MDS Orbit LN Series

High Speed, Long Range, Exceptional Performance for Narrowband Licensed Networks

The MDS™ Orbit Licensed Narrowband (LN) Series radios implement the advanced networking and security features of the MDS Orbit platform to bring new levels of performance and versatility to networks utilizing narrowband licensed spectrum in the 400 and 900 MHz frequency bands. In addition to the core feature suite derived from the Orbit platform, the LN Series radios implement high speed QAM modulation options for a 6 times speed improvement over other narrowband solutions operating in 6.25, 12.5 and 25 KHz channel sizes.

The MDS Orbit LN Series radios are available in both the MCR (Multiservice-Connect Router) and ECR (Edge-Connect Router) models. Both the MCR and ECR share the same networking and security functionality with the MCR being a dual radio router while the ECR supports a single LN radio with optional WiFi in a more compact form factor. The MCR-LN and ECR-LN support IP/Ethernet and serial communication for data acquisition applications to remote PLC, control and metering devices.

Users can simultaneously operate multiple host systems, remote device types and protocols to support SCADA and M2M applications on a common infrastructure.

Key Benefits

- Improved performance for data acquisition and control networks implementing IP/Ethernet communication to remote devices
- Repurpose narrowband networks for new applications through a 6X increase in communication speed
- Secure your network and assets by implementing best-in-class cyber security
- Support converged network applications and hybrid wireless solutions through advanced wireless routing and quality of service
- Implement push communication and report by exception from remote devices

Applications

**Oil & Gas**
- Remote data collection from meters and flow devices
- Monitor and transmit wellhead performance and status data

**Energy**
- Remote control of IEDs and controllers at distribution substations
- Condition monitoring for reclosers and capacitor banks

**Water & Wastewater**
- Monitor lift stations across multiple sites from the control room
- Remote PLC communication for controlling level and flow

**Heavy Industrial**
- Monitor and control remote pumps and compressors
- Transmit video and remote site security information

**Industrial Security**
- Operating temperature range -40°C to 70°C
- CSA Class 1, Div 2 for hazardous locations
- IEEE® 1613, IEC® 61850-3 for electric substation environments
- 5-year warranty

**Advanced Networking**

- 10 Watt peak power with coverage up to 50 miles
- Concurrent routing and bridging enables flexibility for a variety of network designs
- Flexible quality of service (QoS) to prioritize network applications and device connectivity
- Hybrid wireless routing to support two wireless media in a single device

**Exceptional Performance**

- QAM Modulation providing 120 kbps in 25 KHz and 60 kbps in 12.5 KHz channel
- Real-time adaptive modulation automatically adjusts speed to signal characteristics
- Dynamic FEC extends range in difficult conditions
- IP Header and Payload compression to improve throughput over 30%

**Enterprise Security**

- Enterprise-class device and network cyber security functionality for advanced protection of network assets
- AES 128/256 encryption
- Public Key, EAP TLS, Pre-shared, Ike 1-2
- Radius Authentication
Exceptional Network Performance

Improved productivity, optimization, preventive maintenance, quality control, regulatory compliance, safety and security are just a few of the requirements that drive the need for high performance networks to support multiple applications and deliver actionable data collected from remote, geographically dispersed assets.

The MDS Orbit MCR-LN and ECR-LN radios bring new levels of networking performance to users operating narrowband licensed networks in 6.26, 12.5 and 25 KHz channel sizes.

QAM Modulation

The LN Series radios implement QAM modulation to achieve raw data rates up to 6 times faster than traditional FSK modulation variants typically used in legacy narrowband networks. Through QAM modulation, speeds up to 120 kbps in a 25 KHz channel and 60 Kbps in 12.5 KHz are achieved.

### QAM Modulation Table

<table>
<thead>
<tr>
<th>CHANNEL SIZE</th>
<th>LEGACY SPEED</th>
<th>ORBIT LN SERIES SPEED</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>QPSK</td>
<td>16QAM</td>
</tr>
<tr>
<td>6.25 KHz</td>
<td>4.8 kbps</td>
<td>9.6 kbps</td>
</tr>
<tr>
<td>12.5 KHz</td>
<td>9.6 kbps</td>
<td>20.0 kbps</td>
</tr>
<tr>
<td>25.0 KHz</td>
<td>19.2 kbps</td>
<td>40.0 kbps</td>
</tr>
</tbody>
</table>

Real Time Adaptive Modulation

Real time adaptive modulation automatically selects the optimum modulation type per remote radio to achieve the best speed. Adaptive modulation is implemented for both upstream and downstream communication. The Access Point continually monitors signal quality and adapts the modulation type accordingly.

Dynamic Forward Error Correction

Users can activate GE’s MDS proprietary dynamic Forward Error Correction (FEC) to improve the radio receive sensitivity for networks operating in high interference environments or when operation at or near sensitivity limits is necessary. Dynamic FEC improves sensitivity between 3 to 7 dBm. The LN radio automatically optimizes the FEC coding block to the data packet size to minimize network overhead and maintain the best network throughput.

### Dynamic Forward Error Correction Table

<table>
<thead>
<tr>
<th>CHANNEL SIZE</th>
<th>SENSITIVITY USING QPSK MODULATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Typical</td>
</tr>
<tr>
<td>6.25 KHz</td>
<td>117 dBm</td>
</tr>
<tr>
<td>12.5 KHz</td>
<td>112 dBm</td>
</tr>
<tr>
<td>25.0 KHz</td>
<td>107 dBm</td>
</tr>
</tbody>
</table>

IP Header and Payload Compression

For networks operating TCP and UDP protocols, the LN series implements IP Header and Payload compression to improve network throughput. TCP sessions in particular involve a significant amount of handshaking between host systems and remote devices. Virtual over-the-air throughput increases the raw data rates of 30% or more depending upon the compressibility of data packets being transmitted.

Media Access Control

Media Access Control (MAC) is a critically important function particularly in narrowband networks as it is responsible for maintaining optimal network throughput even as more devices and applications are added. The LN series radios implement a proprietary contention MAC designed specifically to consume very little overhead. The LN Series MAC guarantees that user data never collides and that data packets reach the intended destination, preventing throughput drops in congested networks.

Advanced Networking

The Orbit platform endows the LN Series with an advanced array of networking capabilities including simultaneous Layer 2 bridging and Layer 3 routing. Tunneling, integrated terminal server functionality and protocol conversion are also supported.

Quality of Service

Quality of Service (QoS) allows the user to prioritize the flow of information over the network by application and interface using up to 16 QoS priorities. Layer 2, 3 and 4 classification enables the detailed identification of all types of applications for maximum flexibility in addition to standard 802.1p and DSCP based classifications. Traffic Shaping allows users to allocate a percentage of the uplink bandwidth on a per-application basis in order to ensure more deterministic data transmission during network congestion.

Hybrid Wireless

The Orbit LN Series brings added levels of network versatility by supporting seamless bridging and routing through multiple wireless options. This allows users to create separate field subnetworks, extend communications, or support integrated backhaul alternatives.

Both the MCR-LNx and ECR-LNx models support an optional, secure WiFi option. The MCR-LNx will support a second wireless option from other Orbit radio options including unlicensed 900 MHz or 4G LTE, and 3G cellular.
Orbit LN Series Application Advantages

Connectivity
- Connect multiple RTU and Controller types to a single remote radio
- Interface multivariable transmitters via serial or WiFi
- Use Ethernet for PLC or Voice over IP

Performance
- Use advanced QoS to prioritize critical SCADA over lower priority traffic
- Activate compression for >30% throughput improvement
- Adaptive modulation automatically adjusts optimum speed per remote

Communication
- Concurrently operate multiple host systems, applications and protocols
- Network security with robust encryption and authentication
- Use routing and bridging capabilities for more advanced deployments

Enterprise Security
The Orbit LN Series provides a best-in-class cyber security suite designed to meet stringent security requirements such as NERC-CIP and FIPS. It offers a versatile range of options allowing the user to scale security levels to their unique network conditions.

Orbit LN Series secures the network by supporting AES 128/256 encryption, IPSec VPN encryption (server and client), certificate management, firewalling and stateful packet inspection to ensure that the data is protected, and only valid/legitimate data is permitted to flow. The user is secured through central and local authentications and authorization to insure access only with proper privileges. The radio itself is secure through digitally signed firmware, hardware and manufacturing implementations to insure hardware/firmware integrity.

Intuitive User Interface
An easy-to-use Graphical User Interface (GUI) allows for the quick provisioning and maintenance from a web browser. Orbit LN Series radios support HTTP, HTTPS, and SSH. MDS Orbit’s wizards accelerate the configuration of complex network functionality by breaking down processes into simple, concise and automated steps.

Network Management
The Orbit platform supports management using SNMPv1/v2/v3, MIN-II and Enterprise MIB. NETCONF is also supported. Manage Orbit LN Series networks using PulseNET NMS. PulseNET is purpose built for industrial communications and includes sophisticated and meaningful pre-built workflows along with intuitive graphical representations of the network at your fingertips.

Orbit ECR and MCR Model Comparison

<table>
<thead>
<tr>
<th>MODEL</th>
<th>PRIMARY WIRELESS</th>
<th>SECOND WIRELESS OPTION</th>
<th>COMMUNICATION PORTS</th>
<th>MOUNTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCR</td>
<td>LN4: 400 MHz</td>
<td>WiFi</td>
<td>Option A: 2 Ethernet, 1 Serial, 1 USB Option B: 1 Ethernet, 2 Serial, 1 USB</td>
<td>Surface Mount DIN Mount Option</td>
</tr>
<tr>
<td></td>
<td>LN9: 900 MHz**</td>
<td>License 900 MHz**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ECR</td>
<td>LN4: 400 MHz</td>
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</tbody>
</table>

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Specifications

**GENERAL**

- **Frequency**: Configurable
- **Operation Modes**: Simplex, half-duplex
- **Modulation**: QPSK, 16QAM, 64QAM
- **FEC**: Dynamic Forward Error Correction
- **Range**: Up to 50 Miles

**CHANNEL SIZE**

- QPSK: 64QAM, 64QAM
  - 6.25 KHz: 9.6 kbps
  - 12.5 KHz: 20.0 kbps
  - 25.0 KHz: 40.0 kbps

**FREQUENCY BANDS**

- **MCR Option A**: 10/100 Ethernet, RJ45
  - 11 MHz: 2.4 GHz (IEEE 802.11 b/g/n)
- **MCR Option B**: 10/100 Ethernet, RJ45
  - 11 MHz: 2.4 GHz (IEEE 802.11 b/g/n)
- **ECR**: 10/100 Ethernet, RJ45
  - 11 MHz: 2.4 GHz (IEEE 802.11 b/g/n)

**INTERFACES**

- **MCR Option A**: 10/100 Ethernet, RJ45
  - 11 MHz: 2.4 GHz (IEEE 802.11 b/g/n)
  - 11 MHz: 2.4 GHz (IEEE 802.11 b/g/n)
  - 11 MHz: 2.4 GHz (IEEE 802.11 b/g/n)
- **MCR Option B**: 10/100 Ethernet, RJ45
  - 11 MHz: 2.4 GHz (IEEE 802.11 b/g/n)
  - 11 MHz: 2.4 GHz (IEEE 802.11 b/g/n)
  - 11 MHz: 2.4 GHz (IEEE 802.11 b/g/n)
- **ECR**: 10/100 Ethernet, RJ45
  - 11 MHz: 2.4 GHz (IEEE 802.11 b/g/n)
  - 11 MHz: 2.4 GHz (IEEE 802.11 b/g/n)

**SECURITY**

- **PSec VPN**: Server (responder) & Client (initiator)
- **Authentication**: Public Key, EAP TLS, Pre-shared, like 1-2
- **User Authentication**: Local RBAC, AAA/Radius
- **Encryption**: 3DES, AES 128/192/256, CBC, CTR, VCM, CCM, SHA 256/384/512 HMAC
- **Firewall**: Stateful L3-4 Access Control List, Layer 2 MAC Filtering, NAT, Source NAT (Masquerading), Static NAT, Port Forwarding
- **Device Security**: Secure Boot, Secure Firmware, Digitally Signed Hardware and Software, Magnemeter Tamper Detection
- **Certificate Hg**: X.509, SCP, PEM, DER, RSA

**ENVIRONMENTAL**

- **Temperature**: -40° to +70°C (-40°F to +158°F)
- **Humidity**: 95% at 60°C (140°F) non-condensing

**RECEIVER**

- **Type**: Direct Conversion
- **Adjacent Channel Rejection**: 60 dB nominal
- **Sensitivity**: Typical @ 1 x 10^-6 BER
- **Carrier Power Accuracy**: +/- 1.5 dB typical
- **Output Impedance**: 50 Ohms
- **Adjacent Channel Power**: < -60 dBC

**TRANSMITTER**

- **Frequency Stability**: +/- 0.5 ppm
- **Peak Carrier Power**: 1 W (max)
- **Average Power (Programmable)**: QPSK: 0.1 – 5 W, 16QAM: 0.1 – 3.2 W, 64QAM: 0.1 – 2.5 W
- **Carrier Power**: +/- 0.5 dB typical

**WARRANTY**

- 5-year standard warranty

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**ORDERING**

<table>
<thead>
<tr>
<th>Band</th>
<th>MCR Option A</th>
<th>MCR Option B</th>
<th>ECR</th>
</tr>
</thead>
<tbody>
<tr>
<td>L9C</td>
<td>10/100 Ethernet, RJ45</td>
<td>10/100 Ethernet, RJ45</td>
<td>10/100 Ethernet, RJ45</td>
</tr>
<tr>
<td><strong>F</strong></td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td><strong>5</strong></td>
<td>S</td>
<td>D</td>
<td>S</td>
</tr>
<tr>
<td><strong>UNN</strong></td>
<td>406-470 MHz</td>
<td>928-960 MHz</td>
<td>406-470 MHz</td>
</tr>
<tr>
<td><strong>Description</strong></td>
<td>928-960 MHz</td>
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<td>928-960 MHz</td>
</tr>
</tbody>
</table>

**MECHANICAL**

- **Case**: Rugged die-cast aluminum
- **Dimensions MCR**: 1.75 H x 8.0 W x 4.8 D in.
  - 4.45 H x 20.32 W x 12.19 D cm
- **Weight MCR**: 2 lbs., 91 kg
- **Dimensions ECR**: 2.1 H x 4.3 W x 4.6 D in.
  - 5.33 H x 10.82 W x 11.68 D cm
- **Weight ECR**: 1.65 lbs., 65 kg

**ELECTRICAL**

- **Primary Power**: 10 to 60 VDC
- **Power Consumption**: 2 lbs., 91 kg
- **Standby**: 2 lbs., 91 kg
- **Power Consumption**: 1.45 lbs., .65 kg

**APPROVALS**

- **CSA Class I Div 2 for hazardous locations**
- **IEEE 1613, IEC 61850-3**

**WIFI OPTION**

- **Frequency 2.4GHz**
- **Standard**: IEEE 802.11 b/g/n
- **Maximum Data Rate**: 54Mbps
- **Operating Modes**: Access Point, Station
- **VLAN mapping**: Security: WPA/WPA2 PSK, Enterprise
- **Carrier Power**: 20dBm adjustable

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