GE Energy Connections

MDS Orbit Licensed Solutions

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

The constant evolution of industrial SCADA applications coupled with the ever increasing scale of asset deployment cause significant challenges on underlying licensed narrowband networks. Such networks need to offer an always-on connectivity to maximize application availability. They must provide a comprehensive framework of security in order to guard against the intensified waves of cyber attacks. Finally, the wireless networks must enable advanced performance in order to scale and support modern TCP/IP applications.

The GE MDS Orbit is an industrial-strength wireless router platform that helps overcome the challenges of deploying modern industrial automation applications. In addition to enabling high performance communication over the 900MHz, 700MHz, 400 MHz, 200MHz and 100 MHz licensed narrowband spectrum, the Orbit platform offers a diverse range of integrated secondary radio options including cellular, Unlicensed 900MHz ISM as well as Wi-Fi.

Key Benefits

- Repurpose narrowband spectrum for more bandwidth-intensive IP applications using QAM modulation
- Provide backward compatibility with GE MDS SD Series or legacy GE MDS x710 radios to seamlessly expand or migrate networks
- Minimize network downtime with dual radio uplinks and other redundancy features
- Protect network and assets against intrusion with powerful cyber security capabilities
- Simplify operations, reduce learning curves and reduce cost by unifying the deployment of multiple wireless technologies on a single platform

Applications

Oil & Gas
- Well Head and Production Pad Controllers & Metering Automation
- Remote Field Office Connectivity

Water & Wastewater
- Monitoring and Control
- Maintenance Workforce Mobility

Emergency & Utility Vehicles
- Law enforcement connectivity
- Utility Workforce Mobility

Electric Utilities
- Field Area Network
- AMI Backhaul
- Workforce Mobility

Smart Cities & Municipalities
- Traffic Signals Control
- Video Security
- Weather Monitoring Stations

Heavy Industrial
- Train Control and Machinery Monitoring
- Excavation Machine Control

Exceptional Network Performance

- Up to 64QAM of modulation enables newer applications in narrowband networks
- Up to 50kHz bandwidth in 200 and 700 MHz bands
- Bi-directional per-packet, per-remote Adaptive Modulation maximizes network throughput in uplink and downlink directions
- IP Header and Payload compression improve efficiency by up to 30%

Advanced Networking & Security

- Enterprise-class cyber security including VPNs, key rotation, firewalling and centralized authentication for advanced protection
- FIPS 140-2 (Level 2) certification*
- Rich Quality of Service allows for various modes of traffic prioritization in addition to per-application bandwidth allocation

Platform Flexibility

- Backward-compatibility with GE MDS SD Series and x710 networks for a seamless migration path
- Variety of form factors with single or dual radio configurations

Industry Leading Reliability

- A patented Media Access Control guarantees message delivery and eliminates collision at the Access Point
- Various uplink redundancy options, including cellular backup to improve network availability
- 3rd party Certified for IEEE1613, IEC61850-3, ATEX and Class 1 Div 2 for deployment in harsh environments

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 to for high performance networks to support multiple applications and deliver actionable data collected from remote, geographically dispersed assets.

The GE MDS Orbit Licensed radio solutions bring new levels of networking performance to users operating narrowband licensed networks in 6.26, 12.5, 25, and 50* kHz channels.

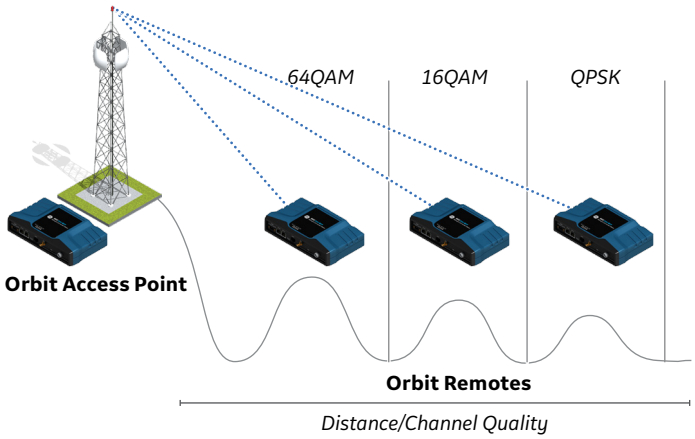
Up to 64QAM of Modulation

The GE MDS Orbit platform implements QAM modulation to achieve raw data rates up to 6 times faster than traditional FSK modulation variants typically utilized in legacy narrowband networks. Through QAM modulation, speeds up to 120 kbps in a 25 kHz channel and 240 Kbps in 50 KHz are achieved..

Channel Size	QPSK	16QAM	64QAM
6.25 kHz	9.6 kbps	19.2 kbps	28.8 kbps
12.5 kHz	20.0 kbps	40.0 kbps	60.0 kbp
25.0 kHz	40.0 kbps	80.0 kbps	120.0 kbps
50.0 kHz	80.0 kbps	160.0 kbps	240.0 kbps

Bi-Directional Adaptive Modulation

Bi-Directional Adaptive modulation maximizes throughput in both upstream and downstream directions for each remote independently. It enables Access Points and Remotes to transmit data at the highest possible modulation in real time, on a per-packet basis. The outcome is a network that does not sacrifice its overall performance for the least common denominator link.



IP Header and Payload Compression

Orbit's IP Header and Payload compression improves network throughput efficiency by up to 30%. It is especially beneficial when using TCP based applications that tend to have a lot of handshaking, thus overhead.

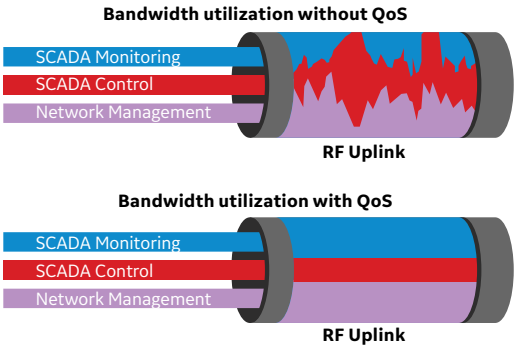
Advanced Security & Networking

Enterprise Class Security

The MDS Orbit platform is built on a comprehensive cyber security framework to enable the deployment of highly secure industrial applications. It offers standards-based IPSec VPN and DMVPN capabilities to ensure end-to-end IP encryption between remotes and headend regardless of the underlying backhaul. As an added layer of security, Orbit supports the encryption of licensed radio links at the RF layer with secure key rotation algorithms. Centralized RADIUS authentication and 802.1x enable only authorized users and machines to access the network at the intended entry points and times. Orbit's stateful firewall and MAC-filtering block unwanted traffic from flowing through the network. Orbit also employs secure device practices such as Secure Firmware and Secure Boot to protects against the tampering with its hardware and software.

Dynamic Routing and Quality of Service

Orbit's support for dynamic and static routing as well as managed switch capabilities facilitate the deployment in a multitude of network architectures. Orbit's advanced QoS functionality enable the transport of multiple application streams in the same network without compromising the performance of critical traffic. With fair and priority queuing, and traffic shaping, Orbit offers choices to engineer traffic priorities and carve dedicated bandwidth on a per-application basis in order to maximize application performance and adhere to Service Level Agreements (SLAs).



Platform Flexibility

Variety of Form Factors

To help extend communications to a variety of enclosure systems, Orbit is offered in compact (ECR) and standard (MCR) form factors. They can be factory-configured with different interface and radio combinations.

Diverse Radio Technologies

In addition to being offered in licensed spectrum, the Orbit platform supports communication in unlicensed 900Mhz, cellular technology as well as WiFi. Orbit can be factory-configured with single or dual-radios. This allows customers to deploy various radio technologies on the same platform, firmware and user experience thus standardizing operations, reducing cost and learning curves.

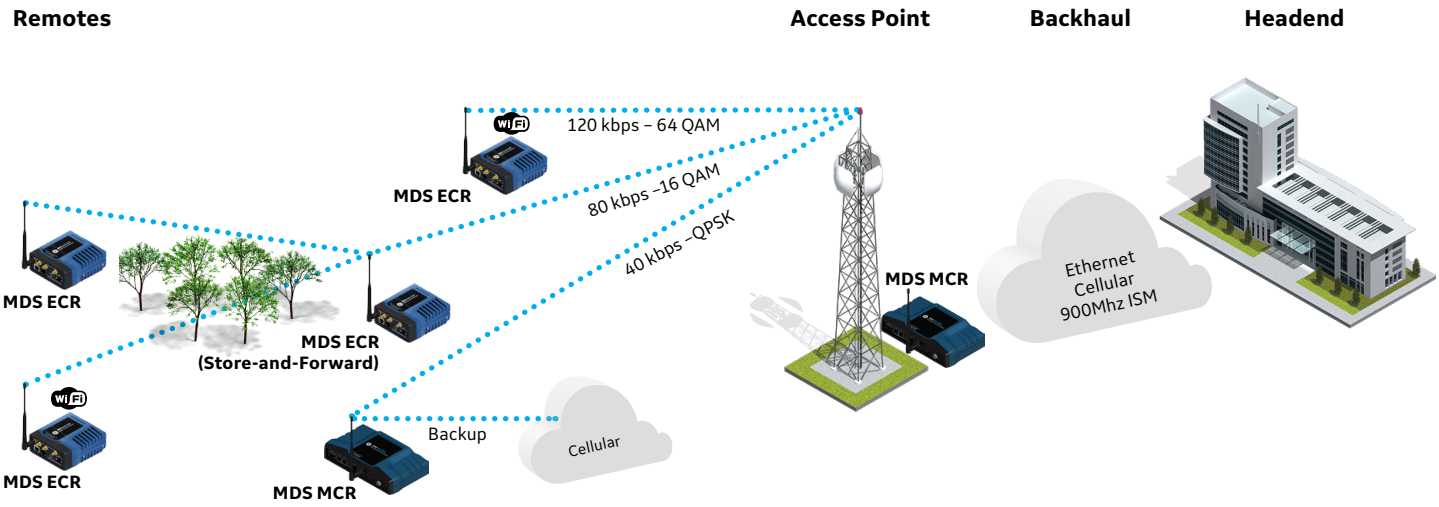
Backward Compatibility with MDS SD and x710

The MDS Orbit licensed narrowband radio can operate in a CPFSK Digital A backward compatible modulation to interface with existing MDS SD Series or x710 Access Points. Supporting Transparent (serial streaming) as well as Packet-with-Mac (IP) modes, this capability enables customers to seamlessly expand or migrate brownfield networks with minimum disruption.

Integration with MDS Master Station

Orbit's Licensed Narrowband radio technology integrates seamlessly with the MDS Master Station. The Master Station is a fully redundant solution for licensed communications, offering dual power supplies, dual radios, an integrated duplexer and with no cooling fans or moving parts.

Application Example



Access Interfaces

- Connect multiple RTU and Controller types to a single remote radio
- Access interfaces include Ethernet, Serial, and an optional WiFi

Performance

- Use QoS to prioritize critical SCADA over lower priority traffic
- Adaptive modulation automatically adjusts optimum speed in both directions
- A patented MAC enables network scalability with minimized impact on performance

Security

- Firewalling and MAC filtering block unwanted traffic at the network perimeter
- RF and IPSec VPN encryptions provide options for end to end communication security
- 802.1x at remote locations allow network access to only authorized users and machines

Industry Leading Reliability

A Patented Media Access Control

Media Access Control (MAC) is a mechanism that orchestrates and manages how devices access a network to transmit data. Orbit's patented MAC maintains optimal throughput as more devices and applications are added to the network. It further guarantees the delivery of data packets to intended destinations and eliminates data collision at the Access Point.

Network High Availability

To achieve maximum application uptime, Orbit supports a variety of High Availability mechanisms to enable multiple uplink paths. The Orbit platform supports dual radio configurations, such as Licensed Narrowband and Cellular, interface bonding, Spanning Tree, Layer 3 failover, VRRP as well as latency and packet-loss based failover. GRE tunneling coupled with IPSec VPNs and DMVPN further enable the establishment of secure Virtual Private Networks (VPN) across any wireless technology.

Ease of Use and Management

Intuitive User Interface

An easy-to-use Graphical User Interface (GUI) allows for the quick provisioning and maintenance from a web browser. Orbit supports HTTP, HTTPS, and SSH. Orbit's wizards speed up the configuration of complex network functionality by breaking down processes into simple, concise and automated steps.

Network Management

The Orbit platform supports standards based management using SNMPv1/2c/3, MIN-II and Enterprise MIB. NETCONF is also supported. The GE MDS PulseNET NMS fully integrates with Orbit to offer advanced network as well as device management capabilities. PulseNet enables auto-provisioning to simplify network deployment and reduce operation expenses.

Orbit ECR and MCR Licensed Spectrum Models Comparison

FORM FACTOR	PRIMARY LICENSED RADIO OPTIONS	SECONDARY RADIO OPTIONS	COMMUNICATION PORTS	MOUNTING
MCR (Multiservice-Connect Router)	150-174 MHz, 216-235 MHz, 330-406 MHz, 406-470 MHz, 450-520 MHz, 757-758 & 787-788 MHz, 896-960 MHz	• 2.4GHz Wi-Fi, 2.4/5GHz 2x2 MIMO Wi-Fi, 2G/3G/4G LTE • 2G/3G GSM World • Unlicensed 900 MHz (some combinations not supported)	• Option A: 2 Ethernet, 1 Serial, 1 USB • Option B: 1 Ethernet, 2 Serial, 1 USB • Option C: 4 Ethernet, 2 Serial, 1 USB*	• Surface Mount • DIN Mount Option
ECR (Edge-Connect Router)	150-174 MHz, 216-235 MHz, 330-406 MHz, 406-470 MHz, 450-520 MHz, 757-758 & 787-788 MHz, 896-960 MHz	• 2.4GHz Wi-Fi	• 1 Ethernet, 1 Serial, 1 USB	• Surface Mount • DIN Mount Option

* High port density Port Option C only supports 2.4GHz Wi-Fi as an optional secondary radio

MDS Orbit Licensed Solutions

Orbit Licensed Narrowband Technology

- Module Configuration – Single
- Frequency – Configurable
- Duplex Modes – Half duplex
- Modulation – CPFSK, QPSK, 16QAM, 64QAM
- Adaptive Modulation – Per-packet, per-remote, bi-directional
- Dynamic FEC – Convolutional, Reed Solomon
- Compression – IP Header and Payload with up to 30% efficiency improvement
- Media Access Control – High performance MAC

Orbit Licensed Narrowband Frequency Bands

- L1B: 150 - 174 MHz
- L2X: 216 - 235 MHz
- L4A: 330 - 406 MHz
- L4E: 406.1 - 470 MHz
- L7A: 757 - 758 and 787 - 788 MHz
- L9C: 896 - 960 MHz

Gross Data Rates (all frequencies)

CHANNEL	QPSK	16QAM	64QAM
6.25 kHz	9.6 Kbps	19.2 Kbps	28.8 Kbps
12.5 kHz	20 Kbps	40 Kbps	60 Kbps
25 kHz	40 Kbps	80 Kbps	120 Kbps
50 kHz	80 Kbps	160 Kbps	240 Kbps

Transmitter Characteristics

- Frequency Stability – +/- 0.5 ppm
- Peak Carrier Power – +40 dBm 330-470 MHz, +39.5 dBm 896-9160 MHz
- Average Power – QPSK: +36 dBm
- (Programmable) – 16QAM: +33 dBm, 64QAM: +33 dBm
- Power Range – +20dBm to +40dBm
- Carrier Power Accuracy – (+/- 1.5 dB typical)
- Adjacent Channel Power – < -60 dB
- Output Impedance – 50 Ohms

Receiver Characteristics

- Type – Direct Conversion
- Adjacent Channel Rejection – > -48 dBm
- Sensitivity (Actual) @ 1x10-6 BER, No FEC

CHANNEL	QPSK	16QAM	64QAM
12.5 kHz	-112 dBm	-102 dBm	-95 dBm
25 kHz	-111 dBm	-102 dBm	-93 dBm
50 kHz	-108 dBm	-99 dBm	-90 dBm

- Sensitivity (Actual) @ 1x10-6 BER, low FEC

CHANNEL	QPSK	16QAM	64QAM
12.5 kHz	-115 dBm	-109 dBm	-102 dBm
25 kHz	-114 dBm	-108 dBm	-101 dBm
50 kHz	- 111 dBm	-105 dBm	-98 dBm

Agency Approvals / Standards

- FCC Part 15 and IC
- ETSI / CE
- PTCRB, GCF
- IEEE 1613**, IEC61850-3
- CSA Class 1, Div. 2, UL 508, UL 1604
- ATEX approval for EU on MCR
- EN 60079-0:2012, EN60079-15:2010
- Shock: MIL-STD-810F Method 516.5
- Vibration: MIL-STD-810F Method 514.5
- Shock and Vibration: EIA RS374A
- Storage Temp: Mil-Std 810F Section 501.4 with 1 week soak test
- IP 40/41 per IEC 60529 for Vertical Falling Water and Pollution 3 for Dust

* Check with local sales representative for availability. 50 kHz available in 200 and 700 MHz band only.

** Requires an external DC to DC converter having floating DC inputs (neither side grounded)

Networking

- IPv4 Routing OSPF, EBGP, RIPv2 with performance-based route failover
- IPv6 Routing*
- Full managed switch capability, IEEE 802.3, 802.1Q/VLANs, 64 VLANs, STP
- Concurrent Bridging & Routing
- GRE Tunneling with Layer 2 (Ethernet) and Layer 3 support
- Route/path failover between any two wireless/Ethernet interfaces based on link loss, latency degradation or packet loss thresholds
- Quality of Service 16 egress queues, Priority Queuing, Fair Queuing, Traffic Shaping, Classification based on DSCP, 802.1p and Layer 2-4 classifiers
- IP Protocols TCP, UDP, ARP, DHCP, ICMP, NTP, FTP, SFTP, TFTP, DNS, configurable HTPP and HTTPS, SSH
- Serial TCP server, Modbus/TCP, Modbus RTU, TCP client, UDP Unicast and Multicast, BSAP, and DNP3

Security

- IPSec VPN Server (responder) and Client (initiator) with DMVPN
- Authentication Public Key, EAPTLS, Pre-Shared, Ike 1-2
- Encryption : 3DES, AES 128/192/256, CBC, CTR, CCM, GCM, SHA 256/384/512 HMAC. Wi-Fi: WPA WPA/WPA2 PSK, Enterprise
- Firewalling: Stateful Layer 3-4 Firewall with MAC Filtering, NAT, Source NAT (Masquerading), Static NAT, Port Forwarding
- Device Security : Secure Boot, Secure Firmware, Digitally Signed Hardware and Software, Magnetometer Tamper Detection
- Certificate Management: X.509, SCEP, PEM, DER, RSA
- User Authentication: Local RBAC, AAA/RADIUS, 802.1x
- FIPS 140-2 (Level 2) certification in progress

Management

- GE MDS PulseNET NMS Support with device management and auto-provisioning
- GUI configuration Wizards to simplify operation
- Secure device management via an intuitive web-based GUI and/or CLI
- Event logging, Syslog-over-TSL, SSH, Console
- Iperf throughput diagnostic, NETCONF
- SNMP v1/2c/3, MIB-II, Enterprise MIB

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., 0.91 kg
- Dimensions ECR – 2.1 H x 4.3 W x 4.6 D in., 5.33 H x 10.92 W x 11.68 D cm
- Weight ECR – 1.45 lbs., 0.65 kg

Environmental

- Operating Temp -40° to +70°C (-40° 158°F)
- Storage Temp -40° to +85°C (-40° 185°F)
- Humidity 95% at 60°C (140°F) non-condensing

Warranty

- 5-year standard manufacturer warranty on all Orbit MCR/ECR models

Secondary Radio Options

Unlicensed 900Mhz ISM

- Frequency Bands: 902-928 MHz FHSS
- Bandwidth 152 to 1320 kHz, up to 80 channels
- Gross Data Rates: 125Kbps, 250Kbps, 500 Kbps, 1000 Kbps, 1250 Kbps
- Latency of < 5 msec
- TX Power: 1 watt, configurable

Cellular

- 2G/3G GSM World (AT&T, GSM, world coverage)
- 2G/3G/4G LTE North America with GPS:. Verizon, AT&T, T-Mobile, Bell Canada, Rogers, Telus, US Cellular. Modem allows switching between carriers by upgrading to corresponding carrier profile firmware.
- 2G/3G/4G LTE EMEA & APAC with GPS
- 2G/3G/4G LTE Australia Telstra with GPS
- LTE Private Band 26

2.4 GHz Wi-Fi

- 1x1 SISO (single antenna/radio chain); 802.11 b/g/n
- Scalability up to 2 SSIDs, up to 7 clients/stations
- Max transmit power (adjustable): up to 20dBm

Dual-Band 2.4/5 GHz Wi-Fi:

- 2x2 MIMO (dual antenna/radio chain); 802.11 a/b/g/n
- Scalability up to 2 SSIDs, up to 32+ clients/stations
- Max transmit power (adjustable): up to 26dBm

Orbit Model Interfaces

MCR Option A	(2) 10/100 Ethernet, RJ45 (1) RS232/485 Serial, RJ45 (1) mini USB 2.0
MCR Option B	(1) 10/100 Ethernet, RJ45 (2) RS232/485 Serial, RJ45 (1) mini USB 2.0
MCR Option C	(4) 10/100 Ethernet, RJ45 (2) RS232/485 Serial, RJ45 (1) mini USB 2.0
ECR	(1) 10/100 Ethernet, RJ45 (1) RS232/485 Serial, RJ45 (1) mini USB 2.0
Antenna Connectors	Licensed NB:TNC 900Mhz Unlic: TNC Wi-Fi: RP-SMA Cellular: SMA GPS: SMA female

Electrical and Power Consumption

- Input Voltage 10 to 60 VDC
- Power Consumption Calculations with nominal 25C at 13.8V

WITH 3G GSM WORLD	POWER	13.8V
• Connected (Idle)	2.5W	182mA
• Typical download	3.2W	235mA
WITH 4G LTE	**POWER**	**13.8V**
• Connected (Idle)	4.0W	292mA
• Typical download	4.3W	310mA
WITH 4G LTE + WI-FI	**POWER**	**13.8V**
• Connected (Idle)	4.8W	350mA
• Typical download	5.5W	400mA
WITH 900MHZ ISM	**POWER**	**13.8V**
• Typical	3.2W	232mA
• Maximum	5.3W	385mA
WITH LICENSED NB	**AP**	**REMOTE**
• Idle	910mA	350mA
• 50% Duty Cycle	950mA	780mA

† 200 and 700 MHz Orbit band options support 12.5, 25, and 50 kHz. Other band options support 6.25, 12.5, and 25 kHz

GE Energy Connections
Automation & Controls
2500 Austin Dr
Charlottesville, VA 22911
1-585-242-9600
www.geautomation.com

© 2017 General Electric. The GE brand and logo are trademarks of General Electric. * Trademark of General Electric. IEC is a registered trademark of Commission Electrotechnique Internationale. IEEE is a registered trademark of the Institute of Electrical Electronics Engineers, Inc. Modbus is a registered trademark of Schneider Automation. NERC is a registered trademark of North American Electric Reliability Council. NIST is a registered trademark of the National Institute of Standards and Technology. All other trademarks are the property of their respective owners. GE reserves the right to make changes to specifications of products described at any time without notice and without obligation to notify any person of such changes.

08.17 GFA2139