Ultra High Spectral Efficiency, Very Low Latency

UHF Radio for Mission Critical Applications

POINT-TO-MULTIPOINT DIGITAL LINK (MDL)

DATA SHEET NOW WITH TORNADO

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Utilities need sophisticated, reliable and high performing mission critical communications solutions to better serve their increasingly complex network requirements and customer demands. As the worldwide trend continues towards smarter and IP based mission critical communication technologies, utilities must strategically engineer their communications networks to support intelligent, scalable and future defensive systems that meet their immediate and long term needs.

By utilising advanced features provided by versatile radio solutions such as the MiMOMax Point-to-Multipoint Digital Link (MDL), utilities can optimise the capacity and performance of their network to provide superior service to their customers.

The MiMOMax MDL is a software flexible, highly reliable and robust radio communications solution that uses advanced technologies to provide ultra high spectral efficiency and very low latency. The MiMOMax MDL supports in near real time a range of mission critical communications applications including SCADA, telemetry and sophisticated packet based IP data. It provides complete network visibility and enables utilities to conduct preventive routine network maintenance and take prompt remedial action in the event of an emergency.

**Benefits**

- **Preserves Valuable Spectrum**
  - Ultra-High Spectral Efficiency

- **Very High Data Throughput**
  - Full-Duplex
  - Digital Cartesian Loop Supports High Level Modulations
  - Data Acceleration Protocols

- **Very Fast Access**
  - Very Low Latency
  - Random Access Protocols
  - Alarms and disturbance data almost instantly available

- **Highly Secure**
  - Comprehensive Range of Industry Standard Security Options

- **Scalable & Adaptable**
  - Supports Up To 1020 Remote Radio Outstations
  - Adaptive Modulation Protocols

- **Intelligent & Future Defensive**
  - Powerful Linux Engine
  - Utilizes Packet Based IP Data
  - Sophisticated Software Features

- **Industry Compatible**
  - Native IP
  - Ease of Implementation; “Plug & Play”
  - Wide Range of Internal & External Interfaces

- **Flexible**
  - User Settable Frequency
  - User Programmable Power
  - Software Feature Enablers

- **Robust**
  - Rugged IP67 Options
  - Extensive Path Redundancy Options

- **Economical**
  - High Level of Integration Reduces Hardware Needs
  - Low Installation & Set-Up Costs

- **Low Maintenance**
  - Internal Interfaces & Micro-Duplexers Eliminate Installation of Additional Hardware, Wiring, Coaxial Cabling and Connectors
  - Digital Cartesian Loop Dramatically Reduces the Need for Ongoing Calibration & Adjustment
The MiMOMax MDL is a unique high performance MiMO Point-to-Multipoint narrowband radio specifically designed to support mission critical Supervisory Control and Data Acquisition (SCADA) and Telemetry applications. The MiMOMax MDL system consists of one or more Base Radio Units (BRUs) that connect to up to 1020 Remote Radio Units (RRUs).

These remote radio units can be high performance MiMOMax RRUs and/or the smaller and lower cost Tornado (RRU-T).

This enables one comprehensive MDL point-to-multipoint system to support both high and low tiered remote radios by connecting to the same BRU on one MDL system thereby providing best throughput utility and economy for the application.

Utilizing high order modulation, MiMO technology and a unique random multi-access protocol, in conjunction with full-duplex operation, the MiMOMax MDL maximises system throughput and at the same time, minimises RRU access time.

The MiMOMax MDL natively supports IP and transports sophisticated packet based IP data, encompassing RTU SCADA, data logs and other traffic including IP enabled devices like line protection relays, transformer controls, power utility monitoring devices and backup battery chargers. The MiMOMax MDL can also simultaneously support legacy Asynchronous Serial RS232 RTUs by means of optional embedded Terminal Server software.

Very high system gains and good receiver sensitivities mean that it is possible to achieve paths in excess of 100kms from high radio sites at full speed. Utilizing MiMO technology enables raw data rates of up to 320 kb/s (full-duplex) in a 25 kHz bandwidth radio channel.

In addition, the MiMOMax MDL supports the intelligent MiMOMax Adaptive Modulation Scheme (M-CAM), which ensures that every RRU is operating at its most effective modulation rate even with varying path characteristics.

Any branch of the MDL system may be extended by using the MiMOMax Point-to-Point Network Digital Link (NDL).

Further system robustness can be achieved by making optional use of the intelligent MiMOMax Routing Adaptation Protocols (M-RAP) or radio diversity solutions that utilise 2x4 MiMO configurations.

While the MiMOMax MDL system is a random access solution, scanning protocols may also be supported. Software downloads do not impact on a Remote Radio Unit’s interrupt capability as the system is full-duplex and optional Data Acceleration Protocol (M-DAP) can further prioritise traffic.

**SYSTEM EXAMPLE**

An example of an MDL network can be seen in the figure to the left. In this example, the MDL consists of a Base Radio and 4 Remote Radio Units. Each radio unit is represented as a router. The BRU connects to the customer network, 172.31.0.0/16 in this example. The BRUs and RRU communicate with each other via the 192.168.1.0/24 subnet. All “air interfaces” in the MDL system are on this subnet. Finally, each RRU is connected to a subnet that contains other IP devices.
**MDL Application Example**

This diagram shows an application of a MiMOMax MDL system in a power utility network providing mission-critical SCADA services.

The network consists of one MDL base BRU servicing two remote RRRUs and two remote RRUs-T and one NDL LRU (point-to-point link). The NDL link provides backhaul link to the BRU.

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**Product Performance**

- **Ultra-high Spectral Efficiency**
  The MiMOMax MDL is capable of achieving up to 16 b/s/Hz in both 25 kHz and 12.5 kHz channels.

- **Very High Data Throughputs**
  The MiMOMax MDL is capable of providing a raw data rate of up to 320 kb/s in a 256QAM 25 kHz channel. Proprietary Data Acceleration protocol can boost the effective data rate even higher.

- **Low Latency**
  The MiMOMax MDL has a very low round trip latency of <50ms per complete round trip when transporting light loads of IP data at a peak raw data rate of 256QAM in a 25 kHz bandwidth channel.

- **Full-duplex**
  The MiMOMax MDL is full-duplex. Operating in full-duplex enables MiMOMax MDL systems to transfer packets down from the BRU to the RRU, while simultaneously transferring packets up from any RRU in the system using different modulation schemes if appropriate for each RRU. This allows the MDL to upload and download data simultaneously from multiple RRUs.

- **Adaptive Modulation**
  The MiMOMax MDL supports an intelligent adaptive modulation protocol (M-CAM), which enables the system to always optimise for maximum data throughput even in fading environments. Supported modulations include QPSK/16/64/256QAM.

- **Random Multi-access**
  The MiMOMax MDL supports a Random Multiple Access protocol that enables a single BRU to efficiently support up to 1020 RRUs.

- **Low bit error rate**
  The MiMOMax MDL has a very low bit error rate of typically less than $10^{-7}$ (signal level dependant on modulation rate). This is provided by the IP transport service (via Ethernet) under appropriate link conditions.

- **High Levels of Security**
  The MiMOMax MDL system supports a range of advanced, industry compliant, security features that prevent both deliberate and inadvertent attacks on the network.

- **RF Performance**
  High system gain enables the MiMOMax MDL to transmit data over paths spanning up to 100 kilometers in length from high sites, with some non-line-of-sight and near-line-of-sight capability over shorter distances.

- **Built in Micro Duplexers**
  The MDL transmits a maximum power of 1 W average per transmitter (for 2x2 MIMO). Both the receive sensitivities and transmit powers are measured at the output of the duplexers.

- **Power Consumption**
  The typical active power consumption for the MiMOMax MDL is 72 W with a standby power consumption of <10W.

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1 For complete details on security features, please view both “Product Features” and “Product Options” sections.
PRODUCT FEATURES

MiMOMax

In true MiMOMax format, each MiMOMax MDL radio unit has 2 internal transmitters and 2 internal receivers. This enables a single radio link to produce high performance, pattern diverse MiMOMax signals and to increase both signal quality and path resilience.

Spectral Efficiency

The MiMOMax MDL is an ultra high spectrally efficient point-to-multipoint radio solution that is capable of providing spectral efficiencies of up to 16 b/s/Hz in its highest modulation mode.

Latency and Access Time

The MiMOMax MDL can access up to 1020 outstations and has typical access times of approx 25 ms when the system is not busy for systems of less than 50 outstations.

Data Throughput

The MiMOMax MDL utilizes true 2 x 2 MiMOMax technologies which are capable of operating in QPSK/16/64/256QAM, to achieve industry-leading full-duplex data throughputs of 80/160/240/320 kb/s (raw data rates) in a 25 kHz channel bandwidth (40/80/120/160 kb/s in a 12.5 kHz channel).

Operating Frequencies

The MiMOMax MDL operates in a range of licensed UHF frequency bands including 369-390 MHz, 420-470 MHz and 806-960 MHz and operates in both 12.5 kHz and 25 kHz narrowband channel bandwidths\(^1\). Please refer to the “Product Specifications” section for details on specific frequency band splits.

Internal Micro-Duplexers

Each MiMOMax MDL radio unit has 2 sets of internal Micro-Duplexers that provide full-duplex operation, maintain an overall small size and reduce the cost and time of installing additional equipment. External antenna duplexer options are available if required\(^2\).

Interfaces

The MiMOMax MDL is a native IP solution that transmits both packet-based IP and serial data via internal Ethernet and internal asynchronous RS232 serial interface ports.

- **Ethernet Interface**
  
  Ethernet connectivity is presented via RJ45 socket and is configurable to provide connectivity to other IP enabled network devices. The network connectivity provided by the MiMOMax MDL is at layer III (IP). In this mode, the MDL will function as a router as opposed to an Ethernet bridge or IP data switch. The MiMOMax MDL is capable of carrying DNP3-IP data (TCP/IP encapsulated SCADA) across all elements of the network. The physical layer of the Ethernet interface is either 10BaseT for MDL Series II or 10/100BaseT for MDL Series II-e.

- **RS232 Asynchronous Serial Interface**
  
  Each MiMOMax MDL radio unit has an optional dual RS232 asynchronous serial interface port that can simultaneously support up to two RS232 asynchronous serial interfaces and enable a single MDL radio unit to connect to up to two device groups. Connectivity is presented via a RJ45 socket and has a baud rate of up to 115,200.

Internal Intelligent Multiplexer

Each MiMOMax MDL radio unit has an internal data multiplexer that supports both RS232 asynchronous serial and packet-based Ethernet IP traffic, depending on the chosen interface configuration. Additionally optional M-DAP and QoS may be applied to the Ethernet traffic.

MiMOMax Configuration, Control & Monitoring Software (CCMS)

The MiMOMax MDL supports connection of an HTTP type web browser, which allows customers to have access to a field level of configuration, control, monitoring and alarm functions\(^3\). The CCMS has two access options including:

- **Local CCMS**
  
  This allows local access to the CCMS web application via the Ethernet port of the local radio modem link. It enables restricted control of the local radio modem.

- **Remote CCMS (Over-the-Air Configuration--OTAC & Over-the-Air Programming--OTAP)**
  
  Optional remote CCMS enables the CCMS web application to be accessible via both the local Ethernet port and over-the-air link. This allows remote configuration (OTAC) & remote programming (OTAP) of the remote radio unit (RRU) and often replaces the need for the user to travel to radio sites, saving both time and cost.

Standard Security\(^4\)

The MiMOMax MDL system has the capability of protecting the wider SCADA network from either deliberate or accidental breach or denial of service. The following security features are included in the MDL radio unit:

- **Licensed Spectrum:** ensures that the spectrum licensee is the only authorised user for that channel.
- **Proprietary MiMOMax Protocol:** avoids any over-the-air interception or manipulation of data, as only MiMOMax radios can reassemble the coded MiMOMax data.
- **Software Image Protection:** prevents determined interceptors from making unauthorised software changes or mimicking MiMOMax radio software.
- **Directed Traffic Control:** only MiMOMax radios registered onto the system will be recognised by the system. Radios must be either paired or part of a system to participate in that system. Prevents “Man in the Middle” intercepts.
- **Transparent Payload Encryption:** transparent to encrypted packets for all data types. Supports “end to end” Encryption schemes.
- **Management Interface Protection:** SSL/TLS & AES 256 provide “end to end” management system interface protection for both directly connected and over-the-air CCMS.
- **Audit Logging:** CCMS user passwords are logged so that the past CCMS history can be interrogated.

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1 For information on alternative operational channel bandwidths, please contact MiMOMax Wireless directly.
2 For information on Duplexer options, please contact MiMOMax Wireless directly.
3 MiMOMax offers a pre-ship configuration service, which will configure a radio unit to a user’s documented requirements, prior to shipping, to expedite implementation.
4 For details on further optional protection and security features, please refer to the “Product Options” section.
**Digital Cartesian Loop**
The MiMOMax MDL has a Digital Cartesian Loop that provides very high linearity and low distortion enabling high order modulation to achieve very high data throughputs while dramatically reducing the need for regular and ongoing calibration and adjustment.

**User Programmable Frequencies**
The MiMOMax MDL transmitter frequencies can be electronically tuned by the user provided they are within the duplexer tuning range. The programmable frequency step size is 5 kHz or 6.25 kHz. Duplexers will need to be manually tuned if the desired frequency is outside of the duplexer bandwidth.

**User Programmable Power**
The MiMOMax MDL has transmitter power output that is user configurable to suit specific path requirements. Users can choose either dBm or mW by selecting dBm or mW in the CCMS. The programmable power range is greater than 20 dB and includes 10 mW to 1 W power levels.

**Internal Power Supplies**
The MiMOMax MDL contains an internal switched mode power supply with an input range of 10.5 VDC to 32 VDC. An optional internal isolated (10-72 VDC) power supply is also available. This option eliminates the need for an external isolated power supply.

**Form, Factor & Installation (Physical Structure)**
MiMOMax radio units can be pole, wall or rack mounted. Pole and wall mounts come with sunshades and rack mount comes with a fan that provides forced-air cooling. In a standard 19 inch rack, occupying only a 2U panel, rack mount radio units can be installed by technicians with normal industry competency. Additionally, MiMOMax pole or wall mount radio units are designed to meet IP 67 waterproofing when deployed outdoors.

**Compliances**
The MiMOMax MDL conforms to a broad range of international compliances which are detailed in the “Product Specifications” section of this document.

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### PRODUCT OPTIONS

**Additional Security Options**
While the MiMOMax MDL comes with a range of inclusive security features, additional security and protection options are available to further enhance network robustness and reliability. These include:

- **SNMP V3**: Management interfaces are password protected and have optional SNMP V3 Authentication & Encryption.
- **Firewall**: Optional Stateful Packet Inspection provides high level of security to any element on the network by isolating network zones.

**Software Feature Enablers (SFEs)**
MiMOMax has developed a wide portfolio of SFEs to optimise network performance and meet unique customer requirements. The MiMOMax SFEs that are compatible with the MiMOMax MDL include:

- MiMOMax Cognizant Adaptive Modulation (M-CAM)
- MiMOMax Data Acceleration Protocol (M-DAP)
- MiMOMax Routing Adaptation Protocol (M-RAP)
- MiMOMax Enhanced Security Options (M-SEC)
- Over-The-Air Configuration (OTAC)
- Over-The-Air Programming (OTAP)
- SNMP Support
- Diversity Enabled (2x4 MIMO) (Future)
- Terminal Server Software
- Redundancy Enabled

### PRODUCT ACCESSORIES

**Antennas**
MiMOMax has developed a range of unique, high performing MIMO antennas that can be connected directly to MiMOMax radio units. All MiMOMax antennas transmit and receive both vertically and horizontally polarized signals. They produce pattern diverse MIMO signals for links that span up to 100 kms (high site) with some near-line-of-sight and non-line-of-sight capability over shorter distances. The MiMOMax MDL is compatible with the complete range of MiMOMax antennas. These include:

- MiMOMax Dual Polarised Loop Yagi Antenna (Single, Dual & Quad Array Variants)
- MiMOMax Ruggardised Panel Antenna
- MiMOMax Collinear Omni Directional Antenna
- MiMOMax 13 dBi Wide Band Antenna

**Radio Filters**
To ensure high quality and interference-free data transmission, MiMOMax offers two radio filter options specifically for MiMOMax radio units. These include a Band Pass Filter and a Band Reject Filter. Various configuration options are available to suit specific application requirements.

**External Power Supplies**
MiMOMax offers two external power supply options that are compatible with MiMOMax radio units. These include the 48 V isolated DC/DC power supply and the 120-240 V AC mains power supply. Both have an output power rating of 150 W.

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1 For comprehensive information on the complete portfolio of MiMOMax SFEs, please refer to the MiMOMax SFE Specification Sheet, located on the MiMOMax website, www.mimomax.com/products/specs-at-a-glance
2 For comprehensive information and specifications on the complete MiMOMax antenna range, please refer to the MiMOMax Antenna Specification sheets, which are available on the MiMOMax website; www.mimomax.com/products/antenna-range
3 For further information on MiMOMax’s Radio Filter options, please refer to the MiMOMax Radio Filter Specification Sheets, which are available on the MiMOMax website; www.mimomax.com/products/specs-at-a-glance
**RF General**

<table>
<thead>
<tr>
<th>RF Bands</th>
<th>400 MHz</th>
<th>900 MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF Frequency Range</td>
<td>365 to 470 MHz</td>
<td>806 to 960 MHz</td>
</tr>
<tr>
<td>RF Frequency Band Splits</td>
<td>365-390 MHz, 420-430 MHz, 440-450 MHz, 450-470 MHz</td>
<td>806-869 MHz, 852-933 MHz, 896-960 MHz</td>
</tr>
<tr>
<td>Configuration</td>
<td>2 x 2 MIMO</td>
<td>2 x 4 MIMO</td>
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<tr>
<td>Supply Voltage (Non-Isolated)</td>
<td>10.5V DC to 32V DC</td>
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</tr>
<tr>
<td>Nominal Channel Bandwidth</td>
<td>12.5 kHz &amp; 25 kHz (50 kHz future)</td>
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</tr>
</tbody>
</table>

**Duplexer (Internal)**

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<tr>
<th>RF Bands</th>
<th>400 MHz</th>
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</thead>
<tbody>
<tr>
<td>Bandwidth</td>
<td>&gt;300 kHz (Stop Band)</td>
<td>&gt;4 MHz (Pass Band)</td>
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<tr>
<td>Tx / Rx Split</td>
<td>5 MHz minimum</td>
<td>24-76 MHz</td>
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<tr>
<td>Stop Band Attenuation</td>
<td>&gt;70 dB</td>
<td></td>
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<tr>
<td>Insertion Loss</td>
<td>&lt;2 dB</td>
<td></td>
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</tbody>
</table>

**Internal Digital Interfaces**

| Format | 10BaseT (400MHz) | 10/100BaseT (900MHz) |
| Connector | RJ45 | RJ45 |

**Compliances**

<table>
<thead>
<tr>
<th>RF Bands</th>
<th>400 MHz</th>
<th>900 MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radio Performance</td>
<td>ACMA AS/NZS 4768 &amp; AS/NZS 4295-2004</td>
<td>ACMA AS/NZS 4768 &amp; EN 300 113</td>
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<tr>
<td>FCC 47CFR part 90</td>
<td>FCC: XMK-MMXRUDHB002</td>
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<tr>
<td>RSS-Gen</td>
<td>RSS-Gen</td>
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<td>IC Canada</td>
<td>8587A-RUBFDHB2</td>
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<tr>
<td>EN 302 113</td>
<td>EN 300-113-2 V1.4.1</td>
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<td>EMS</td>
<td>AS/NZS/CISPR22</td>
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<td>EN 301 489</td>
<td>EN 301 489-1 V1.8.1 &amp; EN301 489-4 V1.3.1</td>
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<tr>
<td>FCC 47CFR part 15</td>
<td>ICES-003</td>
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<tr>
<td>EN 302-113</td>
<td>EN 300-113-2 V1.4.1</td>
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</tbody>
</table>

**Transmitter**

| Modulation | QPSK/16/64/256 QAM |
| RF Power Output | 2 x +30 dBm (1 Watt) Average |
| RF Power Control Range | >20 dB |
| Frequency Step Size | 5 kHz & 6.25 kHz Adjustable |
| Frequency Accuracy and Stability | ±2 ppm at 400 MHz, ±1.5 ppm at 900 MHz |

**Receiver / Diversity Receiver**

| Modulation | QPSK/16/64/256 QAM |
| Typical RF Sensitivity for 10^{-4} BER | 25 kHz | < -102/-99/-94/-87 dBm |
| 12.5 kHz | < -106/-102/-97/-90 dBm |
| Typical RF Sensitivity for 10^{-5} BER | 25 kHz | < -101/-98/-92/-85 dBm |
| 12.5 kHz | < -105/-101/-95/-88 dBm |
| Frequency Step Size | 5 kHz & 6.25 kHz Adjustable |
| Frequency Accuracy and Stability | ±2 ppm at 400 MHz, ±1.5 ppm at 900 MHz |

**Environmental Protection**

| IP67 for outdoor mounting |
| IP20 for indoor rack-mount unit |

**Mounting**

| Rack mount option | 440 x 84.5 x 382 mm box size |
| Wall/ pole mount option | 262 x 393 x 86.5 mm radio unit only, excl. mounting |

**Weight**

| 6.8kg radio unit only, excl. mounting |

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(1) Other frequencies available on request.
(2) The number of RRUs supported depends on individual requirements.
(3) The total aggregate user data rate is typically 56, 112, 170 or 220 kbps depending on the application, configuration, signal path and direction.
(4) Please contact MiMOMax Wireless Ltd directly for more information on individual configuration requirements.
(5) The Dual RS232 does not include hardware flow control.
(6) Designed to be compliant with listed standards.
**MiMOMax Tornado**

The MiMOMax Tornado is a full-duplex, software flexible, ultra spectrally efficient, long range point-to-multipoint remote radio unit with built-in intelligent network features for Critical Network Infrastructure. With scalable data rates and an efficient random access protocol, it can provide near real-time access to a large number of remote sites with very high reliability and low latency. The MiMOMax Tornado is fully compatible with all MiMOMax products and provides economical SCADA and Telemetry solutions to remote sites in the Power, Gas and Water acquisition and distribution industries.

### Benefits
- **Seriously Smart**
  - Scalable
  - Very Economical
  - Highly Efficient
  - Compatible
  - Robust
  - Exclusive to User
  - Future Defensive
  - Environmentally Sound

### Key Features
- Point-to-Multipoint
- Linux Application Engine
- Ultra Spectrally Efficient
- Scalable Data Throughput Rates
- SCADA, Telemetry & Data Solutions
- Software Flexible & Intelligent
- Very Low Latency
- Very Low Power Consumption
- Full-duplex
- Capacity to Simultaneously Operate in Poll and Interrupt Modes
- UHF Licensed Spectrum
- Ethernet, Serial & USB Interfaces
- IP Data Encryption & Firewall Security
- Advanced Software Features
- User Settable Frequency
- User Programmable Power
- Indoor & Outdoor Mountable

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General
Configuration 2 x 2 MIMO / 2 x 4 MIMO
Supply Voltage 10.5V DC to 64V DC
Maximum Power Consumption 26W (at 13.8V) 20W typical
Standby Power Consumption <5W typical
Ambient Temperature Range -30ºC to +70ºC
Mounting 1U High Rack Mount
         Pole Mount Unit
         Wall Mount Unit
         DIN Rail Mount
Dimensions (L x W x H) 180 x 270 x 44mm
Base Gross Data Rate 25kHz 80kb/s Full-duplex
         12.5kHz 40kb/s Full-duplex
Upgradable Gross Data Rates 25kHz 160/240/320kb/s Full-duplex
         12.5kHz 80/120/160kb/s Full-duplex
Weight 2 kg (radio unit only, excl. mounts)

Receiver / Diversity Receiver
Modulation QPSK/16/64/256QAM
Number of MIMO receivers 2 or 4 (future)
Symbol Rate 2x20k symbols/sec (25kHz)
         2x10k symbols/sec (12.5kHz)
Modulation(1) Sensitivity(2) for 10^-4 BER
         25kHz <-112/-105/-99/-92dBm
         12.5kHz <-115/-108/-102/-95dBm
Modulation(1) Sensitivity(2) for 10^-7 BER
         25kHz <-113/-106/-100/-93dBm
         12.5kHz <-110/-103/-97/-90dBm
Measurements via duplexer at antenna port
Frequency Range 420 to 470MHz other frequencies available on request
Frequency Step Size 5kHz & 6.25kHz selectable
Frequency Accuracy and Stability better than +/- 1.5ppm
Nominal Channel Bandwidth 12.5kHz, 25kHz (50kHz future)

Transmitter
Number of MIMO transmitters 2
Modulation QPSK/16/64/256QAM
Symbol Rate 2x20k symbols/sec (25kHz)
         2x10k symbols/sec (12.5kHz)
RF Power Output 2 x +24dBm average
RF Power Control Range >20dB
Frequency Range 420 to 470MHz
Frequency Step Size 5kHz & 6.25kHz selectable
Frequency Accuracy and Stability Better than +/- 1.5ppm

Duplexer (Internal)
Type Bandpass
Tx / Rx Split 5 MHz minimum
Frequency Range 400 to 470MHz other frequencies available on request
Stop Band Attenuation >60 dB @ >5MHz from centre
Pass Band Bandwidth(3) 2 MHz (-0.5dB)

Interfaces (Digital & Analogue)
ETHERNET
Format Dual 10BaseT/100BaseT Connectors 2 x RJ45
ASYNCHRONOUS SERIAL
Format Dual RS232 Connectors 2 x RJ45
Baud Rate 300 - 115,200 baud
USB
Format High speed USB 2.0 Connectors Type A and mini B
ALARM
Format 1 set of volt-free change over contacts
Connector 12 pins EH connector
GPIO
Analogue/Digital
Format 4 x s/w configurable I/O ports
Connector 12 pins EH connector
FREQUENCY REFERENCE
Input/Output
Format isolated differential pair
Connector 12 pins EH connector

Compliances
Radio ACMA
Performance AS/NZS 4295-2004
         FCC 47CFR part 90
         IC Canada
         RSS-119
         ETSI 300-113
EMC
AS/NZS/CISPR22
         EN 301 489
         EN 301 489-1 V1.9.2 (2011-09)
         EN301 489-4 V2.1.1 (2012-11)
         FCC 47CFR part 15

Environmental
60950-22 Outdoor Safety

Important: Specifications are subject to change without prior notice
(1) Systems employing modulation swapping will automatically reduce the modulation order at a signal level higher than the specified sensitivity level. This will maintain the lowest possible error rate.
(2) Sensitivity as specified includes forward error correction and internal duplexer loss.
(3) The maximum acceptable frequency shift without retuning the duplexer is also subject to the stop band performance

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