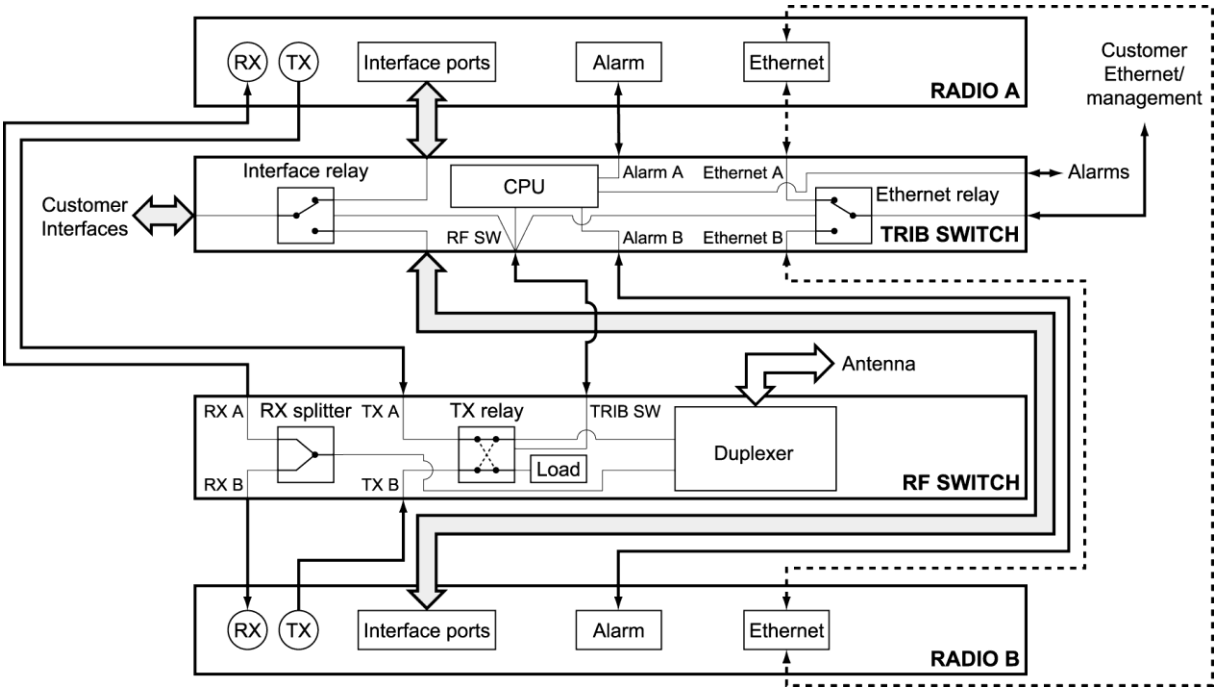
11. Protected Terminals

Monitored Hot Stand By (MHSB)

This section describes configuring the protected terminal in MHSB mode.

A protected terminal in MHSB mode comprises two radios interconnected using a MHSB switch. This MHSB switch comprises one RF switch and up to four tributary switches depending on the number of tributaries requiring switching:



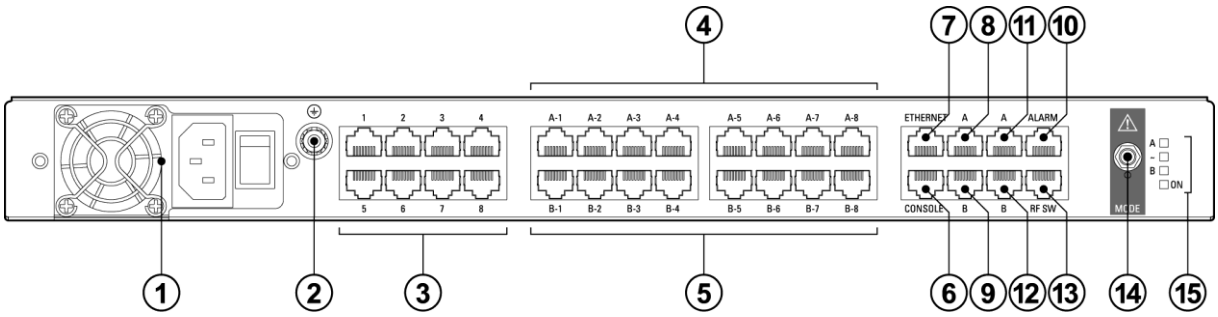
The MHSB switch protect terminals against any single failure in one radio. It also monitors the alarm output of each radio and switches between radios if major radio link alarms occur. The MHSB switch will not allow a switch to a faulty radio.

The MHSB switch uses a CPU to monitor the alarm status received from both the connected radios' alarm ports. When a relevant major radio link alarm is detected on the active radio (that is, transmitter, receiver, power supply or modem), the CPU switches a bank of relays that switches all the interfaces and the transmit port from the main radio to a functioning stand-by radio. The stand-by radio now becomes the active radio.

The MHSB switch has a hysteresis of 30 seconds to prevent switching on short alarm transients.

The tributary switch and the RF switch are both a 19-inch rack-mount 1U high chassis. The MHSB switch option is available for all Aprisa XE frequency bands.

Tributary Switch Front Panel

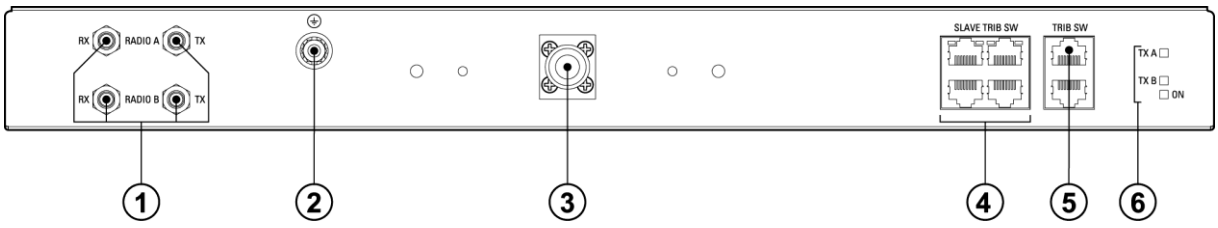


No.	Description	Explanation
1	Power supply input	Input for DC power or AC power
2	Protective earth	M5 terminal intended for connection to an external protective conductor for protection against electric shock in case of a fault
3	Interface ports	Port for connecting to customer interface equipment
4	Radio A interfaces	These connect to the interface ports on radio A
5	Radio B interfaces	These connect to the interface ports on radio B
6	Console	For factory use only
7	Ethernet	Port for connecting to customer Ethernet network. This port is also used to set up and manage the radios remotely over an IP network
8	Radio A Ethernet	Connects to an Ethernet port on radio A
9	Radio B Ethernet	Connects to an Ethernet port on radio B
10	Alarms	Alarm input/output connections for customer equipment
11	Radio A alarms	Connects to the alarm port on radio A
12	Radio B alarms	Connects to the alarm port on radio B
13	RF SW	Provides power and signalling to the RF switch
14	Mode switch	Three-position locking toggle switch to set the MHSB switch into automatic mode or radio A / radio B test mode
15	LEDs	Mode and status LEDs

Tributary Protection Switch LEDs

LED	Colour	Appearance	Explanation
A	Green	Solid	The radio is active and is OK
	Green	Flashing	The radio is in standby mode and is OK
	Red	Solid	The radio is active and there is a fault
	No colour (off)	-	The tributary switch is in 'slave' mode and the switching is controlled by the master tributary switch
	Red	Flashing	The radio is in standby mode, and there is a fault
B	Green	Solid	The radio is active and is OK
	Green	Flashing	The radio is in standby mode and is OK
	Red	Solid	The radio is active and there is a fault
	No colour (off)	-	The tributary switch is in 'slave' mode and the switching is controlled by the master tributary switch
	Red	Flashing	The radio is in standby mode, and there is a fault
~	Green	Solid	The tributary protection switch is in 'auto' mode
	Green	Flashing	The tributary protection switch is in 'slave' mode
	Red	Solid	The tributary protection switch is in 'manual' mode (A or B)
On	Blue	Solid	Indicates that there is power to the tributary protection switch

RF Switch Front Panel



No.	Description	Explanation
1	Radio QMA	QMA connectors for connecting the protected radios
2	Protective earth	M5 terminal intended for connection to an external protective conductor for protection against electric shock in case of a fault
3	Antenna port	N-type female connector for connection to the antenna feeder cable. This view shows an internally mounted duplexer. If an external duplexer is fitted, the antenna port will be on the external duplexer
4	Slave tributary switch outputs	Connects to secondary tributary switch for control of additional interfaces
5	Tributary switch	Connects the RF switch to the tributary switch (the master if more than one tributary switch is required)
6	LEDs	Status LEDs

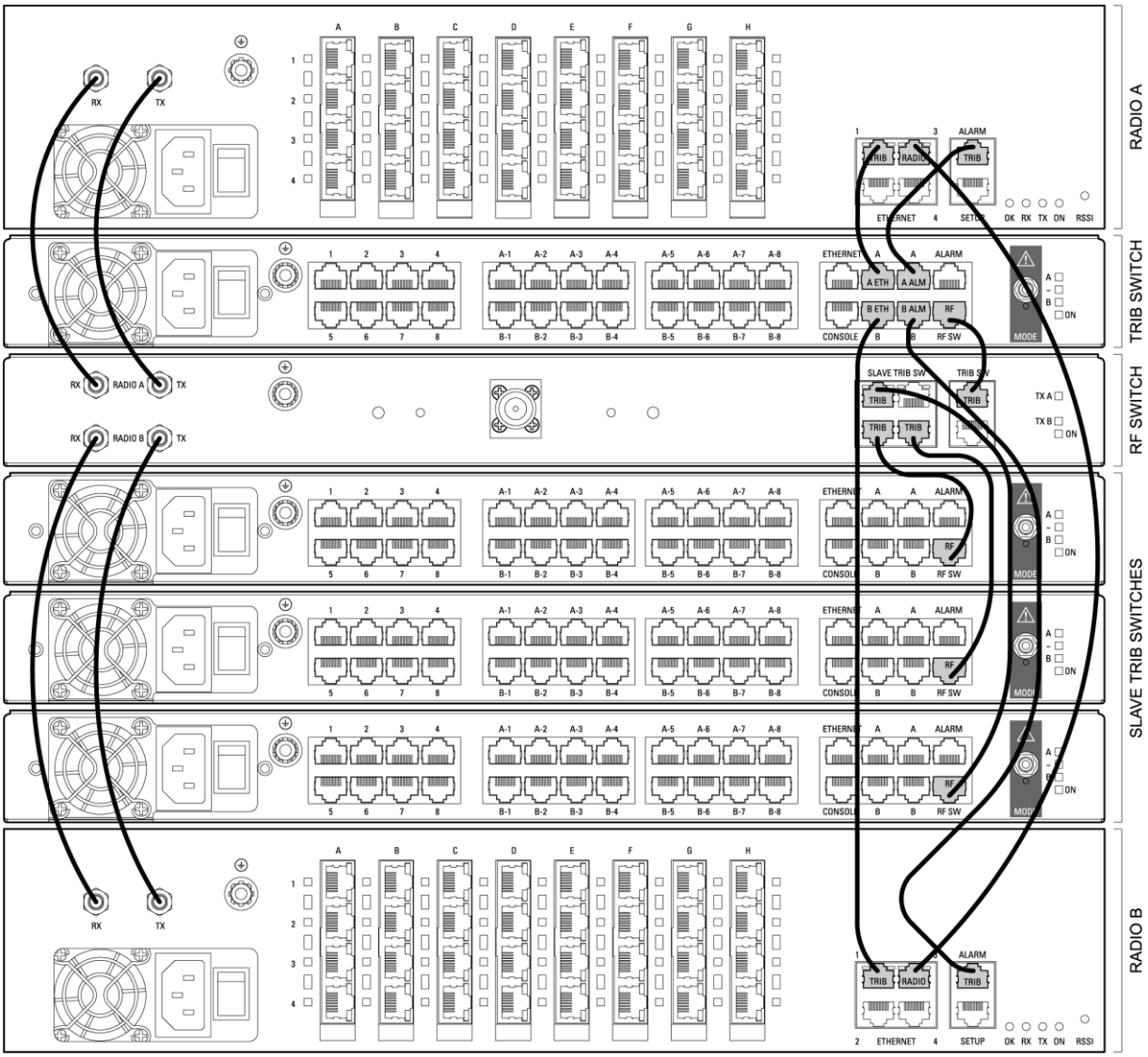
RF Protection Switch LEDs

LED	Colour	Appearance	Explanation
Tx A	Green	Solid	RF is being received from radio A
Tx B	Green	Solid	RF is being received from radio B
On	Blue	Solid	Indicates that there is power to the RF protection switch

Slave Tributary Switches

Each tributary switch protects up to eight ports. Up to three slave tributary switches may be added to a MHSB terminal to protect up to 32 ports. Each slave tributary switch is interconnected by means of the slave tributary switch ports on the RF switch, as shown below.

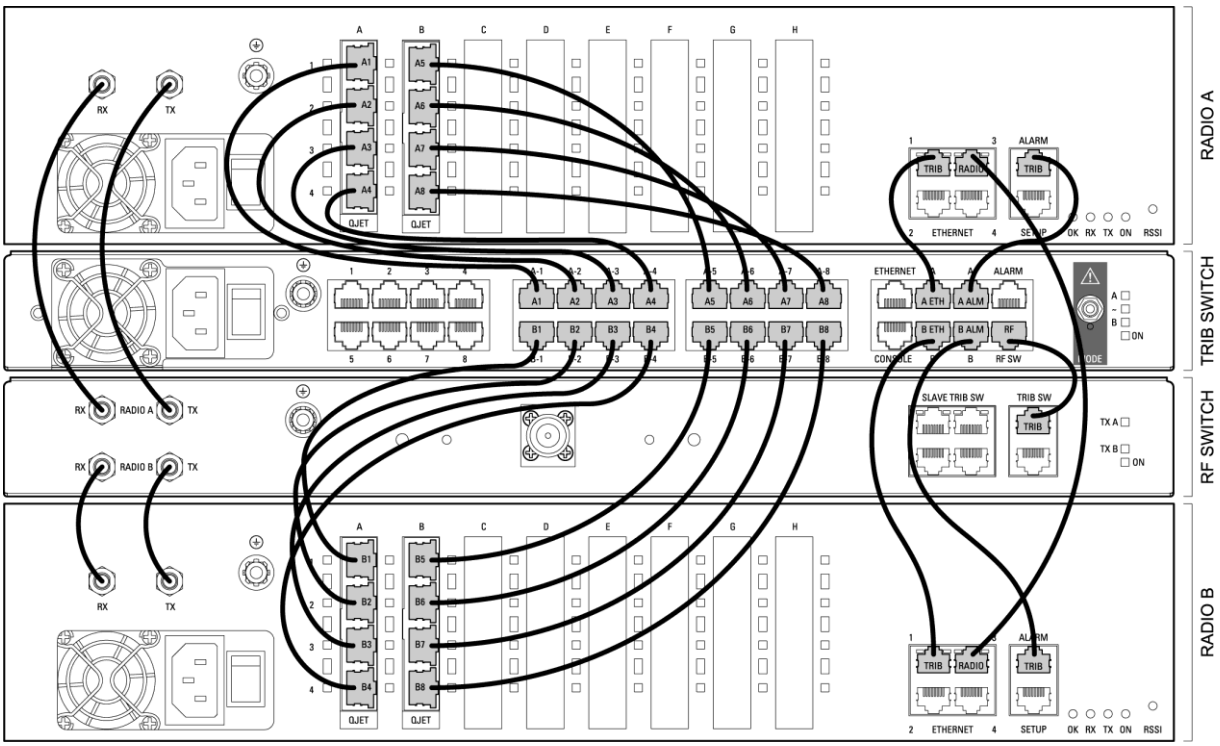
Note: A tributary switch that is operating as a slave (rather than a master) has a RJ-45 V.24 loopback connector plugged into the console port. If the connector is missing, contact Customer Support. Alternatively, you can make this connector. Follow the standard pinouts for a V.24 RJ-45 connection (see 'QV24 Interface connections' on page 273).



MHSB Cabling

The two radios are interconnected as follows:

CAUTION: Do not connect Transmit to Receive or Receive to Transmit as this may damage the radio or the MHSB switch.



Cables supplied with MHSB

The following cables are supplied with a MHSB terminal:

- Ethernet interface: RJ-45 ports standard TIA-568A patch cables .
- Alarm interface: RJ-45 ports standard TIA-568A patch cables.
- RF ports: two QMA male patch cables are supplied.

MHSB Power Supply

See ‘DC Power Supply’ on page 37 and ‘AC Power Supply’ on page 40.

Configuring the Radios for Protected Mode

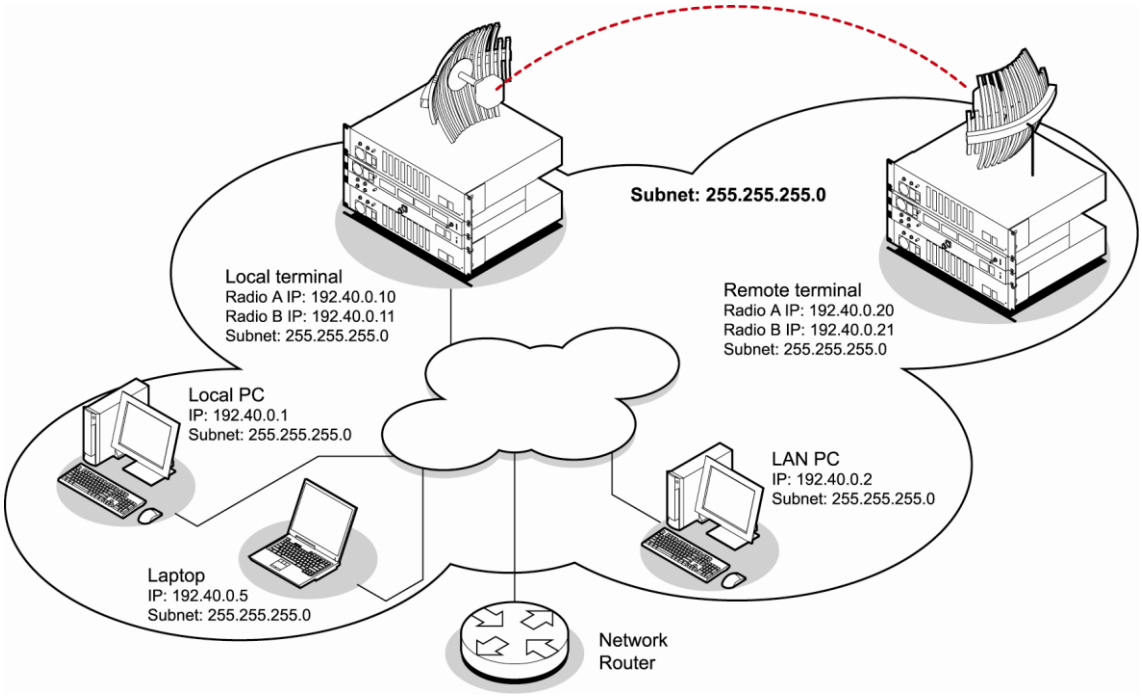
The MHSB switch does not require any special software. However, the radios connected to the MHSB switch must be configured to work with the MHSB switch. This sets the alarm outputs and inputs to function in MHSB mode.

You must configure the interfaces of both radios connected to the MHSB switch identically. To perform this, you can either connect directly to the radio or use the test mode of the MHSB switch.

MHSB Terminal IP Addresses

Before configuring the link, you must ensure that the two independent links have correctly configured IP address details.

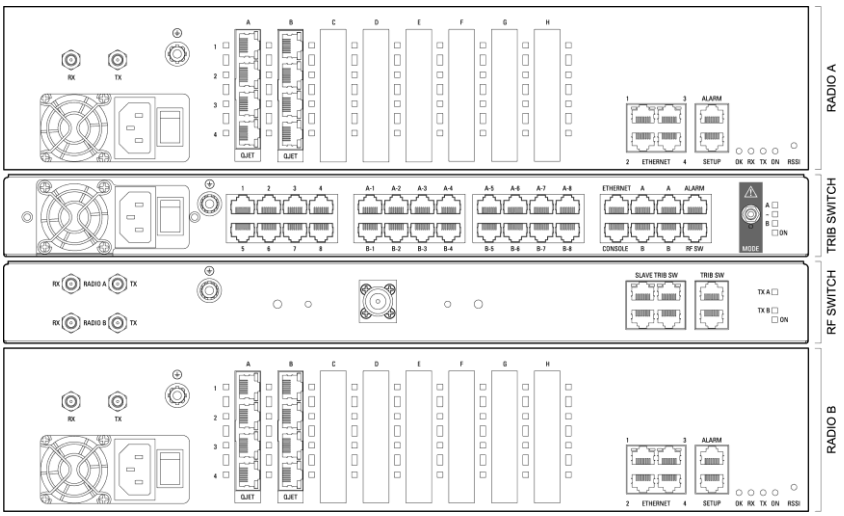
All four radios in the protected link must be on the same subnet.



Example of MHSB IP addressing

Mounting the MHSB Radios and Switches

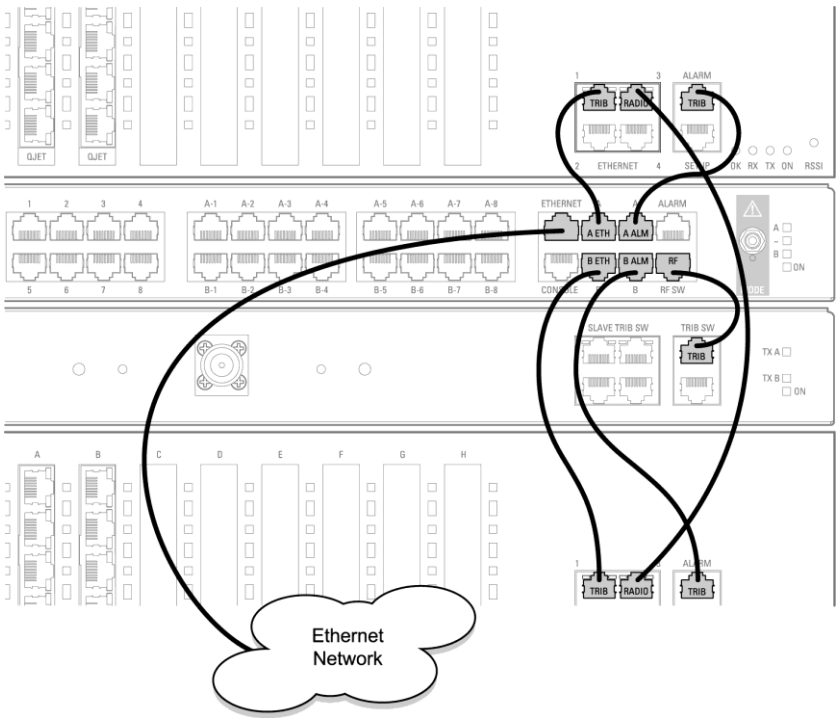
Once the IP addresses are correctly configured, it is important to connect the A and B radios' Ethernet and Alarm ports correctly. In general, mount radio A above the MHSB switch and radio B below the MHSB switch:



There is an Ethernet connection between any of the four Ethernet ports on each radio and the Ethernet port on the Tributary switch. There is also a connection between radio A and radio B, which ensures Ethernet traffic is maintained if a radio loses power.

The Ethernet port on the protection switch can be connected to an Ethernet hub or switch to allow multiple connections.

Important: The management Ethernet capacity on each of the four radios in the protected terminal must be identical for remote communications to work and there should only be one IP connection to the management network (via the tributary switch Ethernet port).



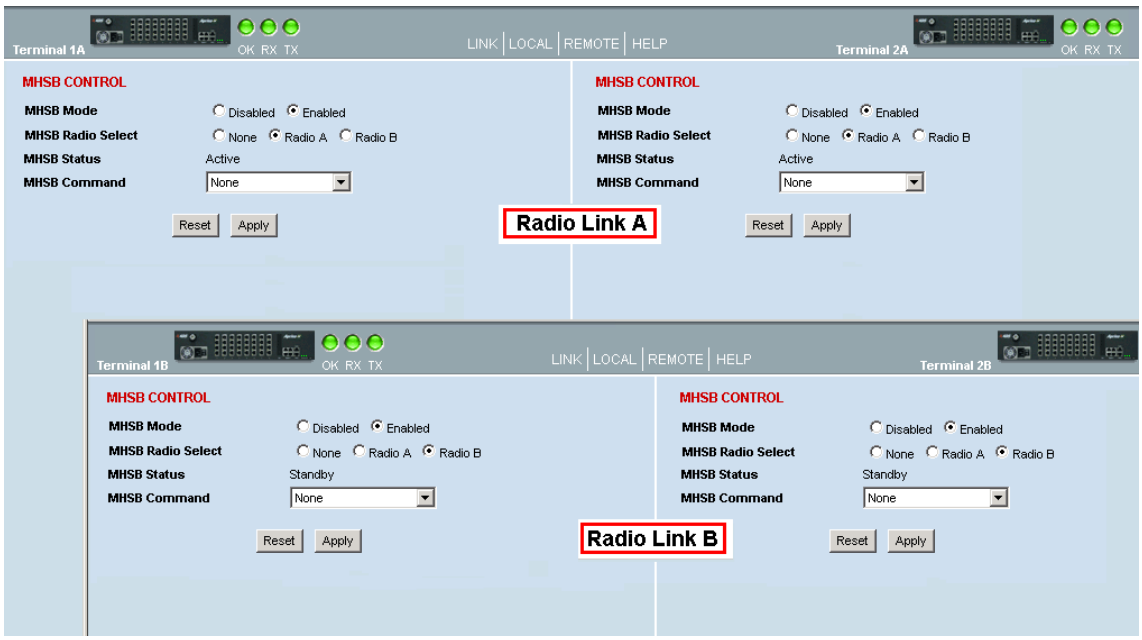
Configuring the Terminals for MHSB

It is recommended that you configure the local and remote A side first, then the local and remote B side. Both the local A and B radios must be configured identically, and both the remote A and B radios must be configured identically.

Tip: As illustrated below, you may find it helpful to have two browser sessions running simultaneously. You can then easily see both the A and B sides of the protected link.

To configure MHSB operation:

1. Select Link > Maintenance > MHSB.



2. Enable MHSB mode.
3. Select whether the radio is A or B.

   Ensure that the radio connected to the A side of the protection switch (normally above the MHSB switch) is set to Radio A and the radio connected to the B side of the protection switch (normally below the MHSB switch) is set to Radio B.

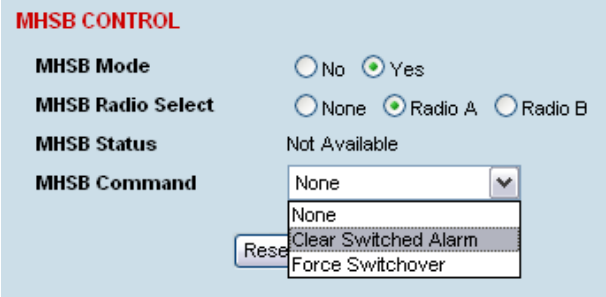
   In the event of a power outage, the radios will switch over to the A side of the protection switch when the power is restored. The A side is also the default active side.

4. When you have made your changes, click Apply to apply changes or Reset to restore the previous configuration.
5. Repeat steps 2 to 4 for the other side of the protected link.

Clearing MHSB Alarms

If a switchover event occurs, the OK LED on the front panel and on the Terminal status and menu bar in SuperVisor changes to amber.

1. Select Clear Switched Alarm from the MHSB Command drop-down list.



2. Click Apply to apply changes or Reset to reset the page.

Note: When MHSB mode is enabled, external alarm input 2 is used by the protection system to carry alarms from the protection switch to the radio. In MHSB mode, therefore, only external alarm input 1 is available for user alarms.

Hitless Space Diversity (HSD)

HSD provides hitless RF receive path protection and hot standby transmitter redundancy. It is typically deployed for paths where high path availability is required.

An Aprisa XE hitless space diversity terminal comprises two radio terminals, radio A and radio B.

Radio A is the primary radio which is fitted with the interface cards and connects to antenna A.

Antenna A always carries the transmitted signal and the received signal for Radio A.

Radio B is the secondary radio the receiver of which connects to antenna B. The transmitter in this radio is the standby transmitter.

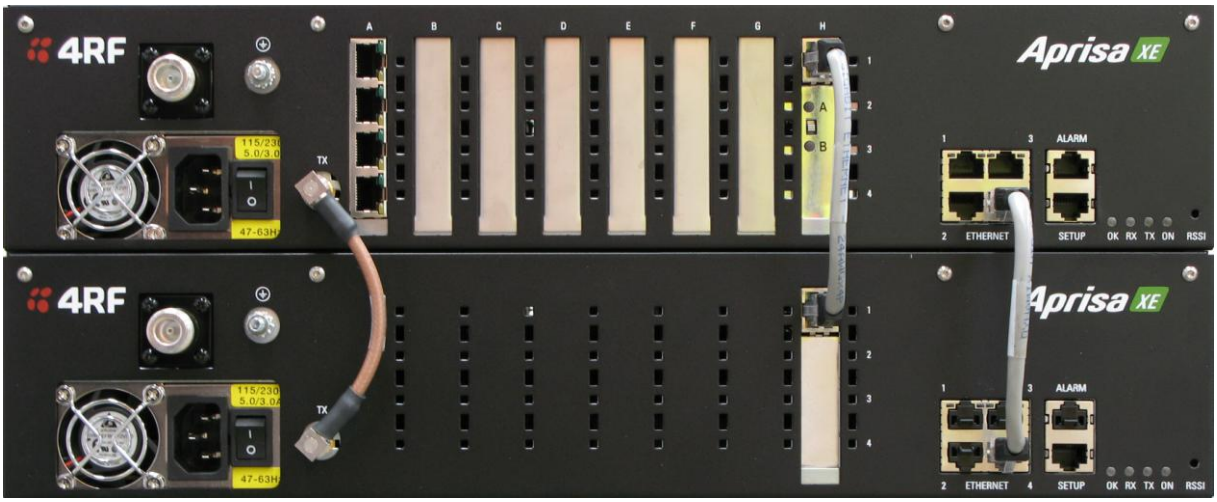
In the event of a radio A active transmitter failure, radio B transmitter becomes active.

Antenna B only carries the received signal for Radio B. This antenna is physically separated on the tower by a pre-determined distance from Antenna A.

As both radios have a receive path, traffic from the path with the best received bit error rate is routed to the customer interfaces in radio A.

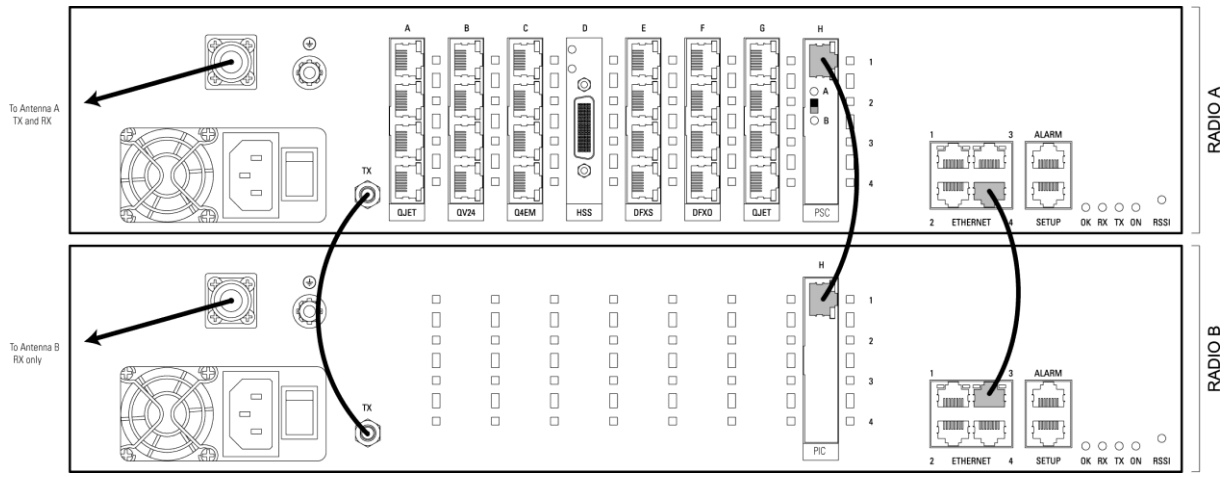
In an HSD terminal, a HSD Protection Switch Card (PSC) is always fitted in slot H in Radio A and a HSD Protection Interface Card (PIC) is always fitted in slot H in Radio B. The PSC card has a card front switch which controls the hardware setting of the HSD system Active Radio (Auto Select, Radio A or Radio B).

Customer interfaces are provided on radio A only in interface slots A to G. Interface connections to Ethernet and the external alarm inputs and outputs are also provided on radio A only.



HSD Terminal Cabling

The two HSD radios are interconnected as follows:



Cables Supplied with HSD Terminal

The following cables are supplied with a HSD terminal:

RF cable

A 110 mm QMA female to QMA female low loss RF cable is required to interconnect between the TX ports of both radio A and radio B. This cable carries the radio B transmitter output to the radio A transmitter switch.

Ethernet Cable

A 200 mm RJ45 to RJ45 Ethernet cable between the Ethernet ports of radio A and radio B. This cable carries management IP traffic between radio A and radio B.

Traffic Cable

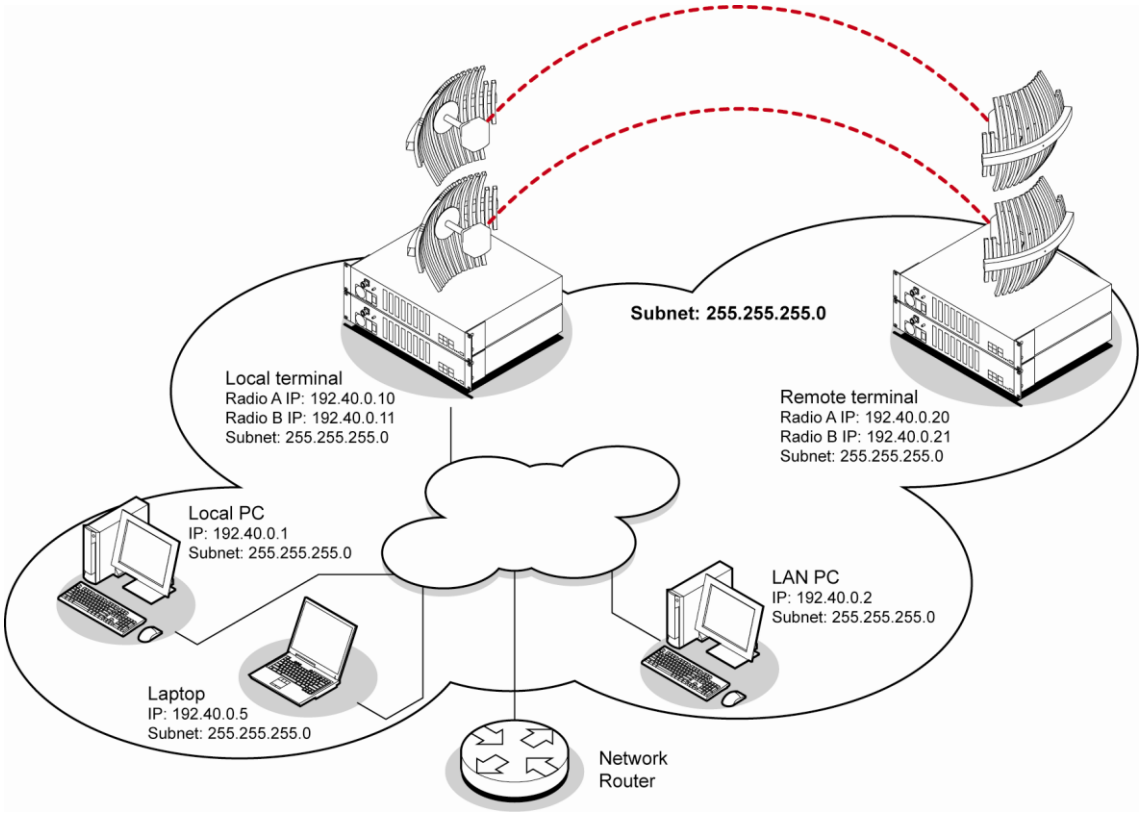
A 200 mm RJ45 to RJ45 Ethernet cable between the PSC and PIC. This cable carries all user traffic between Radio A and Radio B.

HSD Terminal IP Addresses

Each radio in the HSD link is assigned a unique IP address. All four radios in the HSD link must be on the same subnet.

The IP address of the four terminals can only be changed by logging into the relevant radio A or radio B.

When the IP addresses have been setup, an ethernet connection to any of the four radios can access all four radios in the HSD link. The usual ethernet connection is to the near end Radio A (see 'IP Addressing of Terminals' on page 53).



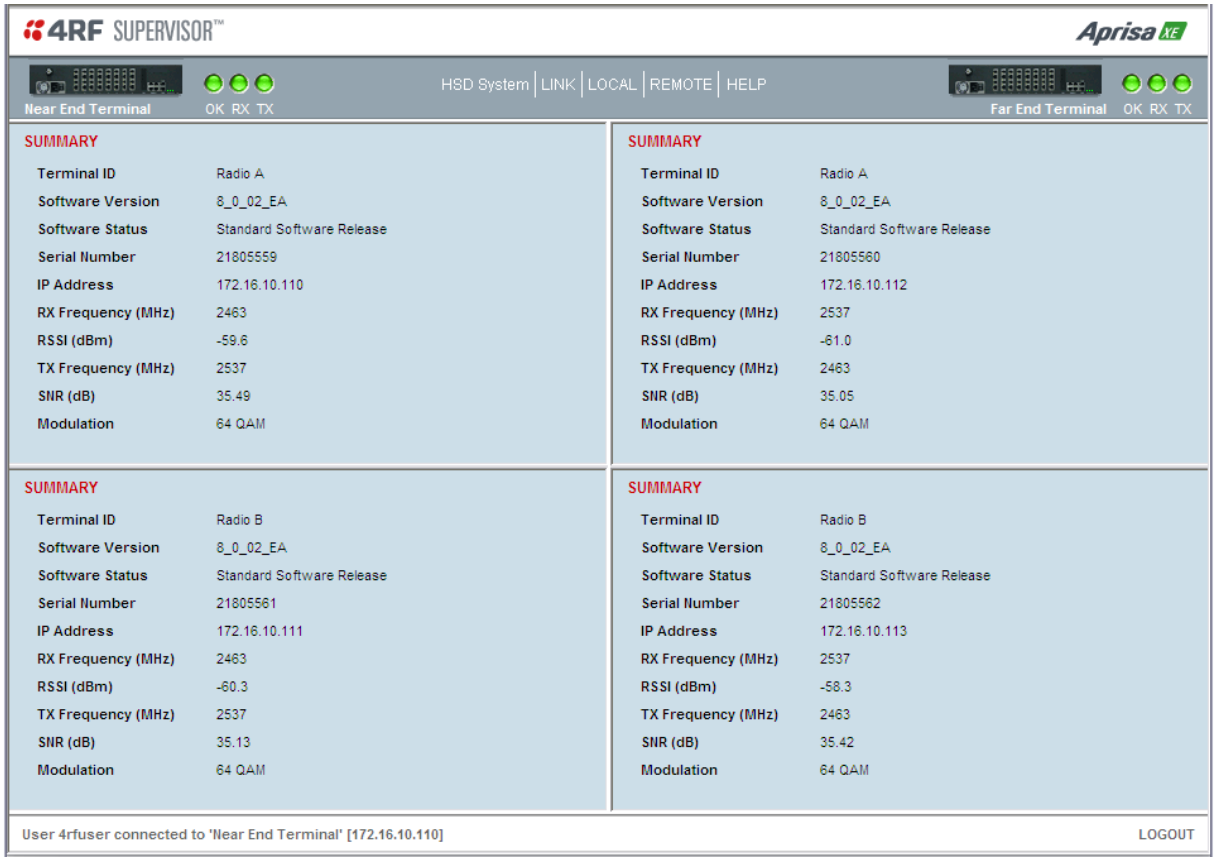
Example of IP addressing

Configuring HSD Terminals

To simplify the management and configuration of the HSD terminals, SuperVisor provides four windows which display the parameters for all four radios, the local and remote, radios A and B. The HSD System menu item displays the four windows.

When a parameter is changed in the four window mode, the relevant parameter is automatically changed to the same setting on the corresponding radio e.g. if a radio A modulation type is changed, the radio B modulation type is also changed to the same setting.

The Local and Remote menus continue to display the parameters for the local and remote radios for the near end terminal logged into.



The majority of SuperVisor HSD System pages contain the same parameters and controls as the standard 1+0 XE terminal. The main exceptions are the HSD Control page and the HSD Performance Summary page.

HSD Active Radio Control

The HSD system 'Active Radio' control determines if the selection of Radio A or Radio B is automatic or manual. This controls both the radio transmitters and receivers.

The Active Radio can be set with the hardware switch on the PSC card front or with the SuperVisor software control. The last change of hardware / software control determines the state of the HSD system.

The SuperVisor software control will always reflect the state of the HSD system.

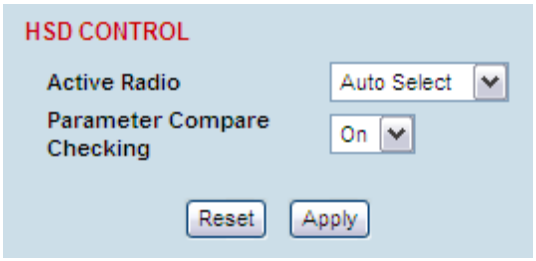
After terminal startup or reboot, the state of the PSC mode switch determines the setting used by the system and the SuperVisor software control is set to reflect the state of the HSD system.

The PSC card has two card front LEDs which indicate the status of the HSD system:

PSC Mode Switch	Hardware Control Change		Software Control Change	
	LED A	LED B	LED A	LED B
Radio A	Solid Amber	Off	Flashing Amber	Off
Auto Select	Solid Green	Solid Green	Flashing Amber	Flashing Amber
Radio B	Off	Solid Amber	Off	Flashing Amber

To set the HSD controls:

1. Select HSD System > Maintenance > Control.



2. Set the Active Radio parameter.

Active Radio	Mode of Operation
Auto Select (default)	Automatic mode: The hitless receive will select traffic from the receive path of best performance The HSD system will switch to the standby transmitter if the active transmitter fails (TX failure alarm)
Radio A Only	Manual selection of radio path A only for both the transmitter and receiver i.e. no automatic switching
Radio B Only	Manual selection of radio path B only for both the transmitter and receiver i.e. no automatic switching

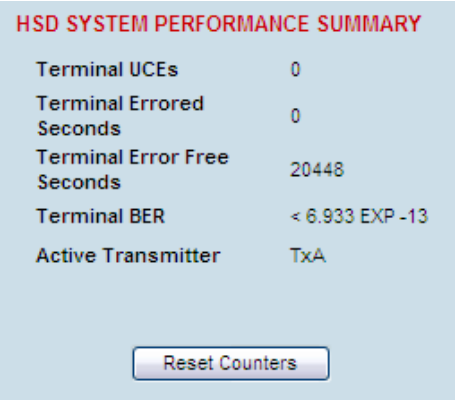
Note: There is no timeout for a manual selection of the Active Radio setting (Radio A only or Radio B only) but a 'Mode Switch Software Override' alarm will warn if the software has overwritten the PSC Mode Switch.

3. Set the Parameter Compare Checking.

Parameter Compare Checking	Option
On (default)	Any mismatch in parameters shown in Terminal Settings between Radio A and Radio B will generate a Parameter Mismatch alarm.
Off	No Parameter Mismatch alarm will be generated.

To view the HSD System Performance Summary:

1. Select HSD System > Performance > Summary.



Field	Explanation
Terminal UCEs	The total number of HSD terminal uncorrectable blocks since the last reset
Terminal Errored seconds	The total number of HSD terminal operational seconds with errored traffic since the last reset
Terminal Error free seconds	The total number of HSD terminal error free operational seconds since the last reset
Terminal BER	The system will report an estimated HSD terminal Bit Error Rate up to a maximum of 1 in 10^{21}
Active Transmitter	Dislays the current active transmitter (TxA or TxB)

Click Reset Counters to reset the error counters to zero.

12. 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 terminal is a simple process and consists of:

1. Powering up the terminals
2. Configuring both the local and remote terminals using SuperVisor
3. Aligning the antennas
4. Synchronizing the terminals
5. Testing the link is operating correctly. As a minimum, conduct the suggested tests to ensure correct operation. More extensive testing may be required to satisfy the end client or regulatory body requirements.
6. Connecting up the client or user interfaces

What You Will Need

- Appropriately qualified commissioning staff at both ends of the link.
- Safety equipment appropriate for the antenna location at both ends of the link.
- Communication equipment, that is, mobile phones or two-way radios.
- SuperVisor software running on an appropriate laptop, computer, or workstation at one end of the link.
- 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 (You can use Surveyor (see ‘Path planning’ on page 23) to calculate the RSSI, fade margin, and availability).

Applying Power to the Terminals

WARNING:

Before applying power to a terminal, ensure you have connected the safety earth and antenna cable.

Apply power to the terminals at each end of the link.

When power is first applied, all the front panel LEDs will illuminate red for several seconds as the system initializes.

After the system is initialized, the OK LED on the front panel should illuminate green and if the terminals are correctly configured, the TX and RX LED should also be illuminated green.

If the RX LED is:

Red	the antennas are may be significantly mis-aligned with no signal being received
Amber	the antennas may be roughly aligned with some signal being received
Green	the antennas are well-aligned and adequate signal is being received to create a reliable path

If the TX LED is:

Red	the transmitter is faulty
Amber	there is a fault in the antenna connection or feeder cable
Green	the transmitter is working normally

Review the Link Configurations Using SuperVisor

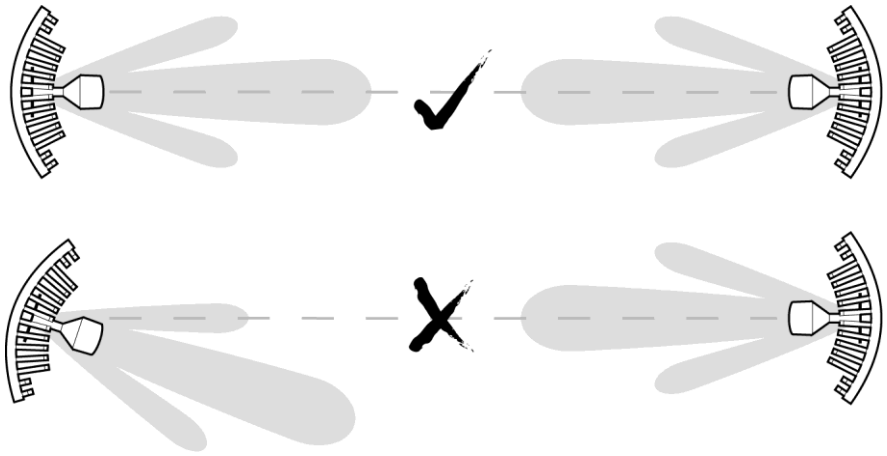
1. Connect a PC, with SuperVisor installed, to both terminals in the link.
2. Log into the link.
3. Select Link > Summary and confirm the following basic information:
   - Terminal IP address(es)
   - Terminal TX and RX frequencies
   - RSSI (dBm)
   - TX power (dBm)
   - SNR (dBm)

Note: If the terminals have not already been configured, refer to ‘Configuring the terminal’ on page 69, ‘Configuring the traffic interfaces’ on page 91, and ‘Configuring the traffic cross connections’ on page 145.

Antenna Alignment

For any point-to-point link, it is important to correctly align the antennas to maximize the signal strength at both ends of the link. Each antenna must be pointing directly at the corresponding antenna at the remote site, and they must both be on the same polarization. The antennas are aligned visually, and then small adjustments are made while the link is operating to maximize the received signal.

Directional antennas have a radiation pattern that is most sensitive in front of the antenna, in line with the main lobe of the radiation pattern. There are several other lobes (side lobes) that are not as sensitive as the main lobe in front of the antenna.



For the link to operate reliably, it is important that the main lobes of both antennas are aligned. If any of the side lobes are aligned to the opposite antenna, the received signal strength of both terminals will be lower, which could result in fading. If in doubt, check the radiation patterns of the antennas you are using.

Checking the Antenna Polarization

Check that the polarization of the antennas at each end of the link is the same.

Antenna polarization of grid antennas are normally indicated by an arrow or with ‘H’ and ‘V’ markers (indicating horizontal and vertical).

On Yagi antennas, ensure the orientation of the elements are the same at each end of the link.

Transmit frequency and power, and antenna polarization would normally be defined by a regulatory body, and typically licensed to a particular user. Refer to your license details when setting the antenna polarization.

Visually Aligning Antennas

1. Stand behind the antenna, and move it from side to side until it is pointing directly at the antenna at the remote site. The remote antenna may be made more visible by using a mirror, strobe light, or flag.

   If the remote end of the link is not visible (due to smoke, haze, or local clutter, etc), align the antenna by using a magnetic compass. Calculate the bearing using a scale map of the link path.

   When setting the antenna on the desired bearing ensure that you use the appropriate true-north to magnetic-north offset. Also ensure that the compass reading is not affected by standing too close to metallic objects.

2. Once the antenna is pointing at the remote antenna, tighten the nuts on the U-bolt or antenna clamp just enough to hold it in position. Leave the nuts loose enough so that small adjustments can still be made. Check that the antenna is still pointing in the correct direction.
3. Move the antenna up or down until it is pointing directly at the remote site.
4. Tighten the elevation and azimuth adjustment clamps.
5. Mark the position of the antenna clamps so that the antenna can be returned to this rough aim point easily when accurately aligning the antennas.
6. Repeat steps 1-5 at the opposite site.

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.

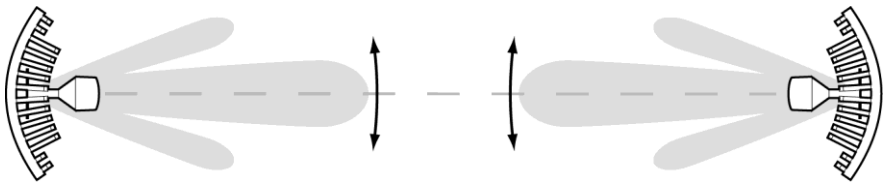
Accurately Aligning the Antennas

Once the antennas are visually aligned, accurately align both antennas by carefully making small adjustments while monitoring the RSSI. This will give the best possible link performance.

Note: Remember that it is important to align the main radiation lobes of the two antennas to each other, not any side lobes. It may be easier to perform this procedure if you can communicate with someone at the remote site by telephone, mobile, or two-way radio.

---

1. Connect a laptop PC running SuperVisor software and power up the terminals at both ends of the link. Select Link > Performance > Summary so that you can see the RSSI indication for the local terminal. Alternatively, use the RSSI test point on the front panel together with a multimeter (see ‘Measuring the RSSI’ on page 202).
2. Move the antenna through a complete sweep horizontally (known as a 'pan') either side of the point established in the visual alignment process above. 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 (known as a 'tilt') vertically either side of the point established in the visual alignment process above. 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. Perform steps 1-8 at the remote site.

Measuring the RSSI

Measure the RSSI value with a multimeter connected to the RSSI test port on the front of the terminal (see 'Front panel connections and indicators' on page 31).

1. Insert the positive probe of the multimeter into the RSSI test port, and clip the negative probe to the chassis of the terminal (earth).
2. Pan and tilt the antenna until you get the highest VDC reading. The values shown in the table below relate the measured VDC to the actual received signal level in dBm regardless of bandwidth and frequency.

RSSI test port value (VDC)	RSSI reading (dBm)
0.000	- 100
0.025	- 99
0.050	- 98
0.075	- 97
0.100	- 96
0.125	- 95
0.150	- 94
0.175	- 93
0.200	- 92
0.225	- 91
0.250	- 90
0.275	- 89
0.300	- 88
0.325	- 87
0.350	- 86
0.375	- 85
0.400	- 84
0.425	- 83
0.450	- 82
0.475	- 81
0.500	- 80
0.525	- 79
0.550	- 78
0.575	- 77
0.600	- 76
0.625	- 75
0.650	- 74

RSSI test port value (VDC)	RSSI reading (dBm)
0.675	- 73
0.700	- 72
0.725	- 71
0.750	- 70
0.775	- 69
0.800	- 68
0.825	- 67
0.850	- 66
0.875	- 65
0.900	- 64
0.925	- 63
0.950	- 62
0.975	- 61
1.000	- 60
1.025	- 59
1.050	- 58
1.075	- 57
1.100	- 56
1.125	- 55
1.150	- 54
1.175	- 53
1.200	- 52
1.225	- 51
1.250	- 50
1.275	- 49
1.300	- 48
1.325	- 47

RSSI test port value (VDC)	RSSI reading (dBm)
1.350	- 46
1.375	- 45
1.400	- 44
1.425	- 43
1.450	- 42
1.475	- 41
1.500	- 40
1.525	- 39
1.550	- 38
1.575	- 37
1.600	- 36
1.625	- 35
1.650	- 34
1.675	- 33
1.700	- 32
1.725	- 31
1.750	- 30
1.775	- 29
1.800	- 28
1.825	- 27
1.850	- 26
1.875	- 25
1.900	- 24
1.925	- 23
1.950	- 22
1.975	- 21
2.000	- 20

Checking Performance

The amount of testing performed on the completed installation will depend on circumstances. Some customers may need to prove to a local licensing regulatory body that the link complies with the license provisions. This may require special telecommunications test equipment to complete these tests. Most customers simply want to confirm that their data traffic is successfully passing over the link, or that the customer interfaces comply with known quality standard.

However, the most important performance verification checks are:

- Receive input level
- Fade margin
- Long-term BER

Checking the Receive Input Level

The received signal strength at the local terminal is affected by many components in the system and has a direct relationship with the resulting performance of the link. A link operating with a lower than expected signal strength is more likely to suffer from degraded performance during fading conditions. The receive input level of a link is normally symmetrical (that is, similar at both ends).

1. Compare the final RSSI figure obtained after antenna alignment with that calculated for the link.
2. If the RSSI figure is in excess of 3 dB down on the predicted level, recheck and correct problems using the table below and then recheck the RSSI. Alternatively, recheck the link budget calculations.

Possible cause	Terminal(s)
Is the terminal operating on the correct frequency?	Local & remote
Is the remote terminal transmit power correct?	Remote
Are all the coaxial connectors tight?	Local & remote
Is the antenna the correct type, that is, gain and frequency of operation?	Local & remote
Is the antenna polarized?	Local & remote
Is the antenna aligned?	Local & remote
Is the path between the terminals obstructed?	

Note: If following the above steps does not resolve the situation, contact Customer Support for assistance.

3. Record the RSSI figure on the commissioning form.
4. Repeat steps 1 to 2 for the other end of the link.

Checking the Fade Margin

The fade margin is affected by many components in the system and is closely related to the received signal strength. A link operating with a lower than expected fade margin is more likely to suffer from degraded performance during fading conditions. A reduced fade margin can be due to operating the link too close to the noise floor, or the presence of external interference. The fade margin of a link can be asymmetrical (that is, different at each end).

Possible causes of low fade margin are as follows:

Problem	Terminal
Low receive signal strength (see above table)	Local and Remote
Interfering signals on the same, or very close to, the frequency of the local terminal receiver.	Local
Intermodulation products that land on the same or very close to the frequency of the local terminal receiver.	Local or Remote
Operating near the local receiver noise floor	Local

To check the fade margin:

1. Confirm (and correct if necessary) the receive input level (see the previous test).

   Note: If the receive input level is lower than expected, the fade margin may also be low.

2. Select Link > Performance > Summary and check the current BER of the link in its normal condition is better than 10^{-6} (If necessary, clear out any extraneous errors by clicking Reset Counters).
3. Check the signal to noise (S/N) indication on the Link > Performance > Summary page. This shows the quality of the signal as it is being processed in the modem. It should typically be better than 30 dB. If it is less than 25 dB, it means that either the RSSI is very low or in-band interference is degrading the S/N performance.
4. Temporarily reduce the remote site's transmit power using either an external attenuator or SuperVisor (Remote > Terminal > Basic).

   Note: Ideally, the transmit power of the remote site should be reduced by up to 20 dB, which will require the use of an external 50 ohm coaxial attenuator capable of handling the transmit power involved. In the absence of an attenuator, reduce the transmit power using SuperVisor.

5. Check and note the current BER of the link in its now faded condition (Again, if necessary, clear out any extraneous errors (introduced by the power reduction step above) by clicking Reset Counters).
6. Compare the unfaded and faded BER performance of the link (steps 2 and 4). Continue to reduce the remote transmit power until either the BER drops to 10^{-6} or the remote transmitter power has been reduced by 20 dB.

   Note: The fade margin of the link is expressed as a number (of dB) that the link can be faded (transmitter power reduced) without reducing the BER below operating specifications ($1 * 10^{-6}$ BER). A 20 dB fade margin is adequate for most links.

7. Record the fade margin and SNR results on the commissioning form.

Note: If the transmit power is reduced using SuperVisor rather than an external attenuator, the fade margin should be recorded as 'Greater than x dB' (where x = the power reduction).

8. Restore the remote terminal transmit power to normal.
9. Repeat steps 1 to 7 for the other end of the link.

Note: If following all the guidelines above does not resolve the situation, contact Customer Support for assistance.

Checking the Long-Term BER

The BER test is a measure of the stability of the complete link. The BER results of a link can be asymmetrical (that is, different at each end).

1. Select Link > Performance > Summary and check the current BER and error counters of the link. If necessary, clear out any extraneous errors by selecting Reset Counters.
2. Wait 15 minutes, and check the BER display and error counters again. If there are a small number of errors and the BER is still better than 1 x 10^{-9}, continue the test for 24 hours. If there are a significant number of errors, rectify the cause before completing the 24 hour test.

Note: It is normal to conduct the BER test in both directions at the same time, and it is important that no further work be carried out on the equipment (including the antenna) during this period.

3. The BER after the 24 hour test should typically be better than 1 x 10^{-8}.
4. Record the BER results on the commissioning form.

Bit Error Rate Tests

A Bit Error Rate (BER) test can be conducted on the bench, (see 'Bench Setup' on page 43).

Attach the BER tester to the interface port(s) of one terminal, and either another BER tester or a loopback plug to the corresponding interface port of the other terminal.

This BER test can be carried out over the Ethernet, E1 / T1, V.24 or HSS interfaces. It will test the link quality with regard to user payload data.

CAUTION: Do not apply signals greater than -20 dBm to the antenna as they can damage the receiver. In a bench setup, there must be 60 - 80 dB at up to 2 GHz of 50 ohm coaxial attenuation (capable of handling the transmit power) between the terminals' antenna connectors.

Additional Tests

Depending on license requirements or your particular needs, you may need to carry out additional tests, such as those listed below.

Refer to the relevant test equipment manuals for test details.

Test	Test equipment required
TX power output measurements (at TX and duplexer outputs)	Power meter
TX spectrum bandwidth	Spectrum analyzer
TX spectral purity or harmonic outputs	Spectrum analyzer
TX center frequency	Frequency counter or spectrum analyzer
Bulk capacity BER test	BER tester
LAN throughput or errors	LAN tester
G.703 / HDB3 waveforms	Digital oscilloscope
Serial interface BER	BER tester
Audio quality	PCM4 or SINAD test set

Checking the Link Performance

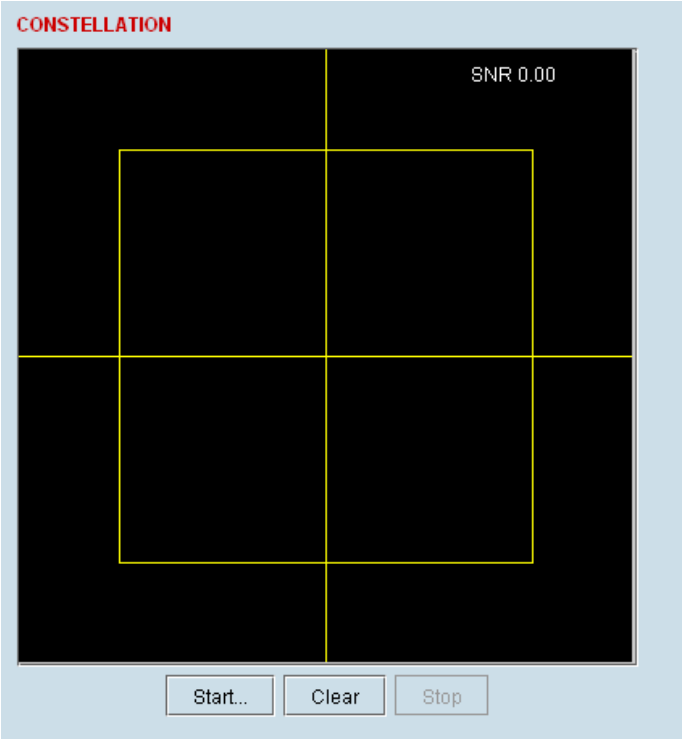
For a graphical indication of the link performance, you can use the constellation analyzer.

The 'dots' are a graphical indication of the quality of the demodulated signal. Small dots that are close together indicate a good signal. If the dots become spaced further apart, this indicates that the signal quality is degrading. This signal quality degradation can be caused by low Rx signal level due to, for example:

- external interference
- failure of any of the following: modem, receiver, far end transmitter, an antenna (either end), a feeder or connector (for example, due to water damage)
- path issues such as multipath fading or obstructions

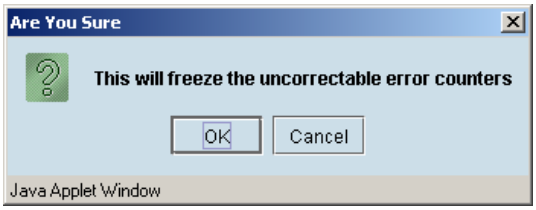
To check the performance of the link using the constellation analyzer:

1. Select Link or Local or Remote > Performance > Constellation.



2. Click Start to start the constellation analyzer.

   While the constellation analyzer is running, the terminal will temporarily stop collecting error performance statistics. If you want to run the constellation analyzer anyway, click OK when you see this warning message:



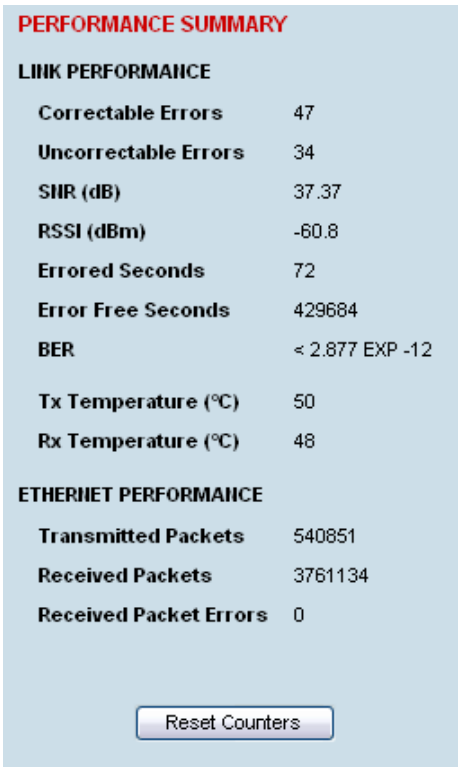
3. Click Stop to stop the constellation analyzer.

   The terminal automatically resumes collecting error performance statistics.

Viewing a Summary of the Link Performance

To view the performance summary for a terminal:

Select Link or Local or Remote > Performance > Summary.



Field	Explanation
Link Performance	
Correctable errors	The total number of correctable blocks since the last reset
Uncorrectable errors	The total number of uncorrectable blocks since the last reset
SNR (dB)	The Signal to Noise Ratio of the link in dB
RSSI (dBm)	The Received Signal Strength Indication at the Rx input in dBm
Errored seconds	The total number of operational seconds with errored traffic since the last reset
Error free seconds	The total number of error free operational seconds since the last reset
BER	The system will report an estimated Bit Error Rate up to a maximum of 1 in 10^{21}
TX temperature	The measured temperature in the transmitter module in °C
RX temperature	The measured temperature in the receiver module in °C
Ethernet performance	
Transmitted packets	The total number of transmitted Ethernet packets
Received packets	The total number of received Ethernet packets
Received packet errors	The total number of packets received with errors

Click Reset Counters to reset the error counters to zero.

Saving the History of the Link Performance

Link performance history data is stored in a rolling buffer which can be saved as a *.cvs file (default filename is savedPerformanceHistory.csv). The maximum history data buffer is 1 week of 1 hour records and the last hour is displayed in minute records.

The parameters saved are:

- Date / Time
- SNR (minimum over period)
- SNR (average over period)
- SNR (maximum over period)
- RSSI (minimum over period)
- RSSI (average over period)
- RSSI (maximum over period)
- BER (value at end of period)
- UCEs count (value at end of period)
- Transmitter temperature (value at end of period)

To save the history of the link performance for a terminal:

Select Local > Performance > Save History.

Example of file (simulated fade data):

PREVIOUS WEEK

TIME	SNR min (dB)	SNR avg (dB)	SNR max (dB)	RSSI min (dBm)	RSSI avg (dBm)	RSSI max (dBm)	BER	UCEs	Tx Temp (deg C)
Mon Apr 6 09:44:50 2009	35.14	35.26	35.39	-54.00	-54.00	-54.00	3.40E-12	144	50
Mon Apr 6 10:44:50 2009	35.14	35.26	35.40	-54.00	-53.90	-53.90	3.39E-12	144	50
Mon Apr 6 11:44:50 2009	35.14	35.26	35.40	-54.00	-53.90	-53.90	3.38E-12	144	50
Mon Apr 6 12:44:51 2009	15.31	25.77	58.54	-114.00	-77.00	-54.00	1.58E-05	1045	50
Mon Apr 6 13:44:51 2009	22.52	22.75	22.89	-84.10	-83.70	-83.60	6.92E-06	9912	51
Mon Apr 6 14:44:51 2009	16.20	26.05	54.61	-87.10	-77.40	-60.20	9.67E-05	72125	52
...									

PREVIOUS HOUR

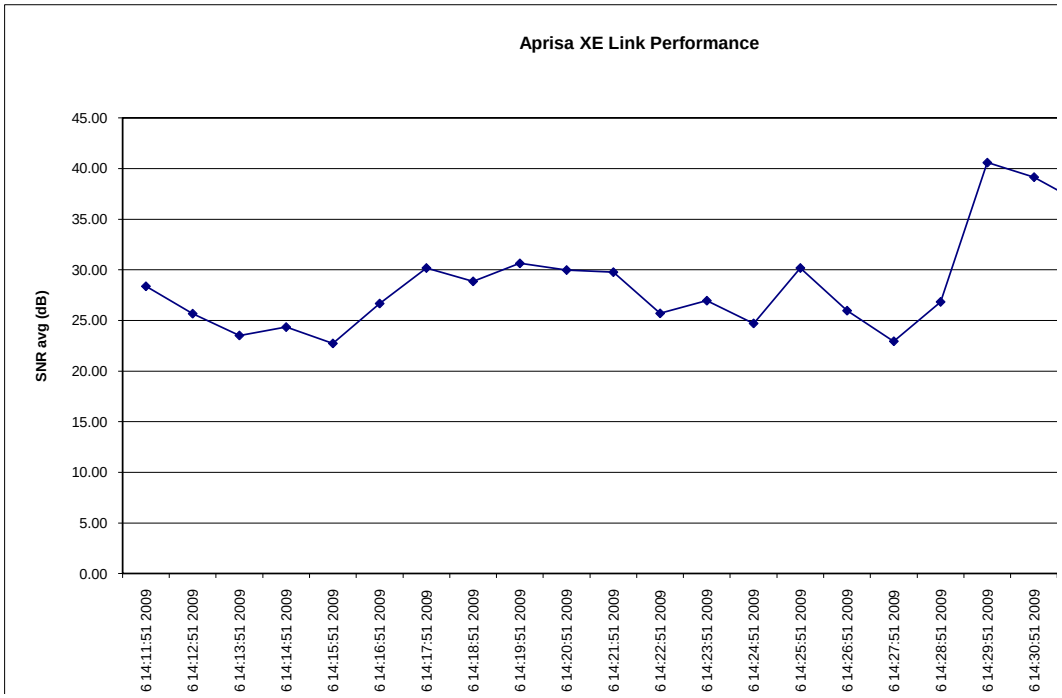
TIME	SNR min (dB)	SNR avg (dB)	SNR max (dB)	RSSI min (dBm)	RSSI avg (dBm)	RSSI max (dBm)	BER	UCEs	Tx Temp (deg C)
Mon Apr 6 14:11:51 2009	22.52	28.38	22.75	-84.10	-78.19	-83.80	5.89E-06	22821	52
Mon Apr 6 14:12:51 2009	22.55	25.67	22.75	-84.10	-80.89	-83.80	5.86E-06	23369	52
Mon Apr 6 14:13:51 2009	22.50	23.52	22.75	-84.10	-83.07	-83.70	5.84E-06	23847	52
Mon Apr 6 14:14:51 2009	22.50	24.35	22.78	-84.10	-82.23	-83.70	5.81E-06	24338	52
Mon Apr 6 14:15:51 2009	22.54	22.73	22.77	-84.10	-83.86	-83.80	5.78E-06	24855	52
Mon Apr 6 14:16:51 2009	22.52	26.67	22.75	-84.10	-79.90	-83.80	5.75E-06	25374	52
Mon Apr 6 14:17:51 2009	22.48	30.19	22.79	-84.10	-76.38	-83.70	5.73E-06	25918	52
Mon Apr 6 14:18:51 2009	22.49	28.87	22.74	-84.10	-77.68	-83.80	5.71E-06	26473	52
Mon Apr 6 14:19:51 2009	22.48	30.65	22.74	-84.10	-75.94	-83.80	5.68E-06	27007	52
Mon Apr 6 14:20:51 2009	22.50	29.99	22.75	-84.00	-76.59	-83.80	5.66E-06	27561	52
Mon Apr 6 14:21:51 2009	22.61	29.78	22.76	-84.00	-76.82	-83.80	5.64E-06	28167	52
Mon Apr 6 14:22:51 2009	22.46	25.70	22.74	-84.10	-80.86	-83.90	5.62E-06	28717	52
Mon Apr 6 14:23:51 2009	22.46	26.96	22.75	-84.10	-79.61	-83.80	5.59E-06	29237	52
Mon Apr 6 14:24:51 2009	22.47	24.71	22.75	-84.10	-81.86	-83.80	5.57E-06	29776	52
Mon Apr 6 14:25:51 2009	22.48	30.19	22.73	-84.10	-76.36	-83.80	5.55E-06	30368	52
Mon Apr 6 14:26:51 2009	22.49	25.97	22.75	-84.20	-80.61	-83.80	5.53E-06	30942	52
Mon Apr 6 14:27:51 2009	16.20	22.94	54.61	-87.10	-83.76	-83.90	7.30E-06	71751	52
Mon Apr 6 14:28:51 2009	16.23	26.84	49.90	-87.00	-73.31	-60.30	6.67E-03	72125	52
Mon Apr 6 14:29:51 2009	35.10	40.60	35.24	-60.50	-54.96	-60.30	1.70E-03	72125	52
Mon Apr 6 14:30:51 2009	35.08	39.17	35.28	-60.50	-56.40	-60.30	9.13E-04	72125	52
Mon Apr 6 14:31:51 2009	35.07	36.63	35.26	-60.50	-58.95	-60.20	6.11E-04	72125	52
Mon Apr 6 14:32:51 2009	35.06	36.68	35.24	-60.60	-58.90	-60.30	4.52E-04	72125	52
Mon Apr 6 14:33:51 2009	35.06	35.34	35.25	-60.60	-60.24	-60.30	3.56E-04	72125	52
Mon Apr 6 14:34:51 2009	35.09	36.28	35.24	-60.50	-59.28	-60.30	2.92E-04	72125	52
Mon Apr 6 14:35:51 2009	35.07	42.56	35.28	-60.60	-53.03	-60.30	2.46E-04	72125	52
...									

To save the alarm history from the Remote terminal, login to the Remote terminal and Select Local > Alarms > Save History.

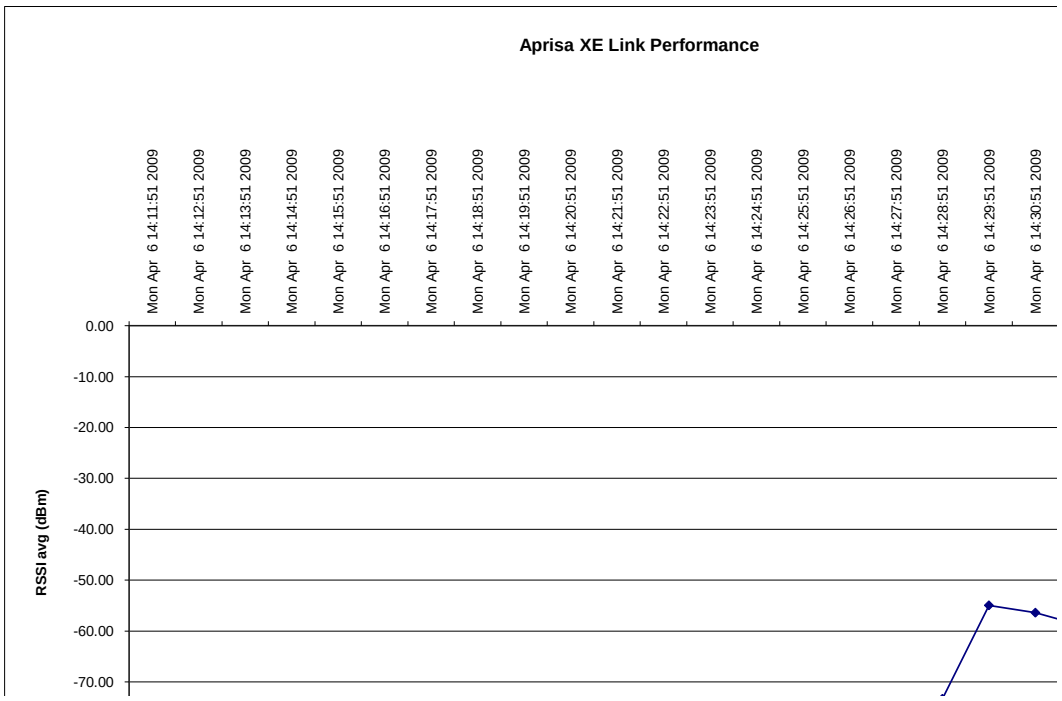
To create an Excel chart of the link performance for a terminal:

1. Open the *.csv file with Excel.
2. Select the 'Time' column and the column you wish to graph e.g. 'SNR avg (dB)' or 'RSSI avg (dBm)'
3. Select 'Insert Chart' from the Excel menu.

Graph of Date / Time vs the average SNR



Graph of Date / Time vs the average RSSI



To clear the history of the link performance for a terminal:

Select Link or Local or Remote > Performance > Clear History.

13. Maintenance

There are no user-serviceable components within the terminal.

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 terminals to 4RF or an authorized service centre.

For more information on maintenance and training, please contact Customer Services.

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

Routine Maintenance

Every six or twelve months, for both ends of the link, you should record the RSSI and SNR levels as well as checking the following:

Item	What to check or look for
Equipment shelter environment	Water leaks Room temperature Excessive vibration Vermin damage
Terminal mounting	Firmly mounted
Antenna cable connections	Tight and dry
Antenna cable and its supports	Not loose or suffering from ultra-violet degradation
Antenna and its mounting hardware	Not loose, rusty or damaged
Safety earth	Connections tight Cabling intact
DC system	Connections tight Voltage in normal limits
Batteries (if installed)	Connections tight Electrolyte levels normal

Terminal Upgrades

You can upgrade all software for both terminals remotely (through a management network), which eliminates the need to physically visit either end of the link.

A terminal is upgraded by accessing a running TFTP server (see 'TFTP Upgrade Process' on page 221). All the required files are uploaded from the TFTP server into the terminal and then activated following a terminal reboot.

System files can be manually uploaded (see 'Uploading System Files' on page 226').

Inventory File

Software release 8.2.10 and all future software releases, contains an inventory file (similar to a manifest file) which is used to validate the software files in the terminal.

To view the Software Status of the terminal:

Select Link, Local or Remote > Summary

Software status	Function
Standard Software Release	The software status indicates 'Standard Software Release' if the following system software files have not been changed since the last TFTP Upgrade. • Kernel image file • Software image file • Firmware image files • Configuration files
Modified Software Release	The software status indicates 'Modified Software Release' if the system software files have been changed since the last TFTP Upgrade. This could be caused by: • an image file which has been uploaded to the terminal since the last TFTP upgrade which is not part of that upgrade. • an image file which was part of the last TFTP upgrade but was subsequently deleted.

Upgrade Prerequisites

To minimize disruption of link traffic and prevent your terminals from being rendered inoperative, please follow the procedures described in this section together with any additional information or instructions supplied with the upgrade package.

Before upgrading the terminal, ensure that you have saved the configuration file (see 'Saving the terminal's configuration' on page 89) as well as the cross connection configuration (see 'Saving cross connection configurations' on page 155).

The Remote terminal upgrade process will be faster if the bandwidth allocated to the management ethernet capacity is maximized.

The terminal software must be identical at both ends of the link.

At the end of the terminal upgrade process, the versions of image files (kernel software, and firmware) that were in use before the upgrade are still in the terminal. You can restore them, if required, by editing the image tables and reactivating the old files (see 'Changing the Status of an Image ' on page 232).

IMPORTANT NOTE: Ensure you are logged into the Near end terminal as Admin before you start an upgrade.

Software Upgrade Process

Unzip and save the following folders to your hard drive:

- 8.6.77 Software
- tftpd32.exe

The following steps are required for the software upgrade process:

1. Identify the correct TFTP upgrade type (see ‘Identifying the Correct TFTP Upgrade Type’ on page 217).
2. If the terminals are operating software prior to 8.3.40:

   Upload the Root File System (see ‘Uploading the Root File System’ on page 216)

   Upload the Motherboard Images (see ‘Uploading the Motherboard Images’ on page 216).

   Reboot the terminal.
3. Go through the steps of the TFTP upgrade process (see ‘TFTP Upgrade Process’ on page 221).
4. Upgrade for new FXO/FXS and modem images
5. Reboot the terminal.
6. Clear the Java and web browser caches (see ‘Step 7: Clear the Java and web browser caches’ on page 223).

If the TFTP upload process fails, an ‘Upload Fail’ alarm is raised. If the TFTP upload process fails due to a power failure, the alarm is raised upon power recovery.

Uploading the Root File System

Note: Uploading of image files can only be performed to the local terminal i.e. not via the link to the remote terminal.

1. Logon to the local terminal as admin.
2. Go to SuperVisor > Local > Maintenance > Upload > Software.
3. Browse to the 8.6.77 Software folder and select 'C-CC-R-8_6_7.img'.
4. Click Upload and wait for the upload status to display Succeeded.
5. Activate the 'C-CC-R-8_6_7.img' with SuperVisor Local > Maintenance > Image Table (see 'Changing the Status of an Image File' on page 232).

Uploading the Motherboard Images

The E1 and E2 motherboard images do not update as part of the TFTP upgrade.

Check if the correct motherboard images are loaded with SuperVisor Local > Maintenance > Image Table.

Example: Radio on V8.4.60 with a Rev C motherboard.

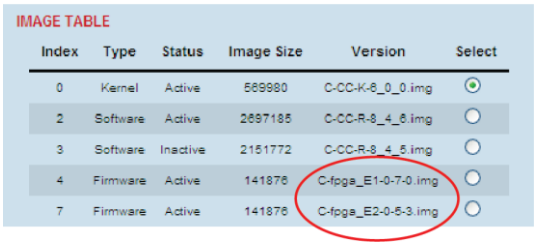


IMAGE TABLE

Index	Type	Status	Image Size	Version	Select
0	Kernel	Active	569980	C-CC-K-8_0_0.img	
2	Software	Active	2697185	C-CC-R-8_4_6.img	
3	Software	Inactive	2151772	C-CC-R-8_4_5.img	
4	Firmware	Active	141876	C-fpga_E1-0-7-0.img	
7	Firmware	Active	141876	C-fpga_E2-0-5-3.img	

The Motherboard Firmware images for this software version are:

Motherboard Type	Image Files Required
Rev C	C-fpga_E1-0-7-0.img (Motherboard 1 C-fpga_E2-0-5-3.img (Motherboard 2)
Rev D	C-fpga_E1-1-7-3.img (Motherboard 1 C-fpga_E2-1-5-4.img (Motherboard 2)

If the motherboard image files are not correct, upload the relevant image files.

Note: Uploading of image files can only be performed to the local terminal i.e. not via the link to the remote terminal.

1. Logon to the local terminal as admin
2. Go to SuperVisor > Local > Maintenance > Upload > Firmware.
3. Browse to the 8.6.77 Software folder and select 'C-fpga_Ex-x-x-x.img'.
4. Click Upload and wait for the upload status to display Succeeded.
5. Activate the 'C-fpga_Ex-x-x-x.img' with SuperVisor Local > Maintenance > Image Table (see 'Changing the Status of an Image File' on page 232).

Identifying the Correct TFTP Upgrade Type

The correct TFTP upgrade type will depend on both the Bootloader Version and the Software Version Type.

Aprisa XE terminals running the older bootloader software (bootloader version 0) have a limitation on the number of software images that can be loaded simultaneously into a terminal.

Identifying the Bootloader Version

Determine which bootloader version your terminal is running by using the SuperVisor menu item Maintenance > Support Summary and look for the 'Bootloader Version' number:

(1) If your terminal is running bootloader version 1 or greater, use the TFTP full upgrade process.

(2) If your terminal is running bootloader version 0 and running a software version prior to 7.0.6, use the TFTP partial upgrade process.

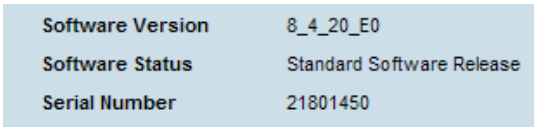
(3) If your terminal is running bootloader version 0 and running a software version 7.0.6 or later, use the TFTP standard upgrade process.

(4) HSD terminals cannot run with bootloader version 0.

Identifying the Software Version Type

There are six different software version types; ETSI type 1, ETSI type 1 HSD, ETSI type 2, ETSI type 2 HSD, FCC Part 101 and FCC Part 90.

To determine which Software Version Type is currently installed on the terminal, take note of the 'Software Version' on SuperVisor Summary page. The last three characters indicate the Software Version Type.



ETSI Compliance Body

8_6_77_E0	The E0 variant supports ETSI (Type 1) 1+0 and MHSB terminals with the same variants as Aprisa XE software version 8.4.40.
8_6_77_E1	The E1 variant supports ETSI (Type 2) 1+0 and MHSB terminals with the same variants as Aprisa XE software version 8.4.40 except for the 400 MHz 25 kHz and 50 kHz which has been replaced with 900 MHz 25 kHz and 50 kHz.
8_6_77_E0h	The E0h variant supports ETSI (Type 1) Hitless Space Diversity (HSD) terminals with the same variants as Aprisa XE software version 8.4.40.
8_6_77_E1h	The E1 variant supports ETSI (Type 2) Hitless Space Diversity (HSD) terminals with the same variants as Aprisa XE software version 8.4.40 except for the 400 MHz 25 kHz and 50 kHz which has been replaced with 900 MHz 25 kHz and 50 kHz.

FCC Compliance Body

8_6_77_F0	The F0 variant supports FCC part 90 1+0 and MHSB terminals.
8_6_77_F0h	The F0h variant supports FCC part 90 Hitless Space Diversity (HSD) terminals.
8_6_77_F1	The F1 variant supports FCC part 101 1+0 and MHSB terminals.
8_6_77_F1h	The F1h variant supports FCC part 101 Hitless Space Diversity (HSD) terminals.

Upgrade Version Files

The following table defines the purpose of the upgrade version files:

Upgrade Version File	Upgrade Type	Software Version Type
8_6_77_E0a	Full TFTP upgrade	ETSI TYPE 1
8_6_77_E0	Standard TFTP upgrade	ETSI TYPE 1
8_6_77_E0h	Standard TFTP upgrade	ETSI TYPE 1 HSD
8_6_77_E0p	Partial TFTP upgrade	ETSI TYPE 1
8_6_77_E1a	Full TFTP upgrade	ETSI TYPE 2
8_6_77_E1	Standard TFTP upgrade	ETSI TYPE 2
8_6_77_E1h	Standard TFTP upgrade	ETSI TYPE 2 HSD
8_6_77_E1p	Partial TFTP upgrade	ETSI TYPE 2
8_6_77_F0a	Full TFTP upgrade	FCC Part 90
8_6_77_F0	Standard TFTP upgrade	FCC Part 90
8_6_77_F1a	Full TFTP upgrade	FCC Part 101
8_6_77_F1	Standard TFTP upgrade	FCC Part 101

Installing RF Synthesizer Configuration Files

If you are upgrading from a software version prior to 7_1_x, you will need to install new RF synthesizer files, refer to 'Configuration Files' on page 226.

You can then upgrade the terminal using TFTP (see page 221).

Frequency Band	Synthesizer File(to be installed)	Comments
300, 400 MHz	XE_300_400_type_1_synth.cfg	BB synthesizer
300, 400 MHz	XE_300_400_type_2_synth.cfg	E3 synthesizer
300, 400 MHz	XE_300_400_type_3_synth.cfg	5 kHz sythesizer step
600, 700, 800, 900 MHz	XE_600_700_800_900_synth.cfg	
1400 MHz	XE_1400_synth.cfg	
1400 MHz	XE_1400TCVR_synth.cfg	New transceiver (introduced April 2012)
1800 MHz	XE_1800_synth.cfg	
2000, 2500 MHz	XE_2000_2500_synth.cfg	

TFTP Upgrade Process Types

TFTP partial upgrade process

Run the TFTP upgrade process by typing 8_6_77_E0p in the Upgrade Version field.

This will perform a partial upgrade which will delete unnecessary image files that might be taking up space in the Image Table (which could prevent a standard upgrade succeeding).

Reboot the terminal.

Run a TFTP standard upgrade process on the terminal.

Reboot the terminal again.

TFTP standard upgrade process

This TFTP standard upgrade process excludes FPGA images for the newly introduced revisions of the Modem, DFXO and DFXS cards.

Run the TFTP upgrade process by typing '8_6_77_E0' in the Upgrade Version field.

If the standard upgrade fails, it may be necessary to make space for the new images by manually deleting 'Inactive' firmware image files.

To delete a firmware image file, select the SuperVisor menu item Maintenance > Image Table, select the firmware image and click on Edit. Set the IMAGE DETAILS Command to 'Delete' and click 'Apply'.

Reboot the terminal.

Additional TFTP upgrade options have been provided to load the new images separately. Run the TFTP upgrade process using the file:

- 'F1_8_6_7' to load images for the newest DFXO and DFXS cards (rev D).
- 'F2_8_6_7' to load images for all revisions of DFXO and DFXS cards.
- 'F3_8_6_7' to load images for the newest Modem card (rev D).

Reboot the terminal again.

TFTP full upgrade process

Run the TFTP upgrade process for 1+0 and MHSB terminals by typing '8_6_77_E0a' in the Upgrade Version field.

Run the TFTP upgrade process for HSD terminals by typing '8_6_77_E0h' in the Upgrade Version field.

Reboot the terminal.

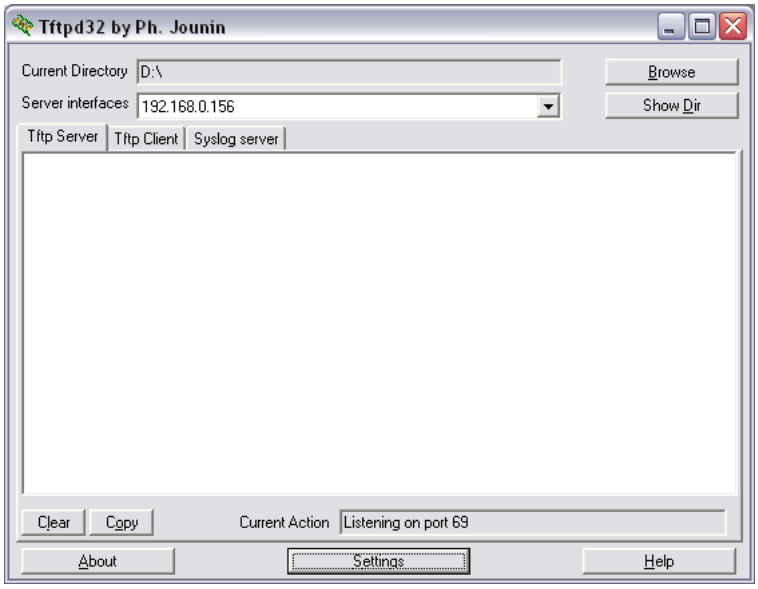
TFTP Upgrade Process

To upgrade a terminal using the TFTP:

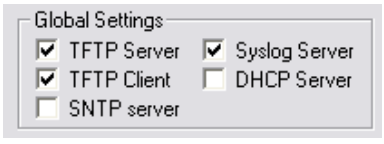
1. Run the TFTP server.
2. Login to the Near end terminal / local terminal (see 'IP Addressing of Terminals' on page 53).
3. Run the TFTP upgrade process on the Remote terminal.
4. Reboot the Remote terminal.
5. Run the TFTP upgrade process on the Local terminal.
6. Reboot the Local terminal.
7. Clear the Java and web browser caches.

Step 1: Run the TFTP server

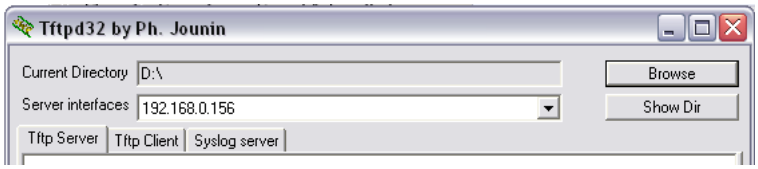
1. Double-click tftpd32.exe (located in the TFTPD directory) from the Aprisa CD supplied with the product. Leave the TFTPD32 application running until the end of the upgrade process.



2. Click Settings and make sure that both SNTP server and DHCP server are not selected (no tick), and click OK.



3. Click Browse and navigate to the root directory on the Aprisa CD (for example, D:\) supplied with the product, then click OK.



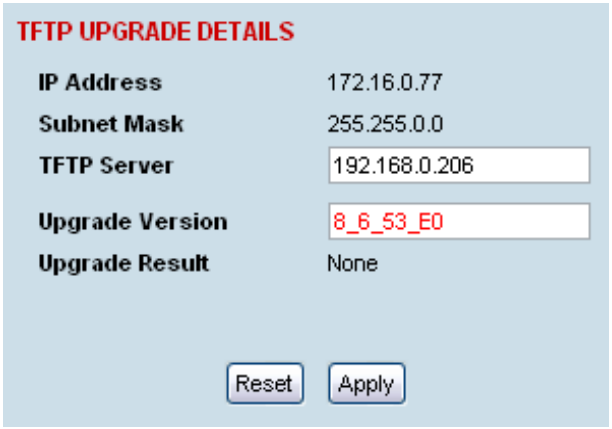
4. Note down the IP address of the TFTP server (shown in the Server Interfaces drop-down list in the TFTPD32 window) as you will need it later.

Step 2: Log into the Local terminal

Use SuperVisor to log into the Near end terminal (now the Local terminal) (see ‘IP Addressing of Terminals’ on page 53) with either 'modify' or 'admin' privileges.

Step 3: Run the TFTP upgrade process on the Remote terminal

1. Select Remote > Maintenance > Upload > TFTP Upgrade.



2. Enter the IP address of the TFTP server.
3. Enter the version number of the software that you are upgrading to as a three digit number separated by underscores, for example, 8_6_77_E0 for ETSI variants.
4. Click Apply and check the TFTP server for download activity.

   The Upgrade Result changes from 'Executing' to either 'Succeeded' or 'Failed'.

   Note: This may take several minutes when upgrading the remote terminal.

   If the upgrade has failed:

   - The TFTP server IP address may be set incorrectly
   - The 'Current Directory' on the TFTP server was not pointing to the location of the upload config file e.g. 'Rel_8_6_77_E0.cfg' .
   - There may not be enough free space in the image table to write the file. Inactive images can be deleted (and the terminal rebooted) to free up space for the new image (see ‘Changing the Status of an Image File’ on page 232).

Step 4: Reboot the Remote terminal

Reboot the remote terminal before proceeding with the next step of the upgrade process (see ‘Rebooting the Terminal’ on page 233).

1. Select Remote > Maintenance > Reboot and select [Hard Reboot]

   Communications to SuperVisor remote page will fail until the remote terminal reboot has completed.

Step 5: Run the TFTP upgrade process on the Local terminal.

1. Select Local > Maintenance > Upload > TFTP Upgrade.
2. Enter the IP address of the TFTP server (that you noted earlier)
3. Enter the version number of the software (that you are upgrading to) for example, 8_6_77_E0.
4. Click Apply and check the TFTP server for download activity.

   The Upgrade Result changes from 'Executing' to either 'Succeeded' or 'Failed'.

Note: This may take several minutes when upgrading the remote terminal.

Step 6: Reboot the Local terminal

Reboot the local terminal before proceeding with the next step of the upgrade process (see ‘Rebooting the Terminal’ on page 233).

1. Select Local > Maintenance > Reboot and select [Hard Reboot]
2. Log back into the Local terminal when the reboot has completed.

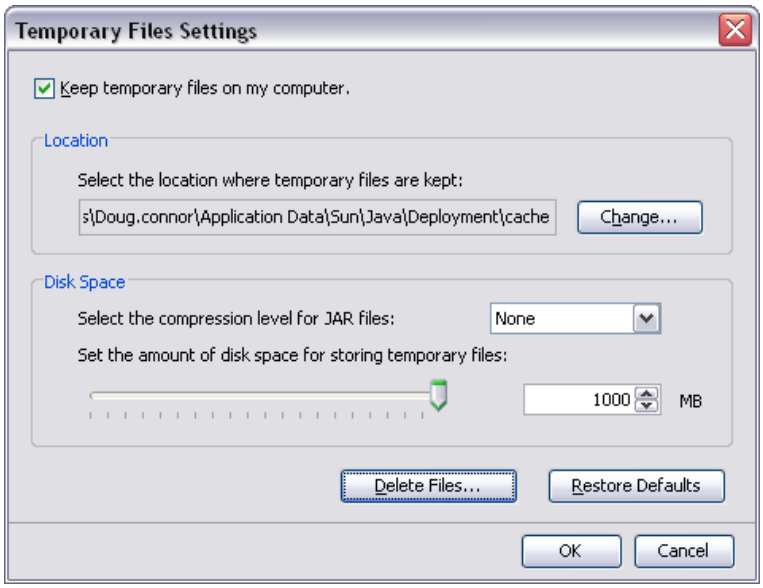
Step 7: Clear the Java and web browser caches

After upgrading the terminal you should clear the Java and web browser caches. The files stored in them may cause the SuperVisor and Cross Connections applications to display incorrectly.

To clear the Java cache (Windows XP, Java 1.6):

1. Select Start > Control Panel.
2. Select Java

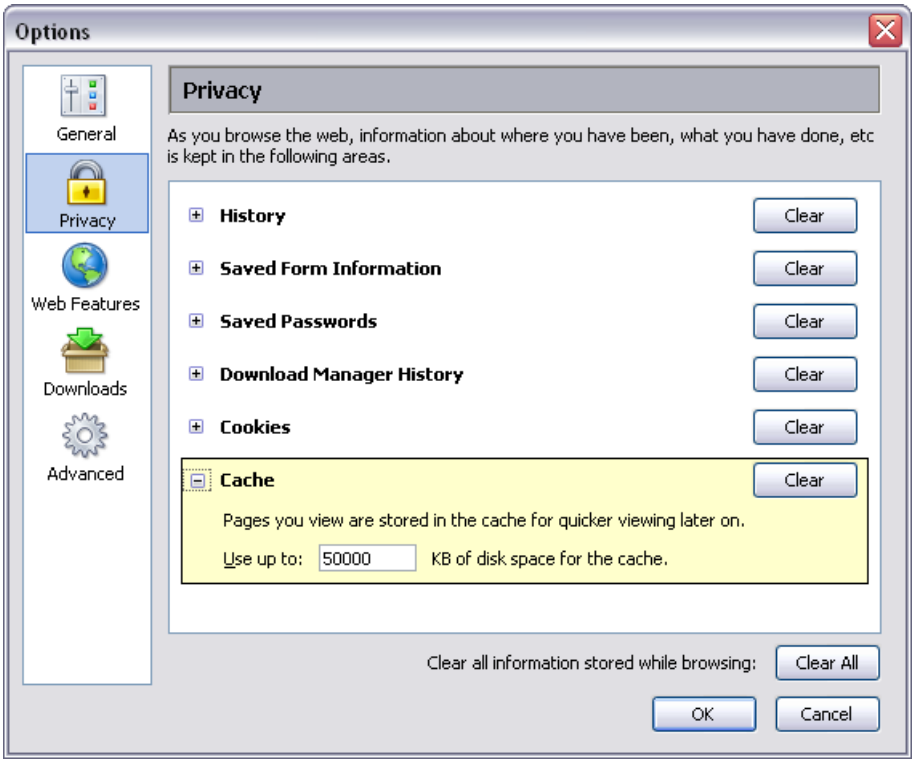
3. Click the General tab.
4. In the ‘Temporary Internet Files’, click Settings



5. Click on ‘Delete Files’ (‘Applications and Applets’ and ‘Trace and Log Files’ both ticked) and OK to confirm.

To clear your web browser cache (Mozilla Firefox 1.x and above):

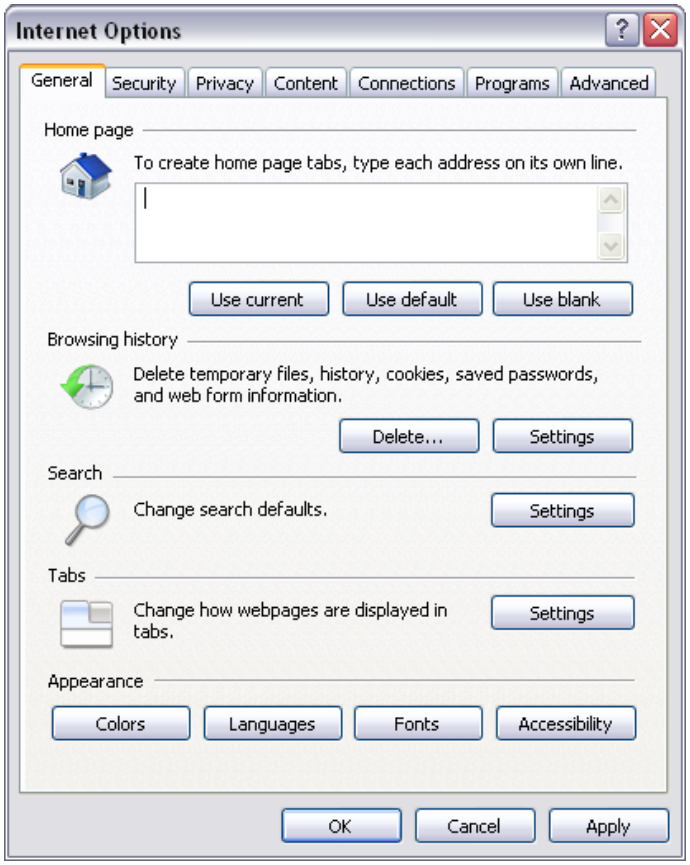
1. Select Tools > Options.
2. Select Privacy and then click Cache.



3. Click Clear to clear the cache, and then click OK to confirm.

To clear your web browser cache (Internet Explorer 7.0 and above):

1. Select Tools > Internet Options.
2. On the General tab



3. In Browsing history, click Delete
4. In the 'Temporary Internet Files', click Delete Files and Yes to confirm.

Uploading System Files

System files e.g. configuration files, kernel image files, software image files and firmware image files can be uploaded manually.

Note: You should only upgrade components that need changing. It is not always necessary, for instance, to replace kernel or software files when upgrading a single firmware file. If interdependency exists between file types, this will be made clear in the documentation that accompanied the update package.

Configuration Files

Configuration files (.cfg) are compressed archives containing a script to instruct the terminal on how to handle the other files in the archive.

Uploading of configuration files can only be performed to the Local Terminal (not via the link to the Remote Terminal).

RF synthesizer configuration files

The RF synthesizer configuration archive contains files that provide values for the transmitter and receiver synthesizers to operate across the supported frequency bands.

Synthesizer configuration filenames have the following format:

XE_(frequency bands)_synth.cfg	e.g. XE_300_400_synth.cfg

Modem configuration files

The Modem configuration archive contains files that provide values for the Modem to operate at the various supported channel sizes and modulation types.

Modem configuration filenames have the following format:

modem_(version number).cfg	e.g. modem_8_3_1.cfg (ETSI variants)

Cross-connect configuration files

The Cross-connect configuration archive contains the Cross Connections application program that can be launched from within SuperVisor.

Cross-connect configuration filenames have the following format:

C-crossconnect_(version number).cfg	e.g. C-crossconnect_8_6_7.cfg

To upload a configuration file:

1. Select Local > Maintenance > Config Files > Upload Configuration
2. Browse to the location of the file required to be uploaded into the terminal *.cfg.
3. Click on Upload.

The normal response is Succeeded if the file has been loaded correctly.

A response of 'Failed' could be caused by:

- Not enough temporary space in the filesystem to uncompress the archive and execute the script
- A file or directory expected by the script not being present on the filesystem

4. Reboot the terminal using a 'Hard Reboot' (see 'Rebooting the Terminal' on page 233).

Image Files

Image files (.img) are loaded into the terminal and either contains code that is executed by the system processor, or contain instructions to configure the various programmable logic elements. The image file types that can be uploaded are:

- Kernel image files
- Software image files
- Firmware image files

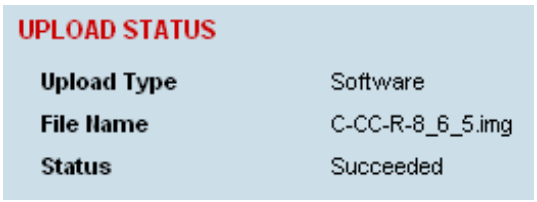
Note: The Bootloader image file C-CC-B-(version number).srec and Flash File System image file C-CC-F-(version number).img can only be changed in the factory.

Uploading of image files can only be performed to the local terminal (not via the link to the remote terminal).

To upload and activate an image file:

1. Upload the required image file.

   If the Upload Status page show 'executing', then 'writing to flash', then 'Succeeded', then the file has been written into the image table correctly.



   If the Upload Status is 'Failed', there may not be enough free space in the image table to write the file. Inactive images can be deleted (and the terminal rebooted) to free up space for the new image (see 'Changing the Status of an Image File' on page 232).

2. Set the status of the image to 'activate' (see 'Changing the Status of an Image ' on page 232).

   This actually sets the status to 'Selected' until after a terminal reboot.

3. Reboot the terminal using a 'Hard Reboot' (see 'Rebooting the Terminal' on page 233).

   This activates the selected image. The image table status will now show 'Active'.

   The previous image file status will now show as 'Inactive'.

Kernel image files

Kernel image files contain code that forms the basis of the microprocessor's operating system. There can only ever be two kernel image files in the image table, the active and the inactive.

Kernel filenames have the following format:

C-CC-K-(version number).img e.g. C-CC-K-6_0_0.img

To upload a kernel image file;

1. Select Local > Maintenance > Upload > Kernel
2. Browse to the location of the file required to be uploaded into the terminal *.img.
3. Click on Upload.

4. Activate the image (see 'Changing the Status of an Image File' on page 232).
5. Reboot the terminal using a 'Hard Reboot' (see 'Rebooting the Terminal' on page 233).

Software image files

Software image files contain code that forms the basis of the terminal's application and management software (including the Web-based GUI). There can only ever be two software image files in the image table, the active and the inactive.

Software image filenames have the following format:

C-CC-R-(version number).img e.g. C-CC-R-8_6_7.img

To upload a software image file;

1. Select Local > Maintenance > Upload > Software
2. Browse to the location of the file required to be uploaded into the terminal *.img.
3. Click on Upload.

Software image files may take one or two minutes to upload as they can be quite large (≈ 2 Mbytes). The size of this file has caused some Microsoft Internet Explorer proxy server setups to abort during the software update process. To avoid this problem, either set the proxy file size limit to 'unlimited' or avoid the use of the proxy altogether.

4. Activate the image (see 'Changing the Status of an Image File' on page 232).
5. Reboot the terminal using a 'Hard Reboot' (see 'Rebooting the Terminal' on page 233).

Firmware image files

Firmware image files contain instructions to configure the various programmable logic elements in the terminal. There can only ever be two firmware image files for the same HSC version in the image table, the active and the inactive.

Firmware image filenames have the following format:

C-fpga_ff-x-y-z.img e.g. C-fpga_E5-0-7-3.img

where ff indicates the function (motherboard, interface card, etc).

Function Number	Function
E1	Motherboard 1
E2	Motherboard 2
E5	QJET Interface Card
E7	Q4EM Interface Card
E8	DFXO Interface Card
E9	DFXS Interface Card
EA	Modem
EB	QV24 Interface Card
EC	HSS Interface Card
ED	PSC (component of HSD system)
EE	PIC (component of HSD system)
FA	HSD modem
FB	QV24 Sync Interface Card

where x indicates the HSC (hardware software compatibility) version.

where y indicates the firmware major revision number

where z indicates the firmware minor revision number

To upload a firmware image file;

1. Select Local > Maintenance > Upload > Firmware
2. Browse to the location of the file required to be uploaded into the terminal *.img.
3. Click on Upload.

4. Activate the image (see ‘Changing the Status of an Image File’ on page 232).
5. Reboot the terminal using a ‘Hard Reboot’ (see ‘Rebooting the Terminal’ on page 233).

Viewing the Image Table

To view the image table:

1. Select Link or Local or Remote > Maintenance > Image Table.

IMAGE TABLE

Index	Type	Status	Image Size	Version	Select
0	Kernel	Active	569980	C-CC-K-6_0_0.img	◉
2	Software	Active	2168552	C-CC-R-8_6_6.img	○
3	Software	Inactive	2188007	C-CC-R-8_6_5.img	○
4	Firmware	Inactive	20072	C-fpga_E1-1-7-4.img	○
5	Firmware	Active	20046	C-fpga_E1-1-7-3.img	○
6	Firmware	Inactive	64621	C-fpga_E2-1-5-4.img	○
7	Firmware	Active	63793	C-fpga_E2-1-5-4.img	○
8	Firmware	Active	76875	C-fpga_EA-0-5-2.img	○
10	Firmware	Active	54268	C-fpga_EA-1-0-3.img	○
12	Firmware	Active	87534	C-fpga_E5-0-8-5.img	○
13	Firmware	Active	70744	C-fpga_E7-1-3-3.img	○
14	Firmware	Active	70960	C-fpga_E7-2-3-3.img	○
15	Firmware	Active	78820	C-fpga_E8-1-4-0.img	○
16	Firmware	Active	78820	C-fpga_E8-2-4-0.img	○
17	Firmware	Active	70519	C-fpga_E9-0-4-1.img	○
18	Firmware	Active	70519	C-fpga_E9-1-4-2.img	○
19	Firmware	Active	66969	C-fpga_EB-0-1-1.img	○
20	Firmware	Active	45791	C-fpga_EC-0-1-4.img	○
21	Firmware	Active	47191	C-fpga_EC-1-1-7.img	○
22	Firmware	Active	65296	C-fpga_E7-5-0-2.img	○
23	Firmware	Active	54443	C-fpga_E8-3-5-3.img	○
24	Firmware	Active	54953	C-fpga_E8-4-5-3.img	○
25	Firmware	Active	74992	C-fpga_E9-2-4-1.img	○
26	Firmware	Active	75412	C-fpga_E9-3-4-1.img	○
27	Firmware	Active	77806	C-fpga_FB-0-1-3.img	○
28	Firmware	Active	18099	C-fpga_FA-1-1-0.img	○
29	Firmware	Active	86373	C-fpga_ED-0-1-0.img	○
30	Firmware	Active	19435	C-fpga_EE-0-1-0.img	○

Edit...

The image table shows the following information:

Heading	Function
Index	A reference number for the image file
Type	The image type ‘Kernel’, ‘Software’ or ‘Firmware’.
Status	The status of the image; 'Active', 'Inactive', ‘Selected’, ‘Current (de-selected)’
Image Size	The image file size in bytes
Version	The image file name and version details

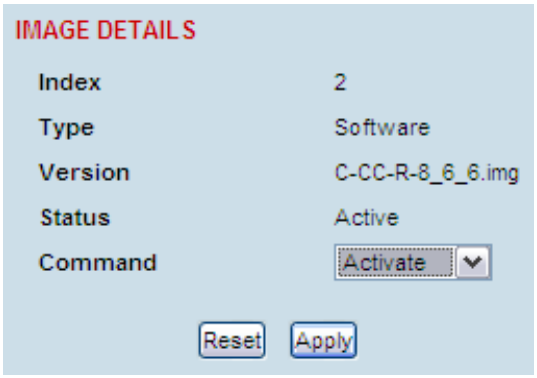
Note: Configuration file details do not appear in the image table.

Changing the Status of an Image File

To change the status of an image:

1. Select Link or Local or Remote > Maintenance > Image Table.

2. Select the image you wish to change and click Edit.



3. On the Image Details, select the status from the Command drop-down list and click Apply.

Status	Function
Active	The image is currently being used by the system.
Inactive	The image is not currently being used by the system and could be deleted.
Selected	The image is not currently being used by the system but has been activated and will become active following a terminal reboot.
Current (deselected)	The image is currently being used by the system but as another image has been selected, it will become inactive following a terminal reboot.

Rebooting the Terminal

The local or remote terminals can be rebooted by SuperVisor.

You can specify a 'Soft Reboot' which reboots the terminal without affecting traffic or a 'Hard Reboot' which reboots the terminal (similar to power cycling the terminal).

You can specify an immediate reboot or setup a reboot to occur at a predetermined time.

To reboot the terminal:

1. Select Link or Local or Remote > Maintenance > Reboot.

2. Select the **Reboot Type** field:

Reboot Type	Function
None	Does nothing.
Soft Reboot	Reboots the software but does not affect customer traffic.
Hard Reboot	Reboots the entire terminal and affects customer traffic. This reboot is similar cycling the power off and on.

3. Select the **Reboot Command** field:

Reboot Command	Function
None	Does nothing
Reboot Now	Execute the selected reboot now
Timed Reboot	Set the **Reboot Time** field to execute the selected reboot at a later date and time. This feature can be used to schedule the resulting traffic outage for a time that has least customer impact.
Cancel Reboot	Cancel a timed reboot.

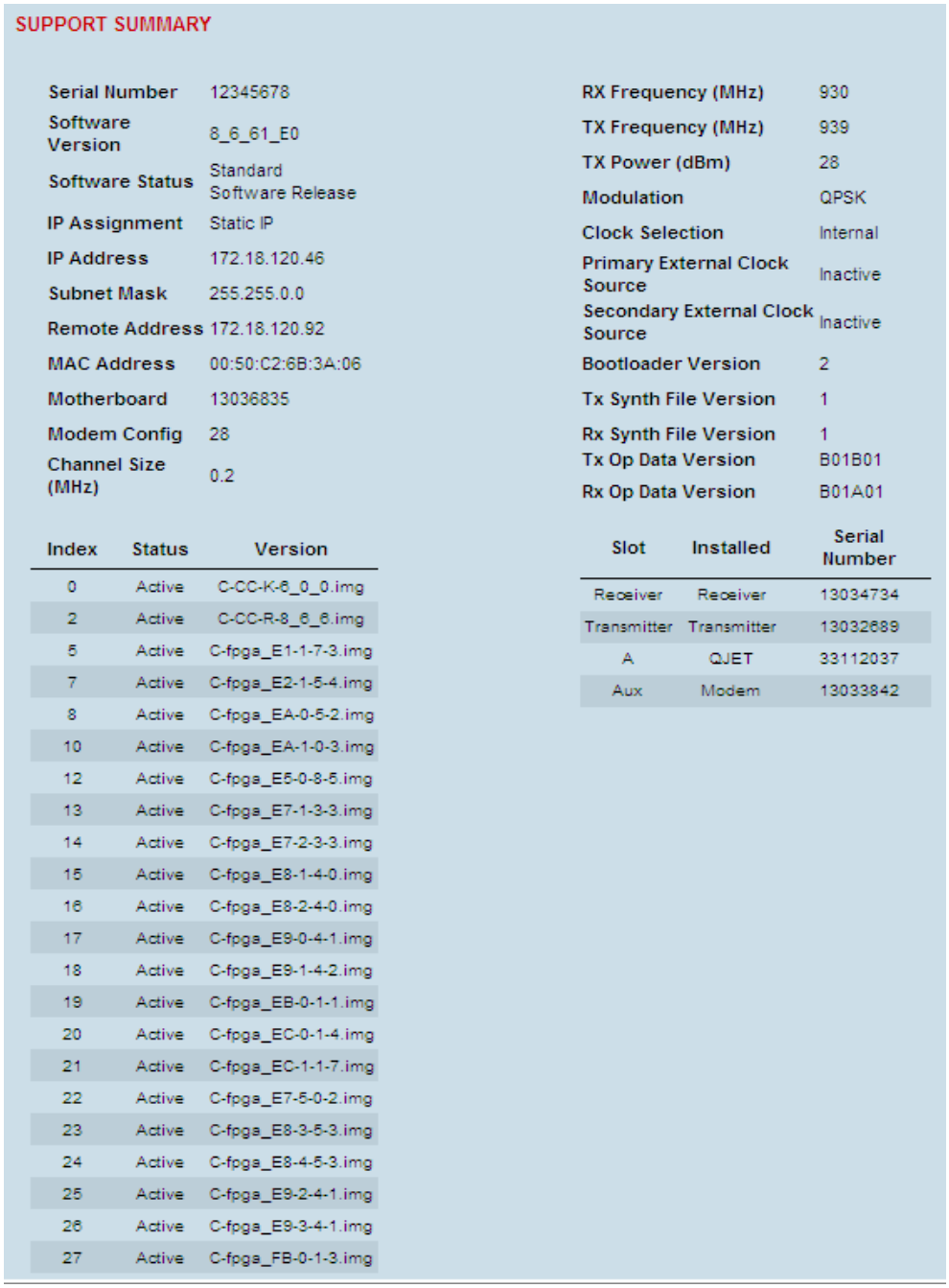
4. Click Apply to execute the reboot or Reset to restore the previous configuration.

Support Summary

The support summary page lists key information about the terminal, for example, serial numbers, software version, frequencies and so on.

To view the support summary:

Select Link or Local or Remote > Maintenance > Support Summary.



SUPPORT SUMMARY

Serial Number	12345678
Software Version	8_6_61_E0
Software Status	Standard Software Release
IP Assignment	Static IP
IP Address	172.18.120.46
Subnet Mask	255.255.0.0
Remote Address	172.18.120.92
MAC Address	00:50:C2:6B:3A:06
Motherboard	13036835
Modem Config	28
Channel Size (MHz)	0.2

RX Frequency (MHz)	930
TX Frequency (MHz)	939
TX Power (dBm)	28
Modulation	QPSK
Clock Selection	Internal
Primary External Clock Source	Inactive
Secondary External Clock Source	Inactive
Bootloader Version	2
Tx Synth File Version	1
Rx Synth File Version	1
Tx Op Data Version	B01B01
Rx Op Data Version	B01A01

Index	Status	Version
0	Active	C-CC-K-8_0_0.img
2	Active	C-CC-R-8_6_6.img
5	Active	C-fpga_E1-1-7-3.img
7	Active	C-fpga_E2-1-5-4.img
8	Active	C-fpga_EA-0-5-2.img
10	Active	C-fpga_EA-1-0-3.img
12	Active	C-fpga_E5-0-8-5.img
13	Active	C-fpga_E7-1-3-3.img
14	Active	C-fpga_E7-2-3-3.img
15	Active	C-fpga_E8-1-4-0.img
16	Active	C-fpga_E8-2-4-0.img
17	Active	C-fpga_E9-0-4-1.img
18	Active	C-fpga_E9-1-4-2.img
19	Active	C-fpga_EB-0-1-1.img
20	Active	C-fpga_EC-0-1-4.img
21	Active	C-fpga_EC-1-1-7.img
22	Active	C-fpga_E7-5-0-2.img
23	Active	C-fpga_E8-3-5-3.img
24	Active	C-fpga_E8-4-5-3.img
25	Active	C-fpga_E9-2-4-1.img
26	Active	C-fpga_E9-3-4-1.img
27	Active	C-fpga_FB-0-1-3.img

Slot	Installed	Serial Number
Receiver	Receiver	13034734
Transmitter	Transmitter	13032689
A	QJET	33112037
Aux	Modem	13033842

Installing Interface Cards

CAUTION: You must power down the terminal before removing or installing interface cards.

Interface cards are initially installed in the factory to the customers' requirements however, during the life of the product, additional interface cards may need to be installed.

Unless the terminals are protected (see 'Protected terminals' on page 197), installing new interface cards involves a substantial interruption of traffic across the link. Staff performing this task must have the appropriate level of education and experience; it should not be attempted by inexperienced personnel.

To install an interface card:

1. Switch off the power to the terminal.
2. Prepare the terminal for new interface cards (see 'Preparing the Terminal for New Interface Cards' on page 236).
3. Install the interface card (see 'Installing an Interface Card' on page 238).
4. Power up the terminal.
5. Configure the slot (see 'Configuring a Slot' on page 240).

   A slot can be configured before installing a new interface card, or after the interface card is installed and the terminal power cycled.
6. Configure the cross connections. (see 'Configuring the traffic cross connections' on page 158)

Preparing the Terminal for New Interface Cards

To prepare the terminal for a new interface card:

1. Remove the terminal from service by first switching off the terminal power. For an AC powered terminal, remove the AC power connector. For a DC powered terminal, switch off the DC circuit breaker or supply fuse.

2. Remove all other cables from the terminal, marking their locations first, if necessary, to aid later restoration. The safety earth connection must be the last cable removed.

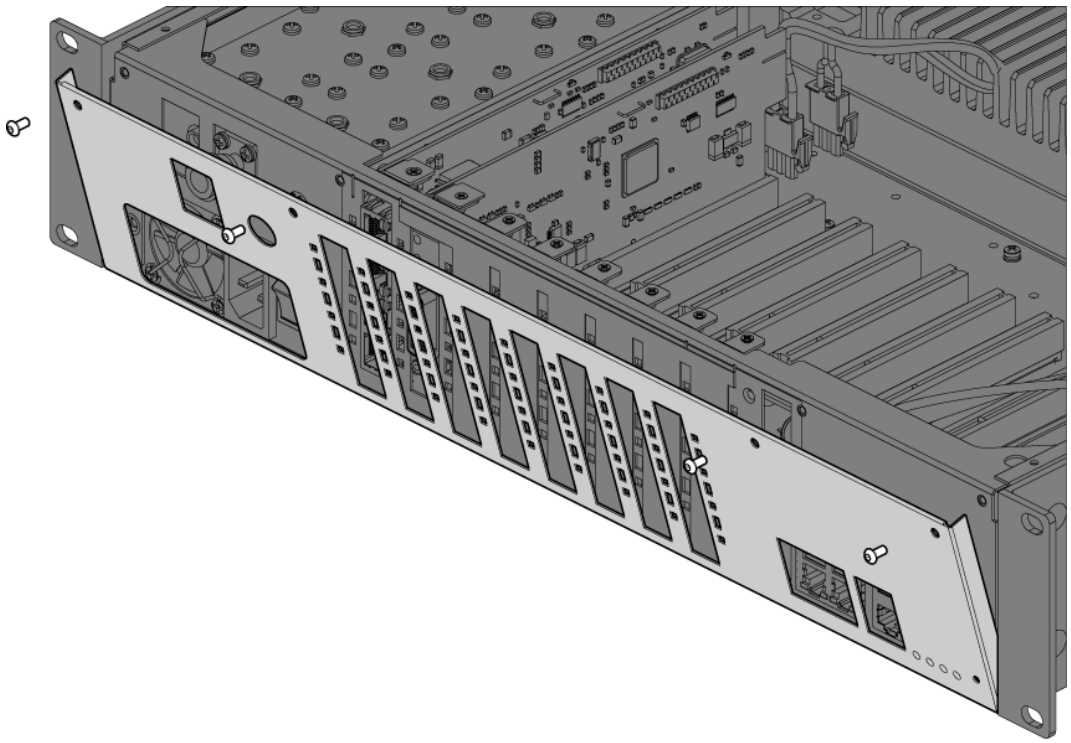
3. Ensure you have unobstructed access to the top and front of the terminal. Remove the terminal from the equipment rack, if required.

4. Remove the top cover of the terminal by removing two socket screws from the rear.

   Note: The top cover slides back towards the rear of the chassis.

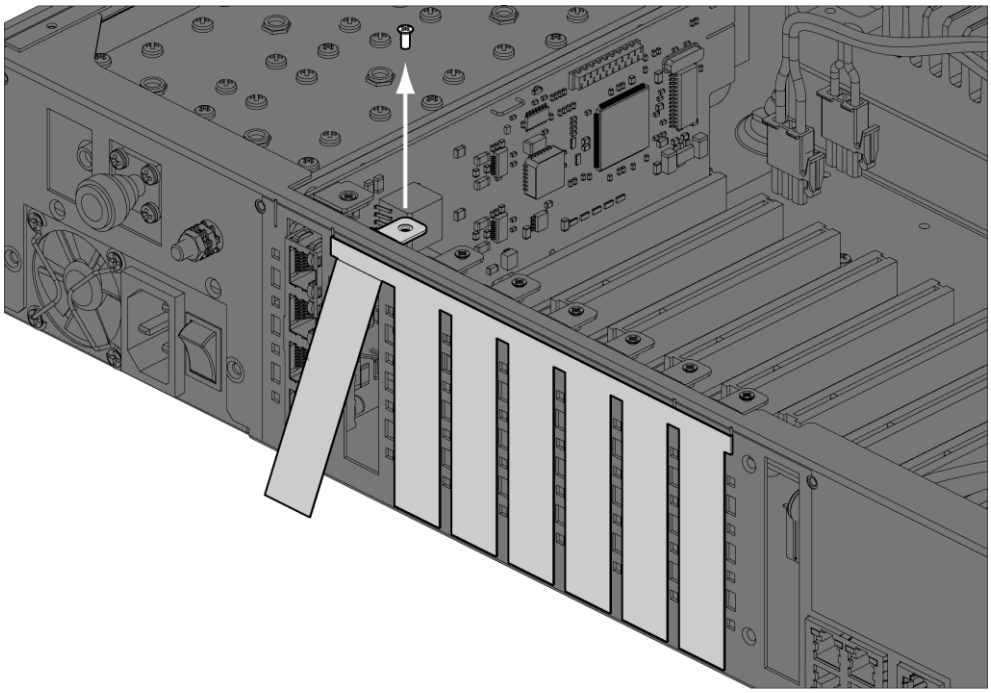
5. Remove the front fascia by removing the four front panel socket screws.

   Note: The front fascia first hinges out to clear the antenna connector and earth stud, and is then removed by unclipping from the chassis and sliding downwards. See illustration below.

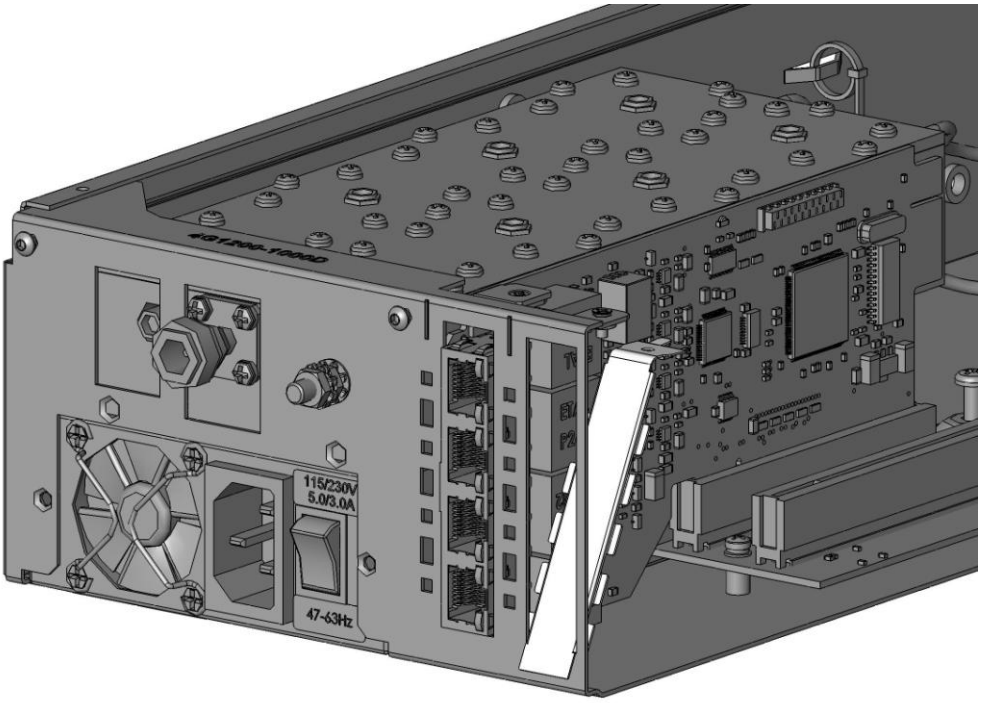


6. Remove the card securing screw from the required interface slot.
7. There are two types of interface slot blanking plates, the seven tab break off and the single slot type (newer type).

   If the blanking plate is the seven tab break off, remove the slot blanking tab by folding the tab to and fro until it breaks off.



If the blanking plate is the single slot type, unclip the blanking plate from behind the slot (assuming that the card securing screw has already been removed).



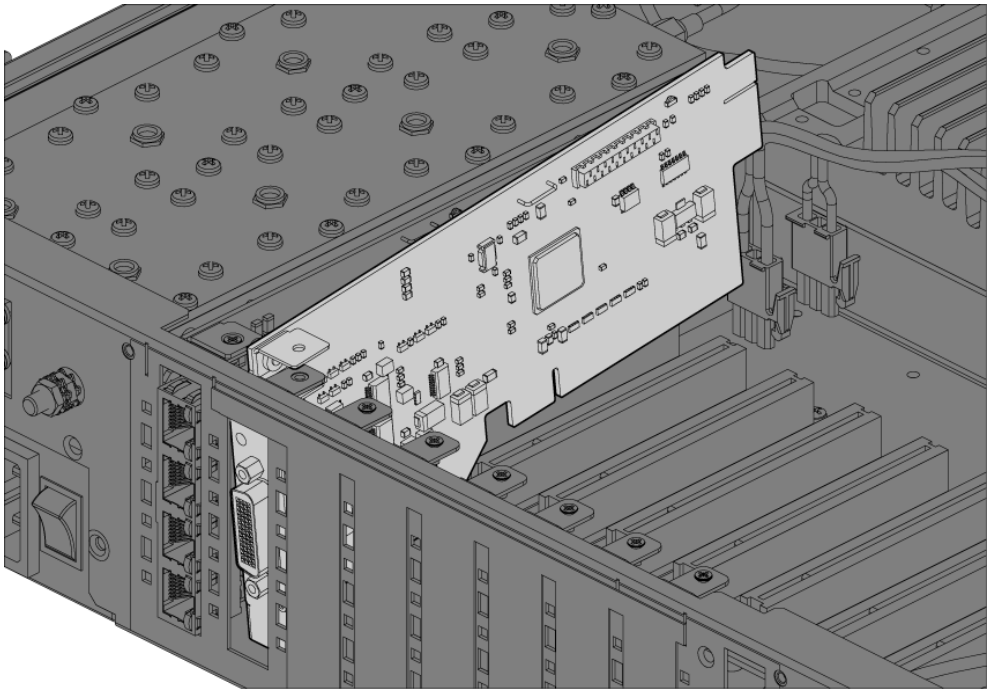
Installing an Interface Card

To install an interface card:

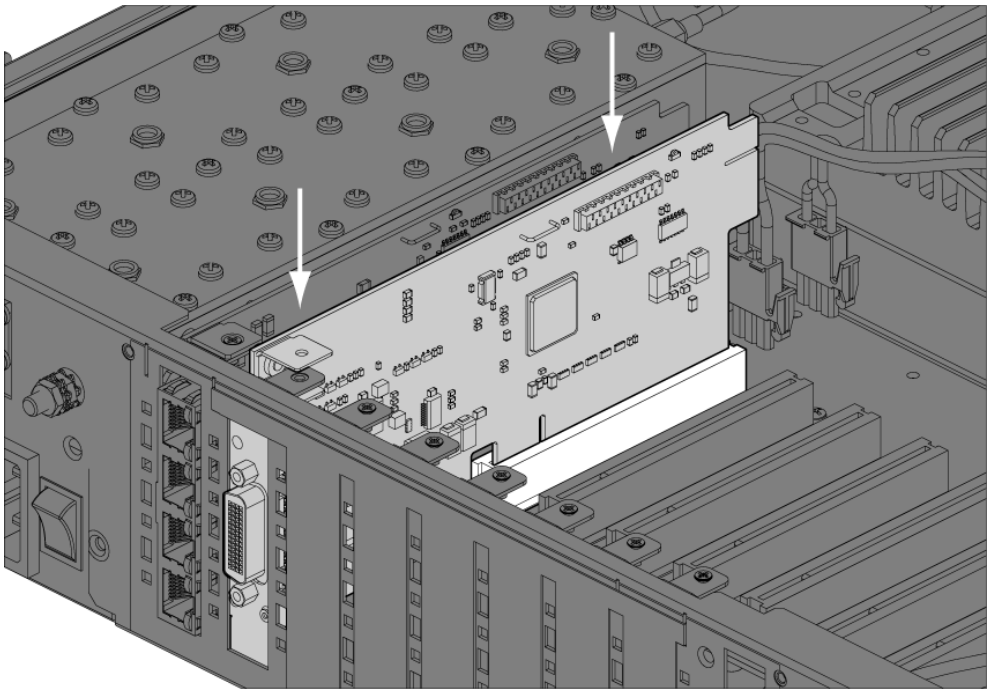
1. Remove the interface card from its packaging and static-safe bag.

CAUTION: To avoid static damage to the terminal or the interface card being installed, use a static discharge wristband or similar antistatic device.

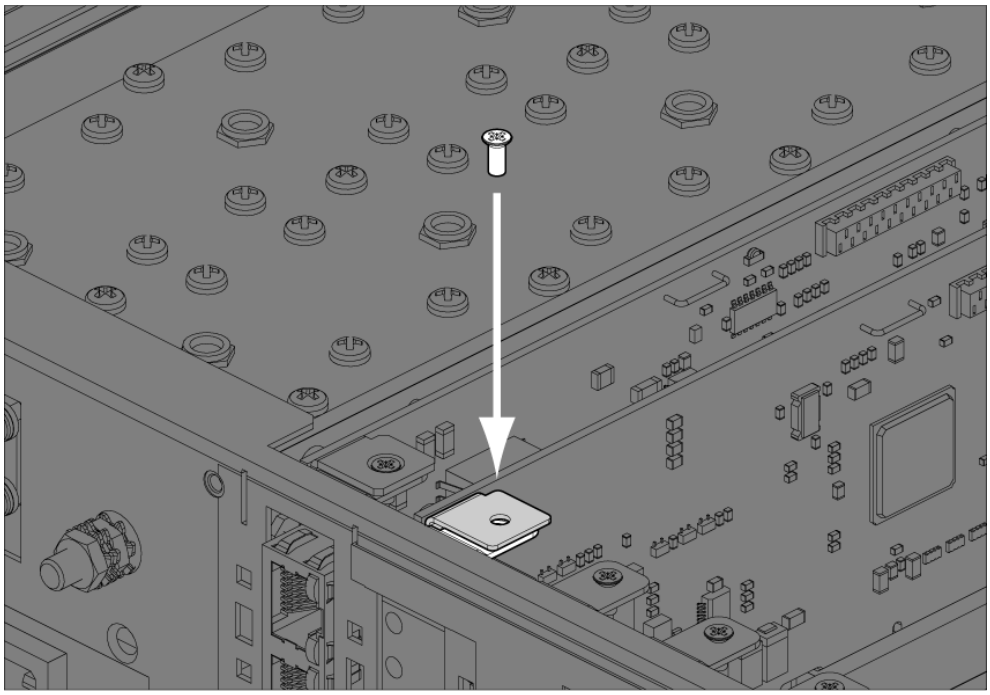
2. Offer the interface card into the chassis at an angle until the front panel of the card engages in the chassis.



3. Rotate the card in the chassis until it is level, and both parts of the card interface bus connector engage with the socket. Push down evenly on the interface card to seat it into the socket.

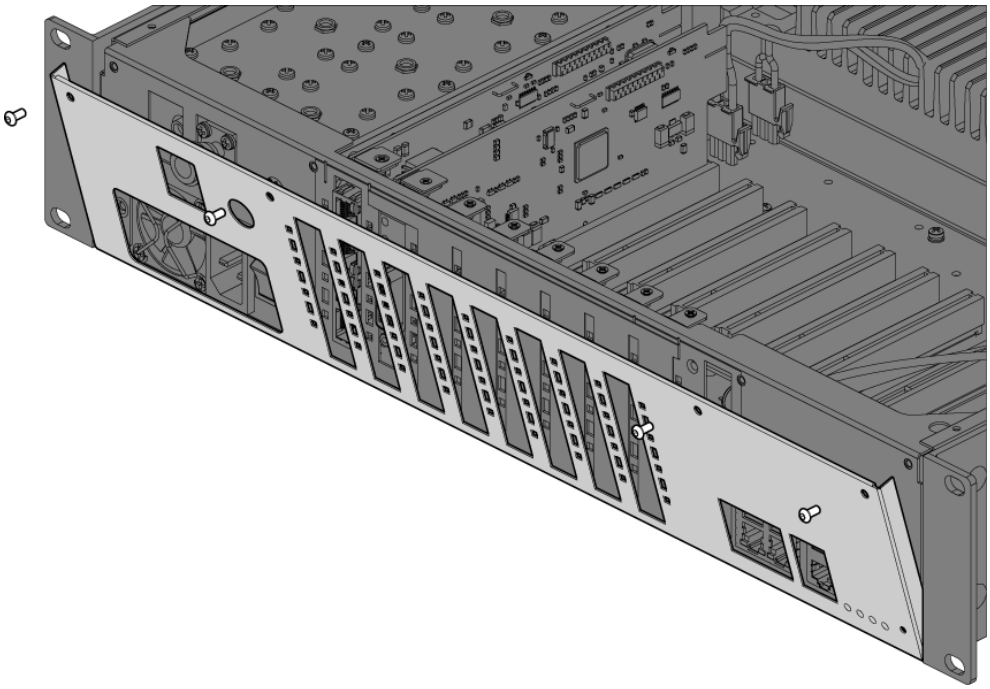


4. Replace the card securing screw.



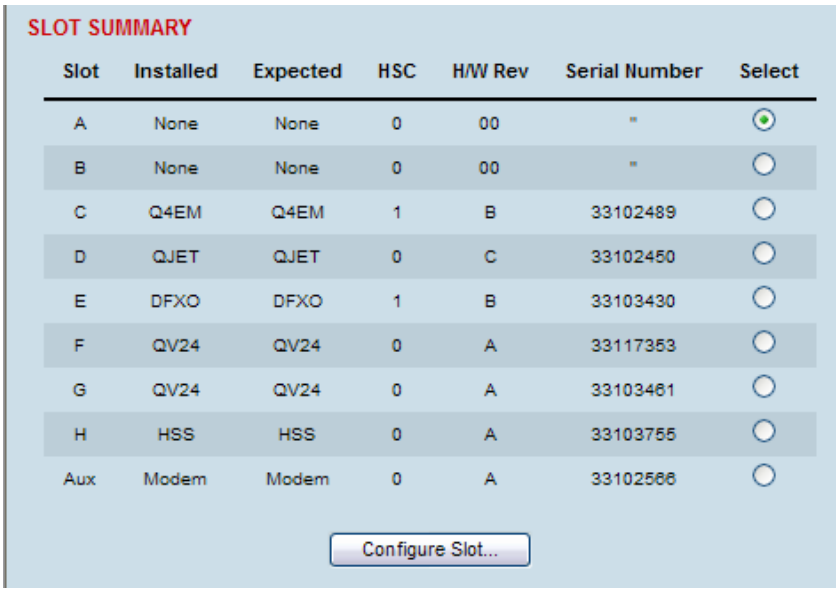
Note: Some interface cards may not have the bracket to accept the card securing screw.

5. Replace the fascia and top covers, restore all cables, and power up the terminal.

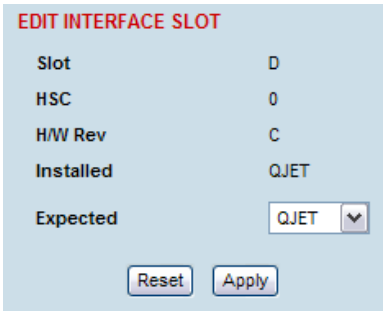


Configuring a Slot

1. Select Link or Local or Remote > Interface > Slot Summary.



2. Select the required slot and click Configure Slot.



'Slot' shows the slot the interface card is plugged into in the terminal (A – H).

Details of the interface card currently installed in the slot are:

'HSC' (hardware software compatibility) A number used by the system software to determine which FPGA 'firmware image file' to use in the interface card installed.

'H/W Rev' (hardware revision).

'Installed' field shows the actual interface card installed in the slot. If there is no interface card installed in the slot, this field will show 'none'.

'Expected' shows interface card type that had been previously installed. Interface cards can be setup before they are installed in the terminal or after they are installed in the terminal.

3. To setup a new interface card in a slot, select the interface card type you want to fit (or has been fitted) from the 'Expected' drop-down menu.

Note: The transmitter, receiver and modem are configured in other sections (see 'Configuring the terminal' on page 69).

4. Click Apply to apply changes or Reset to restore the previous configuration.

14. Troubleshooting

Loopbacks

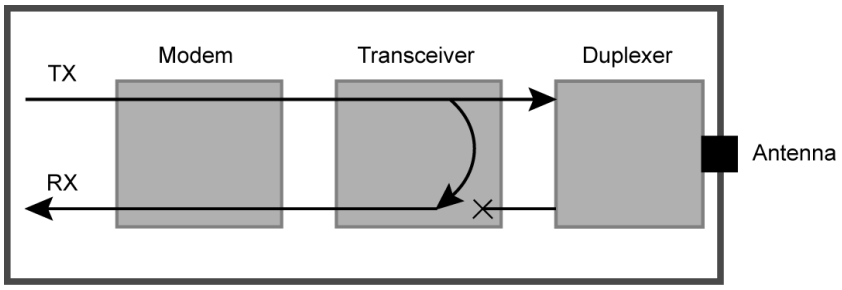
Loopbacks are used as a tool for testing or as part of the commissioning process and will affect customer traffic across the link.

The terminal supports three types of loopbacks:

- RF radio loopback
- Interface loopbacks, set at the interface ports
- Timeslot loopbacks

RF Radio Loopback

The RF radio loopback provides a loopback connection between the radio TX and radio RX. Each terminal is looped back independently.



All traffic entering the transmit stage of the transceiver is transmitted on the RF link but is also looped back to the receiver section of the transceiver. This loopback will affect all traffic through the terminal.

When the RF loopback is activated, both the radio RX and TX LEDs will flash.

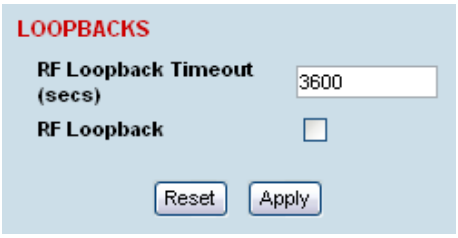
An RF loopback will automatically deactivate after the period set (in seconds) in the RF Loopback Timeout field. The default entry is 3600 seconds (60 minutes).

When an RF loopback is activated, the ethernet path is disabled to prevent ethernet loopbacks.

An RF loopback is deactivated if the terminal is rebooted.

To activate or deactivate the RF loopback:

Select Link or Local or Remote > Maintenance > Loopbacks.



To activate the RF loopback, tick the RF Loopback checkbox. Untick the checkbox to deactivate it.

Click Apply to apply changes or Reset to restore the previous configuration.

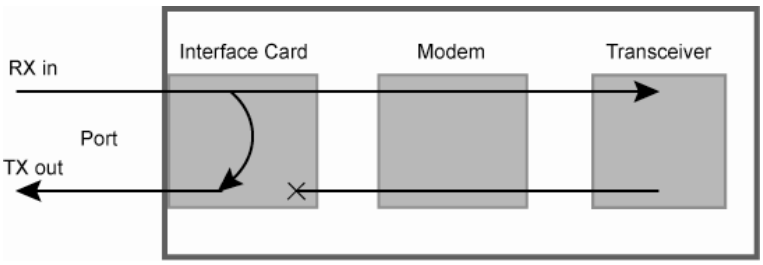
Interface Loopbacks

The interface loopback provides a loopback connection for the customer-connected equipment.

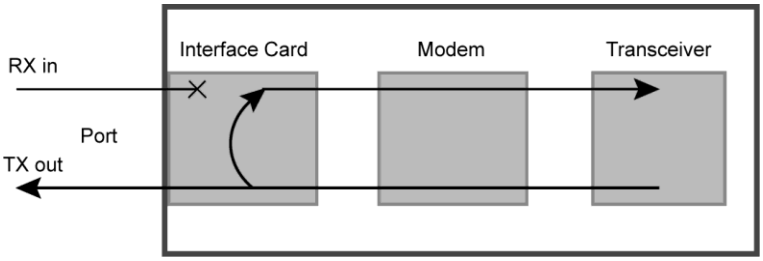
These loopbacks are applied on a port-by-port basis and can only be enabled on active ports i.e. the port has to be activated by assigning traffic to it by the Cross Connections application.

These are two types of interface loopbacks:

Line Facing – port traffic from the customer is transmitted over the RF link but is also looped back to the customer



Radio Facing – traffic received from the RF link is passed to the customer port but is also looped back to be transmitted over the RF link.

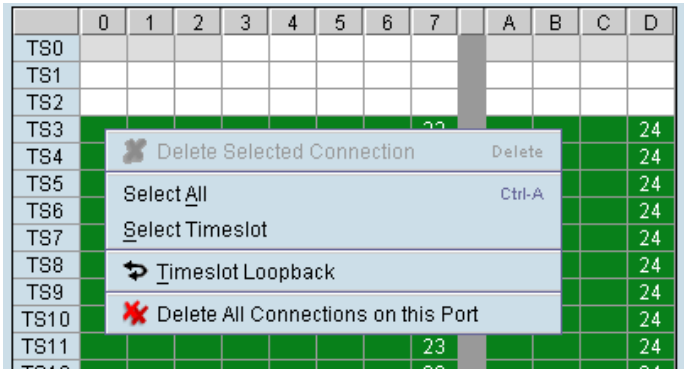


Loopback type	Description
QJET (whole tributary)	The QJET interface port has both Line Facing and Radio Facing loopbacks (see 'QJET Port Settings' on page 102). The interface card green LED flashes while the loopback is active.
QJET (individual timeslot)	The Cross Connections application can loopback framed E1 / T1 timeslots (see 'Timeslot Loopbacks' on page 243).
Q4EM port	The Q4EM interface port has both Line Facing and Radio Facing loopbacks (see 'Q4EM Port Settings' on page 104). The interface card yellow LED flashes while the loopback is active.
DFXO port	The DFXO interface Line Facing loopback loops back the port data to the customer. This loopback is performed on the digital path of the codec. The interface card yellow LED flashes while the loopback is active.
DFXS port	The DFXS interface Line Facing loopback loops back the port data to the customer. This loopback is performed on the digital path of the codec. The interface card yellow LED flashes while the loopback is active.
HSS port	The HSS interface Line Facing loopback loops back the port data to the customer. The interface card top green LED flashes while the loopback is active.
QV24 port	The QV24 interface Line Facing loopback will loop back the port data to the customer.
Ethernet	No loopback possible.

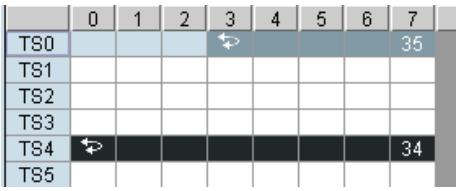
Timeslot Loopbacks

You can loopback framed E1 / T1 timeslots in the Cross Connections application.

1. Open the Cross Connections application.
2. Right-click the timeslot you want to loop back.



3. Select Timeslot Loopback - the looped timeslot will display in black:



Alarms

The LEDs (OK, RX, and TX) on the front panel illuminate either amber or red when there is a fault condition:

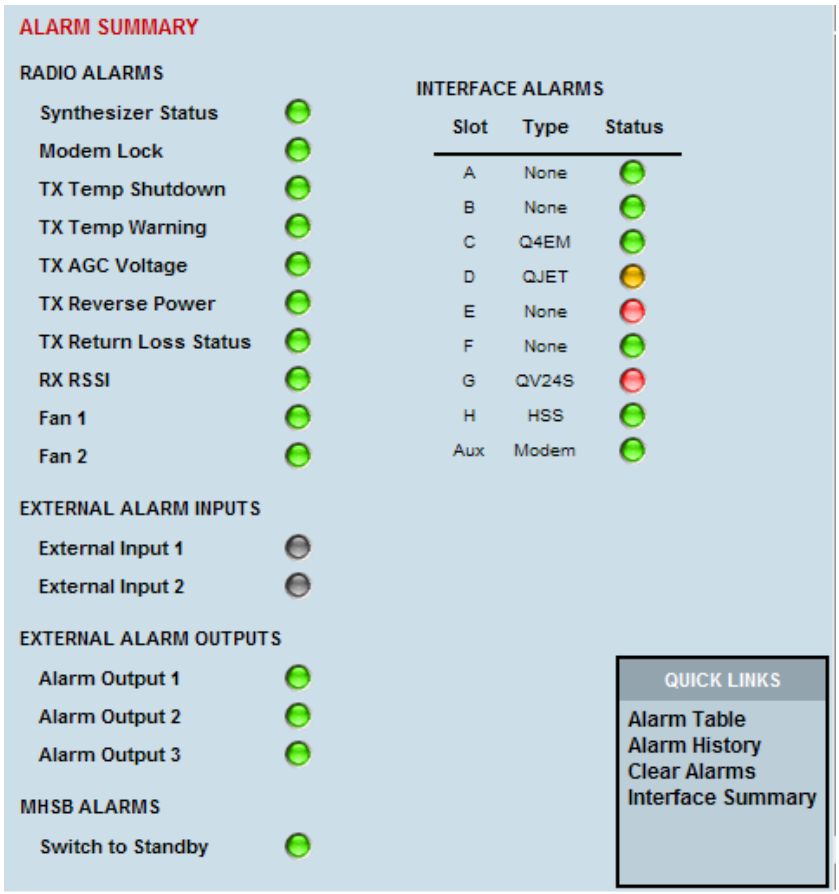
- Amber indicates a minor alarm that should not affect traffic across the link.
- Red indicates a major alarm condition that could affect traffic across the link.

A major or minor alarm can be mapped to the external alarm outputs (see 'Configuring the External Alarm Outputs' on page 83).

Diagnosing Alarms

To view the Alarm Summary and their current states:

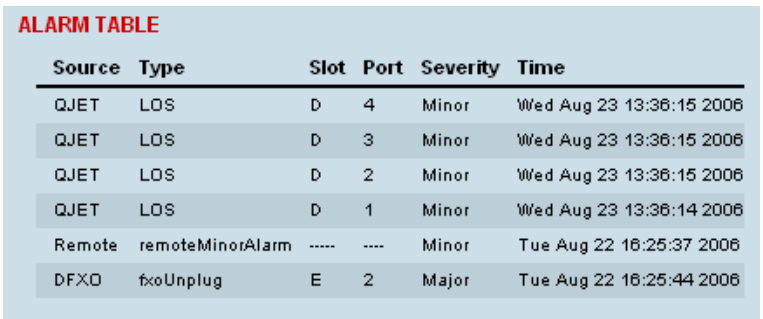
Select Link or Local or Remote > Alarms > Summary.



Alarm	Explanation
Synthesizer Status	The selected transmit frequency is outside the tuning range of the transmitter synthesizer
Modem Lock	The terminal modem is not synchronized with the modem at the other end of the link
TX Temp Shutdown	The transmitter power amplifier temperature is greater than 75°C. The transmitter has shut down to prevent damage.
TX Temp Warning	The transmitter power amplifier temperature is greater than 70°C. The transmitter will continue to operate in this condition, but if the power amplifier temperature increases above 75°C, a major alarm condition is set and the transmitter will shut down to prevent further damage.
TX AGC Voltage	The transmitter power amplifier automatic gain control is out of limits for normal operation
TX Reverse Power	There is excessive reflected power at the transmitter port of the terminal, indicating a low return loss in the path between transmitter port and the antenna.
TX Return Loss Status	Indicates the difference between the transmitted power and the amount of power being reflected back into the terminal. The alarm will trigger when there is too much reflected power from the antenna that will degrade link performance.
RX RSSI	The RX RSSI alarm threshold is determined by the RSSI Thresholds for each of the modulation types (see 'Setting the RSSI Alarm Threshold' on page 80)
Fan 1	The internal cooling fan 1 is not operating
Fan 2	The internal cooling fan 2 is not operating
External Input 1 -2	Indicates an active alarm state on the the external alarm input
Alarm Output 1 - 4	Indicates an active alarm state on the the external alarm output
MHSB Switch	Indicates that the MHSB has switched over. The MHSB alarm is only shown if MHSB mode is enabled (see 'Configuring the Terminals for MHSB' on page 188).

To view detailed alarm information:

Select Link or Local or Remote > Alarms > Alarm Table



The Alarm Table shows the source of the alarm and the type, the slot (and port, if applicable) where the alarm originated, the severity and the date and time the alarm occurred.

To further diagnose the cause of the alarm (see 'Identifying Causes of Alarms' on page 250, and 'Alarm Types' on page 275).

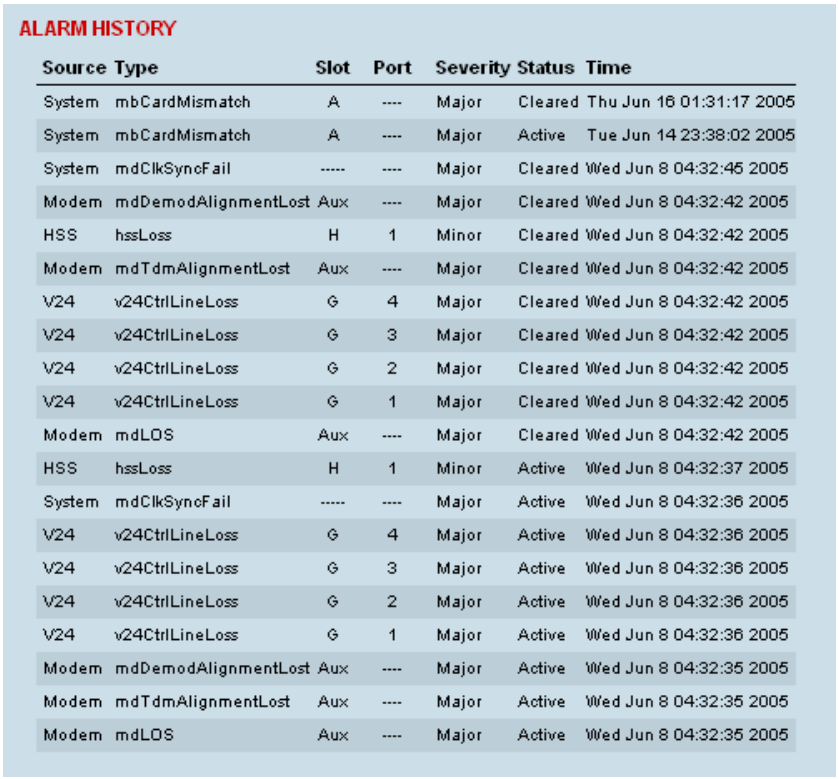
Viewing the Alarm History

The alarm history page shows the historical alarm activity for up to 50 alarms. This page refreshes every 30 seconds.

The alarm history for up to 100 alarms can be seen using SNMP (see 'Configuring SNMP' on page 85).

To view the alarm history:

Select Link or Local or Remote > Alarms > Alarm History.



ALARM HISTORY

Source	Type	Slot	Port	Severity	Status	Time
System	mbCardMismatch	A	----	Major	Cleared	Thu Jun 16 01:31:17 2005
System	mbCardMismatch	A	----	Major	Active	Tue Jun 14 23:38:02 2005
System	mdClkSyncFail	-----	----	Major	Cleared	Wed Jun 8 04:32:45 2005
Modem	mdDemodAlignmentLost	Aux	----	Major	Cleared	Wed Jun 8 04:32:42 2005
HSS	hssLoss	H	1	Minor	Cleared	Wed Jun 8 04:32:42 2005
Modem	mdTdmAlignmentLost	Aux	----	Major	Cleared	Wed Jun 8 04:32:42 2005
V24	v24CtrlLineLoss	G	4	Major	Cleared	Wed Jun 8 04:32:42 2005
V24	v24CtrlLineLoss	G	3	Major	Cleared	Wed Jun 8 04:32:42 2005
V24	v24CtrlLineLoss	G	2	Major	Cleared	Wed Jun 8 04:32:42 2005
V24	v24CtrlLineLoss	G	1	Major	Cleared	Wed Jun 8 04:32:42 2005
Modem	mdLOS	Aux	----	Major	Cleared	Wed Jun 8 04:32:42 2005
HSS	hssLoss	H	1	Minor	Active	Wed Jun 8 04:32:37 2005
System	mdClkSyncFail	-----	----	Major	Active	Wed Jun 8 04:32:36 2005
V24	v24CtrlLineLoss	G	4	Major	Active	Wed Jun 8 04:32:36 2005
V24	v24CtrlLineLoss	G	3	Major	Active	Wed Jun 8 04:32:36 2005
V24	v24CtrlLineLoss	G	2	Major	Active	Wed Jun 8 04:32:36 2005
V24	v24CtrlLineLoss	G	1	Major	Active	Wed Jun 8 04:32:36 2005
Modem	mdDemodAlignmentLost	Aux	----	Major	Active	Wed Jun 8 04:32:35 2005
Modem	mdTdmAlignmentLost	Aux	----	Major	Active	Wed Jun 8 04:32:35 2005
Modem	mdLOS	Aux	----	Major	Active	Wed Jun 8 04:32:35 2005

Field	Explanation
Source	The component within the terminal that generated the alarm
Type	The type of alarm (see 'Alarm types and sources' on page 275)
Slot	The slot where the alarm originated, if applicable
Port	The port where the alarm originated, if applicable
Severity	Whether the alarm was a major or minor alarm
Status	Whether the alarm is active or cleared
Time	The date and time when the alarm occurred

To clear the alarm history:

Select Local or Remote > Alarms > Clear History

This function clears all the alarm history including the 600 alarm rolling buffer (see 'Saving the Alarm History' on page 247).

Saving the Alarm History

The last 1500 alarms are stored in a rolling buffer which can be saved as a *.csv file.

To save the alarm history:

Select Local > Alarms > Save History

A File Download dialog box opens.

Click on Save to save the *.csv file to a folder or click on Open to open the file in the SuperVisor page.

Example of file:

Source	Type	Slot	Port	Severity	Status	Time	SNR (dB)	RSSI (dBm)
Modem	mdLOS	Aux	-	Major	Active	Tue Jan 22 12:45:54 2008	0	0
Modem	mdTdmAlignmentLost	Aux	-	Major	Active	Tue Jan 22 12:45:54 2008	0	0
Modem	mdDemodAlignmentLost	Aux	-	Major	Active	Tue Jan 22 12:45:54 2008	0	0
QV24	v24CtrlLineLoss	G	1	Major	Active	Tue Jan 22 12:45:55 2008	0	0
QV24	v24CtrlLineLoss	G	2	Major	Active	Tue Jan 22 12:45:55 2008	0	0
QV24	v24CtrlLineLoss	G	3	Major	Active	Tue Jan 22 12:45:55 2008	0	0
System	mdClkSyncFail	----	-	Major	Active	Tue Jan 22 12:45:57 2008	0	0
Modem	mdLOS	Aux	-	Major	Cleared	Tue Jan 22 12:45:57 2008	0	0
Modem	mdTdmAlignmentLost	Aux	-	Major	Cleared	Tue Jan 22 12:45:57 2008	0	0
Modem	mdDemodAlignmentLost	Aux	-	Major	Cleared	Tue Jan 22 12:45:57 2008	0	0
Transmitter	txADCChZeroLo	Transmitter	-	Minor	Active	Tue Jan 22 12:45:57 2008	0	0
Transmitter	txADCChZeroLo	Transmitter	-	Minor	Cleared	Tue Jan 22 12:45:58 2008	0	0
System	mdClkSyncFail	----	-	Major	Cleared	Tue Jan 22 12:45:58 2008	0	0
QV24	v24CtrlLineLoss	G	1	Major	Cleared	Tue Jan 22 12:45:59 2008	35.28	0
QV24	v24CtrlLineLoss	G	2	Major	Cleared	Tue Jan 22 12:45:59 2008	35.29	0
QV24	v24CtrlLineLoss	G	3	Major	Cleared	Tue Jan 22 12:45:59 2008	35.26	0
HSS	hssLoss	H	1	Minor	Active	Tue Jan 22 13:51:17 2008	35.28	-52.8
HSS	hssLoss	H	1	Minor	Cleared	Tue Jan 22 13:51:17 2008	35.27	-52.8
QJET	LOS	D	1	Minor	Active	Tue Jan 22 13:51:35 2008	35.29	-52.8

Note: Windows security settings can prevent the download of files. In this case, click on the windows security message and select the SuperVisor menu option again (Alarms > Save History).

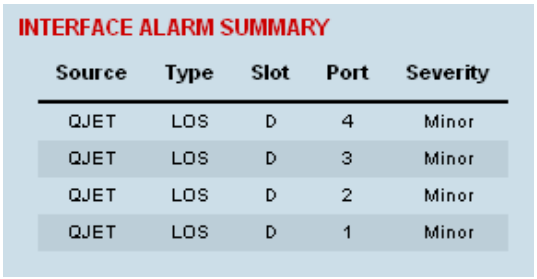
To save the alarm history from the Remote terminal, login to the Remote terminal and Select Local > Alarms > Save History.

Viewing Interface Alarms

To view the alarms for a particular interface:

1. Select Link or Local or Remote > Interface > Interface Summary.
2. Select the desired interface card slot from the Interface Summary and click Alarms.

   This opens a page as shown below with a summary of the alarms on the interface card:



INTERFACE ALARM SUMMARY

Source	Type	Slot	Port	Severity
QJET	LOS	D	4	Minor
QJET	LOS	D	3	Minor
QJET	LOS	D	2	Minor
QJET	LOS	D	1	Minor

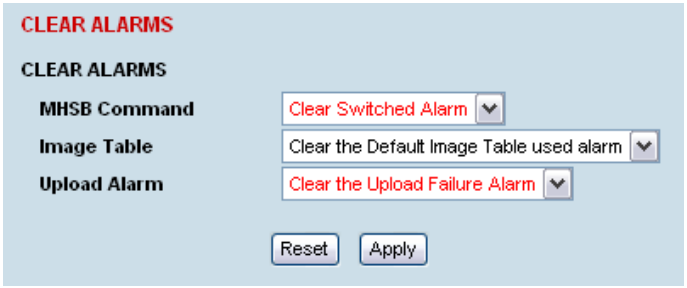
The following fields are displayed:

- Source: The type of interface card that generated the alarm
- Type: The type of interface alarm
- Slot: The slot of the interface card that generated the interface alarm
- Port: The port that generated the interface alarm
- Severity: Whether the interface alarm was major or minor

3. Return to the Interface Summary page by either selecting Options > Interface Summary or clicking Back in the browser window.

Clearing Alarms

Select Link or Local or Remote > Alarms > Clear Alarms



MHSB Command

If a MHSB switchover event occurs, the OK LED on the front panel changes to amber.

To clear the MHSB switchover alarm:

Select 'Clear Switched Alarm' from the MHSB Command drop-down list and click on Apply.

Image Table Alarm

An image table alarm occurs if a problem occurred during the boot process which may have left the image table in an inconsistent state.

To clear the image table alarm:

The default image table alarm: this indicates that the image table has been rebuilt from defaults. This can indicate that an incorrect build of software is running on the terminal.

Select 'Clear the Default Image Table used alarm' from the Image Table drop-down list and click on Apply.

In addition to clearing the image table alarm, you should verify that the active images in the image table are correct for the software release.

Upload Alarm

An Upload Alarm occurs if the TFTP Upgrade process fails. This can indicate that the upgrade process cannot find the TFTP server or cannot find the software version number entered.

To clear the upload alarm alarm:

Select 'Clear the Upload Failure Alarm' from the Upload Alarm drop-down list and click on Apply.

Identifying Causes of Alarms

The following are possible causes of an alarm.

LED	Colour	Possible causes
OK	Amber	A minor system alarm is set
	Red	A major system alarm is set
RX	Amber	Low RSSI or AGC limits have been exceeded
	Red	Receiver power supply or synthesizer failure
TX	Amber	AGC, transmitter temperature, forward power or reverse power limits have been exceeded
	Red	Transmit power supply or synthesizer failure

OK LED		
Colour	Alarm condition	Suggested action
Amber	Fan failure	Check that the fans are not blocked and can spin freely.
Amber	Interface card mismatch	Using SuperVisor, check that the expected interface card and the fitted interface card are the same.
Red	Modem lock	A modem lock alarm is generally seen when other conditions such as low RSSI are present. If there are no other alarms indicated, check the following: The terminal clocking is set up correctly. Both terminals are using the same modulation. Both terminals are using the same version of software. External RF Interference from equipment operating in adjacent channels. Check the constellation pattern for evidence of disturbances in the RF path. Compare RSSI with the expected values from the original path engineering calculation. Investigate any large differences. If the fault persists, contact your local representative.
Red	Interface alarms	Check that the E1 or Ethernet interface cables are fitted correctly and the equipment they are connected to is functioning correctly.

RX LED		
Colour	Alarm condition	Suggested action
Amber	Low RSSI	Check that all antenna and feeder cables are firmly connected and not damaged or kinked Check there is no damage to the antenna Check the TX power and alarm status of the remote terminal
Amber	Receiver AGC	Contact your local 4RF representative
Red	Receiver power supply	Contact your local 4RF representative

TX LED		
Colour	Alarm condition	Suggested action
Amber	Reverse power	Check that all antenna and feeder cables are firmly connected and not damaged or kinked Check there is no damage to the antenna Check that the Receiver and Transmitter ports are correctly connected to the High and Low ports of the duplexer
Red	Transmitter temperature	Check operation of cooling fan or fans Ensure the air grills on the sides of the terminal are clear Ensure the ambient air temperature around the equipment is less than 50˚C

E1 / T1 Alarm Conditions

The QJET interface yellow LED indicates:

- **Loss of signal (LOS)**

  A loss of signal alarm occurs when there is no valid G.703 signal at the E1 / T1 interface RX input from the downstream system.

  This alarm masks the LOF and AIS received alarms.

- **Loss Of Frame alignment (LOF)**

  A loss of frame alignment alarm occurs when the E1 / T1 interface RX input receives a valid G.703 signal (code and frequency) but does not receive a valid G.704 signal i.e. no frame alignment word, from the downstream system (in framed E1 / T1 modes only) (red alarm in framed T1 modes).

  This alarm masks the AIS received alarm.

- **Alarm Indication Signal (AIS)**

  An AIS received alarm occurs when AIS is received from the downstream system.

  An E1 / T1 interface will output AIS to the downstream system if the normal upstream traffic signal is not available e.g. loss of modem synchronization, loss of RF signal across the link (blue alarm in framed T1 modes).

- **Remote Alarm Indicator (RAI)**

  A remote alarm indicator occurs when RAI is received from the downstream system when it has an active LOS or LOF alarm (TS0 NFAS bit 3 in framed E1 modes and yellow alarm in framed T1 modes).

- **TS16 Loss of signal (TS16LOS)**

  A TS16 loss of signal alarm occurs when there is no valid TS16 signal at the E1 interface RX input from the downstream system (in E1 PCM 30 modes only).

- **TS16 Remote Multi-frame Alarm Indicator (RMAI)**

  A remote multiframe alarm indicator occurs when RMAI is received from the downstream system when it has an active TS16LOS alarm (TS16 F0 bit 6 in E1 PCM 30 modes only).

- **TS16 Alarm Indication Signal (TS16AIS)**

  A TS16 Alarm Indication Signal alarm occurs when AIS is received from the downstream system in TS16.

  An E1 interface will output the TS16 AIS signal to the downstream system if the normal TS16 multi-frame signal is not available (in E1 PCM 30 modes only).

The QJET interface green LED indicates:

The QJET interface green LED flashes when the E1 / T1 port loopback is active.

System Log

SuperVisor automatically keeps a log, known as 'syslog', which captures all alarms, errors and events for each terminal.

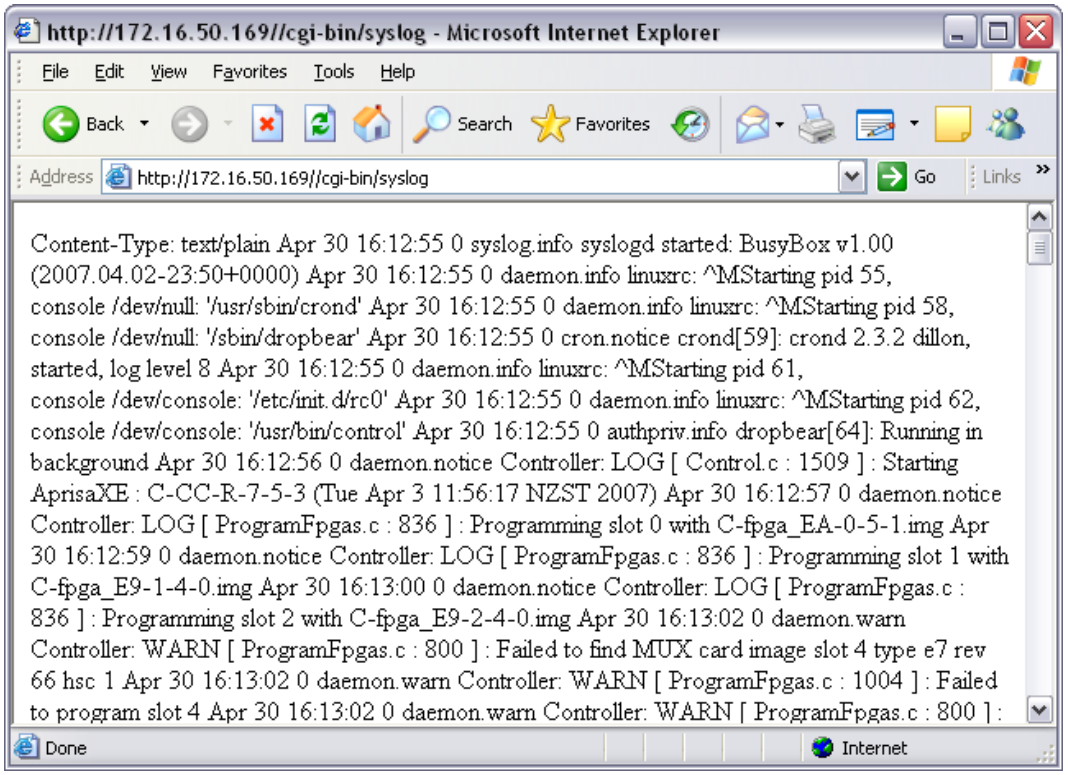
You can specify that the 'syslog' is saved to a particular file (see 'Setting up for Remote Logging' on page 255). You can then email this file to customer service, if requested, to enable them to fault-find more accurately.

Checking the Syslog

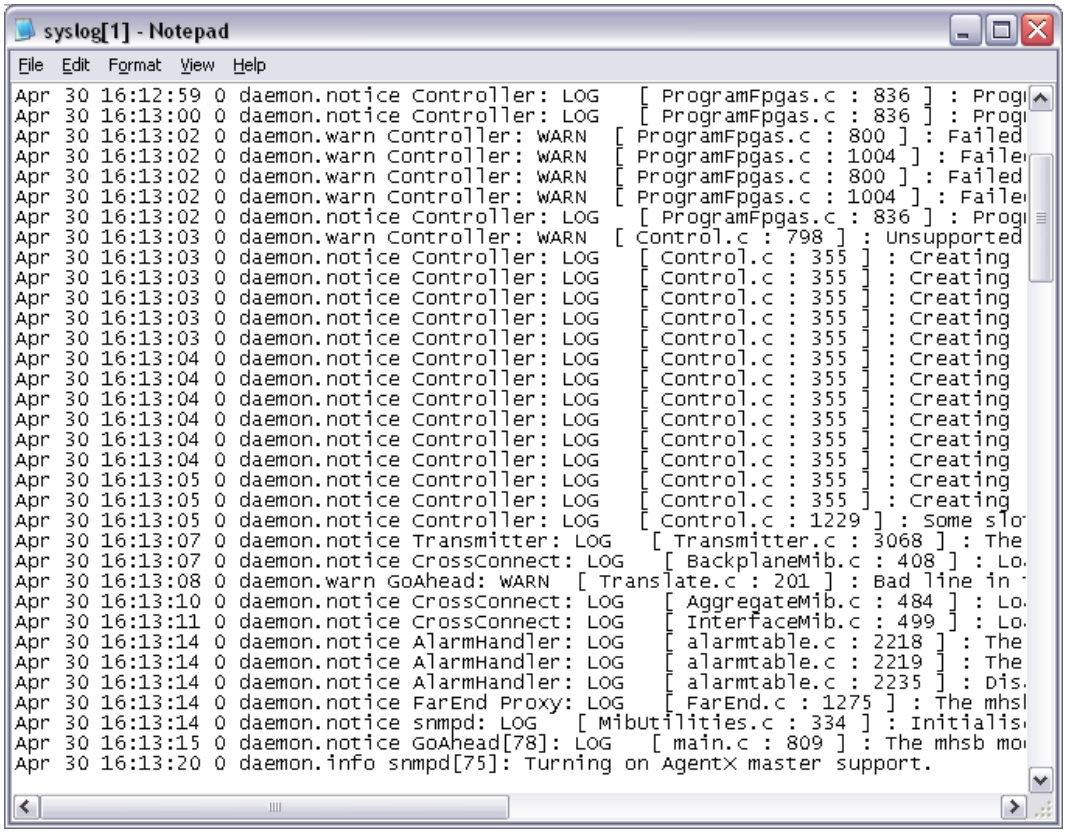
To view the Syslog:

1. Select Local > Performance > Logging > Syslog.

   This opens a new window:



2. The system log is quite hard to decipher in Internet Explorer. If you're using Internet Explorer, select View > Source, which opens the file in a more legible layout in Notepad. Save or print this file, as required.



3. If you want to save the system log, you can save it from within Notepad (or Internet Explorer). Select File > Save As. Navigate to where you want to save the file. Enter a meaningful filename and select 'Text File' from the Save As Type drop-down list. Click Save.

You can specify that this file is automatically saved to a computer (see ‘Setting up for Remote Logging’ on page 255).

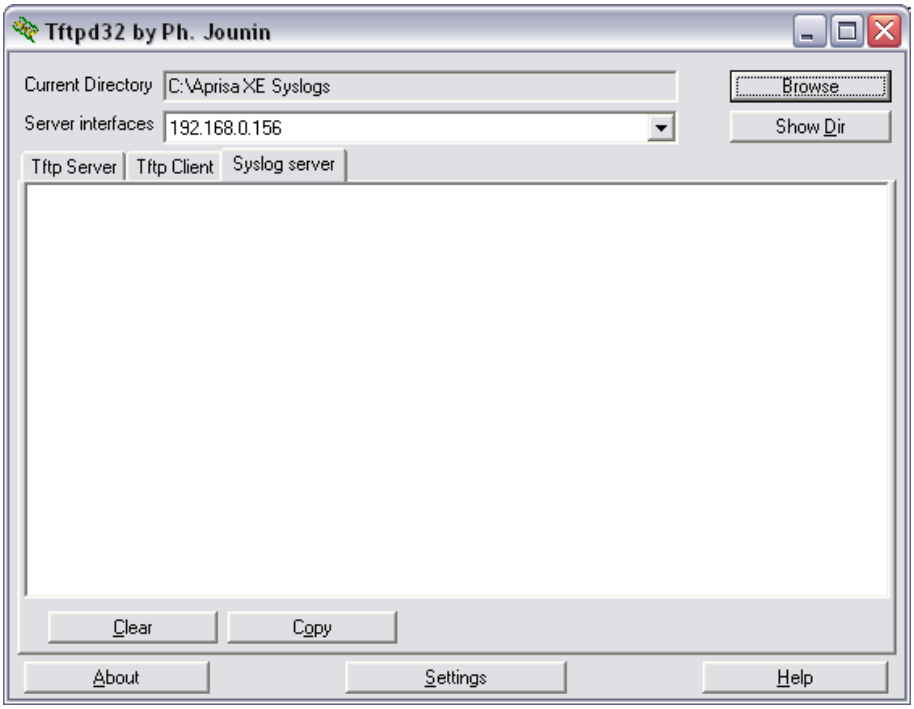
Setting up for Remote Logging

Note: When setting up to save the system log to a specific computer, be aware that the file is constantly updated and may get quite large quite quickly.

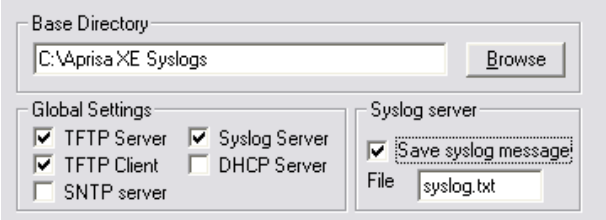
To set up a terminal for remote logging:

1. Copy the TFTP server application (tftpd32.exe, which is located in the TFTPD directory) from the terminal product CD into a suitable directory on the PC (for example, C:\Program Files\TFTP Server).
2. Create another directory where you want the system logs to be saved for example;

   C:\Aprisa XE Syslog
3. Double-click tftpd32.exe.

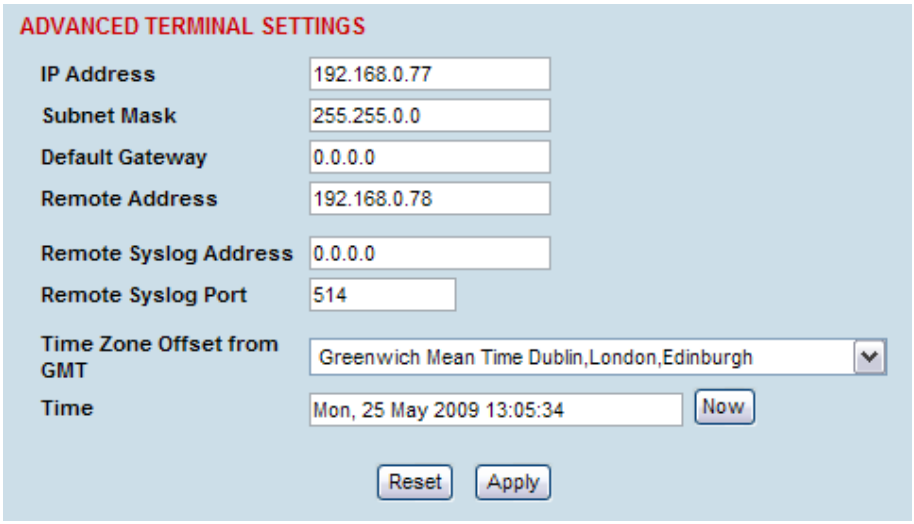


4. Click Settings and make sure that both 'Syslog Server' and 'Save syslog message' boxes are ticked.



5. Click Browse and select a directory where you want the Syslog file to be saved (created in step 2).
6. Click OK to close the Settings dialog box.

7. In SuperVisor, select Link or Link or Local or Remote > Terminal > Advanced.



8. In the Remote Syslog Address field, enter the IP address of the PC on which the Syslog server is running.

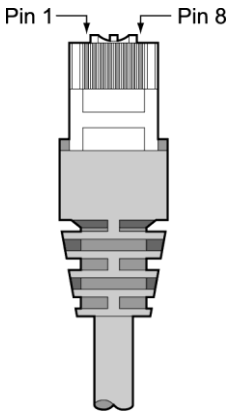
9. In the Remote Syslog Port field, enter 514.

10. Reboot the terminal (Link or Local or Remote > Maintenance > Reboot).

11. Open the directory where the system logs are being saved to. You should see a file called syslog.txt.

15. Interface Connections

RJ-45 Connector Pin Assignments

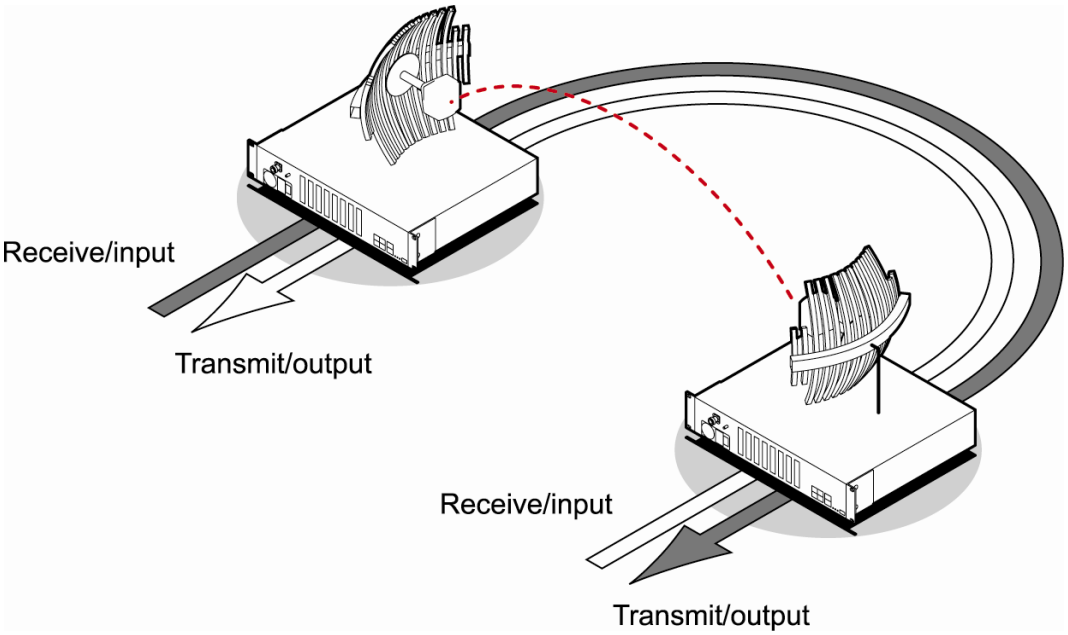


RJ-45 pin numbering

Interface Traffic Direction

All interface traffic directions and labels used in this manual refer to the direction relative to the terminal. Refer to the diagram below.

The traffic direction describes the transmit / receive paths and the direction of handshaking and clocking signals, depending on the interface.



QJET Interface Connections

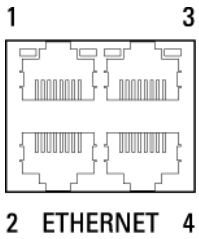
	Pin number	Pin function	Direction	TIA-568A wire colour
	1	Transmit	Output	Green/white
	2	Transmit	Output	Green
	3	Not used		Orange/white
	4	Receive	Input	Blue
	5	Receive	Input	Blue/white
	6	Not used		Orange
	7	Not used		Brown/white
	8	Not used		Brown

RJ-45 connector LED indicators		
LED	**Status**	**Explanation**
Green	On	Normal operation
Yellow	On	Loss of signal (LOS) or Alarm Indication Signal (AIS) or Loss Of Frame alignment (LOF) in Framed modes
Green	Flashing	Port in loopback

The standard QJET interface is 120 ohm balanced.

External Balun transformers can be used to provide a 75 ohm unbalanced interface.

Ethernet Interface Connections



Pin number	Pin function	Direction	TIA-568A wire colour
1	Transmit	Output	Green/white
2	Transmit	Output	Green
3	Receive	Input	Orange/white
4	Not used		Blue
5	Not used		Blue/white
6	Receive	Input	Orange
7	Not used		Brown/white
8	Not used		Brown

RJ-45 connector LED indicators		
LED	**Status**	**Explanation**
Green	On	Ethernet signal received
Green	Flashing	Indicates data traffic present on the interface

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

Q4EM Interface Connections

Pin number	Pin function	Direction	TIA-568A wire colour
1	M	Input	Green/white
2	M_1	Input	Green
3	Receive (Ra/R)	Input	Orange/white
4	Transmit (Tb/R1)	Output	Blue
5	Transmit (Ta/T1)	Output	Blue/white
6	Receive (Rb/T)	Input	Orange
7	E	Output	Brown/white
8	E_1	Output	Brown

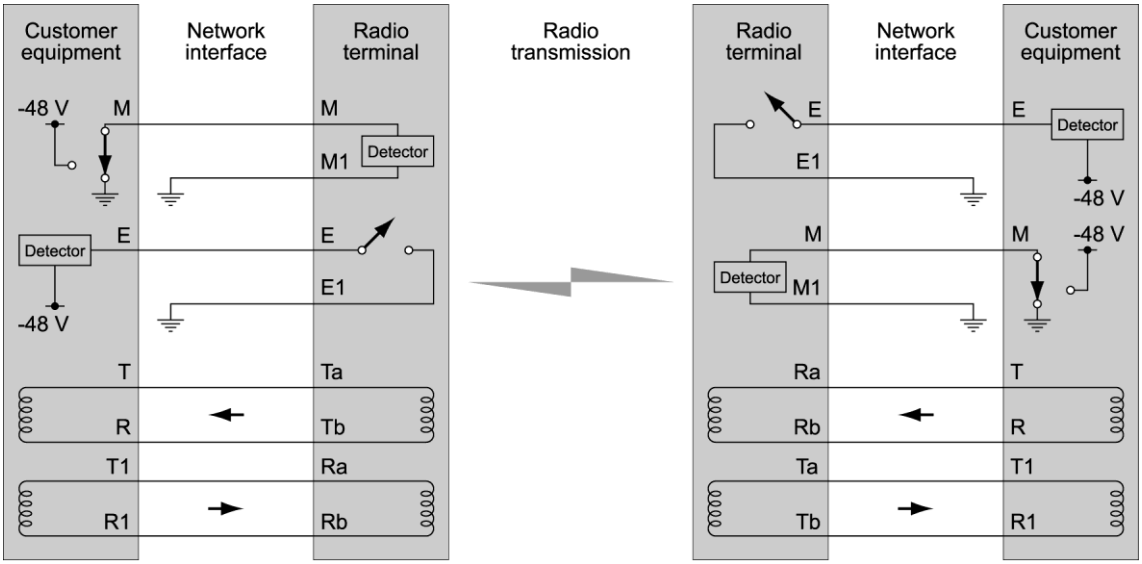
RJ-45 connector LED indicators		
LED	**Status**	**Explanation**
Green	Off	No external source applied to M wire (no M wire current flowing)
Green	On	External source applied to M wire (M wire current flowing)
Green	Flashing	The interface loopback is active
Yellow	Off	E wire relay contact open (no current in external device)
Yellow	On	E wire relay contact closed (current flowing in external device)

E&M Signalling Types

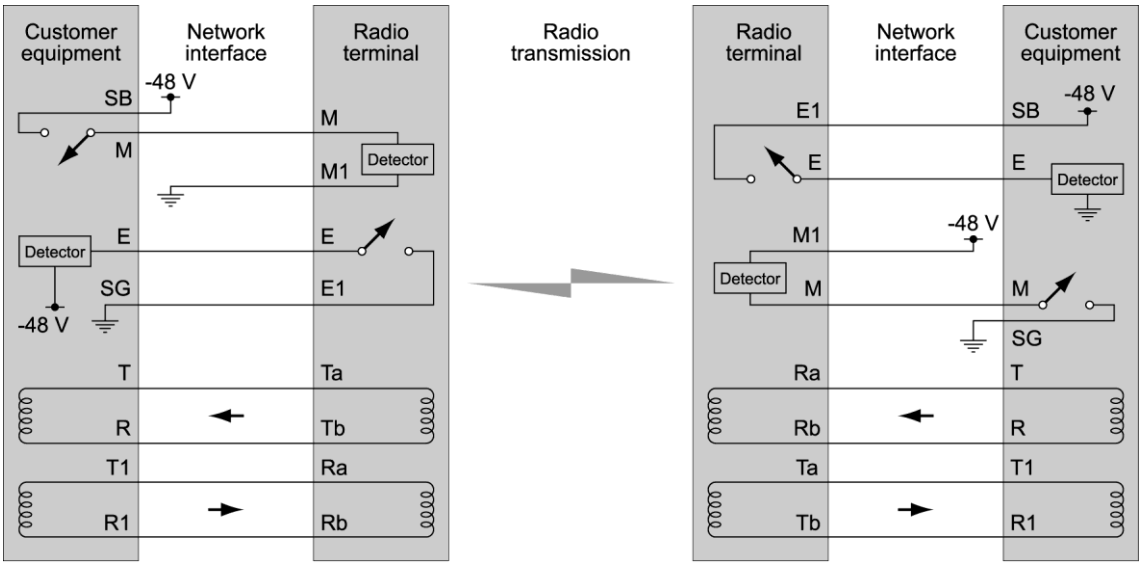
The Q4EM E&M signalling leads are optically isolated, bi-directional lines which can be externally referenced to meet any of the EIA-464 connection types I, II,IV or V (as shown below).

The M1 lead associated with the M wire detector can be externally referenced to earth or battery as required.

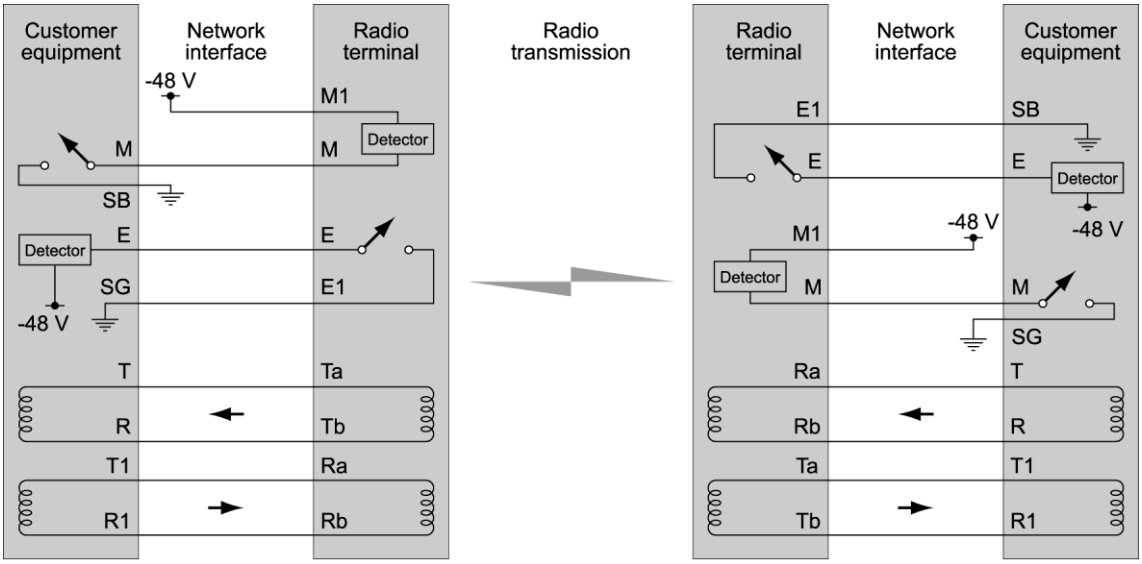
The E1 lead associated with the E wire output can be externally referenced to earth or battery as required.



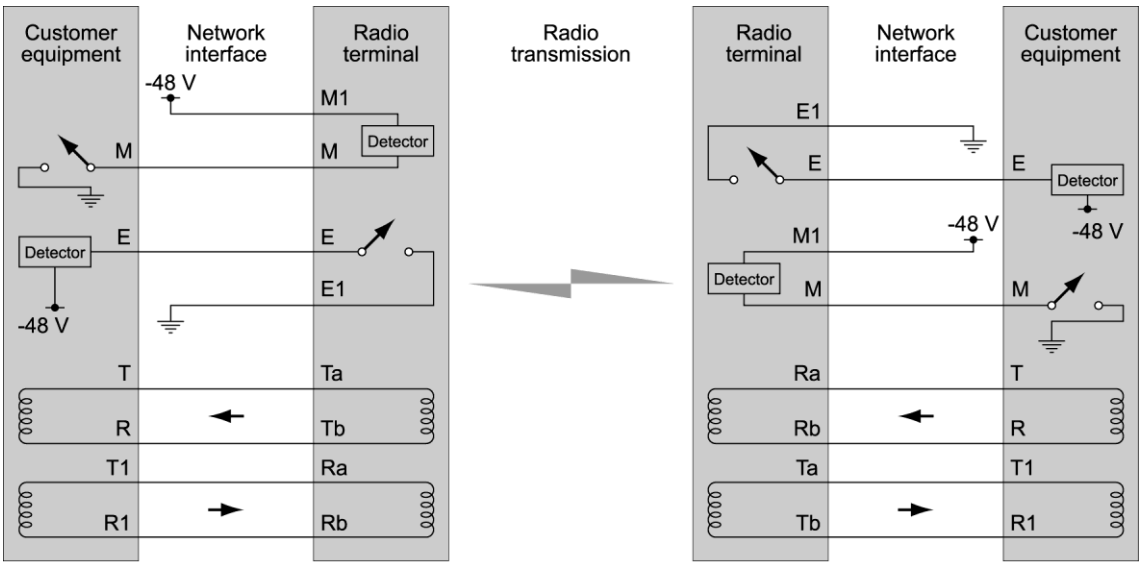
4-Wire E&M Type I



4-Wire E&M Type II

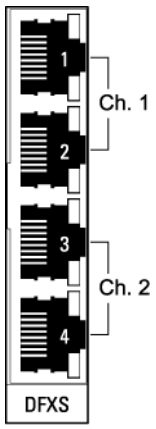


4-Wire E&M Type IV



4-Wire E&M Type V

DFXS Interface Connections



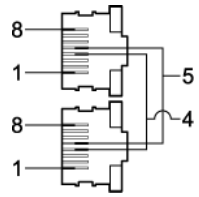
The subscriber interface connects the terminal to the customer's 2 wire telephone via a 2 wire line.

Each 2 wire channel has two access points: one connects to a customer; the other is a local test port.

CAUTION:

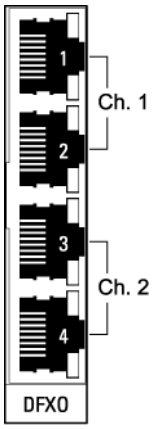
If there is a power failure at either terminal, any telephone connected at the DFXS will not operate.

Please ensure that a separate telephone that is not dependent on local power is available for use in an emergency.

RJ-45	Pin number	Pin function	Direction	TIA-568A wire colour
	1	Not used		Green/white
	2	Not used		Green
	3	Not used		Orange/white
	4	Ring	Bi-directional	Blue
	5	Tip	Bi-directional	Blue/white
	6	Not used		Orange
	7	Not used		Brown/white
	8	Not used		Brown

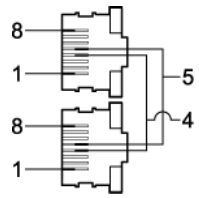
RJ-45 connector LED indicators		
LED	**Status**	**Explanation**
Green	Off	Interface operational but not in service
Green	On	Normal operation
Green	Flashing	Cadenced ringing on line
Yellow	Off	No interface alarm
Yellow	On	Interface alarm
Yellow	Flashing	The interface loopback is active
Both LEDs	Flashing	Loss of CAS signals

DFXO Interface Connections



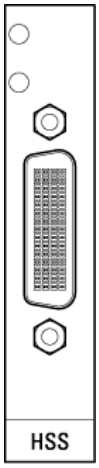
The DFXO interface connects the terminal to the telephone network via a 2 wire line.

Each DFXO channel has two access points: one connects to a customer; the other is a local test port.

RJ-45	Pin number	Pin function	Direction	TIA-568A wire colour
	1	Not used		Green/white
	2	Not used		Green
	3	Not used		Orange/white
	4	Ring	Bi-directional	Blue
	5	Tip	Bi-directional	Blue/white
	6	Not used		Orange
	7	Not used		Brown/white
	8	Not used		Brown

RJ-45 connector LED indicators		
LED	**Status**	**Explanation**
Green	Off	Interface operational but not in service
Green	On	Normal operation
Green	Flashing	Cadenced ringing on line
Yellow	Off	No interface alarm
Yellow	On	Interface alarm
Yellow	Flashing	The interface loopback is active
Both LEDs	Flashing	Loss of CAS signals

HSS Interface Connections



The connector on the high-speed synchronous serial interface is a high density LFH-60 (as used on standard Cisco WAN port serial interface cables and equivalents).

The interface specification (X.21 / V.35 etc) is automatically changed by simply changing the type of interface cable connected to the HSS.

LED indicators		
LED	**Status**	**Explanation**
Top green LED	On	Normal operation
Top green LED	Flashing	Loopback in place
Lower green LED	On	Normal operation

Synchronous cable assemblies

RS-449 Serial Cable Assembly for DCE (Part number: Cab Sync 449FC)

Pin number	Pin function	Direction
1	Shield Ground	-
4 22	SD+ SD-	Input Input
5 23	ST+ ST-	Output Output
6 24	RD+ RD-	Output Output
7 25	RS+ RS-	Input Input
8 26	RT+ RT-	Output Output
9 27	CS+ CS-	Output Output
10 37	LL SC	Input _
11 29	DM+ DM-	Output Output
12 30	TR+ TR-	Input Input
13 31	RR+ RR-	Output Output
17 35	TT+ TT-	Input Input
19 20	SG RC	- -

RS-449 Serial Cable Assembly for DTE (Part number: Cab Sync 449MT)

Pin number	Pin function	Direction
1	Shield Ground	_
4 22	SD+ SD-	Output Output
5 23	ST+ ST-	Input Input
6 24	RD+ RD-	Input Input
7 25	RS+ RS-	Output Output
8 26	RT+ RT-	Input Input
9 27	CS+ CS-	Input Input
10 37	LL SC	Output _
11 29	DM+ DM-	Input Input
12 30	TR+ TR-	Output Output
13 31	RR+ RR-	Input Input
17 35	TT+ TT-	Output Output
19 20	SG RC	- -

V.35 Serial Cable Assembly for DCE (Part number: Cab Sync V35FC)

Pin number	Pin function	Direction
A	Frame Ground	
B	Circuit Ground	
C	RTS	Input
D	CTS	Output
E	DSR	Output
F	RLSD	Output
H	DTR	Input
K	LT	Input
P S	SD+ SD-	Input Input
R T	RD+ RD-	Output Output
U W	SCTE+ SCTE-	Input Input
V X	SCR+ SCR-	Output Output
Y AA	SCT+ SCT-	Output Output

V.35 Serial Cable Assembly for DTE (Part number: Cab Sync V35MT)

Pin number	Pin function	Direction
A	Frame Ground	
B	Circuit Ground	
C	RTS	Output
D	CTS	Input
E	DSR	Input
F	RLSD	Input
H	DTR	Output
K	LT	Output
P S	SD+ SD-	Output Output
R T	RD+ RD-	Input Input
U W	SCTE+ SCTE-	Output Output
V X	SCR+ SCR-	Input Input
Y AA	SCT+ SCT-	Input Input

X.21 Serial Cable Assembly for DCE (Part number: Cab Sync X21FC)

Pin number	Pin function	Direction
1	Shield Ground	-
2 9	Transmit+ Transmit-	Input Input
3 10	Control+ Control-	Input Input
4 11	Receive+ Receive-	Output Output
5 12	Indication+ Indication-	Output Output
6 13	Timing+ Timing-	Output Output
8	Circuit Ground	

X.21 Serial Cable Assembly for DTE (Part number: Cab Sync X21MT)

Pin number	Pin function	Direction
1	Shield Ground	-
2 9	Transmit+ Transmit-	Output Output
3 10	Control+ Control-	Output Output
4 11	Receive+ Receive-	Input Input
5 12	Indication+ Indication-	Input Input
6 13	Timing+ Timing-	Input Input
8	Circuit Ground	

RS-530 Serial Cable Assembly for DCE (Part number: Cab Sync 530FC)

Pin number	Pin function	Direction
2 14	BA(A), TXD+ BA(B), TXD-	Input Input
3 16	BB(A), RXD+ BB(B), RXD-	Output Output
4 19	CA(A), RTS+ CA(B), RTS-	Input Input
5 13	CB(A), CTS+ CB(B), CTS-	Output Output
6 22	CC(A), DSR+ CC(B), DSR-	Output Output
1 -	Shield -	
8 10	CF(A), DCD+ CF(B), DCD-	Output Output
15 12	DB(A), TXC+ DB(B), TXC-	Output Output
17 9	DD(A), RXC+ DD(B), RXC-	Output Output
18 7	LL Circuit Ground	Input -
20 23	CD(A), DTR+ CD(B), DTR-	Input Input
24 11	DA(A), TXCE+ DA(B), TXCE-	Input Input
25	TM, not used	Output

RS-530 Serial Cable Assembly for DTE (Part number: Cab Sync 530MT)

Pin number	Pin function	Direction
2 14	BA(A), TXD+ BA(B), TXD-	Output Output
3 16	BB(A), RXD+ BB(B), RXD-	Input Input
4 19	CA(A), RTS+ CA(B), RTS-	Output Output
5 13	CB(A), CTS+ CB(B), CTS-	Input Input
6 22	CC(A), DSR+ CC(B), DSR-	Input Input
1 -	Shield -	
8 10	CF(A), DCD+ CF(B), DCD-	Input Input
15 12	DB(A), TXC+ DB(B), TXC-	Input Input
17 9	DD(A), RXC+ DD(B), RXC-	Input Input
18 7	LL Circuit Ground	Output -
20 23	CD(A), DTR+ CD(B), DTR-	Output Output
24 11	DA(A), TXCE+ DA(B), TXCE-	Output Output
25	TM, not used	Output

Cable WAN Connectors

Cisco LFH-60 cable name	WAN connector	Connector gender	Label on WAN end
449FC	DB-37	female	'to DTE'
449MT	DB-37	male	'to DCE'
V35FC	M34	female	'to DTE'
V35MT	M34	male	'to DCE'
X21FC	DB-15	female	'to DTE'
X21MT	DB-15	male	'to DCE'
530FC	DB-25	female	'to DTE'
530MT	DB-25	male	'to DCE'

QV24 Interface connections

The QV24 is always configured as a DCE:

RJ45 Pin number	Pin function	Direction	TIA-568A wire colour
1	RTS	Input	Green / white
2	DTR	Input	Green
3	TXD	Input	Orange / white
4	Ground		Blue
5	Ground		Blue / white
6	RXD	Output	Orange
7	DSR	Output	Brown / white
8	CTS	Output	Brown

RJ-45 connector LED indicators		
LED	Status	Explanation
Green	On / flashing	Transmit data
Yellow	On / flashing	Receive data

QV24S Interface connections

The QV24S is always configured as a DCE:

RJ45 Pin number	Pin function	Direction	TIA-568A wire colour
1	RTS	Input	Green / white
2	XTXC	Input	Green
3	TXD	Input	Orange / white
4	Ground		Blue
5	Ground		Blue / white
6	RXD	Output	Orange
7	RXC	Output	Brown / white
8	CTS	Output	Brown

RJ-45 connector LED indicators		
LED	Status	Explanation
Green	On / flashing	Transmit data
Yellow	On / flashing	Receive data

16. Alarm Types and Sources

Alarm Types

Transmitter Alarms

Transmitter Alarms for all Frequency Bands

Type	Explanation
tx11VFail	The transmitter 11 VDC power supply has failed
tx28VFail	The transmitter 28 VDC power supply has failed
tx5VFail	The transmitter 5 VDC power supply has failed
txAmplifierBalance	One side of the transmitter amplifier has failed
txEEFail	The transmitter on-board memory has failed
txMibFail	The transmitter MIB is corrupt in EEPROM
txReturnLoss	The transmitter return loss is high
txSynthLD	The transmitter synthesizer frequency is not set
txTSensorFail	The transmitter temperature sensor has failed

Transmitter Alarms for 300, 400, 600, 700, 800, 900, 1400 MHz Frequency Bands

txADCChZeroLo	The transmitter AGC voltage is low
txADCChZeroHi	The transmitter AGC voltage is high
txADCChOneLo	The transmitter Forward Power Monitor reading is low
txADCChOneHi	The transmitter Forward Power Monitor reading is high
txADCChTwoLo	The transmitter Reverse Power Monitor reading is low
txADCChTwoHi	The transmitter Reverse Power Monitor reading is high
txADCChThreeHi	The transmitter temperature is greater than 75°C and the transmitter has shut down
txADCChFourLo	The transmitter synthesizer tuning voltage is low
txADCChFourHi	The transmitter synthesizer tuning voltage is high
txADCChFiveLo	The transmitter 28 VDC power supply voltage is low
txADCChFiveHi	The transmitter 28 VDC power supply voltage is high
txADCChSixLo	The transmitter 11 VDC power supply voltage is low
txADCChSixHi	The transmitter 11 VDC power supply voltage is high
txADCChSevenLo	The transmitter digital 5 VDC power supply voltage is low
txADCChSevenHi	The transmitter digital 5 VDC power supply voltage is high
txADCChEightLo	The transmitter reference 7 VDC power supply voltage is low
txADCChEightHi	The transmitter reference 7 VDC power supply voltage is high
txADCChNineLo	The transmitter VCO voltage is low
txADCChNineHi	The transmitter VCO voltage is high
txADCChElevenHi	The transmitter temperature is greater than 70°C.

Transmitter Alarms for 2000, 2500 MHz Frequency Bands

txADCChZeroLo	The transmitter AGC voltage is low
txADCChZeroHi	The transmitter AGC voltage is high
txADCChOneLo	The transmitter Forward Power Monitor reading is low
txADCChOneHi	The transmitter Forward Power Monitor reading is high
txADCChTwoLo	The transmitter Reverse Power Monitor reading is low
txADCChTwoHi	The transmitter Reverse Power Monitor reading is high
txADCChThreeHi	The transmitter temperature is greater than 75°C and the transmitter has shut down
txADCChFourLo	The transmitter synthesizer tuning voltage is low
txADCChFourHi	The transmitter synthesizer tuning voltage is high
txADCChFiveLo	The transmitter 28 VDC power supply voltage is low
txADCChFiveHi	The transmitter 28 VDC power supply voltage is high
txADCChSixLo	The transmitter 9 VDC power supply voltage is low
txADCChSixHi	The transmitter 9 VDC power supply voltage is high
txADCChSevenLo	The transmitter digital 5 VDC power supply voltage is low
txADCChSevenHi	The transmitter digital 5 VDC power supply voltage is high
txADCChEightLo	The transmitter reference -5 VDC power supply voltage is low
txADCChEightHi	The transmitter reference -5 VDC power supply voltage is high
txADCChNineLo	The transmitter VCO voltage is low
txADCChNineHi	The transmitter VCO voltage is high
txADCChElevenHi	The transmitter temperature is greater than 70°C.

Receiver Alarms

Receiver Alarms for all Frequency Bands

Type	Explanation
rx12VFail	The receiver 12 VDC power supply has failed
rxEEFail	The on-board memory has failed
rxMibFail	The receiver MIB is corrupt in EEPROM
rxOff	The receiver is off
rxRSSIHi	The receiver maximum input level has been exceeded
rxRSSILo	The RSSI is below the alarm threshold setting (see page 80)
rxSynthLD	The synthesizer frequency is not set

Receiver Alarms for 300, 400, 600, 700, 800, 900 MHz Frequency Bands

rxADCChZeroLo	The receiver 3.3 VDC power supply voltage is low
rxADCChZeroHi	The receiver 3.3 VDC power supply voltage is high
rxADCChOneLo	The receiver synthesizer tuning voltage is low
rxADCChOneHi	The receiver synthesizer tuning voltage is high
rxADCChTwoLo	The receiver +12 VDC power supply is low
rxADCChTwoHi	The receiver +12 VDC power supply is high
rxADCChThreeLo	The receiver +5 VDC power supply is low
rxADCChThreeHi	The receiver +5 VDC power supply is high
rxADCChFourLo	The receiver +12 VDC power supply is low (same alarm as TwoLo)
rxADCChFourHi	The receiver +12 VDC power supply is high (same alarm as TwoHi)
rxADCChFiveLo	The receiver VCO voltage is low
rxADCChFiveHi	The receiver VCO voltage is high
rxADCChSevenLo	The receiver RSSI is lower than the normal operating lower limit
rxADCChSevenHi	The receiver RSSI is higher than the normal operating upper limit
rxADCChEightLo	The receiver temperature is greater than 70°C (below spec)
rxADCChEightHi	The receiver temperature is less than -10°C (below spec)

Receiver Alarms for 1400 MHz Frequency Band

rxADCChZeroLo	The receiver 3.3 VDC power supply voltage is low
rxADCChZeroHi	The receiver 3.3 VDC power supply voltage is high
rxADCChOneLo	The receiver synthesizer tuning voltage is low
rxADCChOneHi	The receiver synthesizer tuning voltage is high
rxADCChTwoLo	The receiver -1.5 VDC power supply is low
rxADCChTwoHi	The receiver -1.5 VDC power supply is high
rxADCChThreeLo	The receiver +5 VDC power supply is low
rxADCChThreeHi	The receiver +5 VDC power supply is high
rxADCChFourLo	The receiver +9 VDC power supply is low
rxADCChFourHi	The receiver +9 VDC power supply is high
rxADCChFiveLo	The receiver VCO voltage is low
rxADCChFiveHi	The receiver VCO voltage is high
rxADCChSevenLo	The receiver RSSI is lower than the normal operating lower limit
rxADCChSevenHi	The receiver RSSI is higher than the normal operating upper limit
rxADCChEightLo	The receiver temperature is greater than 70°C (below spec)
rxADCChEightHi	The receiver temperature is less than -10°C (below spec)

Receiver Alarms for 2000, 2500 MHz Frequency Bands

rxADCChZeroLo	The receiver 3.3 VDC power supply voltage is low
rxADCChZeroHi	The receiver 3.3 VDC power supply voltage is high
rxADCChOneLo	The receiver synthesizer tuning voltage is low
rxADCChOneHi	The receiver synthesizer tuning voltage is high
rxADCChTwoLo	The receiver +12 VDC power supply is low
rxADCChTwoHi	The receiver +12 VDC power supply is high
rxADCChThreeLo	The receiver +5 VDC power supply is low
rxADCChThreeHi	The receiver +5 VDC power supply is high
rxADCChFourLo	The receiver +9 VDC power supply is low
rxADCChFourHi	The receiver +9 VDC power supply is high
rxADCChFiveLo	The receiver VCO voltage is low
rxADCChFiveHi	The receiver VCO voltage is high
rxADCChSevenLo	The receiver RSSI is lower than the normal operating lower limit
rxADCChSevenHi	The receiver RSSI is higher than the normal operating upper limit
rxADCChEightLo	The receiver temperature is greater than 70°C (below spec)
rxADCChEightHi	The receiver temperature is less than -10°C (below spec)

MUX Alarms

Type	Explanation
muxInit	A MUX card failed to program
muxMibEEFail	The MIB EEROM is corrupt
muxCharEEFail	The character data is corrupt

Modem Alarms

Type	Explanation
mdLOS	The modem has loss of synchronization with the far end
mdDemodAlignmentLost	The modem is unable to synchronize to the payload framing
mdTdmAlignmentLost	The modem is unable to synchronize to the system bus timing
mdRefAFail	The modem reference clock A has failed
mdRefBFail	The modem reference clock B has failed
mdClkSyncFail	The modem is unable to synchronize to the system clock
mdEEFail	The modem EEPROM is corrupt
mdUCEPresent	The modem has uncorrectable errors

Motherboard Alarms

Type	Explanation
mbFan1Fail	Fan 1 failure
mbFan2Fail	Fan 2 failure
mbCardMismatch	The expected interface card is different to the card that is fitted
mbHwHsc	A MUX card has an unsupported HSC number

QJET Alarms

Type	Explanation
e1AIS	The E1 interface RX input has received an Alarm Indication Signal from the downstream equipment.
e1RAI	The E1 interface RX input has received a Remote Alarm Indication alarm (RAI) from the downstream equipment. A remote alarm indicator signal is sent from the downstream equipment when it has an active LOS or LOF alarm.
e1LOS	The E1 interface Loss Of Signal alarm (LOS)
e1CRC4	The E1 interface Cyclic Redundancy Check 4 alarm indicates a loss of or corrupted CRC data.
e1LOF	The E1 interface Loss Of Frame alignment (LOF)
e1RMAI	The E1 interface RX input has received an RMAI from the downstream equipment. A TS16 remote alarm indicator signal is sent from the downstream equipment when it has an active TS16 LOS or LOF alarm.
e1TS16AIS	The E1 interface RX input has received a TS16 Alarm Indication Signal from the downstream equipment.
e1TS16LOS	The E1 timeslot 16 Loss Of Signal alarm
t1AIS	The T1 interface RX input has received an Alarm Indication Signal from the downstream equipment (AIS Received alarm)
t1RAI	The T1 interface RX input has received a Remote Alarm Indication alarm (RAI) from the downstream equipment.
t1LOS	The T1 interface Loss Of Signal alarm (LOS)
t1LOF	The T1 interface Loss Of Frame alignment (LOF)

DFXO Alarms

Type	Explanation
fxoCodecOvld	The DFXO detected a codec receive signal overload
fxoBillToneOvld	The DFXO detected a billing tone input signal overload (greater than 0.8 Vrms into 200 Ω)
fxoUnplug	The DFXO detected that the exchange line has been unplugged from interface
fxoCurrentOvld	The DFXO Loop current overload detected (greater than 100 mA)

DFXS Alarms

Type	Explanation
fxsCalibError	The phone was off-hook during the DFXS initialization phase (during power up)
fxsDCDCError	The DFXS DC-DC converter has a low battery voltage error
fxsCasLock	The DFXS has a loss of CAS lock

HSS Alarms

Type	Explanation
hssLoss	The HSS has a loss of control pattern
hssRxFifoFull	The HSS RX FIFO has an overrun
hssRxFifoEmpty	The HSS RX FIFO has an underrun
hssTxFifoFull	The HSS TX FIFO has an overrun
hssTxFifoEmpty	The HSS TX FIFO has an underrun
hssRxClockInvalid	The HSS RX clock is invalid
hssTxClockInvalid	The HSS TX clock is invalid

QV24 Alarms

Type	Explanation
v24CtrlLineLoss	The V.24 control lines are not in sync.

External Alarm Inputs

Type	Explanation
externalAlarm1	There has been an alarm on external alarm input 1.
externalAlarm2	There has been an alarm on external alarm input 2.

Remote Terminal Alarms

Type	Explanation
remoteMajorAlarm	There has been a major alarm on the remote terminal.
remoteMinorAlarm	There has been a minor alarm on the remote terminal.

Cross Connect Alarms

Type	Explanation
ccNoBandwidth	There is insufficient bandwidth for the current cross connection configuration.

MHSB Alarms

Type	Explanation
mhsbSwitchToStandby	The terminal has switched from active to standby.

HSD Alarms

Type	Explanation
Mode Switch Software Override	This alarm provides a warning if the SuperVisor 'Active Radio' HSD Control has overwritten the PSC Mode Switch.
Companion Tx Fail	This alarm occurs on Radio A if the Radio B transmitter (HSD Companion) has failed. This alarm could be caused by a missing RF cable between Radio A and Radio B.
hsdCompanionLost	This alarm occurs if there is no traffic from the HSD Companion radio. This alarm could be caused by a missing traffic cable between Radio A PSC card and Radio B PIC card.
pscMuxAlignmentError	This alarm occurs if the TDM mux loses alignment to the TDM bus. This alarm could be caused by a Radio A PSC hardware failure.
pscDemuxAlignmentLost	This alarm occurs if there is a change in state of the PSC Demux alignment. This alarm could be caused by a HSD system receiver signal loss (both Radio A and Radio B).
pscTDMAlignmentLost	This alarm occurs if there is a change in state of the PSC TDM alignment. This alarm could be caused by a HSD system receiver signal loss (both Radio A and Radio B) or a Radio A PSC hardware failure.
hsdParamMismatch	This alarm occurs if there is a parameter setting mismatch between Radio A and Radio B. The Parameter Mismatch alarms only occur if the HSD Control 'Parameter Compare Checking' option is set to 'On'.
hsdPMTxPower	This alarm occurs if there is a parameter mismatch between Radio A and Radio B transmitter power setting.
hsdPMTermRfChWidth	This alarm occurs if there is a parameter mismatch between Radio A and Radio B channel size setting.
hsdPMTxFreq	This alarm occurs if there is a parameter mismatch between Radio A and Radio B transmitter frequency setting.
hsdPMRxFreq	This alarm occurs if there is a parameter mismatch between Radio A and Radio B receiver frequency setting.
hsdPMTermModState	This alarm occurs if there is a parameter mismatch between Radio A and Radio B modulation setting.
hsdPMModemIntlvEna	This alarm occurs if there is a parameter mismatch between Radio A and Radio B modem interleaver setting.

Software Alarms

Type	Explanation
Upload Fail	An Upload Fail alarm occurs if the TFTP Upgrade process fails. This can indicate that the upgrade process cannot find the TFTP server or cannot find the software version number entered.
defaultImageTableUsed	A default image table alarm indicates that the image table has been rebuilt from defaults. This can indicate that an incorrect build of software is running on the terminal.

17. Country Specific Settings

The following table shows the country-specific settings for the DFXO / DFXS interface cards. If the country you want is not listed, contact the local telephone company for assistance.

Country	DFXO / DFXS Termination / balance impedance	DFXO loop current limiter	DFXO on-hook speed	DFXO ringing impedance	DFXO ringing detection threshold
Argentina	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
Australia	TN12 220Ω + (820Ω ‖ 120nF)	On	26 ms	> 1 MΩ	16 Vrms
Austria	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Bahrain	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Belgium	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Brazil	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
Bulgaria	220Ω + (820Ω ‖ 120nF)	On	3 ms	> 1 MΩ	16 Vrms
Canada	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
Chile	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
China	600Ω and China 200Ω + (680Ω ‖ 100nF)	On	< 500 µs	> 1 MΩ	16 Vrms
Colombia	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
Croatia	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Cyprus	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Czech Republic	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Denmark	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Ecuador	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
Egypt	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
El Salvador	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
Finland	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
France	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Germany	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Greece	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Guam	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
Hong Kong	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
Hungary	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Iceland	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
India	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
Indonesia	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
Ireland	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Israel	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Italy	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Japan	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
Jordan	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
Kazakhstan	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
Kuwait	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms

Latvia	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Lebanon	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Luxembourg	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Macao	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
Malaysia	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
Malta	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Mexico	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
Morocco	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Netherlands	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
New Zealand	BT3 (370Ω + (620Ω ‖ 310nF))	On	< 500 µs	> 1 MΩ	16 Vrms
Nigeria	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Norway	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Oman	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
Pakistan	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
Peru	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
Philippines	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
Poland	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Portugal	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Romania	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Russia	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
Saudi Arabia	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
Singapore	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
Slovakia	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Slovenia	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
South Africa	TBR21 270Ω + (750Ω ‖ 150nF)	On	< 500 µs	> 12 kΩ	16 Vrms
South Korea	600Ω	On	< 500 µs	> 12 kΩ	16 Vrms
Spain	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Sweden	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Switzerland	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Taiwan	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
Thailand	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
UAE	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
UK	BT Network 320Ω + (1050Ω ‖ 230nF) and TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
USA	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
Yemen	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms

18. Specifications

RF Specifications

ETSI

Frequency Bands ETSI

Frequency Bands ETSI

Frequency Bands ETSI	Frequency Band	Frequency Tuning Range	Synthesizer Step Size
	300 MHz	330 - 400 MHz	6.25 kHz
	400 MHz	394 - 460 MHz	5.0 kHz
	400 MHz	400 - 470 MHz	6.25 kHz
	600 MHz	620 - 715 MHz	12.5 kHz
	800 MHz	805 - 890 MHz	12.5 kHz
	900 MHz	850 - 960 MHz	12.5 kHz
	1400 MHz	1350 - 1550 MHz	12.5 kHz
	1800 MHz	1700 - 2100 MHz	62.5 kHz
	2000 MHz	1900 - 2300 MHz	62.5 kHz
	2500 MHz	2300 - 2700 MHz	62.5 kHz

Modulation	16 / 32 / 64 / 128 QAM and QPSK (software configurable)
Frequency stability (short term)	< ±1 ppm
Frequency stability (long term)	< ±2 ppm
Antenna connector	N-type female 50 Ω

Note 1 Frequency Ranges	Country specific frequency ranges within the above tuning ranges can be accommodated
Note 2 Modulation	128 QAM is unreleased: Please contact 4RF for availability.
Note 3 Frequency stability	Short term frequency stability is defined as changes in frequency due to environmental effects and power supply variations
	Long term frequency stability is defined as changes in frequency due to aging of crystal oscillators approx over 5 years

Product Range ETSI

The Aprisa XE terminal provides the following ETSI frequency bands / channel sizes:

Link Capacity ETSI

Channel size		QPSK	16 QAM	32 QAM	64 QAM	128 QAM
25 kHz	Gross		72 kbit/s	96 kbit/s	112 kbit/s	136 kbit/s
	E1		1 timeslot	1 timeslot	1 timeslot	2 timeslots
	Wayside		8 kbit/s	32 kbit/s	48 kbit/s	8 kbit/s
50 kHz	Gross	80 kbit/s	168 kbit/s	208 kbit/s	256 kbit/s	296 kbit/s
	E1	1 timeslot	2 timeslots	3 timeslots	4 timeslots	4 timeslots
	Wayside	16 kbit/s	40 kbit/s	16 kbit/s	0 kbit/s	40 kbit/s
75 kHz	Gross	128 kbit/s	264 kbit/s	312 kbit/s	400 kbit/s	440 kbit/s
	E1	2 timeslots	4 timeslots	4 timeslots	6 timeslots	6 timeslots
	Wayside	0 kbit/s	8 kbit/s	56 kbit/s	16 kbit/s	56 kbit/s
125 kHz	Gross	208 kbit/s	424 kbit/s	536 kbit/s	640 kbit/s	744 kbit/s
	E1	3 timeslots	6 timeslots	8 timeslots	10 timeslots	11 timeslots
	Wayside	16 kbit/s	40 kbit/s	24 kbit/s	0 kbit/s	40 kbit/s
150 kHz	Gross	264 kbit/s	536 kbit/s	672 kbit/s	808 kbit/s	944 kbit/s
	E1	4 timeslots	8 timeslots	10 timeslots	12 timeslots	14 timeslots
	Wayside	8 kbit/s	24 kbit/s	32 kbit/s	40 kbit/s	48 kbit/s
200 kHz	Gross	336 kbit/s	680 kbit/s	840 kbit/s	1024 kbit/s	1168 kbit/s
	E1	5 timeslots	10 timeslots	13 timeslots	16 timeslots	18 timeslots
	Wayside	16 kbit/s	40 kbit/s	8 kbit/s	0 kbit/s	16 kbit/s
250 kHz	Gross	408 kbit/s	824 kbit/s	1032 kbit/s	1240 kbit/s	1448 kbit/s
	E1	6 timeslots	12 timeslots	16 timeslots	19 timeslots	22 timeslots
	Wayside	24 kbit/s	56 kbit/s	8 kbit/s	24 kbit/s	40 kbit/s
500 kHz	Gross	792 kbit/s	1592 kbit/s	1992 kbit/s	2392 kbit/s	2792 kbit/s
	E1	12 timeslots	24 timeslots	31 timeslots	1 E1	1 E1
	Wayside	24 kbit/s	56 kbit/s	8 kbit/s	304 kbit/s	704 kbit/s
1.0 MHz	Gross	1624 kbit/s	3256 kbit/s	4072 kbit/s	4888 kbit/s	5704 kbit/s
	E1	25 timeslots	1 E1	1 E1	2 E1s	2 E1s
	Wayside	24 kbit/s	1168 kbit/s	1984 kbit/s	712 kbit/s	1528 kbit/s
1.35 MHz	Gross	2200 kbit/s	4408 kbit/s	5512 kbit/s	6616 kbit/s	7720 kbit/s
	E1	1 E1	2 E1s	2 E1s	3 E1s	3 E1s
	Wayside	112 kbit/s	232 kbit/s	1336 kbit/s	352 kbit/s	1456 kbit/s
1.75 MHz	Gross	2872 kbit/s	5752 kbit/s	7192 kbit/s	8632 kbit/s	10072 kbit/s
	E1	1 E1	2 E1s	3 E1s	4 E1s	4 E1s
	Wayside	784 kbit/s	1576 kbit/s	928 kbit/s	280 kbit/s	1720 kbit/s
3.5 MHz	Gross	5720 kbit/s	11448 kbit/s	14312 kbit/s	17176 kbit/s	20040 kbit/s
	E1	2 E1s	5 E1s	6 E1s	8 E1s	9 E1s
	Wayside	1544 kbit/s	1008 kbit/s	1784 kbit/s	472 kbit/s	1248 kbit/s
7.0 MHz	Gross	11832 kbit/s	23672 kbit/s	29592 kbit/s	35512 kbit/s	41432 kbit/s
	E1	5 E1s	11 E1s	14 E1s	17 E1s	19 E1s
	Wayside	1392 kbit/s	704 kbit/s	360 kbit/s	16 kbit/s	1760 kbit/s
14 MHz	Gross	23992 kbit/s	47992 kbit/s	59992 kbit/s	65464 kbit/s	65400 kbit/s
	E1	11 E1s	22 E1s	28 E1s	28 E1s	28 E1s
	Wayside	1024 kbit/s	2056 kbit/s	1528 kbit/s	7000 kbit/s	6936 kbit/s

Notes

The capacities specified are for Unframed E1 and so require 2088 kbit/s to transport via the radio.

The management ethernet capacity must be subtracted from the gross capacity (default 64 kbit/s).

See Product Range table for Channel Size / Frequency Band cross reference

Receiver Sensitivity ETSI

Channel size	QPSK	16 QAM	32 QAM	64 QAM	128 QAM
25 kHz	NA	-105 dBm	-102 dBm	-99 dBm	-96 dBm
50 kHz	-109 dBm	-103 dBm	-100 dBm	-97 dBm	-94 dBm
75 kHz	-107 dBm	-101 dBm	-98 dBm	-95 dBm	-92 dBm
125 kHz	-105 dBm	-99 dBm	-96 dBm	-93 dBm	-90 dBm
150 kHz	-104 dBm	-98 dBm	-95 dBm	-92 dBm	-89 dBm
200 kHz	-102 dBm	-96 dBm	-93 dBm	-90 dBm	-87 dBm
250 kHz	-101 dBm	-95 dBm	-92 dBm	-89 dBm	-86 dBm
500 kHz	-99 dBm	-93 dBm	-90 dBm	-87 dBm	-84 dBm
1.0 MHz	-96 dBm	-90 dBm	-87 dBm	-84 dBm	-81 dBm
1.35 MHz	-95 dBm	-89 dBm	-86 dBm	-83 dBm	-80 dBm
1.75 MHz	-94 dBm	-88 dBm	-85 dBm	-82 dBm	-79 dBm
3.5 MHz	-90 dBm	-84 dBm	-81 dBm	-78 dBm	-75 dBm
7.0 MHz	-87 dBm	-81 dBm	-78 dBm	-75 dBm	-72 dBm
14 MHz	-84 dBm	-78 dBm	-75 dBm	-72 dBm	-69 dBm

Notes

Typical performance specified at the antenna port for 10^{-6} BER.

The receiver is typically 1 dB more sensitive for a BER of 10^{-3}.

NA (Not Available)

Transmitter Power ETSI

Frequency Band	QPSK	16 QAM	32 QAM	64 QAM	128 QAM
300 MHz	21 to 35 dBm	17 to 31 dBm	16 to 30 dBm	15 to 29 dBm	15 to 29 dBm
400 MHz	21 to 35 dBm	17 to 31 dBm	16 to 30 dBm	15 to 29 dBm	15 to 29 dBm
600 MHz	21 to 35 dBm	17 to 31 dBm	16 to 30 dBm	15 to 29 dBm	15 to 29 dBm
800 MHz	21 to 35 dBm	17 to 31 dBm	16 to 30 dBm	15 to 29 dBm	15 to 29 dBm
900 MHz	21 to 35 dBm	17 to 31 dBm	16 to 30 dBm	15 to 29 dBm	15 to 29 dBm
1400 MHz	21 to 35 dBm	17 to 31 dBm	16 to 30 dBm	15 to 29 dBm	15 to 29 dBm
1800 MHz	21 to 35 dBm	17 to 31 dBm	16 to 30 dBm	15 to 29 dBm	15 to 29 dBm
2000 MHz	20 to 34 dBm	17 to 31 dBm	16 to 30 dBm	15 to 29 dBm	15 to 29 dBm
2500 MHz	20 to 34 dBm	17 to 31 dBm	16 to 30 dBm	15 to 29 dBm	15 to 29 dBm

System Gain ETSI

Channel Size	QPSK	16 QAM	32 QAM	64 QAM	128 QAM
25 kHz	NA	136 dB	132 dB	128 dB	125 dB
50 kHz	144 dB	134 dB	130 dB	126 dB	123 dB
75 kHz	142 dB	132 dB	128 dB	124 dB	121 dB
125 kHz	140 dB	130 dB	126 dB	122 dB	119 dB
150 kHz	139 dB	129 dB	125 dB	121 dB	118 dB
200 kHz	137 dB	127 dB	123 dB	119 dB	116 dB
250 kHz	136 dB	126 dB	122 dB	118 dB	115 dB
500 kHz	134 dB	124 dB	120 dB	116 dB	113 dB
1.0 MHz	131 dB	121 dB	117 dB	113 dB	110 dB
1.35 MHz	130 dB	120 dB	116 dB	112 dB	109 dB
1.75 MHz	129 dB	119 dB	115 dB	111 dB	108 dB
3.5 MHz	125 dB	115 dB	111 dB	107 dB	104 dB
7.0 MHz	122 dB	112 dB	108 dB	104 dB	101 dB
14 MHz	119 dB	109 dB	105 dB	101 dB	98 dB

Notes

Typical performance specified at the antenna port for 10^{-6} BER.
The system gain is typically 1 dB greater for a BER of 10^{-3}.
Figures decrease by 1 dB for the 2000 and 2500 MHz bands at QPSK.
System Gain = maximum transmit power - receiver sensitivity
NA (Not Available)

Link Delays ETSI

Note: The default Modem Interleaver Mode setting is on for channel sizes of 250 kHz and greater and off for channel sizes of 200 kHz and less (see 'Modem Interleaver Mode' on page 72).

Typical 1+0, MHSB end-to-end link delay - interleaver off

Channel size	QPSK	16 QAM	32 QAM	64 QAM	128 QAM
25 kHz	NA	51.8 ms	40.6 ms	35.7 ms	30.3 ms
50 kHz	46.2 ms	24.3 ms	20.2 ms	16.9 ms	15.0 ms
75 kHz	30.4 ms	16.2 ms	14.0 ms	11.4 ms	10.6 ms
125 kHz	22.3 ms	12.1 ms	10.0 ms	8.6 ms	7.0 ms
150 kHz	15.9 ms	8.8 ms	7.3 ms	6.4 ms	5.7 ms
200 kHz	12.8 ms	7.2 ms	6.2 ms	5.3 ms	4.9 ms
250 kHz	10.8 ms	6.2 ms	5.3 ms	4.6 ms	4.2 ms
500 kHz	6.3 ms	3.9 ms	3.4 ms	3.1 ms	2.8 ms
1.0 MHz	3.8 ms	2.6 ms	2.3 ms	2.2 ms	2.1 ms
1.35 MHz	3.1 ms	2.3 ms	2.1 ms	2.0 ms	1.9 ms
1.75 MHz	3.1 ms	2.3 ms	2.1 ms	2.0 ms	1.9 ms
3.5 MHz	2.0 ms	1.7 ms	1.6 ms	1.6 ms	1.6 ms
7.0 MHz	1.7 ms	1.5 ms	1.5 ms	1.5 ms	1.4 ms
14 MHz	1.5 ms	1.4 ms	1.4 ms	1.4 ms	1.4 ms

Typical 1+0, MHSB end-to-end link delay - interleaver on

	QPSK	16 QAM	32 QAM	64 QAM	128 QAM
25 kHz	NA	153.6 ms	118.9 ms	103.5 ms	86.9 ms
50 kHz	138.8 ms	70.5 ms	57.9 ms	47.8 ms	41.8 ms
75 kHz	90.3 ms	46.1 ms	39.5 ms	31.4 ms	28.8 ms
125 kHz	65.6 ms	33.7 ms	27.3 ms	23.1 ms	17.8 ms
150 kHz	45.8 ms	23.7 ms	19.3 ms	16.4 ms	14.3 ms
200 kHz	36.5 ms	19.0 ms	15.8 ms	13.2 ms	11.8 ms
250 kHz	30.4 ms	16.0 ms	13.1 ms	11.2 ms	9.8 ms
500 kHz	16.5 ms	9.0 ms	7.5 ms	6.5 ms	5.7 ms
1.0 MHz	8.8 ms	5.1 ms	4.3 ms	3.9 ms	3.5 ms
1.35 MHz	6.8 ms	4.1 ms	3.6 ms	3.2 ms	2.9 ms
1.75 MHz	5.6 ms	3.5 ms	3.1 ms	2.8 ms	2.9 ms
3.5 MHz	3.5 ms	2.4 ms	2.2 ms	2.1 ms	2.0 ms
7.0 MHz	2.4 ms	1.9 ms	1.8 ms	1.7 ms	1.7 ms
14 MHz	1.9 ms	1.6 ms	1.6 ms	1.5 ms	1.5 ms

Notes

The end to end link delays are measured from E1 / T1 interface to E1 / T1 interface

The delay figures are typical and can vary when the system re-synchronizes

NA (Not Available)

Typical HSD end-to-end link delay - interleaver on

	QPSK	16 QAM	32 QAM	64 QAM	128 QAM
25 kHz	NA	305.4 ms	223.2 ms	202.2 ms	NA
50 kHz	247.1 ms	142.0 ms	122.1 ms	95.2 ms	NA
75 kHz	185.3 ms	95.8 ms	82.8 ms	67.0 ms	NA
125 kHz	NA	NA	NA	NA	NA
150 kHz	93.3 ms	47.3 ms	39.5 ms	33.7 ms	NA
200 kHz	75.6 ms	38.9 ms	32.7 ms	25.5 ms	NA
250 kHz	63.6 ms	32.8 ms	25.2 ms	21.6 ms	NA
500 kHz	34.0 ms	17.0 ms	14.8 ms	11.4 ms	NA
1.0 MHz	16.9 ms	9.5 ms	8.0 ms	6.5 ms	NA
1.35 MHz	NA	NA	NA	NA	NA
1.75 MHz	9.9 ms	5.1 ms	4.9 ms	4.4 ms	NA
3.5 MHz	5.5 ms	3.5 ms	3.1 ms	3.1 ms	NA
7.0 MHz	3.6 ms	2.5 ms	2.3 ms	2.3 ms	NA
14 MHz	2.4 ms	2.0 ms	2.0 ms	2.0 ms	NA

Notes

The end to end link delays are measured from E1 / T1 interface to E1 / T1 interface

The delay figures are typical and can vary when the system re-synchronizes

NA (Not Available)

FCC

Frequency Bands FCC

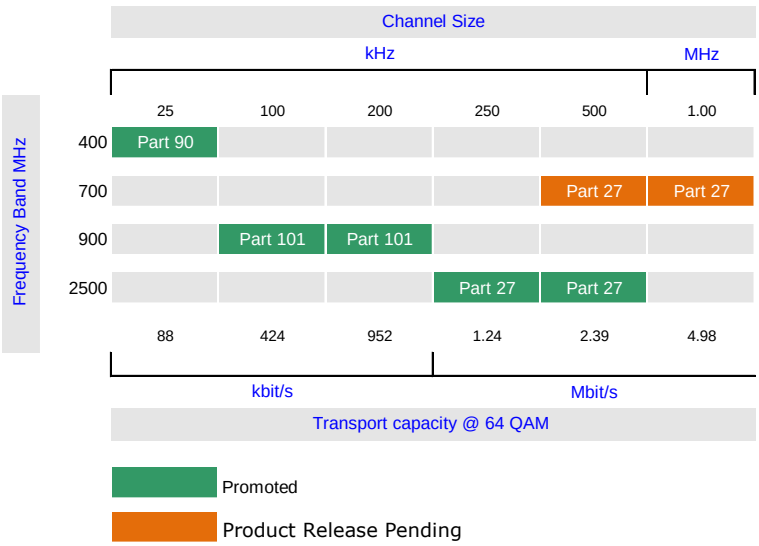
Frequency Bands FCC	Frequency Band	Frequency Tuning Range	Synthesizer Step Size
	400 MHz	421 - 512 MHz	6.25 kHz
	700 MHz	698 - 806 MHz	12.5 kHz
	900 MHz	928 - 960 MHz	12.5 kHz
	2500 MHz	2314 - 2350 MHz	62.5 kHz

Modulation	16 / 32 / 64 / 128 QAM and QPSK (software configurable)
Frequency stability (short term)	< ±1 ppm
Frequency stability (long term)	< ±2 ppm
Antenna connector	N-type female 50 Ω

Note 1 Frequency bands	Contact 4RF for other frequency band options
Note 2 Modulation	128 QAM is unreleased: Please contact 4RF for availability.
Note 3 Frequency stability	Short term frequency stability is defined as changes in frequency due to environmental effects and power supply variations
	Long term frequency stability is defined as changes in frequency due to aging of crystal oscillators approx over 5 years

Product Range FCC

The Aprisa XE terminal provides the following FCC frequency bands / channel sizes:



Link Capacity FCC

Channel size		QPSK	16 QAM	32 QAM	64 QAM	128 QAM
25 kHz	Gross		56 kbit/s	72 kbit/s	88 kbit/s	104 kbit/s
	T1		0 timeslots	1 timeslot	1 timeslot	1 timeslot
	Wayside		56 kbit/s	8 kbit/s	24 kbit/s	40 kbit/s
100 kHz	Gross	136 kbit/s	280 kbit/s	352 kbit/s	424 kbit/s	608 kbit/s
	T1	2 timeslots	4 timeslots	5 timeslots	6 timeslots	9 timeslots
	Wayside	8 kbit/s	24 kbit/s	32 kbit/s	40 kbit/s	32 kbit/s
200 kHz	Gross	312 kbit/s	632 kbit/s	792 kbit/s	952 kbit/s	1112 kbit/s
	T1	4 timeslots	9 timeslots	12 timeslots	14 timeslots	17 timeslots
	Wayside	56 kbit/s	56 kbit/s	24 kbit/s	56 kbit/s	24 kbit/s
250 kHz	Gross	408 kbit/s	824 kbit/s	1032 kbit/s	1240 kbit/s	1448 kbit/s
	T1	6 timeslots	12 timeslots	16 timeslots	19 timeslots	22 timeslots
	Wayside	24 kbit/s	56 kbit/s	8 kbit/s	24 kbit/s	40 kbit/s
500 kHz	Gross	792 kbit/s	1592 kbit/s	1992 kbit/s	2392 kbit/s	2792 kbit/s
	T1	12 timeslots	1 T1	1 T1	1 T1	1 T1
	Wayside	24 kbit/s	8 kbit/s	408 kbit/s	808 kbit/s	1208 kbit/s
1.0 MHz	Gross	1656 kbit/s	3320 kbit/s	4152 kbit/s	4984 kbit/s	5816 kbit/s
	T1	1 T1	2 T1s	2 T1s	3 T1s	3 T1s
	Wayside	72 kbit/s	152 kbit/s	984 kbit/s	232 kbit/s	1064 kbit/s

Notes

The capacities specified are for Unframed T1 and so require 1584 kbit/s to transport via the radio.

The management ethernet capacity must be subtracted from the gross capacity (default 64 kbit/s).

See Product Range table for Channel Size / Frequency Band cross reference

Receiver Sensitivity FCC

Channel Size	QPSK	16 QAM	32 QAM	64 QAM	128 QAM
25 kHz	NA	-105 dBm	-102 dBm	-99 dBm	-96 dBm
100 kHz	-106 dBm	-100 dBm	-97 dBm	-94 dBm	-91 dBm
200 kHz	-102 dBm	-96 dBm	-93 dBm	-90 dBm	-87 dBm
250 kHz	-101 dBm	-95 dBm	-92 dBm	-89 dBm	-86 dBm
500 kHz	-99 dBm	-93 dBm	-90 dBm	-87 dBm	-84 dBm
1.0 MHz	-96 dBm	-90 dBm	-87 dBm	-84 dBm	-81 dBm

Notes

Typical performance specified at the antenna port for 10^{-6} BER.

The receiver is typically 1 dB more sensitive for a BER of 10^{-3}.

Transmit Power FCC

Frequency Band	QPSK	16 QAM	32 QAM	64 QAM	128 QAM
400 MHz	NA	17 to 31 dBm	16 to 30 dBm	15 to 29 dBm	15 to 29 dBm
700 MHz	21 to 35 dBm	17 to 31 dBm	16 to 30 dBm	15 to 29 dBm	15 to 29 dBm
900 MHz	15 to 29 dBm	15 to 29 dBm	15 to 29 dBm	15 to 29 dBm	15 to 29 dBm
2500 MHz	15 to 29 dBm	15 to 29 dBm	15 to 29 dBm	15 to 29 dBm	15 to 29 dBm

System Gain FCC

400 MHz, 700 MHz, 900 MHz

Channel Size	QPSK	16 QAM	32 QAM	64 QAM	128 QAM
25 kHz	NA	136 dB	132 dB	128 dB	125 dB
100 kHz	135 dB	129 dB	126 dB	123 dB	120 dB
200 kHz	131 dB	125 dB	122 dB	119 dB	116 dB
500 kHz	134 dB	124 dB	120 dB	116 dB	113 dB
1.0 MHz	131 dB	121 dB	117 dB	113 dB	110 dB

2500 MHz

	QPSK	16 QAM	32 QAM	64 QAM	128 QAM
250 kHz	130 dB	124 dB	121 dB	118 dB	115 dB
500 kHz	128 dB	122 dB	119 dB	116 dB	113 dB

Notes

Typical performance specified at the antenna port for 10^{-6} BER.

The system gain is typically 1 dB greater for a BER of 10^{-3}.

System Gain = maximum transmit power - receiver sensitivity

Link Delays FCC

Note: The default Modem Interleaver Mode setting is on for channel sizes of 250 kHz and greater and off for channel sizes of 200 kHz and less (see 'Modem Interleaver Mode' on page 72).

Interleaver off

Channel size	QPSK	16 QAM	32 QAM	64 QAM	128 QAM
25 kHz	NA	64.4 ms	52.3 ms	44.2 ms	38.5 ms
100 kHz	28.8 ms	15.3 ms	12.7 ms	10.9 ms	8.2 ms
200 kHz	15.9 ms	8.8 ms	7.3 ms	6.4 ms	5.1 ms
250 kHz	11.2 ms	6.6 ms	5.4 ms	5.0 ms	4.2 ms
500 kHz	5.9 ms	3.5 ms	3.4 ms	3.2 ms	2.8 ms
1.0 MHz	3.8 ms	2.6 ms	2.3 ms	2.2 ms	2.1 ms

Interleaver on

Channel size	QPSK	16 QAM	32 QAM	64 QAM	128 QAM
25 kHz	NA	191.6 ms	154.1 ms	129.1 ms	111.2 ms
100 kHz	85.3 ms	43.6 ms	35.3 ms	29.7 ms	21.4 ms
200 kHz	45.8 ms	23.7 ms	19.3 ms	16.4 ms	12.3 ms
250 kHz	33.2 ms	17.5 ms	14.3 ms	12.1 ms	9.8 ms
500 kHz	17.5 ms	9.3 ms	8.0 ms	6.9 ms	5.7 ms
1.0 MHz	8.8 ms	5.1 ms	4.3 ms	3.9 ms	3.5 ms

Notes

The end to end link delays are measured from E1 / T1 interface to E1 / T1 interface

The delay figures are typical and can vary when the system re-synchronizes

Industry Canada

Frequency Bands IC

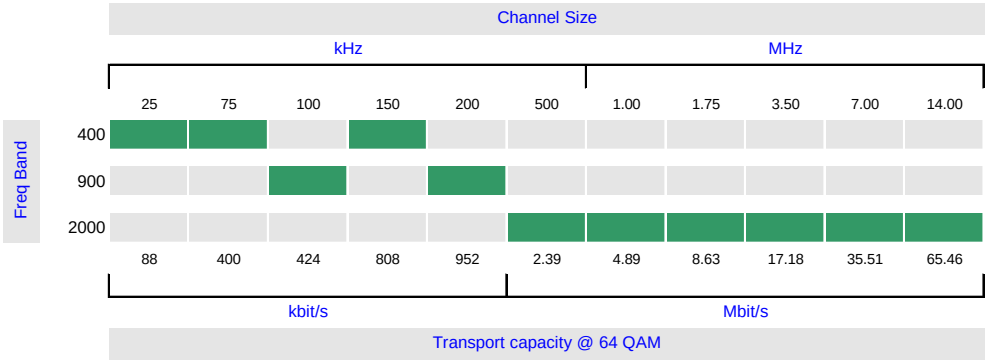
Frequency Bands IC	Frequency Band	Frequency Tuning Range	Synthesizer Step Size
	400 MHz	400 - 470 MHz	6.25 kHz
	900 MHz	928 - 960 MHz	12.5 kHz
	2000 MHz	1900 - 2300 MHz	62.5 kHz

Modulation	16 / 32 / 64 / 128 QAM and QPSK (software configurable)
Frequency stability (short term)	< ±1 ppm
Frequency stability (long term)	< ±2 ppm
Antenna connector	N-type female 50 Ω

Note 1 Frequency bands	Contact 4RF for other frequency band options
Note 2 Modulation	128 QAM is unreleased: Please contact 4RF for availability.
Note 3 Frequency stability	Short term frequency stability is defined as changes in frequency due to environmental effects and power supply variations
	Long term frequency stability is defined as changes in frequency due to aging of crystal oscillators approx over 5 years

Product Range IC

The Aprisa XE terminal provides the following Industry Canada frequency bands / channel sizes:



Link Capacity IC

Channel size		QPSK	16 QAM	32 QAM	64 QAM	128 QAM
25 kHz	Gross	NA	56 kbit/s	72 kbit/s	88 kbit/s	NA
	T1		0 timeslots	1 timeslot	1 timeslot	
	Wayside		56 kbit/s	8 kbit/s	24 kbit/s	
75 kHz	Gross	128 kbit/s	264 kbit/s	312 kbit/s	400 kbit/s	440 kbit/s
	T1	2 timeslots	4 timeslots	4 timeslots	6 timeslots	6 timeslots
	Wayside	0 kbit/s	8 kbit/s	56 kbit/s	16 kbit/s	56 kbit/s
100 kHz	Gross	136 kbit/s	280 kbit/s	352 kbit/s	424 kbit/s	608 kbit/s
	T1	2 timeslots	4 timeslots	5 timeslots	6 timeslots	9 timeslots
	Wayside	8 kbit/s	24 kbit/s	32 kbit/s	40 kbit/s	32 kbit/s
150 kHz	Gross	264 kbit/s	536 kbit/s	672 kbit/s	808 kbit/s	944 kbit/s
	T1	4 timeslots	8 timeslots	10 timeslots	12 timeslots	14 timeslots
	Wayside	8 kbit/s	24 kbit/s	32 kbit/s	40 kbit/s	48 kbit/s
200 kHz	Gross	312 kbit/s	632 kbit/s	792 kbit/s	952 kbit/s	1112 kbit/s
	T1	4 timeslots	9 timeslots	12 timeslots	14 timeslots	17 timeslots
	Wayside	56 kbit/s	56 kbit/s	24 kbit/s	56 kbit/s	24 kbit/s
500 kHz	Gross	792 kbit/s	1592 kbit/s	1992 kbit/s	2392 kbit/s	2792 kbit/s
	T1	12 timeslots	1 T1	1 T1	1 T1	1 T1
	Wayside	24 kbit/s	8 kbit/s	408 kbit/s	808 kbit/s	1208 kbit/s
1.0 MHz	Gross	1624 kbit/s	3256 kbit/s	4072 kbit/s	4888 kbit/s	5704 kbit/s
	T1	1 T1	2 T1s	2 T1s	3 T1s	3 T1s
	Wayside	40 kbit/s	88 kbit/s	904 kbit/s	136 kbit/s	952 kbit/s
1.75 MHz	Gross	2872 kbit/s	5752 kbit/s	7192 kbit/s	8632 kbit/s	10072 kbit/s
	T1	1 T1	3 T1s	4 T1s	5 T1s	6 T1s
	Wayside	1288 kbit/s	1000 kbit/s	856 kbit/s	712 kbit/s	568 kbit/s
3.5 MHz	Gross	5720 kbit/s	11448 kbit/s	14312 kbit/s	17176 kbit/s	20040 kbit/s
	T1	3 T1s	7 T1s	9 T1s	10 T1s	12 T1s
	Wayside	968 kbit/s	360 kbit/s	56 kbit/s	1336 kbit/s	1032 kbit/s
7.0 MHz	Gross	11832 kbit/s	23672 kbit/s	29592 kbit/s	35512 kbit/s	41432 kbit/s
	T1	7 T1s	14 T1s	18 T1s	22 T1s	26 T1s
	Wayside	744 kbit/s	1496 kbit/s	1080 kbit/s	664 kbit/s	248 kbit/s
14 MHz	Gross	NA	47992 kbit/s	59992 kbit/s	65464 kbit/s	65400 kbit/s
	T1		30 T1s	32 T1s	32 T1s	32 T1s
	Wayside		472 kbit/s	9304 kbit/s	14776 kbit/s	14712 kbit/s

Notes

The capacities specified are for Unframed T1 and so require 1584 kbit/s to transport via the radio.
The management ethernet capacity must be subtracted from the gross capacity (default 64 kbit/s).
See Product Range table for Channel Size / Frequency Band cross reference
NA (Not Available)

Receiver Sensitivity IC

Channel size	QPSK	16 QAM	32 QAM	64 QAM	128 QAM
25 kHz	NA	-105 dBm	-102 dBm	-99 dBm	NA
75 kHz	-107 dBm	-101 dBm	-98 dBm	-95 dBm	-92 dBm
100 kHz	-106 dBm	-100 dBm	-97 dBm	-94 dBm	-91 dBm
150 kHz	-104 dBm	-98 dBm	-95 dBm	-92 dBm	-89 dBm
200 kHz	-102 dBm	-96 dBm	-93 dBm	-90 dBm	-87 dBm
500 kHz	-99 dBm	-93 dBm	-90 dBm	-87 dBm	-84 dBm
1.0 MHz	-96 dBm	-90 dBm	-87 dBm	-84 dBm	-81 dBm
1.75 MHz	-94 dBm	-88 dBm	-85 dBm	-82 dBm	-79 dBm
3.5 MHz	-90 dBm	-84 dBm	-81 dBm	-78 dBm	-75 dBm
7.0 MHz	-87 dBm	-81 dBm	-78 dBm	-75 dBm	-72 dBm
14 MHz	NA	-78 dBm	-75 dBm	-72 dBm	-69 dBm

Notes

Typical performance specified at the antenna port for 10^{-6} BER.

The receiver is typically 1 dB more sensitive for a BER of 10^{-3}.

NA (Not Available)

Transmitter Power IC

Frequency Band	QPSK	16 QAM	32 QAM	64 QAM	128 QAM
400 MHz	15 to 35 dBm	15 to 31 dBm	15 to 30 dBm	15 to 29 dBm	15 to 29 dBm
900 MHz	15 to 29 dBm	15 to 29 dBm	15 to 29 dBm	15 to 29 dBm	15 to 29 dBm
2000 MHz	20 to 34 dBm	17 to 31 dBm	16 to 30 dBm	15 to 29 dBm	15 to 29 dBm

System Gain IC

Channel Size	QPSK	16 QAM	32 QAM	64 QAM	128 QAM
25 kHz	NA	136 dB	132 dB	128 dB	NA
75 kHz	142 dB	132 dB	128 dB	124 dB	121 dB
100 kHz	135 dB	129 dB	126 dB	123 dB	120 dB
150 kHz	139 dB	129 dB	125 dB	121 dB	118 dB
200 kHz	131 dB	125 dB	122 dB	119 dB	116 dB
500 kHz	133 dB	124 dB	120 dB	116 dB	113 dB
1.0 MHz	130 dB	121 dB	117 dB	113 dB	110 dB
1.75 MHz	128 dB	119 dB	115 dB	111 dB	108 dB
3.5 MHz	124 dB	115 dB	111 dB	107 dB	104 dB
7.0 MHz	121 dB	112 dB	108 dB	104 dB	101 dB
14 MHz	NA	109 dB	105 dB	101 dB	98 dB

Notes

Typical performance specified at the antenna port for 10^{-6} BER.

The system gain is typically 1 dB greater for a BER of 10^{-3}.

System Gain = maximum transmit power - receiver sensitivity

NA (Not Available)

Link Delays IC

Note: The default Modem Interleaver Mode setting is on for channel sizes of 250 kHz and greater and off for channel sizes of 200 kHz and less (see 'Modem Interleaver Mode' on page 72).

Interleaver off

Channel size	QPSK	16 QAM	32 QAM	64 QAM	128 QAM
25 kHz	NA	49.6 ms	39.4 ms	34.9 ms	NA
75 kHz	35.5 ms	19.0 ms	16.8 ms	13.6 ms	10.6 ms
100 kHz	28.8 ms	15.3 ms	12.7 ms	10.9 ms	8.2 ms
150 kHz	17.5 ms	10.1 ms	8.5 ms	7.1 ms	5.7 ms
200 kHz	15.9 ms	8.8 ms	7.3 ms	6.4 ms	5.1 ms
500 kHz	6.3 ms	3.5 ms	3.4 ms	3.2 ms	2.8 ms
1.0 MHz	3.8 ms	2.6 ms	2.3 ms	2.2 ms	2.1 ms
1.75 MHz	3.1 ms	2.3 ms	2.1 ms	2.0 ms	1.9 ms
3.5 MHz	2.6 ms	2.0 ms	1.8 ms	1.8 ms	1.7 ms
7.0 MHz	2.0 ms	1.7 ms	1.6 ms	1.6 ms	1.6 ms
14 MHz	NA	1.6 ms	1.5 ms	1.5 ms	1.5 ms

Interleaver on

Channel size	QPSK	16 QAM	32 QAM	64 QAM	128 QAM
25 kHz	NA	164.7 ms	127.7 ms	111.8 ms	NA
75 kHz	103.7 ms	53.2 ms	45.8 ms	36.4 ms	28.8 ms
100 kHz	85.3 ms	43.6 ms	35.3 ms	29.7 ms	21.4 ms
150 kHz	51.4 ms	26.8 ms	21.9 ms	18.6 ms	14.3 ms
200 kHz	45.8 ms	23.7 ms	19.3 ms	16.4 ms	12.3 ms
500 kHz	16.5 ms	9.3 ms	8.0 ms	6.9 ms	5.7 ms
1.0 MHz	8.8 ms	5.1 ms	4.3 ms	3.9 ms	3.5 ms
1.75 MHz	6.8 ms	4.1 ms	3.6 ms	3.2 ms	2.9 ms
3.5 MHz	5.1 ms	3.2 ms	2.8 ms	2.6 ms	2.4 ms
7.0 MHz	3.5 ms	2.4 ms	2.2 ms	2.1 ms	2.0 ms
14 MHz	NA	2.1 ms	1.9 ms	1.8 ms	1.8 ms

Notes

The end to end link delays are measured from E1 / T1 interface to E1 / T1 interface

The delay figures are typical and can vary when the system re-synchronizes

NA (Not Available)

Receiver Performance

Maximum input level		-20 dBm
Dynamic range		58 to 87 dB (at 10^{-6} BER) depending on modulation type and channel size
C/I ratio (carrier to interference ratio)		C/I ratio = $C_{dB} - I_{dB}$
	Co-channel	better than 16 dB at QPSK
		better than 20 dB at 16 QAM
		better than 23 dB at 32 QAM
		better than 27 dB at 64 QAM
		better than 30 dB at 128 QAM
	1st adjacent channel	better than -5 dB
	2nd adjacent channel	better than -30 dB

Notes Typical performance specified at the antenna port for 10^{-6} BER.
The dynamic range is typically 2 dB greater for a BER of 10^{-3}.

Duplexers

Code	Frequency Band	Option	TX / RX Min Split	Passband	Lo Band	Hi Band	Mounting
A0	300 MHz	Standard	9.45 MHz	2 MHz	330 - 400 MHz	330 - 400 MHz	External
A1	300 MHz	Option 1	5 MHz	0.5 MHz	330 - 400 MHz	330 - 400 MHz	External
A2	300 MHz	Option 2	20 MHz	3.5 MHz	330 - 400 MHz	330 - 400 MHz	External
B0	400 MHz	Standard	9.45 MHz	2 MHz	400 - 470 MHz	400 - 470 MHz	External
B1	400 MHz	Option 1	5 MHz	0.5 MHz	400 - 470 MHz	400 - 470 MHz	External
B2	400 MHz	Option 2	20 MHz	3.5 MHz	400 - 470 MHz	400 - 470 MHz	External
C0	400 MHz	Standard	3 MHz	0.5 MHz	470 - 492 MHz	473 - 495 MHz	External
D0	600 MHz	Standard	45 MHz	7 MHz	620 - 715 MHz	620 - 715 MHz	Internal
E0	700 MHz	Standard	30 MHz	7 MHz	698 - 806 MHz	698 - 806 MHz	Internal
F0	800 MHz	Standard	40 MHz	7 MHz	805 - 890 MHz	805 - 890 MHz	Internal
G0	900 MHz	Standard	40 MHz	7 MHz	850 - 960 MHz	850 - 960 MHz	Internal
G1	900 MHz	Option 1	9 MHz	1.5 MHz	928 - 960 MHz	928 - 960 MHz	External
G2	900 MHz	Option 2	9 MHz	1 MHz	928 - 960 MHz	928 - 960 MHz	Internal
G3	900 MHz	Option 3	5.5 MHz	0.5 MHz	900 - 960 MHz	900 - 960 MHz	External
G4	900 MHz	Option 4	3.6 MHz	0.5 MHz	900 - 960 MHz	900 - 960 MHz	External
H0	1400 MHz	Standard	48 MHz	7 MHz	1350 - 1550 MHz	1350 - 1550 MHz	Internal
H1	1400 MHz	Option 1	23.5 MHz	7 MHz	1350 - 1550 MHz	1350 - 1550 MHz	Internal
K0	1800 MHz	Standard	47.5 MHz	14 MHz	1700 - 2100 MHz	1700 - 2100 MHz	Internal
I0	2000 MHz	Standard	91 MHz	14 MHz	1900 - 2300 MHz	1900 - 2300 MHz	Internal
J0	2500 MHz	Standard	74 MHz	14 MHz	2300 - 2700 MHz	2300 - 2700 MHz	Internal
J1	2500 MHz	Option 1	32 MHz	4 MHz	2314 - 2318 MHz	2346 - 2350 MHz	Internal

Notes All duplexers are bandpass
Contact 4RF for other duplexer options

Interface Specifications

Ethernet Interface

General	Interface	RJ-45 * 4 (Integrated 4-port switch)
	Cabling	CAT-5 UTP, supports auto MDIX (Standard Ethernet)
	Maximum line length	100 metres on cat-5 or better
	Bandwidth allocation	n x 8 kbit/s up to maximum available. n x 64 kbit/s is recommended for terminals with higher channel size (> 500 kHz, 32 QAM).
	Ethernet capacity	The ethernet capacity maximum is determined by the lesser of the available radio link capacity or 50 Mbit/s.
	Maximum packet size	'Standard' Ethernet packets: max 1518 octets Tagged and double-tagged packets: max 1526 octets
	Data buffer size	Up to 256 frames
	Address table size	2048 IP addresses
	WAN protocol	HDLC
	Ethernet mode	10Base-T or 100Base-TX Full duplex or half duplex (Auto-negotiating and auto-sensing)
	VLAN tagging	IEEE 802.1Q VLAN tagging
	QoS	IEEE 802.1p Ipv4 TOS DiffServ Ipv6 traffic class
	Spanning Tree	Forwards 802.1D Spanning Tree Protocol packets up to 1526 bytes in length.
Diagnostics	Green LED	On: Ethernet signal received Flashing: Indicates data traffic present on the interface

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

QJET Quad E1 / T1 Interface

General	Standard	G.703 and G.704
	Interface	RJ-45
	Line termination impedance	E1 120 Ω balanced T1 100 Ω balanced
	Maximum line length	E1 typically up to 1.7 km (43 dB of loss at 1024 kHz in standard 0.4 mm^2 cable). T1 typically up to 1.7 km (36 dB of loss at 772 kHz in standard 0.4 mm^2 cable).
	Bandwidth allocation	Framed E1s require a link bandwidth of 2048 kbit/s. Unframed E1s require a link bandwidth of 2088 kbit/s. Framed T1s require a link bandwidth of 1544 kbit/s. Unframed T1s require a link bandwidth of 1584 kbit/s.
	Line code	E1 HDB3 or AMI T1 B8ZS or AMI
	Tx Waveform Shaper (T1 only)	0 ~ 133 ft 133 ~ 266 ft 266 ~ 399 ft 399 ~ 533 ft 533 ~ 655 ft
	Stability	±50 ppm
	Jitter performance	G.823 (sections 2 & 3)
Diagnostics	Green LED	On: Interface is operational and in service Off: No 2 Mbit/s input signal Flashing: The interface loopback is active.
	Yellow LED	On: Alarm Off: No alarm

Q4EM Quad 4 Wire E&M Interface

General	Audio	64 kbit/s (PCM A-Law as per ITU G.711) 32, 24 and 16 kbit/s (ADPCM as per ITU G.726 and ANSI TI.303)
	E&M signalling	8 kbit/s per port
	Maximum line length	400 metres
Analogue	Transmission performance characteristics	ITU G.712 E4 for an operating level range of -14 dBr to +4 dBr for a G.711 64 kbit/s coded channel
	Input level range	-14.0 dBr to +4.0 dBr in 0.5 dB steps
	Output level range	-14.0 dBr to +4.0 dBr in 0.5 dB steps
	Default output level	0 dBr
	Default input level	0 dBr
	Maximum level	+3.14 dBm0
	Port impedance	600 Ω
	Return loss	better than 25 dB over the frequency range 200 - 3600 Hz
	Transformer isolation	3.88 kV
	End to end gain Frequency response	0 dB ± 0.1 dB (300-3000 Hz) 0 dB ± 0.5 dB (250-3400 Hz)
	Audio line protection	Secondary protection
	Signal to total distortion	> 30 dB (0 dBm0 to -30 dBm0) > 22 dB (-45 dBm0)

Signalling	E&M	Mode independent (external power supply / ground reference required)
	Pulse distortion	4:1 multiplexed < 2.250 ms Non-multiplexed ≤ 250 µs
	M loop current	5.0 to 6.5 mA (constant current)
	M detection voltage	9 VDC
	M maximum voltage	60 VDC
	E circuit impedance	45 Ω closed > 100 kΩ open
	Maximum E circuit current	100 mA
	E maximum voltage	60 V
	E&M circuit protection	E: Current limited to 120 mA, overvoltage to 350 V M: Current limited to 6.5 mA, overvoltage to 100 V
Diagnostics	Green LED	Off: No external source applied to M wire On: External source applied to M wire Flashing: The interface loopback is active
	Yellow LED	Off: E wire relay contact open On: E wire relay contact closed

DFXO Dual Foreign Exchange Office Interface

General	Audio	64 kbit/s (PCM as per ITU G.711) 32, 24 and 16 kbit/s (ADPCM as per ITU G.726 and ANSI TI.303)
	Signalling allocation	8 or 32 kbit/s allocated for CAS (multiplexed / non multiplexed)
	Companding	A-Law or µ-Law
	Maximum line length	600 metres (2000 feet) on 0.4 mm / 26 AWG copper pair
	Calling line ID (CLI)	Support provided for ETSI: EN 300 659-1 & 2 and BT: SIN 227 and 242
	Fax	Conforms to G3 standard for 64 kbit/s PCM and 32 kbit/s ADPCM compression
Analogue	Transmission performance characteristics	ITU G.712 E2 for an operating level range of -6 dBr to +1 dBr for a G.711 64 kbit/s coded channel
	Input level range	-10 dBr to +1.0 dBr in 0.5 dB steps
	Output level range	-10 dBr to +1.0 dBr in 0.5 dB steps
	Default Input level	-4.0 dBr
	Default Output level	-1.0 dBr
	Maximum level	+3.14 dBm0
	Line impedance / Hybrid balance impedance options	600 Ω 900 Ω 600 Ω + 2.16 µF 900 Ω + 2.16 µF 270 Ω + 750 Ω || 150 nF (TBR-21) 220 Ω + 820 Ω || 120 nF (TN12) 370 Ω + 620 Ω || 310 nF (BT3) 320 Ω + 1050 Ω || 210 nF (BT Network) 200 Ω + 680 Ω || 100 nF (China)
	Return Loss	better than 12 dB 300 Hz to 600 Hz better than 15 dB 600 Hz to 3400 Hz
	Trans hybrid loss	better than 13 dB 300 Hz to 3400 Hz better than 17 dB 500 Hz to 2500 Hz (with matched external line and hybrid balance impedance)
	Common mode rejection ratio	better than 40 dB 50 Hz to 3800 Hz better than 46 dB 600 Hz to 3400 Hz
	Echo Canceller	provides up to 64 ms of echo cancellation reduces the echo by more than 15 dB at an input signal level of −10 dBm0.

Signalling	DTMF dialing	Standard DTMF dialing over the voice channel
	Pulse dialing	Transparent decadic signalling at 7 - 14 PPS with break period limits of 60 - 73 %
	Pulse distortion	4:1 multiplexed < 2.250 ms Non-multiplexed ≤ 250 µs
	Reversals	Line polarity reversal detection
	Loop current limit	maximum of 60 mA with Loop Current Limiter On maximum of 160 mA with Loop Current Limiter Off
	Metering level sensitivity	12 kHz / 16 kHz billing tone detection with a selectable level sensitivity of -17dBm to -40 dBm in 1dB steps into 200 Ω (60 mV rms to 5 mV rms into 200 Ω).
	Metering level maximum	The maximum level of metering signal the DFXO can tolerate without voice band interference is 0.8 Vrms into 200 Ω.
	Loop resistance on-hook	>1 MΩ
	Ringing detection threshold	Three selectable options of 16 Vrms, 26 Vrms and 49 Vrms ± 20 %.
	Ringing detection frequency	15 to 50 Hz sine wave
	Ringing input impedance	Two selectable options of >1 MΩ and >12 kΩ
	Ringing DC offset range tolerance	0 to -75VDC
	Ringing input voltage maximum	up to 100 Vrms
	Ringing cadence limits	min / max Ringing ON: 270 ms / 10 secs Ringing OFF: 180 ms / 4 secs
	Ringing cadence distortion	< 40 ms cadence error on both ring and silent periods
Physical	Physical interface	Dual RJ-45 per port (1 line port, 1 monitor port)
Diagnostics	Green LED	Off: Interface operational but not in service On: Interface in service Flashing: Cadenced ringing on line
	Yellow LED	Off: No interface alarm On: Interface alarm Flashing: The interface loopback is active

DFXS Dual Foreign Exchange Subscriber Interface

General	Audio	64 kbit/s (PCM as per ITU G.711) 32, 24 and 16 kbit/s (ADPCM as per ITU G.726 and ANSI TI.303)
	Signalling Allocation	8 or 32 kbit/s allocated for CAS (multiplexed / non multiplexed)
	Compression coding	A-Law or µ-Law
	Maximum line length	600 metres (2000 feet) on 0.4 mm / 26 AWG copper pair
	Calling line ID (CLI)	Support provided for ETSI: EN 300 659-1 & 2 and BT: SIN 227 and 242
	Fax	Conforms to G3 standard for 64 kbit/s PCM and 32 kbit/s ADPCM compression
Analogue	Transmission performance characteristics	ITU G.712 E2 for an operating level range of -6 dBr to +2.0 dBr for a G.711 64 kbit/s coded channel
	Input level range	-9.0 dBr to +2.0 dBr in 0.5 dB steps
	Output level range	-9.5 dBr to +2.5 dBr in 0.5 dB steps
	Default Input level	+1.0 dBr
	Default Output level	-6.0 dBr
	Maximum level	+3.14 dBm0
	Line impedance / Hybrid balance impedance options	600 Ω 900 Ω 600 Ω + 2.16 µF 900 Ω + 2.16 µF 220 Ω + (820 Ω || 120 nF) (TN12) 270 Ω + (750 Ω || 150 nF) (TBR21) 370 Ω + (620 Ω || 310 nF) (BT3)
	Return Loss	better than 12 dB 300 Hz to 600 Hz better than 15 dB 600 Hz to 3400 Hz
	Trans hybrid loss	better than 13 dB 300 Hz to 3400 Hz better than 17 dB 500 Hz to 2500 Hz (with matched external line and hybrid balance impedance)
	Common mode rejection ratio	better than 40 dB 50 Hz to 3800 Hz better than 46 dB 600 Hz to 3400 Hz

Signalling	Feed voltage output	-48 V (160 + 160 Ω voltage source current limited)
	Loop current limit	35 mA ± 10 %.
	Seize signal	Loop start only (no ground start)
	Loop detect threshold	9 to 12 mA (step function between on hook and off hook)
	Loop non-seizure current	> 6 mA (step function between on hook and off hook)
	Loop release threshold	> 4 mA
	DTMF dialing	Standard DTMF dialing over the voice channel
	Pulse dialing	Transparent decadic signalling at 7 - 14 PPS with break period limits of 60 - 73 % (with loop current > 23 mA)
	Pulse distortion	4:1 multiplexed < 2.250 ms Non-multiplexed ≤ 250 µs
	Reversals output	Line polarity reversal output (optional)
	Metering output frequency	12 kHz / 16 kHz ± 0.5 %.
	Metering output voltage	Four selectable output voltages of 100 mV, 200 mV, 300 mV and 400 mV rms into 200 Ω ± 20 % sourced via the Line Impedance setting but limited to a maximum open circuit voltage of 1 Vrms.
	Metering output distortion	Billing tone total distortion < 5 %.
	Ringer waveform	Sinusoidal with a maximum total distortion of 10% (into 3 REN load)
	Ringer voltage (open circuit)	Five selectable ringer output voltages sourced via an internal ringing resistance of 178 Ω per port. The ringing output is a composite balanced AC ringing voltage with a differential DC offset voltage. 60 Vrms + 0 VDC 55 Vrms + 10 VDC 50 Vrms + 18 VDC 45 Vrms + 22 VDC 40 Vrms + 24 VDC Both the DC and AC components have a tolerance of ± 5%.
	Ringer output frequency	Three selectable options of 17, 25 or 50 Hz ± 5%
	Ringer output power	60 Vrms source into a load of 2 REN 45 Vrms source into a load of 3 REN (1 REN ≈ 6930 Ω □in series with 8 µF)
	Ring trip	Ring trip will ocurr in < 150 ms following DC loop of > 20 mA
	Ring trip immunity	Ring trip will not ocurr if the DFXS outputs ringing into a load of 500 Ω in series with 4.4µF or less.
Physical	Physical interface	Dual RJ-45 per port (1 line port, 1 monitor port)
	Line protection	Secondary protection (4RF recommends the use of external primary protection in lightning prone areas)
Diagnostics	Green LED	Off: Interface operational but not in service On: Interface in service Flashing: Cadenced ringing on line
	Yellow LED	Off: No interface alarm On: Interface alarm Flashing: The interface loopback is active

QV24 Quad V.24 Serial Data Interface

General	Interface	ITU-T V.24 / EIA/TIA RS-232E
	Interface direction	DCE only
	Bandwidth allocation	8 to 120 kbit/s in 8 kbit/s steps (dependent on rate selected)
	Control line allocation	8 kbit/s
	Maximum line length	10 metres
	Data clamp	Mark hold when out of sync.
	Control line clamp	Off when loss of sync.
	Clock	Internally generated from 2.048 MHz system clock (synchronized at both ends)
Async parameters	Transparent mode	Operation is completely transparent but limited to 0-600 bit/s
	Standard mode data bits	7 or 8 bits
	Standard mode parity	Transparent (enable / disable)
	Standard mode stop bits	1 or 2 bits
	Asynchronous Data rates	300, 600, 1200, 2400, 4800, 7200, 9600, 12800, 14400, 19200, 23040, 28800, 38400, 57600 and 115200 bit/s
Control signals	End-to-end	CTS to RTS, DSR to DTR
Diagnostics	Green LED	Indicates RX data traffic present
	Yellow LED	Indicates TX data traffic present

QV24S Quad V.24 Serial Data Interface

General	Interface	ITU-T V.24 / EIA/TIA RS-232E
	Interface direction	DCE only
	Bandwidth allocation	8 to 120 kbit/s in 8 kbit/s steps (dependent on rate selected)
	Control line allocation	8 kbit/s
	Maximum line length	10 metres
	Data clamp	Mark hold when out of sync.
	Control line clamp	Off when loss of sync.
	Synchronous Data rates	300, 600, 1200, 2400, 4800, 9600 and 19200 bit/s
Control signals	End-to-end	CTS to RTS
Diagnostics	Green LED	Indicates RX data traffic present
	Yellow LED	Indicates TX data traffic present

HSS Single High Speed Synchronous Data Interface

General	Interfaces	ITU-T V.35 ITU-T X.21 EIA RS-449 EIA RS-530
	Bandwidth allocation	8 to 2048 kbit/s in 8 kbit/s steps (dependent on rate selected) 8 kbit/s for control lines
	Maximum line length	3 metres
	Clock	Internally generated from 2.048 MHz system clock (synchronized at both ends) on DCE to DCE mode. Clock provided by external DCE when in DTE mode. Remote DCE outputs clock-timed by incoming clock at DTE.
Diagnostics	Top Green LED	On: Normal operation Flashing: Loopback
	Lower Green LED	On: Normal operation

External Alarm Interfaces

Alarm inputs	Detector type	Isolated current detectors
	Detection current	5.0 to 6.5 mA (constant current)
	Detection voltage	9 to 60 VDC or AC rms
Alarm outputs	Contact type	Isolated semiconductor relay type contacts
	Maximum current	100 mA
	Maximum voltage	0 to 60 VDC or AC rms
	Ouput impedance	45 Ω closed > 100 kΩ open
Overall	Latency	The latency for an alarm presented on an external alarm input to the alarm being output on an external alarm output is < 2 seconds

Auxiliary Interfaces

Management	Configuration and management	Embedded web server and / or SNMP accessed via Ethernet interface or across link
Test points	RSSI	Front panel test point for measuring the RSSI voltage

Power Specifications

AC Power Supply

Nominal voltage	Input voltage range	Maximum Power input	Max VA	Frequency
115 VAC	103 - 127 Vrms	180 W	400 VA	47 - 63 Hz
230 VAC	207 - 254 Vrms	180 W	400 VA	47 - 63 Hz

DC Power Supply

Nominal voltage	Input voltage range	Maximum Power input	Maximum input current	Recommended DC breaker rating
+12 VDC LP	10.5 to 18 VDC	53 W	5 A	8 A
±12 VDC	10.5 to 18 VDC	180 W	18 A	25 A
±24 VDC	20.5 to 30 VDC	180 W	8 A	10 A
±48 VDC	40 to 60 VDC	180 W	4 A	5 A

Power Consumption

Terminal Type	**Power Consumption** (min – max)
Standard Aprisa XE 1+0 terminal	34 to 170 W Input power (dependent on the transmitter output power, the interface cards fitted and the power supply option)
Standard Aprisa XE 1+1 terminal	74 to 375 W Input power (dependent on the transmitter output power, the interface cards fitted, the number of trib switches and the power supply option)
Standard Aprisa XE HSD terminal	68 to 286 W Input power (dependent on the transmitter output power, the interface cards fitted and the power supply option)

Power Consumption Model

An Aprisa XE Power Consumption model program called XEpower is on the Aprisa XE CD. This program shows the typical power consumption for any product configuration. Java 1.6 is required to be installed on your PC to run this program.

Standard Aprisa XE 1+0 terminal – 48 VDC

These power consumption figures represent the typical power drawn by a single standard 1400 MHz 1+0 terminal measured at the input to a ± 48 VDC power supply.

Power Consumption (min – max)	40 to 150 W Input power (dependent on interface cards fitted and transmitter output power level)
Terminal only:	
TX power of + 20 dBm	44 W
TX power of + 25 dBm	54 W
TX power of + 30 dBm	61 W
TX power of + 35 dBm	64 W
Interface cards:	
QJET four port E1 card	2.3 W (four ports operating)
Q4EM four port 4W E&M card	0.6 W (all states)
QV24 four port V.24 card	0.2 W (all states)
DFXO two port 2W FXO card	0.7 W (all states)
DFXS two port 2W FXS card	One DFXS card installed with both ports idle (on hook): 2.5 W Plus: 1.9 W / line off-hook (200 ohm copper loop plus 450 ohm telephone) 1.0 W / line ringing (60 Vrms 25Hz source via 100 ohm copper loop into a 1 REN load) 1.5 W / line ringing (45 Vrms 25Hz source via 100 ohm copper loop into a 3 REN load)
HSS single port high speed data	1.0 W (all states)
MHSB:	
Tributary and RF switch	13 W not switched
	25 W switched

Low Power Aprisa XE 1+0 terminal – 12 VDC

These power consumption figures represent the typical power drawn by a single low power 1400 MHz 1+0 terminal measured at the input to a low power +12 VDC power supply.

Power Consumption (min – max)	34 to 53 W Input power (dependent on interface cards fitted and transmitter output power level)
Terminal only:	
TX power of + 20 dBm	34 W
TX power of + 24 dBm	40 W
Interface cards:	
QJET four port E1 card	1.9 W (four ports operating)
Q4EM four port 4W E&M card	0.53 W (all states)
QV24 four port V.24 card	0.15 W (all states)
DFXO two port 2W FXO card	0.56 W (all states)
DFXS two port 2W FXS card	One DFXS card installed with both ports idle (on hook): 2.1 W Plus: 1.6 W / line off-hook (200 ohm copper loop plus 450 ohm telephone) 0.8 W / line ringing (60 Vrms 25Hz source via 100 ohm copper loop into a 1 REN load) 1.2 W / line ringing (45 Vrms 25Hz source via 100 ohm copper loop into a 3 REN load)
HSS single port high speed data	0.85 W (all states)

Protection System Specifications

MHSB Protection

MHSB switches	Switching time	< 25 ms from detection of alarm condition
	Switch hysteresis	30 seconds (to prevent switching on short alarm transients)
	RF path restore time	< 10 seconds
RF switch	TX relay / cable loss	≤ 1.0 dB
	RX splitter / cable loss	≤ 4.0 dB
	Total system loss	System gain reduced by a maximum of 5 dB
Tributary switch	Ports	8

HSD Protection

TX path	TX relay / cable loss	≤ 1.0 dB
Switching times	Transmit path	< 25 ms from detection of alarm condition
	Receive path	Hitless

General Specifications

Environmental

Operating range	-10 to +50˚ C
Storage range	-20 to +70˚ C
Humidity	Maximum 95% non-condensing
Acoustic noise emission	59 dBA (A-weighted Sound Power Level)

Mechanical

Height	Standard terminal 2 U high (internal duplexer) 3 - 4 U high (depending on external duplexer type) MHSB terminal 6 U high (internal duplexer) 7 - 8 U high (depending on external duplexer type) HSD terminal 4 U high (internal duplexer) 6 - 8 U high (depending on external duplexer type)
Width	19-inch rack mount 434 mm (without mounting brackets attached) 483 mm (with mounting brackets attached)
Depth	372 mm
Colour	Pure black
Weight	Standard terminal 8 kg (internal duplexer) 9 - 12 kg (depending on external duplexer type) MHSB terminal 25 kg (internal duplexer) 26 - 29 kg (depending on external duplexer type) HSD terminal 17 kg (internal duplexer) 19 - 24 kg (depending on external duplexer type)

ETSI Compliance

Radio	EN 301 751, EN 300 630 EN 302 217 Parts 1, 2.1, and 2.2
EMI/EMC	EN 301 489 Parts 1 & 4
Safety	EN 60950 CSA 253147 applicable for AC, 48 VDC and 24 VDC product variants
Environmental	ETS 300 019 Class 3.2

19. 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 Limited 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 XE terminal, contact us (on page 19).

20. Abbreviations

ADC	Analogue to Digital Converter
ADPCM	Adaptive Differential Pulse Code Modulation
ADSL	Asymmetrical Digital Subscriber Line
AGC	Automatic Gain Control
AMP	Amplifier
BER	Bit Error Rate
CAS	Channel Associated Signalling
CPE	Customer Premises Equipment
CLI	Calling Line Identification
DAC	Digital to Analogue Converter
dB	Decibels
dBc	Decibels relative to carrier power
dBm	Decibels relative to 1 mW
dBr	Decibels relative to the transmission reference point
DCE	Data Communications Equipment
DTE	Data Terminal Equipment
DTI	Digital Trunk Interface
E&M	Ear and Mouth
EMC	Electro-Magnetic Compatibility
EMI	Electro-Magnetic Interference
ESD	Electro-Static Discharge
ETSI	European Telecommunications Standards Institute
FAS	Frame Alignment Signal (E1 frame)
FEC	Forward Error Correction
FFE	Feed Forward Equalizer
F/W	Firmware
FXO	Foreign Exchange Office
FXS	Foreign Exchange Subscriber
GSM	Global System for Mobile communications
HSC	Hardware Software Compatibility
HSS	High-Speed Synchronous Serial
H/W	Hardware
IC	Integrated Circuit
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
LOS	Loss of Signal
mA	Milliamps
MAC	Media Access Control
Mbit/s	Megabits per second
MHSB	Monitored Hot Standby
MHz	Megahertz
MIB	Management Information Base
MTBF	Mean Time Between Failures
MTTR	Mean Time To Repair
ms	milliseconds
NFAS	Not Frame Alignment Signal (E1 frame)
NMS	Network Management System
OSI	Open Systems Interconnection
PABX	Private Automatic Branch Exchange
PBX	Private Branch Exchange
PC	Personal Computer
PCM	Pulse Code Modulation
PCA	Printed Circuit Assembly
PLL	Phase Locked Loop
POP	Point of Presence
POTS	Plain Old Telephone Service
ppm	Parts Per Million
PSTN	Public Switched Telephone Network
PMR	Public Mobile Radio

QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keying
RAI	Remote Alarm Indicator
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
TETRA	Terrestrial Trunk Radio
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
VoIP	Voice over Internet Protocol
WEEE	Waste Electrical and Electronic Equipment

21. Acknowledgments and Licensing

The Aprisa XE product software runs the GNU Linux Operating System and incorporates several other packages in accordance with the free software philosophy.

The following list identifies the licensed software used:

BusyBox

Description: Tiny versions of common UNIX utilities

Reference: http://busybox.net/

License Type: GNU General Public License (GPL)

DropBear SSH Server

Description: Small and secure SSH Server

Reference: http://matt.ucc.asn.au/dropbear/

License Type: MIT Style License

GoAhead WebServer 2.1

Description: Embedded Web Server

Reference: http://webserver.goahead.com/

License Type: Private License

Linux Kernel

Description: Linux Kernel version 2.4.26

Reference: http://www.kernel.org/

License Type: GNU General Public License (GPL)

Net-SNMP

Description: Various tools relating to SNMP

Reference: http://www.net-snmp.org/

License Type: CMU/UCD and BSD License

uClibc

Description: C library for embedded Linux systems

Reference: http://uclibc.org/

License Type: GNU Lesser General Public License (LGPL)

U-Boot

Description: Bootloader

Reference: http://u-boot.sourceforge.net/

License Type: GNU General Public License (GPL)

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Dropbear SSH Server (MIT License)

Dropbear—a SSH2 server

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Net-SNMP

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Part 5: Sparta, Inc. (BSD)

GoAhead WebServer (Private License)

22. Commissioning Form

APRISA XE COMMISSIONING FORM

Site name		
Terminal name		
IP address	A:	B:
Serial number	A:	B:
Installation date		
Channel size		

Remote site name		
Remote terminal name		
Remote IP address	A:	B:

RX frequency	
TX frequency	
TX power	
Modulation	
RSSI	
Fade margin	
SNR	
BER	period

Cross-connection configuration file saved	☐

Notes

Name
Signature
Date

23. Index

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