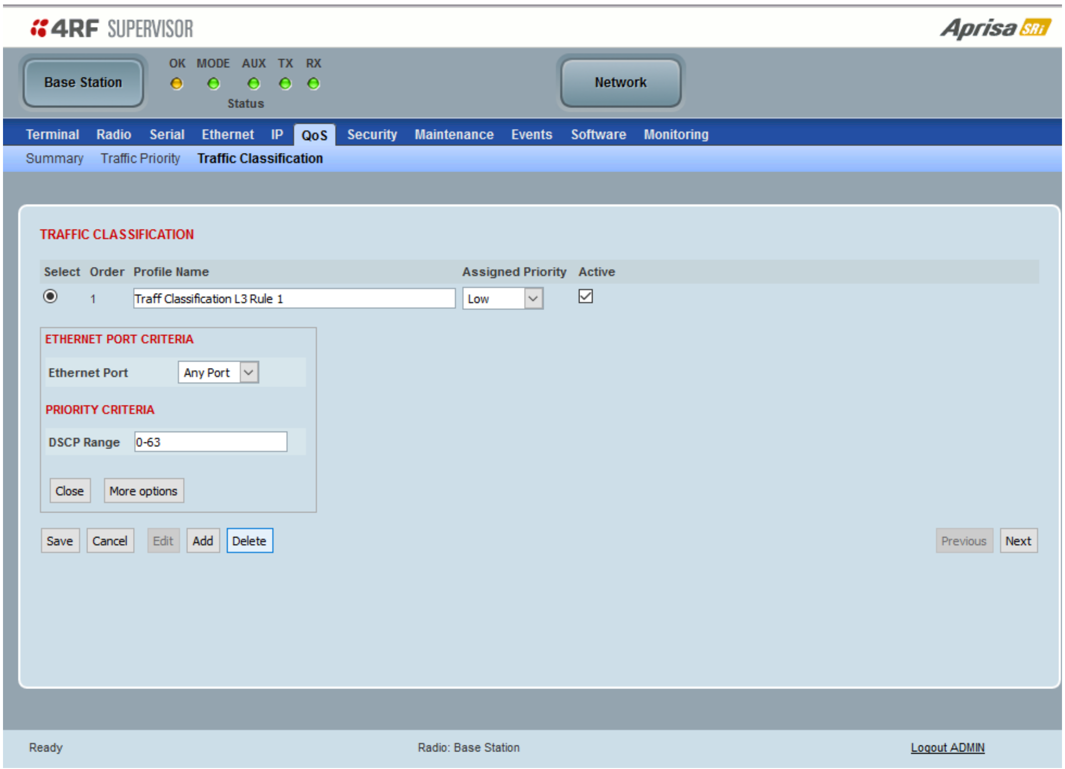
The Move up button will move the selected profile up one in the order of profiles

The Move Down button will move the selected profile down one in the order of profiles

The Previous button displays the previous page in the list of profiles. A pop up will be displayed if any profile has been modified and not saved, preventing the previous page being displayed.

The Next button will display the next page in the list of profiles.

To edit a traffic classification, select the profile and click on the Edit button



4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary Traffic Priority Traffic Classification

TRAFFIC CLASSIFICATION

| Select | Order | Profile Name | Assigned Priority | Active |
|---|---|---|---|---|
| ● | 1 | Traff Classification L3 Rule 1 | Low | ☑ |

ETHERNET PORT CRITERIA

Ethernet Port: Any Port

PRIORITY CRITERIA

DSCP Range: 0-63

## ETHERNET PORT CRITERIA

*Ethernet Port*

Set the layer 1 Ethernet port number or all Ethernet ports in the selected profile classification rules.

## PRIORITY CRITERIA

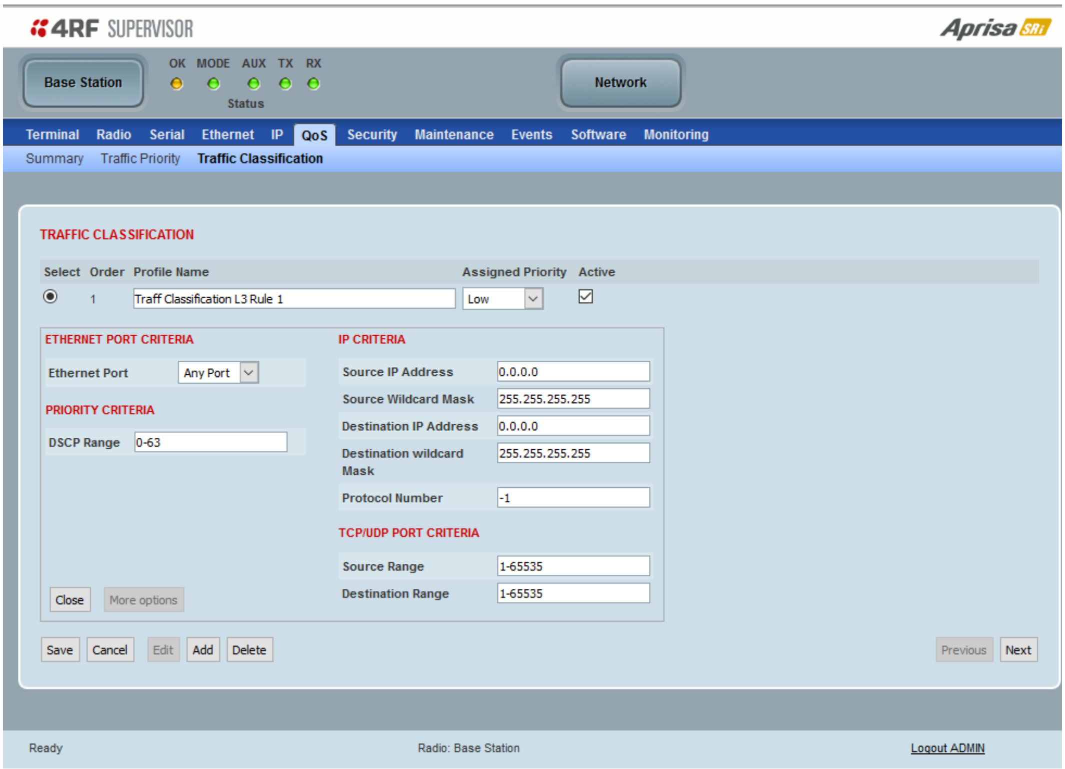
*DSCP Range*

Sets the DSCP priority value/s field in the selected profile classification rule. The value can be set to a single priority or a single range (no multiple range are allowed), for example, priority value can be 46 (EF) or a range of priority values like 10-14.

The following table shows the layer 3 packet IP header DSCP priority field values

| DSCP Value (Decimal) | DSCP Priority |
|---|---|
| 46 | EF (Expedited Forwarding) |
| 10 | AF11 (Assured Forwarding) |
| 12 | AF12 |
| 14 | AF13 |
| 18 | AF21 |
| 20 | AF22 |
| 22 | AF23 |
| 26 | AF31 |
| 28 | AF32 |
| 30 | AF33 |
| 34 | AF41 |
| 36 | AF42 |
| 38 | AF43 |
| 0 | CS0/Best Effort (BE) |
| 8 | CS1 (Class Selector ) |
| 16 | CS2 |
| 24 | CS3 |
| 32 | CS4 |
| 40 | CS5 |
| 48 | CS6 |
| 56 | CS7 |

Click on More Options if more Layer 3/4 packet header fields are required for the selected profile classification rule. This page describes all the possible fields that can be used for the classification rules in router mode.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary Traffic Priority Traffic Classification
Close
More options
Save Cancel Edit Add Delete
Previous Next
Ready
Radio: Base Station
Logout ADMIN

TRAFFIC CLASSIFICATION

| Select | Order | Profile Name | Assigned Priority | Active |
|---|---|---|---|---|
| ● | 1 | Traff Classification L3 Rule 1 | Low | ☑ |

ETHERNET PORT CRITERIA

Ethernet Port: Any Port

PRIORITY CRITERIA

DSCP Range: 0-63

IP CRITERIA

Source IP Address: 0.0.0.0

Source Wildcard Mask: 255.255.255.255

Destination IP Address: 0.0.0.0

Destination wildcard Mask: 255.255.255.255

Protocol Number: -1

TCP/UDP PORT CRITERIA

Source Range: 1-65535

Destination Range: 1-65535

## IP CRITERIA

### *Source IP Address*

This parameter sets the Layer 3 packet IP header Source IP Address field in the selected profile classification rules. This parameter is written in the standard IPv4 format of ‘xxx.xxx.xxx.xxx’.

### *Source IP Wildcard Mask*

This parameter sets the wildcard mask applied to the ‘Source IP Address’. This parameter is written in the standard IPv4 format of ‘xxx.xxx.xxx.xxx’.

0 means that it must be a match. If the wildcard mask is set to 0.0.0.0, the complete Source IP Address will be evaluated for the classification rules.

If the wildcard mask is set to 0.0.255.255, the first 2 octets of the Source IP Address will be evaluated for the classification rules.

If the wildcard mask is set to 255.255.255.255, none of the Source IP Address will be evaluated for the classification rules.

Note: The wildcard mask operation is the inverse of subnet mask operation

### *Destination IP Address*

This parameter sets the Layer 3 packet IP header Destination IP Address field in the selected profile classification rules. This parameter is written in the standard IPv4 format of ‘xxx.xxx.xxx.xxx’.

*Destination IP Wildcard Mask*

This parameter sets the wildcard mask applied to the 'Destination IP Address'. This parameter is written in the standard IPv4 format of 'xxx.xxx.xxx.xxx'.

0 means that it must be a match. If the wildcard mask is set to 0.0.0.0, the complete Destination IP Address will be evaluated for the classification rules.

If the wildcard mask is set to 0.0.255.255, the first 2 octets of the Destination IP Address will be evaluated for the classification rules.

If the wildcard mask is set to 255.255.255.255, none of the Destination IP Address will be evaluated for the classification rules.

Note: The wildcard mask operation is the inverse of subnet mask operation

*Protocol Number*

This parameter sets the Layer 3 IP packet header 'Protocol' field in the selected profile classification rule. This field defines the protocol used in the data portion of the IP datagram.

Protocol number Examples:

| Protocol | Protocol value (decimal) |
|---|---|
| ICMP | 1 |
| TCP | 6 |
| UDP | 17 |

## TCP / UDP Port Criteria

*Source Range*

This parameter sets the Layer 4 TCP / UDP packet header Source Port or Source Port range field in the selected profile classification rule. To specify a range, insert a dash between the ports e.g. 1000-2000. If the source port range is set to 1-65535, traffic from any source port will meet the criteria.

*Destination Range*

This parameter sets the Layer 4 TCP / UDP packet header Destination Port or Destination Port range field in the selected profile classification rule. To specify a range, insert a dash between the ports e.g. 1000-2000. If the source port range is set to 1-65535, traffic from any source port will meet the criteria.

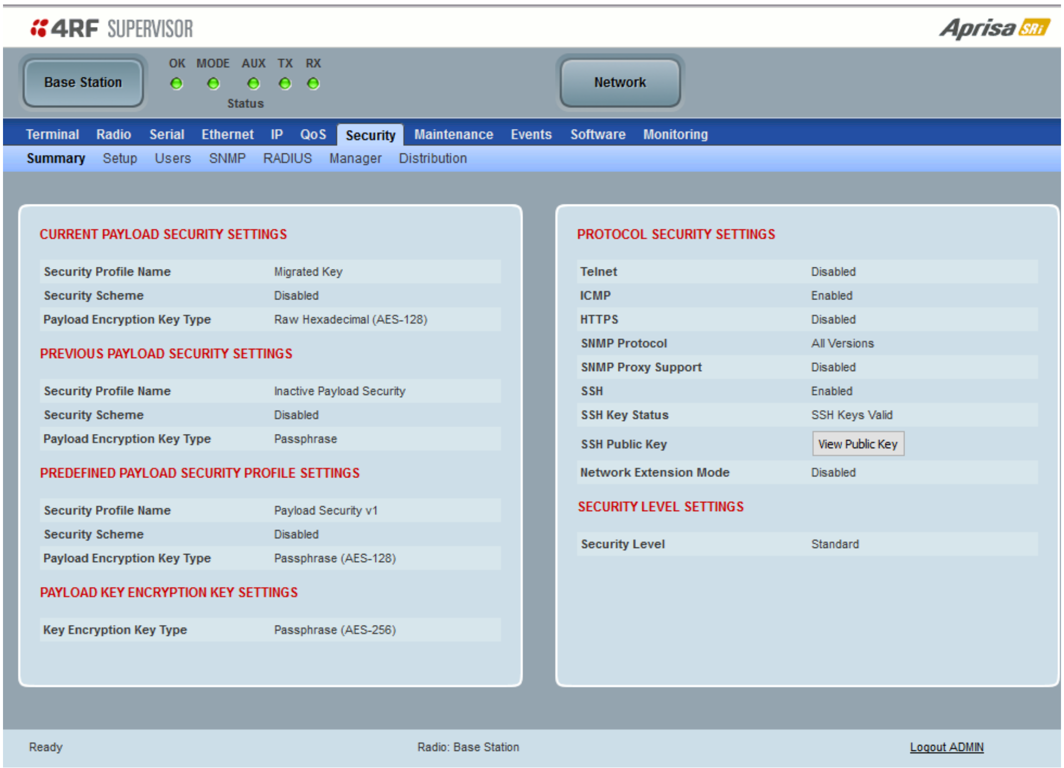
Examples for TCP / UDP Port Numbers:

| Protocol | TCP / UDP Port # (decimal) |
|---|---|
| Modbus | 502 |
| IEC 60870-5-104 | 2,404 |
| DNP 3 | 20,000 |
| SNMP | 161 |
| SNMP TRAP | 162 |

# Security

## Security > Summary

This page displays the current settings for the Security parameters.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary Setup Users SNMP RADIUS Manager Distribution

CURRENT PAYLOAD SECURITY SETTINGS

| | |
|---|---|
| Security Profile Name | Migrated Key |
| Security Scheme | Disabled |
| Payload Encryption Key Type | Raw Hexadecimal (AES-128) |

PREVIOUS PAYLOAD SECURITY SETTINGS

| | |
|---|---|
| Security Profile Name | Inactive Payload Security |
| Security Scheme | Disabled |
| Payload Encryption Key Type | Passphrase |

PREDEFINED PAYLOAD SECURITY PROFILE SETTINGS

| | |
|---|---|
| Security Profile Name | Payload Security v1 |
| Security Scheme | Disabled |
| Payload Encryption Key Type | Passphrase (AES-128) |

PAYLOAD KEY ENCRYPTION KEY SETTINGS

| | |
|---|---|
| Key Encryption Key Type | Passphrase (AES-256) |

PROTOCOL SECURITY SETTINGS

| | |
|---|---|
| Telnet | Disabled |
| ICMP | Enabled |
| HTTPS | Disabled |
| SNMP Protocol | All Versions |
| SNMP Proxy Support | Disabled |
| SSH | Enabled |
| SSH Key Status | SSH Keys Valid |
| SSH Public Key | View Public Key |
| Network Extension Mode | Disabled |

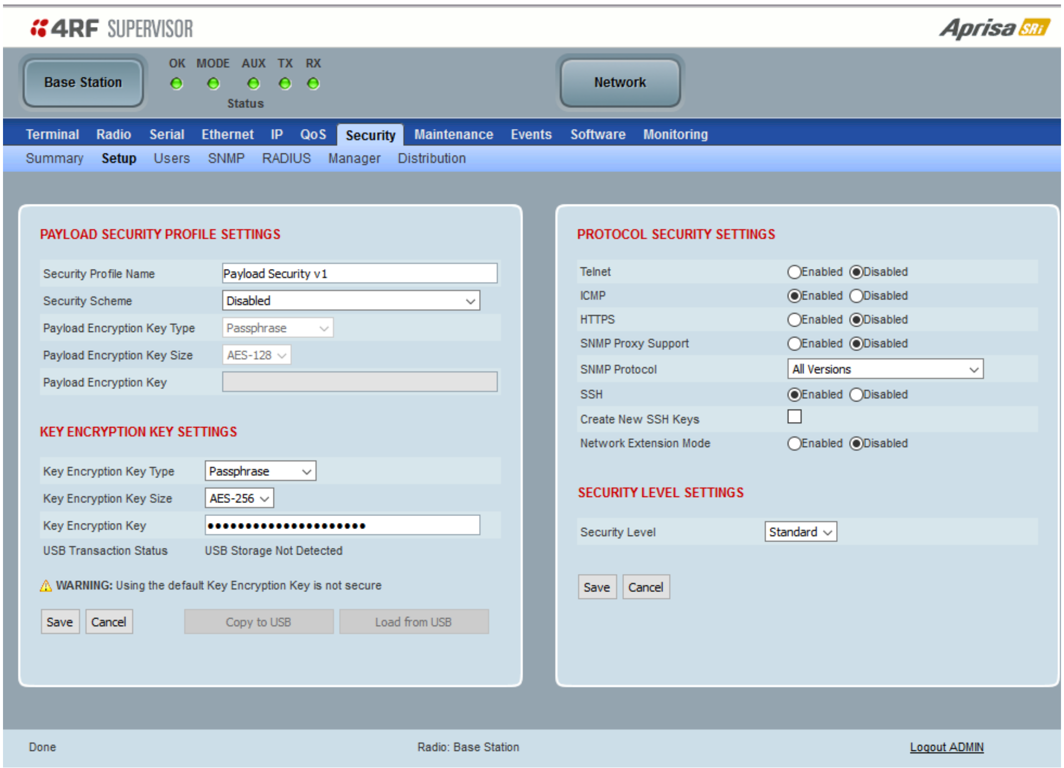
SECURITY LEVEL SETTINGS

| | |
|---|---|
| Security Level | Standard |

Ready Radio: Base Station Logout ADMIN

See ‘Security > Setup’ and ‘Security > Manager’ for configuration options.

## Security > Setup


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary Setup Users SNMP RADIUS Manager Distribution

PAYLOAD SECURITY PROFILE SETTINGS

| | |
|---|---|
| Security Profile Name | Payload Security v1 |
| Security Scheme | Disabled |
| Payload Encryption Key Type | Passphrase |
| Payload Encryption Key Size | AES-128 |
| Payload Encryption Key | |

KEY ENCRYPTION KEY SETTINGS

| | |
|---|---|
| Key Encryption Key Type | Passphrase |
| Key Encryption Key Size | AES-256 |
| Key Encryption Key | •••••••••••••••••••• |
| USB Transaction Status | USB Storage Not Detected |

⚠ **WARNING:** Using the default Key Encryption Key is not secure

PROTOCOL SECURITY SETTINGS

| | |
|---|---|
| Telnet | ○Enabled ●Disabled |
| ICMP | ●Enabled ○Disabled |
| HTTPS | ○Enabled ●Disabled |
| SNMP Proxy Support | ○Enabled ●Disabled |
| SNMP Protocol | All Versions |
| SSH | ●Enabled ○Disabled |
| Create New SSH Keys | □ |
| Network Extension Mode | ○Enabled ●Disabled |

SECURITY LEVEL SETTINGS

| | |
|---|---|
| Security Level | Standard |

### PAYLOAD SECURITY PROFILE SETTINGS

*Security Profile Name*

This parameter enables the user to predefine a security profile with a specified name.

*Security Scheme*

This parameter sets the security scheme to one of the values in the following table:

| Security Scheme |
|---|
| Disabled (No encryption and no Message Authentication Code) |
| AES Encryption + CCM Authentication 128 bit |
| AES Encryption + CCM Authentication 64 bit |
| AES Encryption + CCM Authentication 32 bit |
| AES Encryption only |
| CCM Authentication 128 bit |
| CCM Authentication 64 bit |
| CCM Authentication 32 bit |

The default setting is Disabled.

*Payload Encryption Key Type*

This parameter sets the Payload Encryption Key Type:

| Option | Function |
|---|---|
| Pass Phrase | Use the Pass Phrase password format for standard security. |
| Raw Hexadecimal | Use the Raw Hexadecimal key format for better security. It must comply with the specified encryption key size e.g. if Encryption Type to AES128, the encryption key must be 16 bytes (32 chars) |

The default setting is Pass Phrase.

*Payload Encryption Key Size*

This parameter sets the Encryption Type to AES128, AES192 or AES256. The default setting is AES128.

The higher the encryption size the better the security.

*Payload Encryption Key*

This parameter sets the Payload Encryption password. This key is used to encrypt the payload.

Pass Phrase

Good password policy:

- contains at least eight characters, and
- contains at least one upper case letter, and
- contains at least one lower case letter, and
- contains at least one digit or another character such as @+... , and
- is not a term in a familiar language or jargon, and
- is not identical to or derived from the accompanying account name, from personal characteristics or from information from one's family/social circle, and
- is easy to remember, for instance by means of a key sentence

Raw Hexadecimal

The Raw Hexadecimal key must comply with the specified encryption key size e.g. if Encryption Type to AES128, the encryption key must be 16 bytes (32 chars).

### KEY ENCRYPTION KEY SETTINGS

The Key Encryption Key provides the ability to encrypt the Payload Encryption Key so it can be safely transmitted over the radio link to remote radios.

The Key Encryption Key Type, Key Encryption Key Size and Key Encryption Key must be the same on all radios in the network.

#### *Key Encryption Key Type*

This parameter sets the Payload Encryption Key Type:

| Option | Function |
|---|---|
| Pass Phrase | Use the Pass Phrase password format for standard security. |
| Raw Hexadecimal | Use the Raw Hexadecimal key format for better security. It must comply with the specified encryption key size e.g. if Encryption Type to AES128, the encryption key must be 16 bytes (32 chars) |

The default setting is Pass Phrase.

#### *Key Encryption Key Size*

This parameter sets the Encryption Type to AES128, AES192 or AES256. The default setting is AES128.

The higher the encryption type the better the security.

#### *Key Encryption Key*

This parameter sets the Key Encryption Key. This is used to encrypt the payload encryption key.

#### *USB Transaction Status*

This parameter shows if a USB flash drive is plugged into the radio host port .

| Option | Function |
|---|---|
| USB Storage Not Detected | A USB flash drive is not plugged into the radio host port. |
| USB Storage Detected | A USB flash drive is plugged into the radio host port. |

Note: 4RF radios only support the FAT32 file system for flash drives. If the flash drive is a different format such as exFAT or NTFS, you will need to reformat it to FAT32.

Also, some brands of USB flash drives may not work with 4RF radios.

## Controls

The ‘Save’ button saves the Key Encryption Key settings to the radio. If the Security Level is set to Strong (see ‘Security Level’ on page 210), this button will be grayed out.

The ‘Load From USB’ button loads the Key Encryption Key settings from the USB flash drive. If a USB flash drive is not detected, this button will be grayed out

The ‘Copy To USB’ button copies the Key Encryption Key settings to a file called ‘asrkek.txt’ on the USB flash drive. This settings file can be used to load into other radios. If a USB flash drive is not detected or the Security Level is set to Strong (see ‘Security Level’ on page 210), this button will not be shown.

## Key Encryption Key Summary

The security of over-the-air-rekeying depends on a truly random Key Encryption Key. This is why the use of a Raw Hexadecimal key is recommended as a plain text phrase based on known spelling and grammar constructs is not very random. The *default* Key Encryption Key is provided only to allow testing of the security mechanism and is not intended for operational use. Using the default Key Encryption Key undermines the security of the AES payload encryption because an attacker using the default Key Encryption Key would immediately recover the AES payload key after the first over-the-air-rekeying event.

When the Security Level is set to Strong, various protections are applied to the Key Encryption Key setting to prevent tampering. In addition, the Key Encryption Key Type, Key Encryption Key Size, and the Key Encryption Key itself are all loaded from a customer prepared USB key. This is a one way operation to prevent key recovery from radios. While the ability to save a Key Encryption Key to USB exists in Standard Security Level, the Strong Security Level Key Encryption Key is not compromised because the Strong Key Encryption Key is not the same as the Standard Security Level Key Encryption Key.

PROTOCOL SECURITY SETTINGS

*Telnet option*

This parameter option determines if you can manage the radio via a Telnet session. The default setting is disabled.

*ICMP option (Internet Control Message Protocol)*

This parameter option determines whether the radio will respond to a ping. The default setting is disabled.

*HTTPS option*

This parameter option determines if you can manage the radio via a HTTPS session (via a Browser). The default setting is disabled.

*SNMP Proxy Support*

This parameter option enables an SNMP proxy server in the base station. This proxy server reduces the radio link traffic during SNMP communication to remote radios. This option applies to the base station only. The default setting is disabled.

This option can also be used if the radio has Serial Only interfaces.

*SNMP Protocol*

This parameter sets the SNMP Protocol:

| Option | Function |
|---|---|
| Disabled | All SNMP functions are disabled. |
| All Versions | Allows all SNMP protocol versions. |
| SNMPv3 Only | Only SNMPv3 transactions will be accepted including authenticated or encrypted transactions |
| SNMPv3 With Authentication Only | Only SNMPv3 transactions authenticated using HMAC-MD5 or HMAC-SHA will be accepted (as per table below). |
| SNMPv3 With Encryption Only | Only SNMPv3 transactions with an encrypted type of DES or AES will be accepted (as per table below). |

The default setting is All Versions.

The default SNMPv3 with Authentication User Details provided are:

| User Name | Encryption Type | Authentication Type | Context Name | Authentication Passphrase | Encryption Passphrase |
|---|---|---|---|---|---|
| noAuthUser | - | - | noAuth | noAuthUser | noAuthUser |
| desUserMD5 | DES | MD5 | priv | desUserMD5 | desUserMD5 |
| desUserSHA | DES | SHA | priv | desUserSHA | desUserSHA |
| authUserMD5 | - | MD5 | auth | authUserMD5 | authUserMD5 |
| authUserSHA | - | SHA | auth | authUserSHA | authUserSHA |
| privUserMD5 | AES | MD5 | priv | privUserMD5 | privUserMD5 |
| privUserSHA | AES | SHA | priv | privUserSHA | privUserSHA |

## SNMPv3 Authentication Passphrase

The SNMPv3 Authentication Passphrase can be changed via the SNMPv3 secure management protocol interface (not via SuperVisor).

When viewing / managing the details of the users via SNMPv3, the standard SNMP-USER-BASED-SM-MIB interface is used. This interface can be used to change the SNMPv3 Authentication Passphrase of the users.

The SNMPv3 Authentication Passphrase of a user required to be changed cannot be changed by the same user i.e. a different user must be used for the transactions.

## Generate New Keys from SNMPv3 USM User Passphrases

Net-SNMP is a suite of open source software for using and deploying the SNMP protocol. Similar functionality is built into many commercial SNMP managers.

This next step of loading the Aprisa SRi radios with keys generated from USM user passphrases requires the SNMPv3 USM Management utility provided as part of NET-SNMP.

The utility is called 'snmpusm'. It provides a range of commands including the management of changing passwords for SNMPv3 users. In order to use this utility, the user will need to install NET-SNMP on a Linux (or Windows®) or machine. The examples below are from the Linux environment. This tool automatically obtains the engine ID from the target radio before generating the keys and loading them into the target.

**To change a user authentication passphrase:**

The following are examples of:

Changing the privUserSHA user encryption key / password from privUserSHA to privUserSHANew:

```
c:\usr\bin>snmpusm -v 3 -u privUserSHA  -n priv -l authPriv -a SHA -A privUserSHA -x AES -X privUserSHA -Cx 172.17.70.17 passwd privUserSHA privUserSHANew
```

Changing the privUserSHA user authentication key / password from privUserSHA to privUserSHANew:

```
c:\usr\bin>snmpusm -v 3 -u privUserSHA  -n priv -l authPriv -a SHA -A privUserSHA -x AES -X privUserSHANew -Ca 172.17.70.17 passwd privUserSHA privUserSHANew
```

Changing the desUserSHA user encryption key / password from desUserSHA to desUserSHANew:

```
c:\usr\bin>snmpusm -v 3 -u desUserSHA  -n priv -l authPriv -a SHA -A desUserSHA -x DES -X desUserSHA -Cx 172.17.70.17 passwd desUserSHA desUserSHANew
```

Changing the desUserSHA user authentication key / password from desUserSHA to desUserSHANew:

```
c:\usr\bin>snmpusm -v 3 -u desUserSHA  -n priv -l authPriv -a SHA -A desUserSHA -x DES -X desUserSHANew -Ca 172.17.70.17 passwd desUserSHA desUserSHANew
```

Changing the privUserMD5 user encryption key / password from privUserMD5 to privUserMD5New:

```
c:\usr\bin>snmpusm -v 3 -u privUserMD5  -n priv -l authPriv -a MD5 -A privUserMD5 -x AES -X privUserMD5 -Cx 172.17.70.17 passwd privUserMD5 privUserMD5New
```

Changing the privUserMD5 user authentication key / password from privUserMD5 to privUserMD5New:

```
c:\usr\bin>snmpusm -v 3 -u privUserMD5  -n priv -l authPriv -a MD5 -A privUserMD5 -x AES -X privUserMD5New -Ca 172.17.70.17 passwd privUserMD5 privUserMD5New
```

Changing the desUserMD5 user encryption key / password from desUserMD5 to desUserMD5New:

```
c:\usr\bin>snmpusm -v 3 -u desUserMD5  -n priv -l authPriv -a MD5 -A desUserMD5 -x DES -X desUserMD5
-Cx 172.17.70.17 passwd desUserMD5 desUserMD5New
```

Changing the desUserMD5 user authentication key / password from desUserMD5 to desUserMD5New:

```
c:\usr\bin>snmpusm -v 3 -u desUserMD5  -n priv -l authPriv -a MD5 -A desUserMD5 -x DES -X
desUserMD5New -Ca 172.17.70.17 passwd desUserMD5 desUserMD5New
```

Changing the authUserSHA user authentication key / password from authUserSHA to authUserSHANew:

```
c:\usr\bin>snmpusm -v 3 -u authUserSHA  -n auth -l authNoPriv -a SHA -A authUserSHA -Ca 172.17.70.17
passwd authUserSHA authUserSHANew
```

Changing the authUserMD5 user authentication key / password from authUserMD5 to authUserMD5New:

```
c:\usr\bin>snmpusm -v 3 -u authUserMD5  -n auth -l authNoPriv -a MD5 -A authUserMD5 -Ca 172.17.70.17
passwd authUserMD5 authUserMD5New
```

*Notes*

-Cx option is to change the Encryption key/password

-Ca option is to change the Authentication key/password

Other information on this utility can be obtained from the utility command help itself or online

*Summary*

It is necessary to record the new passphrases loaded into the Aprisa SRi radios and then load the passphrases into the SNMP manager. There is a separate passphrase for the two supported forms of authentication (MD5 and SHA1) only as well as the two forms of authentication used in combination the two forms of encryption (DES and AES). It is vital to change all passphrases even if the depreciated mechanism are not used (MD5 and DES) otherwise an attacker could still use the default passphrases.

### Reset Unknown Passphrases with the Command Line Interface

As it is not possible for users to read previously set passphrases, a CLI command is available from Aprisa SRi software release 1.1.0 to 'reset' the SNMPv3 USM users back to defaults.

**Note**: USM users are not related to CLI and SuperVisor users. This command will only be accessible to the CLI 'admin' user logins.

**To reset unknown passphrases:**

1. Telnet into each radio in the network and via the CLI reset the passphrases
2. Login to the radio with:

   Login: admin

   Password: *********
3. Set all SNMP3 users to default values with the 'snmpusm reset' command (see 'SNMP3 users to default values' below for the list of default values).
4. Reboot the radio with the 'reboot' command.

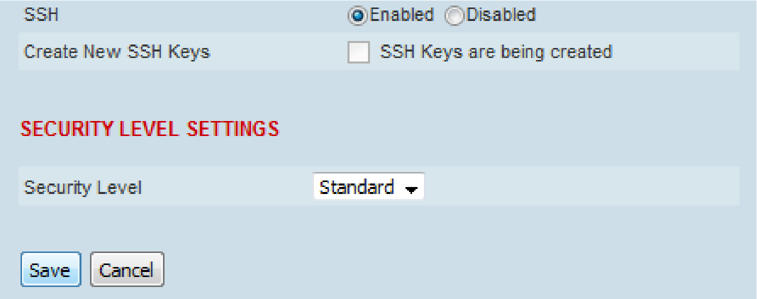
*SSH*

This parameter enables / disables Secure Shell (SSH). The default setting is enabled.

*Create New SSH Keys*

This parameter creates a replacement public and private SSH keys.

Tick the check box and click Save. This process can take a few minutes.



SSH ● Enabled ○ Disabled

Create New SSH Keys □ SSH Keys are being created

SECURITY LEVEL SETTINGS

Security Level Standard

*Network Extension Mode*

This parameter enables this radio to be part of the extended network radio list. The default setting is disabled.

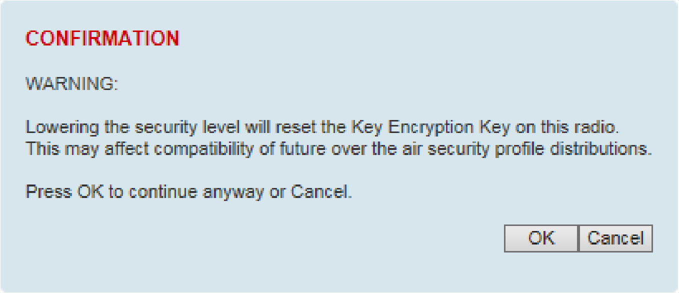
SECURITY LEVEL SETTINGS

*Security Level*

This parameter sets the Security Level active security features. The default setting is Standard.

| Option | Payload Encryption | HTTPS | SNMPv3 | USB KEK Only |
|---|---|---|---|---|
| Standard | ✓ | ✓ | ✓ | |
| Strong | ✓ | ✓ | ✓ | ✓ |

If the Security Level is reduced, there will be a pop up message warning that Key Encryption Key will be reset to the default value.

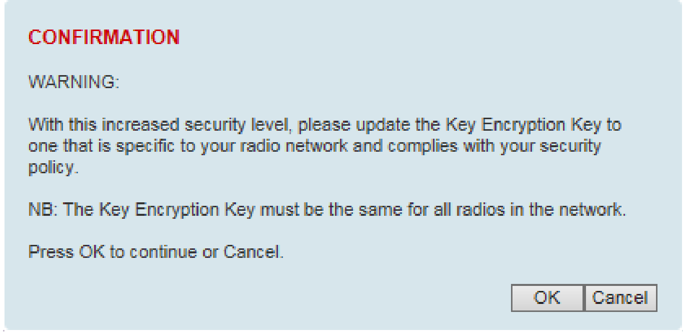

CONFIRMATION

WARNING:

Lowering the security level will reset the Key Encryption Key on this radio.
This may affect compatibility of future over the air security profile distributions.

Press OK to continue anyway or Cancel.

If the Security Level is increased, there will be a pop up message reminding user to enter a new Key Encryption Key.


CONFIRMATION

WARNING:

With this increased security level, please update the Key Encryption Key to one that is specific to your radio network and complies with your security policy.

NB: The Key Encryption Key must be the same for all radios in the network.

Press OK to continue or Cancel.

If the Security Level is set to Strong, the ‘Save’ button will be grayed out and the ‘Copy To USB’ button will not be shown.

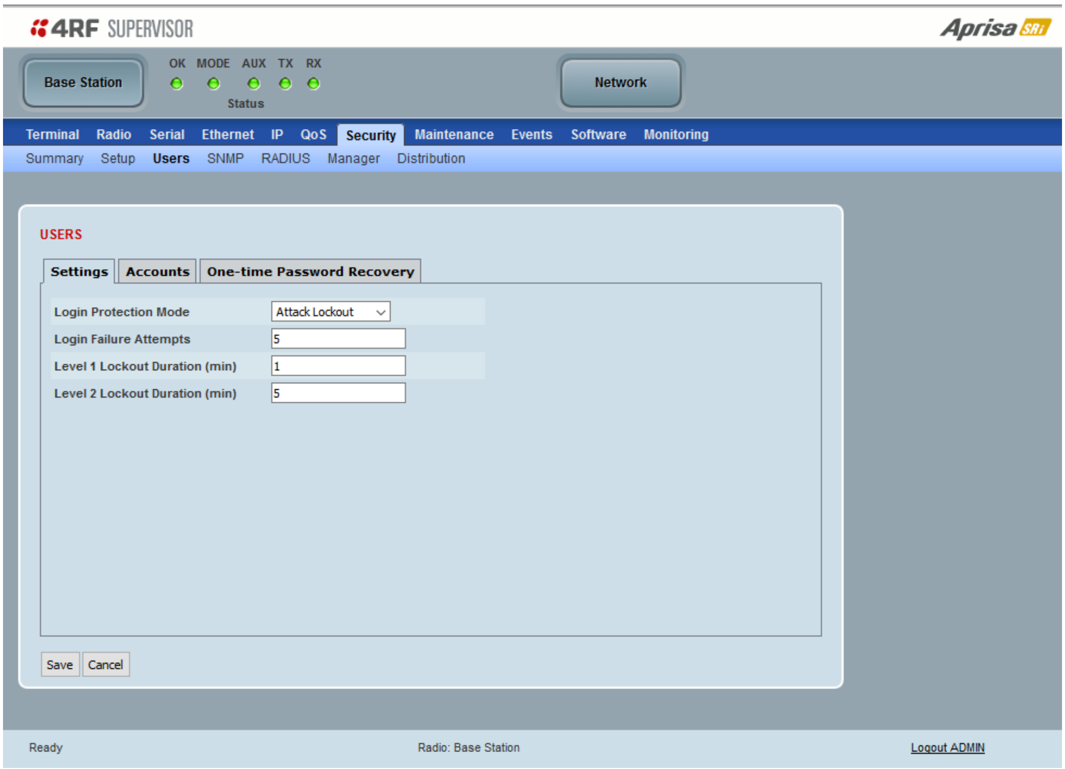
SNMPv3 Context Addressing

SNMPv3 is not user configurable and user can use this option with any NMS. The radio SNMP management interface supports SNMPv3/2 context addressing. The SNMv3 context addressing allows the user to use secure SNMPv3 management while improving NMS performance.

A NMS (Network Management System) can access any remote radio directly by using its IP address or via the base / master station SNMPv3 context addressing. The SNMPv3 context addressing can compress the SNMPv3 management traffic OTA (Over The Air) to the remote radio by up to 90% relative to direct OTA SNMPv3 access to remote radio, avoiding the radio narrow bandwidth traffic loading.

## Security > Users

### Settings


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary Setup Users SNMP RADIUS Manager Distribution
USERS
Settings Accounts One-time Password Recovery
Save Cancel
Ready
Radio: Base Station
Logout ADMIN

| | |
|---|---|
| Login Protection Mode | Attack Lockout |
| Login Failure Attempts | 5 |
| Level 1 Lockout Duration (min) | 1 |
| Level 2 Lockout Duration (min) | 5 |

*Login Protection Mode*

This parameter sets the Login Protection Mode. They provide user account lockout mechanisms to mitigate brute force password guessing attacks.

| Option | Function |
|---|---|
| Disabled | Disables login protection |
| Attack Slowdown | In this mode, the user account will be locked out for the duration specified in Level 1 Lockout Duration and Level 2 Lockout Duration, cycling between the two.<br>This mode slows down attacks. |
| Attack Lockout | In this mode, the user account will be permanently locked out if the protection mechanism has reached Locked Level 1 and Locked Level 2 and the next login attempt fails.<br>The user account must then be manually unlocked by an ‘Admin’ user account either from SuperVisor or via SNMP.<br>This mode blocks persistent attacks. |

### *Attack Slowdown*

The Attack Slowdown login protection lockout mechanism will be processed as follows:

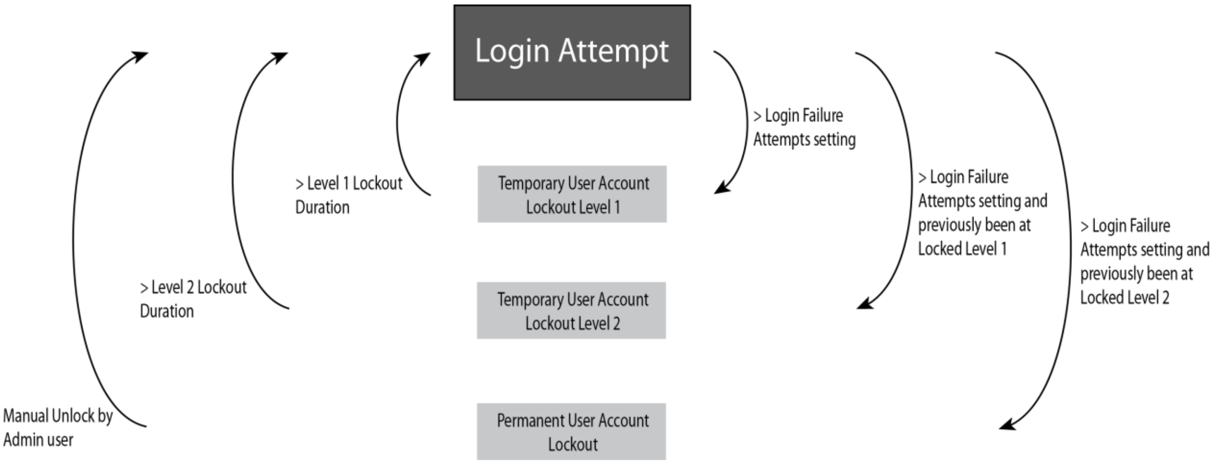
- When the number of login failure attempts is less than the setting of the 'Login Failure Attempts' field, the login attempt is processed.
- When the number of login failure attempts is greater than the setting of the 'Login Failure Attempts' field, the user account will be:
  - temporarily disabled at level 1 for the 'Level 1 Lockout Duration' period, if the user account was not previously already released from locked level 2.
  - temporarily disabled at level 2 for the 'Level 2 Lockout Duration' period, if the user account was previously already released from locked level 1.

This lockout mode will cycle the lockout of the accounts between locked level 1 and locked level 2.

### *Attack Lockout*

The Attack Lockout login protection lockout mechanism will be processed as follows:

- When the number of login failure attempts is less than the setting of the 'Login Failure Attempts' field, the login attempt is processed.
- When the number of login failure attempts is greater than the setting of the 'Login Failure Attempts' field, the user account will be:
  - temporarily disabled at level 1 for the 'Level 1 Lockout Duration' period, if the user account was not previously already released from locked level 1.
  - temporarily disabled at level 2 for the 'Level 2 Lockout Duration' period, if the user account was previously already released from locked level 1.
  - permanently disabled if the user account was previously already released from locked level 2. The user account must then be manually unlocked by an 'Admin' user account either from SuperVisor or via SNMP.


Login Attempt
Temporary User Account Lockout Level 1
Temporary User Account Lockout Level 2
Permanent User Account Lockout
> Login Failure Attempts setting
> Login Failure Attempts setting and previously been at Locked Level 1
> Login Failure Attempts setting and previously been at Locked Level 2
> Level 1 Lockout Duration
> Level 2 Lockout Duration
Manual Unlock by Admin user

### *Login Failure Attempts*

When Login Protection Mode is active, this parameter sets the maximum number of consecutive failed login attempts before the relevant user account lockout process is initiated. This field can be set from 3 to 10 times and the default value is 5.

*Level 1 Lockout Duration (min)*

When Login Protection Mode is active and the user account is in the state of ‘locked level 1’, the user account will be locked out for the duration specified. This field can be set from 1 to 15 minutes and the default value is 1 minute.

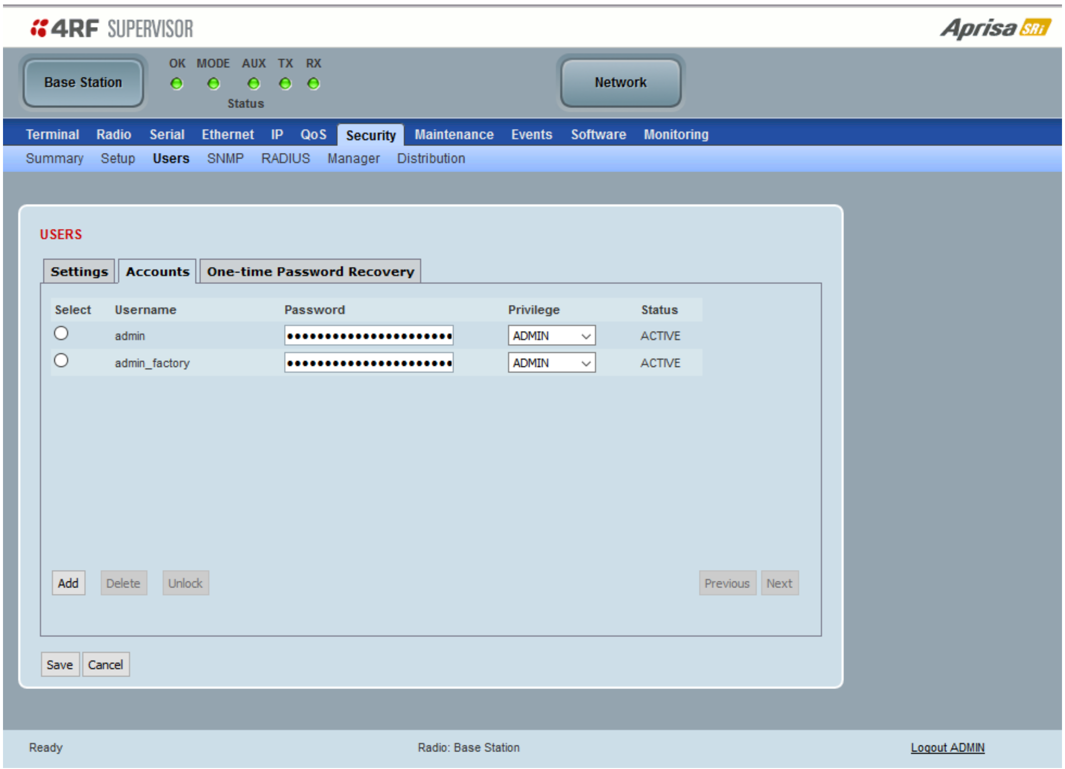
A user account in the state of ‘locked level 1’ shall be unlocked and put in the released from level 1 lockout state after this level 1 lockout duration has expired.

*Level 2 Lockout Duration (min)*

When Login Protection Mode is active and the user account is in the state of ‘locked level 2’, the user account will be locked out for the duration specified. This field can be set from 5 to 30 minutes and the default value is 5 minutes.

A user account in the state of ‘locked level 2’ shall be unlocked and put in the released from level 2 lockout state after this level 2 lockout duration has expired.

## Accounts


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary Setup Users SNMP RADIUS Manager Distribution
USERS
Settings Accounts One-time Password Recovery
Add Delete Unlock
Previous Next
Save Cancel
Ready
Radio: Base Station
Logout ADMIN

| Select | Username | Password | Privilege | Status |
|---|---|---|---|---|
| ○ | admin | •••••••••••••••••••••• | ADMIN | ACTIVE |
| ○ | admin_factory | •••••••••••••••••••••• | ADMIN | ACTIVE |

**Note:** You must login with ‘admin’ privileges to add, disable, delete a user or change a password.

Shows a list of the current user accounts setup in the radio.

**To add a new user:**

1. Click Add.

If the currently viewed page is full (displaying 8 user accounts), SuperVisor shall automatically display the last user account page when a new user is added. However, if there are unsaved changes on the current page, the user shall be prompted to save the changes first before adding a new user.

2. Enter the Username.

A username can be up to 32 characters but cannot contain tabs. Usernames are case sensitive.

3. Enter the Password.

A password can be 8 to 32 printable characters but cannot contain tabs. Passwords are case sensitive.

Good password policy:

- contains at least one upper case letter, and
- contains at least one lower case letter, and
- contains at least one digit, and
- is not a term in a familiar language or jargon, and
- is not identical to or derived from the accompanying account name, from personal characteristics or from information from one's family/social circle, and
- is easy to remember, for instance by means of a key sentence

4. Select the User Privileges

There are four pre-defined User Privilege settings to allocate access rights to users. These user privileges have associated default usernames and passwords of the same name.

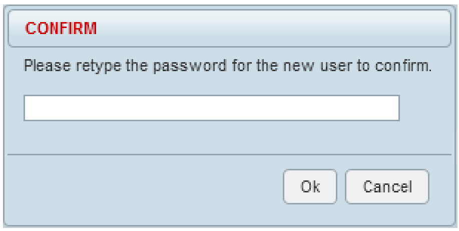
The default login is 'admin'.

This login has full access to all radio parameters including the ability to add and change users. There can only be a maximum of two usernames with admin privileges and the last username with admin privileges cannot be deleted.

| User Privilege | Default Username | Default Password | User Privileges |
|---|---|---|---|
| View | | | Users in this group can only view the summary pages. |
| Technician | | | Users in this group can view and edit parameters except Security > Users and Security > Setup. |
| Engineer | | | Users in this group can view and edit parameters except Security > Users. |
| Admin | admin | admin | Users in this group can view and edit all parameters. |

See 'SuperVisor Menu Access' on page 96 for the list of SuperVisor menu items versus user privileges.

When the password is changed, you will be prompted for confirmation of the password to avoid mistypes.



CONFIRM

Please retype the password for the new user to confirm.

The Status will show PENDING until the entry is saved.

5. Click Save.

*Status*

The Status indicates whether a user account is active or locked out.

| Option | Function |
|---|---|
| ACTIVE | The user account is currently active. |
| PENDING | The user account has been entered but not saved. |
| LOCKED (Level 1) | Login Protection Mode is active and the user account has been locked out due to repeated unsuccessful login attempts. The account will remain locked out for a period defined in 'Level 1 Lockout Duration' at the 'Security > Users' > Settings tab. |
| LOCKED (Level 2) | Login Protection Mode is active and the user account has been locked out due to repeated unsuccessful login attempts. The account will remain locked out for a period defined in 'Level 2 Lockout Duration' at the 'Security > Users' > Settings tab. |
| LOCKED | Login Protection Mode is active and the user account has been locked out due to repeated unsuccessful login attempts. The user account is permanently locked out. |

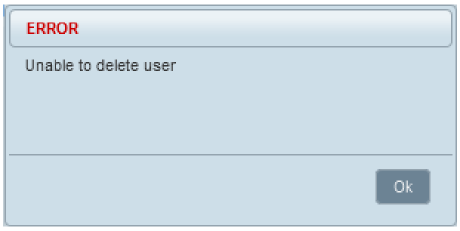
This tab shall also provide the interface for the ADMIN user to unlock any locked user accounts.

The 'Unlock' button shall be disabled unless a locked account is selected, in which case, clicking the button will unlock the selected account.

**To delete a user:**

1. Select Terminal Settings > Security > Users
2. Click on the Select button for the user you wish to delete.
3. Click 'Delete
4. Click Save.

The user can delete any user account as long as there is at least one ADMIN account left on the radio. If the user attempts to delete the last ADMIN account on the radio (and click Save), an error popup shall be displayed.


ERROR

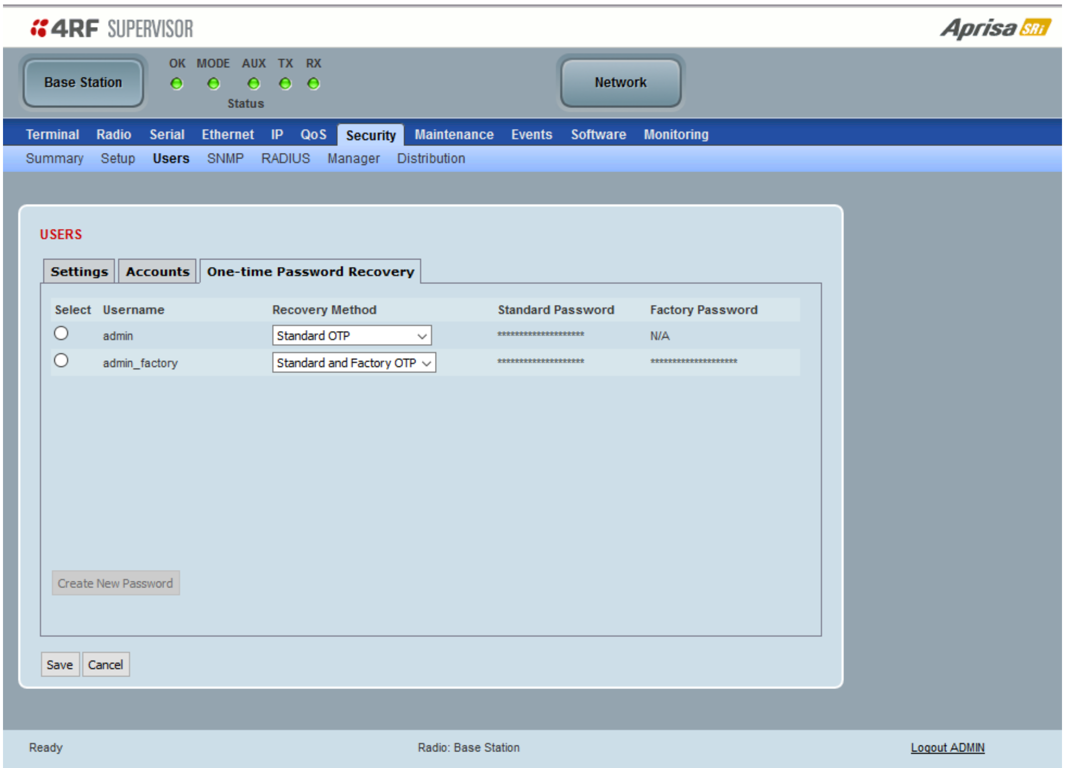
Unable to delete user

**To change a Password:**

1. Select Terminal Settings > Security > Users
2. Click on the Select button for the user you wish to change the Password.
3. Enter the Password.
4. Click Save.

A password can be 8 to 32 characters but cannot contain tabs.

## One-time Password Recovery


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary Setup Users SNMP RADIUS Manager Distribution
USERS
Settings Accounts One-time Password Recovery
Create New Password
Save Cancel
Ready
Radio: Base Station
Logout ADMIN

| Select | Username | Recovery Method | Standard Password | Factory Password |
|---|---|---|---|---|
| ○ | admin | Standard OTP | ******************** | N/A |
| ○ | admin_factory | Standard and Factory OTP | ******************** | ******************** |

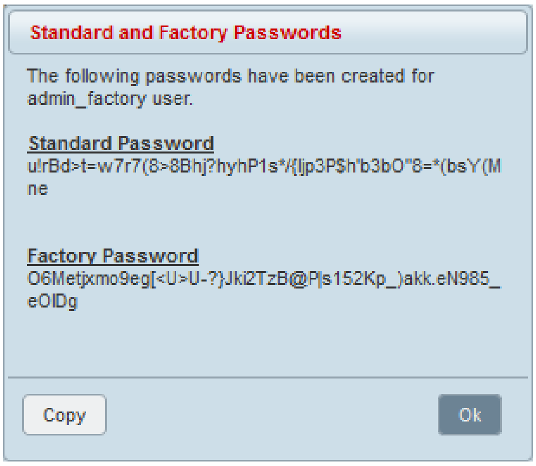
The One-time Password Recovery is a future proofing mechanism that allows an Admin user access to change the Admin password if the Admin user is permanently locked out or the Admin password is unknown. OTP passwords can be entered on this page and then saved in a text file for future use.

If these passwords are used to login to a radio, the password is immediately changed so it can't be used again.

### *Recovery Method*

| Option | Function |
|---|---|
| Standard OTP | Using the 'Standard OTP' password when logging into a radio, allows the user to change the radio Admin password so it can then be used to login and access the radio. |
| Standard and Factory OTP | Using the 'Standard and Factory OTP password' when logging into a radio, allows the user to change the radio Admin password BUT also restores the entire radio to Factory Defaults so be careful using this! |

Whenever new passwords are generated for a user, a popup box shall be displayed with the new passwords in clear text.



Standard and Factory Passwords

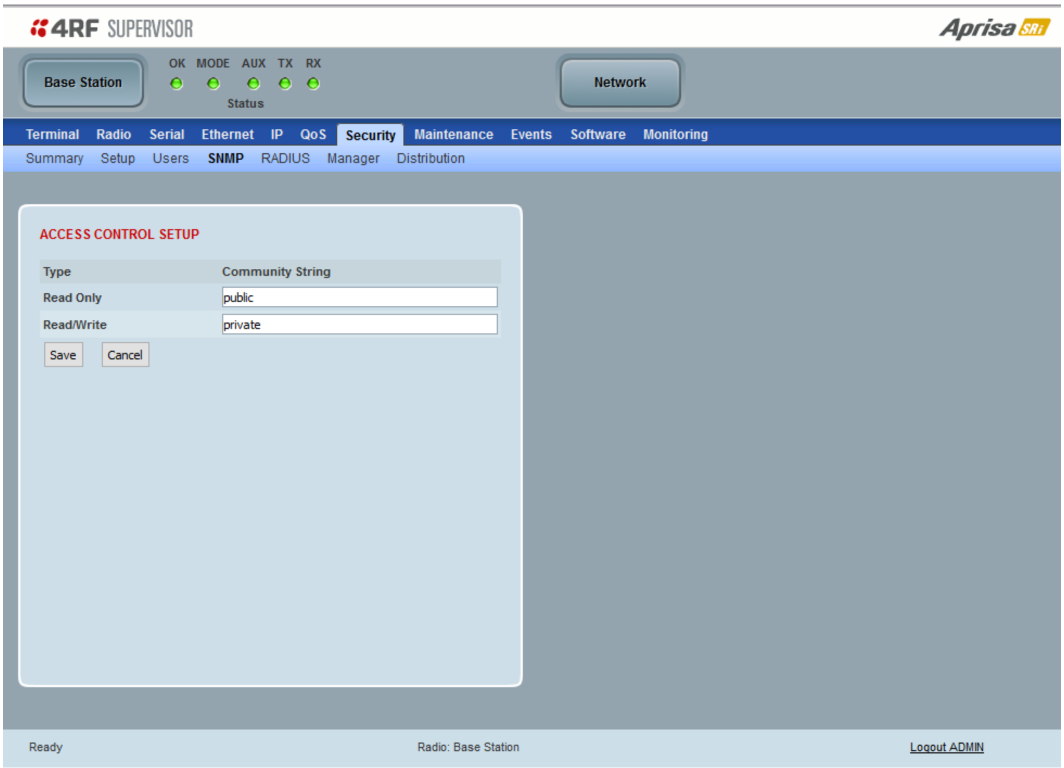
The following passwords have been created for admin_factory user.

Standard Password
u!rBd>t=w7r7(8>8Bhj?hyhP1s*/{ljp3P$h'b3bO"8=*(bsY(M
ne

Factory Password
O6Metjxmo9eg[<U>U-?}Jki2TzB@P|s152Kp_)akk.eN985_
eOIDg

The Copy button copies the generated passwords to the clipboard, for storage in a text file for future use.

## Security > SNMP


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary Setup Users SNMP RADIUS Manager Distribution
Save
Cancel
Ready
Radio: Base Station
Logout ADMIN

ACCESS CONTROL SETUP

| Type | Community String |
|---|---|
| Read Only | public |
| Read/Write | private |

In addition to web-based management (SuperVisor), the network can also be managed using the Simple Network Management Protocol (SNMP) using any version of SNMP v1/2/3. MIB files are supplied, and these can be used by a dedicated SNMP Manager, such as Castle Rock’s SNMPc, to access most of the radio’s configurable parameters.

For communication between the SNMP manager and the radio, Access Controls and Community strings must be set up as described in the following sections.

A SNMP **Community String** is used to protect against unauthorized access (similar to a password). The SNMP agent (radio or SNMP manager) will check the community string before performing the task requested in the SNMP message.

### ACCESS CONTROL SETUP

A SNMP **Access Control** is the IP address of the radio used by an SNMP manager or any other SNMP device to access the radio. The Aprisa SRi allows access to the radio from any IP address.

#### *Read Only*

The default Read Only community string is public.

#### *Read Write*

The default ReadWrite community string is private.

## SNMP Manager Setup

The SNMP manager community strings must be setup to access the base station and remote radios.

To access the base station, a community string must be setup on the SNMP manager the same as the community string setup on the radio (see ‘Security > SNMP’ on page 219).

SNMP access to remote radios can be achieved by using the radio’s IP address and the normal community string or by proxy in the base station.

## SNMP Access via Base Station Proxy

To access the remote radios via the base station proxy, the community strings must be setup on the SNMP manager in the format:

ccccccccc:bbbbbb

Where:

ccccccccc is the community string of the base station

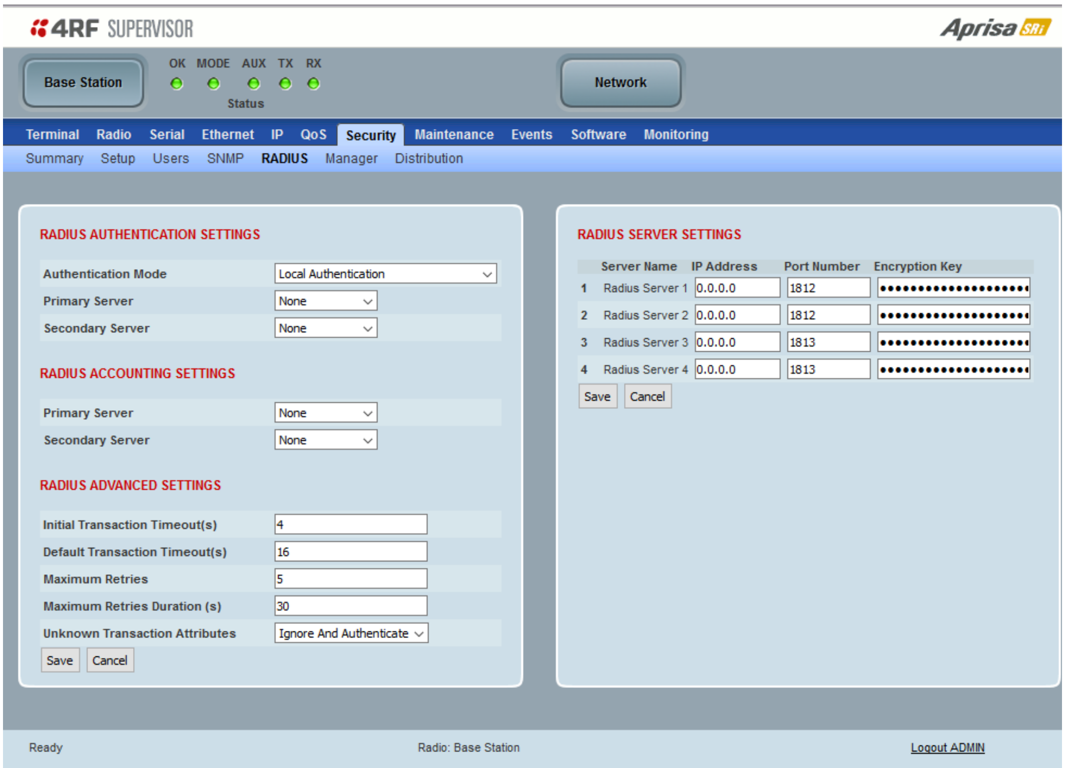
and

bbbbbb is the last 3 bytes of the remote radio MAC address (see ‘Network Status > Network Table’ on page 297).

The SNMP Proxy Support must be enabled for this method of SNMP access to operate (see ‘SNMP Proxy Support’ on page 206).

## Security > RADIUS

This page displays the current settings for the Security RADIUS.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary Setup Users SNMP RADIUS Manager Distribution

RADIUS AUTHENTICATION SETTINGS

| | |
|---|---|
| Authentication Mode | Local Authentication |
| Primary Server | None |
| Secondary Server | None |

RADIUS ACCOUNTING SETTINGS

| | |
|---|---|
| Primary Server | None |
| Secondary Server | None |

RADIUS ADVANCED SETTINGS

| | |
|---|---|
| Initial Transaction Timeout(s) | 4 |
| Default Transaction Timeout(s) | 16 |
| Maximum Retries | 5 |
| Maximum Retries Duration (s) | 30 |
| Unknown Transaction Attributes | Ignore And Authenticate |

RADIUS SERVER SETTINGS

| | Server Name | IP Address | Port Number | Encryption Key |
|---|---|---|---|---|
| 1 | Radius Server 1 | 0.0.0.0 | 1812 | ••••••••••••••••••• |
| 2 | Radius Server 2 | 0.0.0.0 | 1812 | ••••••••••••••••••• |
| 3 | Radius Server 3 | 0.0.0.0 | 1813 | ••••••••••••••••••• |
| 4 | Radius Server 4 | 0.0.0.0 | 1813 | ••••••••••••••••••• |

RADIUS - Remote Authentication Dial In User Service

RADIUS is a client / server system that secures the radio link against unauthorized access. It is based on open standard RFCs: RFC 2865/6, 5607, 5080 and 2869. It is used for remote user Authorization, Authentication and Accounting.

When a user logs into a radio with RADIUS enabled, the user's credentials are sent to the RADIUS server for authentication of the user.

Transactions between the RADIUS client and RADIUS server are authenticated through the use of a shared secret, which is never sent over the network.

For a RADIUS server to respond to the radio, it must be configured with the following **Management-Privilege-level** attributes:

Admin Level = 4

Technician Level = 2

Viewer Level = 1

Alternatively, for Admin level only, for a RADIUS server to respond to the radio, it must be configured with attributes Service-Type (6) = Administrative (6) which will grant the user admin access to the radio.

A RADIUS server can act as a proxy client to other RADIUS servers or other kinds of authentication servers.

## RADIUS AUTHENTICATION SETTINGS

*Authentication Mode*

This parameter sets the Authentication Mode.

| Option | Function |
|---|---|
| Local Authentication | No radius Authentication – allows any local user privilege |
| Radius Authentication | Only radius Authentication – no local user privilege |
| Radius Authentication and Local admin | Uses radius Authentication if it is available.<br>If radius Authentication is not available, uses local Admin login |
| Radius Then Local Authentication | If the user is not authenticated in the radius server, it allows any local user privilege. |
| Local Then Radius Authentication | If the user is not allowed in the local user privilege, radius authentication is used. |

*Primary Server*

This parameter sets which radius server is used as the primary server for authentication. Select one of the possible authentication servers setup in Radius Server Settings.

*Secondary Server*

This parameter sets which radius server is used as the secondary server for authentication. Select one of the possible authentication servers setup in Radius Server Settings.

## RADIUS ACCOUNTING SETTINGS

*Primary Server*

This parameter sets which radius server is used as the primary server for accounting (log of user activity). Select one of the possible accounting servers setup in Radius Server Settings.

*Secondary Server*

This parameter sets which radius server is used as the secondary server for accounting. Select one of the possible accounting servers setup in Radius Server Settings.

## RADIUS ADVANCED SETTINGS

*Initial Transaction Timeouts (IRT) (seconds)*

This parameter sets the initial time to wait before the retry mechanism starts when the server is not responding.

*Default Transaction Timeouts (MRT) (seconds)*

This parameter sets the maximum time between retries.

*Maximum Retries (MRC)*

This parameter sets the maximum number of retry attempts when the server is not responding.

*Maximum Retries Duration (MRD) (seconds)*

This parameter sets the maximum duration it will attempt retries when the server is not responding.

*Unknown Transaction Attributes*

This parameter sets the radio's response to unknown attributes received from the radius server.

| Option | Function |
|---|---|
| Ignore and Authenticate | Ignore the unknown attributes and accept the authentication received from the radius server |
| Reject and Deny | Reject the authentication received from the radius server |

## RADIUS SERVER SETTINGS

*Server Name*

You can enter up to four radius servers 1-4.

*IP Address*

The IP address of the Radius server.

*Port Number*

The Port Number of the Radius server. RADIUS uses UDP as the transport protocol.

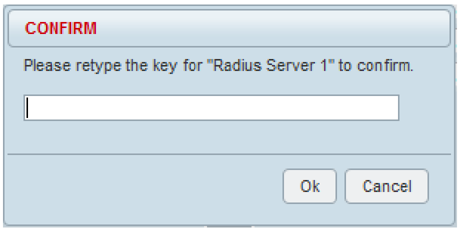
- UDP port 1812 is used for authentication / authorization
- UDP port 1813 is used for accounting.

Old RADIUS servers may use unofficial UDP ports 1645 and 1646.

*Encryption Key*

The password of the Radius server.

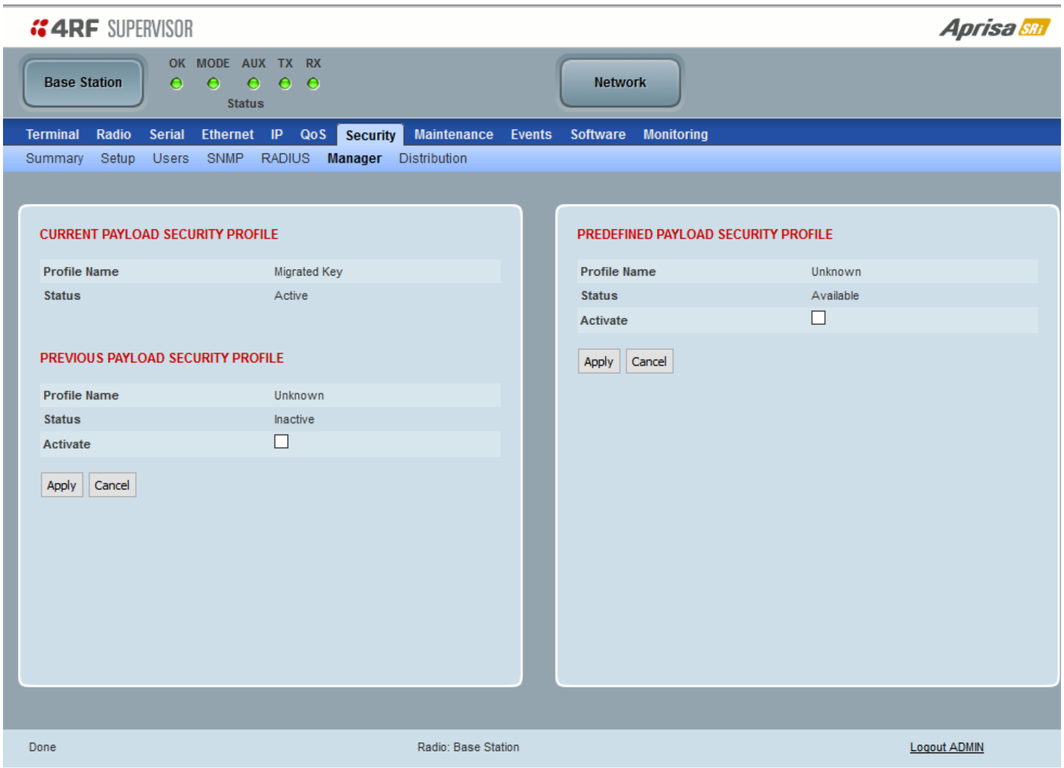
When the password is changed, you will be prompted for confirmation of the password to avoid mistypes.



CONFIRM

Please retype the key for "Radius Server 1" to confirm.

## Security > Manager


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary Setup Users SNMP RADIUS Manager Distribution

CURRENT PAYLOAD SECURITY PROFILE

| | |
|---|---|
| Profile Name | Migrated Key |
| Status | Active |

PREVIOUS PAYLOAD SECURITY PROFILE

| | |
|---|---|
| Profile Name | Unknown |
| Status | Inactive |
| Activate | □ |

Apply Cancel

PREDEFINED PAYLOAD SECURITY PROFILE

| | |
|---|---|
| Profile Name | Unknown |
| Status | Available |
| Activate | □ |

Apply Cancel

Done Radio: Base Station Logout ADMIN

### CURRENT PAYLOAD SECURITY PROFILE

*Profile Name*

This parameter shows the predefined security profile active on the radio.

*Status*

This parameter displays the status of the predefined security profile on the radio (always active).

### PREVIOUS PAYLOAD SECURITY PROFILE

*Profile Name*

This parameter displays the security profile that was active on the radio prior to the current profile being activated.

*Status*

This parameter displays the status of the security profile that was active on the radio prior to the current profile being activated.

| Option | Function |
|---|---|
| Active | The security profile is active on the radio. |
| Inactive | The security profile is not active on the radio but could be activated if required. |

*Activate*

This parameter activates the previous security profile (restores to previous version).

PREDEFINED PAYLOAD SECURITY PROFILE

*Profile Name*

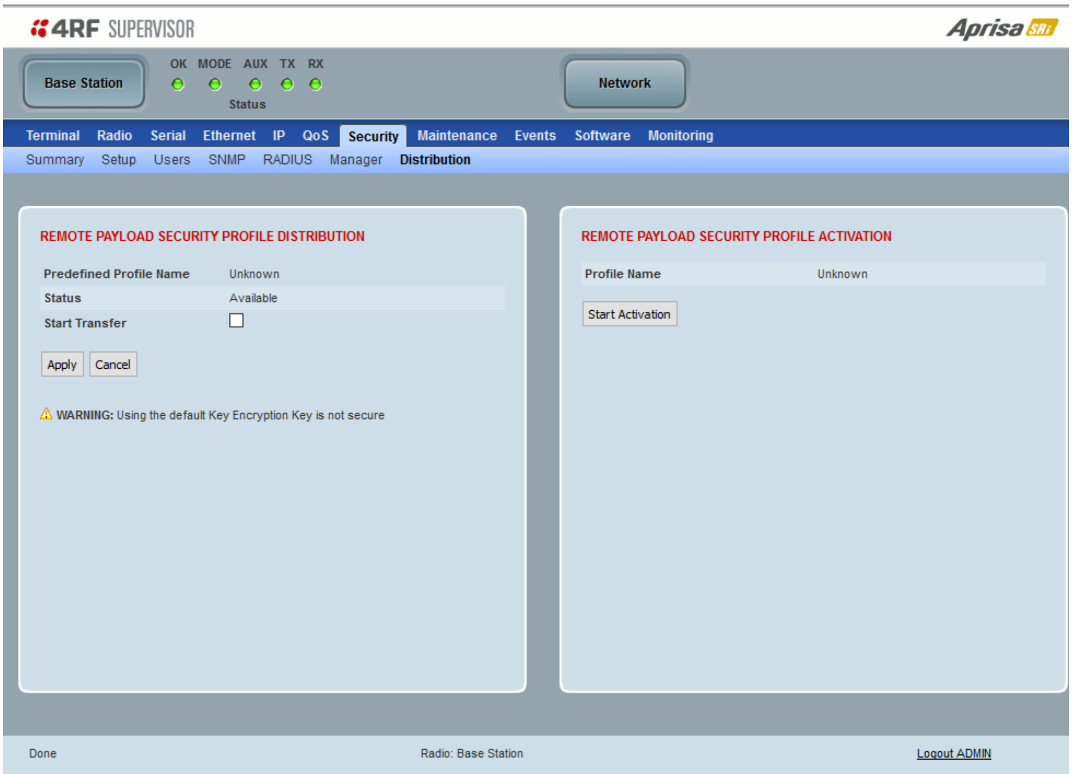
This parameter displays the new security profile that could be activated on the radio or distributed to all remote radios with Security > Distribution.

*Status*

This parameter displays the status of the new security profile.

| Option | Function |
|---|---|
| Unavailable | A predefined security profile is not available on this radio.<br>To create a predefined security profile, go to 'Security > Setup' on page 202. |
| Available | A predefined security profile is available on this radio for distribution and activation. |

## Security > Distribution


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary Setup Users SNMP RADIUS Manager Distribution
Apply
Cancel
Start Activation
Done
Radio: Base Station
Logout ADMIN

REMOTE PAYLOAD SECURITY PROFILE DISTRIBUTION

| | |
|---|---|
| Predefined Profile Name | Unknown |
| Status | Available |
| Start Transfer | □ |

⚠ **WARNING:** Using the default Key Encryption Key is not secure

REMOTE PAYLOAD SECURITY PROFILE ACTIVATION

| | |
|---|---|
| Profile Name | Unknown |

### REMOTE PAYLOAD SECURITY PROFILE DISTRIBUTION

*Predefined Profile Name*

This parameter displays the predefined security profile available for distribution to remote radios.

*Status*

This parameter shows if a predefined security profile is available for distribution to remote radios.

| Option | Function |
|---|---|
| Unavailable | A predefined payload security profile is not available on this radio. |
| Available | A predefined payload security profile is available on this radio for distribution and activation. |

*Start Transfer*

This parameter when activated distributes (broadcasts) the new payload security profile to all remote radios in the network.

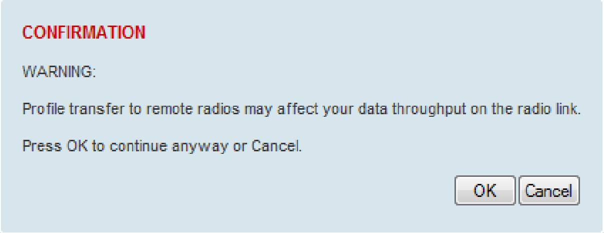
**Note:** The distribution of the payload security profile to remote radios does not stop customer traffic from being transferred.

Payload security profile distribution traffic is classified as 'management traffic' but does <u>not</u> use the Ethernet management priority setting. Security profile distribution traffic priority has a fixed priority setting of 'very low'.

**To distribute the payload security profile to remote radios:**

This process assumes that a payload security profile has been setup (see ‘Security > Setup’ on page 202).

1. Tick Start Transfer and click Apply.



CONFIRMATION

WARNING:

Profile transfer to remote radios may affect your data throughput on the radio link.

Press OK to continue anyway or Cancel.

**Note:** This process could take up to 1 minute per radio depending on channel size, Ethernet Management Priority setting and the amount of customer traffic on the network.

2. When the distribution is completed, activate the software with the Remote Payload Security Profile Activation.

## REMOTE PAYLOAD SECURITY PROFILE ACTIVATION

When the security profile has been distributed to all the remote radios, the security profile is then activated in all the remote radios with this command.

The base station will always attempt to distribute the profile successfully. This broadcast distribution has its own retry mechanism. The user can find out if all the remote radios have the latest profile when the managed activation process is attempted. A pop up confirmation will be shown by SuperVisor with relevant information and the user can decide to proceed or not. The user can attempt to redistribute again if needed. If the decision is made to continue, on completion of the activation process, communication with the remote radios that did not have the new security profile will be lost.

### *Predefined Profile Name*

This parameter displays the predefined security profile available for activation on all remote radios.

**To activate the security profile in remote radios:**

This process assumes that a security profile has been setup into the base station (see ‘Security > Setup’ on page 202) and distributed to all remote radios in the network.

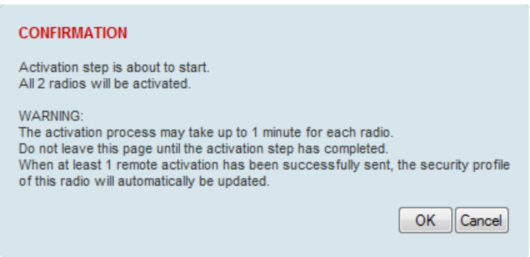
**Note:** Do not navigate SuperVisor away from this page during the activation process (SuperVisor can lose PC focus).

1. Click Start Activation

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

| Result | Function (X of Y) |
|---|---|
| Remote Radios Polled for New Profile | X is the number of radios polled to determine if the radio contains the new security profile.<br>Y is the number of remote radios registered with the base station. |
| Remote Radios Activated | X is the number of radios activated.<br>Y is the number of radios with the new security profile requiring activation. |
| Remote Radios On New Profile | X is the number of radios activated and on the new security profile.<br>Y is the number of radios with the new security profile that have been activated. |

When the activation is ready to start:


CONFIRMATION

Activation step is about to start.
All 2 radios will be activated.

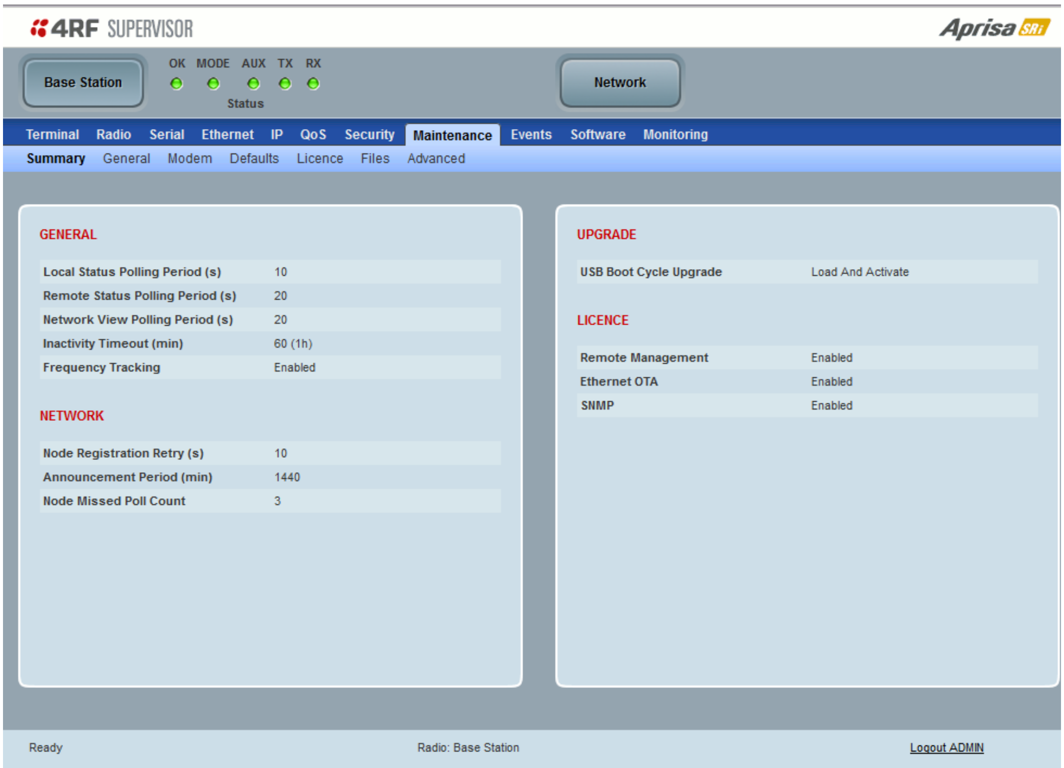
WARNING:
The activation process may take up to 1 minute for each radio.
Do not leave this page until the activation step has completed.
When at least 1 remote activation has been successfully sent, the security profile of this radio will automatically be updated.

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

# Maintenance

## Maintenance > Summary

This page displays the current settings for the Maintenance parameters.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary General Modem Defaults Licence Files Advanced
Ready
Radio: Base Station
Logout ADMIN

GENERAL

| | |
|---|---|
| Local Status Polling Period (s) | 10 |
| Remote Status Polling Period (s) | 20 |
| Network View Polling Period (s) | 20 |
| Inactivity Timeout (min) | 60 (1h) |
| Frequency Tracking | Enabled |

NETWORK

| | |
|---|---|
| Node Registration Retry (s) | 10 |
| Announcement Period (min) | 1440 |
| Node Missed Poll Count | 3 |

UPGRADE

| | |
|---|---|
| USB Boot Cycle Upgrade | Load And Activate |

LICENCE

| | |
|---|---|
| Remote Management | Enabled |
| Ethernet OTA | Enabled |
| SNMP | Enabled |

GENERAL

*Local Status Polling Period (sec)*

This parameter displays the rate at which SuperVisor refreshes the Local Radio alarm LED states and RSSI value.

*Remote Status Polling Period (sec)*

This parameter displays the rate at which SuperVisor refreshes the Remote Radio alarm LED states and RSSI value.

*Network View Polling Period (sec)*

This parameter displays the rate at which SuperVisor polls all remote radios for status and alarm reporting.

*Inactivity Timeout (min)*

This parameter displays the period of user inactivity before SuperVisor automatically logs out of the radio.

*Frequency Tracking*

This parameter displays if Frequency Tracking is enabled or disabled.

### NETWORK

*Node Registration Retry (sec)*

This parameter displays the base station poll time at startup or the remote radio time between retries until registered.

*Announcement Period (min)*

This parameter displays the period between base station announcement messages. The announcement messages are used to distribute the base station date and time to remote radios. The default setting is 1440 minutes (24 hours).

Setting this parameter to 0 will stop periodic announcement messages being transmitted.

*Node Missed Poll Count*

This parameter displays the number of times the base station attempts to poll the network at startup or if a duplicate IP is detected when a remote radio is replaced.

### UPGRADE

*USB Boot Cycle Upgrade*

This parameter shows the type of USB Boot Cycle upgrade defined in ‘Software Setup > USB Boot Upgrade’ on page 259.

## LICENCE

*Remote Management*

This parameter displays if Remote Management is enabled or disabled. The default setting is enabled.

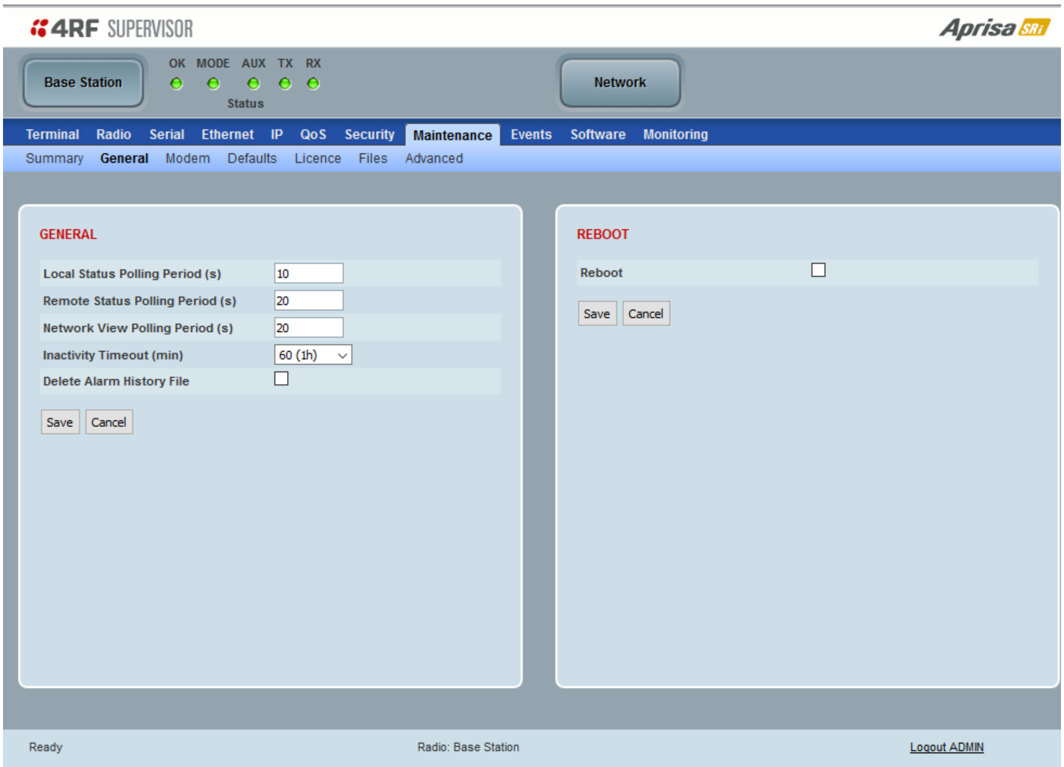
*Ethernet OTA (over the air)*

This parameter displays if Ethernet traffic is enabled or disabled. The Ethernet OTA will be enabled if the Ethernet feature licence has been purchased (see ‘Maintenance > Licence’ on page 237).

## SNMP Management

This parameter displays if SNMP management is enabled or disabled. The default setting is enabled.

## Maintenance > General


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary General Modem Defaults Licence Files Advanced
Save Cancel
Save Cancel
Ready
Radio: Base Station
Logout ADMIN

GENERAL

| | |
|---|---|
| Local Status Polling Period (s) | 10 |
| Remote Status Polling Period (s) | 20 |
| Network View Polling Period (s) | 20 |
| Inactivity Timeout (min) | 60 (1h) |
| Delete Alarm History File | □ |

REBOOT

| | |
|---|---|
| Reboot | □ |

### GENERAL

*Local Status Polling Period (sec)*

This parameter sets the rate at which SuperVisor refreshes the Local Radio alarm LED states and RSSI value. The default setting is 10 seconds.

*Network View Polling Period (sec)*

This parameter sets the rate at which SuperVisor polls all remote radios for status and alarm reporting. The default setting is 20 seconds.

*Remote Status Polling Period (sec)*

This parameter sets the rate at which SuperVisor refreshes the Remote Radio alarm LED states and RSSI value. To avoid problems when managing Aprisa SRi Networks, ensure that the Remote Polling Period is set to be longer than the Inband Management Timeout (set on page 102). The default setting is 20 seconds.

*Inactivity Timeout (min)*

This parameter sets the period of user inactivity before SuperVisor automatically logs out of the radio. The default setting is 15 minutes.

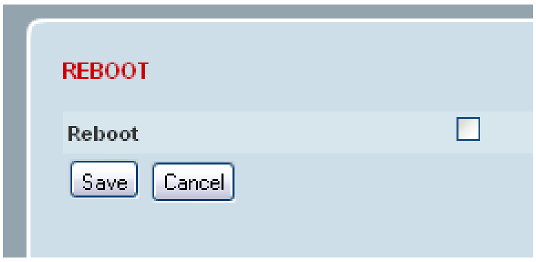
*Delete Alarm History file*

This parameter when activated deletes the alarm history file stored in the radio.

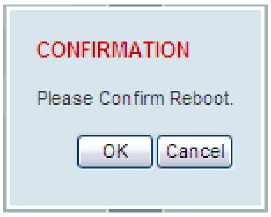
REBOOT

**To reboot the radio:**

1. Select Maintenance > General.
2. Tick the ‘Reboot’ checkbox.



3. Click ‘Save’ to apply the changes or ‘Cancel’ to restore the current value.



Please Confirm Reboot.

4. Click ‘OK’ to reboot the radio or ‘Cancel’ to abort.

All the radio LEDs will flash repeatedly for 1 second.

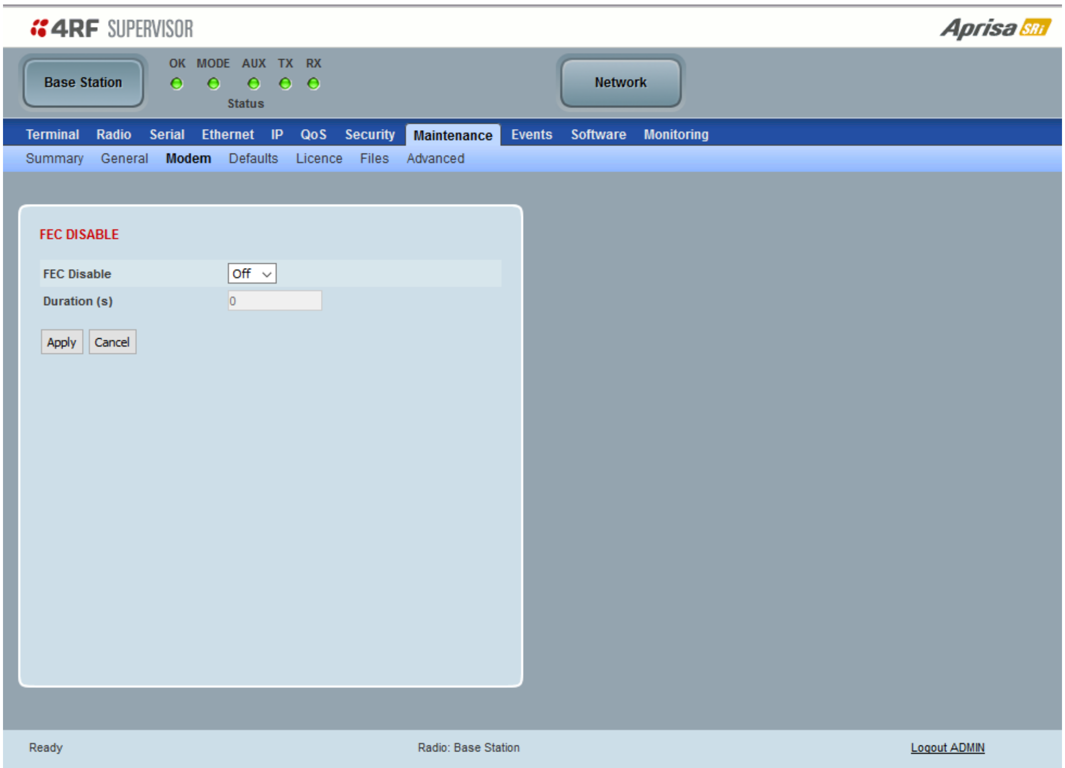
The radio will be operational again in about 10 seconds.

The OK, MODE, and AUX LEDs will light green and the TX and RX LEDs will be green (steady or flashing) if the network is operating correctly.

5. Login to SuperVisor.

## Maintenance > Modem

Base Station


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary General Modem Defaults Licence Files Advanced
Apply Cancel
Ready
Radio: Base Station
Logout ADMIN

FEC DISABLE

FEC Disable: Off

Duration (s): 0

### FEC DISABLE

*FEC Disable*

This diagnostic function allows the user to temporarily disable forward error correction on the channel when diagnosing problems on the link.

Therefore, enabling this diagnostic function would temporarily disable FEC on the channel and the associated maintenance mode alarm would activate.

Note that the opposite is not true for this diagnostic function. In other words, this diagnostic function does not provide the user with the option to temporarily enable forward error correction on the channel.

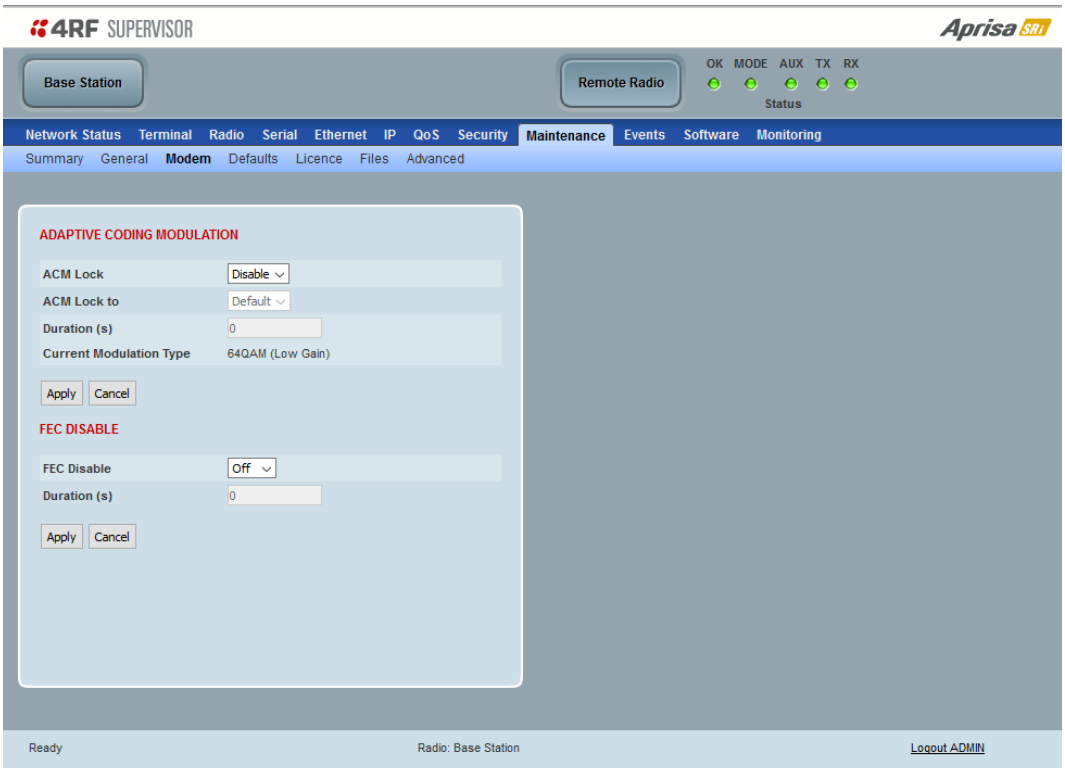
All diagnostic functions are not persistent and will be return to disabled states should the system restart.

| Option | Function |
|---|---|
| Enable | Enables the FEC Disable diagnostic function |
| Disable | Disables the FEC Disable diagnostic function |
| Timer | Allows the FEC to be disabled but only for a predetermined period. |

*Duration (s)*

This parameter defines the period required for disabling of the FEC. When this period elapses, the FEC is enabled.

Remote radio


4RF SUPERVISOR
Aprisa SRi
Base Station
Remote Radio
OK MODE AUX TX RX
Status
Network Status Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary General Modem Defaults Licence Files Advanced
Apply
Cancel
Ready
Radio: Base Station
Logout ADMIN

ADAPTIVE CODING MODULATION

ACM Lock: Disable
ACM Lock to: Default
Duration (s): 0
Current Modulation Type: 64QAM (Low Gain)

FEC DISABLE

FEC Disable: Off
Duration (s): 0

## ADAPTIVE CODING AND MODULATION

### *ACM Lock*

This parameter sets whether adaptive modulation can be locked or not.

| Option | Function |
|---|---|
| Disable | Disables manual locking of the adaptive modulation i.e. allows for automatic adaptive modulation. |
| Enable | Allows the adaptive modulation to be manually locked |
| Timer | Allows the adaptive modulation to be manually locked but only for a predetermined period. |

### *ACM Lock To*

This parameter manually locks the adaptive modulation.

| Option | Function |
|---|---|
| Default | Manually locks the adaptive modulation to the default |
| Current | Manually locks the adaptive modulation to the current modulation at that time. |

### *Duration (s)*

This parameter defines the period required for manually locking the adaptive modulation. When this period elapses, the adaptive modulation becomes automatic.

FEC DISABLE

*FEC Disable*

This diagnostic function allows the user to temporarily disable forward error correction on the channel when diagnosing problems on the link.

Therefore, enabling this diagnostic function would temporarily disable FEC on the channel and the associated maintenance mode alarm would activate.

Note that the opposite is not true for this diagnostic function. In other words, this diagnostic function does not provide the user with the option to temporarily enable forward error correction on the channel.

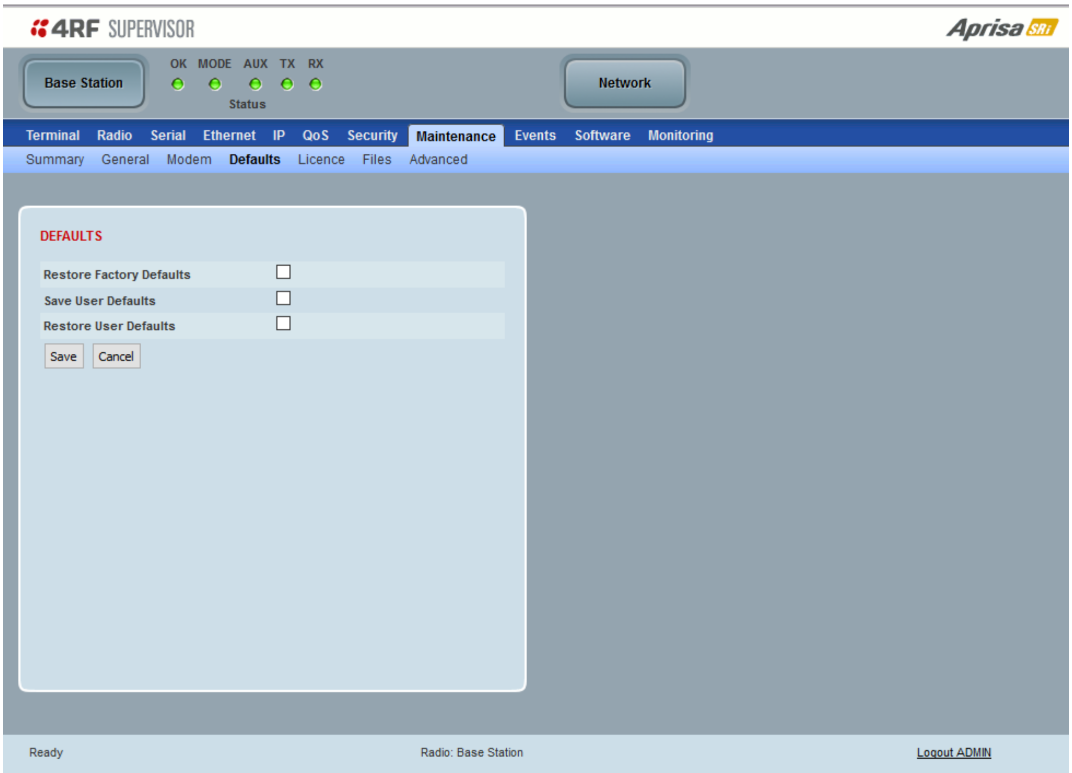
All diagnostic functions are not persistent and will be return to disabled states should the system restart.

| **Option** | **Function** |
|---|---|
| Enable | Enables the FEC Disable diagnostic function |
| Disable | Disables the FEC Disable diagnostic function |
| Timer | Allows the FEC to be disabled but only for a predetermined period. |

*Duration (s)*

This parameter defines the period required for disabling of the FEC. When this period elapses, the FEC is enabled.

## Maintenance > Defaults


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary General Modem Defaults Licence Files Advanced
Save
Cancel
Ready
Radio: Base Station
Logout ADMIN

DEFAULTS

Restore Factory Defaults □

Save User Defaults □

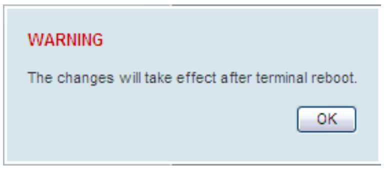
Restore User Defaults □

DEFAULTS

The Maintenance Defaults page is only available for the local terminal.

### *Restore Factory Defaults*

When activated, all radio parameters will be set to the factory default values. This includes resetting the radio IP address to the default of 169.254.50.10.



WARNING

The changes will take effect after terminal reboot.

**Note**: Take care using this command.

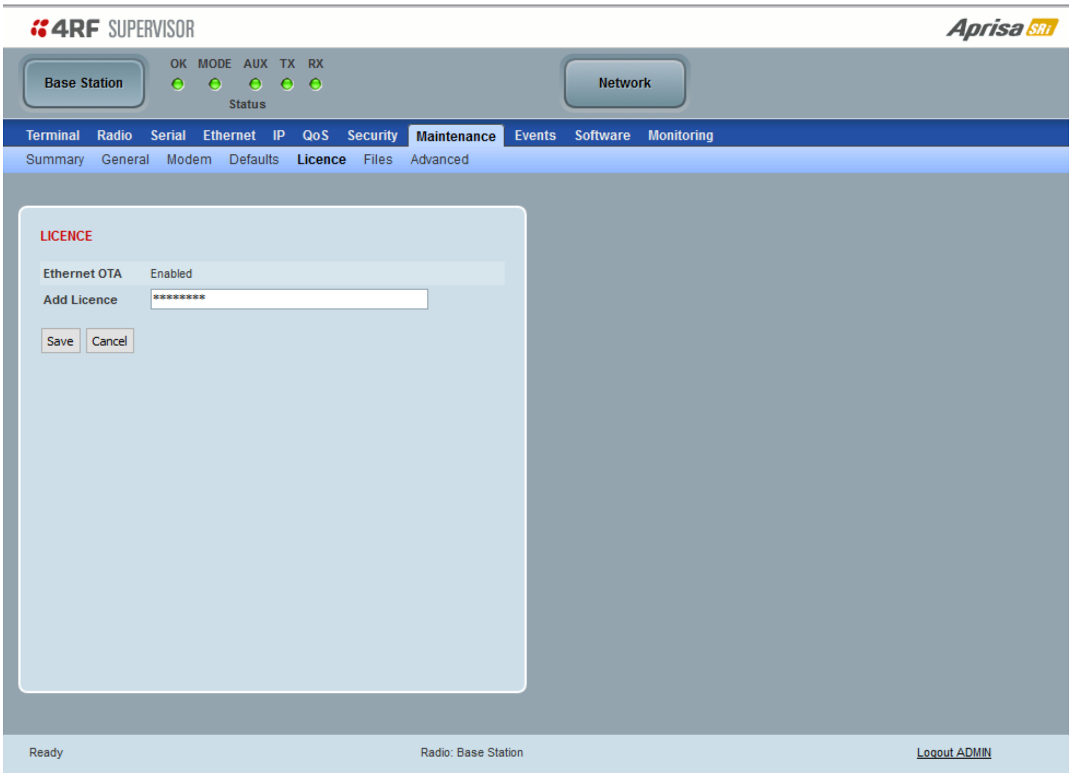
### *Save User Defaults*

When activated, all current radio parameter settings will be saved to non-volatile memory within the radio.

### *Restore User Defaults*

When activated, all radio parameters will be set to the settings previously saved using ‘Save User Defaults’.

## Maintenance > Licence


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary General Modem Defaults Licence Files Advanced
Save
Cancel
Ready
Radio: Base Station
Logout ADMIN

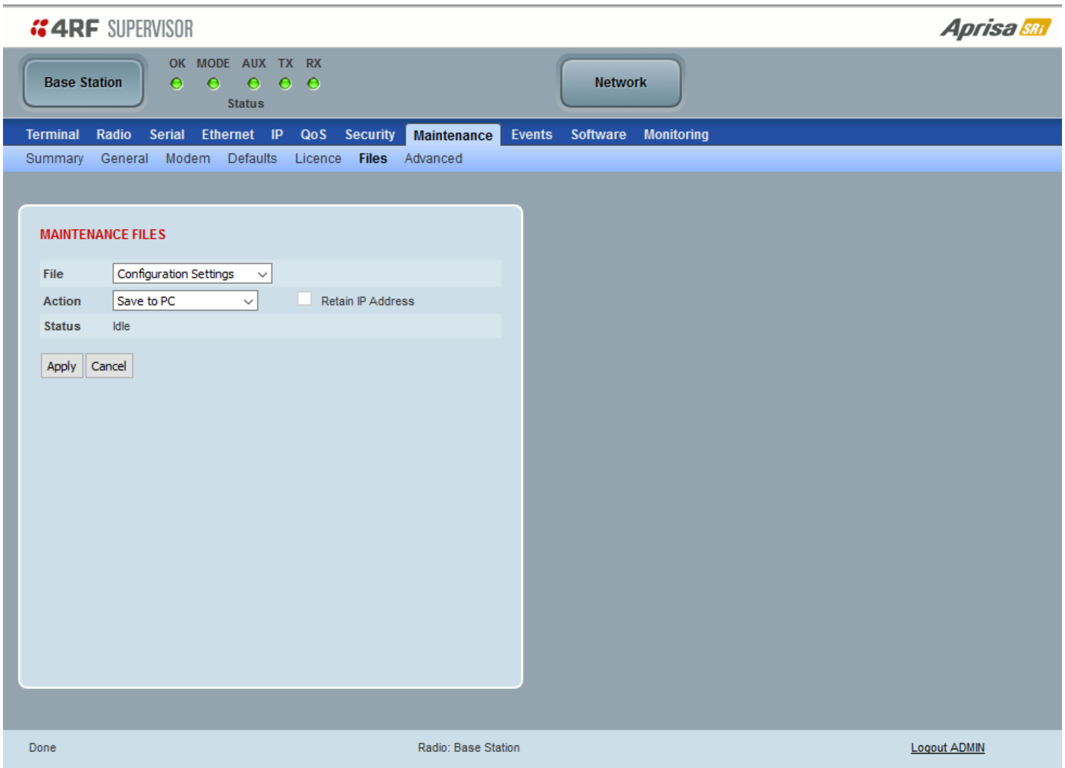
LICENCE

|  |  |
|---|---|
| Ethernet OTA | Enabled |
| Add Licence | ******** |

### LICENCE

In this software version, Remote Management, Ethernet Traffic and SNMP management are enabled by default.

## Maintenance > Files


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary General Modem Defaults Licence Files Advanced
Apply
Cancel
Done
Radio: Base Station
Logout ADMIN

MAINTENANCE FILES

| | | |
|---|---|---|
| File | Configuration Settings | |
| Action | Save to PC | □ Retain IP Address |
| Status | Idle | |

### MAINTENANCE FILES

There are three maintenance file types which can saved / restored to / from PC or USB flash drive:

Note: 4RF radios only support the FAT32 file system for flash drives. If the flash drive is a different format such as exFAT or NTFS, you will need to reformat it to FAT32.

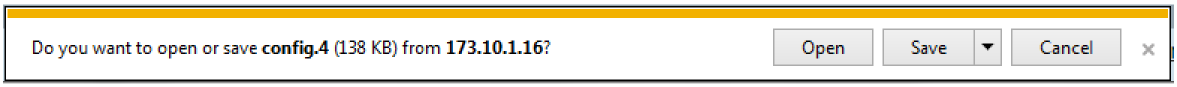
Also, some brands of USB flash drives may not work with 4RF radios.

*File - Configuration Settings*

This feature enables the configuration of a radio to be saved to a file for configuration backup or for copying to another radio, however the target radio being restored must be operating on the same software version as the source radio the configuration file was saved from e.g. if the configuration file was saved from a radio operating on software version 1.1.0, it can only be restored to a radio operating on software version 1.1.0.

Action

| Action | Option |
|---|---|
| Save to PC | This saves the file with a filename of ‘Config.4’ to a binary encrypted file. This can then be saved from the Browser popup (example is Windows Internet Explorer 11). The file should be renamed to be able to identify the radio it was saved from. |
| Save to Radio USB | This saves the file with a filename of ‘asrcfg_1.1.0’ to a binary encrypted file on the radio USB flash drive root directory. |
| Restore from PC | This restores all user configuration settings from a binary encrypted file on a PC directory to the radio.<br>A reboot warning message will warn of a pending reboot after the PC file is selected. Clicking OK will open a browser file selection window to select the file.<br>**Note:** If you are using Explorer, it must be IE10 or above for this feature to work correctly. |
| Restore from Radio USB | This restores all user configuration settings from a binary encrypted file on the USB root directory to the radio. |


Do you want to open or save **config.4** (138 KB) from **173.10.1.16**?

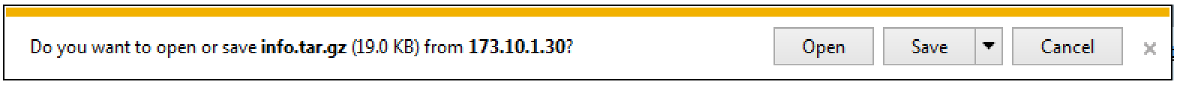
**Note**: ‘Payload Encryption Key’ and ‘Key Encryption Key’ parameters (see ‘Security > Setup’) are not saved to the configuration file. When a ‘Restore from PC’ or ‘Restore from Radio USB’ is used, these parameters will retain their existing values so are not changed by the operation of restoring the configuration file.

**Note**: If the remote radios are running software versions prior to 1.0.6, the configuration file cannot be downloaded over the air.

*File - Event History Log*

Action

| Action | Option |
|---|---|
| Save to PC | This saves the Event History Log file with a filename of 'Info.tar.gz' to a binary encrypted file. This can then be saved from the Browser popup (example is Windows Internet Explorer 11). The file should be renamed to be able to identify the radio it was saved from.<br>The 'tar.gz' file is normally for sending back to 4RF Limited for analysis but can be opened with widely available archive tools e.g. WinRar or 7-ZIP. |



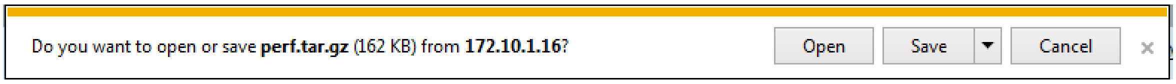
Do you want to open or save **info.tar.gz** (19.0 KB) from **173.10.1.30**?

| | |
|---|---|
| Save to Radio USB | This saves the file with a filename of e.g. 'alarm_173.10.1.30_2014-11-10,15.54.14.txt' to a text file on the radio USB flash drive root directory. |

*File - Performance History Log*

Action

| Action | Option |
|---|---|
| Save to PC | This saves the Performance History Log file with a filename of 'Perf.tar.gz'. This can then be saved from the Browser popup (example is Windows Internet Explorer 11). The file should be renamed to be able to identify the radio it was saved from.<br>The 'tar.gz' file is normally for sending back to 4RF Limited for analysis but can be opened with widely available archive tools e.g. WinRar or 7-ZIP. |



Do you want to open or save **perf.tar.gz** (162 KB) from **172.10.1.16**?

The Performance Log file contains the following files:

- perfQhour.csv

  This file contains the performance data for the radio recorded on a quarter hourly basis. Up to 24 hours of data is stored in this file.

- perfDaily.csv

  This file contains the performance data for the radio recorded on a daily basis. Up to 31 days of data is stored in this file.

- perfUnitQhour.csv

  This file contains the performance data for the RF path of the radio to each remote radio, recorded on a quarter hourly basis. Up to 24 hours of data for each RF path is stored in this file.

- perfUnitDaily.csv

  This file contains the performance data for the RF path of the radio to each remote radio, recorded on a daily basis. Up to 31 days of data for each RF path is stored in this file.

4RF has developed templates for viewing the data from the Performance Log files. These templates include the instructions for importing and graphing the log data.

The Performance History Log Templates are available from the 4RF website http://www.4rf.com/secure (login required) or from 4RF.

### *File - Configuration Script*

Action

| Action | Option |
|---|---|
| Load and Execute | This loads and executes configuration script files.<br>There are sample Master Configuration script files available from the 4RF website http://www.4rf.com/secure.<br>The purpose of these files is to use as templates to create your own configuration scripts.<br>Note: Be careful using this feature as incompatible configurations will change the radios settings and break radio connectivity. |

**Note:** Activating this function will over-write all existing configuration settings in the radio (except for the non-saved settings e.g. security passwords, licence keys etc) without any verification of the command setting in the radio. Precautions should be taken to prevent radio outages with incorrect radio configurations. The following process steps are recommended:

a. Save the current radio configuration to a PC or USB before uploading the new configuration script file

b. Upload the new configuration script file to the radio

c. If for some reason the radio doesn't work as expected, the saved configuration file can be uploaded to the radio (roll back to previous configuration).

### *Retain IP Address*

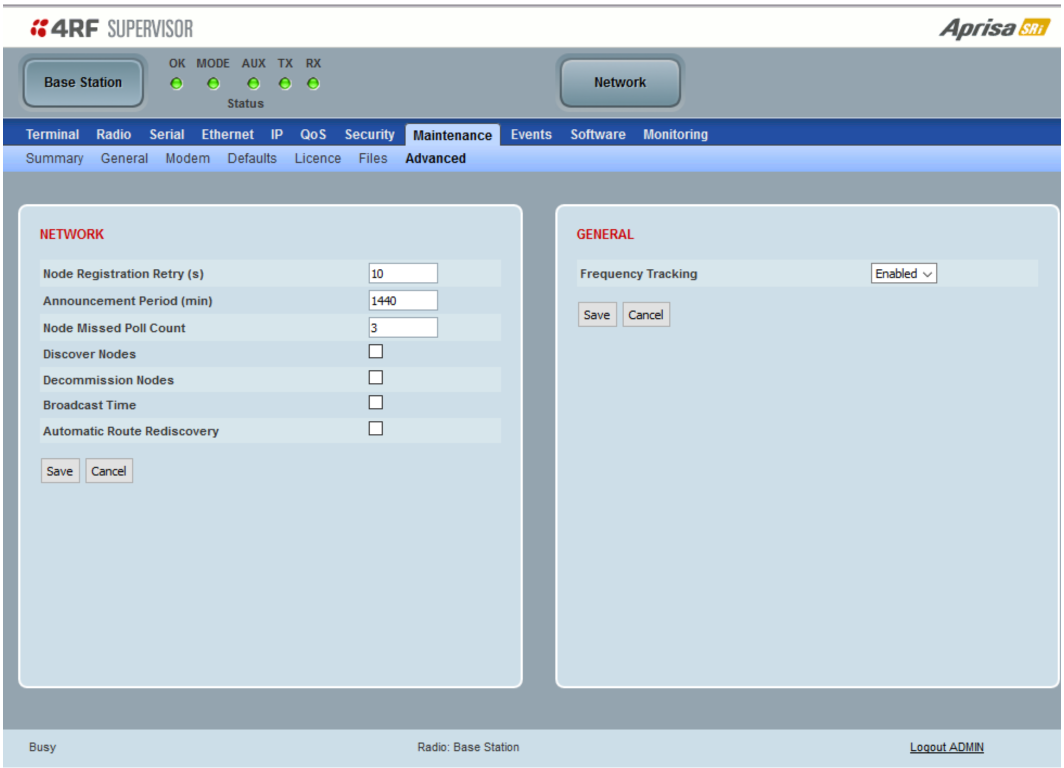
This parameter when enabled ensures that the radio IP address is not changed when the radio configuration settings are restored from a configuration file with a different IP radio address. It prevents the radio losing connectivity when the configuration settings are restored from a configuration file.

### *Revert Config if Connection Lost*

When the Maintenance Files feature is used on remote radios from the base station, this parameter allows the configurations to be restored to the previous configuration if the connection is lost.

This must be set before executing the Configuration Settings / Configuration Script restore functions.

## Maintenance > Advanced


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary General Modem Defaults Licence Files Advanced

NETWORK

| | |
|---|---|
| Node Registration Retry (s) | 10 |
| Announcement Period (min) | 1440 |
| Node Missed Poll Count | 3 |
| Discover Nodes | □ |
| Decommission Nodes | □ |
| Broadcast Time | □ |
| Automatic Route Rediscovery | □ |

Save Cancel

GENERAL

| | |
|---|---|
| Frequency Tracking | Enabled |

Save Cancel

Busy Radio: Base Station Logout ADMIN

NETWORK

*Node Registration Retry (sec)*

This parameter sets the base station poll time at startup or the remote radio time between retries until registered. The default setting is 10 seconds.

*Announcement Period (min)*

This parameter displays the period between base station announcement messages. The announcement messages are used to distribute the base station date and time to remote radios. The default setting is 1440 minutes (24 hours).

Setting this parameter to 0 will stop periodic announcement messages being transmitted.

*Node Missed Poll Count*

This parameter sets the number of times the base station attempts to poll the network at startup or if a duplicate IP is detected when a remote radio is replaced. The default setting is 3.

*Discover Nodes*

This parameter when activated triggers the base station to poll the network with Node Missed Poll Count and Node Registration Retry values.

*Decommission Node(s)*

This parameter when activated resets the network registrations to remove the entire network from service.

**Note**: Take care using this option.

*Broadcast Time*

This parameter when activated sends the base station Date / Time setting to all the remote radios in the network and sets their Date / Time. This option applies to the base station only.

*Automatic Route Rediscovery*

This parameter enables the radio to transmit route discovery messages when packets are unacknowledged.

When enabled, unacknowledged unicast packets are converted into uni-broadcast messages and sent through the network. All nodes see the message and populate their routing tables accordingly.

When the destination node is reached, it sends a route response message via the shortest path. The intermediate nodes see this message and populate their routing tables in the reverse direction, thus re-establishing the route.

The default setting is disabled.

*Delete Received Channel List – Remote Radios Only*

This parameter deletes the existing zone channel list and uses the configured zone channel allocation setup with Zone Setup on page 123 until it re-registers with the base station and receives the new distributed zone channel list.

GENERAL

*Frequency Tracking*

Frequency Tracking enables the receiver to track any frequency drift in the transmitter to maintain optimum SNR and radio link performance over the full temperature range.

When enabled, remote radios adjust their receive frequency to the frequency of the incoming packet rate and the base station notifies remote radios if their transmit frequency requires adjustment.

The default setting is Enabled.

# Events

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

## Events > Alarm Summary

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

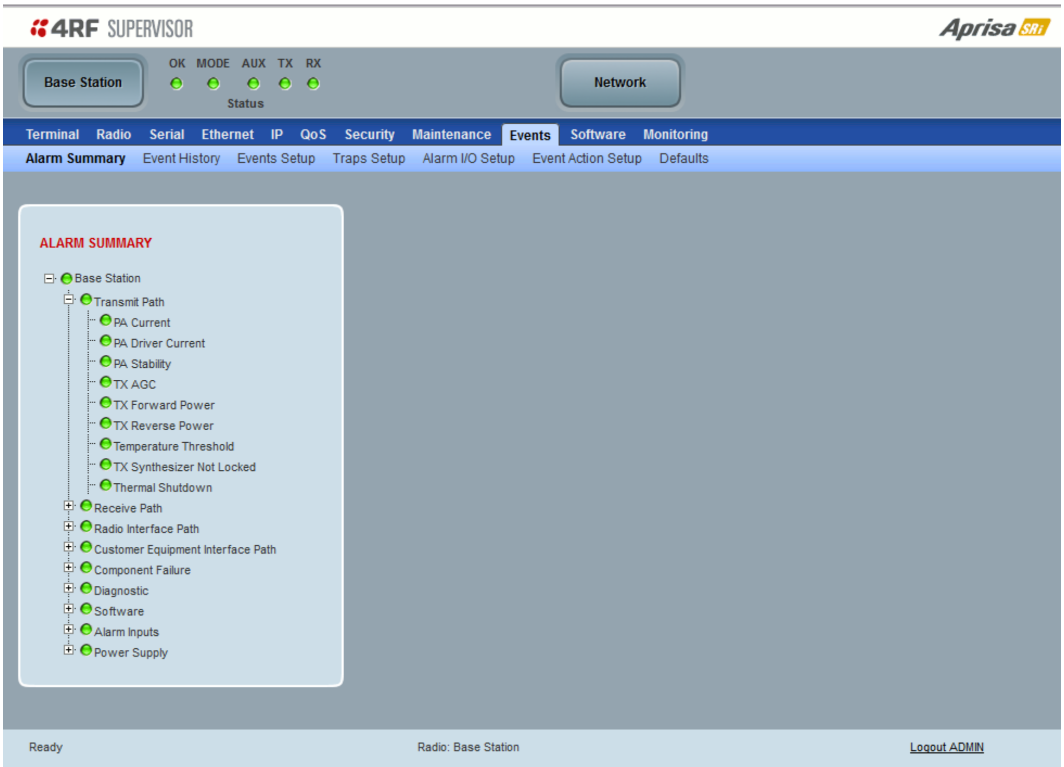
1. Alarm Events

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 330 for a complete list of events.

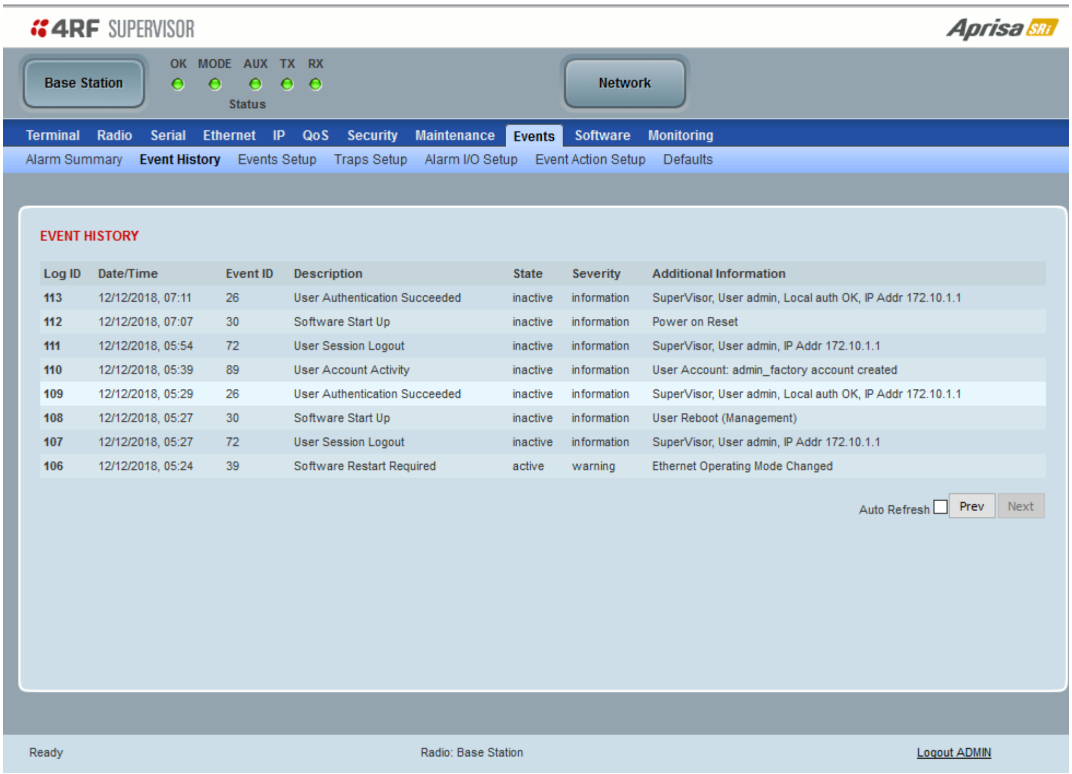


ALARM SUMMARY

The Alarm Summary is a display tree that displays the current states of all radio alarms. The alarm states refresh automatically every 12 seconds.

| LED Colour | Severity |
|---|---|
| Green | No alarm |
| Orange | Warning alarm |
| Red | Critical, major or minor alarm |

## Events > Event History


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Alarm Summary Event History Events Setup Traps Setup Alarm I/O Setup Event Action Setup Defaults
Auto Refresh □ Prev Next
Ready
Radio: Base Station
Logout ADMIN

EVENT HISTORY

| Log ID | Date/Time | Event ID | Description | State | Severity | Additional Information |
|---|---|---|---|---|---|---|
| 113 | 12/12/2018, 07:11 | 26 | User Authentication Succeeded | inactive | information | SuperVisor, User admin, Local auth OK, IP Addr 172.10.1.1 |
| 112 | 12/12/2018, 07:07 | 30 | Software Start Up | inactive | information | Power on Reset |
| 111 | 12/12/2018, 05:54 | 72 | User Session Logout | inactive | information | SuperVisor, User admin, IP Addr 172.10.1.1 |
| 110 | 12/12/2018, 05:39 | 89 | User Account Activity | inactive | information | User Account: admin_factory account created |
| 109 | 12/12/2018, 05:29 | 26 | User Authentication Succeeded | inactive | information | SuperVisor, User admin, Local auth OK, IP Addr 172.10.1.1 |
| 108 | 12/12/2018, 05:27 | 30 | Software Start Up | inactive | information | User Reboot (Management) |
| 107 | 12/12/2018, 05:27 | 72 | User Session Logout | inactive | information | SuperVisor, User admin, IP Addr 172.10.1.1 |
| 106 | 12/12/2018, 05:24 | 39 | Software Restart Required | active | warning | Ethernet Operating Mode Changed |

EVENT HISTORY

The last 1500 events are stored in the radio. The complete event history list can be downloaded to a USB flash drive (see ‘File - Event History Log’ on page 240).

The Event History can display the last 50 events stored in the radio in blocks of 8 events.

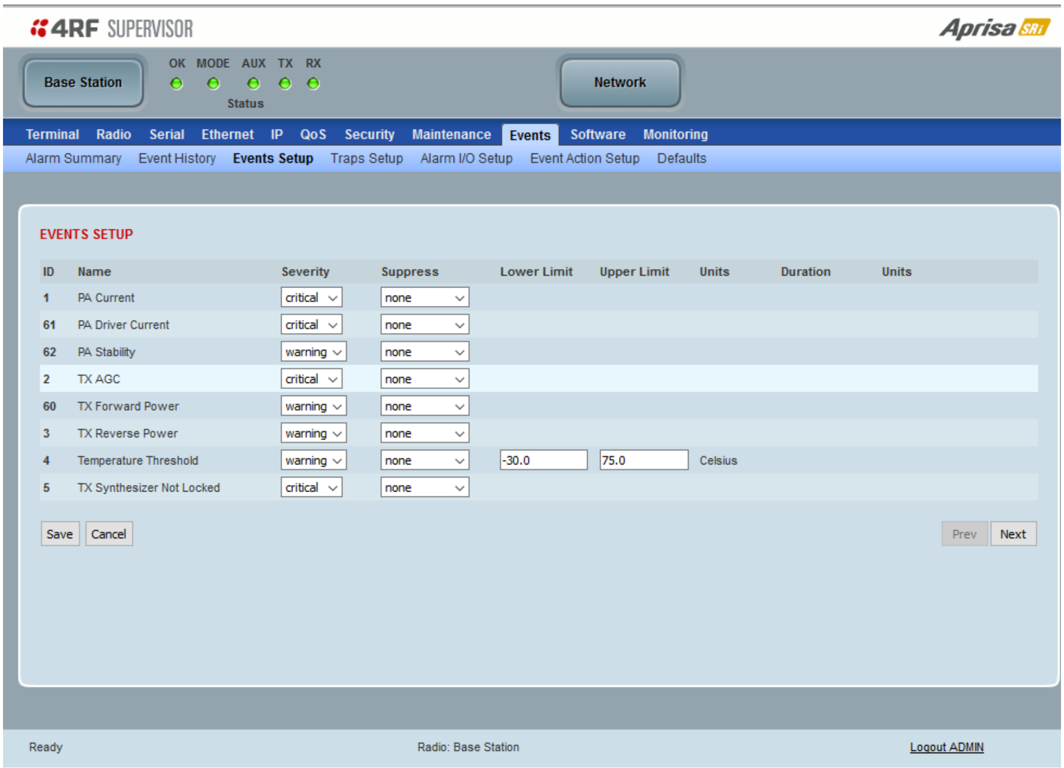
The Next button will display the next page of 8 events and the Prev button will display the previous page of 8 events. Using these buttons will disable Auto Refresh to prevent data refresh and page navigation contention.

The last 50 events stored in the radio are also accessible via an SNMP command.

### *Auto Refresh*

The Event History page selected will refresh automatically every 12 seconds if the Auto Refresh is ticked.

## Events > Events Setup


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Alarm Summary Event History Events Setup Traps Setup Alarm I/O Setup Event Action Setup Defaults
Save Cancel
Prev Next
Ready
Radio: Base Station
Logout ADMIN

EVENTS SETUP

| ID | Name | Severity | Suppress | Lower Limit | Upper Limit | Units | Duration | Units |
|---|---|---|---|---|---|---|---|---|
| 1 | PA Current | critical | none | | | | | |
| 61 | PA Driver Current | critical | none | | | | | |
| 62 | PA Stability | warning | none | | | | | |
| 2 | TX AGC | critical | none | | | | | |
| 60 | TX Forward Power | warning | none | | | | | |
| 3 | TX Reverse Power | warning | none | | | | | |
| 4 | Temperature Threshold | warning | none | -30.0 | 75.0 | Celsius | | |
| 5 | TX Synthesizer Not Locked | critical | none | | | | | |

### EVENTS SETUP

Alarm event parameters can be configured for all alarm events (see ‘Alarm Events’ on page 331).

All active alarms for configured alarm events will be displayed on the Monitoring pages (see ‘Monitoring’ on page 275).

#### *Severity*

The Severity parameter sets the alarm severity.

| Severity | Function |
|---|---|
| Critical | The Critical severity level indicates that a service affecting condition has occurred and an immediate corrective action is required. Such a severity can be reported, for example, when a managed object becomes totally out of service and its capability must be restored. |
| Major | The Major severity level indicates that a service affecting condition has developed and an urgent corrective action is required. Such a severity can be reported, for example, when there is a severe degradation in the capability of the managed object and its full capability must be restored. |
| Minor | The Minor severity level indicates the existence of a non-service affecting fault condition and that corrective action should be taken in order to prevent a more serious (for example, service affecting) fault.<br>Such a severity can be reported, for example, when the detected alarm condition is not currently degrading the capacity of the managed object. |
| Warning | The Warning severity level indicates the detection of a potential or impending service affecting fault, before any significant effects have been felt. Action should be taken to further diagnose (if necessary) and correct the problem in order to prevent it from becoming a more serious service affecting fault. |
| Information | No problem indicated – purely information |

*Suppress*

This parameter determines if the action taken by an alarm.

| Option | Function |
|---|---|
| None | Alarm triggers an event trap and is logged in the radio |
| Traps | Alarm is logged in the radio but does not trigger an event trap |
| Traps and Log | Alarm neither triggers an event trap nor is logged in the radio |

*Lower Limit / Upper Limit*

Threshold alarm events have lower and upper limit settings. The alarm is activated if the current reading is outside the limits.

Example: 9 RX CRC Errors

The Upper Limit is set to 0.7 and the Duration is set to 5 seconds.

If in any 5 second period, the total number of errored packets divided by the total number of received packets exceeds 0.7, the alarm will activate.

*Units (1)*

The Units parameter shows the unit for the Lower Limit and Upper Limit parameters.

Duration

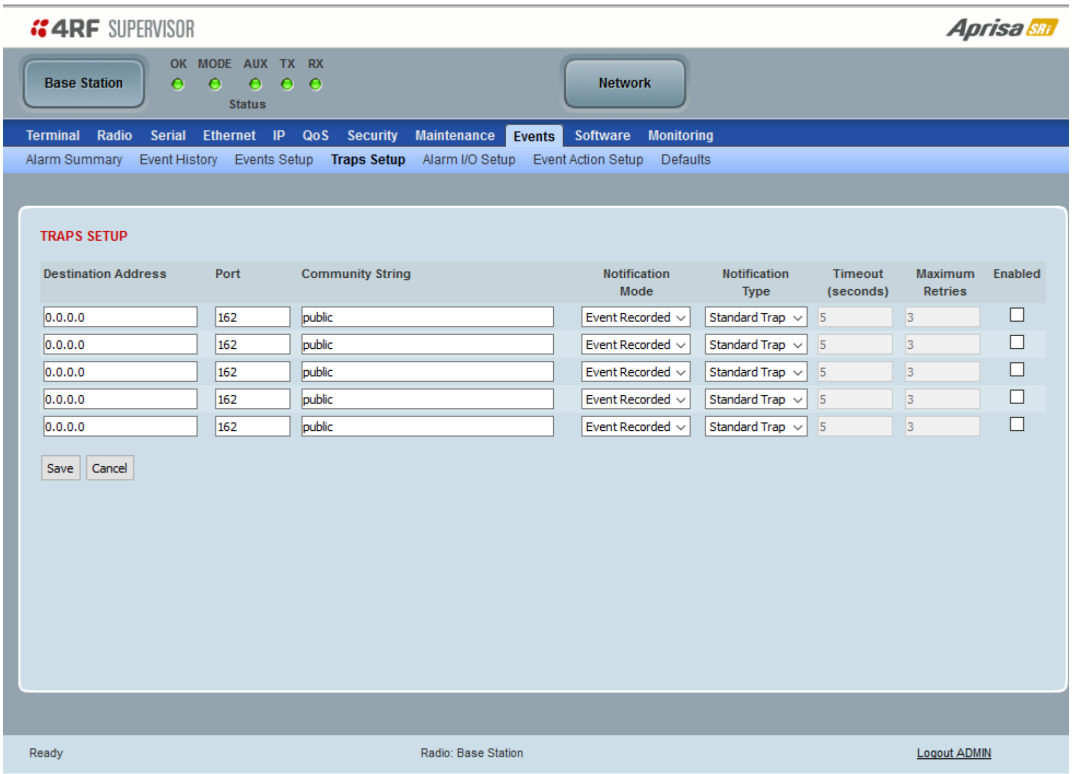
This parameter determines the period to wait before an alarm is raised if no data is received.

*Units (2)*

This parameter shows the unit for the Duration parameters.

The Next button will display the next page of 8 alarm events and the Prev button will display the previous page of 8 alarm events.

## Events > Traps Setup


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Alarm Summary Event History Events Setup Traps Setup Alarm I/O Setup Event Action Setup Defaults
Save
Cancel
Ready
Radio: Base Station
Logout ADMIN

TRAPS SETUP

| Destination Address | Port | Community String | Notification Mode | Notification Type | Timeout (seconds) | Maximum Retries | Enabled |
|---|---|---|---|---|---|---|---|
| 0.0.0.0 | 162 | public | Event Recorded | Standard Trap | 5 | 3 | ☐ |
| 0.0.0.0 | 162 | public | Event Recorded | Standard Trap | 5 | 3 | ☐ |
| 0.0.0.0 | 162 | public | Event Recorded | Standard Trap | 5 | 3 | ☐ |
| 0.0.0.0 | 162 | public | Event Recorded | Standard Trap | 5 | 3 | ☐ |
| 0.0.0.0 | 162 | public | Event Recorded | Standard Trap | 5 | 3 | ☐ |

### TRAPS SETUP

All events can generate SNMP traps. The types of traps that are supported are defined in the ‘Notification Mode’.

*Destination Address*

This parameter sets the IP address of the server running the SNMP manager.

*Port*

This parameter sets the port number the server running the SNMP manager.

*Community String*

This parameter sets the community string which is sent with the IP address for security. The default community string is ‘public’.

*Notification Mode*

This parameter sets when an event related trap is sent:

| Option | Function |
|---|---|
| None | No event related traps are sent. |
| Event Recorded | When an event is recorded in the event history log, a trap is sent. |
| Event Updated | When an event is updated in the event history log, a trap is sent. |
| All Events | When an event is recorded or updated in the event history log, a trap is sent. |

*Notification Type*

This parameter sets the type of event notification:

| Option | Function |
|---|---|
| Standard Trap | Provides a standard SNMP trap event |
| Inform Request | Provides a SNMP v2 Inform Request trap event including trap retry and acknowledgement |

Notification Type set to Inform Request:

*Timeout (second)*

This parameter sets the time interval to wait for an acknowledgement before sending another retry.

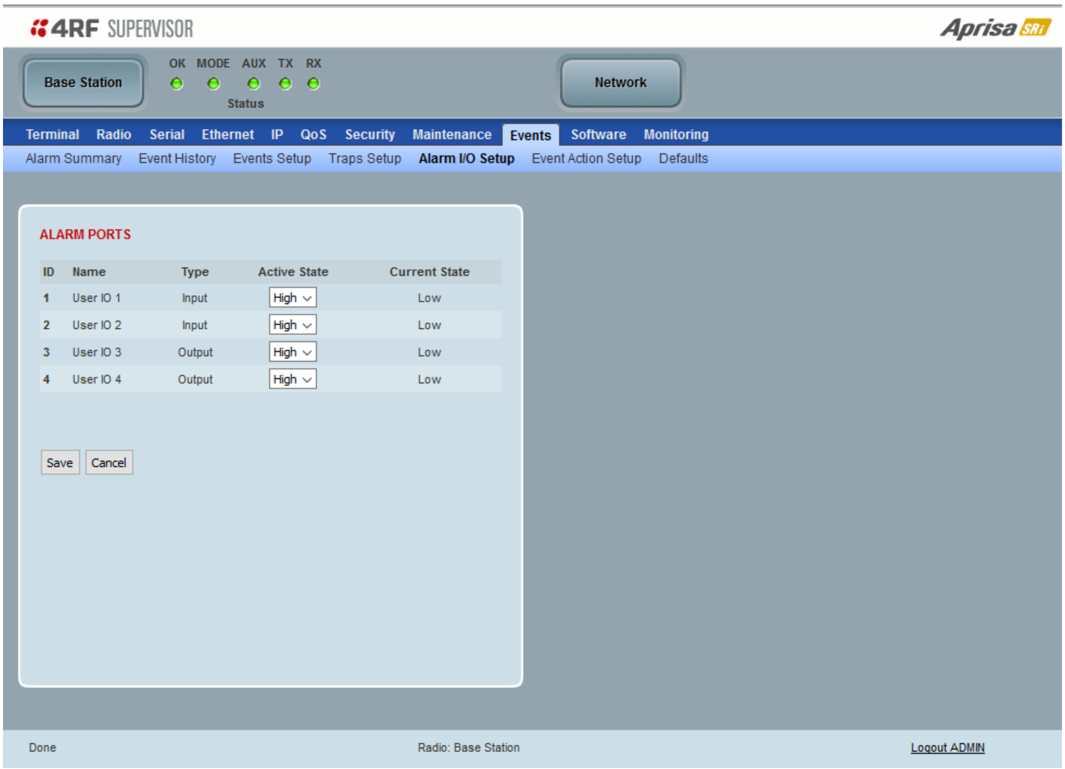
*Maximum Retries*

This parameter sets the maximum number of retries to send the event without acknowledgement before it gives up.

*Enabled*

This parameter determines if the entry is used.

## Events > Alarm I/O Setup


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Alarm Summary Event History Events Setup Traps Setup Alarm I/O Setup Event Action Setup Defaults
Save
Cancel
Done
Radio: Base Station
Logout ADMIN

ALARM PORTS

| ID | Name | Type | Active State | Current State |
|---|---|---|---|---|
| 1 | User IO 1 | Input | High | Low |
| 2 | User IO 2 | Input | High | Low |
| 3 | User IO 3 | Output | High | Low |
| 4 | User IO 4 | Output | High | Low |

### ALARM PORTS

This page provides control of the two hardware alarm inputs and two hardware alarm outputs provided on the alarm connector.

The alarm inputs are used to transport alarms to the other radios in the network. The alarm outputs are used to receive alarms from other radios in the network.

*Name*

The alarm IO number.

*Type*

The Type shows if the alarm is an input or output.

### *Active State*

The Active State parameter sets the alarm state when the alarm is active.

Alarm Input

| Option | Function |
|---|---|
| Low | The alarm is active low i.e. a ground contact on the port will cause an active alarm state |
| High | The alarm is active high i.e. an open contact on the port will cause an active alarm state |

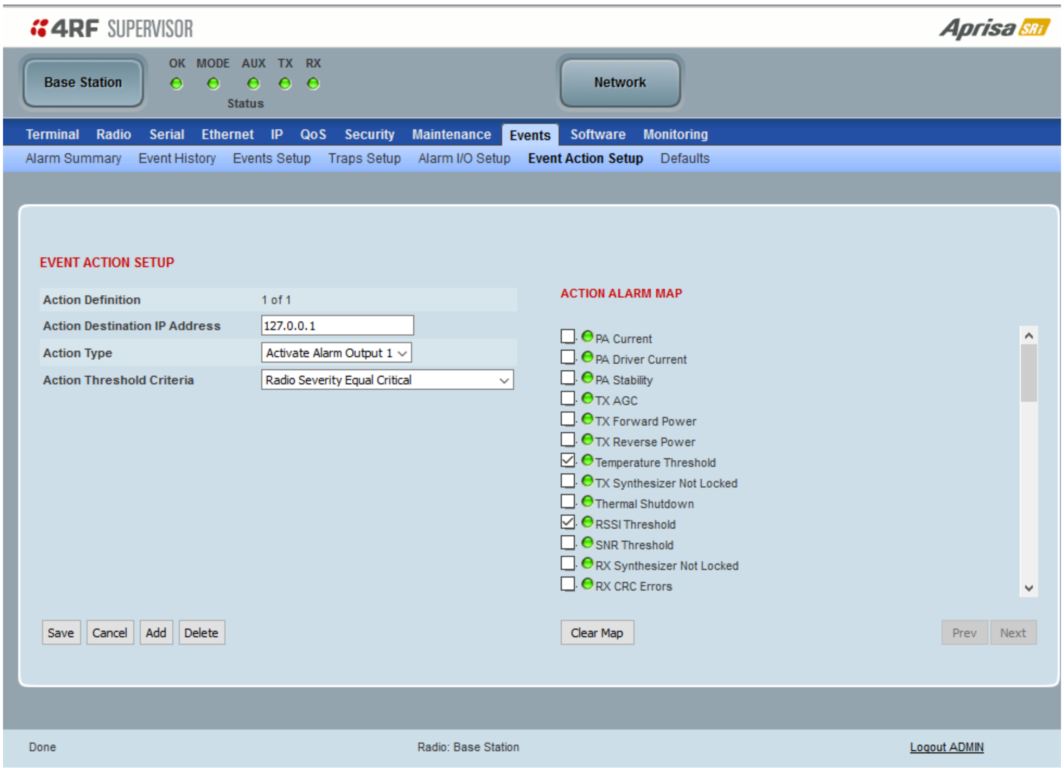
Alarm Output

| Option | Function |
|---|---|
| Low | The alarm is active low i.e. the active alarm state will generate a ground contact output |
| High | The alarm is active high i.e. the active alarm state will generate a open contact output |

### *Current State*

The Current State shows the current state of the alarm.

## Events > Event Action Setup


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Alarm Summary Event History Events Setup Traps Setup Alarm I/O Setup Event Action Setup Defaults
Save Cancel Add Delete
Clear Map
Prev Next
Done
Radio: Base Station
Logout ADMIN

EVENT ACTION SETUP

| | |
|---|---|
| Action Definition | 1 of 1 |
| Action Destination IP Address | 127.0.0.1 |
| Action Type | Activate Alarm Output 1 |
| Action Threshold Criteria | Radio Severity Equal Critical |

ACTION ALARM MAP

- □ 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
- □ SNR Threshold
- □ RX Synthesizer Not Locked
- □ RX CRC Errors

### EVENT ACTION SETUP

This page provides control of the mapping of events to specific actions. Specific alarm events can setup to trigger outputs.

*Action Definition*

This parameter shows the number of the event action setup and the maximum number of setups stored.

*Action Destination IP Address*

This parameter sets the IP address of the radio that will output the action type.

*Action Type*

This parameter sets the action type that will be activated on the radio.

| Option | Function |
|---|---|
| None | This action setup does not activate any alarm output |
| Activate Alarm Output 1 | This action setup activates alarm output 1 |
| Activate Alarm Output 2 | This action setup activates alarm output 2 |

*Action Threshold Criteria*

This parameter sets the radio event that will trigger the action output.

| Option | Function |
|---|---|
| None | No action output. |
| Radio Severity Equal Critical | Activates the action output when a radio alarm is critical alarm |
| Radio Severity Equal Major | Activates the action output when a radio alarm is a major alarm |
| Radio Severity Equal Minor | Activates the action output when a radio alarm is minor alarm |
| Radio Severity Equal Warning | Activates the action output when a radio alarm is a warning alarm |
| Radio Severity Equal Cleared | Activates the action output when a radio alarm is cleared |
| Radio Severity Equal or Worse than Major | Activates the action output when a radio alarm is a major alarm or a critical alarm |
| Radio Severity Equal or Worse than Minor | Activates the action output when a radio alarm is a minor alarm, a major alarm or a critical alarm |
| Radio Severity Equal or Worse than Warning | Activates the action output when a radio alarm is a warning, a major alarm, a minor alarm or a critical alarm |

## Controls

The Save button saves the current event action setup.

The Cancel button cancels the new event action setup.

The Add button adds a new event action setup.

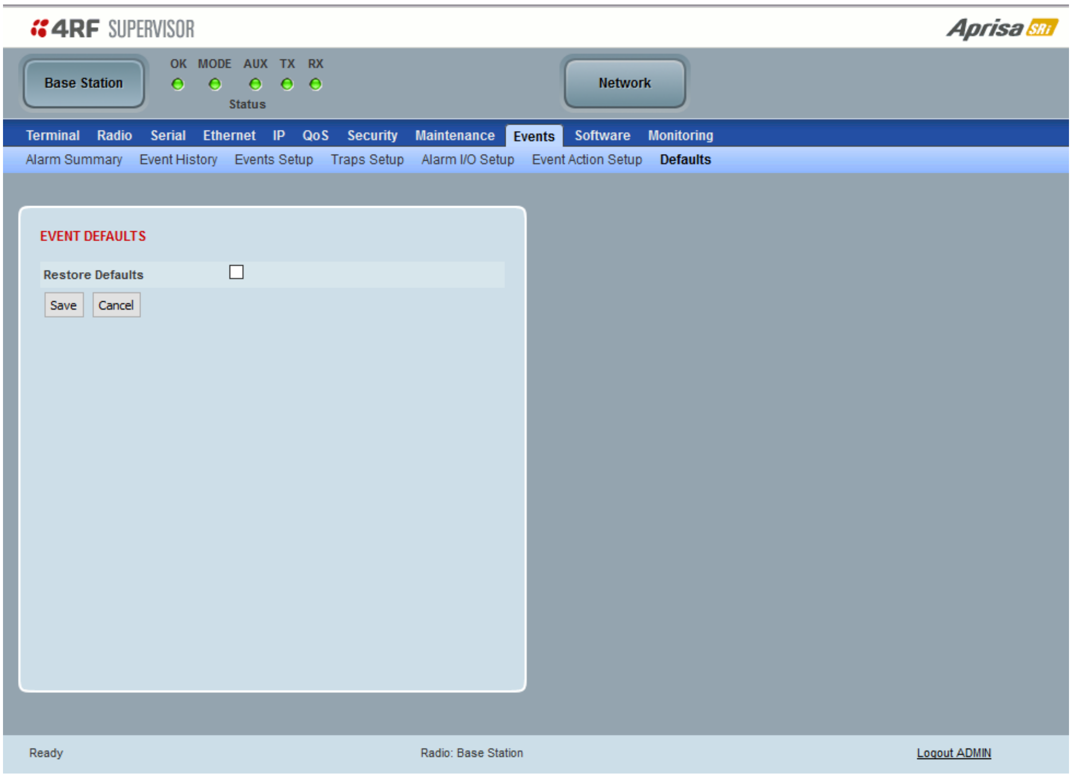
The Delete button deletes the current event action setup.

The Clear Map button clears all alarm selections on the current setup.

**To add an event action setup:**

1. Click on the Add button.
2. Enter the Action Destination IP Address. This is the IP address of the radio that will output the action type.
3. Select the Action Type from the list.
4. Select the Action Threshold Criteria from the list.
5. Tick the alarms required for the event action setup from the Action Alarm Map. You can clear all alarm selections with the Clear Map button.
6. Click on Save.

## Events > Defaults



4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Alarm Summary Event History Events Setup Traps Setup Alarm I/O Setup Event Action Setup Defaults
Save
Cancel
Ready
Radio: Base Station
Logout ADMIN

EVENT DEFAULTS

Restore Defaults □

### EVENT DEFAULTS

*Restore Defaults*

This parameter when activated restores all previously configured event parameters using 'Events > Events Setup' to the factory default settings.

## Software

The Software menu contains the setup and management of the system software including network software distribution and activation. The distribution of the system software to the remote radios is encrypted by the AES session key over-the-air.

### Single Radio Software Upgrade

The radio software can be upgraded on a single Aprisa SRi radio (see 'Single Radio Software Upgrade' on page 325). This process would only be used if the radio was a replacement or a new station in an existing network.

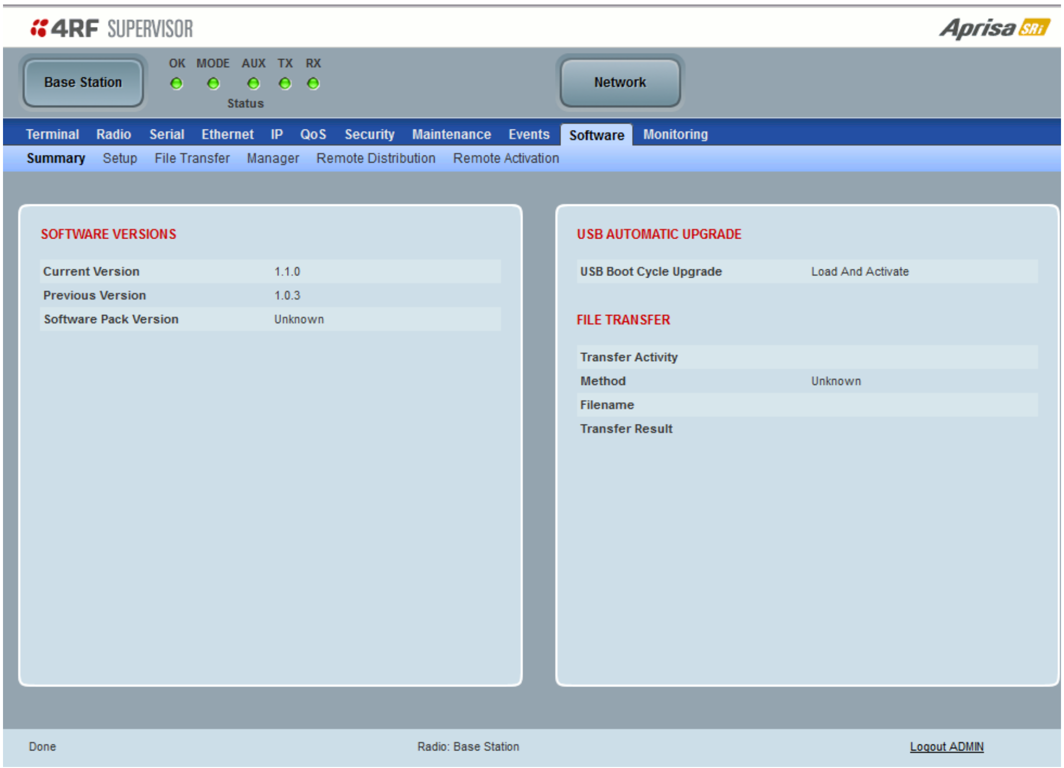
### Network Software Upgrade

The radio software can be upgraded on an entire Aprisa SRi radio network remotely over the radio link (see 'Network Software Upgrade' on page 323). This process involves following steps:

1. Transfer the new software to base station with 'Software > File Transfer'
2. Distribute the new software to all remote radios with 'Software > Remote Distribution'
3. Activate of the new software on remote radios with 'Software > Remote Activation'.
4. Finally, activate the new software on the base station radio with 'Software > Manager'. Note: activating the software will reboot the radio.

## Software > Summary

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


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary Setup File Transfer Manager Remote Distribution Remote Activation
Done
Radio: Base Station
Logout ADMIN

SOFTWARE VERSIONS

| | |
|---|---|
| Current Version | 1.1.0 |
| Previous Version | 1.0.3 |
| Software Pack Version | Unknown |

USB AUTOMATIC UPGRADE

| | |
|---|---|
| USB Boot Cycle Upgrade | Load And Activate |

FILE TRANSFER

| | |
|---|---|
| Transfer Activity | |
| Method | Unknown |
| Filename | |
| Transfer Result | |

### SOFTWARE VERSIONS

*Current Version*

This parameter displays the software version running on the radio.

*Previous Version*

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

*Software Pack Version*

On the base station, this parameter displays the software version available for distribution to all radios in the network.

On the all stations, this parameter displays the software version ready for activation.

### USB AUTOMATIC UPGRADE

*USB Boot Upgrade*

This parameter shows the type of USB Boot upgrade defined in ‘Software Setup > USB Boot Upgrade’ on page 259.

FILE TRANSFER

*Transfer Activity*

This parameter shows the status of the transfer, ‘Idle’, ‘In Progress’ or ‘Completed’.

*Method*

This parameter shows the file transfer method. When the software distribution is in progress, this parameter will change to ‘Over the Air’ (from xx.xx.xx.xx) to show that the interface is busy and the transfer is in progress.

*File*

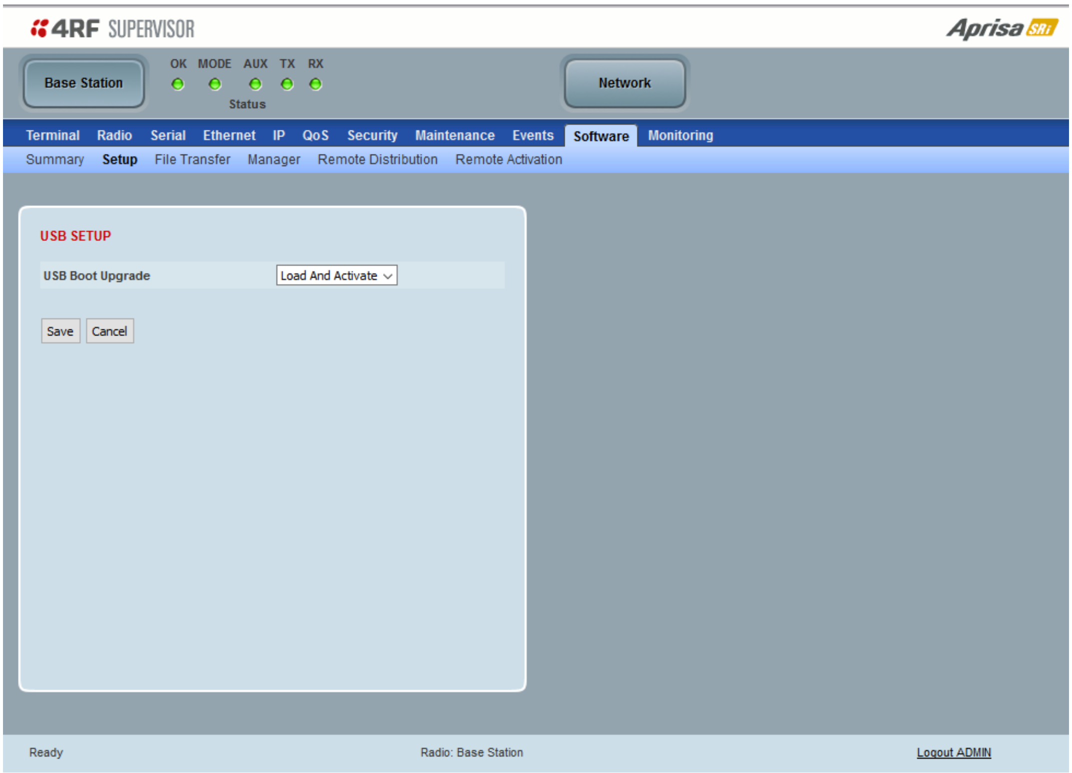
This parameter shows the software file source.

*Transfer Result*

This parameter shows the progress of the transfer.

## Software > Setup

This page provides the setup of the USB flash drive containing a Software Pack.



4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary Setup File Transfer Manager Remote Distribution Remote Activation
Save
Cancel
Ready
Radio: Base Station
Logout ADMIN

USB SETUP

USB Boot Upgrade: Load And Activate

### USB SETUP

*USB Boot Upgrade*

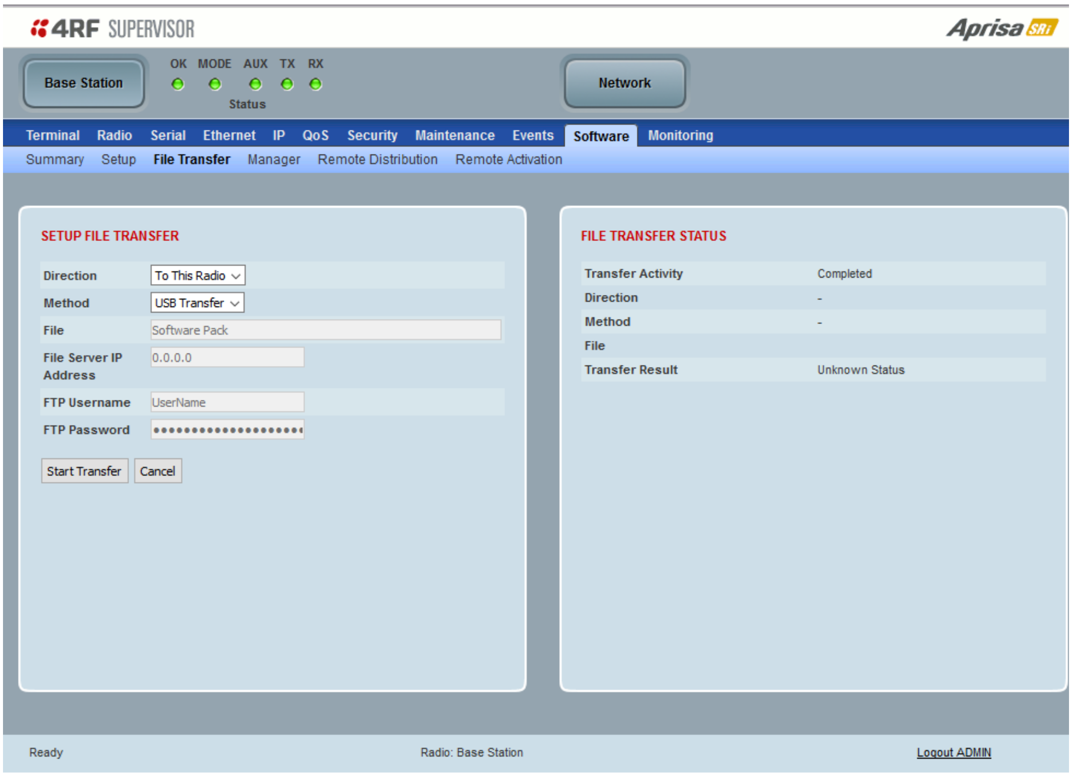
This parameter determines the action taken when the radio power cycles and finds a USB flash drive in the Host port. The default setting is ‘Load Only’.

| Option | Function |
|---|---|
| Load and Activate | New software will be uploaded from a USB flash drive in to the Aprisa SRi when the radio is power cycled and activated automatically. |
| Load Only | New software will be uploaded from a USB flash drive in to the Aprisa SRi when the radio is power cycled. The software will need to be manually activated (see ‘Software > Manager’ on page 264). |
| Disabled | Software will not be uploaded from a USB flash drive into the Aprisa SRi when the radio is power cycled. |

**Note:** This parameter must be set to ‘Disabled’ if the ‘File Transfer and Activate’ method of upgrade is used. This ‘Disabled’ setting prevents the radio from attempting another software upload when the radio boots (which it does automatically after activation).

## Software > File Transfer

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


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary Setup File Transfer Manager Remote Distribution Remote Activation
Start Transfer
Cancel
Logout ADMIN

SETUP FILE TRANSFER

| | |
|---|---|
| Direction | To This Radio |
| Method | USB Transfer |
| File | Software Pack |
| File Server IP Address | 0.0.0.0 |
| FTP Username | UserName |
| FTP Password | ••••••••••••••••••• |

FILE TRANSFER STATUS

| | |
|---|---|
| Transfer Activity | Completed |
| Direction | - |
| Method | - |
| File | |
| Transfer Result | Unknown Status |

Ready Radio: Base Station

### SETUP FILE TRANSFER

*Direction*

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

*Method*

This parameter sets the method of file transfer.

| Option | Function |
|---|---|
| USB Transfer | Transfers the software from the USB flash drive to the radio. |
| FTP | Transfers the software from an FTP server to the radio. |
| HTTP / HTTPS | Transfers the software directly from a PC software pack file to the radio. |

*File*

This parameter shows the software file source.

*FTP Username*

This parameter sets the Username to access the FTP server.

*FTP Password*

This parameter sets the Password to access the FTP server.

FILE TRANSFER STATUS

*Transfer Activity*

This parameter shows the status of the transfer, ‘Idle’, ‘In Progress’ or ‘Completed’.

*Direction*

This parameter shows the direction of file transfer. In this software version, the only choice is ‘To The Radio’.

*Method*

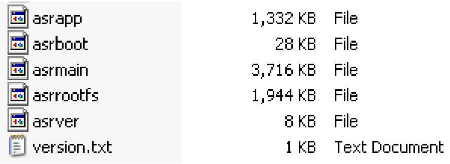
This parameter shows the file transfer method.

*File*

This parameter shows the software file source.

*Transfer Result*

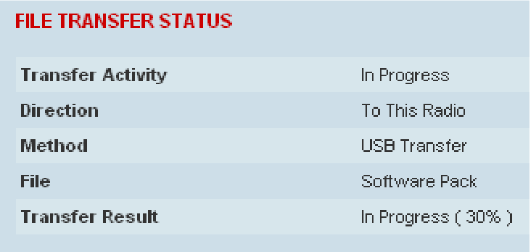
This parameter shows the progress of the transfer:

| **Transfer Result** | **Function** |
|---|---|
| Starting Transfer | The transfer has started but no data has transferred. |
| In Progress (x %) | The transfer has started and has transferred x % of the data. |
| Successful | The transfer has finished successfully. |
| File Error | The transfer has failed.<br>Possible causes of failure are:<br>• Is the source file available e.g. USB flash drive plugged in<br>• Does the file source contain the Aprisa SRi software release files;<br><br>asrapp 1,332 KB File<br>asrboot 28 KB File<br>asrmain 3,716 KB File<br>asrrootfs 1,944 KB File<br>asrver 8 KB File<br>version.txt 1 KB Text Document |

**To transfer software into the Aprisa SRi radio:**

USB Transfer Method

1. Unzip the software release files into the root directory of a USB flash drive.
2. Insert the USB flash drive into the 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 host port. If the SuperVisor ‘USB Boot Upgrade’ setting is set to ‘Disabled’ (see ‘USB Boot Upgrade’ on page 259), the USB flash drive doesn’t need to be removed as the radio won’t try to load from it.

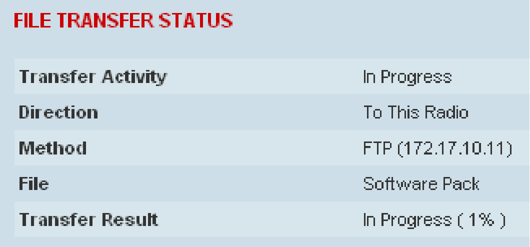
Go to Supervisor > Software > Manager and activate the Software Pack (see ‘Software > Manager’ on page 264). The radio will reboot automatically.

If the file transfer fails, check the Event History page (see ‘Events > Event History’ on page 246) for more details of the transfer.

Note: Some brands of USB flash drives may not work with 4RF radios.

FTP Method

1. Unzip the software release files into 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

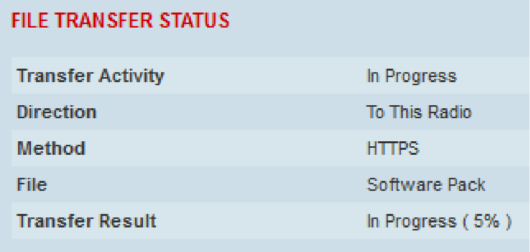
| | |
|---|---|
| Transfer Activity | In Progress |
| Direction | To This Radio |
| Method | FTP (172.17.10.11) |
| File | Software Pack |
| Transfer Result | In Progress ( 1% ) |

Go to Supervisor > Software > Manager and activate the Software Pack (see ‘Software > Manager’ on page 264). The radio will reboot automatically.

If the file transfer fails, check the Event History page (see ‘Events > Event History’ on page 246) for more details of the transfer.

HTTP / HTTPS Method

1. Unzip the software release files into a temporary directory.
2. Click on ‘Start Transfer’.
3. Browse to the *.swpack file in the temporary directory and open the file.



FILE TRANSFER STATUS

| | |
|---|---|
| Transfer Activity | In Progress |
| Direction | To This Radio |
| Method | HTTPS |
| File | Software Pack |
| Transfer Result | In Progress ( 5% ) |

Go to Supervisor > Software > Manager and activate the Software Pack (see ‘Software > Manager’ on page 264). The radio will reboot automatically.

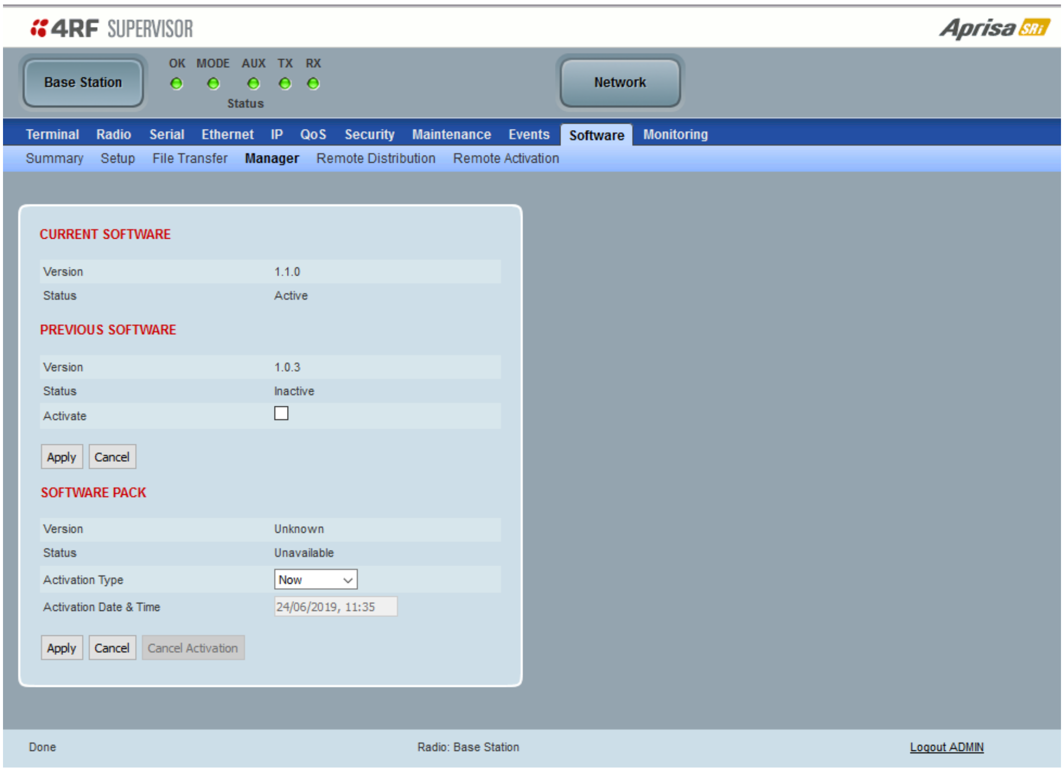
If the file transfer fails, check the Event History page (see ‘Events > Event History’ on page 246) for more details of the transfer.

## Software > Manager

This page summarises and manages the software versions available in the radio.

The manager is predominantly used to activate new software on single radios. Network activation is performed with ‘Software > Remote Activation’.

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


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary Setup File Transfer Manager Remote Distribution Remote Activation

CURRENT SOFTWARE

| | |
|---|---|
| Version | 1.1.0 |
| Status | Active |

PREVIOUS SOFTWARE

| | |
|---|---|
| Version | 1.0.3 |
| Status | Inactive |
| Activate | □ |

SOFTWARE PACK

| | |
|---|---|
| Version | Unknown |
| Status | Unavailable |
| Activation Type | Now |
| Activation Date & Time | 24/06/2019, 11:35 |

Apply Cancel Cancel Activation
Done
Radio: Base Station
Logout ADMIN

### CURRENT SOFTWARE

#### *Version*

This parameter displays the software version running on the radio.

#### *Status*

This parameter displays the status of the software version running on the radio (always active).

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 that was running on the radio prior to the current software being activated.

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

*Activate*

This parameter activates the previous software version (restores to previous version).

The Aprisa SRi will automatically reboot after activation.

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.<br>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*

This parameter activates the software pack.

The Aprisa SRi will automatically reboot after activation.

*Activation Type*

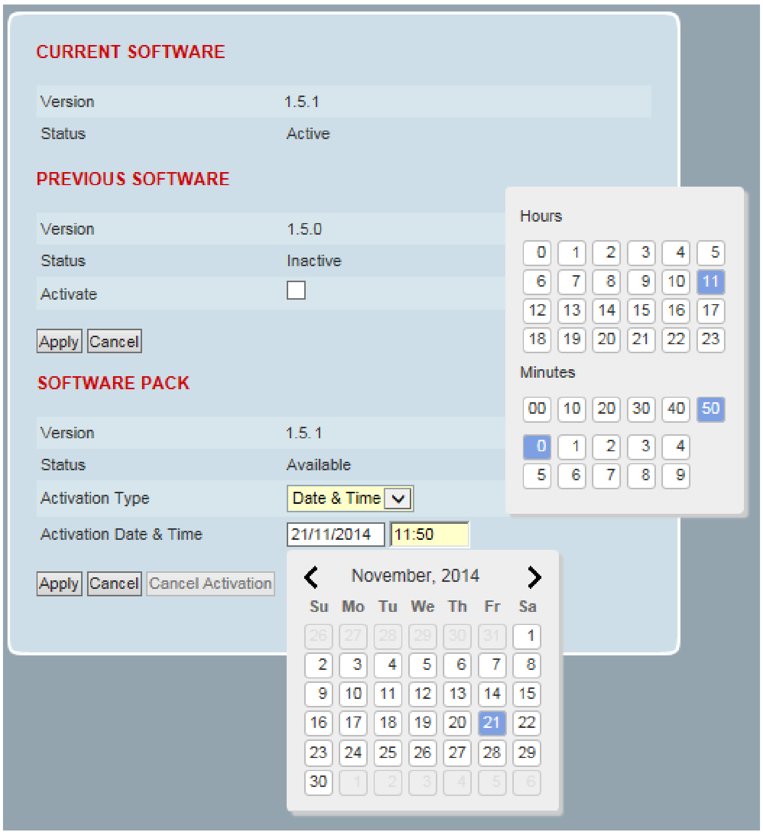
This parameter sets when the software pack activation will occur.

| 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.



CURRENT SOFTWARE

| | |
|---|---|
| Version | 1.5.1 |
| Status | Active |

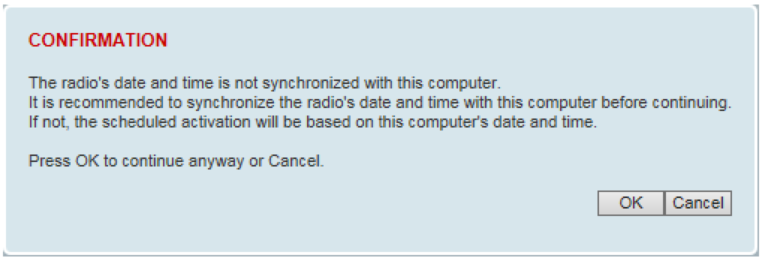
PREVIOUS SOFTWARE

| | |
|---|---|
| Version | 1.5.0 |
| Status | Inactive |
| Activate | □ |

SOFTWARE PACK

| | |
|---|---|
| Version | 1.5.1 |
| Status | Available |
| Activation Type | Date & Time |
| Activation Date & Time | 21/11/2014 11:50 |

If the network base station radio date / time is not synchronized, you will get the following popup:



CONFIRMATION

The radio's date and time is not synchronized with this computer.
It is recommended to synchronize the radio's date and time with this computer before continuing.
If not, the scheduled activation will be based on this computer's date and time.

Press OK to continue anyway or Cancel.

You can manually enter the base station radio date / time or use the Date And Time Synchronization from a SNTP server feature (see ‘Terminal > Date / Time’ on page 107).

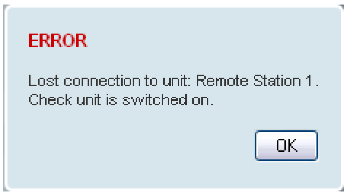
**To activate a software version:**

1. Tick the software version required to be activated (previous software or software pack).
2. Click ‘Apply’.

The page will display a Status of ‘Activating’.

Once started, activation cannot be cancelled.

When the activation is completed, the radio will reboot. This will cause the current SuperVisor session to expire.



ERROR

Lost connection to unit: Remote Station 1 .
Check unit is switched on.

3. Login to SuperVisor to check the result.

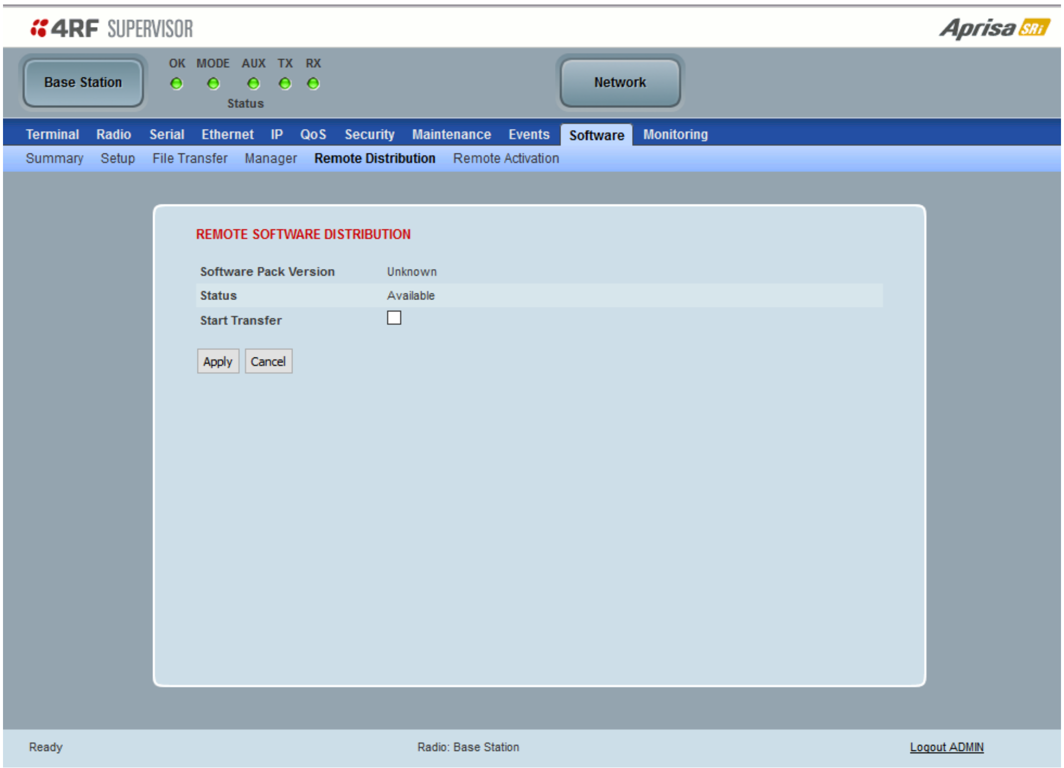
## Software > Remote Distribution

This page provides the mechanism to distribute software to all remote radios into the Aprisa SRi network (network) and then activate it.

The Software Pack that was loaded into the base station with the file transfer process (see ‘Software > File Transfer’ on page 260) can be distributed via the radio link to all remote radios.

This page is used to manage the distribution of that software pack to all remote radios on the network.

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


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Summary Setup File Transfer Manager Remote Distribution Remote Activation
Apply
Cancel
Ready
Radio: Base Station
Logout ADMIN

REMOTE SOFTWARE DISTRIBUTION

Software Pack Version Unknown

Status Available

Start Transfer □

### 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 radios in the network.

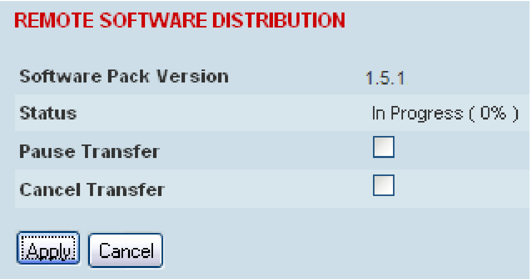
**Note:** The distribution of software to remote radios does not stop customer traffic from being transferred. However, due to the volume of traffic, the software distribution process may affect customer traffic.

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 radios:**

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 260).

1. To ensure that the Network Table is up to date, it is recommended running the node discover function (see 'Discover Nodes' on page 243).
2. Click on 'Start Transfer'.



REMOTE SOFTWARE DISTRIBUTION

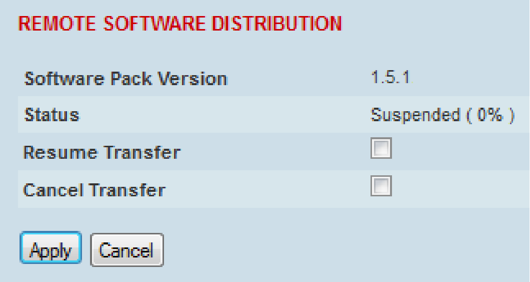
| | |
|---|---|
| Software Pack Version | 1.5.1 |
| Status | In Progress ( 0% ) |
| Pause Transfer | □ |
| Cancel Transfer | □ |

**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.

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

*Pause Transfer*

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



REMOTE SOFTWARE DISTRIBUTION

| | |
|---|---|
| Software Pack Version | 1.5.1 |
| Status | Suspended ( 0% ) |
| Resume Transfer | □ |
| Cancel Transfer | □ |

*Cancel Transfer*

This parameter when activated, cancels the distribution 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.

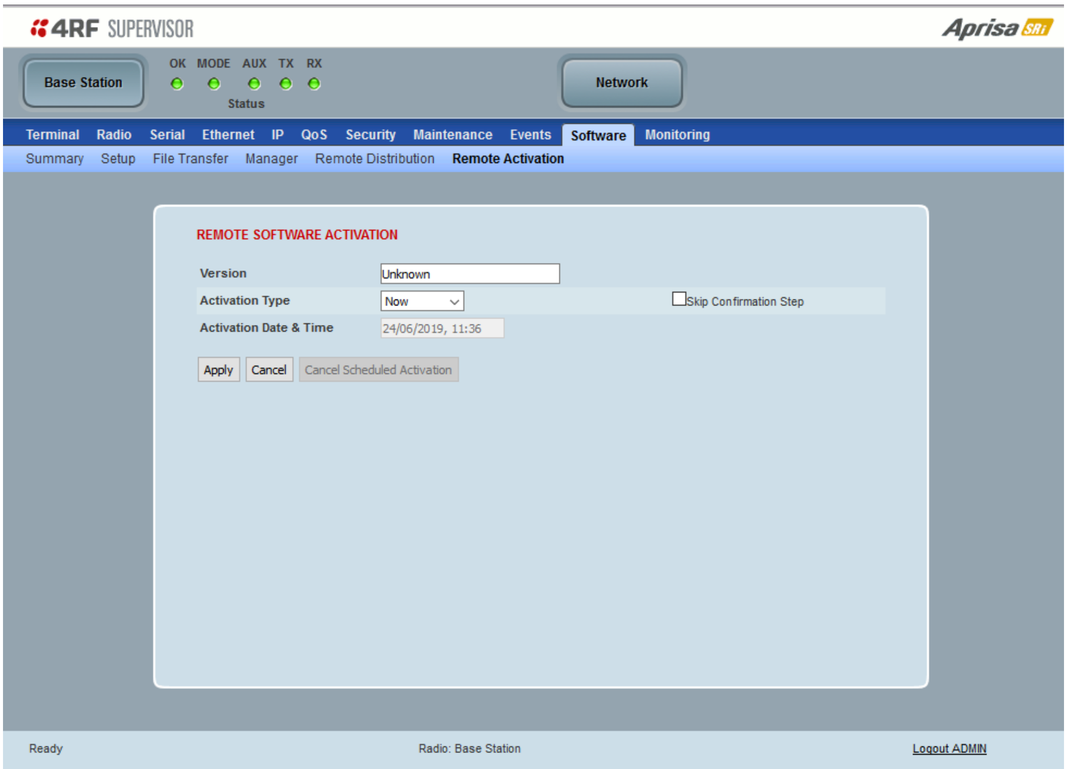
## Software > Remote Activation

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

The Software Pack was loaded into the base station with the file transfer process (see ‘Software > File Transfer’ on page 260) and was distributed via the radio link to all remote radios.

This page is used to manage the activation of that software pack on all remote radios on the network.

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



REMOTE SOFTWARE ACTIVATION

| | | |
|---|---|---|
| Version | Unknown | |
| Activation Type | Now | □ Skip Confirmation Step |
| Activation Date & Time | 24/06/2019, 11:36 | |

Ready

Radio: Base Station

### REMOTE SOFTWARE ACTIVATION

When the software pack version has been distributed to all the remote radios, the software is then activated in all the remote radios 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.

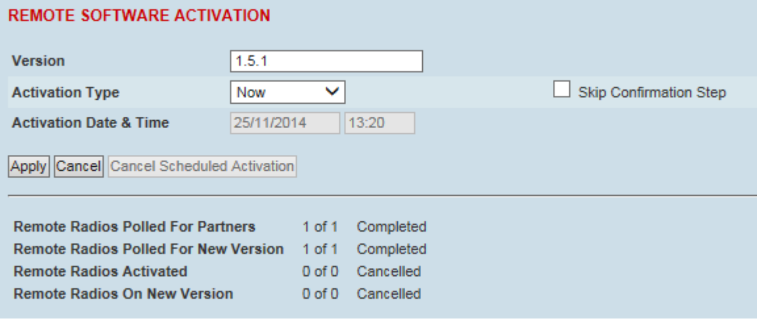
Normally, the confirmation step will require use intervention to accept the confirmation which will halt the activation process. Skipping the confirmation will enable the activation process to continue without use intervention.

**To activate software in remote radios:**

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 260) and 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).



REMOTE SOFTWARE ACTIVATION

Version: 1.5.1

Activation Type: Now

□ Skip Confirmation Step

Activation Date & Time: 25/11/2014 13:20

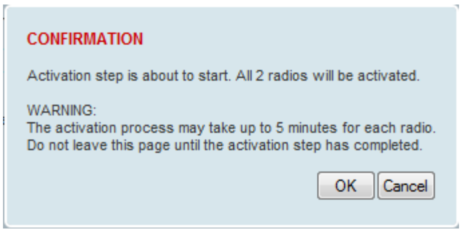
| | | |
|---|---|---|
| Remote Radios Polled For Partners | 1 of 1 | Completed |
| Remote Radios Polled For New Version | 1 of 1 | Completed |
| Remote Radios Activated | 0 of 0 | Cancelled |
| Remote Radios On New Version | 0 of 0 | Cancelled |

2. Select the Activation type.
3. Click Apply.

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

| Result | Function (X of Y) |
|---|---|
| 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.<br>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.<br>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.<br>Y is the number of radios that the activation command was executed on.<br>**Note:** When upgrading from software version 1.2.5 to 1.2.6 or later, communication to all remote radios will be lost due to a MAC protocol change. This will prevent this function from working correctly. In this case, activate the new software on the base station and run the Discover Nodes function on 'Maintenance > Advanced' page 243. |

When the activation is ready to start:



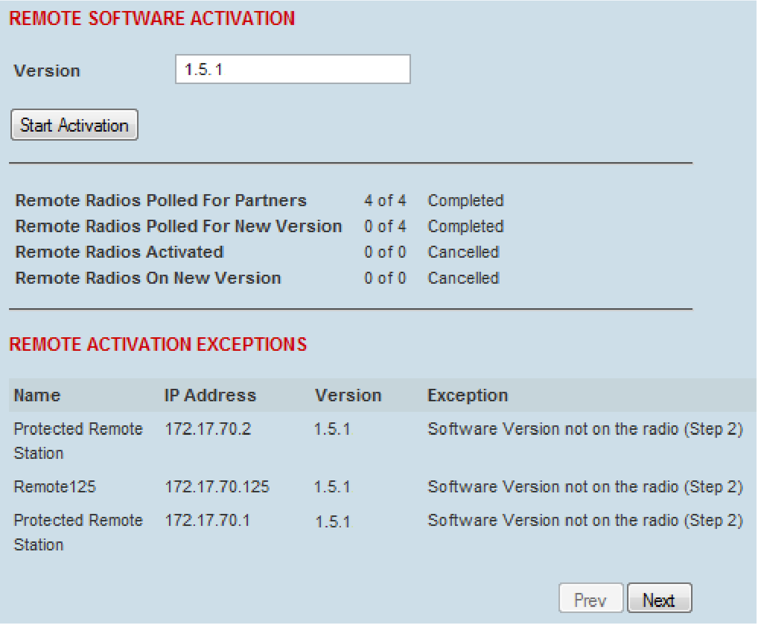
CONFIRMATION

Activation step is about to start. All 2 radios will be activated.

WARNING:
The activation process may take up to 5 minutes for each radio.
Do not leave this page until the activation step has completed.

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

The page will display the progress of the activation.



REMOTE SOFTWARE ACTIVATION

Version 1.5.1

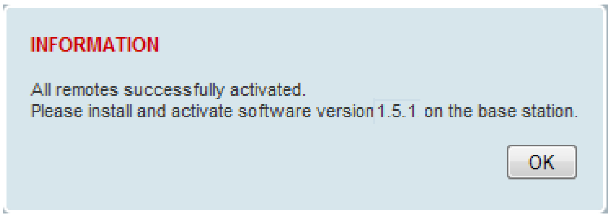
|  |  |  |
|---|---|---|
| Remote Radios Polled For Partners | 4 of 4 | Completed |
| Remote Radios Polled For New Version | 0 of 4 | Completed |
| Remote Radios Activated | 0 of 0 | Cancelled |
| Remote Radios On New Version | 0 of 0 | Cancelled |

REMOTE ACTIVATION EXCEPTIONS

| Name | IP Address | Version | Exception |
|---|---|---|---|
| Protected Remote Station | 172.17.70.2 | 1.5.1 | Software Version not on the radio (Step 2) |
| Remote125 | 172.17.70.125 | 1.5.1 | Software Version not on the radio (Step 2) |
| Protected Remote Station | 172.17.70.1 | 1.5.1 | Software Version not on the radio (Step 2) |

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 264).



INFORMATION

All remotes successfully activated.
Please install and activate software version 1.5.1 on the base station.

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

*Activation Type*

This parameter sets when the remote software activation will occur.

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

*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.

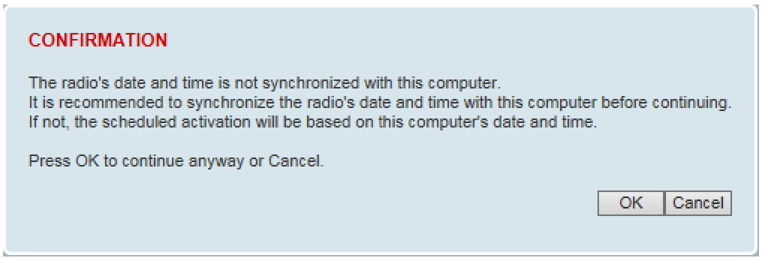
*Activation Date & Time*

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

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

When the date and time is set, the remotes will be polled to setup the scheduled activation date and time.

If the network base station radio date / time is not synchronized, you will get the following popup:



CONFIRMATION

The radio's date and time is not synchronized with this computer.
It is recommended to synchronize the radio's date and time with this computer before continuing.
If not, the scheduled activation will be based on this computer's date and time.

Press OK to continue anyway or Cancel.

You can manually enter the base station radio date / time or use the Date And Time Synchronization from a SNTP server feature (see ‘Terminal > Date / Time’ on page 107).

# Monitoring

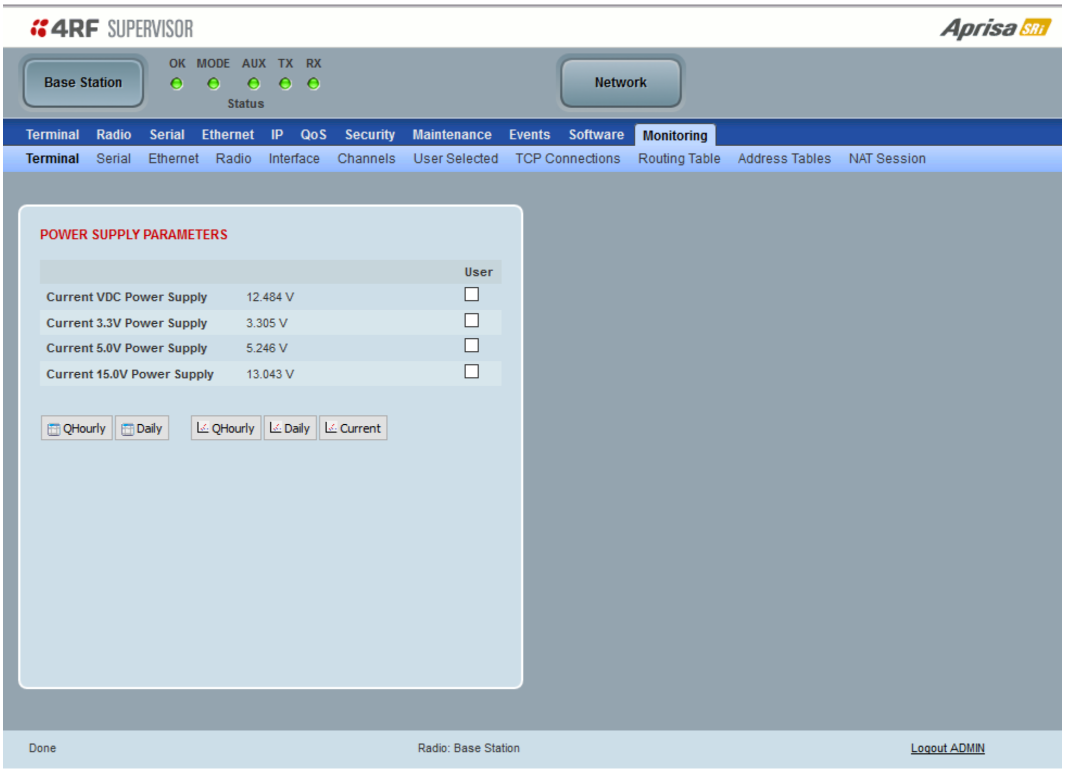
The Terminal, Serial, Ethernet, Radio and User Selected Monitored Parameter results have history log views for both Quarter Hourly and Daily.

Monitored parameter data is accumulated into 2 sets:

- 15 minutes of data, for 96 readings for the last 24 hours
- 24 hours of data, for 31 readings for the last 31 days.

## Monitoring > Terminal

This page displays the current radio internal and external input source radio power supply voltage diagnostic parameters.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Terminal Serial Ethernet Radio Interface Channels User Selected TCP Connections Routing Table Address Tables NAT Session
QHourly Daily QHourly Daily Current
Done
Radio: Base Station
Logout ADMIN

POWER SUPPLY PARAMETERS

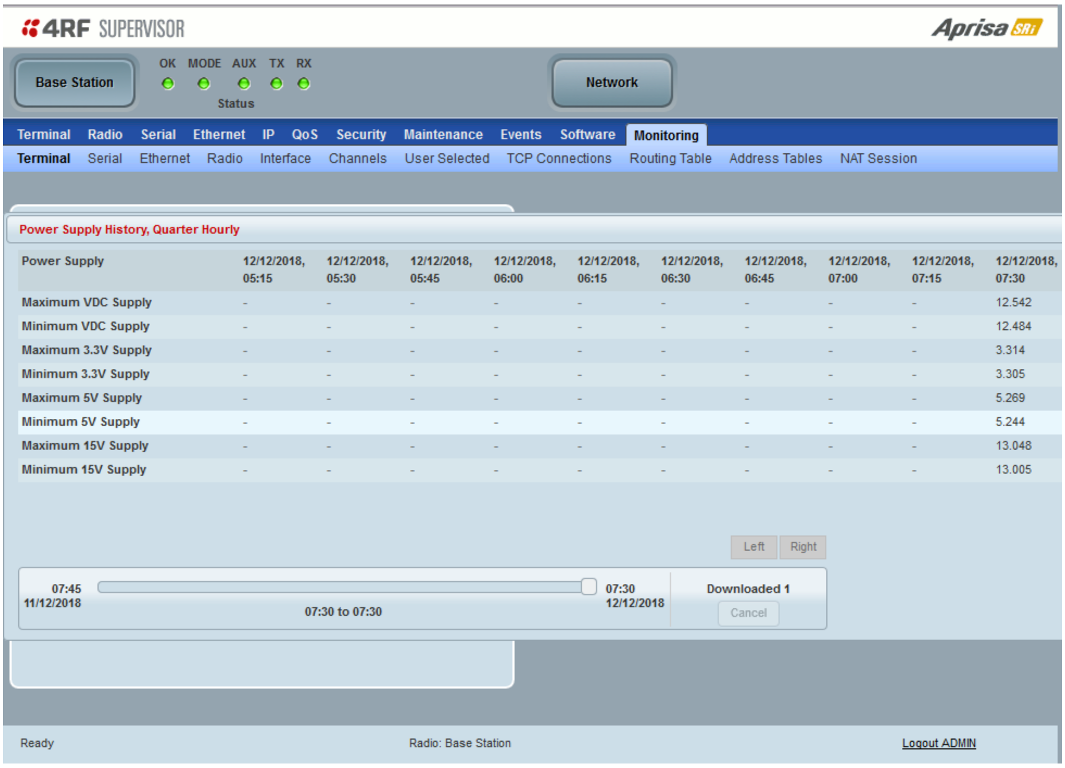
| | | User |
|---|---|---|
| Current VDC Power Supply | 12.484 V | □ |
| Current 3.3V Power Supply | 3.305 V | □ |
| Current 5.0V Power Supply | 5.246 V | □ |
| Current 15.0V Power Supply | 13.043 V | □ |

## POWER SUPPLY PARAMETERS

| Monitored Parameter | Function | Normal Operating Limits |
|---|---|---|
| Current VDC Power Supply | Parameter to show the current power supply input voltage | 10 to 30 VDC |
| Current 3.3 Volts Power Supply | Parameter to show the current 3.3 volt power rail voltage | 3.1 to 3.5 VDC |
| Current 5.0 Volts Power Supply | Parameter to show the current that the current 5.0 volt power rail voltage | 4.7 to 5.5 VDC |
| Current 7.2 Volts Power Supply | Parameter to show the current that the current 7.2 volt power rail voltage | 6.9 to 7.5 VDC |
| Current 15 Volts Power Supply | Parameter to show the current that the current 15 volt power rail voltage.<br>The 15 volt power supply is used to power the transmitter driver and power amplifier. | 12.7 to 13.5 VDC |

### Controls

The History Quarter Hourly button presents a log of results every quarter of an hour.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Terminal Serial Ethernet Radio Interface Channels User Selected TCP Connections Routing Table Address Tables NAT Session
Left
Right
Cancel

Power Supply History, Quarter Hourly

| Power Supply | 12/12/2018, 05:15 | 12/12/2018, 05:30 | 12/12/2018, 05:45 | 12/12/2018, 06:00 | 12/12/2018, 06:15 | 12/12/2018, 06:30 | 12/12/2018, 06:45 | 12/12/2018, 07:00 | 12/12/2018, 07:15 | 12/12/2018, 07:30 |
|---|---|---|---|---|---|---|---|---|---|---|
| Maximum VDC Supply | - | - | - | - | - | - | - | - | - | 12.542 |
| Minimum VDC Supply | - | - | - | - | - | - | - | - | - | 12.484 |
| Maximum 3.3V Supply | - | - | - | - | - | - | - | - | - | 3.314 |
| Minimum 3.3V Supply | - | - | - | - | - | - | - | - | - | 3.305 |
| Maximum 5V Supply | - | - | - | - | - | - | - | - | - | 5.269 |
| Minimum 5V Supply | - | - | - | - | - | - | - | - | - | 5.244 |
| Maximum 15V Supply | - | - | - | - | - | - | - | - | - | 13.048 |
| Minimum 15V Supply | - | - | - | - | - | - | - | - | - | 13.005 |

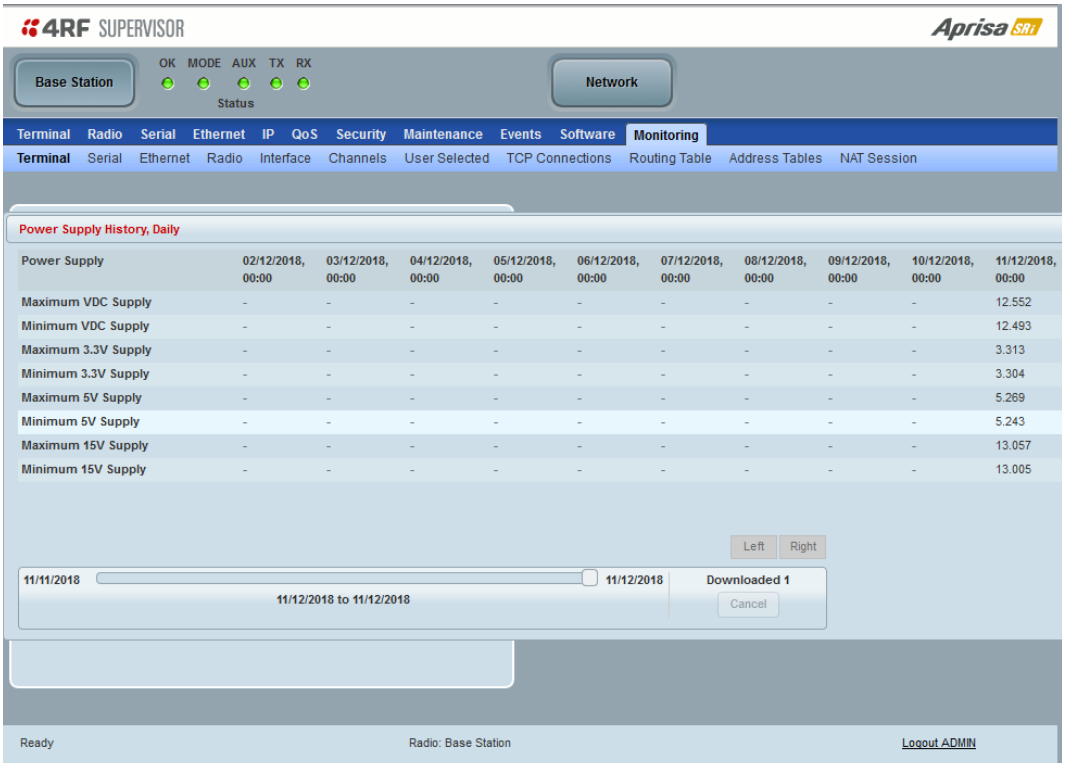
07:45 11/12/2018 — 07:30 12/12/2018

07:30 to 07:30

Downloaded 1

Ready    Radio: Base Station    Logout ADMIN

The History Daily button presents a log of results every day.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Terminal Serial Ethernet Radio Interface Channels User Selected TCP Connections Routing Table Address Tables NAT Session
Left
Right
Cancel

Power Supply History, Daily

| Power Supply | 02/12/2018, 00:00 | 03/12/2018, 00:00 | 04/12/2018, 00:00 | 05/12/2018, 00:00 | 06/12/2018, 00:00 | 07/12/2018, 00:00 | 08/12/2018, 00:00 | 09/12/2018, 00:00 | 10/12/2018, 00:00 | 11/12/2018, 00:00 |
|---|---|---|---|---|---|---|---|---|---|---|
| Maximum VDC Supply | - | - | - | - | - | - | - | - | - | 12.552 |
| Minimum VDC Supply | - | - | - | - | - | - | - | - | - | 12.493 |
| Maximum 3.3V Supply | - | - | - | - | - | - | - | - | - | 3.313 |
| Minimum 3.3V Supply | - | - | - | - | - | - | - | - | - | 3.304 |
| Maximum 5V Supply | - | - | - | - | - | - | - | - | - | 5.269 |
| Minimum 5V Supply | - | - | - | - | - | - | - | - | - | 5.243 |
| Maximum 15V Supply | - | - | - | - | - | - | - | - | - | 13.057 |
| Minimum 15V Supply | - | - | - | - | - | - | - | - | - | 13.005 |

11/11/2018 — 11/12/2018

11/12/2018 to 11/12/2018

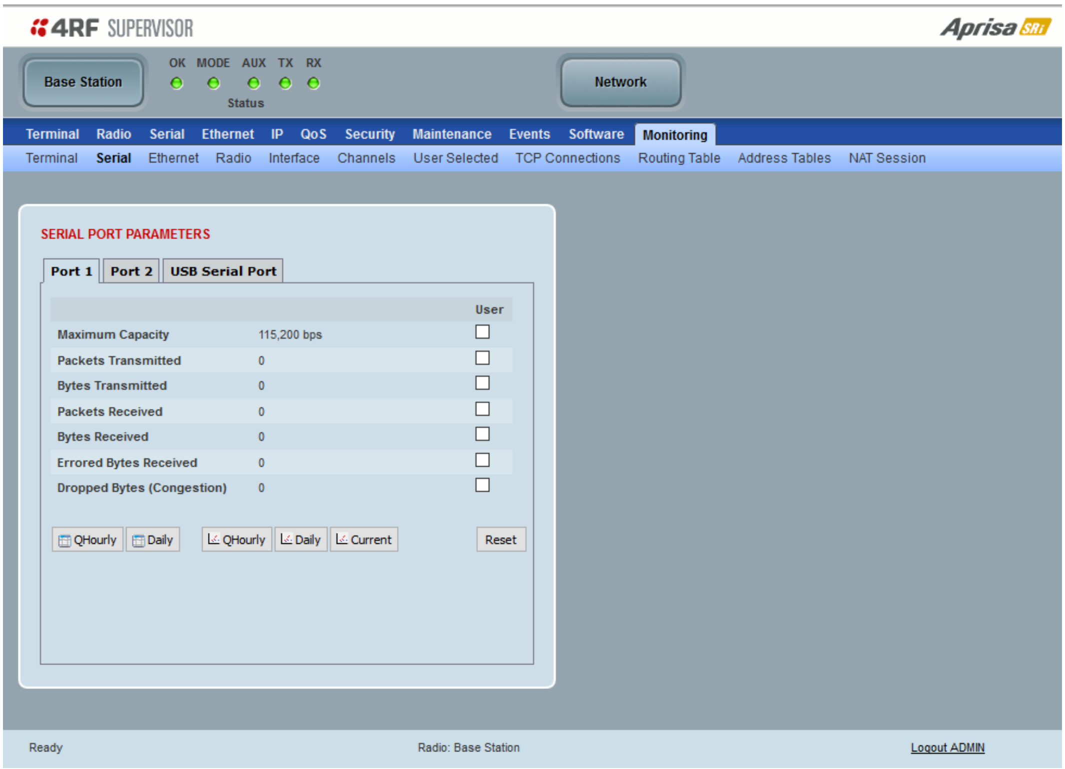
Downloaded 1

Ready    Radio: Base Station    Logout ADMIN

## Monitoring > Serial

This page displays the current radio performance monitoring parameters per serial port in packet and byte level granularity, for serial port high level statistics and troubleshooting.

The results shown are since the page was opened and are updated automatically every 12 seconds.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Terminal Serial Ethernet Radio Interface Channels User Selected TCP Connections Routing Table Address Tables NAT Session
SERIAL PORT PARAMETERS
Port 1 Port 2 USB Serial Port
QHourly Daily QHourly Daily Current Reset
Ready
Radio: Base Station
Logout ADMIN

| | | User |
|---|---|---|
| Maximum Capacity | 115,200 bps | □ |
| Packets Transmitted | 0 | □ |
| Bytes Transmitted | 0 | □ |
| Packets Received | 0 | □ |
| Bytes Received | 0 | □ |
| Errored Bytes Received | 0 | □ |
| Dropped Bytes (Congestion) | 0 | □ |

## SERIAL PORT PARAMETERS

### All Serial Ports

| Monitored Parameter | Function | Normal Operating Limits |
|---|---|---|
| Maximum Capacity | Parameter to show the maximum serial data rate of the serial port | Equal to the serial port baud rate setting |
| Packets Transmitted | Parameter to show the number of packets transmitted to the customer from the serial port | |
| Packets Received | Parameter to show the number of packets received from the customer into the serial port | |
| Bytes Received | Parameter to show the number of bytes received from the customer into the serial port | |
| Errored Bytes Received | Parameter to show the number of bytes received from the customer into the serial port that have errors | |
| Dropped Bytes (Congestion) | Parameter to show the number of bytes received from the customer into the serial port that are dropped due to over the air congestion | |

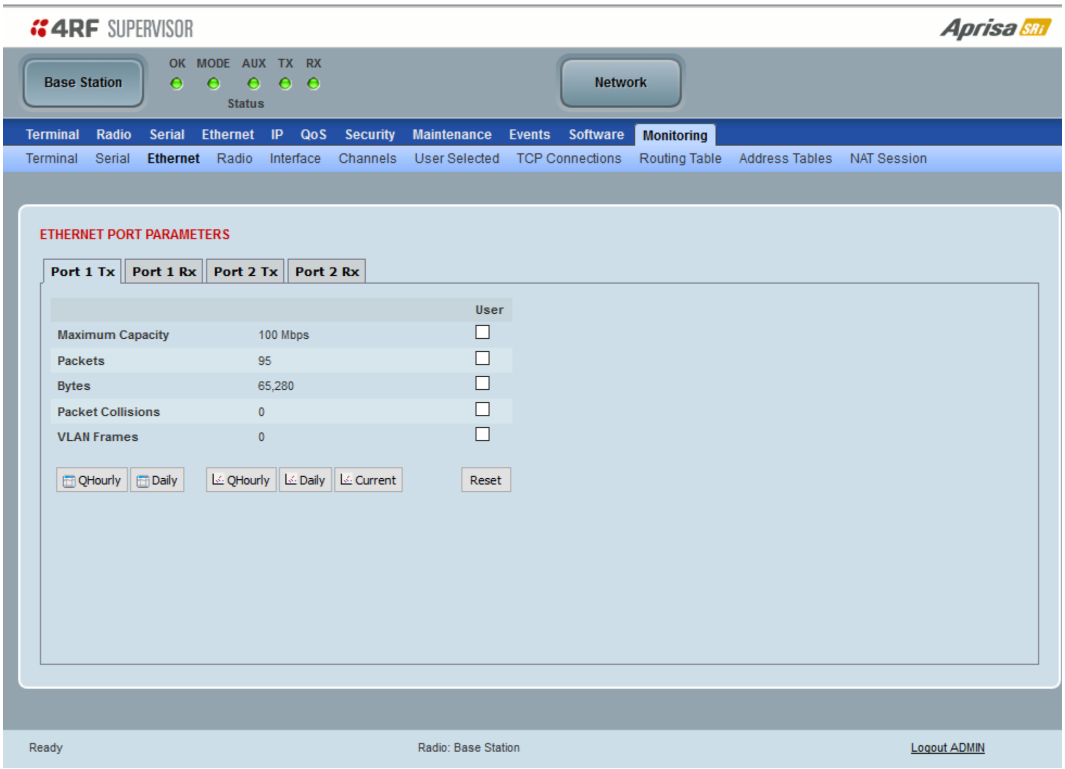
### Controls

The Reset button clears the current results.

## Monitoring > Ethernet

This page displays the current radio performance monitoring parameters per Ethernet port transmission (TX) out of the radio in packet and byte level granularity, for Ethernet port high level statistics and troubleshooting.

The results shown are since the page was opened and are updated automatically every 12 seconds.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Terminal Serial Ethernet Radio Interface Channels User Selected TCP Connections Routing Table Address Tables NAT Session
Port 1 Tx Port 1 Rx Port 2 Tx Port 2 Rx
QHourly Daily QHourly Daily Current Reset
Ready
Radio: Base Station
Logout ADMIN

ETHERNET PORT PARAMETERS

| | | User |
|---|---|---|
| Maximum Capacity | 100 Mbps | □ |
| Packets | 95 | □ |
| Bytes | 65,280 | □ |
| Packet Collisions | 0 | □ |
| VLAN Frames | 0 | □ |

## ETHERNET PORT PARAMETERS

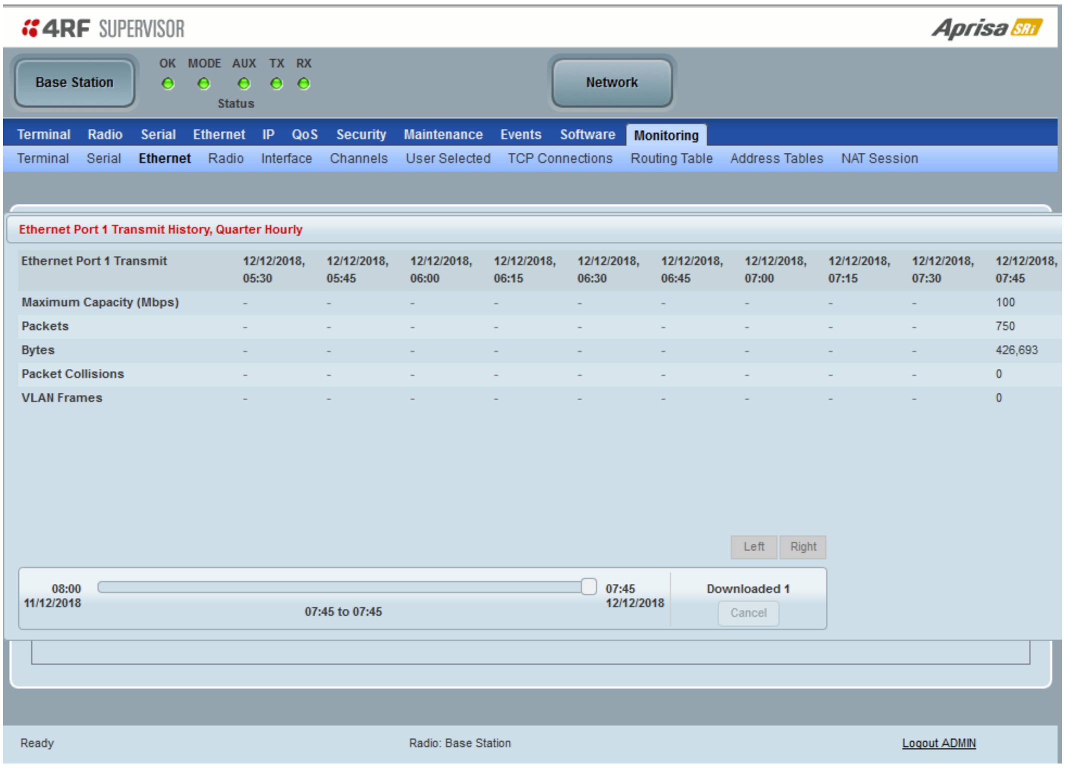
### All Ethernet Ports TX

| Monitored Parameter | Function | Normal Operating Limits |
|---|---|---|
| Maximum Capacity | Parameter to show the maximum Ethernet data rate of the Ethernet port | Equal to the Ethernet port speed setting |
| Packets | Parameter to show the number of packets transmitted to the customer from the Ethernet port | |
| Bytes | Parameter to show the number of bytes transmitted to the customer from the Ethernet port | |
| Packet Collisions | Parameter to show the number of packet collisions on the data transmitted to the customer from the Ethernet port on a shared LAN | |
| VLAN Frames | Parameter to show the number of VLAN tagged frames transmitted to the customer from the Ethernet port | |

### Controls

The Reset button clears the current results.

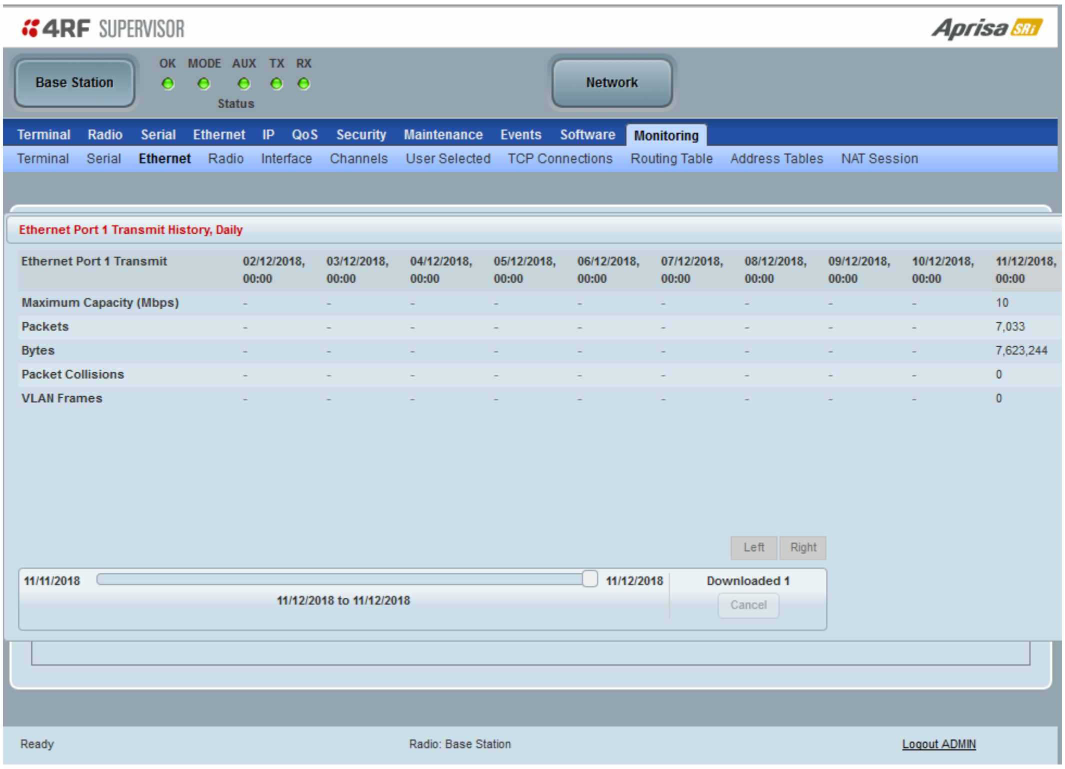
The History Quarter Hourly button presents a log of results every quarter of an hour.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Terminal Serial Ethernet Radio Interface Channels User Selected TCP Connections Routing Table Address Tables NAT Session
Left
Right
08:00
11/12/2018
07:45 to 07:45
07:45
12/12/2018
Downloaded 1
Cancel
Ready
Radio: Base Station
Logout ADMIN

Ethernet Port 1 Transmit History, Quarter Hourly

| Ethernet Port 1 Transmit | 12/12/2018, 05:30 | 12/12/2018, 05:45 | 12/12/2018, 06:00 | 12/12/2018, 06:15 | 12/12/2018, 06:30 | 12/12/2018, 06:45 | 12/12/2018, 07:00 | 12/12/2018, 07:15 | 12/12/2018, 07:30 | 12/12/2018, 07:45 |
|---|---|---|---|---|---|---|---|---|---|---|
| Maximum Capacity (Mbps) | - | - | - | - | - | - | - | - | - | 100 |
| Packets | - | - | - | - | - | - | - | - | - | 750 |
| Bytes | - | - | - | - | - | - | - | - | - | 426,693 |
| Packet Collisions | - | - | - | - | - | - | - | - | - | 0 |
| VLAN Frames | - | - | - | - | - | - | - | - | - | 0 |

The History Daily button presents a log of results every day.

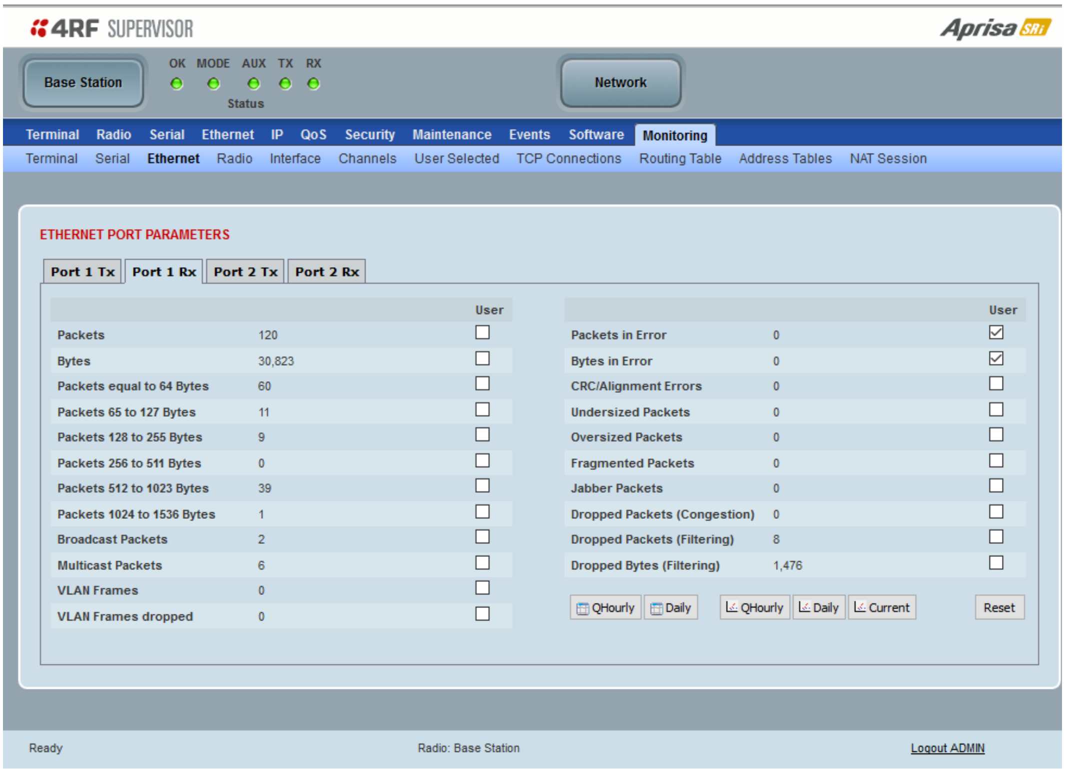

4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Terminal Serial Ethernet Radio Interface Channels User Selected TCP Connections Routing Table Address Tables NAT Session
Left
Right
11/11/2018
11/12/2018 to 11/12/2018
11/12/2018
Downloaded 1
Cancel
Ready
Radio: Base Station
Logout ADMIN

Ethernet Port 1 Transmit History, Daily

| Ethernet Port 1 Transmit | 02/12/2018, 00:00 | 03/12/2018, 00:00 | 04/12/2018, 00:00 | 05/12/2018, 00:00 | 06/12/2018, 00:00 | 07/12/2018, 00:00 | 08/12/2018, 00:00 | 09/12/2018, 00:00 | 10/12/2018, 00:00 | 11/12/2018, 00:00 |
|---|---|---|---|---|---|---|---|---|---|---|
| Maximum Capacity (Mbps) | - | - | - | - | - | - | - | - | - | 10 |
| Packets | - | - | - | - | - | - | - | - | - | 7,033 |
| Bytes | - | - | - | - | - | - | - | - | - | 7,623,244 |
| Packet Collisions | - | - | - | - | - | - | - | - | - | 0 |
| VLAN Frames | - | - | - | - | - | - | - | - | - | 0 |

This page displays the current radio performance monitoring parameters per Ethernet port received (RX) data in packet and byte level granularity, for Ethernet port high level statistics and troubleshooting.

The results shown are since the page was opened and are updated automatically every 12 seconds.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Terminal Serial Ethernet Radio Interface Channels User Selected TCP Connections Routing Table Address Tables NAT Session
Port 1 Tx
Port 1 Rx
Port 2 Tx
Port 2 Rx
QHourly
Daily
QHourly
Daily
Current
Reset
Ready
Radio: Base Station
Logout ADMIN

ETHERNET PORT PARAMETERS

| | | User | | | User |
|---|---|---|---|---|---|
| Packets | 120 | □ | Packets in Error | 0 | ☑ |
| Bytes | 30,823 | □ | Bytes in Error | 0 | ☑ |
| Packets equal to 64 Bytes | 60 | □ | CRC/Alignment Errors | 0 | □ |
| Packets 65 to 127 Bytes | 11 | □ | Undersized Packets | 0 | □ |
| Packets 128 to 255 Bytes | 9 | □ | Oversized Packets | 0 | □ |
| Packets 256 to 511 Bytes | 0 | □ | Fragmented Packets | 0 | □ |
| Packets 512 to 1023 Bytes | 39 | □ | Jabber Packets | 0 | □ |
| Packets 1024 to 1536 Bytes | 1 | □ | Dropped Packets (Congestion) | 0 | □ |
| Broadcast Packets | 2 | □ | Dropped Packets (Filtering) | 8 | □ |
| Multicast Packets | 6 | □ | Dropped Bytes (Filtering) | 1,476 | □ |
| VLAN Frames | 0 | □ | | | |
| VLAN Frames dropped | 0 | □ | | | |

## ETHERNET PORT PARAMETERS

### All Ethernet Ports RX

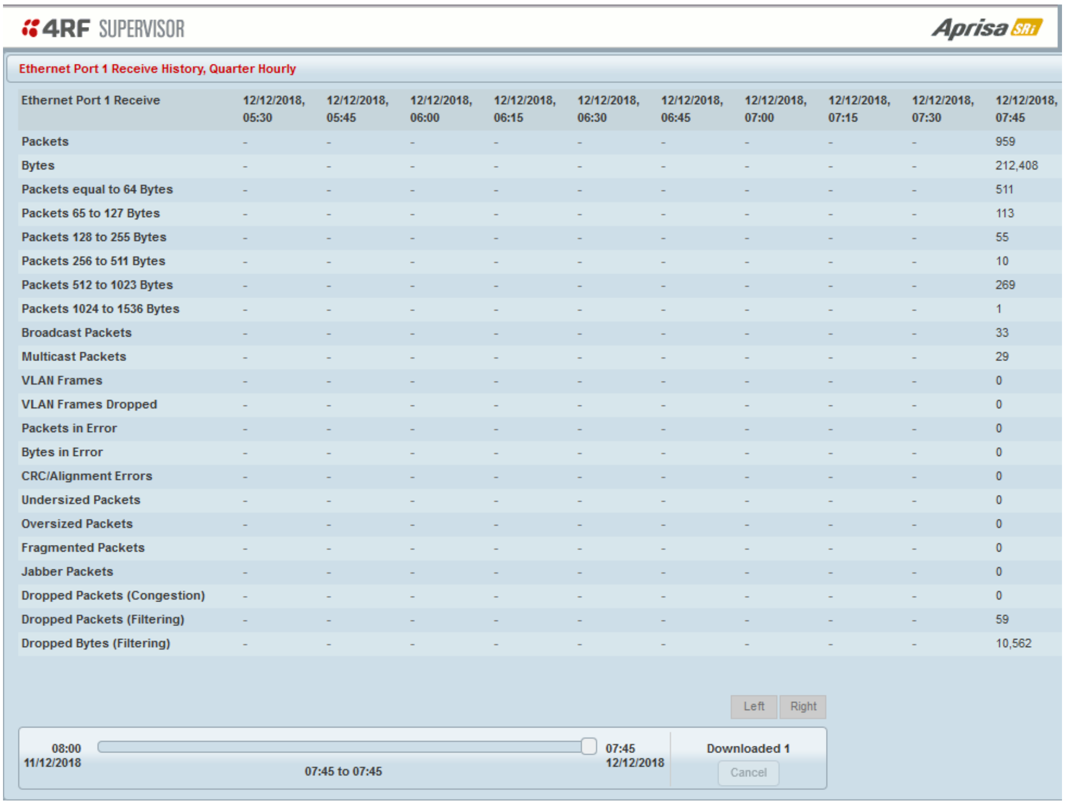
| Monitored Parameter | Function |
|---|---|
| Packets | Parameter to show the number of packets received by the customer from the Ethernet port (including broadcasts, multicasts, unicasts, FCS/CRC error, alignment error, undersize, jabber, oversize, and fragments) |
| Bytes | Parameter to show the number of bytes received by the customer from the Ethernet port (including broadcasts, multicasts, unicasts, FCS/CRC error, alignment error, undersize, jabber, oversize, and fragments and excluding IFG framing bytes/bits) |
| Packets equal to 64 bytes | Parameter to show the number of packets received from the customer into the Ethernet port that are equal to 64 bytes (including broadcasts, multicasts, unicasts, FCS/CRC error, alignment error, undersize, jabber, oversize, and fragments) |
| Packets 65 to 127 bytes | Parameter to show the number of packets received from the customer into the Ethernet port that are between 65 and 127 bytes (including broadcasts, multicasts, unicasts, FCS/CRC error, alignment error, undersize, jabber, oversize, and fragments) |
| Packets 128 to 255 bytes | Parameter to show the number of packets received from the customer into the Ethernet port that are between 128 and 255 bytes (including broadcasts, multicasts, unicasts, FCS/CRC error, alignment error, undersize, jabber, oversize, and fragments) |
| Packets 256 to 511 bytes | Parameter to show the number of packets received from the customer into the Ethernet port that are between 256 and 511 bytes (including broadcasts, multicasts, unicasts, FCS/CRC error, alignment error, undersize, jabber, oversize, and fragments) |
| Packets 512 to 1023 bytes | Parameter to show the number of packets received from the customer into the Ethernet port that are between 512 and 1023 bytes (including broadcasts, multicasts, unicasts, FCS/CRC error, alignment error, undersize, jabber, oversize, and fragments) |
| Packets 1024 to 1536 bytes | Parameter to show the number of packets received from the customer into the Ethernet port that are between 1024 and 1536 bytes (including broadcasts, multicasts, unicasts, FCS/CRC error, alignment error, undersize, jabber, oversize, and fragments) |

| Monitored Parameter | Function |
|---|---|
| Broadcast Packets | Parameter to show the number of broadcast packets received from the customer into the Ethernet port. Broadcast packets are good packets received that were directed to the broadcast address. Note that this does not include multicast packets. |
| Multicast Packets | Parameter to show the number of multicast packets received from the customer into the Ethernet port. Multicast packets are packets that were directed to a multicast address. Note that this number does not include packets directed to the broadcast address. |
| VLAN Frames | Parameter to show the number of VLAN tagged frames received from the customer into the Ethernet port, including filtering, congestion but excludes VLAN dropped packets |
| VLAN Frames Dropped | Parameter to show the number of VLAN tagged frames received from the customer into the Ethernet port that were dropped due to filtered VLAN frames (filtering configuration in VLAN configuration). L3 filtered packets, bad packets or congestion dropped packets are not counted in this parameter. |
| Packet In Error | Parameter to show the number of errored packets received from the customer into the Ethernet port caused by CRC errors, FCS Errors, alignment errors, oversized packets, undersized packets, fragmented packets and jabber packets |
| Bytes In Error | Parameter to show the number of errored bytes received from the customer into the Ethernet port |
| CRC / Alignment Error | Parameter to show the number of CRC / alignment errors received from the customer into the Ethernet port. CRC / alignment errors are defined as frames that had a length excluding framing bits, but including FCS octets of between 64 and 1518 octets, inclusive, but had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets. |
| Undersized Packets | Parameter to show the number of undersized packets received from the customer into the Ethernet port. Undersized packets are less than 64 octets long excluding framing bits, but including FCS octets. |
| Oversized Packets | Parameter to show the number of oversized packets received from the customer into the Ethernet port. Oversized packets are longer than 1518 octets excluding framing bits, but including FCS octets. |
| Fragmented Packets | Parameter to show the number of fragmented packets received from the customer into the Ethernet port. Fragmented packets have either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS. |
| Jabber Packets | Parameter to show the number of jabber packets received from the customer into the Ethernet port |
| Dropped Packets (congestion) | Parameter to show the number of dropped packets received from the customer into the Ethernet port due to congestion |
| Dropped Packets (filtering) | Parameter to show the number of dropped packets received from the customer into the Ethernet port caused by packet L2 / L3 filtering |
| Dropped Bytes (filtering) | Parameter to show the number of dropped bytes received from the customer into the Ethernet port caused by packet L2 / L3 filtering |

## Controls

The Reset button clears the current results.

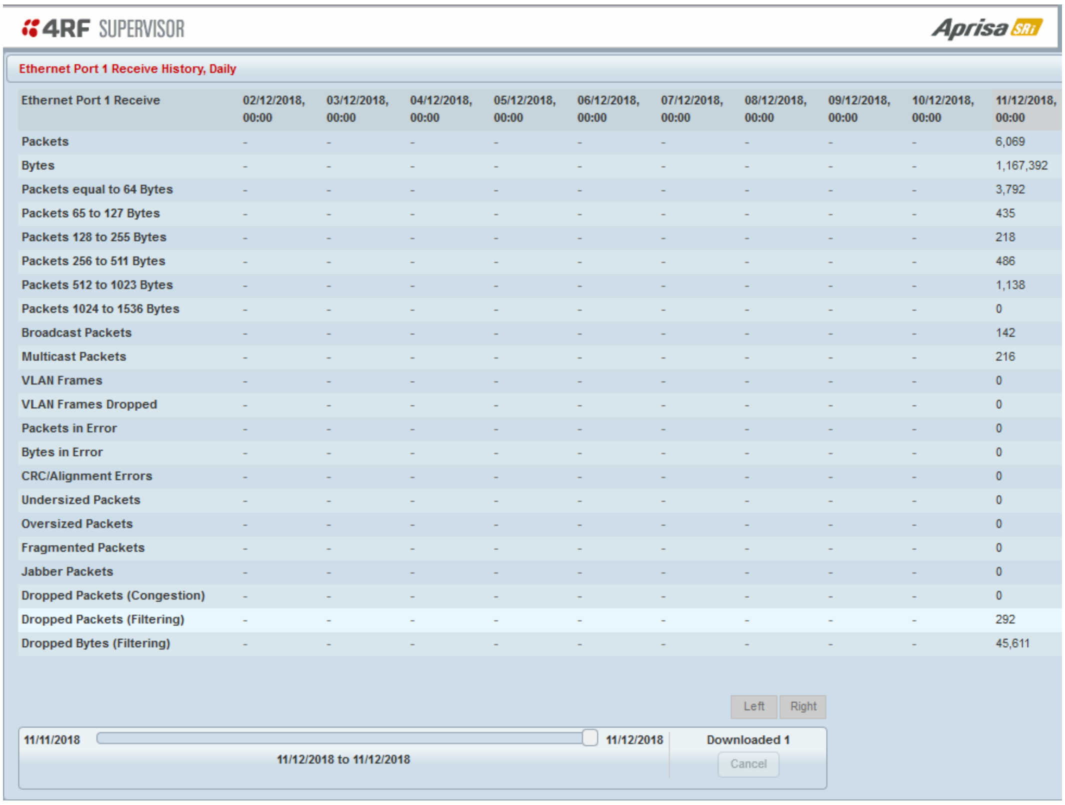
The History Quarter Hourly button presents a log of results every quarter of an hour.



Ethernet Port 1 Receive History, Quarter Hourly

| Ethernet Port 1 Receive | 12/12/2018, 05:30 | 12/12/2018, 05:45 | 12/12/2018, 06:00 | 12/12/2018, 06:15 | 12/12/2018, 06:30 | 12/12/2018, 06:45 | 12/12/2018, 07:00 | 12/12/2018, 07:15 | 12/12/2018, 07:30 | 12/12/2018, 07:45 |
|---|---|---|---|---|---|---|---|---|---|---|
| Packets | - | - | - | - | - | - | - | - | - | 959 |
| Bytes | - | - | - | - | - | - | - | - | - | 212,408 |
| Packets equal to 64 Bytes | - | - | - | - | - | - | - | - | - | 511 |
| Packets 65 to 127 Bytes | - | - | - | - | - | - | - | - | - | 113 |
| Packets 128 to 255 Bytes | - | - | - | - | - | - | - | - | - | 55 |
| Packets 256 to 511 Bytes | - | - | - | - | - | - | - | - | - | 10 |
| Packets 512 to 1023 Bytes | - | - | - | - | - | - | - | - | - | 269 |
| Packets 1024 to 1536 Bytes | - | - | - | - | - | - | - | - | - | 1 |
| Broadcast Packets | - | - | - | - | - | - | - | - | - | 33 |
| Multicast Packets | - | - | - | - | - | - | - | - | - | 29 |
| VLAN Frames | - | - | - | - | - | - | - | - | - | 0 |
| VLAN Frames Dropped | - | - | - | - | - | - | - | - | - | 0 |
| Packets in Error | - | - | - | - | - | - | - | - | - | 0 |
| Bytes in Error | - | - | - | - | - | - | - | - | - | 0 |
| CRC/Alignment Errors | - | - | - | - | - | - | - | - | - | 0 |
| Undersized Packets | - | - | - | - | - | - | - | - | - | 0 |
| Oversized Packets | - | - | - | - | - | - | - | - | - | 0 |
| Fragmented Packets | - | - | - | - | - | - | - | - | - | 0 |
| Jabber Packets | - | - | - | - | - | - | - | - | - | 0 |
| Dropped Packets (Congestion) | - | - | - | - | - | - | - | - | - | 0 |
| Dropped Packets (Filtering) | - | - | - | - | - | - | - | - | - | 59 |
| Dropped Bytes (Filtering) | - | - | - | - | - | - | - | - | - | 10,562 |

The History Daily button presents a log of results every day.



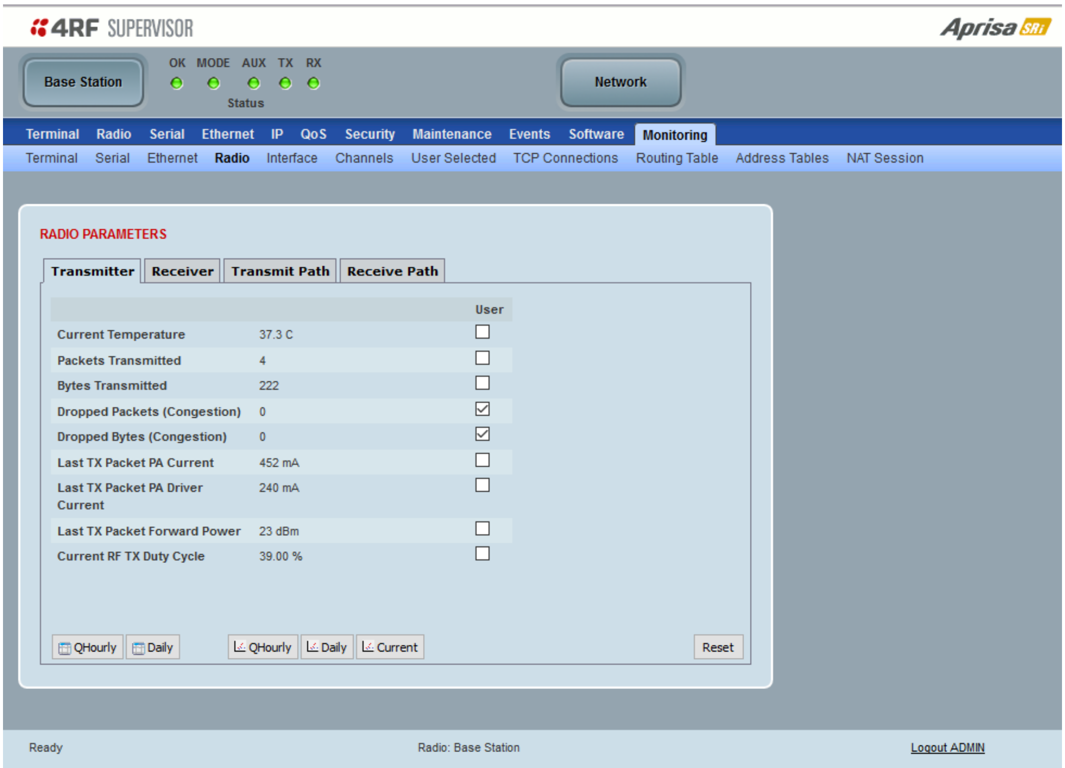
Ethernet Port 1 Receive History, Daily

| Ethernet Port 1 Receive | 02/12/2018, 00:00 | 03/12/2018, 00:00 | 04/12/2018, 00:00 | 05/12/2018, 00:00 | 06/12/2018, 00:00 | 07/12/2018, 00:00 | 08/12/2018, 00:00 | 09/12/2018, 00:00 | 10/12/2018, 00:00 | 11/12/2018, 00:00 |
|---|---|---|---|---|---|---|---|---|---|---|
| Packets | - | - | - | - | - | - | - | - | - | 6,069 |
| Bytes | - | - | - | - | - | - | - | - | - | 1,167,392 |
| Packets equal to 64 Bytes | - | - | - | - | - | - | - | - | - | 3,792 |
| Packets 65 to 127 Bytes | - | - | - | - | - | - | - | - | - | 435 |
| Packets 128 to 255 Bytes | - | - | - | - | - | - | - | - | - | 218 |
| Packets 256 to 511 Bytes | - | - | - | - | - | - | - | - | - | 486 |
| Packets 512 to 1023 Bytes | - | - | - | - | - | - | - | - | - | 1,138 |
| Packets 1024 to 1536 Bytes | - | - | - | - | - | - | - | - | - | 0 |
| Broadcast Packets | - | - | - | - | - | - | - | - | - | 142 |
| Multicast Packets | - | - | - | - | - | - | - | - | - | 216 |
| VLAN Frames | - | - | - | - | - | - | - | - | - | 0 |
| VLAN Frames Dropped | - | - | - | - | - | - | - | - | - | 0 |
| Packets in Error | - | - | - | - | - | - | - | - | - | 0 |
| Bytes in Error | - | - | - | - | - | - | - | - | - | 0 |
| CRC/Alignment Errors | - | - | - | - | - | - | - | - | - | 0 |
| Undersized Packets | - | - | - | - | - | - | - | - | - | 0 |
| Oversized Packets | - | - | - | - | - | - | - | - | - | 0 |
| Fragmented Packets | - | - | - | - | - | - | - | - | - | 0 |
| Jabber Packets | - | - | - | - | - | - | - | - | - | 0 |
| Dropped Packets (Congestion) | - | - | - | - | - | - | - | - | - | 0 |
| Dropped Packets (Filtering) | - | - | - | - | - | - | - | - | - | 292 |
| Dropped Bytes (Filtering) | - | - | - | - | - | - | - | - | - | 45,611 |

## Monitoring > Radio

This page displays the current radio diagnostic and performance monitoring parameters of the radio transmitter.

The results shown are since the page was opened and are updated automatically every 12 seconds.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Terminal Serial Ethernet Radio Interface Channels User Selected TCP Connections Routing Table Address Tables NAT Session
QHourly Daily QHourly Daily Current Reset

RADIO PARAMETERS

Transmitter | Receiver | Transmit Path | Receive Path

| | | User |
|---|---|---|
| Current Temperature | 37.3 C | □ |
| Packets Transmitted | 4 | □ |
| Bytes Transmitted | 222 | □ |
| Dropped Packets (Congestion) | 0 | ☑ |
| Dropped Bytes (Congestion) | 0 | ☑ |
| Last TX Packet PA Current | 452 mA | □ |
| Last TX Packet PA Driver Current | 240 mA | □ |
| Last TX Packet Forward Power | 23 dBm | □ |
| Current RF TX Duty Cycle | 39.00 % | □ |

Ready    Radio: Base Station    Logout ADMIN

## RADIO PARAMETERS

### Transmitter

| Monitored Parameter | Function | Normal Operating Limits |
|---|---|---|
| Current Temperature | Parameter to show the current temperature of the transmitter | 0 to 70 °C |
| Packets Transmitted | Parameter to show the number of packets transmitted over the air | |
| Bytes Transmitted | Parameter to show the number of bytes transmitted over the air | |
| Dropped Packets (congestion) | Parameter to show the number of dropped packets not transmitted over the air due to congestion | |
| Dropped Bytes (congestion) | Parameter to show the number of dropped bytes not transmitted over the air due to congestion | |
| Last TX Packet PA Current | Parameter to show the current consumed by the transmitter power amplifier in mA. The value is stored from the last time the transmitter was active and transmitted a packet. | This value will change depending on the transmitter power setting, modulation, temperature and the VSWR of the antenna. The alarm limits for this are 50 mA to 2.5 A |
| Last TX Packet Driver Current | Parameter to show the current consumed by the transmitter power amplifier driver in mA. The value is stored from the last time the transmitter was active and transmitted a packet. | This value will change depending on the transmitter power setting, modulation and temperature. The alarm limits for the PA Driver Current are 10 mA to 500 mA. |

| Monitored Parameter | Function | Normal Operating Limits |
|---|---|---|
| Last TX Packet Forward Power | Parameter to show the actual transmitter power in dBm. The value is stored from the last time the transmitter was active and transmitted a packet. | This value will be dependent on the output power, the ATPC setting, the temperature and the VSWR of the antenna. The alarm limits for the Tx forward power are +/-4 dB. |
| Last TX Packet Reverse Power (note [1]) | Parameter to show the reflected power. The value is stored from the last time the transmitter was active and transmitted a packet. | The value will be dependent on the impedance presented to that antenna port of the radio by the feeder and antenna system. A reflected power of 15 dB below the transmit power shows an acceptable performance. |
| Last TX Packet VSWR<br>(note [1]) | Parameter to show numerically how well the antenna is impedance matched to the radio. The value is stored the last time the transmitter was active and transmitted a packet. | This value will be dependent on the feeder and antenna performance, a value of <1.5:1 shows acceptable performance. A value of >3.0:1 would indicate that most of the power is being reflected to the radio and that there is a fault in the feeder or antenna. |
| Current RF TX Duty Cycle | Parameter to show the average percentage of the RF channel utilization | Dependent on the amount of TX traffic |

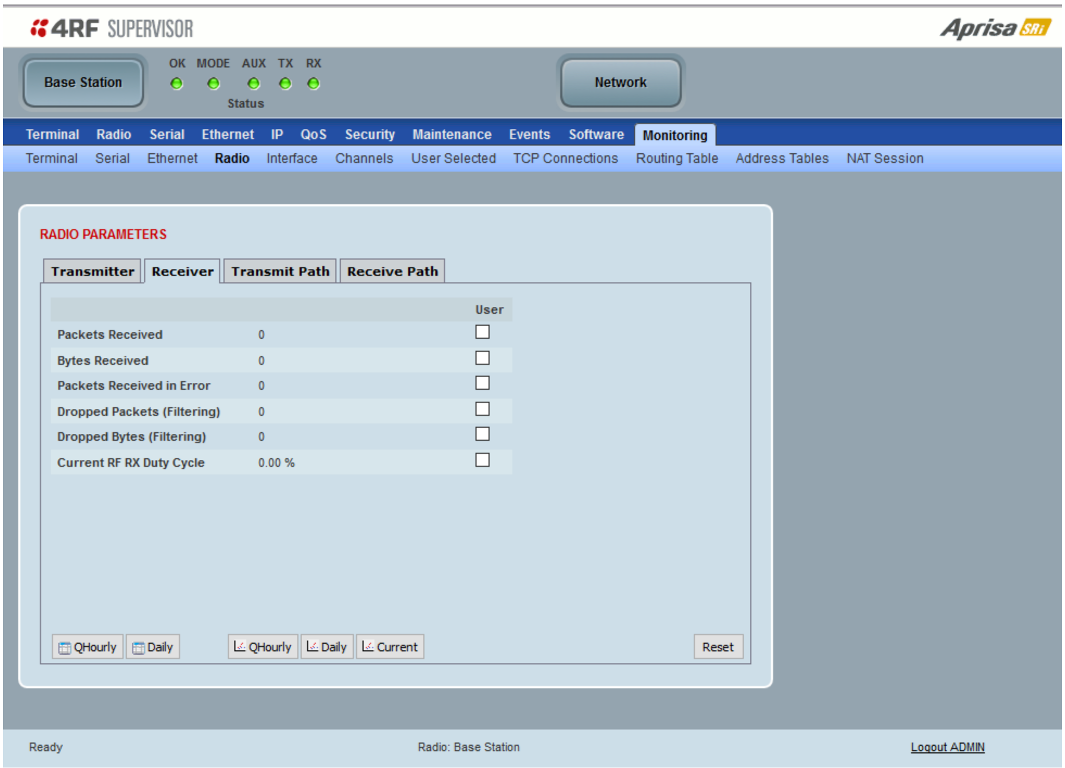
Note 1: Currently only some hardware variants are capable of providing this data. If these parameters are not shown on the Radio Parameters > Transmitter page, the hardware variant is not capable of providing this data.

Controls

The Reset button clears the current results.

This page displays the current radio performance monitoring parameters of radio receiver.

The results shown are since the page was opened and are updated automatically every 12 seconds.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Terminal Serial Ethernet Radio Interface Channels User Selected TCP Connections Routing Table Address Tables NAT Session
RADIO PARAMETERS
Transmitter Receiver Transmit Path Receive Path
QHourly Daily QHourly Daily Current Reset
Ready
Radio: Base Station
Logout ADMIN

| | | User |
|---|---|---|
| Packets Received | 0 | □ |
| Bytes Received | 0 | □ |
| Packets Received in Error | 0 | □ |
| Dropped Packets (Filtering) | 0 | □ |
| Dropped Bytes (Filtering) | 0 | □ |
| Current RF RX Duty Cycle | 0.00 % | □ |

## RADIO PARAMETERS

### Receiver

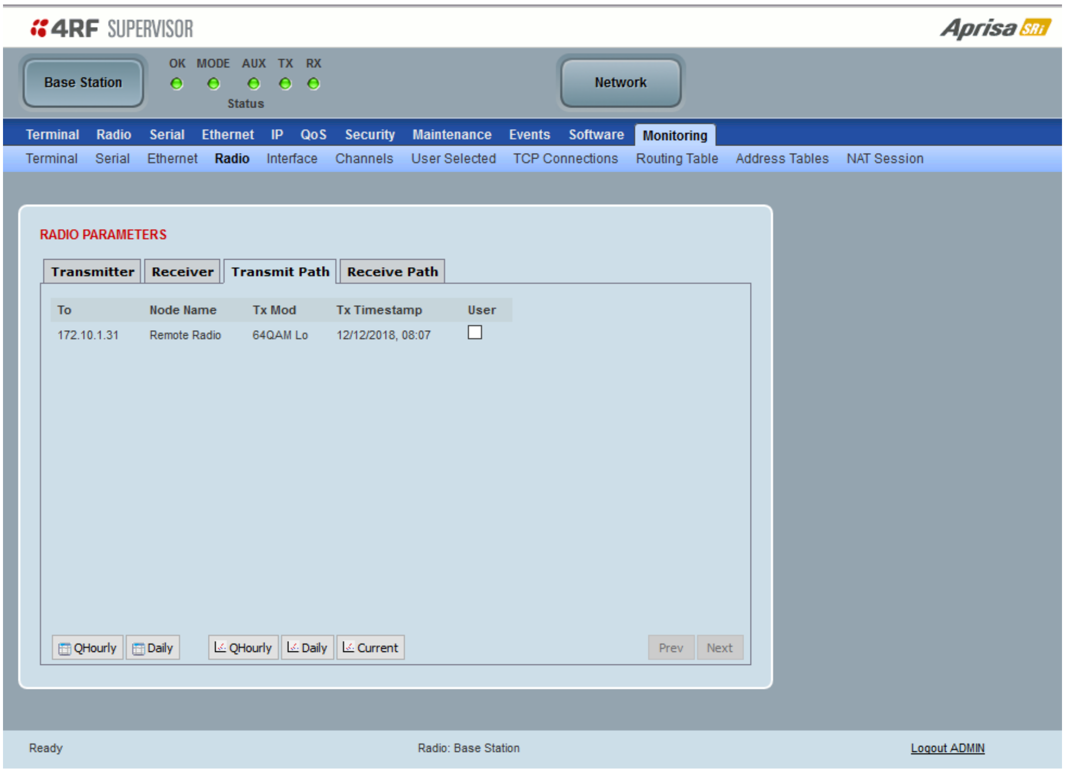
| Monitored Parameter | Function | |
|---|---|---|
| Packets Received | Parameter to show the number of packets received over the air without errors | |
| Bytes Received | Parameter to show the number of bytes received over the air | |
| Packets Received In Error | Parameter to show the number of packets received over the air that contained errors. It is normal to see this counter increment when ACM is enabled, and a unicast packet is sent to another radio that supports a faster modulation. | |
| Dropped Packets (filtering) | Parameter to show the number of packets dropped because received packets were either destined for another radio or could not be decrypted. It is normal to see this counter increment as radios filter out unicast Ethernet or management packets. | |
| Dropped Bytes (filtering) | Parameter to show the number of bytes dropped because received packets were either destined for another radio or could not be decrypted. It is normal to see this counter increment as radios filter out unicast Ethernet or management packets. | |
| Last RX Packet RSSI | Parameter to show the received signal strength. | Expected values for a normally operating radio are between -115 to -10 dBm |
| Last RX Packet SNR | Parameter to show the received signal to noise ratio. | Typical values for SNR > 12 dB.<br>No signal received = 0 dB |
| Current RF RX Duty Cycle | Parameter to show the average percentage of the RF channel utilization | Dependent on the amount of RX traffic |

### Controls

The Reset button clears the current results.

This page displays the current radio RF transmit path modulation setting to single or multiple destination radios that the radio is transmitting to.

The results shown are since the page was opened and are updated automatically every 12 seconds.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Terminal Serial Ethernet Radio Interface Channels User Selected TCP Connections Routing Table Address Tables NAT Session
RADIO PARAMETERS
Transmitter Receiver Transmit Path Receive Path
QHourly Daily QHourly Daily Current
Prev Next
Ready
Radio: Base Station
Logout ADMIN

| To | Node Name | Tx Mod | Tx Timestamp | User |
|---|---|---|---|---|
| 172.10.1.31 | Remote Radio | 64QAM Lo | 12/12/2018, 08:07 | □ |

## RADIO PARAMETERS

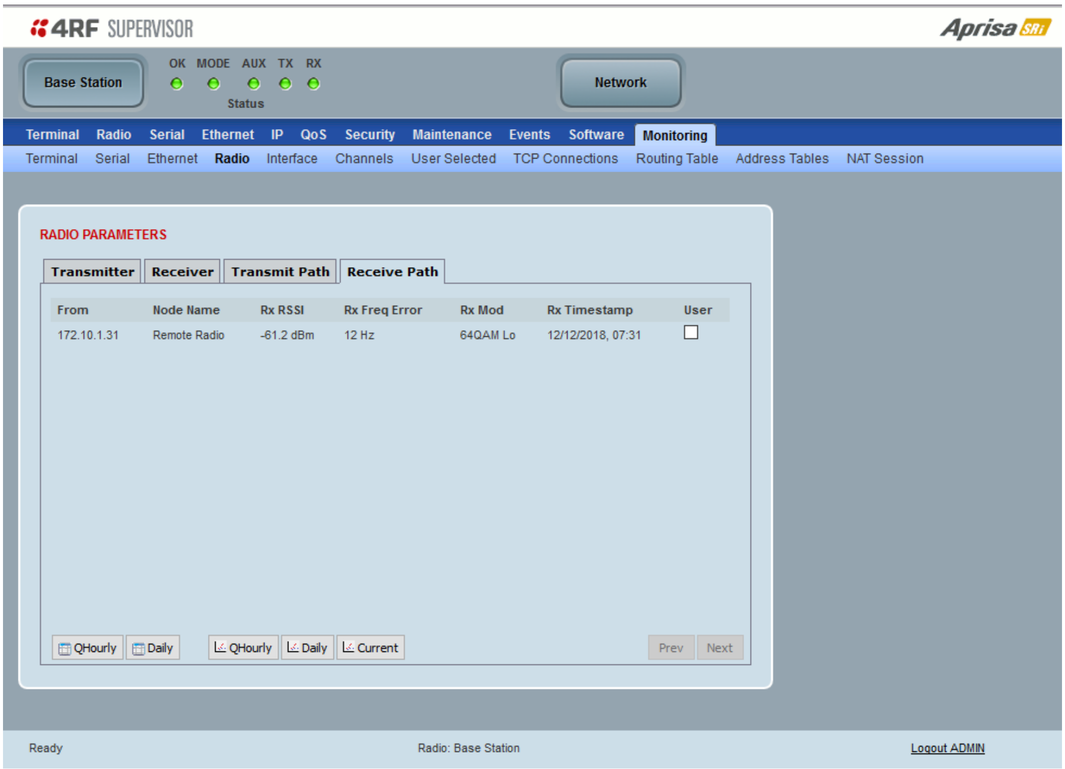
| Result | Function |
|---|---|
| To | The destination Node Address of the radio/s transmitting data to. |
| Tx Mod | The current radio transmitter modulation being used to communicate with the destination radio/s. |
| Tx Timestamp | The timestamp of the last transmitted packet to the destination radio/s. |

### Controls

The Next button will display the next page of 8 radios and the Prev button will display the previous page of 8 radios.

This page displays the current radio RF receive path parameters from single or multiple source radios that the radio is receiving from.

The results shown are since the page was opened and are updated automatically every 12 seconds.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Terminal Serial Ethernet Radio Interface Channels User Selected TCP Connections Routing Table Address Tables NAT Session
RADIO PARAMETERS
Transmitter Receiver Transmit Path Receive Path
QHourly Daily QHourly Daily Current
Prev Next
Ready
Radio: Base Station
Logout ADMIN

| From | Node Name | Rx RSSI | Rx Freq Error | Rx Mod | Rx Timestamp | User |
|---|---|---|---|---|---|---|
| 172.10.1.31 | Remote Radio | -61.2 dBm | 12 Hz | 64QAM Lo | 12/12/2018, 07:31 | □ |

## RADIO PARAMETERS

### Receive Path

| Result | Function |
|---|---|
| From | The IP Address and Node Name of the radio receiving data from. |
| Rx RSSI | The RSSI of the RF signal received from the source radio/s. This parameter displays the receiver RSSI reading taken from the last data packet received. |
| Rx SNR | The SNR of the RF signal received from the source radio/s. This parameter displays the receiver SNR reading taken from the last data packet received. |
| Rx Freq Error | The frequency difference between this radio’s receiver and the frequency of the incoming packet rate from the source radio/s. |
| Rx Mod | The current radio receive modulation being used to communicate with the source radio/s. |
| Rx Timestamp | The timestamp of the last received packet from the source radio/s. |

### Controls

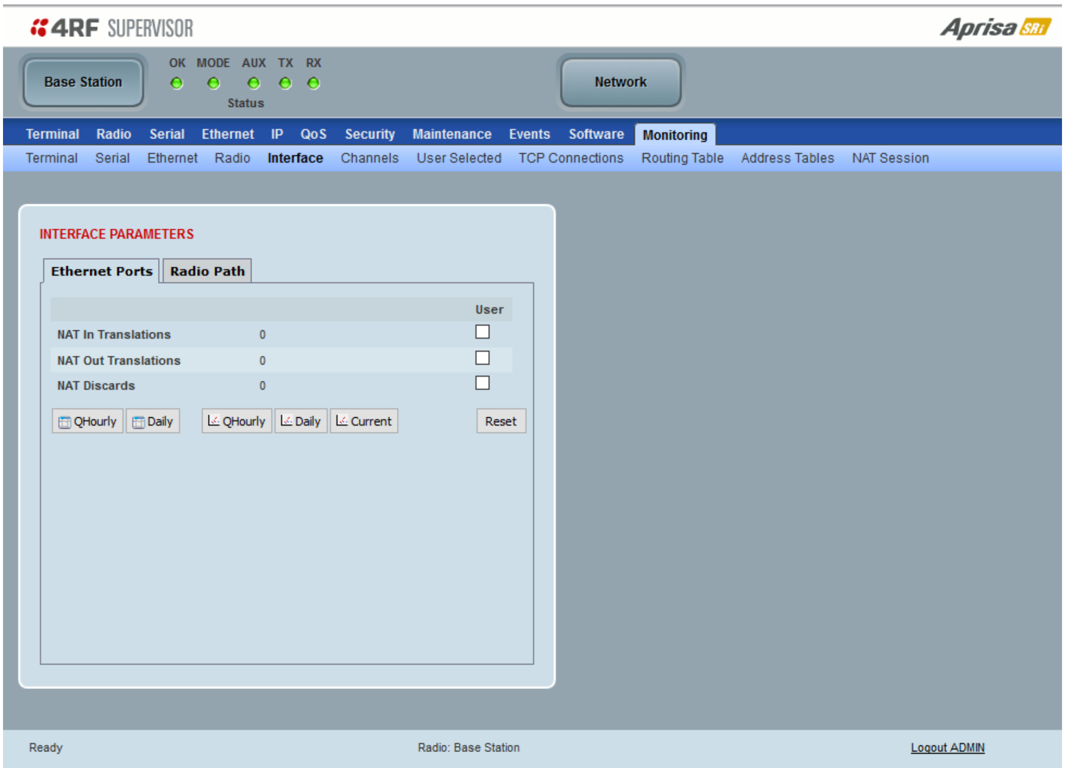
The Next button will display the next page of 8 radios and the Prev button will display the previous page of 8 radios.

## Monitoring > Interface

This page displays the current radio Network Address Translation statistics.

The results shown are since the page was opened and are updated automatically every 12 seconds.

### Ethernet Ports


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Terminal Serial Ethernet Radio Interface Channels User Selected TCP Connections Routing Table Address Tables NAT Session
INTERFACE PARAMETERS
Ethernet Ports
Radio Path
QHourly
Daily
QHourly
Daily
Current
Reset
Ready
Radio: Base Station
Logout ADMIN

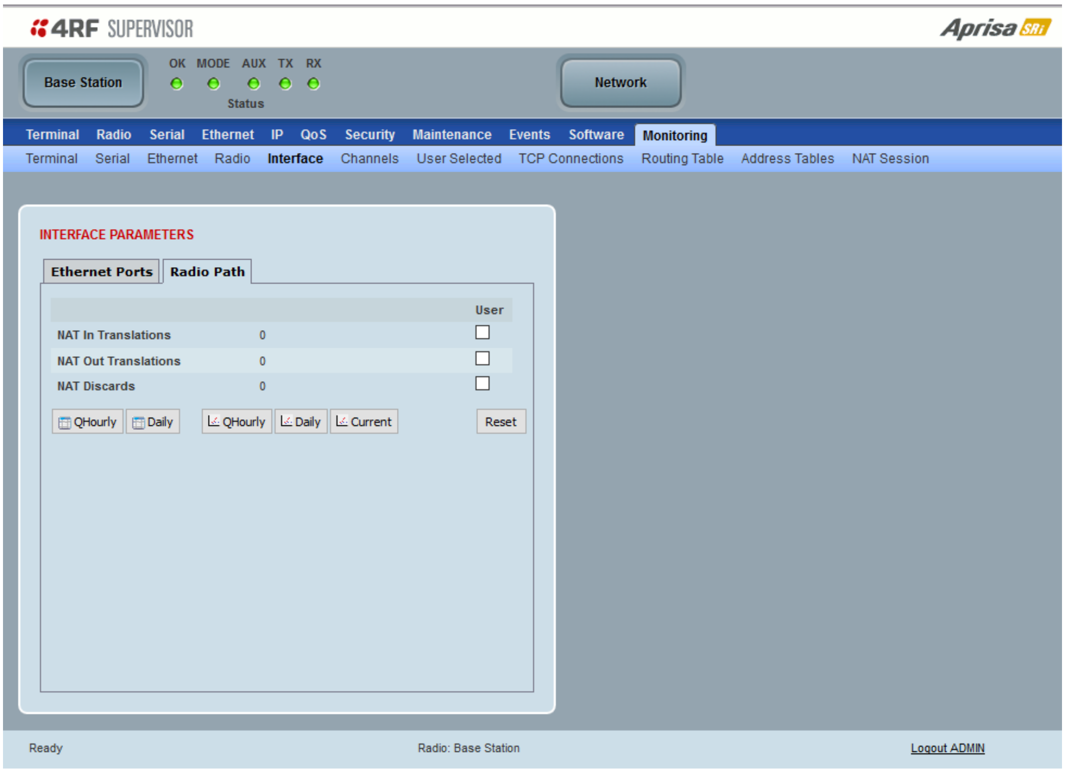
| | | User |
|---|---|---|
| NAT In Translations | 0 | □ |
| NAT Out Translations | 0 | □ |
| NAT Discards | 0 | □ |

## INTERFACE PARAMETERS

### Ethernet Ports

| Monitored Parameter | Function |
|---|---|
| NAT In Translations | The number of translated packets received on Ethernet ports |
| NAT Out Translations | The number of translated packets transmitted on Ethernet ports |
| NAT Discards | The number of translated packets rejected / discarded on Ethernet ports due to the lack of resource or other reason |

Radio Path


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Terminal Serial Ethernet Radio Interface Channels User Selected TCP Connections Routing Table Address Tables NAT Session
Ethernet Ports
Radio Path
QHourly
Daily
QHourly
Daily
Current
Reset
Ready
Radio: Base Station
Logout ADMIN

INTERFACE PARAMETERS

| | | User |
|---|---|---|
| NAT In Translations | 0 | □ |
| NAT Out Translations | 0 | □ |
| NAT Discards | 0 | □ |

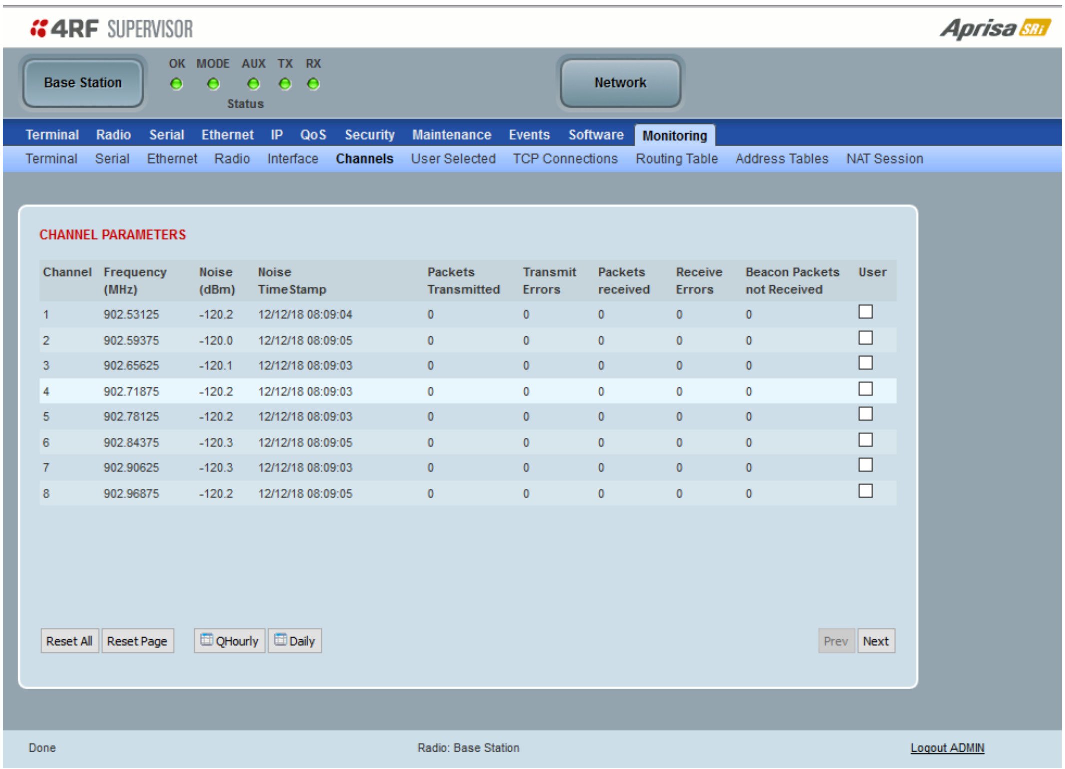
Radio Path

| Monitored Parameter | Function |
|---|---|
| NAT In Translations | The number of translated packets received on the radio interface |
| NAT Out Translations | The number of translated packets transmitted on the radio interface |
| NAT Discards | The number of translated packets rejected / discarded on the radio interface due to the lack of resource or other reason |

## Monitoring > Channels

This page displays the current radio diagnostic and performance monitoring parameters of the channels.

The results shown are since the page was opened and are updated automatically every 12 seconds.



4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Terminal Serial Ethernet Radio Interface Channels User Selected TCP Connections Routing Table Address Tables NAT Session
Reset All
Reset Page
QHourly
Daily
Prev
Next
Done
Radio: Base Station
Logout ADMIN

CHANNEL PARAMETERS

| Channel | Frequency (MHz) | Noise (dBm) | Noise TimeStamp | Packets Transmitted | Transmit Errors | Packets received | Receive Errors | Beacon Packets not Received | User |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 902.53125 | -120.2 | 12/12/18 08:09:04 | 0 | 0 | 0 | 0 | 0 | □ |
| 2 | 902.59375 | -120.0 | 12/12/18 08:09:05 | 0 | 0 | 0 | 0 | 0 | □ |
| 3 | 902.65625 | -120.1 | 12/12/18 08:09:03 | 0 | 0 | 0 | 0 | 0 | □ |
| 4 | 902.71875 | -120.2 | 12/12/18 08:09:03 | 0 | 0 | 0 | 0 | 0 | □ |
| 5 | 902.78125 | -120.2 | 12/12/18 08:09:03 | 0 | 0 | 0 | 0 | 0 | □ |
| 6 | 902.84375 | -120.3 | 12/12/18 08:09:05 | 0 | 0 | 0 | 0 | 0 | □ |
| 7 | 902.90625 | -120.3 | 12/12/18 08:09:03 | 0 | 0 | 0 | 0 | 0 | □ |
| 8 | 902.96875 | -120.2 | 12/12/18 08:09:05 | 0 | 0 | 0 | 0 | 0 | □ |

### CHANNEL PARAMETERS

| Result | Function |
|---|---|
| Channel | The channel number. |
| Noise RSSI | The RSSI measured when the channel is clear. It is used to determine if interference is present. |
| RSSI Timestamp | The timestamp of the last received packet used for RSSI. |
| Packets Transmitted | The number of packets transmitted from the radio. |
| Transmit Errors | The number of transmit packets not acknowledged by the base station. |
| Packets Received | The number of packets received by the radio. |
| Receive Errors | The number of errored packets received by the radio. |
| Beacon Packets Not Received | The base station sends broadcast beacon packets to the remotes to sync to the hop channels. This is the number of Beacon Packets not received at the remotes. |

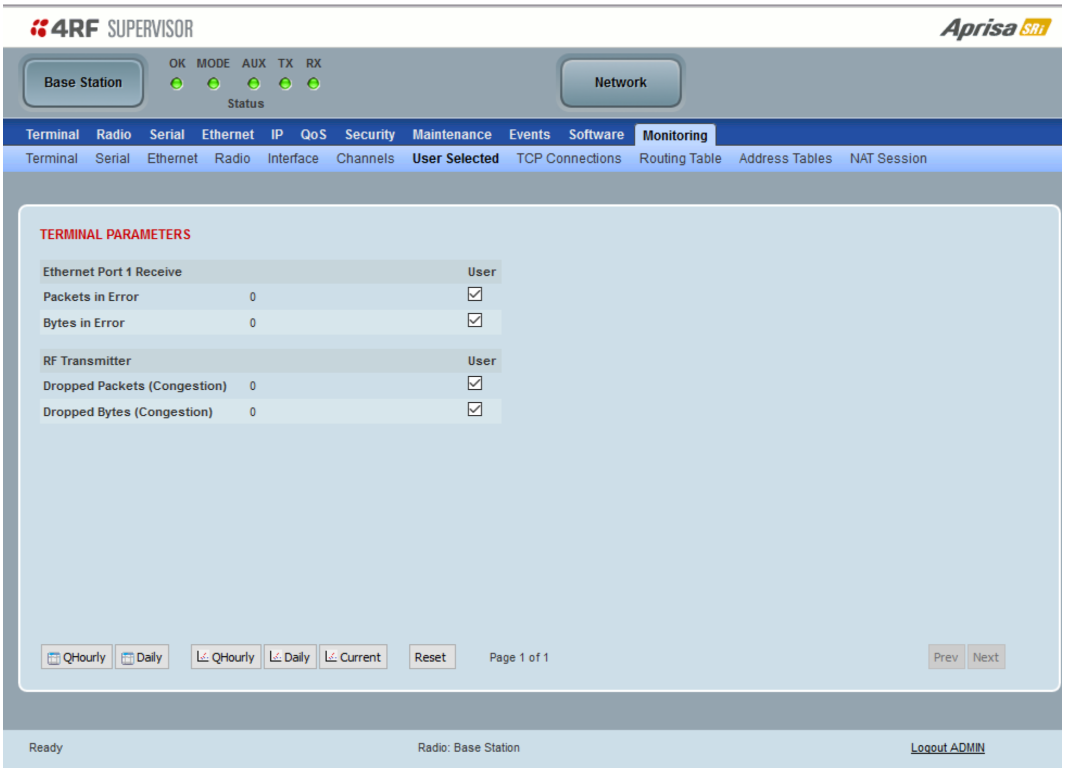
### Controls

The Next button will display the next page of 8 connections and the Prev button will display the previous page of 8 connections.

## Monitoring > User Selected

This page displays the ‘User’ parameters setup in all the other Monitoring screens e.g. in the Monitoring > Radio > Transmitter, the User checkbox is ticked for the Dropped Packets (Congestion) and Dropped Bytes (Congestion).

The results shown are since the page was opened and are updated automatically every 12 seconds.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Terminal Serial Ethernet Radio Interface Channels User Selected TCP Connections Routing Table Address Tables NAT Session
QHourly Daily QHourly Daily Current Reset Page 1 of 1 Prev Next
Ready Radio: Base Station Logout ADMIN

TERMINAL PARAMETERS

| Ethernet Port 1 Receive | | User |
|---|---|---|
| Packets in Error | 0 | ☑ |
| Bytes in Error | 0 | ☑ |

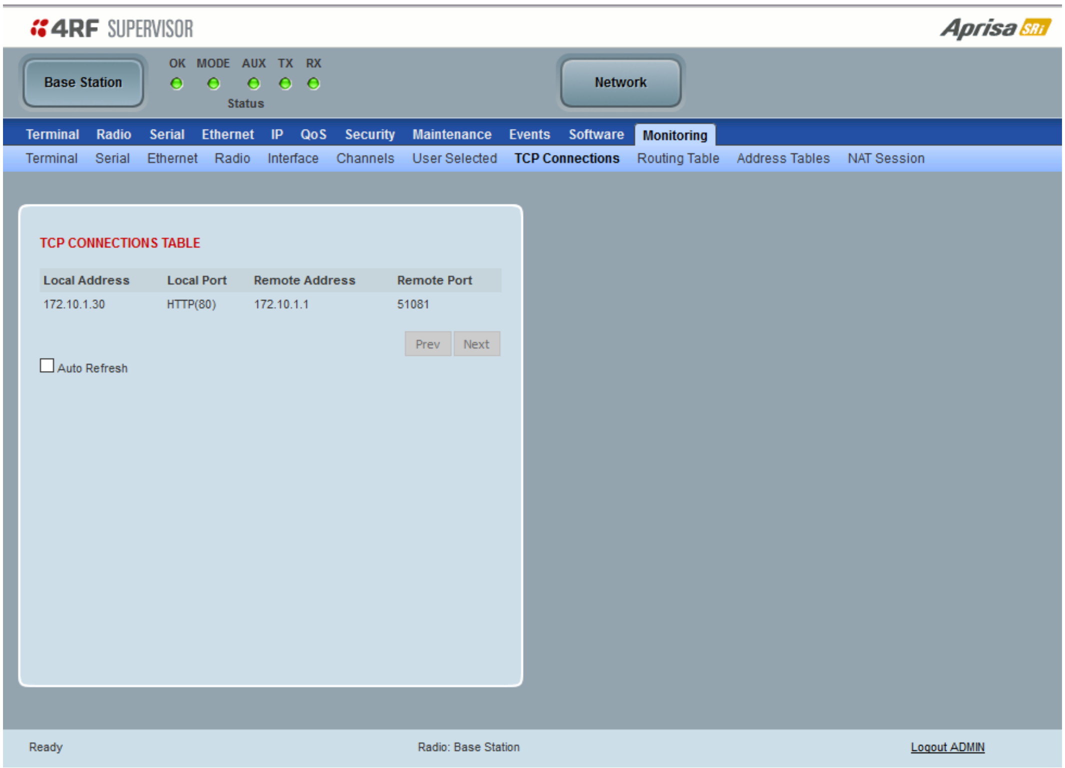
| RF Transmitter | | User |
|---|---|---|
| Dropped Packets (Congestion) | 0 | ☑ |
| Dropped Bytes (Congestion) | 0 | ☑ |

### Controls

The Reset button clears the current results.

## Monitoring > TCP Connections

This page displays the list of active TCP connections on the radio.



4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Terminal Serial Ethernet Radio Interface Channels User Selected TCP Connections Routing Table Address Tables NAT Session
Prev Next
Ready
Radio: Base Station
Logout ADMIN

TCP CONNECTIONS TABLE

| Local Address | Local Port | Remote Address | Remote Port |
|---|---|---|---|
| 172.10.1.30 | HTTP(80) | 172.10.1.1 | 51081 |

□ Auto Refresh

### TCP CONNECTIONS TABLE

| Result | Function |
|---|---|
| Local Address | The local radio IP address |
| Local Port | The local radio TCP port number |
| Remote Address | The remote host IP address (in most case a host PC connected to radio/network) |
| Remote Port | The local radio TCP port number (in most case a host PC connected to radio / network) |

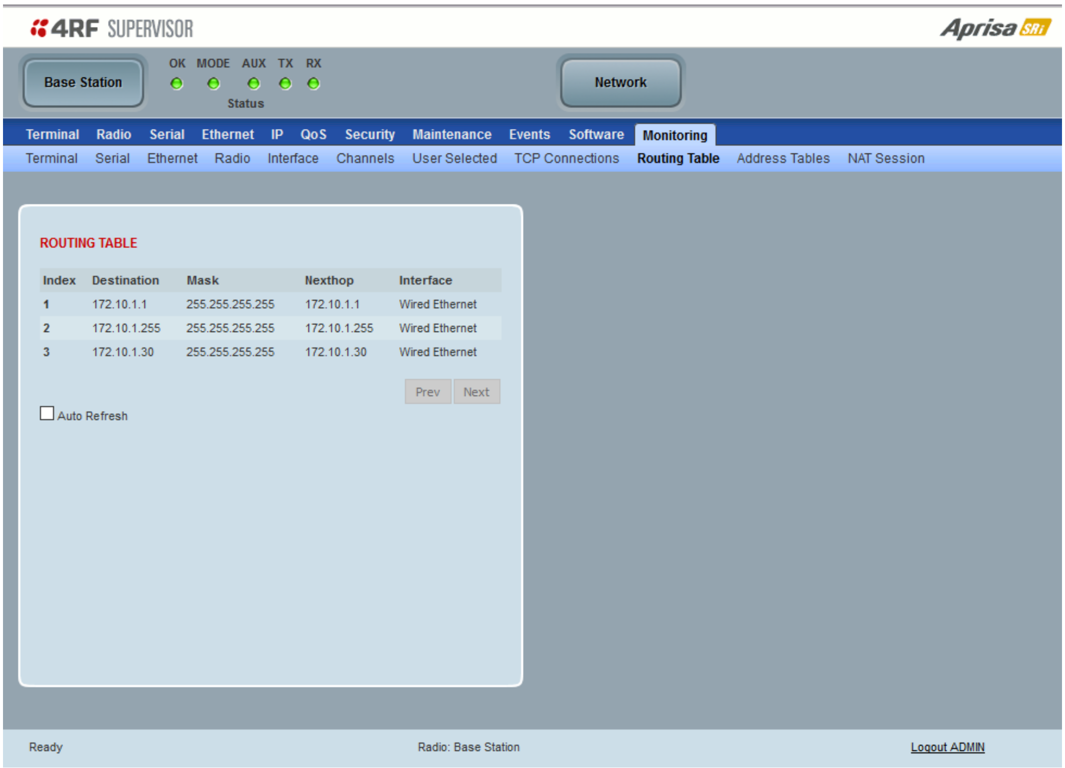
### Controls

The Next button will display the next page of 8 connections and the Prev button will display the previous page of 8 connections.

If the Auto Refresh option is ticked, the TCP Connections table will refresh every 12 seconds.

## Monitoring > Routing Table

This page displays the list of active routes on the radio.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Terminal Serial Ethernet Radio Interface Channels User Selected TCP Connections Routing Table Address Tables NAT Session
Prev
Next

ROUTING TABLE

| Index | Destination | Mask | Nexthop | Interface |
|---|---|---|---|---|
| 1 | 172.10.1.1 | 255.255.255.255 | 172.10.1.1 | Wired Ethernet |
| 2 | 172.10.1.255 | 255.255.255.255 | 172.10.1.255 | Wired Ethernet |
| 3 | 172.10.1.30 | 255.255.255.255 | 172.10.1.30 | Wired Ethernet |

□ Auto Refresh

Ready Radio: Base Station Logout ADMIN

### ROUTING TABLE

| Result | Function |
|---|---|
| Index | The routing table index |
| Destination | The target destination IP address of the route |
| Mask | The subnet mask of the destination IP address of the route |
| Next Hop | The next hop IP address on the path to the destination IP address of the route |
| Interface | The physical interface output on the path to the destination IP address of the route |

### Controls

The Next button will display the next page of 8 routes and the Prev button will display the previous page of 8 routes.

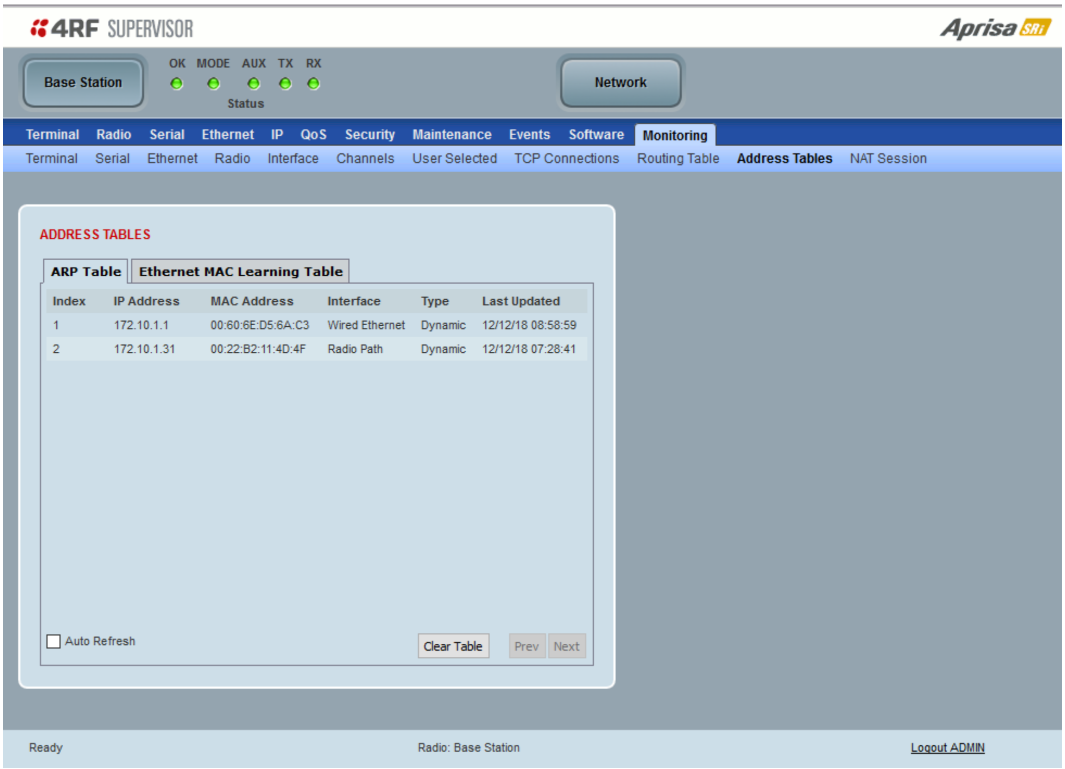
If the Auto Refresh option is ticked, the routing table will refresh every 12 seconds.

## Monitoring > Address Tables

### ARP Table

This page displays the current Address Resolution Protocols (ARP) on the radio. The radio implemented ARP protocol is used for resolution of network layer addresses into link layer addresses. It is used to map a IPv4 address to an Ethernet MAC address. The ARP table shows the results of the ARP protocol linkage between IPv4 address and Ethernet MAC address of the devices attached to the radio.

In a layer 2 bridge LAN, an upper layer protocol may include the IP address of the destination, but since it is an Ethernet LAN network, it also needs to know the destination MAC address. First, the radio uses a cached ARP table to look up the IPv4 destination address for the matching MAC address records. If the MAC address is found, it sends the IPv4 packet encapsulated in Ethernet frame with the found MAC address. If the ARP cache table did not produce a result for the destination IPv4 address, the radio sends a broadcast ARP message requesting an answer (of MAC address that matches) for IP address. The destination device responds with its MAC address (and IP). The response information is cached in radios' ARP table and the message can now be sent with the appropriate destination MAC address.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Terminal Serial Ethernet Radio Interface Channels User Selected TCP Connections Routing Table Address Tables NAT Session
ADDRESS TABLES
ARP Table
Ethernet MAC Learning Table
□ Auto Refresh
Clear Table
Prev
Next
Ready
Radio: Base Station
Logout ADMIN

| Index | IP Address | MAC Address | Interface | Type | Last Updated |
|---|---|---|---|---|---|
| 1 | 172.10.1.1 | 00:60:6E:D5:6A:C3 | Wired Ethernet | Dynamic | 12/12/18 08:58:59 |
| 2 | 172.10.1.31 | 00:22:B2:11:4D:4F | Radio Path | Dynamic | 12/12/18 07:28:41 |

### ADDRESS TABLES

| Title | Function |
|---|---|
| IP Address | The IPv4 address of a neighboring device in the radio LAN network |
| MAC Address | The ARP result matching or mapping MAC address from the IPv4 address. |
| Interface | The Ethernet port interface the ARP results found the matching/mapping |
| Type | 'Dynamic' indicates an ARP result and 'Static' indicates a user static mapping. |

### Controls

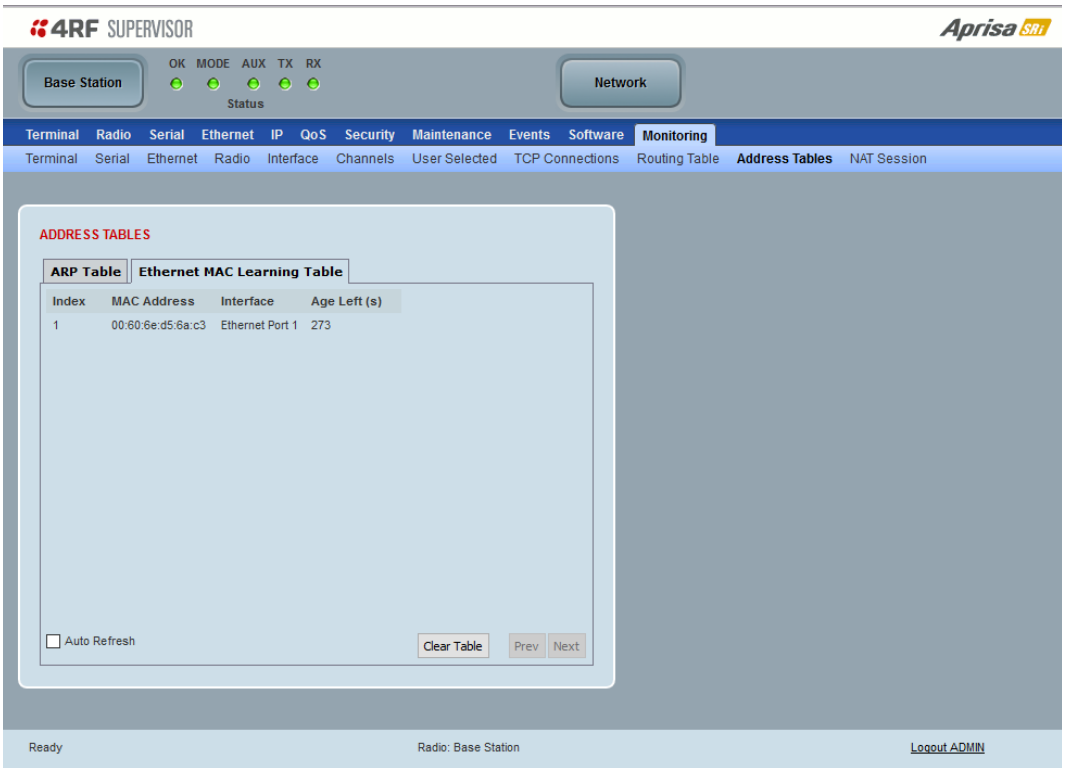
The Next button will display the next page of 8 addresses and the Prev button will display the previous page of 8 addresses.

If the Auto Refresh option is ticked, the ARP table will refresh every 12 seconds.

## Ethernet MAC Learning Table

This page displays the current Ethernet Media Access Control (MAC) Address table on the radio LAN network. In order for the radio to switch frames between Ethernet LAN ports efficiently, the radio layer 2 bridge maintains a MAC address table. When the radio bridge receives a frame, it associates the MAC address of the sending network device with the LAN port on which it was received.

The bridge dynamically learns and builds the MAC address table by using the MAC source address of the frames received. When the radio bridge receives a frame for a MAC destination address not listed in its address table, it floods the frame to all LAN ports of the same LAN (or in case of VLAN, to the specific VLAN) except the port that received the frame. When the destination bridge device replies, the radio bridge adds its relevant MAC source address and interface port number to the MAC address table. The switch then forwards subsequent frames to a single LAN port without flooding all LAN ports.


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Terminal Serial Ethernet Radio Interface Channels User Selected TCP Connections Routing Table Address Tables NAT Session
ADDRESS TABLES
ARP Table
Ethernet MAC Learning Table
□ Auto Refresh
Clear Table
Prev
Next
Ready
Radio: Base Station
Logout ADMIN

| Index | MAC Address | Interface | Age Left (s) |
|---|---|---|---|
| 1 | 00:60:6e:d5:6a:c3 | Ethernet Port 1 | 273 |

ADDRESS TABLES

| Title | Function |
|---|---|
| MAC Address | The learned MAC address of a neighboring bridge device in the LAN network. |
| Interface | The Ethernet port interface the MAC address has learned |
| Age left | The aging time of this MAC entry will stay in the table, even if this MAC address is not used. Every time this MAC address is used, the aging time restarts from its maximum. Default is 300 sec. |

Controls

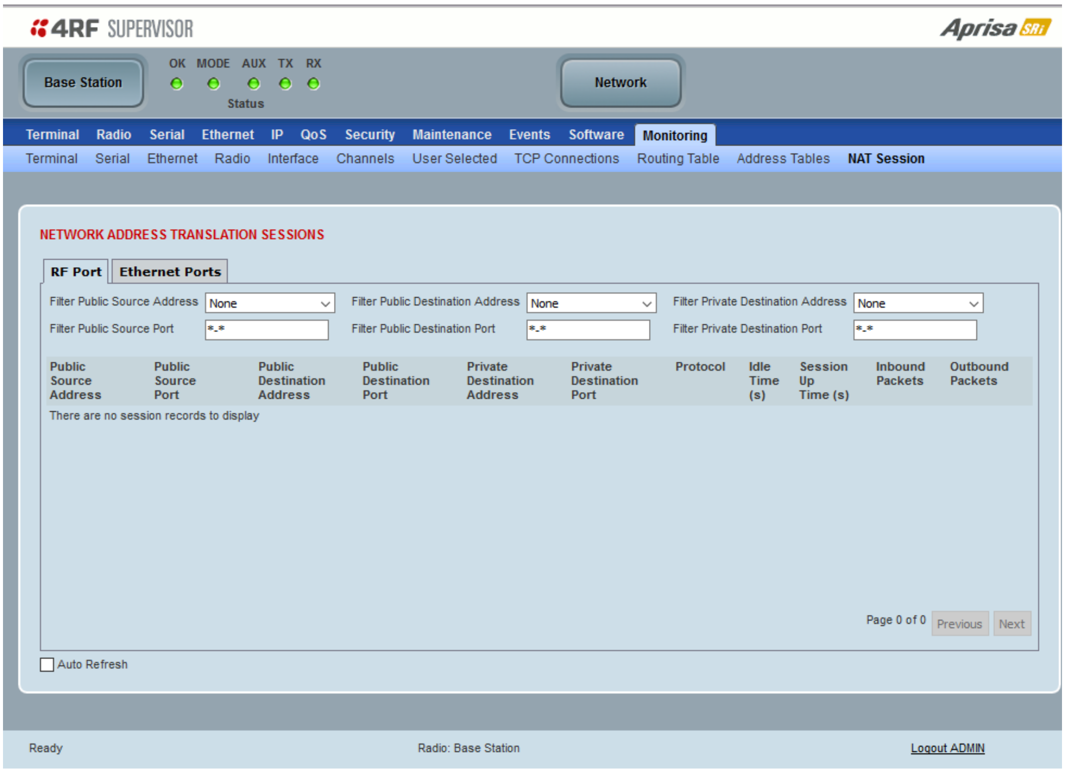
The Next button will display the next page of 8 addresses and the Prev button will display the previous page of 8 addresses.

If the Auto Refresh option is ticked, the routing table will refresh every 12 seconds.

## Monitoring > NAT

This page displays the number of NAT sessions. The maximum number of sessions is 250.

### RF Port


4RF SUPERVISOR
Aprisa SRi
Base Station
OK MODE AUX TX RX
Status
Network
Terminal Radio Serial Ethernet IP QoS Security Maintenance Events Software Monitoring
Terminal Serial Ethernet Radio Interface Channels User Selected TCP Connections Routing Table Address Tables NAT Session
RF Port
Ethernet Ports
Previous
Next
Logout ADMIN

NETWORK ADDRESS TRANSLATION SESSIONS

Filter Public Source Address: None
Filter Public Destination Address: None
Filter Private Destination Address: None
Filter Public Source Port: *-*
Filter Public Destination Port: *-*
Filter Private Destination Port: *-*

| Public Source Address | Public Source Port | Public Destination Address | Public Destination Port | Private Destination Address | Private Destination Port | Protocol | Idle Time (s) | Session Up Time (s) | Inbound Packets | Outbound Packets |
|---|---|---|---|---|---|---|---|---|---|---|

There are no session records to display

Page 0 of 0

□ Auto Refresh

Ready

Radio: Base Station

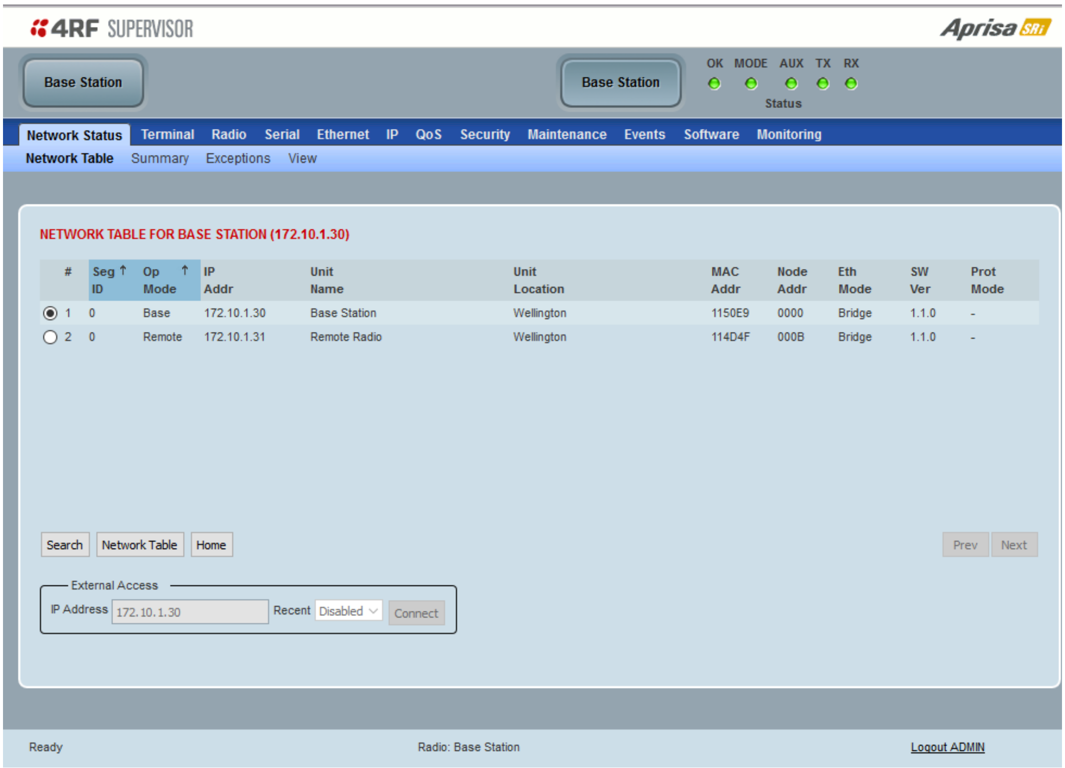
### NETWORK ADDRESS TRANSLATION SESSIONS

| Title | Function |
|---|---|
| Idle Time (s) | The total duration where the session has been idle. Traffic on this session will reset the Idle Time to zero. |
| Session Up Time (s) | The total duration that this session has been shown in the session table. |
| Inbound Packets | The total number of packets received on the public interface for this session. |
| Outbound Packets | The total number of packets transmitted from the public interface for this session. |

## Network Status

### Network Status > Network Table

This page displays a list of all the registered remote radios for the base station and provides management access to each of the remote radios.



NETWORK TABLE FOR BASE STATION (172.10.1.30)

| | # | Seg ID | Op Mode | IP Addr | Unit Name | Unit Location | MAC Addr | Node Addr | Eth Mode | SW Ver | Prot Mode |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | 1 | 0 | Base | 172.10.1.30 | Base Station | Wellington | 1150E9 | 0000 | Bridge | 1.1.0 | - |
| ○ | 2 | 0 | Remote | 172.10.1.31 | Remote Radio | Wellington | 114D4F | 000B | Bridge | 1.1.0 | - |

IP Address 172.10.1.30 Recent Disabled

NETWORK TABLE

This Network Table is only available when the local radio is the base station i.e. SuperVisor is logged into the base station.

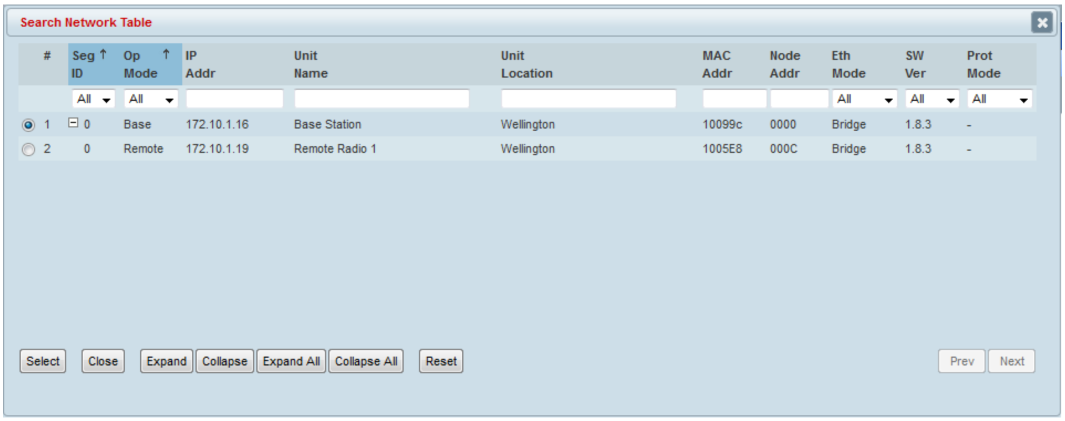
**To manage a remote radio with SuperVisor:**

Click on the radio button of the required station. The remaining menu items then apply to the selected remote radio.

## Controls

### Search

The Search button brings up a search form.



Search Network Table

| # | Seg ID | Op Mode | IP Addr | Unit Name | Unit Location | MAC Addr | Node Addr | Eth Mode | SW Ver | Prot Mode |
|---|---|---|---|---|---|---|---|---|---|---|
|  | All | All |  |  |  |  |  | All | All | All |
| ● 1 | ⊟ 0 | Base | 172.10.1.16 | Base Station | Wellington | 10099c | 0000 | Bridge | 1.8.3 | - |
| ○ 2 | 0 | Remote | 172.10.1.19 | Remote Radio 1 | Wellington | 1005E8 | 000C | Bridge | 1.8.3 | - |

### Filtering

The first row of the table in the pop up window is the search filter.

There are two types of filters:

1. Drop down lists with a finite set of options to select from

2. Text entry where any text can be entered.

When the filters are applied, the rows in the rest of the table are displayed only if they match all the filters.

Example 1 - one filter; select ‘remote’ in the ‘Op Mode’ filter with the other drop down list set to ‘All’ and the text entry filters blank, will show all the remote radios

Example 2 - two filters; type ‘98’ in the MAC Addr filter and select ‘Bridge’ for the ‘Eth Mode’ filter.

### Grouping

Entries in the network table can be grouped based on the Segment IDs. The user can expand the groups with the ⊞ and collapse the groups with the ⊟ button to help locate an entry.

### Sorting

Clicking on a column header of the table will sort the table by that column.

The Select button closes the popup, updates the selection on the Network Table and saves the search/filter parameters which are reused the next time the search is initiated in the same SuperVisor session.

The Close button closes the Search popup.

The Expand button expands the group of the selected entry and the Expand All button expands all groups.

The Collapse button collapses the group of the selected entry and the Collapse All button collapses all groups.

The Reset button removes all filtering and expands all groups.

Network Table

Refreshes the Network table from the currently selected IP address.

External Access

Sets the IP address of an extended network radio for SuperVisor management.

Recent

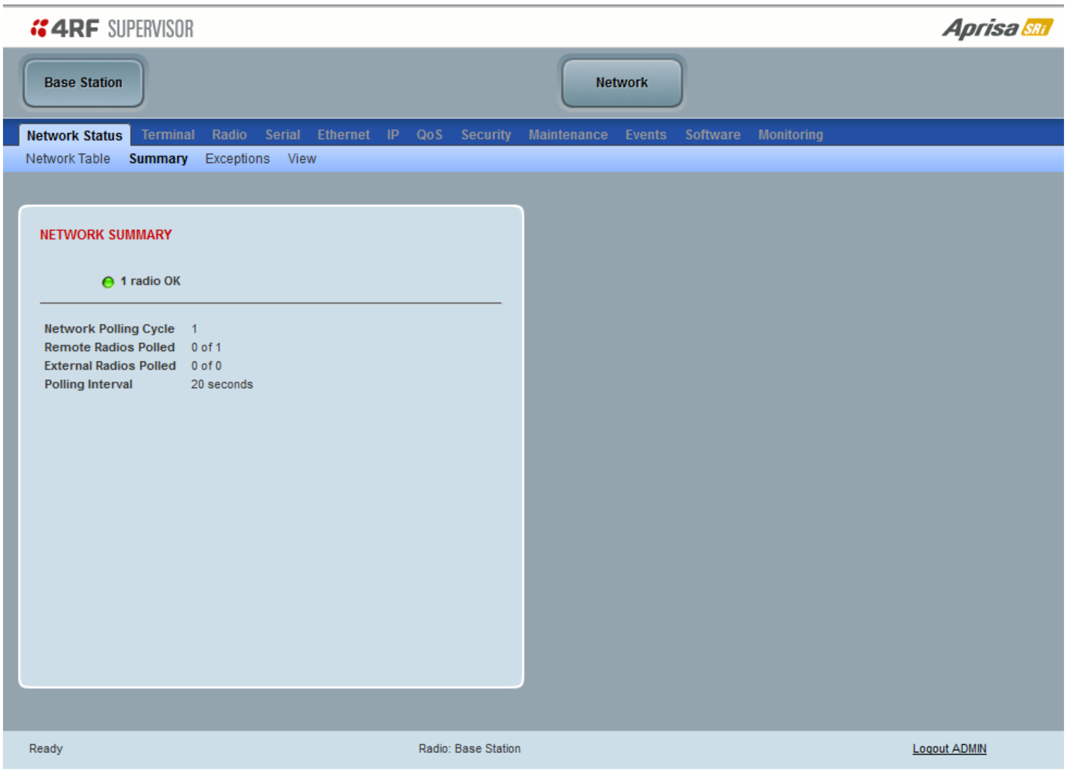
The Recent dropdown list shows the IP addresses that have been managed recently with the extended network radio.

## Network Status > Summary

Network View is an overview of the health of the network providing the ability to investigate issues directly within SuperVisor.

This page provides an overall summary view of the alarm status of all registered remote radios for the base station. When open, it provides a continuous monitor of the network.

Depending on the poll period set (20 seconds minimum) and the number of remotes in the network, it will take at least three poll cycles to indicate a failure in the network. Initial results may indicate 'All ok' until at least three poll cycles completed. This could take Number Of Remotes * Poll Period * 3 seconds to complete.



NETWORK SUMMARY

● 1 radio OK

| | |
|---|---|
| Network Polling Cycle | 1 |
| Remote Radios Polled | 0 of 1 |
| External Radios Polled | 0 of 0 |
| Polling Interval | 20 seconds |

### NETWORK SUMMARY

A network poll will start when any of the Network Status pages are opened (Summary, Exceptions or View). The network poll will only continue to poll the remote radios if one of the Network Status pages is open (SuperVisor can lose PC focus). The network poll continues from where it was stopped last time it was polling.

The initial result assumes that all remote radios are operating correctly.

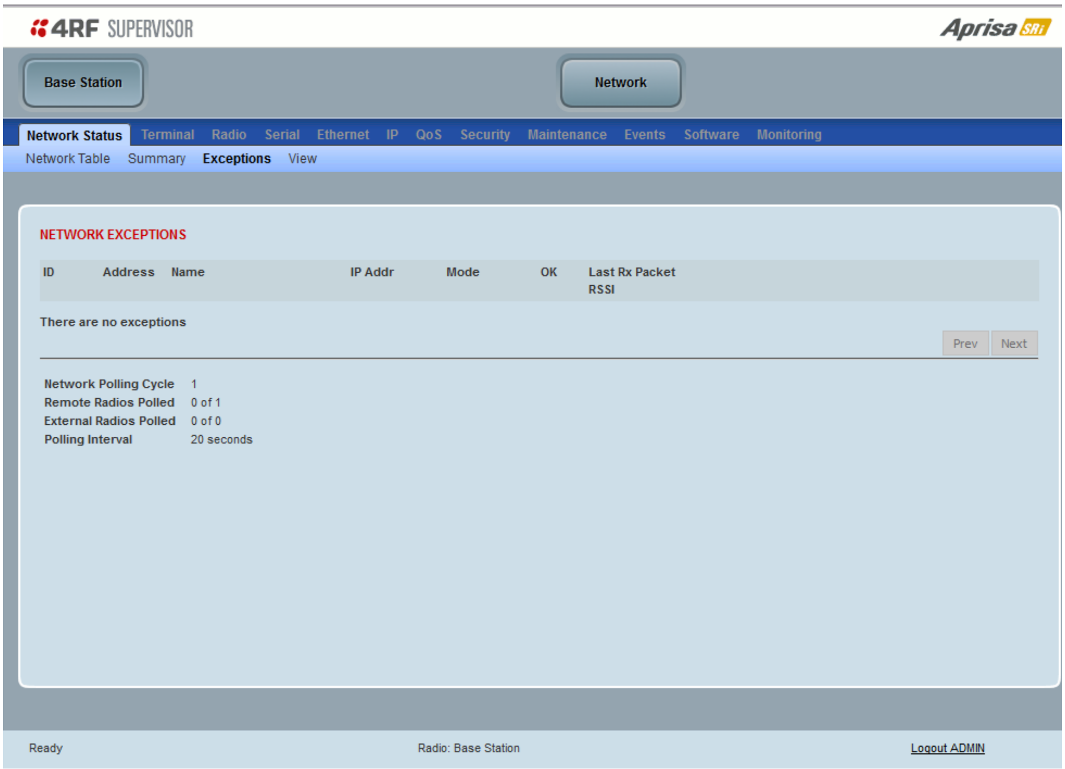
Network Summary Example:

| Result | Function |
|---|---|
| Network Polling Cycle | The number of poll cycles since first opening a Network Status > Summary, Exceptions or View page. |
| Remote Radios Polled | This shows the number of remote radios polled for the current polling cycle out of the number of remote radios registered with the base station. |
| Polling Interval | The time interval between the completion of one radio poll and the start of the next radio poll. To set the polling interval, see 'Maintenance > General' on page 231. |

If a remote radio does not respond to a poll request within 10 seconds, the previous readings from that radio will be presented. Connectivity to a remote radio will be show as 'lost' if the remote radio has not responded to 3 consecutive poll requests.

## Network Status > Exceptions

This page provides a list of all registered remote radios that are in an alarmed state or have stopped responding to the SuperVisor polling. When open, it provides a continuous monitor of the network.



NETWORK EXCEPTIONS

| ID | Address | Name | IP Addr | Mode | OK | Last Rx Packet RSSI |
|---|---|---|---|---|---|---|

There are no exceptions

| | |
|---|---|
| Network Polling Cycle | 1 |
| Remote Radios Polled | 0 of 1 |
| External Radios Polled | 0 of 0 |
| Polling Interval | 20 seconds |

Ready    Radio: Base Station

### NETWORK EXCEPTIONS

A network poll will start when any of the Network Status pages are opened (Summary, Exceptions or View). The network poll will only continue to poll the remote radios if one of the Network Status pages is open (SuperVisor can lose PC focus). The network poll continues from where it was stopped last time it was polling.

Network Exceptions Example:

| Result | Function |
|---|---|
| Network Polling Cycle | The number of poll cycles since first opening a Network Status > Summary, Exceptions or View page. |
| Remote Radios Polled | This shows the number of remote radios polled for the current polling cycle out of the number of remote radios registered with the base station. |
| Polling Interval | The time interval between the completion of one radio poll and the start of the next radio poll. To set the polling interval, see ‘Maintenance > General’ on page 231. |

If a remote radio does not respond to a poll request within 10 seconds, the previous readings from that radio will be presented. Connectivity to a remote radio will be show as 'lost' if the remote radio has not responded to 3 consecutive poll requests.

If a remote radio on the list is detected to be responding to a poll request and no longer be in an alarmed state, the entry for this remote radio will be removed from the list.

#### *View Events*

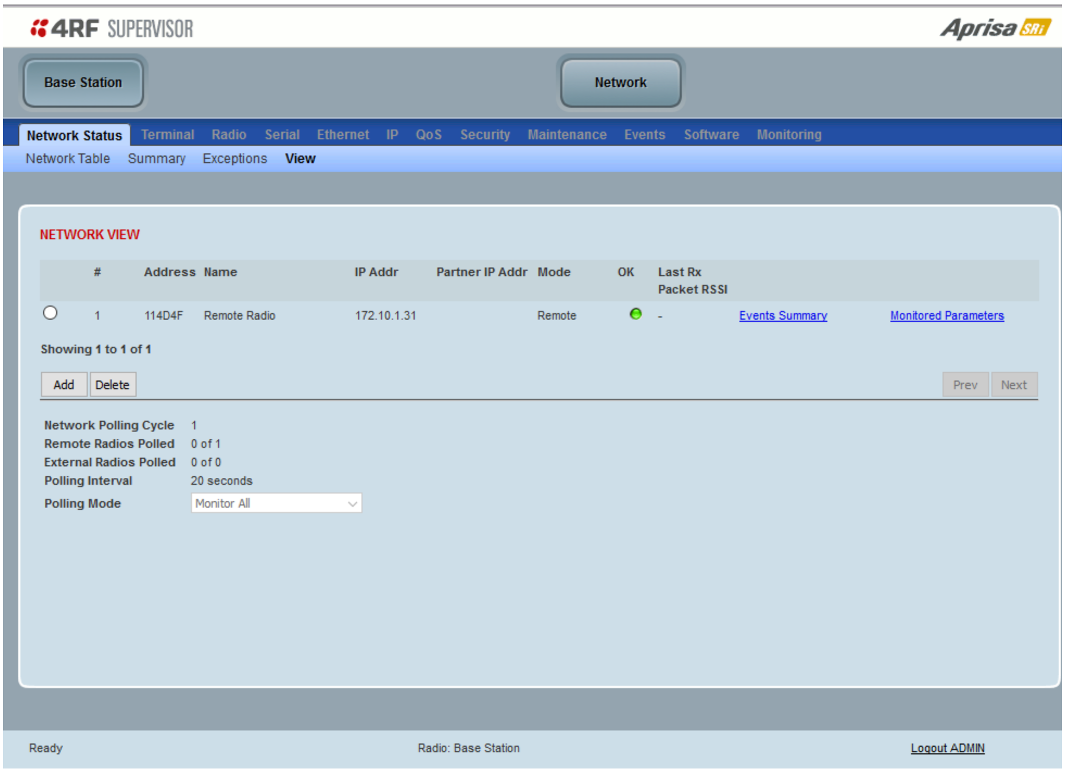
Clicking on View Events navigates to the Events page (see 'Events' on page 245) for the specific remote radio where the radio events will be displayed.

#### *View Parameters*

Clicking on View Parameters navigates to the Monitoring page (see 'Monitoring' on page 275) for the specific remote radio where the radio parameters will be displayed.

## Network Status > View

This page provides a complete list of all registered remote radios. It is similar to the Exceptions page but it shows all radios, not limited to the radios with alarms. When open, it provides a continuous monitor of the network.



NETWORK VIEW

| | # | Address | Name | IP Addr | Partner IP Addr | Mode | OK | Last Rx Packet RSSI | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ○ | 1 | 114D4F | Remote Radio | 172.10.1.31 | | Remote | ● | - | Events Summary | Monitored Parameters |

Showing 1 to 1 of 1

| | |
|---|---|
| Network Polling Cycle | 1 |
| Remote Radios Polled | 0 of 1 |
| External Radios Polled | 0 of 0 |
| Polling Interval | 20 seconds |
| Polling Mode | Monitor All |

### NETWORK VIEW

A network poll will start when any of the Network Status pages are opened (Summary, Exceptions or View). The network poll will only continue to poll the remote radios if one of the Network Status pages is open (SuperVisor can lose PC focus). The network poll continues from where it was stopped last time it was polling.

Network View Example:

| Result | Function |
|---|---|
| Network Polling Cycle | The number of poll cycles since first opening a Network Status > Summary, Exceptions or View page. |
| Remote Radios Polled | This shows the number of remote radios polled for the current polling cycle out of the number of remote radios registered with the base station. |
| External Radios Polled | This shows the number of extended network radios polled for the current polling cycle out of the total extended network radios. |
| Polling Interval | The time interval between the completion of one radio poll and the start of the next radio poll. To set the polling interval, see ‘Maintenance > General’ on page 231.<br>Note: as this polling feature utilizes air time, the polling interval should be selected to suit the network traffic. |

If a remote radio does not respond to a poll request within 10 seconds, the previous readings from that radio will be presented. Connectivity to a remote radio will be show as 'lost' if the remote radio has not responded to 3 consecutive poll requests.

*Events Summary*

Clicking on Events Summary navigates to the Events page (see 'Events > Alarm Summary' on page 245) for the specific remote radio where the radio events will be displayed.

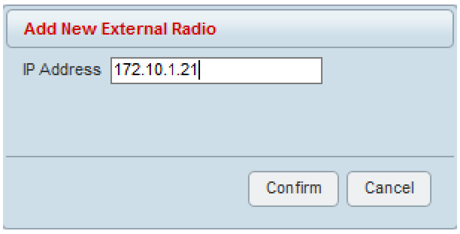
*Monitored Parameters*

Clicking on Monitored Parameters navigates to the Monitoring page (see 'Monitoring' on page 275) for the specific remote radio where the radio parameters will be displayed.

## Controls

Add

The Add button adds a radio to the extended network radio list.



Add New External Radio

IP Address 172.10.1.21

An error message will warn the user if the IP address entered is not a radio in the external network.

A maximum of 480 external radios can be added to the monitoring list but only the first 24 radios will be saved. If the user adds external radios beyond the first 24, an additional informational message will be displayed in the pop up box to inform the user that these entries will not be saved and will be lost when logging out of SuperVisor.

Delete

Deletes the selected radio from the extended network radio list.

# Command Line Interface

The Aprisa radio 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;

- USB via the Management Port (MGMT USB micro type B) or the USB host port •⭠ (USB type A) with a USB converter to RS-232 convertor.
- Telnet via the Ethernet Port (RJ45) using standard TCP/UDP port 23.
- Secure Shell (SSH) application via the Ethernet Port (RJ45) using standard TCP/UDP port 22.

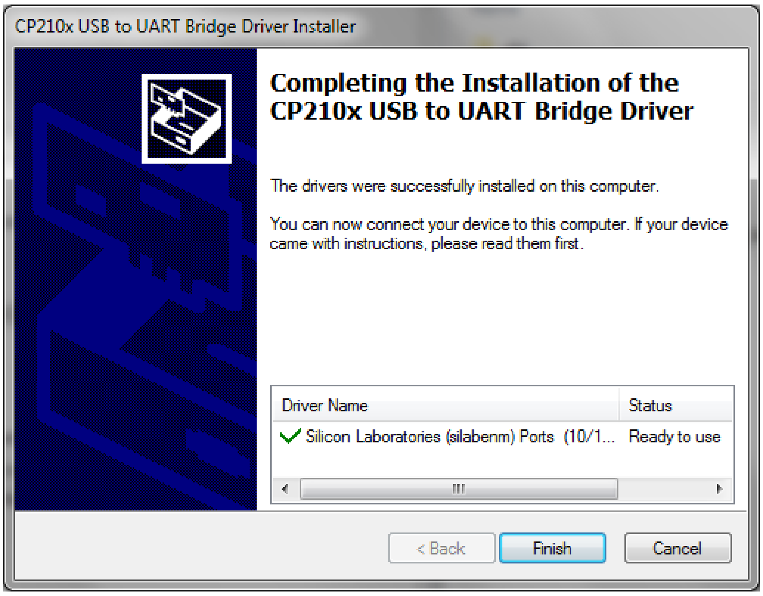
## Connecting to the CLI via the Management Port (MGMT)

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 radio (MGMT).
2. USB to UART Bridge VCP Drivers are required to connect the radio USB port to your PC. You can download and install the relevant driver from;

   https://www.silabs.com/products/development-tools/software/usb-to-uart-bridge-vcp-drivers

   Unzip the USB serial driver to a temporary location and install the appropriate driver on your computer.



CP210x USB to UART Bridge Driver Installer

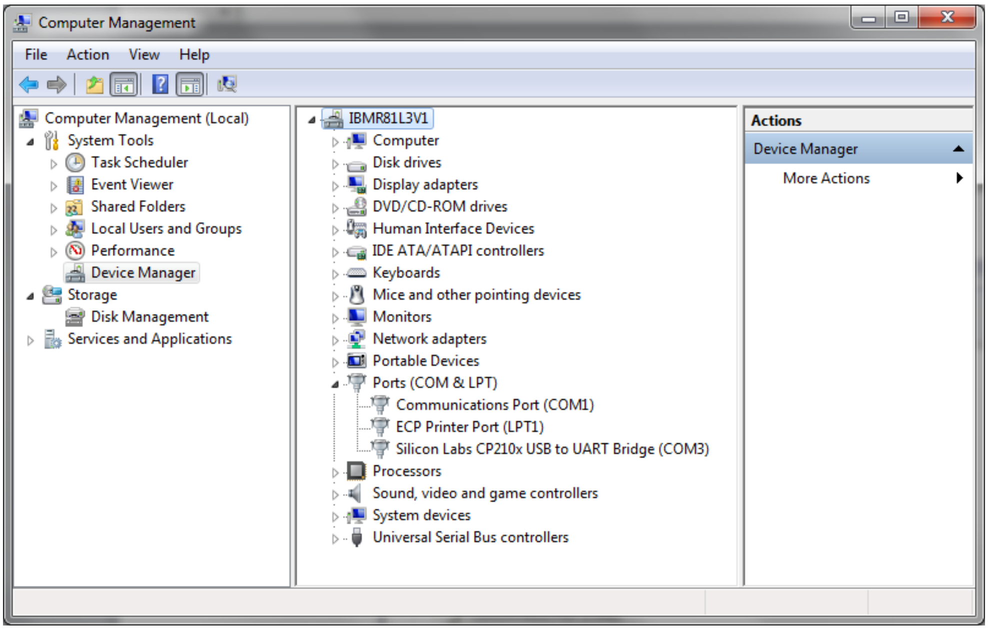
**Completing the Installation of the CP210x USB to UART Bridge Driver**

The drivers were successfully installed on this computer.

You can now connect your device to this computer. If your device came with instructions, please read them first.

| Driver Name | Status |
|---|---|
| ✓ Silicon Laboratories (silabenm) Ports (10/1... | Ready to use |

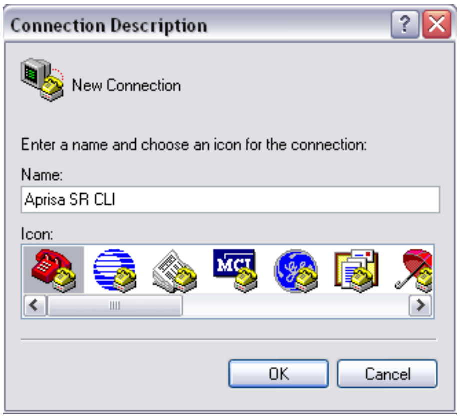
3. Go to your computer device manager (Win 7: Control Panel > Administrative Tools > Computer Management > Device Manager)
4. Click on ‘Ports (COM & LPT)’
5. Make a note of the COM port which has been allocated to the ‘Silicon Labs CP210x USB to UART Bridge’ (COM3 in the example below)



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

<u>HyperTerminal Example</u>

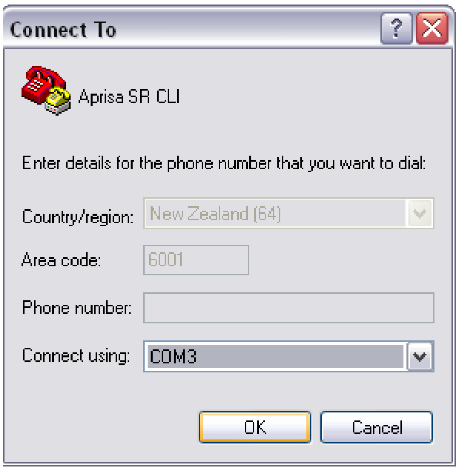
7. Enter a name for the connection (Aprisa radio CLI for example) and click OK.



Enter a name and choose an icon for the connection:

Name: Aprisa SR CLI

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



Enter details for the phone number that you want to dial:

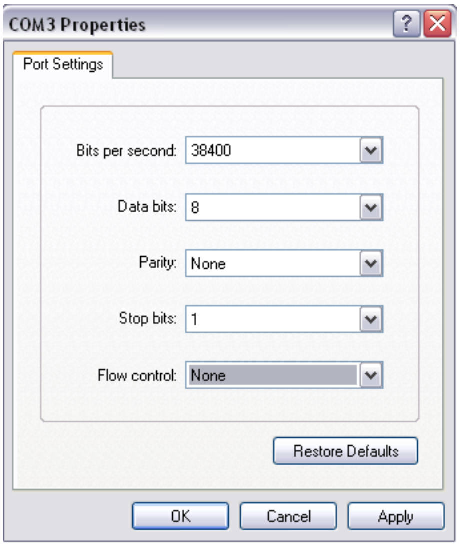
Country/region: New Zealand (64)

Area code: 6001

Phone number:

Connect using: COM3

9. Set the COM port settings as follows:



Bits per second: 38400

Data bits: 8

Parity: None

Stop bits: 1

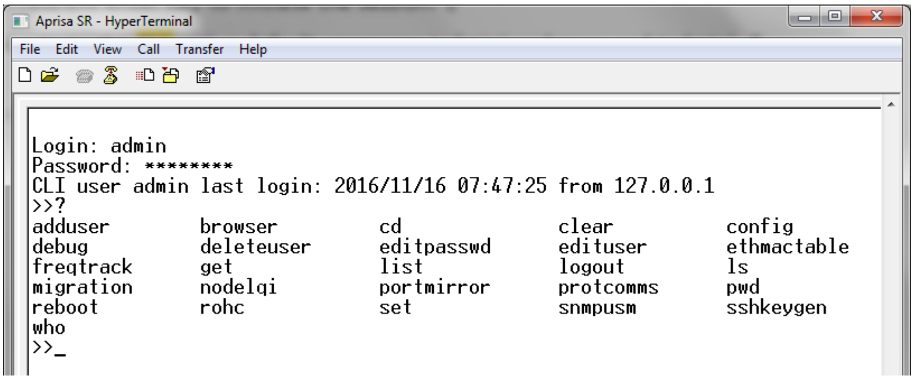
Flow control: None

10. Click OK. The HyperTerminal window will open.

11. Press the enter key to initiate the session.

12. Login to the CLI with a default username ‘admin’ and password ‘admin’.

The Aprisa radio CLI menu is shown:



```
Login: admin
Password: ********
CLI user admin last login: 2016/11/16 07:47:25 from 127.0.0.1
>>?
adduser         browser         cd              clear           config
debug           deleteuser      editpasswd      edituser        ethmactable
freqtrack       get             list            logout          ls
migration       nodelqi         portmirror      protcomms       pwd
reboot          rohc            set             snmpusm         sshkeygen
who
>>_
```

## Connecting to the CLI via Telnet

1. Connect the PC Ethernet to the radio Ethernet port (assuming a compatible IP address range).
2. Open the PC Command Prompt.
3. Type Telnet and the IP address of the radio ‘Telnet xx.xx.xx.xx’.
4. Login to the CLI with a default username ‘admin’ and password ‘admin’.

## Connecting to the CLI via SSH

Secure Shell (SSH) is a cryptographic network protocol for operating network services securely over an unsecured network. It is used in the Aprisa radio to provide a secure CLI remote access connection to the radio. SSH is operated in server client mode, where the radio is acting as the SSH server. The communication between the client and radio (server) is encrypted in SSHv2 (where SSHv2 vs SSHv1 uses a more enhanced security encryption algorithm).

The SSHv2 protocol consists of three major components:

- The Transport Layer Protocol provides server authentication, confidentiality and integrity with perfect forward secrecy.
- The User Authentication Protocol which authenticates the client to the server.
- The Connection Protocol which multiplexes the encrypted tunnel into several logical channels.

The SSHv2 protocol has the following advantages:

- Allows secure CLI connection over the internet.
- Provides an alternate secure CLI connection to the un-secure CLI Telnet connection.
- RADIUS, retype password change, user privilege and user account lockout are also applied over SSHv2.

The Aprisa radio supports the following SSH features capabilities:

- SSH is operated over Ethernet ports. It is also operated over the RF port when the radio is in Advanced Router or Gateway router modes. SSH is not operated over USB or microUSB CLI.
- The radio SSH supports ‘key re-exchange’ which is initiated after 1 hour or 1GB data but only if client initiates this process.
- The radio supports simultaneous sessions of CLI / USB-CLI / Telnet / SSH.
- SSH is supported OTA to repeater/remotes using the RF IP Address in advanced router mode.
- Current SSH is supported OTA to repeater/remotes using the RF IP Address in advanced router mode.
- Regenerates a new random SSH public/private key-pairs, using the CLI command ‘sshkeygen’. This command will delete current key pairs and on next reboot the radio will create a new pair.
- Factory reset doesn’t clear the public / private key pairs.
- Supervisor ‘Inactivity timeout’ in Maintenance > General is also used for SSH to expire idle sessions.
- Supervisor Maintenance > Advanced configuration save/restore does not save/restore the SSH public / private keys pairs.
- A maximum 5 simultaneous SSH sessions can be supported.

The Aprisa radio SSH server uses the following algorithms to secure the connection:

- Key exchange: diffie-hellman-group14-sha1, diffie-hellman-group1-sha1
- Data Integrity: hmac-sha2-256, hmac-sha1-96, hmac-sha1
- Encryption: aes128-cbc
- Host key: RSA

1. Connect the PC Ethernet to the radio Ethernet port (assuming a compatible IP address range).
2. Install one of the following tested SSH clients on your PC.
   - PuTTY - Windows / Ubuntu
   - TeraTerm
   - Secure CRT
   - MobaXterm
   - OpenSSH
   - Linux Terminal (Ubuntu)
   - Kitty portal
   - DameWare
   - smartTTY
   - Terminals (https://terminals.codeplex.com/)
   - mRemoteng - Multi-Remote Next Generation

2. Open the SSH client.
4. Login to the CLI with a default username ‘admin’ and password ‘admin’.

# CLI Commands

The cd and ls commands can be used to navigate the MIBs in the CLI however, 4RF recommends the use of the get and set commands in conjunction with the distributed MIB files.

The MIB files are provided as part of the software pack available on the 4RF website http://www.4rf.com/secure.

Contact support@4rf.com if you are not familiar with the use of MIB files.

**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 |
|---|---|
| get | Read the value of a MIB object<br>The MIB object name can be obtained in the MIB files. It can be a scalar object or a table object.<br>If the MIB object is a scalar, then the CLI command needs to be ‘get ObjectName’<br>If the MIB object name is a table, then the CLI command needs to be ‘get ObjectName ObjectIndex’<br>Examples:<br>get termName<br>get unitConfigOperatingMode 1 |
| set | Set the value of a MIB object<br>The MIB object name can be obtained in the MIB files. It can be a scalar object or a table object.<br>If the MIB object is a scalar, then the CLI command needs to be ‘set ObjectName ObjectValue’<br>If the MIB object name is a table, then the CLI command needs to be ‘set ObjectName ObjectValue ObjectIndex’<br>Examples:<br>set termName MyRadio<br>set unitConfigOperatingMode 1 1 |
| cd | Change directory |
| ls | Displays the next level menu items |
| pwd | Displays the current working directory |
| clear | Clear the screen |
| logout | Logs out from the CLI |
| adduser | adduser [-i <role>] <user name> <password> <password confirmation><br>Notes:<br>- The role parameter must be ALL CAPS<br>- Neither password nor account aging are being used by the radio |
| deleteuser | deleteuser <userName> |

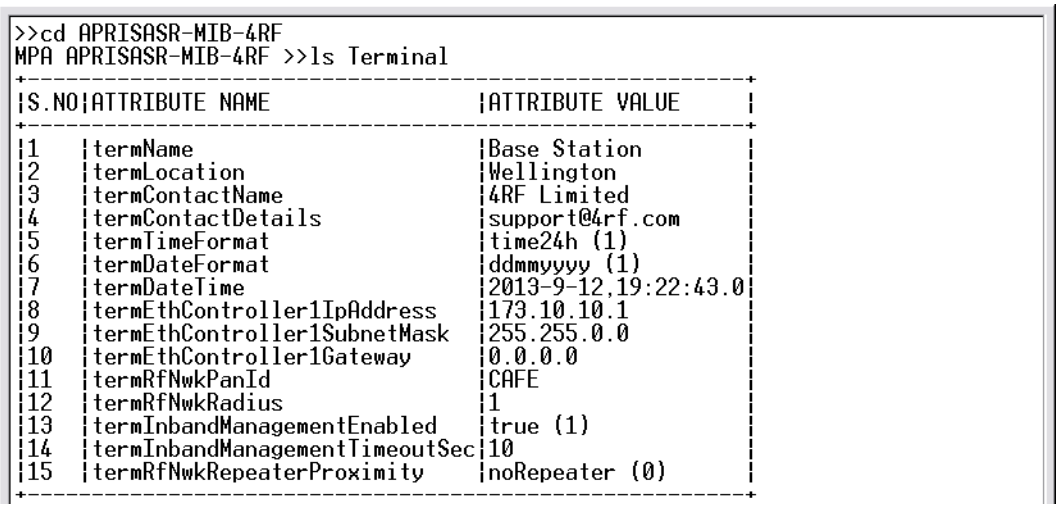
| CLI Command | Usage |
|---|---|
| edituser | edituser  [-p <password>] [-c <password confirmation>] [-i <role>] <userName> |
| editpasswd | editpasswd <old password> <new password> <password confirmation> |
| who | Shows the users currently logged into the radio |
| debug | Used by 4RF for detailed debug |
| list | list <tablename><br>Example: list user |
| reboot | Reboots the radio |
| snmpusm reset | To reset SNMPv3 users to Default |

## Viewing the CLI Terminal Summary

At the command prompt, type:

cd APRISASR-MIB-4RF

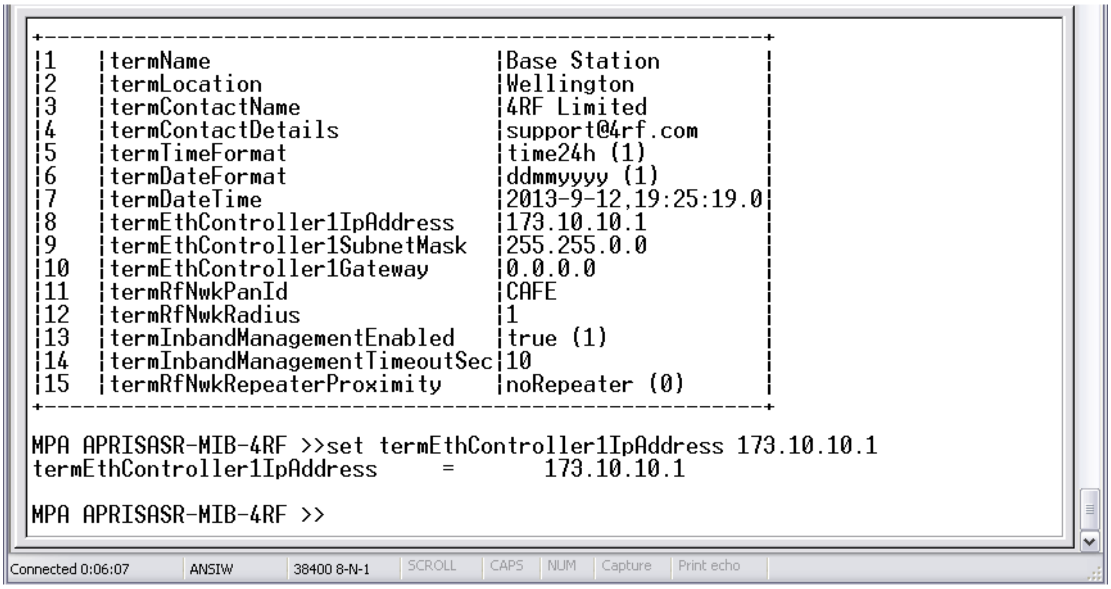
MPA APRISASR-MIB-4RF >>ls Terminal



```
>>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 >>
```

# 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 radio yagi antennas must also have vertical polarization.

## Aligning the Antennas

Align the remote radio yagi antennas by making small adjustments while monitoring the RSSI. The Aprisa SRi 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 58).

**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.

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

## Country Specific Products

The standard Aprisa SRi provides product option part numbers for the following country compliance bodies;

APSI-N915-SSC-SO-22-C1AA

| Country | Compliance Body |
|---|---|
| United States Of America | FCC |
| Canada | ISED |

APSI-N915-SSC-SO-22-C2AA

| Country | Compliance Body |
|---|---|
| Australia | ACMA |
| New Zealand | R-NZ |

# Duplexer Kits

The Aprisa SRi product range contains Duplexer Kit accessories for use with Aprisa SRi radios.

## Radio Duplexer Kits

Example of part number: APIB-KDUP-915-G5-BR

| Part Number | Description |
|---|---|
| APIB-KDUP-915-G5-BR | Aprisa SRi Duplexer Kit for an Aprisa SRi radio containing:<br>1x 1U 19" rack front mount shelf with mounting brackets and screws to mount 2x Aprisa SRi radios and 1x APIT-DUPL-915-G5 duplexer<br>1x G5 Duplexer 900 MHz, split 26 MHz, passband 7 MHz<br>2x TNC to SMA right angle 640mm cables<br>Fixed tuning - does not require factory tuning<br>Used for overlapping coverage - two Aprisa SRi base stations coupling to a single antenna (base station 1 zones 1&2, base station 2 zones 7&8)<br>Note: cannot be used with ACMA / RSM radios |

# USB Serial Ports

## USB RS-232 / RS-485 Serial Port

The Aprisa SRi 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 130).

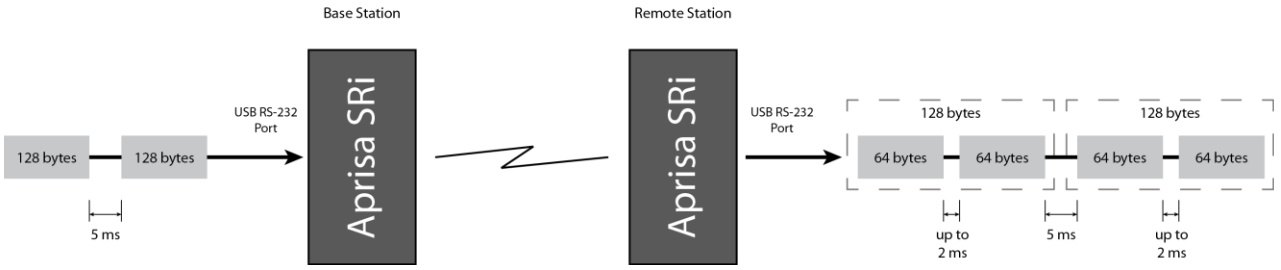
The Aprisa SRi USB port has driver support for these USB serial converters. Other USB serial converters may not operate correctly.

## 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.



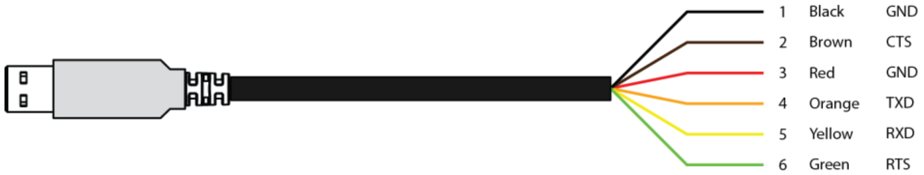
On a USB RS-232 port, Modbus RTU can operate up to 9600 bit/s with all packet sizes and up to 115200 bit/s if the packet size is less than 64 bytes. The standard RS-232 port is fully compatible with Modbus RTU at all baud rates.

# USB RS-232 Cabling Options

The following converter cables are available as Aprisa SRi accessories to provide the customer interface. The kit contains a USB connector retention clip (see ‘USB Retention Clip’ on page 320).

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 SRi 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 SRi 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.

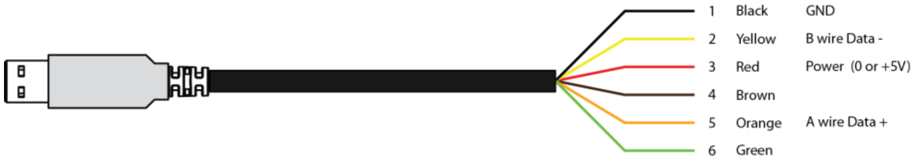
| Part Number | Part Description |
|---|---|
| APSB-KFCA-USB-23-D9-MF18 | 4RF SRi Acc, Kit, Interface, USB Conv, RS-232, DB9, Female, 1.8m |

# USB RS-485 Cabling Options

The following converter cable is available as an Aprisa SRi accessory to provide the customer interface RS-485 2 wire. The kit contains a USB connector retention clip (see ‘USB Retention Clip’ on page 320).

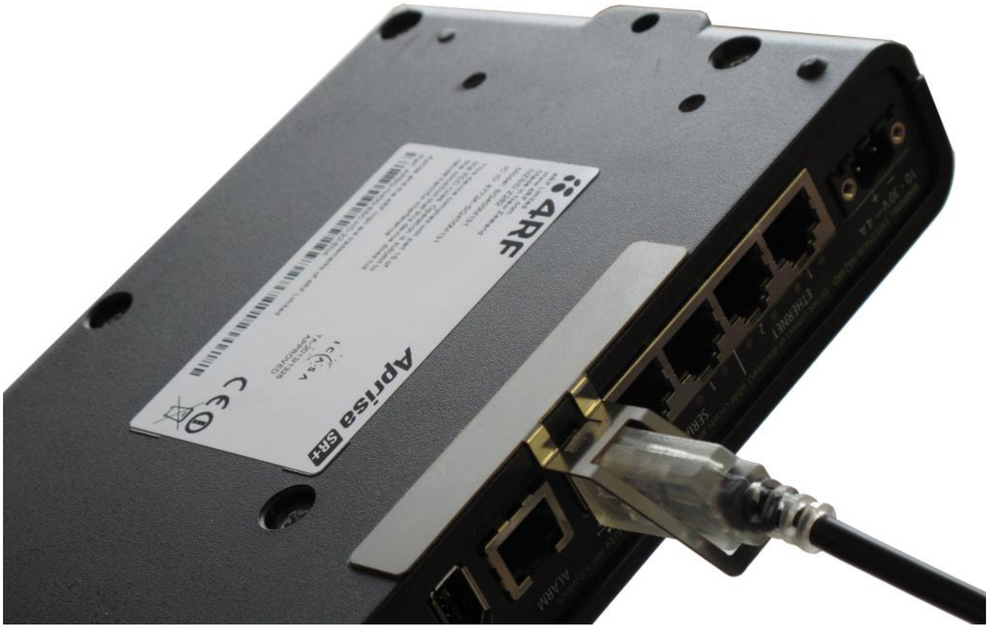
1. USB Converter to 1.8 metre multi-strand cable 6 wire for termination of customer interface

| Part Number | Part Description |
|---|---|
| APSB-KFCA-USB-48-MS-18 | 4RF SRi 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 SRi 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 SRi enclosure ensuring that it aligns to the middle of the radio USB connector.

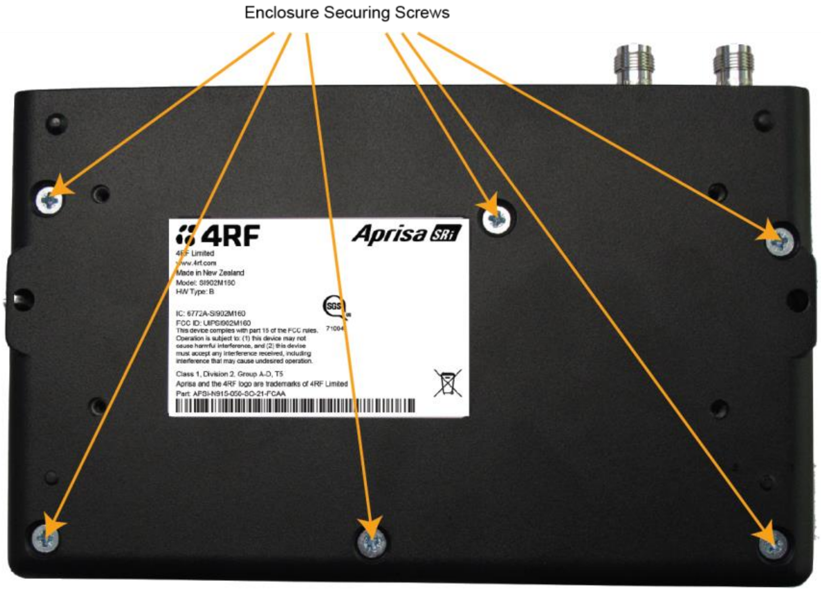
# 10. Maintenance

## Spare Fuses

The Aprisa SRi PBA contains two fuses in the power input with designators F1 and F2. Both the positive and negative power connections are fused. The fuse type is a Littelfuse 0454007 with a rating of 7 A, 75 V, very fast acting.

**To replace the fuses:**

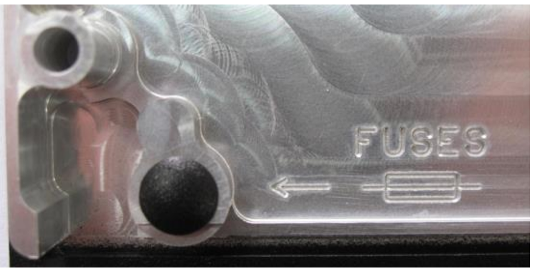
1. Remove the input power and antenna cable.
2. Unscrew the enclosure securing screws (posi 2).

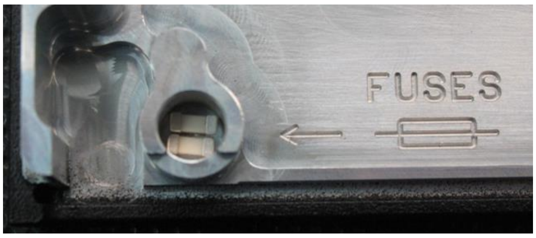


2. Separate the enclosure halves.

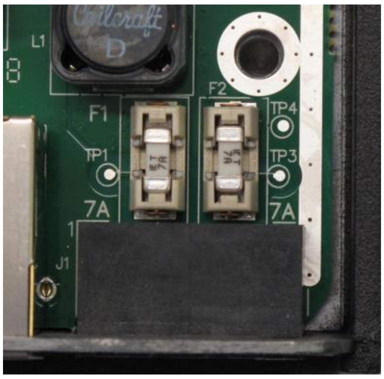
**CAUTION:** Antistatic precautions must be taken as the internal components are static sensitive.

3. Access the enclosure spare fuses under the plastic cap.





4. Replace the two fuses.



5. Close the enclosure and tighten the screws.

**Note:** Is it critical that the screws are re-tightened to 1.2 Nm. The transmitter adjacent channel performance can be degraded if the screws are not tightened correctly.

## Additional Spare Fuses

Additional spare fuses can be ordered from 4RF:

| Part Number | Part Description |
|---|---|
| APST-FNAN-454-07-02 | 4RF SR+ Spare, Fuse, Nano SMF, 454 Series, 7A, 2 items |

# No User-Serviceable Components

Except for fuse replacement, 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 SRi radio or an entire Aprisa SRi network.

## Network Software Upgrade

This process allows customers to upgrade their Aprisa SRi 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 260) and distributed via the radio link to all remote radios.

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

**To upgrade the entire Aprisa SRi network software:**

1. Using File Transfer, load the software pack into the base station (see 'Software > File Transfer' on page 260). The software can be transferred to the radio via an FTP transfer or from a USB flash drive.

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

2. Distribute the software to the entire network of remote radios (see 'Software > Remote Distribution' on page 268). Note that the distribution process over the air will take some time, depending on RF and Transfer rate settings.

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

   **Note:** The distribution of software to remote radios 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 270).

   **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 264).

5. When the new software has been activated, remote radios will re-register with the base station. The remote radios software version can verified with 'Network Status > Network Table' on page 297.

6. When the base station restarts with the new software, rediscover the nodes (see 'Discover Nodes' on page 243).

7. Check that all remote radios are now running on the new software (see ‘Network Status > Network Table’ on page 297).

**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 264).
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.

# Single Radio Software Upgrade

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

## File Transfer Method

The Software Pack is loaded into the radio with the file transfer process (see ‘Software > File Transfer’ on page 260) and activated (see ‘Software > Manager’ on page 264).

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

**To upgrade the Aprisa SRi 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 260).
4. Remove the USB flash drive from the host port.
5. Activate the software on the radio (see ‘Software > Manager’ on page 264).

## USB Boot Upgrade Method

A single Aprisa SRi 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 SRi front panel and power cycling the radio.

**To upgrade the Aprisa SRi 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 259) if you require the new software to load and automatically activate following the radio power cycle on step 7.
3. Power off the Aprisa SRi and insert the USB flash drive into the host port .
4. Power on the Aprisa SRi.
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 SRi.

Login to the radio being upgraded and go to SuperVisor 'Software > Manager' on page 264.

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 SRi 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 259).

In this case, go to SuperVisor see 'Software > Manager' on page 264 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.

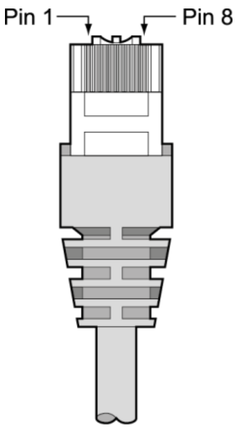
## Software Downgrade

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.

# 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 SRi 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<br>Pin Number | Pin Function | Direction | TIA-568A Wire Colour | TIA-568B Wire Colour |
|---|---|---|---|---|
| 1 | RTS | Input | Green / white | Orange/white |
| 2 | DTR | 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<br>Pin Number | Pin Function | Direction | Pin Function | DB9 Male Pinout | Pin Function | DB9 Female Pinout |
| 1 | RTS | Input | RTS | 7 | CTS | 8 |
| 2 | DTR / Sleep Mode | Input | DTR | 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 | 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<br>Pin Number | Pin Function | Direction | TIA-568A Wire Colour | TIA-568B Wire Colour |
|---|---|---|---|---|
| 1 | Alarm 1 Input | 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 / Sleep Mode | 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.

# 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 247 for setup of alarm thresholds / sample durations etc.

# Alarm Events

## Transmit Path 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. |
| 90 | VSWR Threshold | warning(4) | Threshold Type | Alarm to indicate that there is a high SWR on the antenna port. | Check antenna is not open or shorted, check duplexer correctly connected and tuned. |

## Receive Path 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. |
| 88 | SNR Threshold | warning(4) | Threshold Type | Alarm to indicate that the monitored SNR has exceeded its configured threshold 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. |
| 87 | Payload Decryption Failure | warning(4) | Sample Duration Type | Alarm to indicate that packets have been received over the air where the radio has failed to decrypt the content. | Check the event history log for more details. If the decryption failure is solely due to security setting mismatch, then the security settings of the radios involved needs to be checked and corrected. If the decryption failure is also possibly due to a security key mismatch, then this indicates that another unauthorized radio is attempting to connect to the radio network, or an authorized radio has got an invalid key that needs updating. |

## 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. |
| 86 | RF Profile Manual Lock | warning(4) | Not Configurable | Alarm to indicate that the diagnostics function to lock the radio to a specific RF profile has been activated. This is only relevant when the radio has been configured with more than one RF profile. | No action required. This indicates that the diagnostic function is active. |

## 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. |
| 15 | Port 1 Eth Port Down | critical(1) | Sample Duration Type | Alarm to indicate that Ethernet port 1 has no detected connection during the defined duration period. | Check the cable and connector. Check switch port or RTU is active. Check Ethernet Port speed/duplex 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. |
| 38 | Port 2 Eth Port Down | critical(1) | Sample Duration Type | Alarm to indicate that Ethernet port 2 has no detected connection during the defined duration period. | Check the cable and connector. Check switch port or RTU is active. Check Ethernet Port speed/duplex 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. |
| 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. |

| Event ID | Event Display Text | Default Severity | Configuration Type | Function | Recommended Actions |
|---|---|---|---|---|---|
| 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. |
| 47 | Port 3 Eth Port Down | critical(1) | Sample Duration Type | Alarm to indicate that Ethernet port 3 has no detected connection during the defined duration period. | Check the cable and connector. Check switch port or RTU is active. Check Ethernet Port speed/duplex 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. |
| 51 | Port 4 Eth Port Down | critical(1) | Sample Duration Type | Alarm to indicate that Ethernet port 4 has no detected connection during the defined duration period. | Check the cable and connector. Check switch port or RTU is active. Check Ethernet Port speed/duplex 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. |
| 22 | Remote Communications Lost | major(2) | Not Configurable | Alarm to indicate that a remote radio is not receiving packets from the base station. | Check RF configuration settings. |
| 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. |
| 74 | Software Activation Pending | warning(4) | Not Configurable | Alarm to indicate that a software activation is about to occur. The activation can be on a software pack, configuration pack or security profile. | No action required. This is a warning to indicate that a type of software activation is about to happen. The information in the event history log will describe the type of activation |

### 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. |

## 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<br>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. |
| 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<br>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<br>No action required unless unexpected |
| 41 | File Transfer Activity | information (5) | Event to indicate that a data file is being transferred to or from the radio. | Information<br>No action required unless unexpected |
| 42 | Software Management Activity | information (5) | Event to indicate that software is being distributed to remote radios. | Information<br>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<br>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<br>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<br>No action required unless unexpected |
| 75 | Config Management Activity | information (5) | Event to indicate that there has been some management activity related to the configuration of the radio. As an example, the configuration of the radio has been changed via SNMP, or a new configuration script has been loaded into the radio. | Information<br>No action required unless unexpected |
| 78 | Security Information | information (5) | Security related events that occur on the radio. This may include events that report that a user account has been locked or recovered. Or events related to RADIUS authentication. | Refer to the event history logs for details of the events. |
| 81 | Date And Time Activity | information (5) | Events related to the date and time settings of the radio. This may include user changes to the date and time or SNTP related events. | Refer to the event history logs for details of the events. |
| 85 | GPS Activity | information (5) | Events related to GPS coordinates of the radio. This includes updates to the GPS coordinates of the radio | Refer to the event history logs for details of the events. |

| Event ID | Event Display Text | Default Severity | Function | Recommended Actions |
|---|---|---|---|---|
| 89 | User Account Activity | information (5) | Events related to the management of User Accounts of the radio. This includes adding or deleting user accounts, or updates to existing accounts. | Refer to the event history logs for details of the events. |

# 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

| Compliance Body | Frequency Band | Frequency Range | Synthesizer Step Size |
|---|---|---|---|
| FCC | 915 MHz | 902-928 MHz | 6.250 kHz |
| ISED | 915 MHz | 902-928 MHz | 6.250 kHz |
| ACMA | 915 MHz | 915-928 MHz | 6.250 kHz |
| RSM | 915 MHz | 915-928 MHz | 6.250 kHz |
| ANATEL | 915 MHz | 902-907.5 and 915-928 MHz | 6.250 kHz |

## Channel Sizes

Minimum Coded Forward Error Correction

| Channel Size | Gross Radio Capacity less FEC | | | |
|---|---|---|---|---|
| | 64 QAM | 16 QAM | QPSK | |
| 50 kHz | 240 kbit/s | 160 kbit/s | 80 kbit/s | |

# Receiver

## Receiver Sensitivity

| | | 50 kHz |
|---|---|---|
| BER < $10^{-2}$ | 64 QAM | -100 dBm |
| BER < $10^{-2}$ | 16 QAM | -108 dBm |
| BER < $10^{-2}$ | QPSK | -113 dBm |
| BER < $10^{-6}$ | 64 QAM | -96 dBm |
| BER < $10^{-6}$ | 16 QAM | -104 dBm |
| BER < $10^{-6}$ | QPSK | -109 dBm |

## Adjacent Channel Selectivity

| | | 50 kHz |
|---|---|---|
| Adjacent channel selectivity | | > -37 dBm |
| BER < $10^{-2}$ | 64 QAM | > 53 dB |
| BER < $10^{-2}$ | 16 QAM | > 53 dB |
| BER < $10^{-2}$ | QPSK | > 58 dB |

## Co-Channel Rejection

| | | 50 kHz |
|---|---|---|
| BER < $10^{-2}$ | 64 QAM | > -23 dB |
| BER < $10^{-2}$ | 16 QAM | > -19 dB |
| BER < $10^{-2}$ | QPSK | > -12 dB |

## Intermodulation Response Rejection

| | | 50 kHz |
|---|---|---|
| Intermodulation response rejection | | > -35 dBm |
| BER < $10^{-2}$ | 64 QAM | > 55 dB |
| BER < $10^{-2}$ | 16 QAM | > 55 dB |
| BER < $10^{-2}$ | QPSK | > 60 dB |

## Blocking or Desensitization

| | | 50 kHz |
|---|---|---|
| Blocking or desensitization | | > -17 dBm |
| BER < $10^{-2}$ | 64 QAM | > 73 dB |
| BER < $10^{-2}$ | 16 QAM | > 73 dB |
| BER < $10^{-2}$ | QPSK | > 78 dB |

## Spurious Response Rejection

| | | **50 kHz** |
|---|---|---|
| Spurious response rejection | | > -32 dBm |
| BER < $10^{-2}$ | 64 QAM | > 58 dB |
| BER < $10^{-2}$ | 16 QAM | > 58 dB |
| BER < $10^{-2}$ | QPSK | > 63 dB |

## Receiver Spurious Radiation

| | **50 kHz** |
|---|---|
| Receiver spurious radiation | > -57 dBm |

## Transmitter

| | | |
|---|---|---|
| Average Power output<br>Note: The Peak Envelope Power (PEP) at maximum set power level is 1.0 W (+30 dBm). | 64 QAM | 0.01 to 0.2 W (+10 to +23 dBm, in 1 dB steps) |
| | 16 QAM | 0.01 to 0.25 W (+10 to +24 dBm, in 1 dB steps) |
| | QPSK | 0.01 to 0.4 W (+10 to +26 dBm, in 1 dB steps) |

Note: The Aprisa SRi 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 | < -20 dBc<br>< -49 dBm 800 MHz to 915 MHz<br>< -33 dBm 928 MHz to 1 GHz |
| Attack time | < 1.5 ms |
| Release time | < 0.5 ms |
| Data turnaround time | < 2 ms |
| Frequency stability | ± 0.5 ppm |
| Frequency aging | < 1 ppm / annum |

## Spread Spectrum

| | |
|---|---|
| Number of standard hop zones | 8 (non-overlapping) |
| Zone / channel selection | Zone selection list and channel blacklist |
| Hop Frequency | 62.5 kHz |
| Minimum number of channels | 50 |

FCC / ISED

| | |
|---|---|
| Number of channels per hop zone | 50 |
| Full band option | 400 channels full band single zone |

ACMA / RSM

| | |
|---|---|
| Number of channels per hop zone | 25 |
| Full band option | 200 channels full band single zone |

ANATEL

| | |
|---|---|
| Number of channels per hop zone | 35 |
| Full band option | 280 channels full band single zone |

## Modem

| | |
|---|---|
| Forward Error Correction | Variable length concatenated Reed Solomon plus convolutional code |
| Adaptive Burst Support | Adaptive FEC<br>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 SRi 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<br>Full duplex or half duplex<br>(Auto-negotiating and auto-sensing) |
| **Diagnostics** | Left Green LED | Off: no Ethernet signal received<br>On: Ethernet signal received |
| | Right Orange LED | Off: no data present on the interface<br>Flashing: data present on the interface |

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

# RS-232 Asynchronous Interface

The Aprisa SRi 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<br>On: RS-232 device connected |
| | Right Orange LED | Off: no data present on the interface<br>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 |

# Power Specifications

## Power Supply

| | |
|---|---|
| Nominal voltage | +13.8 VDC (negative earth) |
| Absolute input voltage range | +10 to +30 VDC |
| Maximum power input | 20 W |
| Connector | Molex 2 pin male screw fitting<br>39526-4002 |

## Power Consumption

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

| **Mode** | Transmit Peak Power | 13.8 VDC |
|---|---|---|
| Transmit / Receive | 1.0 W | < 15 W |
| Receive only | | < 4.5 W |

## Power Dissipation

| **Mode** | Transmit Peak Power | 13.8 VDC |
|---|---|---|
| Transmit / Receive | 1.0 W | < 14 W |
| Receive only | | < 4.5 W |

# General Specifications

## Environmental

| | |
|---|---|
| Operating temperature range | -40 to +70˚ C (-40 to +158˚ F) |
| Storage temperature range | -40 to +85˚ C (-40 to +185˚ F) |
| Operating humidity | Maximum 95% non-condensing |
| Acoustic noise emission | No audible noise emission |

## Mechanical

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

# Compliance

## FCC

| | |
|---|---|
| Radio | FCC CFR47 Part 15.247 |
| EMC | 47CFR part 15 Radio Frequency Devices |
| Safety | EN 60950-1:2006<br>Class 1 division 2 for hazardous locations |
| Environmental | ETS 300 019 Class 3.4<br>Ingress Protection IP51 |

## Innovation, Science and Economic Development (ISED)

| | |
|---|---|
| Radio | RSS-247 |
| EMC | This Class A digital apparatus complies with Canadian standard ICES-003.<br>Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada. |
| Safety | EN 60950-1:2006<br>Class 1 division 2 for hazardous locations |
| Environmental | ETS 300 019 Class 3.4<br>Ingress Protection IP51 |

## ACMA

| | |
|---|---|
| Radio | Radio Communications (Short Range Devices) Standard 2004 |
| EMC | AS/NZS 4268 |
| Safety | EN 60950-1:2006<br>Class 1 division 2 for hazardous locations |
| Environmental | ETS 300 019 Class 3.4<br>Ingress Protection IP51 |

## RSM

| | |
|---|---|
| Radio / EMC | AS/NZS 4268 |
| Safety | EN 60950-1:2006<br>Class 1 division 2 for hazardous locations |
| Environmental | ETS 300 019 Class 3.4<br>Ingress Protection IP51 |

## ANATEL (compliance pending)

| | |
|---|---|
| Radio / EMC | Resolution No. 680 |
| Safety | EN 60950-1:2006<br>Class 1 division 2 for hazardous locations |
| Environmental | ETS 300 019 Class 3.4<br>Ingress Protection IP51 |

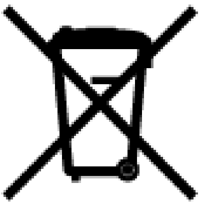
# 14. Product End Of Life

## 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 SRi radio, contact us (see page 19).

# 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 |