PRODUCT DESCRIPTION

Aprisa XE Product Description

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1.0 INTRODUCTION

Aprisa radios operate in a number of frequency bands from 300 MHz up to 2.7 GHz carrying Internet, voice and data traffic over long distances up to 100 kilometers. They are designed to meet the demands of a wide range of low to medium capacity access and backhaul applications. The Aprisa XE digital access radio is a compact, powerful point-to-point linking solution with up to 16 Mbps capacity, and customer-configurable interface options integrated within the radio platform.

Figure 1 – 4RF Aprisa

The 4RF design philosophy is to engineer high-performance characteristics and operating features to provide customers with:

- superior performance and spectral efficiency
- integrated customer-configurable interfaces
- straightforward integration into their networks.

These attributes, integrated into every one of our Aprisa™ digital access radios, deliver network operators greater control and enhanced operational independence. They are a catalyst for creating a competitive advantage and building value opportunities in networks around the world.

Key differentiators of the Aprisa XE from other radio solutions are the flexible multiplexing architecture integrated within the radio platform. An in-built micro cross-connect switch combined with a full range of analog and digital customer interface options provide the adaptability to suit many applications. The high performance radio platform provides class leading spectral efficiency and high system gain for robust long distance linking.

Aprisa XE is simple to install and commission. The embedded 4RF SuperVisor management software is an easy-to-use application, pre-loaded into an integrated web-server within the Aprisa XE. SuperVisor uses SNMP and runs on any Java™ enabled web browser. The Java based application requires no training and assists network operators in reducing integration and ongoing support costs.

Aprisa XE meets all relevant directives and is designed and engineered to be compliant to world standards including ETSI specifications ensuring excellent performance for congested radio sites.

APRISA XE FEATURES

- Spectrally efficient 16, 32 and 64 QAM modulation
- QPSK modulation for higher system gain
- Capacities from 400 kbps (6 x DS0) up to 16 Mbps (8 x E1)
- Several channel sizes from 250 kHz to 3.5 MHz
- A full E1 (2 Mbps) bearer in just 500 kHz of spectrum
- Integrated 4-port ethernet switch
- Available in various frequency bands from 300MHz to 2.7 GHz
- Integrated digital cross-connect.
- Customer-configurable interface options for data and voice traffic
- Complies with international standards including ETSI
- Modular design reduces the mean time to repair (MTTR)
- Embedded Java™ enabled SuperVisor™ element management software
- Integrated SNMP for network management
- Intelligent protection with errorless RX switching
- 19” rack mounting

FREQUENCY BANDS

Aprisa XE has been designed to operate in a number of licensed frequency bands used internationally for linking applications. The standard frequency ranges are:

- 400 MHz band - 330 to 470 MHz
- 700 MHz band - 689 to 806 MHz
- 800/900 MHz band - 790 to 960 MHz
- 1400 MHz band - 1350 to 1550 MHz

Each frequency variant is synthesized and customer tunable across the entire frequency range maximizing deployment flexibility. Other frequency bands are being developed, please contact 4RF for availability details. The duplexer is factory tuned with the pass band centered on the specific operating frequency required. Duplexers may be customer tuned at a depot level repair facility with appropriate test equipment or returned to 4RF as needed for re-tuning.

CHANNEL SIZES AND CAPACITIES

The table below shows the data rates available for each licensed frequency channel size and modulation type. Increasing the data capacity of each Aprisa radio involves selecting a higher modulation rate using the Aprisa SuperVisor software. You can select QPSK, 16, 32 and 64 QAM for all channel sizes.

Channel Size		QPSK	16 QAM	32 QAM	64 QAM
250 kHz	Gross Data Capacity	408 kbps	840 kbps	1000 kbps	1224 kbps
	Equivalent E1 *Wayside*	6 x DS0 *24 kbps*	13 x DS0 *8 kbps*	15 x DS0 *40 kbps*	19 x DS0 *8 kbps*
500 kHz	Gross Data Capacity	824 kbps	1656 kbps	2072 kbps	2488 kbps
	Equivalent E1 *Wayside*	12 x DS0 *56 kbps*	25 x DS0 *56 kbps*	1 x E1 *8 kbps*	1 x E1 *424 kbps*
1 MHz	Gross Data Capacity	1680 kbps	3368 kbps	4208 kbps	5056 kbps
	Equivalent E1 *Wayside*	26 x DS0 *16 kbps*	1 x E1 *1304 kbps*	2 x E1 *80 kbps*	2 x E1 *928 kbps*
1.75 / 2.0 MHz	Gross Data Capacity	2872 kbps	5752 kbps	7192 kbps	8632 kbps
	Equivalent E1 *Wayside*	1 x E1 *808 kbps*	2 x E1 *1624 kbps*	3 x E1 *1000 kbps*	4 x E1 *376 kbps*
3.50 MHz	Gross Data Capacity	5504 kbps	11072 kbps	13888 kbps	16640 kbps
	Equivalent E1 *Wayside*	2 x E1 *1344 kbps*	5 x E1 *704 kbps*	6 x E1 *1472 kbps*	8 x E1 *128 kbps*

Table 1 – Channel Sizes and Capacities

The data rates shown above show are the gross data rates available in each RF channel. Also shown is the equivalent E1 capacity with the wayside capacity. Wayside capacity may be allocated to any interface including the 2-wire or 4-wire cards or the integrated ethernet ports. The data rates shown above are gross data capacity and an allowance for management should be allowed for.

PERFORMANCE

The Aprisa product family has been designed with enhanced features to provide robust, reliable, 'carrier-class' transmission performance for long and challenging paths. Reed Solomon forward error correction (FEC) delivers exceptional data integrity and improves the 10^{-6} BER performance by at least 2 to 3 dB, while the multi-tap equalizers optimize Aprisa's multi-path performance. Advanced digital filters provide optimum protection against adjacent channel interference, allowing maximum frequency reuse.

Spectrum efficient 16, 32 and 64 QAM modulation maximizes data throughput in narrow radio channels reducing frequency licensing costs. QPSK modulation provides increased gain for very long obstructed paths.

INTEGRATED MULTIPLEXER AND CROSS-CONNECT.

Unlike many radio solutions available today, Aprisa XE provides primary multiplexing options built-in to the radio without the need for external equipment. The Aprisa XE has eight interface card slots that can be fitted with one of several interface card options with their terminations presented on the front panel.

All Aprisa XE radios come with *an* ***integrated 4-port Ethernet Switch as standard***. The Ethernet Switch supports VLAN tagging and QoS for customer traffic and management traffic.

Other interface card options include:

- Dual 2-Wire FXS Subscriber (PCM/ADPCM)
- Dual 2-Wire FXO Exchange (PCM/ADPCM)
- Quad 4-Wire E&M (PCM/ADPCM)
- Quad E1 – 2 Mbps G.703/4
- Quad Asynchronous V.24/RS-232 low speed data.
- Single Synchronous Serial interface[1]

One of the key features giving Aprisa XE its adaptability is an embedded cross-connect switch. The cross-connect allows distribution of capacity to each of the interfaces. The Aprisa XE is capable of distributing traffic to anyone of the possible 32 interface ports as well as the integrated Ethernet interface. This provides the flexibility to reconfigure traffic as the network demand changes, or grooming of user traffic onto E1 bearers between equipment.

An example could see a typical E1 bearer distributed as follows:

- Four 64 kbps PCM 2-wire voice circuits.
- CAS signalling using 64 kbps
- Four 9600 bps V24 circuits each using 24 kbps.
- One X.21 circuit carried on 128 kbps.
- One Ethernet 100/10Base-T circuit carried on 384 kbps.
- 16 timeslots for fractional E1 traffic using 1024 kbps.
- Management channel using 64 kbps.

[1] Supported interfaces include V.24/RS-232, V.36/RS-449, V.35, X.21 and EIA 530.

ETSI PERFORMANCE STANDARDS

Aprisa has been designed to comply with the European Telecommunications Standards Institute (ETSI) specifications as follows:

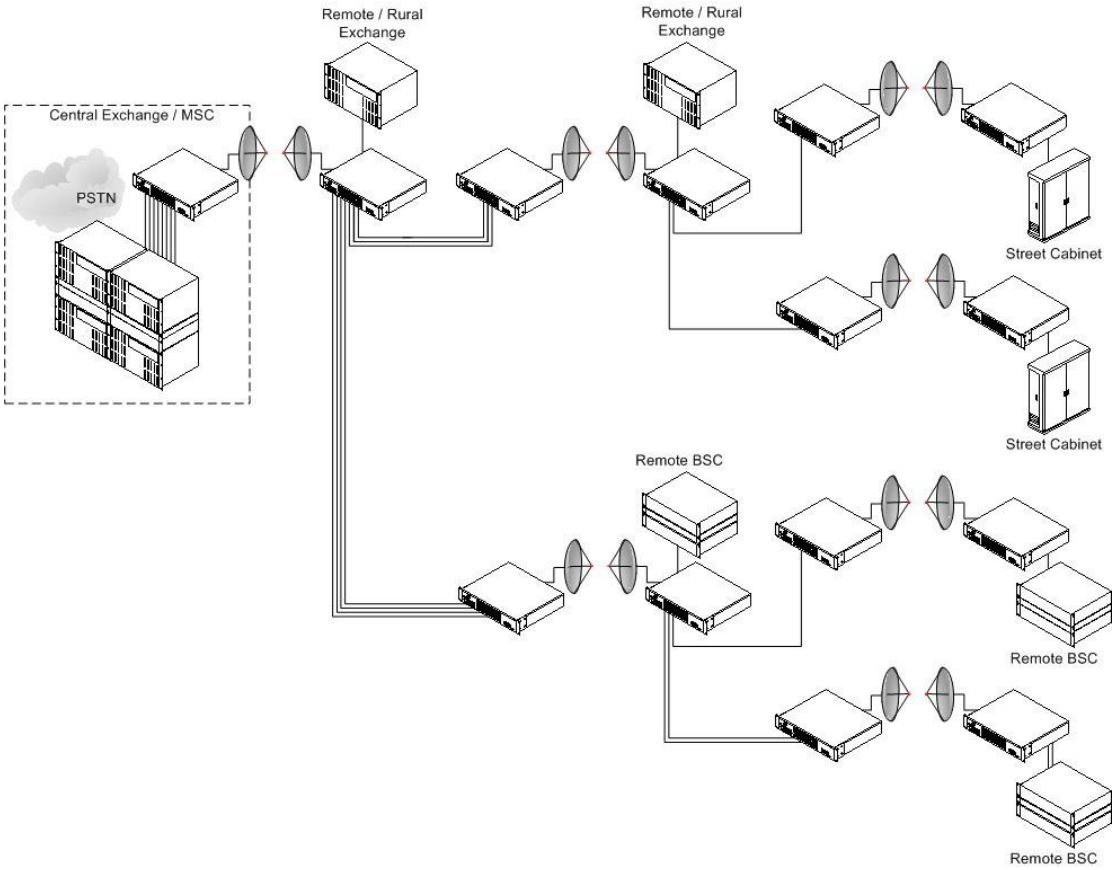
- Radio performance – EN 300 630 class 3 & EN 301 751
- EMI/EMC – EN 301 489 Parts 1 & 4
- Environmental – EN 300 019, Class 3.2
- Safety – EN 60950

The 1.4GHz band is specifically tested and compliant to the ETSI radio specifications and suitably displays the CE logo. Other bands are compliant to the same radio performance specifications as adapted by 4RF and therefore may be used in regions where compliance requirements demand CE performance at other frequencies.

2.0 APPLICATIONS

TELECOMMUNICATIONS AND CELLULAR BACKHAUL

The Aprisa XE is an ideal solution for extending the reach of both the wired and cellular telecommunications networks. The frequencies offered in the Aprisa XE allow it to operate in rough terrains over longer paths than the traditional point-to-point radio systems. This gives Aprisa XE far greater reach for the operator while maintaining the same grade of service as the wired backhaul network. Spectrally efficient design maximizes the amount of data that can be carried in narrow channels minimizing spectrum licensing costs. The Aprisa XE point-to-point digital microwave radio solution is a simple cost effective means of expanding the backhaul and distribution network for inter-exchange and cell site linking.

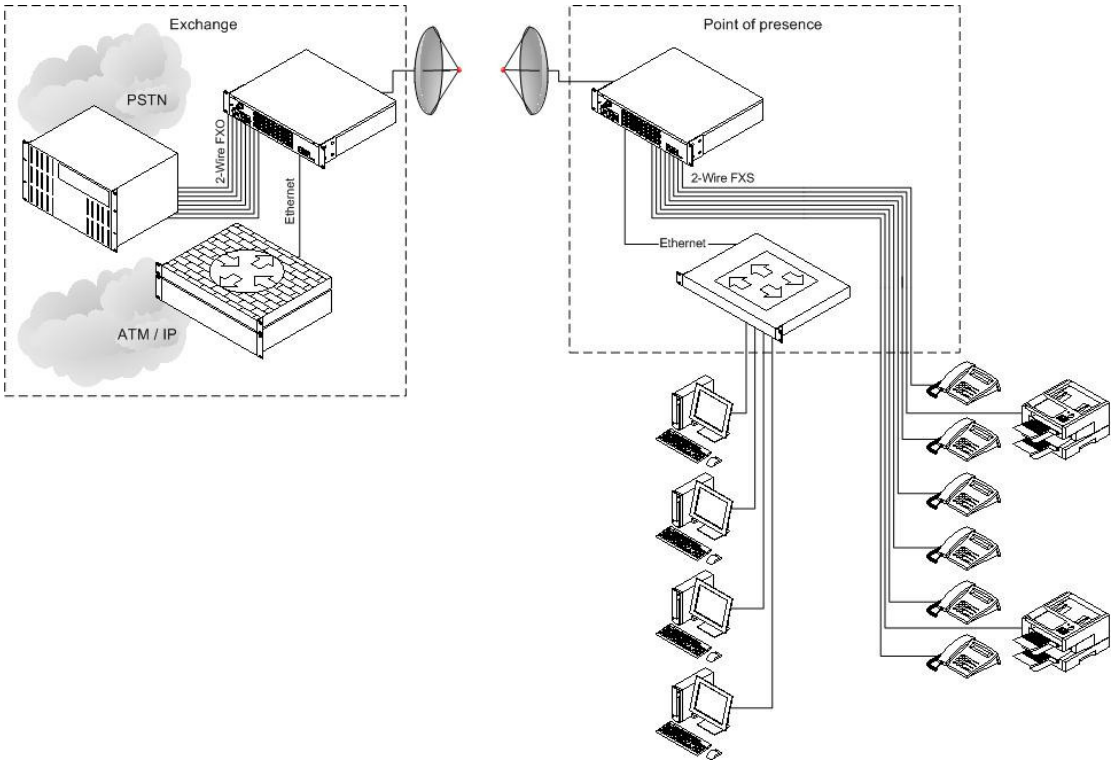


Aprisa XE can groom traffic from multiple interface's onto a common backhaul system from remote exchanges or cell sites back towards the central exchange or MSC. This minimizes the amount of infrastructure required in the transport network. Traffic from several fractional E1 interfaces at the far end can be groomed onto a single E1 at the local end minimizing the number of interfaces required to carry the various traffic types back to the core of the network.

The integrated ethernet interface gives the operator the capability to add broadband access and evolve their networks to IP, as and when required. When demand justifies the expansion of the wired network to the radio site, the Aprisa XE can be easily re-deployed else where in the network.

SUBSCRIBER ACCESS – POTS AND ETHERNET

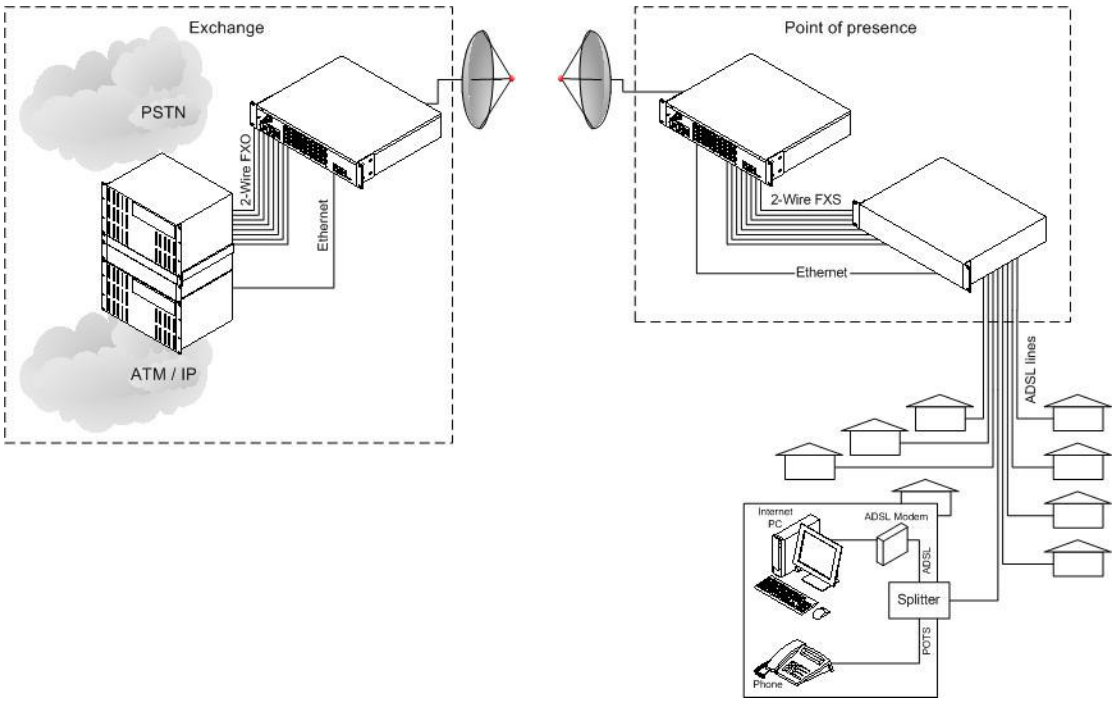
Aprisa XE is the ideal radio solution for delivering new broadband access and traditional POTS services to remote businesses and low-density subscribers. Aprisa XE point-to-point digital microwave radio solutions allow operators too quickly and cost effectively deploy new services to remote communities and businesses. Operators can quickly realize revenue and in many cases profitably answer government imperatives to deliver broadband services to remote subscribers.



Aprisa XE has a built in multiplexer that allows a wide range of analog and digital interfaces to be fitted to the chassis. This gives operators the flexibility to provide a wide range of voice and data services to remote subscribers minimizing the need for external infrastructure such as multiplexers and cross connects, CSU/DSU's and protocol converters. An integrated layer-2 ethernet switch also allows the delivery of a wide range of broadband enables services including Internet, VPN and LAN interconnection, VoIP, Video-conferencing, web-hosting and E-business applications.

DSL EXTENSION

Aprisa XE is the perfect partner for broadband xDSL systems. The wired network can be extended to remote communities using Aprisa XE point-to-point digital microwave radio. In many cases, xDSL services are not offered in remote areas where subscriber densities are to low as it is to expensive to deliver the service using traditional methods.



Aprisa XE's integrated multiplexer allows a mix of voice and data interfaces can be integrated into the one radio link. The Aprisa XE can be used to transport traditional POTS services using the 2-wire FXO/FXS interface. DSL services can be transported across the link using either ethernet for PPPoE systems or Inverse multiplexed ATM over E1 (IMA E1) for PPPoA systems to an existing remote POP. At the remote POP, a "mini" DSLAM can terminate the data network and POTS service and deliver both POTS and broadband xDSL using existing copper to the subscriber.

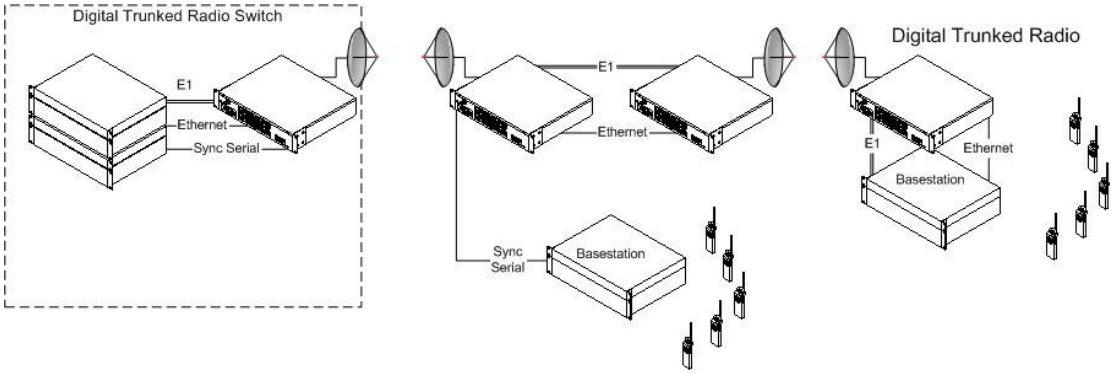
Many vendors now offer "mini" DSLAM type products that support 4 to 60 xDSL ports and are small enough to be mounted in street cabinets.

MOBILE RADIO

Trunked / public mobile, analog and digital radio networks often require low to medium capacity base station sites for permanent or temporary use. The flexibility of the Aprisa XE architecture allows support for a wide range of both analog and digital based mobile radio networks. The Aprisa XE is used to inter-connect base stations and provide a reliable backhaul to centralized switches. In trunked mobile radio networks, point-to-point digital microwave radio can provide cost effective in-band or out of band linking and is a replacement for expensive leased wire-line circuits. It also has the added advantage that it can be easily redeployed in the case of an emergency.

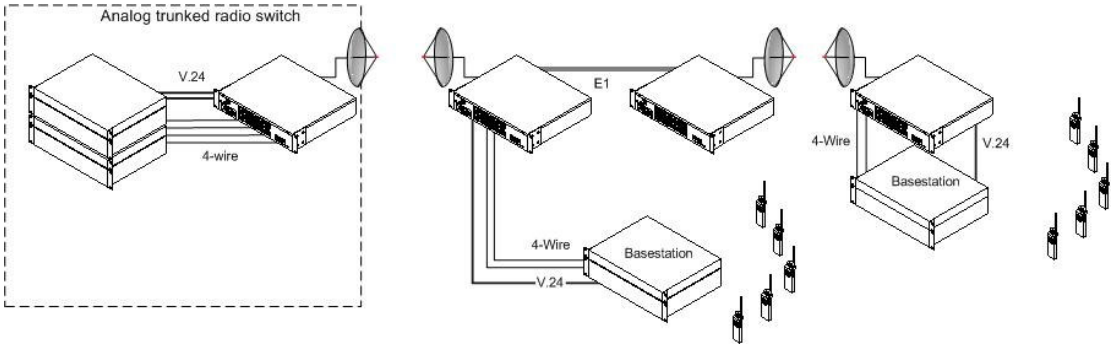
Digital mobile radio networks.

Digital mobile radio networks such as Tetra, Tetrapol, Apco-25 / P-25 and other types of digital trunked radio are well served by Aprisa XE. The digital interfaces offered in the Aprisa XE including E1, Ethernet and synchronous serial such as X.21 and V.35.



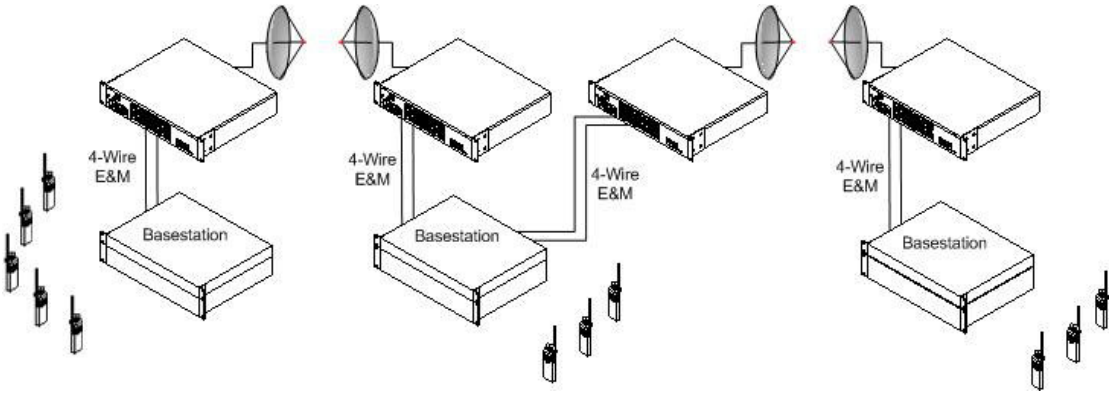
Analog trunked radio.

MPT-1327 analog trunked radio networks are supported by Aprisa XE. The integrated multiplexer allows for multiple 4-wire audio and V.24 signaling circuits to be carried across the radio link. At intermediary sites, interfaces can be dropped from one radio to a base station or passed across to a second or third hop. Traffic destined for a second or third hop may be encapsulated within an E1 bearer and extracted from the E1 bearer at the final destination where in can be passed onto the base station using 4-wire audio and V.24. The drop and insert capability of the cross-connect allows for simple traffic management across the network.



Conventional radio

Conventional mobile radio is easily accommodated using 4-wire interfaces with E&M signaling. E&M provides the signaling to key the transmitter and receiver and the audio is carried as standard PCM or ADPCM traffic. The Aprisa XE solution can also be easily integrated into more complex conventional networks that may use voters or conferencing bridges.



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UTILITIES

The flexible interfacing architecture of the Aprisa XE makes it the logical building block for utility communication infrastructures. Utility networks such as those used in electricity, oil, gas, railways and mining cover a wide area operating in remote locations over difficult terrain. There is generally a need to interface to a wide range of infrastructure equipment including legacy analog equipment, IP based SCADA equipment, telemetry and teleprotection equipment, as well as traditional voice or PBX and corporate LAN data equipment.

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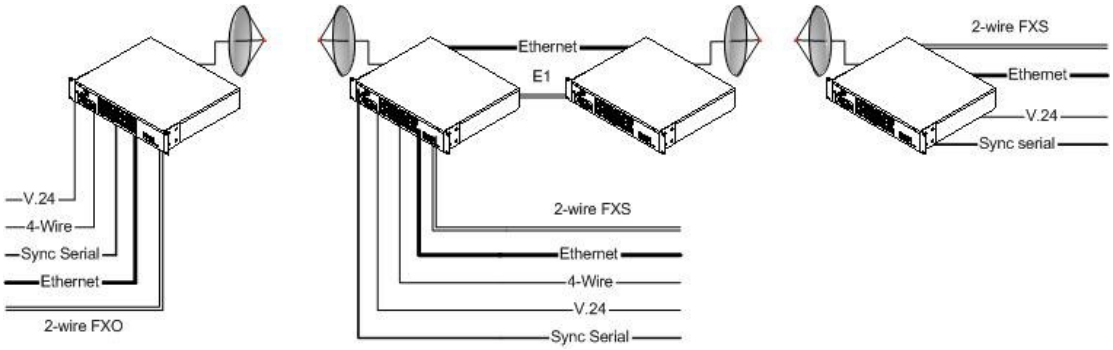
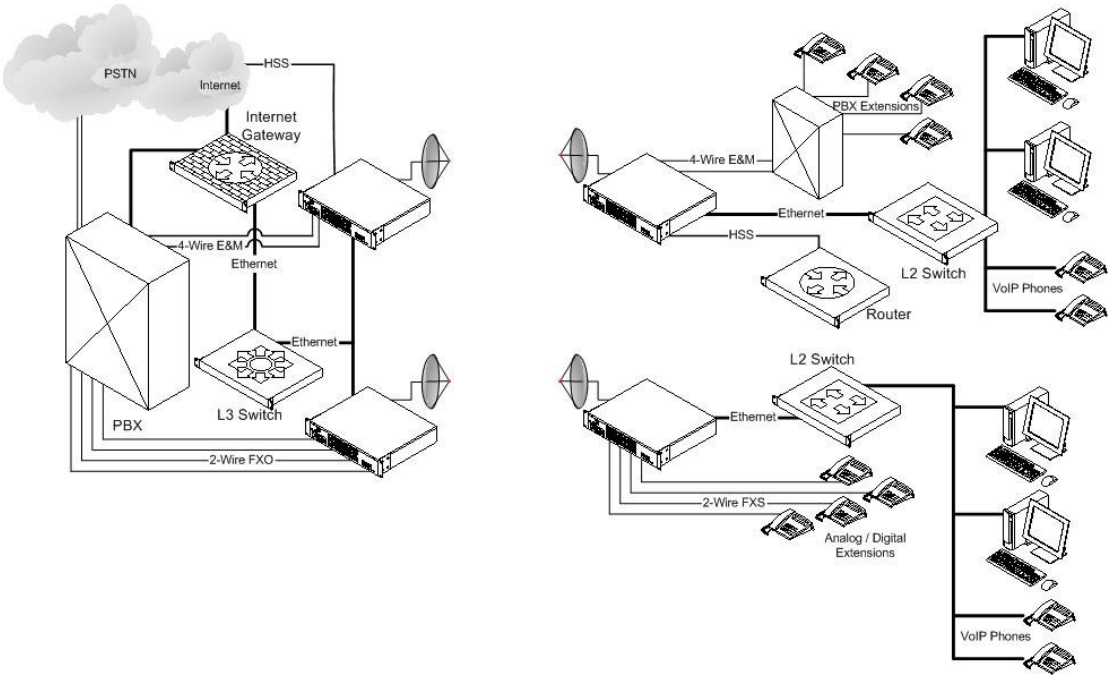


A mixture of interface types can be fitted to transport analog or digital traffic to support both legacy and next generation network equipment. Common use would include support for 4-Wire interfaces for protection signaling equipment, Asynchronous or Synchronous serial interfaces for low and high speed data terminal equipment, ethernet for IP-based SCADA systems and telemetry equipment and 2-wire interfaces for voice circuits.

The Aprisa XE can aggregate and efficiently transport all the traffic from various sources across a common radio link. The integrated multiplexer and radio allows utilities to reduce the amount of infrastructure required in the network reducing capital and operational costs in-turn lowering the total cost of ownership for the network.

PRIVATE NETWORKS

Aprisa XE is a cost effective solution for linking offices in a private network. A private network such as those used by large corporate organizations, government, military, international relief and protection agencies need to link their remote offices back to a central office which is often the hub for the voice and data network.



The in-built multiplexer and flexible interfacing architecture offers a single box solution with the flexibility to support a wide range of voice and data interfaces for linking remote PBXs to a central PBX, extending extensions and delivering the corporate LAN to the remote offices.

Operating Aprisa XE in a private network minimizes the dependency on the service provider and the cost of the equipment can be amortized over the life of the link saving the ongoing charges of an expensive leased line.

Aprisa XE also has the added benefit of dedicated bandwidth. You are no longer reliant on a service provider offering a connection that may be shared across several different customers. The licensed frequency gives long term reliability along with security and high availability. It also has the added benefit of being easy to redeploy in the case of office relocation in the event of an emergency or disaster.

3.0 ARCHITECTURE

MODULAR DESIGN

Aprisa XE is modular in design which helps reduce mean time to repair (MTTR). Aprisa is designed for 19-inch rack mounting and is only 2U high[2].

The five main modules housed inside the chassis are the RF Brick, Modem, Motherboard, Power Supply and Duplexer. Interface Cards are fitted into PCI type slots on the Motherboard. Modules are interconnected via several buses on the Motherboard. A duplexer can be mounted inside or outside the chassis.

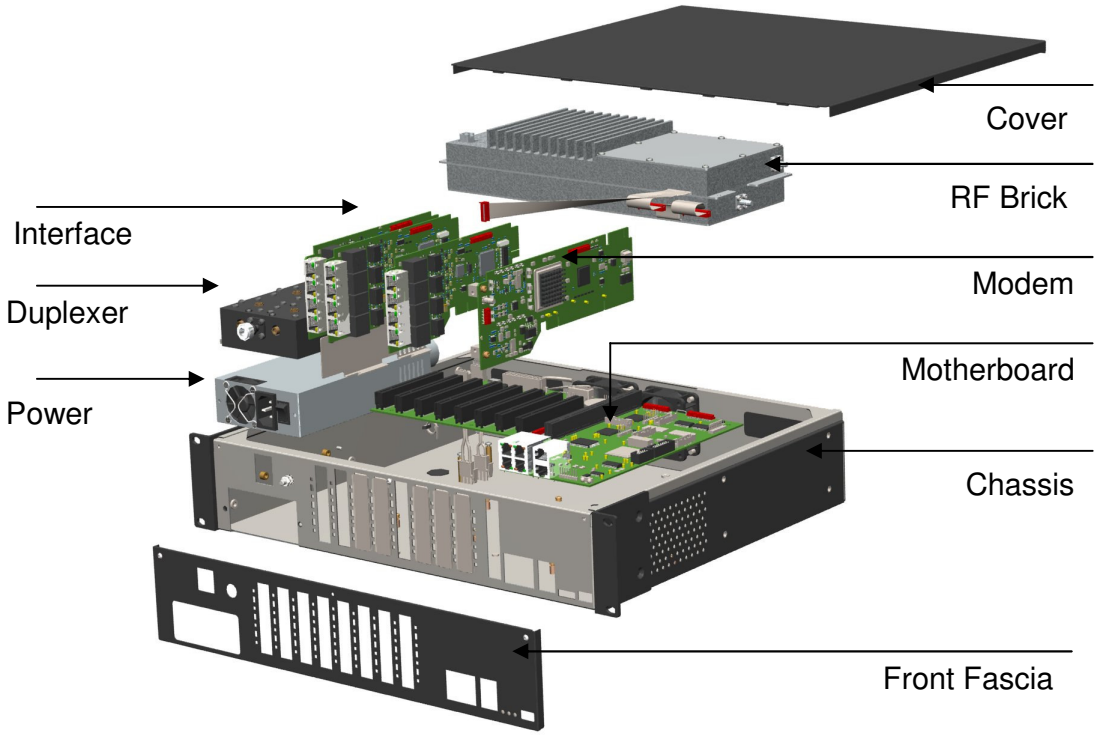


Figure 2 - Architecture

[2] Internally mounted duplexer.

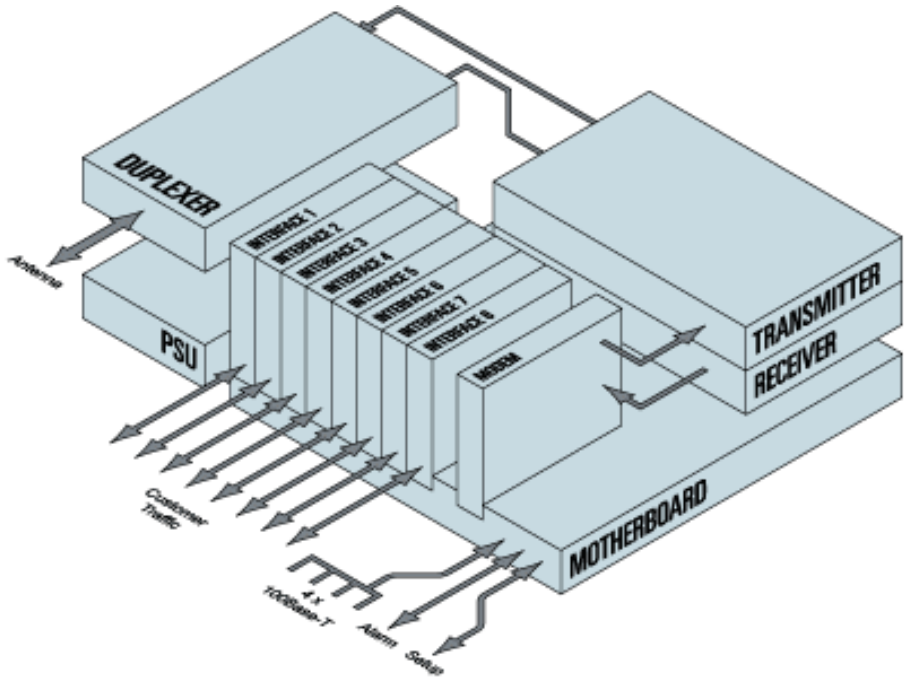


Figure 3 – Block Diagram

FRONT PANEL CONNECTIONS AND INDICATORS

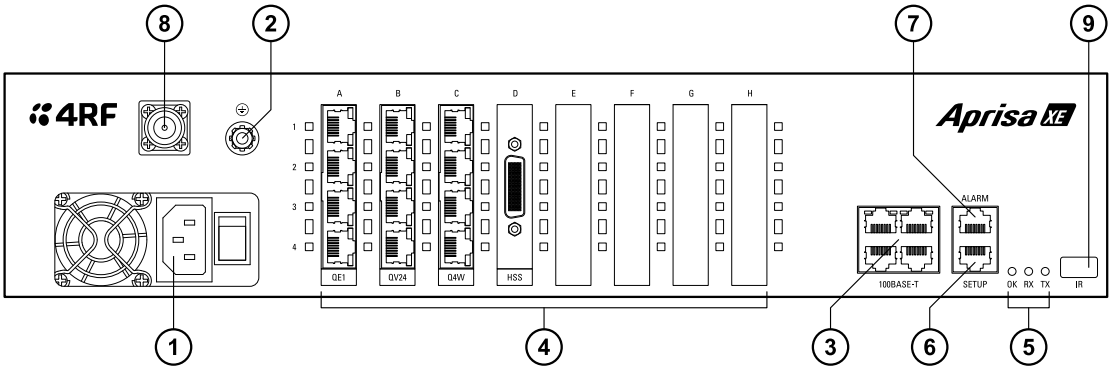


Figure 4 - Front Panel

No.	Label	Description
1	AC / DC Input	Two types of power supply are supplied. AC power supplies come with IEC power cable and country specific plug. DC power supplies are supplied with a pre-terminated cable suitable for connection to a terminal block.
2	Protective Earth	An M5 terminal intended for connection to an external protective conductor for protection against electric shock in case of a fault.
3	Ethernet	Integrated 4-port layer 2 switch.
4	Interface Slots	Eight PCI type slots are available on the motherboard to fit interface cards to. Please refer to Section 4 on page 23 for Interface options.
5	LEDs	Three tri-color LEDs indicate the operational status of the link.
	OK	LED indication for normal operation and minor/major alarm conditions.
	RX	LED indication for receive path status including normal operation and alarms such as BER, RSSI and loss of sync.
	TX	LED indication for transmit path status including normal operation and alarms such as forward/reverse power and temperature.
6	Setup	RJ-45 for initial configuration PC connection.
7	Alarms	RJ-45 connector for 2 input and 2 output alarm connections.
8	Antenna	50Ω N-type male connector.
9	IR	Infra-red port for use with IR capable devices.

RECEIVER

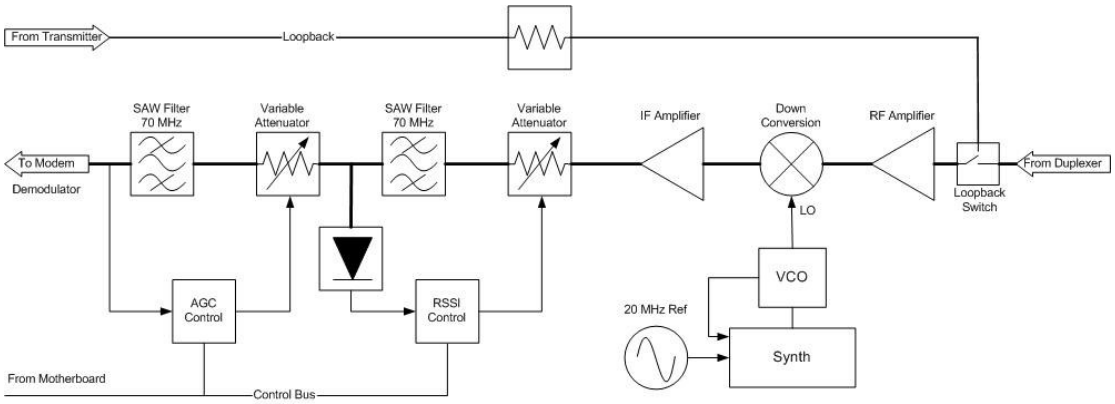


Figure 5 - Receiver Block Diagram

The receiver provides low-noise amplification and downconversion of the received signal ready for the demodulation by the modem. The incoming signal is downconverted at the receive frequency set by the synthesizer. The receive frequency synthesizer tunes the receiver across the entire band of operation.

The 70 MHz intermediate frequency (IF) is amplified and passed through a channel filter to provide the main receiver selectivity and to reject unwanted mixing products. An appropriate channel filter is fitted during production for 250 & 500 kHz, 1.0, 1.75 / 2.0 and 3.5 MHz channel sizes.

Receive Signal Strength Indication (RSSI) is monitored after the last IF amplifier stage and then the signal gain is adjusted to a level suitable for the modem.

TRANSMITTER

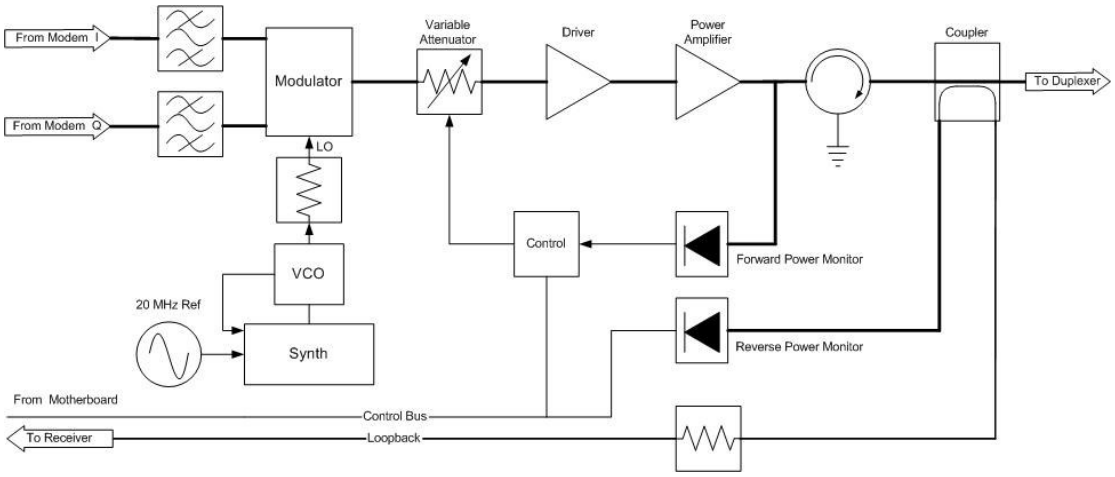


Figure 6 - Transmitter Block Diagram

I and Q signals from the modem modulator are passed to the transmitter modulator where the final transmit frequency is set by a transmit frequency synthesizer. The final transmit frequency is passed through a multi-stage high efficiency linear RF amplifier and associated forward power detection and control feedback loop.

The RF output signal is passed through a circulator that provides VSWR protection before being delivered to the duplexer. The circulator prevents reverse power damage to the transmitter caused by antenna return loss or no-load situations. A reverse power measurement is taken from the circulator to detect VSWR conditions.

DUPLEXER

The duplexer is an integral component in the Aprisa radio circuit, providing specific transmission mask refinement and transmitter image rejection as well as providing RF isolation between the transmitter and receiver sections, enabling a single antenna to be used. It incorporates several bandpass / wavelength filter sections for the transmit and receive paths.

MODEM

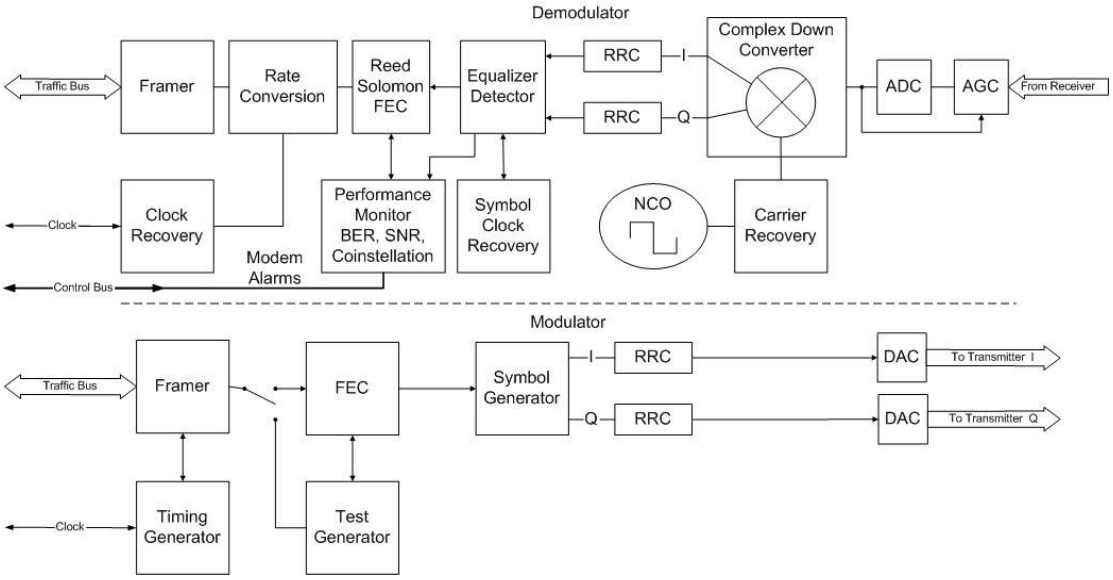


Figure 7 - Modem Block Diagram

The modem provides the QPSK and QAM modulation and demodulation functions for Aprisa. The modem modulation rate is software configurable to deliver the appropriate data rate for each available channel size.

In the receive direction the modem converts the incoming analog signal to digital and down converts into I&Q signals for processing. The I&Q signals are passed through digital filtering and adaptive equalization. The resultant signal is error corrected and performance data extracted. Data is rate converted and framed and passed onto the traffic bus for use by the interface cards. The modem also provides a recovered clock from the incoming received signal.

In the transmit direction data from the traffic bus is framed with timing and FEC information added. The modulator provides a test generation function that can be used when testing the radio link to confirm modem and RF functions are working independent of the interface data. I&Q signals created by the symbol generator are passed onto through Digital to Analog converters before being passed onto the transmitter at the base band frequency. The Aprisa XE uses direct modulation technology and there is no IF or up conversion stages in the modulator or transmitter.

The modem provides link performance monitoring data including error counts, Signal to Noise Ratio (SNR) and constellation information.

MOTHERBOARD

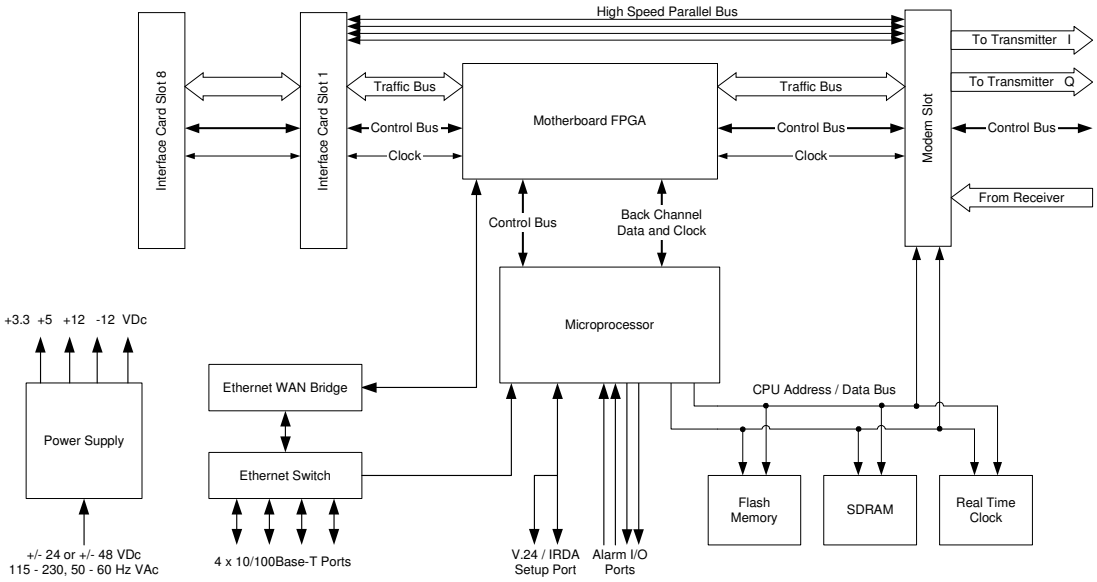


Figure 8 - Motherboard Block Diagram

The motherboard contains the central microprocessor and traffic management control for the radio, including the traffic multiplexing and cross-connect functions.

The motherboard uses a Power PC based microprocessor with a Linux based webserver used to run the Aprisa SuperVisor browser based setup and management software. The Aprisa SuperVisor software interrogates the various elements within the radio over a control bus using SNMP and stores the variables within the webserver which can be later interrogated by any major web browser. The same software can also be used to set radio parameters such as frequencies, modulation and power levels. Parameters are fed to the webserver which in turn again uses SNMP to load these parameters into the various elements within the radio.

The FPGA manages the traffic distribution to/from the interfaces ports on interface cards fitted to PCI slots on the motherboard. The motherboard has eight standard PCI slots for interface cards and one extended PCI slot for the modem.

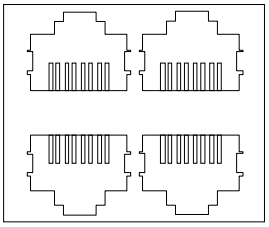
Alarms are gathered via the control bus using SNMP traps and stored in the webserver. LED indicators on the front panel show the status of the terminal. An alarm I/O port also gives users the ability to connect to external Alarm monitoring equipment and has two inputs and four outputs.

The internal power supply delivers +3.3, ± 5 and ± 12 VDC nominal inputs to the various radio elements. Power supplies are depot level changeable should the supply voltage requirement change after shipment.

4.0 INTERFACE OPTIONS

The integrated multiplexer and cross-connect built into every Aprisa XE allows users to add various interface cards into one of eight slots. These interface cards include 2-wire and 4-wire for analogue, E1 for digital and asynchronous and synchronous data interfaces. All radios have an integrated layer-2 ethernet switch as standard for ethernet and IP based traffic.

4.1 INTEGRATED QUAD PORT ETHERNET BRIDGE (10/100BASE-T) INTERFACE



10/100BASE-T

Integrated onto the motherboard of the Aprisa XE is a quad port IEEE 802.3 compatible 10Base-T / 100Base-TX layer-2 ethernet switch. Each port supports auto negotiation and auto sensing MDI/MDIX simplifying network setup. Each port can also be manually set to one of four preset modes; 10Base-T or 100Base-TX, half or full duplex. The switch supports both VLAN and Quality of Service (QoS) tagged packets and in its most basic mode will pass these extended packets as they are received.

VLAN tagging uses the IEEE 802.1Q standard and a unique ID can be set on each individual port or a group of ports. This allows radio or network management traffic to be kept separate to other types of customer traffic. By default all ports are set with the same VLAN ID and both customer and management traffic is carried on this VLAN.

To allow traffic in existing VLANS to be transported across the radio link, double tagging is supported. VLAN ID's added at the ingress port are removed at the egress port and ethernet traffic carried across the radio link in a VLAN along with the original VLAN ID is maintained. The radios VLAN ID can be set to be the same as the existing VLAN ID to simplify management or something completely different.

Each port has four priority queues to provide QoS classification. QoS is determined based on a preset order using the IEEE 802.1p standard, IPv4 Type of Service (TOS), Differentiated Services (DiffServ), IPv6 traffic class and VLAN ID.

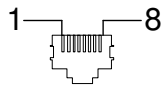
Each port can be rate limited to one of eight discrete settings; 128kbps, 256kbps, 512kbps, 1Mbps, 2Mbps, 4Mbps, 8Mbps or none. Rate limiting ensures that the interface is not flooded with traffic exceeding the available capacity of the link. If rate limiting is not set, the ethernet switch will use all the bandwidth allocated to the ethernet switch in the radio cross connect and share this across all four ports.

Flow control, used in conjunction with port based rate limiting ensures the radios traffic buffers are not flooded. QoS ensures that the traffic transmitted is always sent with higher priority traffic ahead of lower priority traffic. A high-speed address look-up engine provides a filtering and forwarding with automatic learning and aging and can support up to 2048 preferential MAC address's. This ensures that only traffic destined for the far end of the link is sent.

Ethernet Specifications

Interface	RJ-45	*Bandwidth allocation*	n x 8 kbps up to max available
Cabling	Standard ethernet	*Data buffer size*	Up to 256 frames
Maximum line length	100 m	*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 standard, IPv4 TOS DiffServ, IPv6 traffic class.		

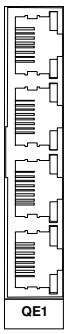
Solid Green LED – Link OK
Flashing Green LED – Data traffic



Pin number	Pin function	Direction	Wire color
1	Transmit positive	Output	Green/white
2	Transmit negative	Output	Green
3	Receive positive	Input	Orange/white
4	Not used		Blue
5	Not used		Blue/white
6	Receive negative	Input	Orange
7	Not used		Brown/white
8	Not used		Brown

Table 2- Ethernet Pinout

4.2 QUAD PORT E1 G.703/4 INTERFACE CARD

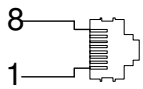


The quad port 2 Mbps G.703/4 E1 digital trunk interface allows direct connection to E1 trunks or other G.703/4 compliant equipment. Individual or multiple timeslots can be groomed from any E1 interface in Aprisa XE and transmitted across the radio on a common bearer back into the transport network.

Drop and Insert applications are also supported. Any E1 timeslot from any interface can be mapped to any other E1 timeslot on any other E1 interface, either locally or at the remote end.

E1 Specifications

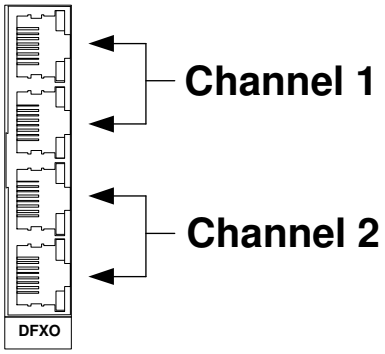
General	*Standard*	G.703 and G.704
	Interface	120 Ω balanced RJ-45
	Cabling	Crossover and straight through
	Maximum line length	Typically, up to 1.7 km (36 dB of loss in standard cat5 cable)
	Bandwidth allocation	64 kbps time slots
	Line code	HDB3
	Stability	±50 ppm
	Jitter performance	G.823 (sections 2 & 3)
Diagnostics	Local and remote alarm logging	Green LED – Link OK
	Local and remote software set loopbacks	Yellow LED – LOS



Pin number	Pin function	Direction	Wire color
1	Transmit positive	Output	Green/white
2	Transmit negative	Output	Green
3	Not used		Orange/white
4	Receive negative	Input	Blue
5	Receive positive	Input	Blue/white
6	Not used		Orange
7	Not used		Brown/white
8	Not used		Brown

Table 3 - E1 Pinout

4.3 DUAL PORT 2-WIRE EXCHANGE (FXO) INTERFACE CARD



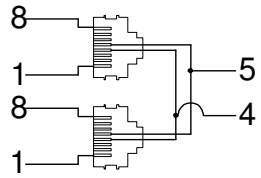
The Exchange interface connects the Aprisa terminal to the telephone network via a 2-wire line. Each 2-wire channel has two ports. One port can be used to connect to a customer and the second port is a local test port.

The analog signal is digitized using either 64 kbps PCM (G.711 compliant) or 32, 24 or 16 kbps ADPCM compression (G.726 compliant) providing phone quality voice transmission. Signaling to the remote FXS is provided using CAS. The CAS bits can be manipulated at the FXO end to match any type of signaling at the remote end.

Line impedances are synthesized via high performance DSP architecture and are fully software configurable. As a default, Balance Impedance is set to match the Line Impedance unless otherwise requested by the customer.

2-wire FXO Specifications

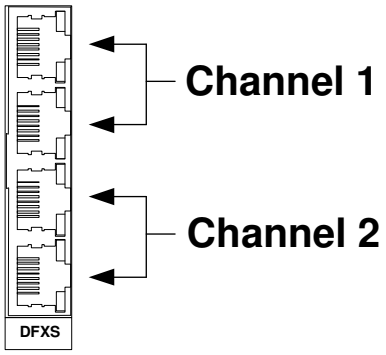
General	*Audio*	64 kbps (PCM A-law as per CCITT G.711) 32, 24 and 16 kbps (ADPCM as per CCITT G.721 and ANSI TI.303)		
	Signalling Allocation	64 kbps allocated for CAS		
	Compression coding	A-Law		
	Maximum line length	600 m (2000') on 0.4 mm / 26 AWG		
	Calling line ID (CLI)	Support provided EN 300 659-1.		
	FAX	Conforms to G3 standard for 64 kbps PCM and 32 kbps ADPCM compression.		
Analog parameters	*Payphone support*	12/16 kHz tones Line reversals	*Line impedance*	600 Ω (General) 900 Ω (General)
	Pulse dialing	Transparent, pulse distortion ≤1ms	*Options (Software set)*	600 Ω+2.16 µF (FCC part 68) 900 Ω+2.16 µF (AT&T) 270 Ω+750 Ω//150nF (TBR-021) 220 Ω+820 Ω//120nF 220 Ω+820 Ω//115nF 370 Ω+620 Ω//310nF (NZ – BT3)
	Resistance to earth	>10 MΩ		
	Loop resistance on-hook	>1 MΩ		
	Nominal level	0 dBm		
	Maximum level	+3 dBm		
	Input gain	+6 dB to –6 dB		
	Output gain	+4 dB to –26 dB		
	Physical interface	RJ-45		
Yellow LED – Off hook Green LED – Ringing				



Pin number	Pin function	Direction	Wire color
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

Table 4 - FXO Pinout

4.4 DUAL PORT 2-WIRE SUBSCRIBER (FXS) INTERFACE CARD



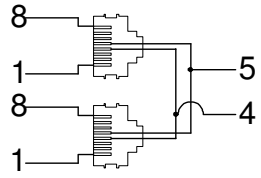
The subscriber interface connects the Aprisa terminal to the customers' 2-wire telephone via a 2-wire line. Each 2-wire channel has two ports. One port can be used to connect to a customer and the second port is a local test port.

The analog signal is digitized using either 64 kbps PCM (G.711 compliant) or 32, 24 or 16 kbps ADPCM compression (G.726 compliant) providing high quality voice transmission. Signaling is provided using CAS allowing the FXS interface to also interface directly to an E1 bearer at the remote end.

Line impedances are synthesized via high performance DSP architecture and are fully software configurable. Transhybrid balance is also software adjustable so separate balance impedance networks are not required.

2-wire FXS Specifications

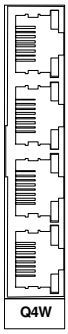
General	*Audio*	64 kbps (PCM A-law as per CCITT G.711) 32, 24 and 16 kbps (ADPCM as per CCITT G.721 and ANSI TI.303)		
	Signalling Allocation	64 kbps allocated for CAS		
	Compression coding	A-Law		
	Maximum line length	600 m (2000') on 0.4 mm / 26 AWG		
	Calling line ID (CLI)	Support provided EN 300 659-1.		
	Fax	Conforms to G3 standard for 64 kbps PCM and 32 kbps ADPCM compression		
Analog parameters	*Payphone support*	12/16 kHz tones Line reversals	*Line impedance Options (Software set)*	600Ω (General) 900Ω (General) 600Ω+2.16µF (FCC part 68) 900Ω+2.16µF (AT&T) 270Ω+750Ω//150nF (TBR-021) 220Ω+820Ω//120nF 220Ω+820Ω//115nF 370Ω+620Ω//310nF (NZ – BT3)
	Pulse dialing	Transparent, pulse distortion ≤1ms		
	Feed voltage	48 V		
	Loop current	25 mA		
	Seize signal	Loop start		
	Nominal level	0 dBm		
	Maximum level	+3 dBm		
	Input gain	+6 dB to -15dB	*Trans-hybrid balance*	>46 dB
	Output gain	+6 dB to -15dB		
	Ringer waveform	Sinusoidal		
	Ringer voltage	60 V RMS		
	Ringer frequency	Software selectable 17, 25, 50 Hz (±5%)		
	Physical interface	RJ-45		
Yellow LED – Off hook Green LED – Ringing Both LED flashing – loss of CAS signals				



Pin number	Pin function	Direction	Wire color
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

Table 5 - FXS Pinout

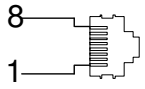
4.5 QUAD PORT 4-WIRE E&M INTERFACE CARD



The 4-wire interface digitizes the analog signals at either 64 kbps PCM (G.711 compliant) or 40, 32, 24 or 16 kbps ADPCM compression (G.726 compliant). The E&M signaling is software selectable and can be switched on or off. The E&M signaling connections have no internal voltage or earthing connections allowing them to be externally strapped to meet any of the EIA-464 types I, II,IV or V as shown on the next two pages. The E&M connections are optically isolated, bi-directional lines and can be connected with either M1/M2 or E1/E2 to earth or battery as needed. To minimize delay, only the M signal is transmitted across to the remote E signal.

4-wire E&M Specifications

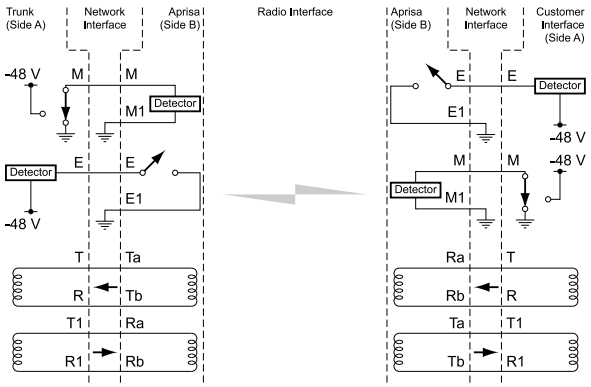
General	*Audio*	64 kbps (PCM A-law as per CCITT G.711) 40, 32, 24 & 16 kbps (ADPCM as per CCITT G.721 and ANSI TI.303)		
	E&M signaling	8 kbps per port		
	Maximum line length	400 m		
Analog parameters	*CCITT standard*	G.712	*End to end gain*	0dB ± 0.6dB (300 – 3000 Hz) 0dB ± 1.5dB (250 – 3400 Hz)
	Nominal output level	0 dBm		
	Maximum output level	+3 dBm	*Signal line protection*	Secondary protection
	Nominal input level	-10 dBm	*Signal to total distortion*	>30 dB (0 dBm0 to -30 dBm0) >22 dB (-45 dBm0)
	Maximum input level	-7 dBm		
	Dynamic range	50 dB	*Idle channel noise*	<-70 dBmp
	Normal impedance	600 Ω		
	Return loss	better than 25 dBm		
	Transformer isolation	2000 Vrms		
Signaling	*E&M*	Mode independent (External power supply required)	*E circuit impedance* *Maximum E circuit current*	45 Ω closed >100 KΩ open 100 mA
	Pulse distortion	Better than 150 µS	*E maximum voltage*	60 V
	M Loop Current	6.5mA Max (Constant current)	*E&M circuit protection*	100 V 0.5 A fuse
	M detection voltage	9 V		
	M maximum voltage	60 V		
Yellow LED – E circuit active Green LED – M circuit active				



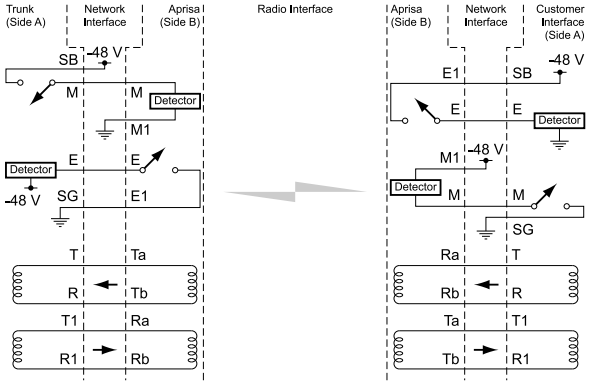
Pin number	Pin function	Direction	Wire color
1	§M_1	Input	Green/white
2	§M_2	Input	Green
3	Receive (Ra/R)	Input	Orange/white
4	Transmit (Tb/R1)	Output	Blue
5	Transmit (Ta/T1)	Output	Blue/white
6	Receive (Rb/T)	Input	Orange
7	§E_1	Output	Brown/white
8	§E_2	Output	Brown

Table 6 - 4-Wire E&M Pinout

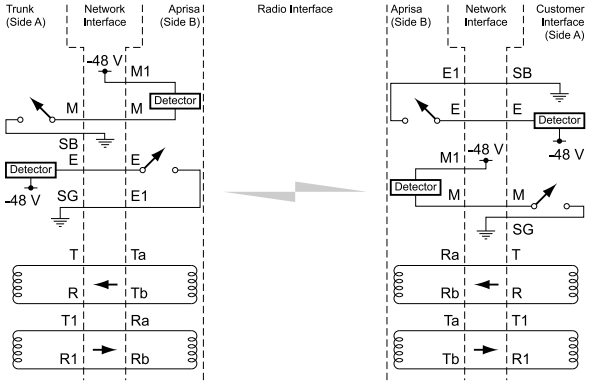
4-Wire E&M TYPE I



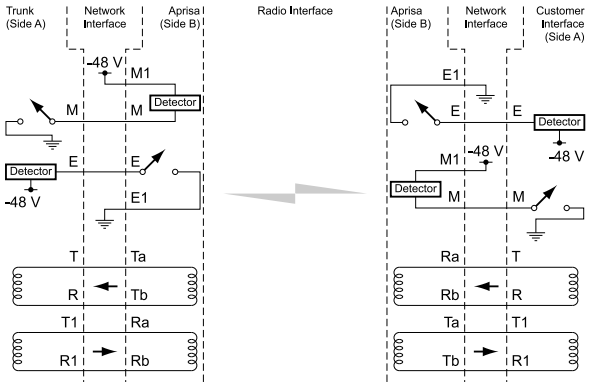
4-Wire E&M TYPE II



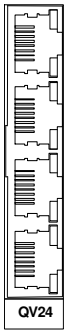
4-Wire E&M TYPE IV



4-Wire E&M TYPE V



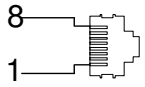
4.6 QUAD PORT ASYNCHRONOUS LOW SPEED DATA INTERFACE CARD



The EIA/TIA-232 compliant V.24/RS-232 interface is configured as a Cisco pin out DCE. The interface can be terminated to a DTE using a straight through cable; for DCE to DCE connection or a crossover cable can be used. Two control lines are used for handshaking. The CTS signal is transported across the link and will appear at the remote terminal as an RTS output. The DSR signal will appear as DTR on the remote terminal.

Asynchronous V.24 Specifications

General	*Interface*	CCITT V.24/EIA RS-232E	*Data clamp*	Mark hold when out of sync
	Bandwidth allocation	8–120 kbps *in 8kbps steps* (dependant on rate selected)	*Control line clamp*	Off when loss of sync
	Control line allocation	8 kbps	*Clock*	Internally generated from 2.048 MHz system clock (Synchronized at both ends)
	Maximum line length	10 m		
Asynchronous parameters	*Transparent mode*	Operation is completely transparent but limited to 0– 600 bps (accessed by selecting 300 bps)		
	Standard mode data bits	5,6,7,8		
	Standard mode parity	Transparent (enable / disable)		
	Standard mode stop Bits	1,2		
	Data rates	300, 1200, 2400, 4800, 9600, 14400, 19200, 28800, 38400, 57600, and 115200 bps		
Control signals	*End-to-end*	CTS-RTS, DSR-DTS		
Yellow LED – TD data traffic Green LED – RD data traffic				



Pin number	Pin function	Direction	Wire color
1	RTS	Input	Green/white
2	DTR	Input	Green
3	TXD	Input	Orange/white
4	Ground		Blue
5	DCD/Ground	Input	Blue/white
6	RXD	Output	Orange
7	DSR	Output	Brown/white
8	CTS	Output	Brown

Table 7 - Asynchronous V.24 Pinout

4.7 SINGLE PORT SYNCHRONOUS HIGH SPEED DATA INTERFACE CARD

The synchronous high speed data interface (Sync Serial) is designed to allow for flexibility. The sync serial interface will support a range of N x 64 kbps synchronous high speed data options acting as either DCE or DTE. The sync serial interface will support data rates from 8 kbps up to 2048 kbps.

Supported synchronous interfaces include V.24 / RS-232 (Sync & Async), V.36 / RS-449, V.35, X.21 and EIA 530 by using a range of cable options. Changing interface will be a simple process of changing a cable. The connector used on the sync serial interface is a high density DB-60 as used on standard Cisco® WAN port serial interface cables and equivalents.

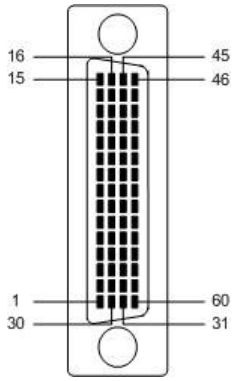
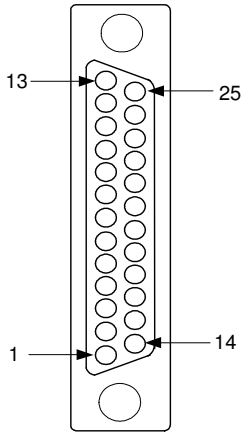
Synchronous Serial General Specifications

General	*Interfaces*	ITU-T V.24 EIA/TIA 232E ITU-T V.35 ITU-T V.36 EIA/TIA 449 ITU-T X.21 EIA/TIA 530	*Clock*	Internally generated from 2.048 MHz system clock (Synchronized at both ends)
	Bandwidth allocation	8–2048 kbps *in 8kbps steps* (dependant on rate selected)		
	Maximum line length	8 kbps 3 m		

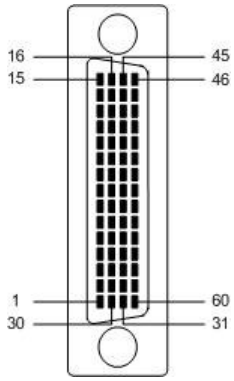
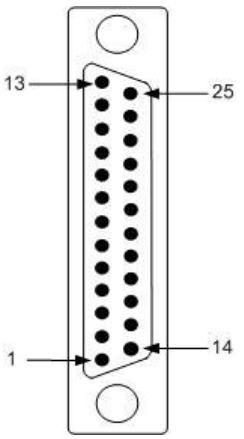
Cable	Interfaces
CAB SYNC 232FC	ITU-T V.24 & EIA/TIA 232 DCE DB-60 – DB-25 female
CAB SYNC 232MT	ITU-T V.24 & EIA/TIA 232 DTE DB-60 – DB-25 male
CAB SYNC V35FC	ITU-T V.35 DCE DB-60 – 34 Pin Winchester female
CAB SYNC V35MT	ITU-T V.35 DTE DB-60 – 34 Pin Winchester male
CAB SYNC X21FC	ITU-T X.21 DCE DB-60 – DB-15 female
CAB SYNC X21MT	ITU-T X.21 DTE DB-60 – DB-15 male
CAB SYNC 449FC	ITU-T V.36 & EIA/TIA 449 DCE DB-60 – DB-37 female
CAB SYNC 449MT	ITU-T V.36 & EIA/TIA 449 DTE DB-60 – DB-37 male
CAB SYNC 530MT	EIA/TIA 530 DTE DB-60 – DB-25 male

Table 8 - Synchronous Serial Cable Options

ITU-T V.24 & EIA/TIA 232 DCE Pinout DB-60 – DB-25 female

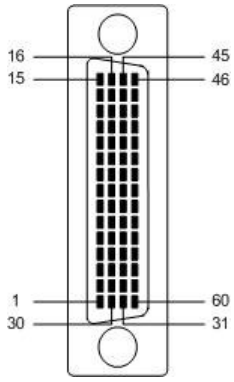
DB-60 male		Signal	DB-25 female		Signal
	50 & 51	Shorting Group			
	36	RXD/TXD		*2*	*TXD*
	41	TXD/RXD		*3*	*RXD*
	35	CTS/RTS		*4*	*RTS*
	42	RTS/CTS		*5*	*CTS*
	43	DTR/DSR		*6*	*DSR*
	45	Circuit GND		*7*	*Circuit GND*
	44	LL/DCD		*8*	*DCD*
	39	TXCE/TXC		*15*	*TXC*
	40	NIL/RXC		*17*	*RXC*
	33	DCD/LL		*18*	*LTST*
	34	DSR/DTR		*20*	*DTR*
	38	RXC/TXCE		*24*	*TXCE*

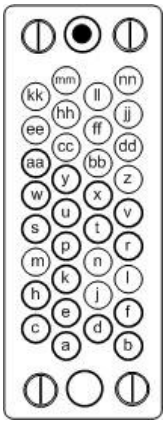
ITU-T V.24 & EIA/TIA 232 DTE Pinout DB-60 – DB-25 male

DB-60 male		Signal	DB-25 male		Signal
	50, 51, 52	Shorting Group			
	36	RXD/TXD		2	TXD
	41	TXD/RXD		3	RXD
	35	CTS/RTS		4	RTS
	42	RTS/CTS		5	CTS
	43	DTR/DSR		6	DSR
	45	Circuit GND		7	Circuit GND
	44	LL/DCD		8	DCD
	39	TXCE/TXC		15	TXC
	40	NIL/RXC		17	RXC
	33	DCD/LL		18	LTST
	34	DSR/DTR		20	DTR
	38	RXC/TXCE		24	TXCE

ITU-T V.35 DCE Pinout DB-60 – 34 Pin Winchester female

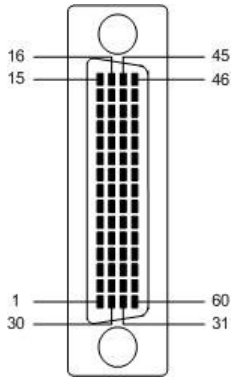
DB-60 male		Signal	34 Pin female		Signal
	49 & 48	Shorting Group			
	50 & 51	Shorting Group			
	53, 54, 55, 56	Shorting Group			
	46	Shield GND		A	Chassis GND
	45	Circuit GND		B	Circuit GND
	35	CTS/RTS		C	RTS
	42	RTS /CTS		D	CTS
	43	DTR/DSR		E	DSR
	44	LL/DCD		F	RLSD
	34	DSR/DTR		H	DTR
	33	DCD/LL		K	LT
	28	RxD/TxD +		P	TxD +
	27	RxD/TxD -		S	TxD -
	18	TxD/RxD +		R	RxD +
	17	TxD/RxD -		T	RxD -
	26	RxC/TxCE +		U	SCTE +
	25	RxC/TxCE -		W	SCTE -
	22	NIL/RxC +		V	SCR +
	21	Nil / RxC -		X	SCR -
	20	TxCE/TXC +		Y	SCT +
	19	TxCE/TxC -		AA	SCT -

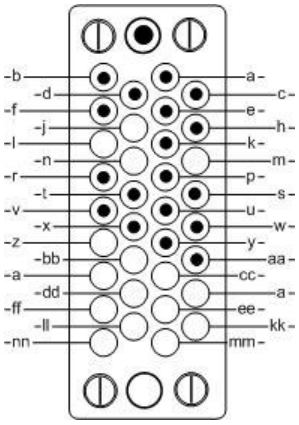




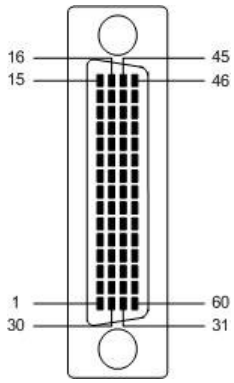
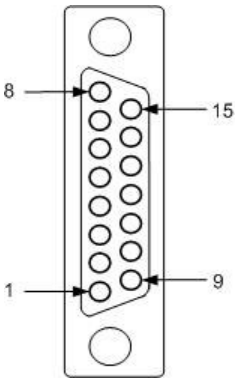
ITU-T V.35 DTE Pinout DB-60 – 34 Pin Winchester male

DB-60 male		Signal	34 Pin male		Signal
	49 & 48	Shorting Group			
	50, 51 & 52	Shorting Group			
	53, 54, 55, 56	Shorting Group			
	46	Shield GND		A	Chassis GND
	45	Circuit GND		B	Circuit GND
	42	RTS/CTS		C	RTS
	35	CTS/RTS		D	CTS
	34	DSR/DTR		E	DSR
	33	DCD/LL		F	RLSD
	43	DTR/ DSR		H	DTR
	44	LL/DCDL		K	LT
	18	TxD/RxD +		P	TxD +
	17	TxD/RxD -		S	TxD -
	28	RxD/TxD +		R	RxD +
	27	RxD/TxD/ -		T	RxD -
	20	TxCE/TxC +		U	SCTE +
	19	TxCE/TxC -		W	SCTE -
	26	RxC/TxCE +		V	SCR +
	25	RxC/TxCE -		X	SCR -
	24	TxC/RxC +		Y	SCT +
	23	TxC/RxC -		AA	SCT -

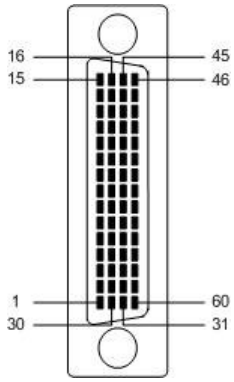
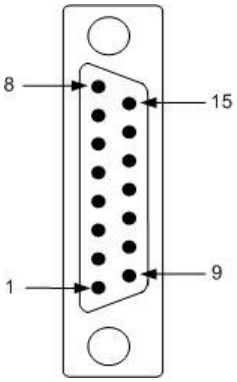




ITU-T X.21 DCE Pinout DB-60 – DB-15 female

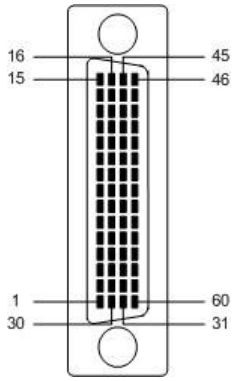
DB-60 male		Signal	DB-25 female		Signal
	48 & 47	Shorting Group			
	46	Shield GND		1	Shield GND
	28	RxD/TxD +		2	TxD +
	27	RxD/TxD -		9	TxD -
	1	CTS/RTS +		3	Control +
	2	CTS/RTS -		10	Control -
	11	TxD/RxD +		4	RxD +
	12	TxD/RxD -		11	RxD -
	9	RTS/CTS +		5	Indication +
	10	RTS/CTS -		12	Indication -
	24	TxC/RxC +		6	Timing +
	23	TxC/RxC -		13	Timing -
	15	Control GND		8	Control GND
	Shield			Shield	

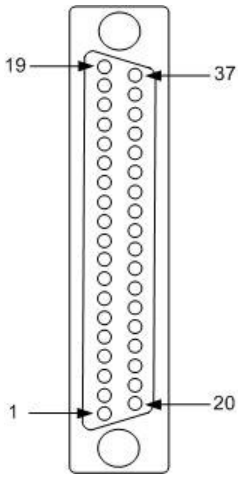
ITU-T X.21 DTE Pinout DB-60 – DB-15 male

DB-60 male		Signal	DB-15 male		Signal
	48 & 47	Shorting Group			
	51 & 52	Shorting Group			
	46	Shield GND		1	Shield GND
	11	TxD/RxD +		2	TxD +
	12	TxD/RxD -		9	TxD -
	9	RTS/CTS +		3	Control +
	10	RTS/CTS -		10	Control -
	28	RxD/TxD +		4	RxD +
	27	RxD/TxD -		11	RxD -
	1	CTS/RTS +		5	Indication +
	2	CTS/RTS -		12	Indication -
	26	RxC/TxCE		6	Timing +
	25	RxC/TxCE		13	Timing -
	15	Control GND		8	Control GND
	Shield			Shield	

ITU-T V.36 & EIA/TIA 449 DCE Pinout DB-60 – DB-37 female

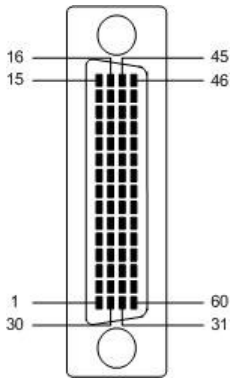
DB-60 male		Signal	DB-37 Female		Signal
	49 & 48	Shorting Group			
	46	Shield GND		1	Shield GND
	28	RXD/TXD+		4	TXD +
	27	RXD/TXD-		22	TXD -
	13	TXCE/TXC+		5	TXC+
	14	TXCE/TXC-		23	TXC -
	11	TXD/RXD+		6	RXD+
	12	TXD/RXD-		24	RXD-
	1	CTS/RTS+		7	RTS+
	2	CTS/RTS-		25	RTS -
	24	TXC/RXC+		8	RXC +
	23	TXC/RXC-		26	RXC -
	9	RTS/CTS+		9	CTS+
	10	RTS/CTS-		27	CTS-
	29	MIL / LL		10	Local Loopback
	30	Circuit GND		37	Send Common
	7	DTR/DSR+		11	DTR +
	8	DTR/DSR-		29	DTR -
	3	DSR/DTR+		12	DSR+
	4	DSR/DTR-		30	DSR -
	5	DCD/DCD+		13	DCD +
	6	DCD/DCD-		31	DCD -
	26	RXC/TXCE+		17	RXC +
	25	RXC/TXCE-		35	RXC -
	15	Circuit GND		19	Signal GND
	16	Circuit GND		20	Receive Common

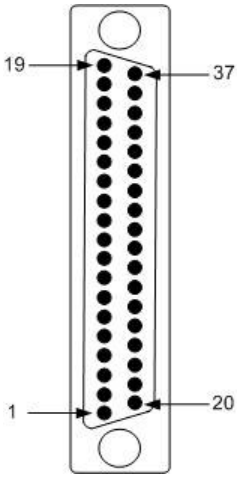




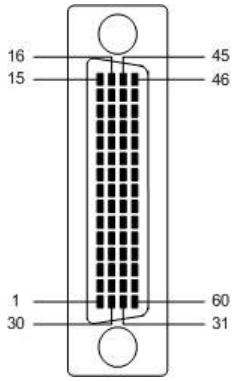
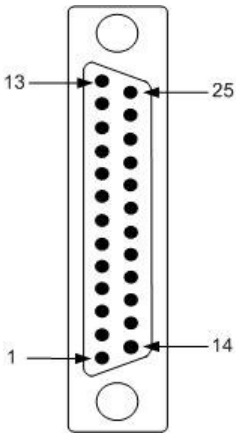
ITU-T V.36 & EIA/TIA 449 DTE Pinout DB-60 – DB-37 male

DB-60 male		Signal	DB-37 Male		Signal
	49 & 48	Shorting Group			
	55 & 52	Shorting Group			
	46	Shield GND		1	Shield GND
	11	TXD/RXD+		4	TXD +
	12	TXD/RXD-		22	TXD -
	24	TXC/RXC+		5	TXC +
	23	TXC/RXC-		23	TXC -
	28	RXD/TXD+		6	RXD +
	27	RXD/TXD-		24	RXD -
	9	RTS/CTS+		7	RTS+
	10	RTS/CTS-		25	RTS -
	26	RXC/TXCE+		8	RXC+
	25	RXC/TXCE-		26	RXC -
	1	CTS/RTS+		9	CTS+
	2	CTS/RTS-		27	CTS-
	44	MIL / LL		10	Local Loopback
	45	Circuit GND		37	Send Common
	3	DSR/DTR+		11	DSR +
	4	DSR/DTR-		29	DSR - -
	7	DTR/DSR+		12	DTR +
	8	DTR/DSR-		30	DTR -
	5	DCD/DCD+		13	DCD+
	6	DCD/DCD-		31	DCD -
	13	TXCE/TXC+		17	TXC+
	14	TXCE/TXC-		35	TXC -
	15	Circuit GND		19	Signal GND
	16	Circuit GND		20	Receive Common





EIA/TIA 530 DTE Pinout DB-60 – DB-25 male

DB-60 male		Signal	DB-25 male		Signal
	48 & 49	Shorting Group			
	46 & 47	Shorting Group		1	Shield GND
	11	TXD/RXD +		2	TxD +
	12	TXD/RXD -		14	TxD -
	28	RXD/TXD+		3	RxD +
	27	RXD/TXD-		16	RxD -
	9	RTS/CTS+		4	RTS +
	10	RTS/CTS-		19	RTS -
	1	CTS/RTS+		5	CTS +
	2	CTS/RTS-		13	CTS -
	3	DSR/DTR+		6	DSR +
	4	DSR/DTR-		22	DSR -
	5	DCD/DCD+		8	DCD +
	6	DCD/DCD-		10	DCD -
	24	TXC/RXC+		15	TxC +
	23	TXC/RXC-		12	TxC -
	26	RXC/TXCE+		17	RxC +
	25	RXC/TXCE-		9	RxC -
	44	MIL / LL		18	LL
	45	Circuit GND		7	Circuit GND
	7	DTR/DSR+		20	DTR +
	8	DTR/DSR-		23	DTR -
	13	TXCE/TXC+		24	TxCE +
	14	TXCE/TXC-		11	TxCE -
	51	GND			
	52	Mode DCE			

5.0 INSTALLATION & MAINTENANCE

MOUNTING OPTIONS

The Aprisa XE is designed to be mounted in a 19" rack. The 1.4GHz is 2U high and comes with the duplexer mounted internally. The UHF variants are supplied with duplexers mounted on the base of the chassis and are 3U high.

HEAT DISSIPATION

Cooling is always guaranteed with the speed controlled fans fitted into the rear of the chassis. As standard two fans are fitted; however provision for two fans is made in cases where extra redundancy is required for very remote sites. The fans are microprocessor controlled to run at the minimum speed required to keep the terminal below a preset temperature. This ensures a maximum life for the fans and the radio terminal itself. The fans are monitored and an alarm raised in the event of a failure.

6.0 SOFTWARE

The Aprisa XE is configured using 4RF's Aprisa SuperVisor™ software. Supervisor is the new Java based management and setup platform integrated into the radio's Linux server and can be accessed using any major web browser[3]

Aprisa SuperVisor provides both the setup and management functions for the Aprisa XE platform and allows access to radio and interface parameters as well as reporting performance, radio status and alarm details.

Aprisa Supervisor has three access levels with each level giving certain rights. The basic level is for users who need to view radio information. The second level is for users who may need to configure radio parameters and the third level is for system administrators.

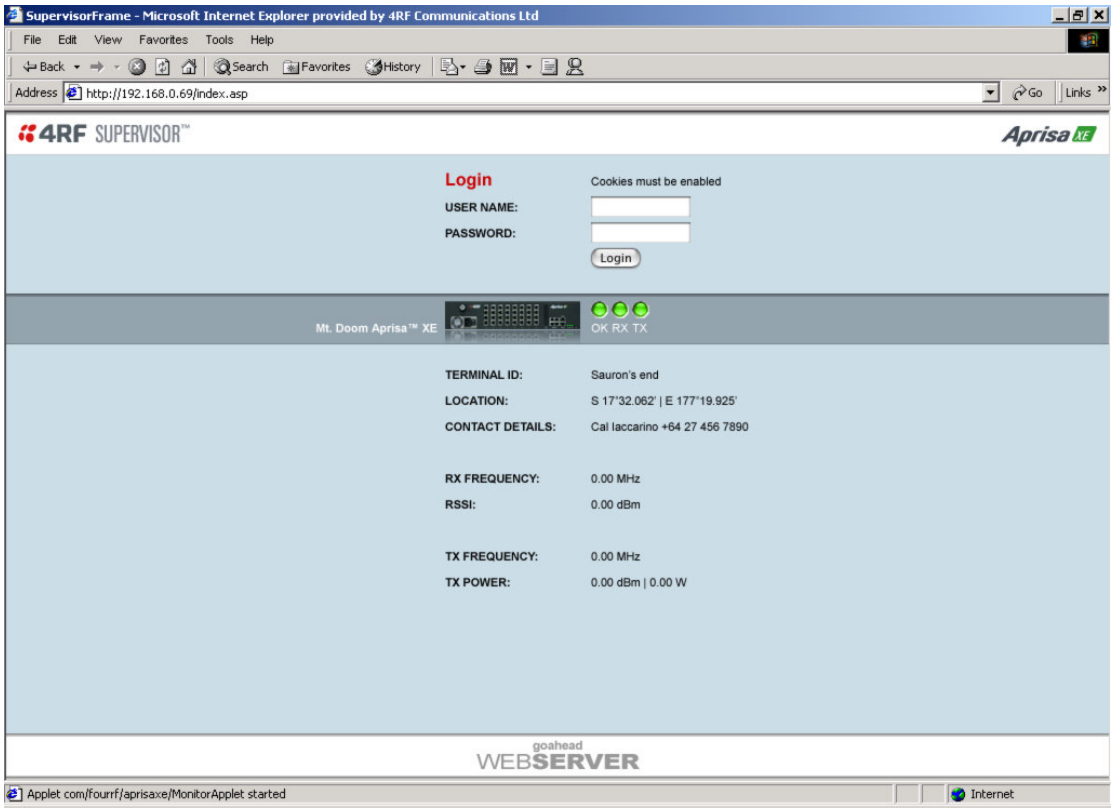


Figure 9 - Login Screen

[3] Microsoft Windows Explorer, Netscape Navigator or Mozilla.

SUMMARY

After successfully logging on a summary screen is displayed and provides a quick summary of the status of the link. The following parameters are displayed.

- Link transmit and receive frequencies
- TX power output level and received signal strength
- Radio and link status
- Terminal name and ID as well as contact details.

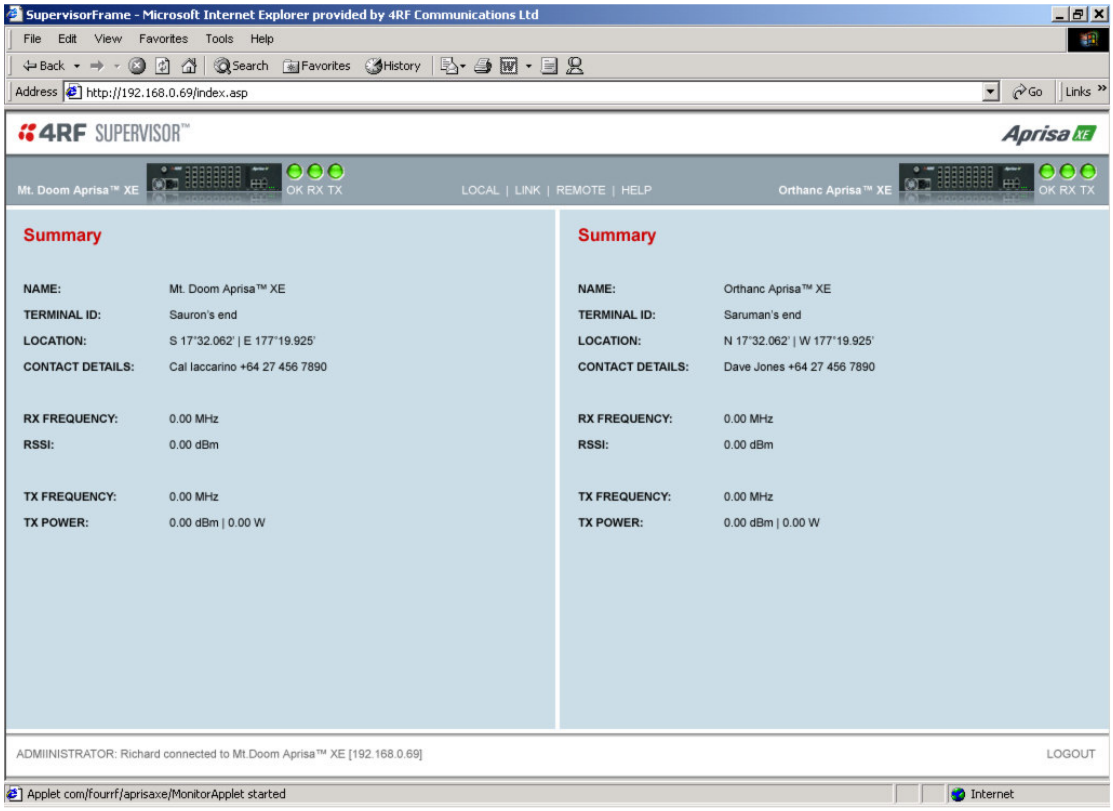


Figure 10 - Summary screen

RADIO SETTINGS

The radio settings page allows the user to configure the standard radio settings including

- Transmit Frequency
- Receive Frequency
- Transmit Power
- Modulation

You are also able to view the radio channel width and IP address details from this screen.

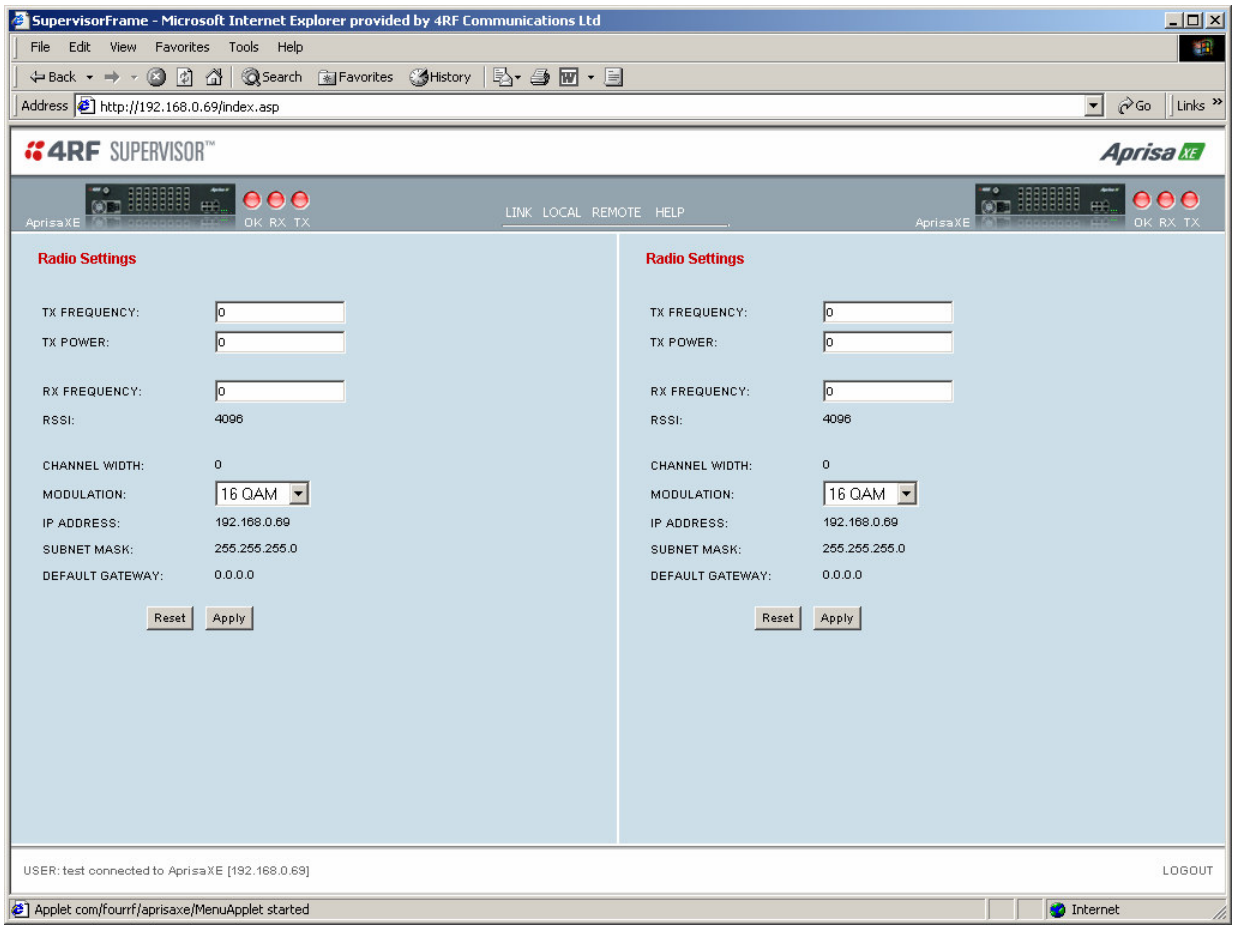


Figure 11 - Radio settings screen

INTERFACE CONFIGURATION

Aprisa SuperVisor allows simple interface configuration of each port on each interface card. Each Interface Card is automatically detected and the relevant configuration options are made available when selected for configuration.

Each interface has its own set of criteria that need to be set. These settings automatically adjust the internal cross connect and multiplexer. Settings include assigning traffic channels, compression levels, data rates, gains and loopbacks.

The Interfaces may be configured remotely via a remote management channel.

Aprisa provides loopback functionality for use during link commissioning and as a tool to assist in debugging activities. The loopback simultaneously sets a radio and line facing loopback and can be set at different points in the traffic path. The loopbacks provided with each interface are:

- Interface loopback: This loopback is set at the interface port by the software and loops back all traffic at the physical interface to and from the radio.
- Cross-connect loopback: This loopback is set at the cross connect by the software and loops back all traffic at the digital interface to and from the modem.

Loopbacks are configured in the terminal setup software.

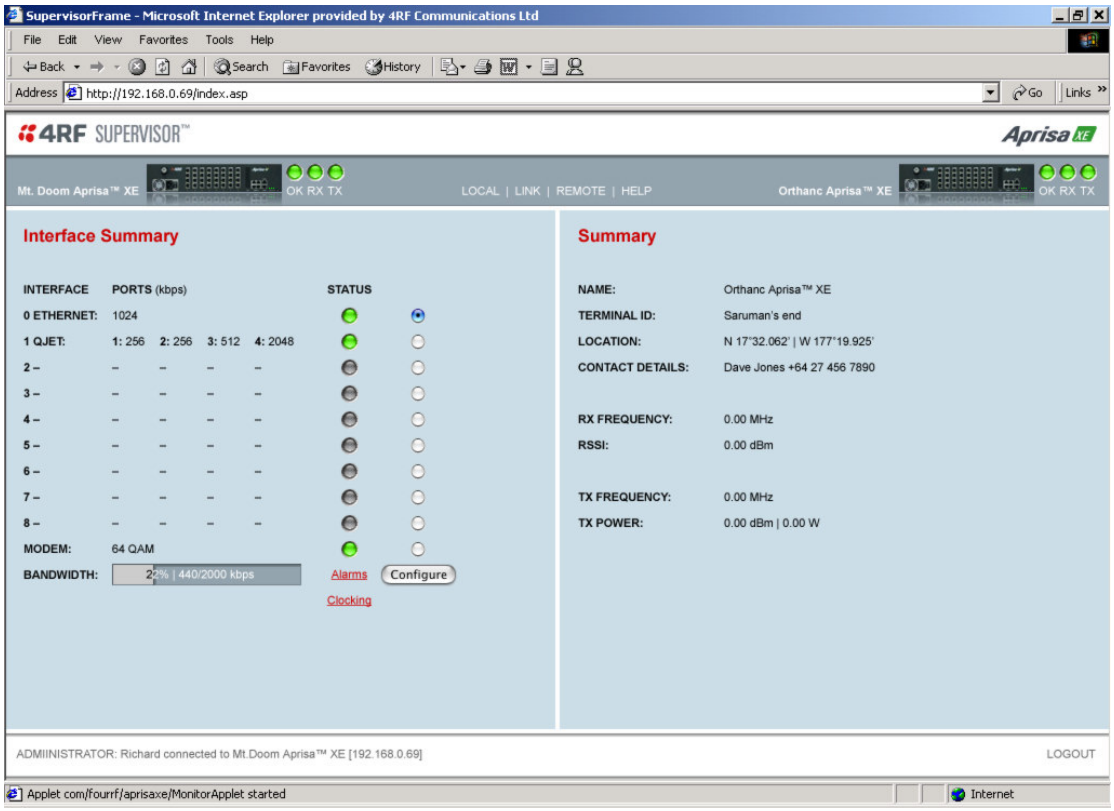


Figure 12 - Interface configuration

ALARMS SCREEN

Aprisa Setup provides comprehensive terminal alarm diagnostics. A summary of the alarms presented includes:

- Forward power
- Reverse power
- High temperature
- Loss of synchronisation
- RSSI
- Internal voltages
- Correctable and *un-correctable(?)* modem errors
- E1 and other interface card alarms
- Fan stopped
- Discrete Alarm input status

In addition to alarms, AprisaSupervisor provides link performance functions for both the local and remote terminal. Performance monitoring functions include:

- Error count statistics
- RSSI
- SNR
- Constellation display

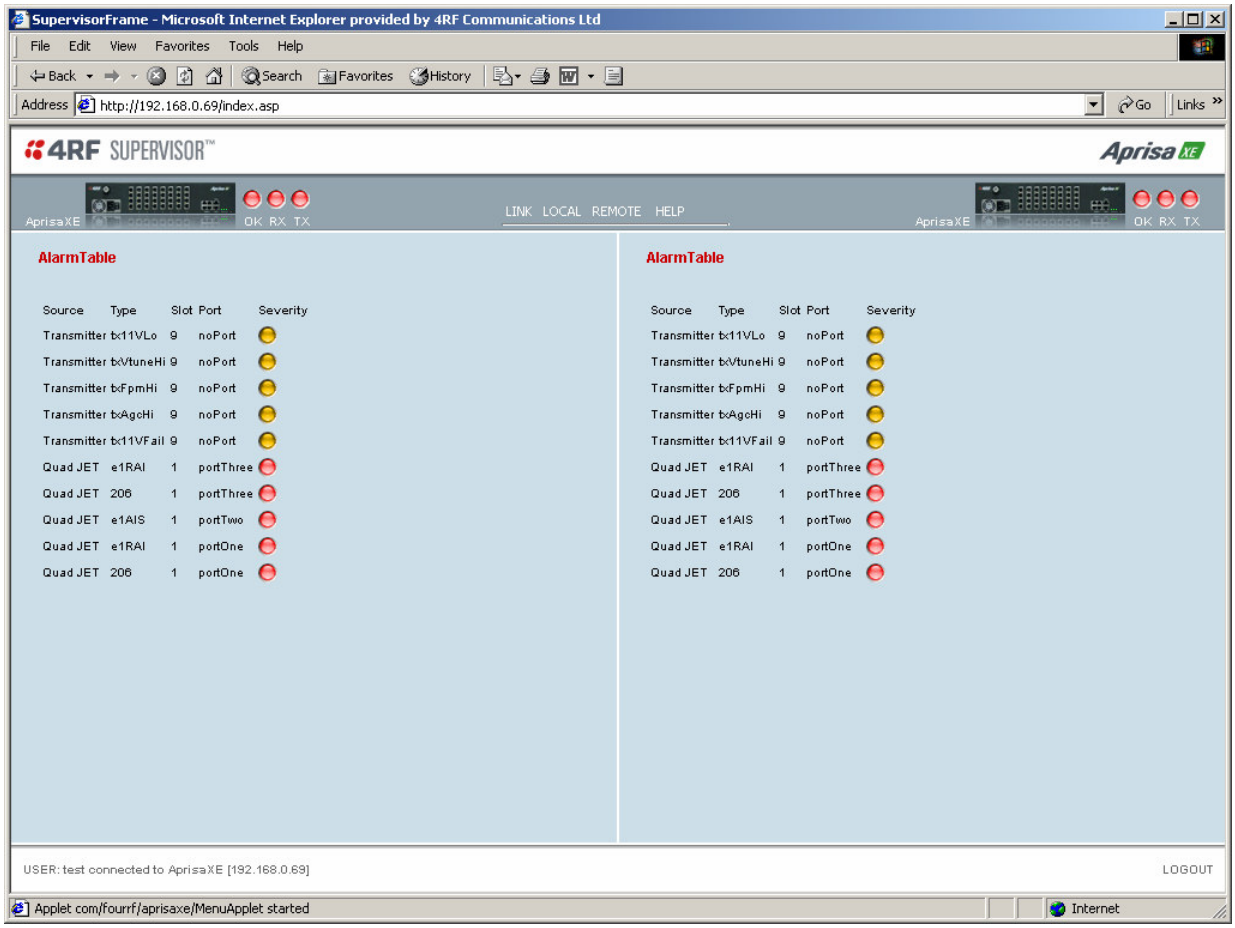


Figure 13 - Alarms screen

7.0 NETWORK MANAGEMENT

The Aprisa XE network can be managed using any industry standard SNMPc Management software. An SNMPc client running on a standard PC can be used to interrogate SNMP agents within Aprisa XE. The SNMP traps and events are used to raise alarms and log performance criteria within the SNMPc network management platform. Radio and interface parameters can be configured with the SNMPc client software also.

The SNMPc client software can remotely access many Aprisa links in a network from one location via an IP network. This client software polls and monitors the status of each terminal in the network. Alarm and fault report events are captured, the operator alerted by visual indication and audible alarm. Each event is time stamped and stored in a database for later analysis.

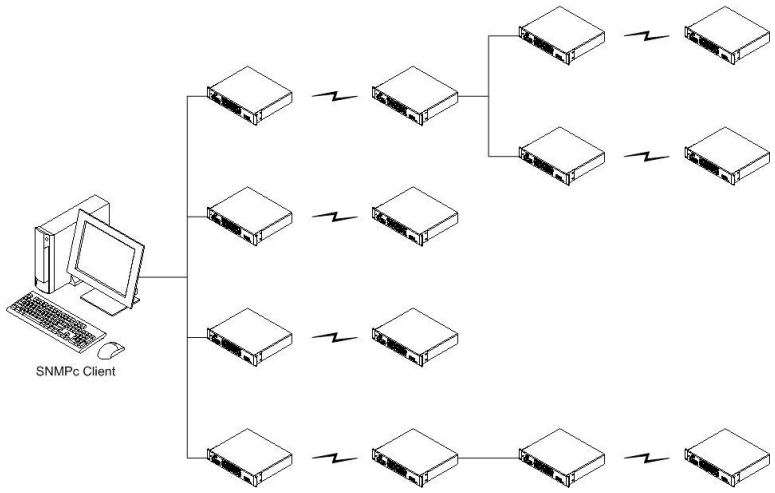
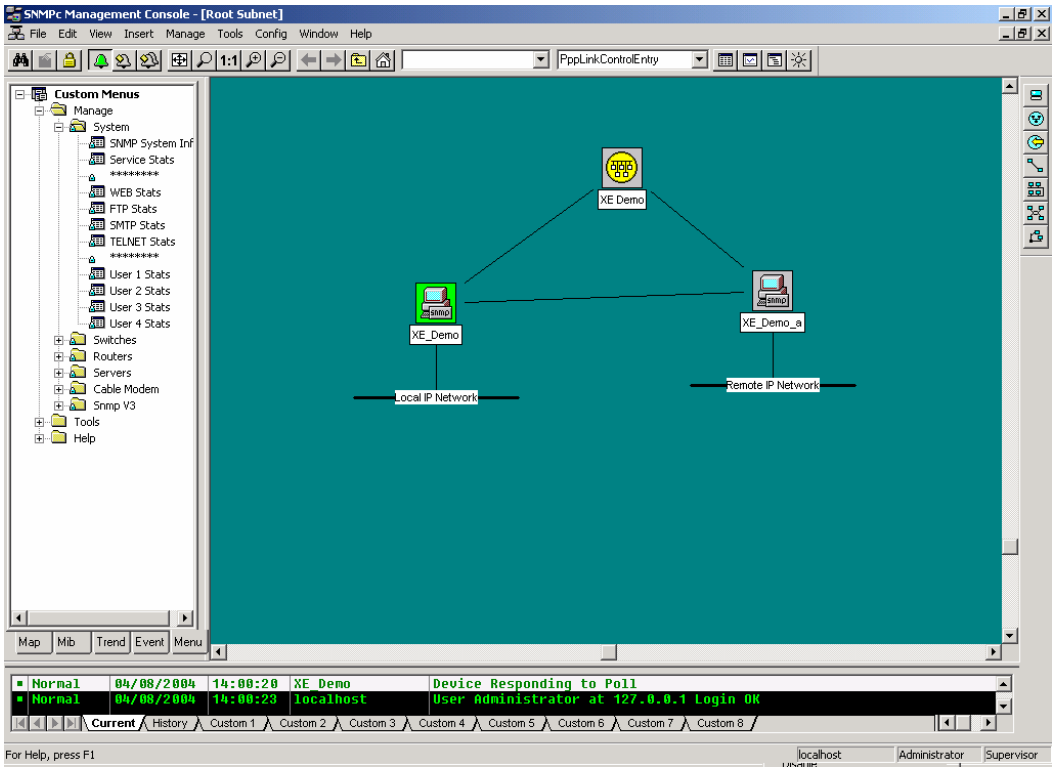


Figure 14 - SNMPc Network Management (single client)



The system can also be configured to operate in Client Server type architecture. Many SNMPc clients can be configured to run in a server mode. A server module is loaded onto the Client PC and the server module will interrogate the Aprisa SNMP agents via the server's client application. External SNMPc clients can then interrogate the server for details on each of the individual Aprisa terminals.

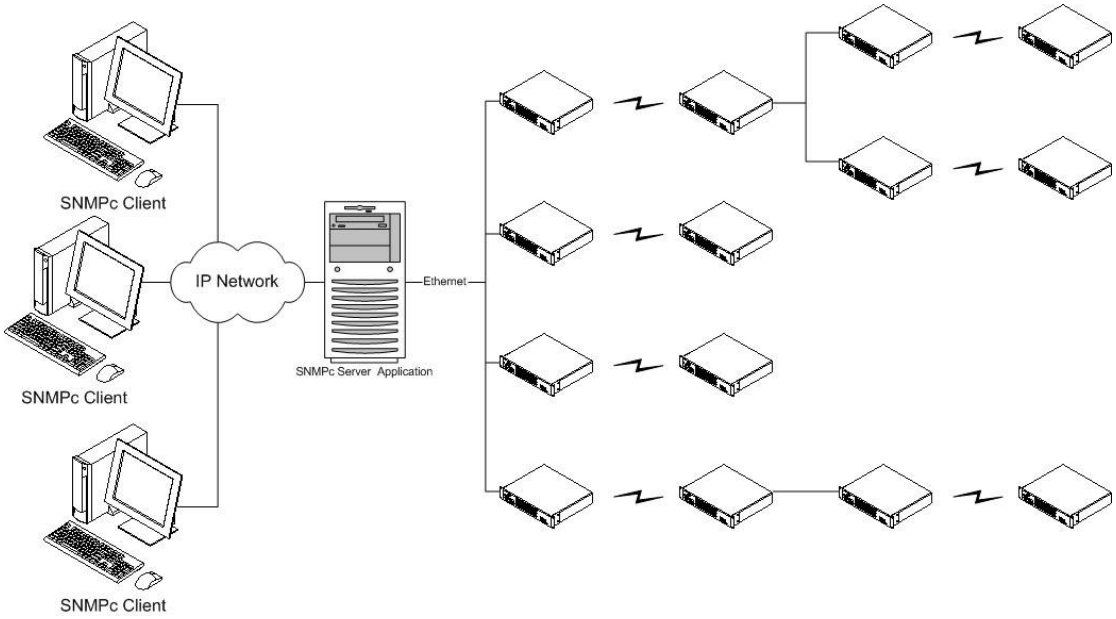


Figure 15 - SNMP Network Management (Client/Server setup)

8.0 PROTECTED OPTIONS

There are three options for protected Aprisa XE; monitored hot stand by (MHSB), frequency diversity and space diversity. The MHSB option provides protection for up to 8 x E1 interfaces through a 1U high protection chassis as shown on the left hand side in Figure 16 below. The frequency and space diversity options will offer protection for all interfaces in the Aprisa XE chassis and requires a 2U protection chassis. The frequency and space diversity protection switch houses a common multiplexer in which the interfaces are fitted and multiplexed onto a common radio bearer. The radio bearer is then switched to a the active radio and transmitted to the remote end.

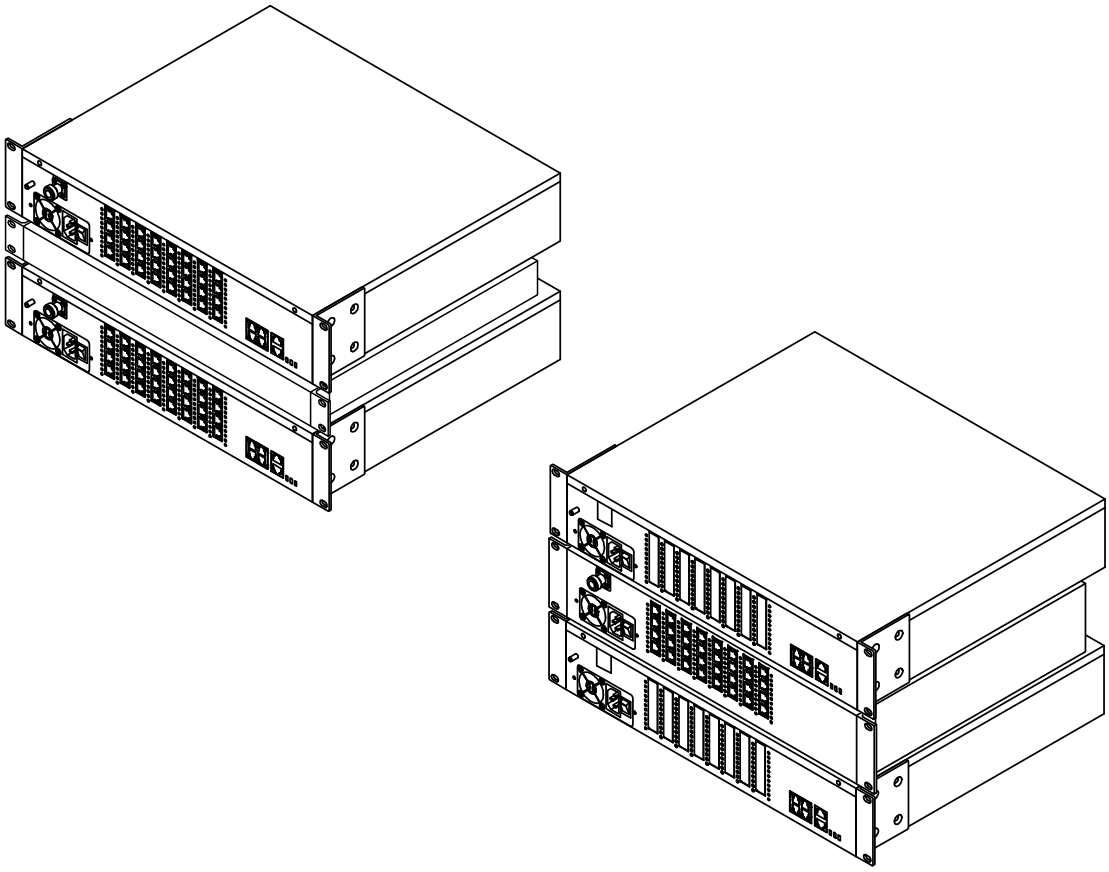


Figure 16 - Protected Options

APPENDIX 1.1: GENERAL RADIO SPECIFICATIONS

General RF

Frequency Ranges	330 – 400 MHz 400 – 470 MHz 698 – 806 MHz 806 – 960 MHz 1350 – 1550 MHz
For other bands please contact 4RF.	
Modulation	QPSK, 16, 32 & 64 QAM Software configurable
Frequency Selection	Synthesized 12.5 kHz steps
Frequency Stability	±1.5 ppm
Antenna Connection	N-type female 50 ohm

Transmitter

Power Output [1]	QPSK	+34 dBm
	16 QAM	+31 dBm
	32 QAM	+30 dBm
	64 QAM	+29 dBm
Tolerance	±1 dB	
Power Control	15 dB (in 1 dB steps)	

Duplexer (Bandpass)

Passband Width	1.5 MHz (300/400MHz) 2 MHz (700/900MHz) 5 MHz (1400 MHz)
TX/RX Split	
	> 5 MHz (400 MHz opt)
	> 9 MHz (400 MHz)
	> 15 MHz (300 MHz)
	> 30 MHz (700/900 MHz)
	> 48 MHz (1400 MHz)
Other duplexer options are available on request.	

DC Power Supply

Input Range	±24 V (20.5 - 30 VDC) ±48 V (40 - 60 VDC) 115 – 230 VAC (50 – 60 Hz)
Power Consumption (subject to interface	90 - 220 W typical cards fitted)

Environmental

Operating	-10 to + 50˚C
Storage	-20 to + 70˚C
Humidity	Max. 95% non-cond.
Altitude	Up to 5000 m

Receiver

Max. Input Level	-30 dBm
Dynamic Range	> 50 dB
C/I Ratio	
Co-channel	> 30 dB
	> 37 dB (64 QAM)
1st Adj. Channel	> 0 dB
2nd Adj. Channel	> -25 dB

Mechanical

19-Inch Rack Mount	2U high (Internal Duplexer) 3U high (External Duplexer)
Weight	< 8 kilograms

ETSI Performance

Radio	EN 300 630 - Class 3 EN 301 750
EMI/EMC	EN 301 489 Parts 1 & 4
Safety	EN 60950
Environmental	ETS 300 019 - Class 3.2

Specifications are typical unless stated otherwise and are subject to change without notice.

1. Performance guaranteed at the antenna port.

APPENDIX 1.2: SYSTEM SPECIFICATIONS

System Performance						
Channel Spacing		250 kHz	500 kHz	1 MHz	1.75 MHz	3.5 MHz
Capacity	QPSK	408 kbps	824 kbps	1680 kbps	2872 kbps	5504 kbps
	16 QAM	840 kbps	1656 kbps	3368 kbps	5752 kbps	11072 kbps
	32 QAM	1000 kbps	2072 kbps	4208 kbps	7192 kbps	13888 kbps
	64 QAM	1224 kbps	2488 kbps	5056 kbps	8632 kbps	16640 kbps
Receiver Sensitivity *(10^{-6} BER)*[2]	QPSK	-98 dBm	-96 dBm	-93 dBm	-91 dBm	-87 dBm
	16 QAM	-91 dBm	-89 dBm	-86 dBm	-84 dBm	-80 dBm
	32 QAM	-88 dBm	-86 dBm	-83 dBm	-81 dBm	-77 dBm
	64 QAM	-85 dBm	-83 dBm	-80 dBm	-78 dBm	-74 dBm
System Gain *(10^{-6} BER)*	QPSK	132 dB	130 dB	127 dB	125 dB	121 dB
	16 QAM	122 dB	120 dB	117 dB	115 dB	111 dB
	32 QAM	118 dB	116 dB	113 dB	111 dB	107 dB
	64 QAM	114 dB	112 dB	109 dB	107 dB	103 dB
End to End Delay	Typical end to end link delay is less than 10mS based on a standard Forward Error Correction block size, Interleaving and RF variant Delay figures are greatly improved by reducing the FEC block size and interleaving or selecting a RF variant with a larger channel width. Please contact 4RF for more information on detailed delay figures					

Specifications are typical unless stated otherwise and are subject to change without notice.

2. Receiver sensitivities for 10^{-3} BER are typically 3 dB better

APPENDIX 2.0: ABBREVIATIONS

ADC	Analog to Digital Converter	**MHz**	Megahertz
ADPCM	Adaptive Differential Pulse Code Modulation	**MMIC**	Monolithic Microwave Integrated Circuit
ADSL	Asymmetric Digital Subscriber Line	**MTBF**	Mean Time Between Failures
AGC	Automatic Gain Control	**MTTR**	Mean Time To Repair
AMP	Amplifier	**ms**	milliseconds
BER	Bit Error Rate	**NCO**	Numerically Controlled Oscillator
CLI	Calling Line Identification	**NMS**	Network Management System
DAC	Digital to Analog Converter	**OSI**	Open Systems Interconnection
dB	Decibels	**PABX**	Private Automatic Branch Exchange
dBm	Decibels relative to 1 mW	**PBX**	Private Branch Exchange
dBc	Decibels relative to carrier power	**PC**	Personal Computer
DCE	Data Communications Equipment	**PCM**	Pulse Code Modulation
DFE	Differential Feed Equalizer	**PCA**	Printed Circuit Assembly
DS0	64 kbps PCM Timeslot	**PLL**	Phase Locked Loop
DTE	Data Terminal Equipment	**POP**	Point of Presence
DTI	Digital Trunk Interface	**POTS**	Plain Old Telephone Service
E&M	Ear and Mouth	**ppm**	Parts Per Million
E1	32 x DS0 Timeslots	**PSTN**	Public Switched Telephone Network
EMC	Electromagnetic Compatibility	**PMR**	Public Mobile Radio
EMI	Electromagnetic Interference	**QAM**	Quadrature Amplitude Modulation
ESD	Electrostatic Discharge	**QPSK**	Quadrature Phase Shift Keying
ETSI	European Telecommunications Standards Institute	**RAM**	Random Access Memory
FEC	Forward Error Correction	**RF**	Radio Frequency
FFE	Feed Forward Equalizer	**RRC**	Root Raised Cosine filter
FXO	Foreign Exchange Office	**RSSI**	Received Signal Strength Indication
FXS	Foreign Exchange Station	**RX**	Receiver
GaAs	Gallium Arsenide	**SCADA**	Supervisory Control and Data Acquisition
GSM	Global System for Mobile communications	**SNMP**	Simple Network Management Protocol
IC	Integrated Circuit	**SNR**	Signal to Noise Ratio
IF	Intermediate Frequency	**SOHO**	Small Office/Home Office
IMA	Inverse Multiplexed ATM	**TCP/IP**	Transmission Control Protocol/Internet Protocol
IP	Internet Protocol	**TCXO**	Temperature Compensated Crystal Oscillator
I/O	Input/Output	**TETRA**	Terrestrial Trunk Radio
ISP	Internet Service Provider	**TMR**	Trunk Mobile Radio
kbps	Kilobits per second	**TX**	Transmitter
kHz	Kilohertz	**UTP**	Unshielded Twisted Pair
LAN	Local Area Network	**V.24**	Serial data communications interface (also called RS-232)
LED	Light Emitting Diode	**VCO**	Voltage Controlled Oscillator
LNA	Low Noise Amplifier	**VDC**	Volts DC
LOS	Loss of Signal	**VoIP**	Voice over Internet Protocol
mA	milliamps	**VSWR**	Voltage Standing Wave Ratio
MAC	Media Access Control		
Mbps	Megabits per second		
MHSB	Monitored Hot Stand By		