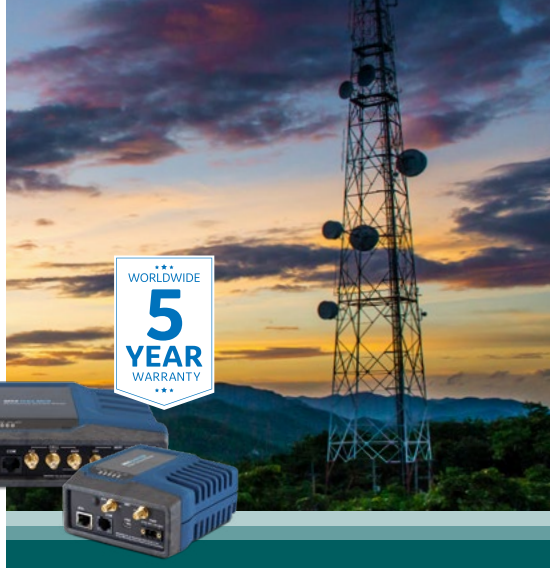
Grid Solutions

MDS ORBIT CELLULAR SOLUTIONS



For secure, reliable public and private LTE networks

MDS™ Orbit is an industrially hardened wireless communications networking platform designed with a common operating system, device management tools, and a comprehensive networking and cybersecurity framework. These commonalities in the platform significantly reduce the overall learning time for users, simplifying the set-up and commissioning of networks, and enable the deployment of a variety of network designs and topologies.

MDS Orbit offers 4G LTE and supports a host of different cellular models including private and public options. The MDS Orbit is available in three form factors: the Outdoor-Connect Router (OCR), the Multiservice-Connect Router (MCR) which supports dual Wide Area Network (WAN) radio options, and the Edge-Connect Router (ECR) which supports a single WAN radio option. The MDS Orbit platform supports multiple wireless technologies including 4G cellular, unlicensed 900 MHz, and licensed 100, 200, 400, 700, and 900 MHz.

In addition to the core feature suite derived from the MDS Orbit platform, the cellular options enable operators to extend secure and reliable 4G LTE cellular connectivity to critical applications while minimizing network downtime and improving application availability. The platform provides Dual-Active LTE modems with Tri-SIM or Dual-SIM options and supports dual SIM and failover options, and covers a wide variety of bands to maximize the flexibility of deployment across carriers and countries.

Key Benefits

- New Dual-Active Orbit MCR provides two active links to separate private/public cellular networks with faster failover in seconds vs minutes compared with other single modem devices
- Extend cellular coverage into rural areas using a cellular uplink and a private point to multipoint radio downlink on the MDS Orbit MCR
- Protect the network and assets against electromagnetic pulse (EMP) attacks and cybersecurity threats
- Overcome harsh environments with IEEE® 1613 and Class 1 Div 2 standard certifications

Applications

Electric Utilities

- Distribution automation
- Maintenance workforce mobility
- RTU serial/IP SCADA and IEC 618500

Oil & Gas

- Well head automation
- Wi-Fi connectivity
- Remote field office connectivity

Water & Wastewater

- Pressure monitoring
- Pipeline monitoring and control
- Maintenance workforce mobility

Smart Cities & Municipalities

- Traffic signals control
- Video security
- Weather monitoring stations

What's New

- New Dual-Active Tri-SIM Cellular Orbit MCR
- FCC certfied to operate on Anterix 900 & CBRS
- FirstNet Ready™ supporting FirstNet band 14 spectrum
- Cellular options for 450MHz b31, 72 or 87
- Standard LTE models with dual-SIM, GSMA eSIM compatible with roaming and multi-carrier auto-switching based on signal quality
- 2G fallback for Europe/LATAM
- Over the air (OTA) firmware updates
- SFP or 6 Ethernet interface options

Enterprise-class Cybersecurity

- Flexible Quality of Service (QoS) enables simultaneous applications on the same uplink while preserving performance
- Concurrent routing and bridging enables flexibility for a variety of network designs
- Enterprise-class device with network cybersecurity functionality and VPNs ensures advanced protection for network assets

Enhanced Reliability

- Industry-leading Mean Time Between Failures (MTBF) of 68 years
- 5-year manufacturer warranty lowers total cost of ownership
- EMP hardened per MIL-STD-461G, RS105

Ease of Use & Compact Design

- Intuitive user interface and configuration wizards simplify complex network configuration tasks resulting in accelerated deployment of advanced networking
- One of the industry's most compact radios with full router functionality

GE VERNOVA

Diverse Cellular Options

Support for a variety of cellular technologies including 4G with 2G or 3G fallback on GSM and CDMA networks allow the flexibility of global deployment across carriers and regions. GPS support on select 4G LTE models enable position reporting for asset tracking as well as GIS integration.

Flexible Networking

Concurrent routing and bridging allow for the flexibility of deployment in a variety of network designs and topologies. Layer 2 (Ethernet) and Layer 3 GRE tunneling further enable the establishment of point-to-point VPNs across any type of network, including the tunneling of Layer 2 automation protocols such as IEC 61850 GOOSE over cellular networks.

Hybrid Radios

The MDS Orbit MCR's support for redundant private and cellular radio uplinks maximizes network availability for critical applications. It further allows the extension of cellular connectivity using licensed or unlicensed private networks to expand cellular network coverage deep into rural and deserted areas. Private radio options include unlicensed 900 MHz Frequency Hopping Spread Spectrum with throughput of up to 1.25Mbps, in addition to licensed narrowband in the 100, 200, 400, 700, and 900 MHz spectrum with throughput up to 240 Kbps.

Enterprise-Class Security

The MDS Orbit platform's hardware and software is built on an extensive enterprise-class cybersecurity framework. Advanced features such as firewalling, VPNs, X.509 certificates, and RADIUS authentication as well as secure boot and firmware provide advanced security for the device, network, and users.

Advanced Quality of Service

Advanced Quality of Service (QoS) allows the simultaneous handling of various applications while ensuring the preservation of each application's priority and performance requirements. Layer 2, 3, and 4 classification enables the detailed identification of application types for maximum flexibility in addition to standard 802.1p and DSCP based classifications.

Intuitive User Interface

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

MDS Orbit MCR and ECR Model Comparison

MDS Orbit Product	Networking & Security Capabilities	Cellular Options (factory configured)	Optional Secondary Radio (factory configured)	Port Options
MCR (Multiservice-Connect Router) 	Identical, based on MDS Orbit	• 4GC: 4G LTE, 3G, Anterix Active™, GPS, NAM • 4GB: 4G LTE-A Pro, 3G, CBRS, FirstNet, GPS, US • 4GD: 4G LTE/3G/2G, GPS, EMEA / LATAM • 4GF: 4G LTE, 450 MHz b31/b72 , EMEA / LATAM • 4GG: 4G LTE, 410 MHz b87, EMEA / LATAM • M1A: LTE-M 400MHz, EMEA / LATAM • M1B: LTE-M Australia	• Dual active LTE* • 900 MHz ISM • Licensed narrowband* • 2.4GHz Wi-Fi • 2.4/5GHz 2×2 MIMO Wi-Fi	• Option 1: 2 Ethernet, 1 Serial, 1 USB • Option 2: 1 Ethernet, 2 Serial, 1 USB • Option 3: 4 Ethernet, 2 Serial, 1 USB* • Option 4: 6 Ethernet, 1 USB* • Option 5: 1 SFP, 2 Ethernet, 2 Serial, 1 USB*
ECR (Edge-Connect Router) 	Identical, based on MDS Orbit	• 4GC: 4G LTE, 3G, Anterix Active™, GPS, NAM • 4GB: 4G LTE-A Pro, 3G, CBRS, FirstNet, GPS, US • 4GD: 4G LTE/3G/2G, GPS, EMEA / LATAM • 4GF: 4G LTE, 450 MHz b31/b72 , EMEA / LATAM • 4GG: 4G LTE, 410 MHz b87, EMEA / LATAM • M1A: LTE-M 400MHz, EMEA / LATAM • M1B: LTE-M Australia	2.4GHz Wi-Fi	1 Ethernet, 1 Serial, 1 USB
	Identical, based on MDS Orbit	• 2G/3G/4G GSM/GPRS/LTE EMEA, LATAM + GPS • 4G LTE North America	900 MHz ISM	• 1 PoE Ethernet with integrated antennas • 1 PoE Ethernet with 2 N-type Antenna Connectors*

** Check with local sales representative for availability*

MDS Orbit OCR
with 4G LTE and integrated antennas

MDS Orbit MCR
with Dual-Active Tri-SIM Cellular

MDS Orbit MCR
with Cellular and 900 MHz

MDS Orbit ECR
with 4G LTE Cellular and WiFi

A Multiservice Router for Electric Utility Field Area Networks

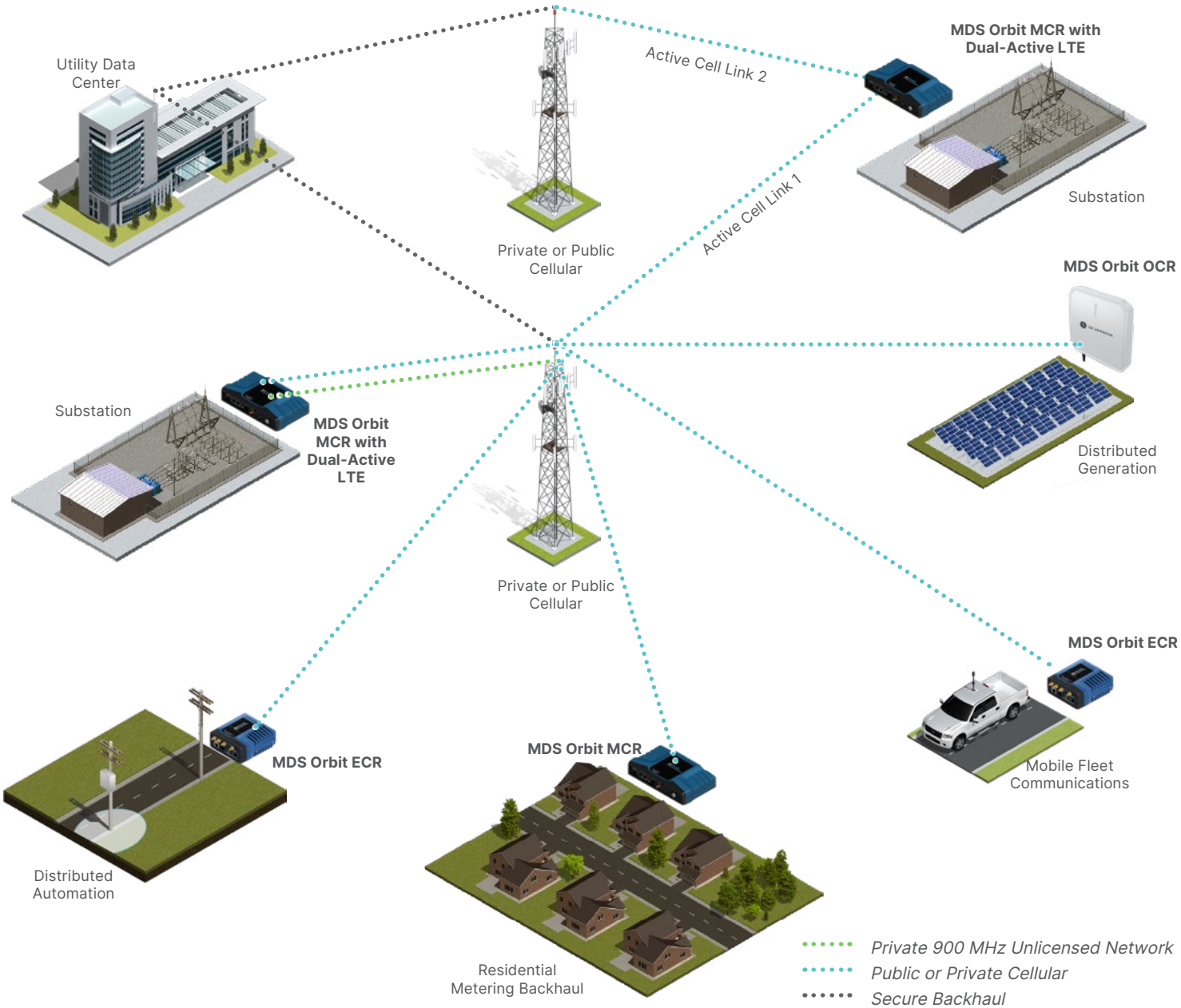
The MDS Orbit routers offer a number of key features and benefits when applied as a multiservice router gateway for distribution automation field area networks. The substation hardened design complies with IEC 61850-3 and, IEEE 1613 standards and NFPA 70 Class 1 Div 2 thus permitting a reliable deployment in harsh substation environments.

Many of the Orbit 4G LTE cellular models support a GPS/Glonass functionality to feed location information into fleet management and GIS applications. Advanced QoS allows multiple traffic streams to co-exist efficiently on the same uplink such that each application's priority and performance criteria are preserved while ensuring critical applications are handled first.

Support for concurrent private radios and cellular uplinks dramatically improves network availability and offer a viable replacement for legacy Telco 4-wire circuits.

The MDS Orbit MCR with dual active-active cellular modems allows for two active connections to separate private/public cellular networks providing faster failover in the event of a network outage - transferring data to a second SIM/carrier in seconds vs minutes compared with other single modem devices. The MDS Orbit OCR provides an easy to deploy 900MHz unlicensed remote or all-in-one cellular router solution with integrated antennas.

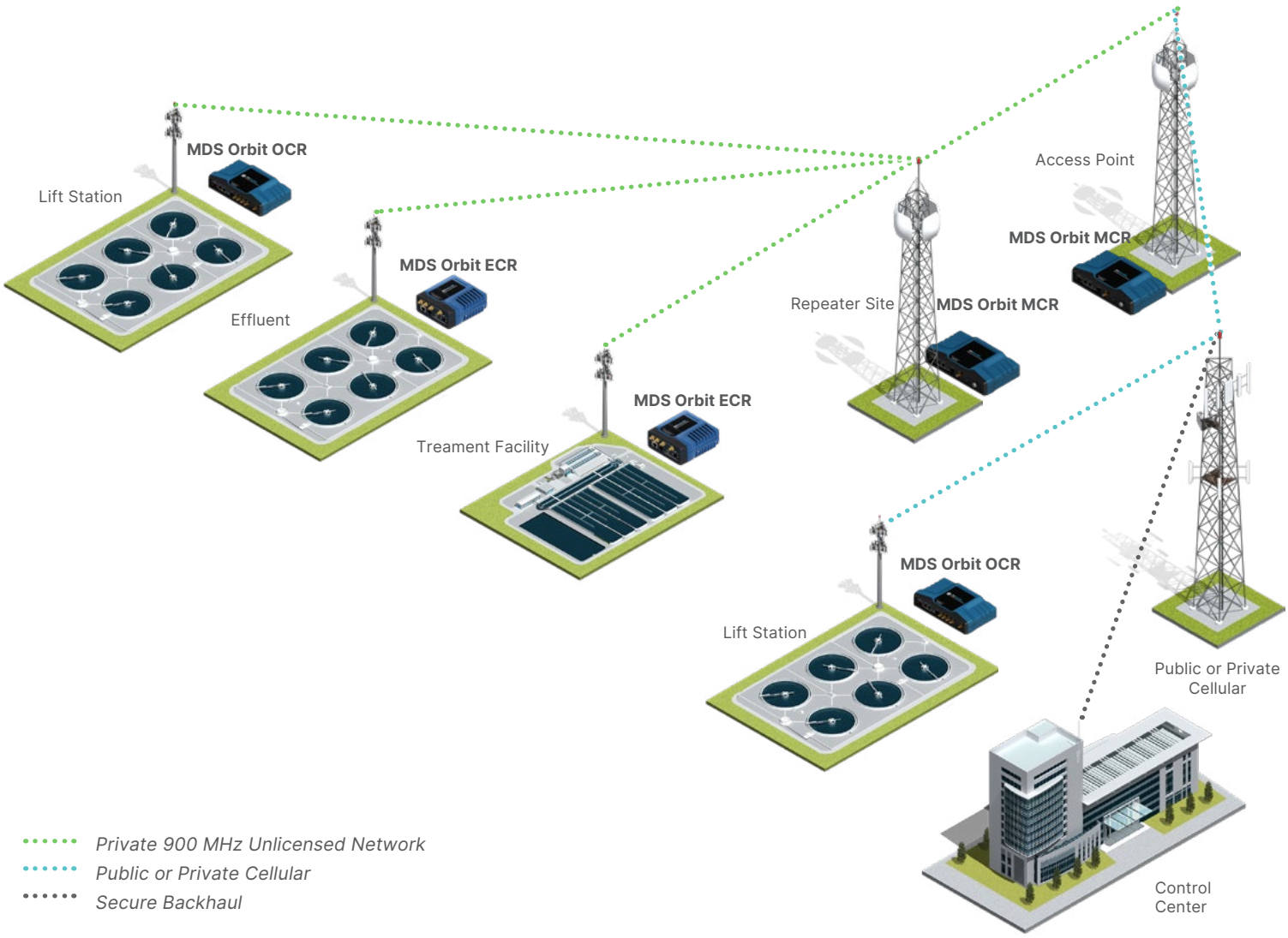
Flexible Layer 2 and Layer 3 GRE combined with routing and IPSec VPNs enable the transport of various applications, including IEC 61850 GOOSE protocol seamlessly over private and/or cellular networks. Enterprise-class security including APNs, IPSec VPNs, RADIUS authentication, stateful firewalling and MAC filtering enable grid operators to securely transport critical data over cellular carriers and protect network assets. MDS Orbit's security framework allows integration into applications demanding NERC® CIP compliance.



Electric Utility Application Examples

Flexible SCADA and Video Communication Solutions for Water & Wastewater

The MDS Orbit routers offer a number of key benefits for water and wastewater applications. Coupled with low-cost cellular plans, the MDS Orbit offers a rich, long-lasting, and cost-effective M2M solution. When applicable, cellular and private networks can be deployed simultaneously on the MCR form factor to interconnect various sites for SCADA, video security, and other applications. In addition, advanced QoS capabilities ensure that various applications can co-exist effectively on the same uplink.



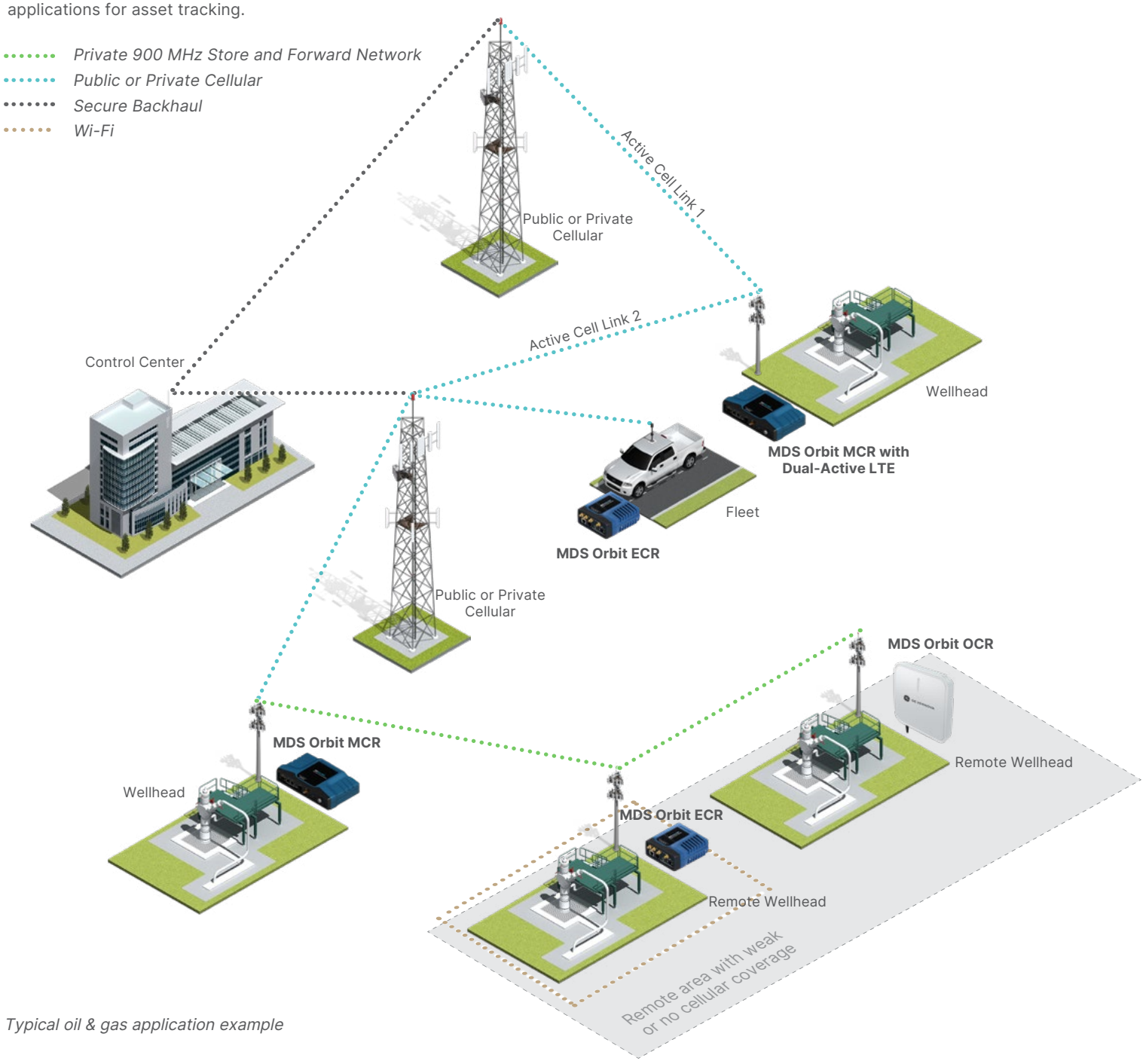
Typical water & wastewater application example

Hybrid Cellular and Private Communications Enable the Digital Oil & Gas Field

MDS Orbit routers provide a number of key benefits for oil and gas applications including a dual or single uplink connectivity over cellular and/or private networks. Connectivity extends into remote areas with weak or no cellular coverage using MDS Orbit 900 MHz unlicensed FHSS technology which provides a self-healing network with 1.25Mbps of throughput and a network depth of 8 hops via Store-and-Forward technology.

MDS Orbit's rich networking and advanced QoS capabilities allow for a variety of applications such as SCADA, voiceover IP, video, and WiFi access to co-exist on the same uplinks even when bandwidth is limited. Advanced QoS ensures that data traffic entering the network is re-organized and prioritized in such a way that critical applications are handled first in order to minimize performance impact due to any unforeseeable network congestion.

The MDS Orbit MCR with dual active-active cellular modems allows for two active connections to separate private/public cellular networks providing faster failover in the event of a network outage, transferring data to a second SIM/carrier in seconds - not minutes, as compared with other single modem devices. The MDS Orbit OCR is an easy-to-deploy 900MHz unlicensed remote solution or all-in-one cellular router solution with integrated antennas. The single-radio MDS Orbit ECR cellular router can be deployed in mobile or nomadic applications requiring ubiquitous network connectivity. The integrated active GPS allows for transmission of coordinates to feed into fleet management applications for asset tracking.



Typical oil & gas application example

Supported Cellular Radios on MDS Orbit

Model/Region	ECR	MCR	Protocol/Frequences	Fallback Support	Approvals/ Certifications	Max Rate down/up Mbps	Dual SIM	GPS
4GC 4G LTE, 3G, NAM, Anterix Active™	Yes	Yes	• LTE Cat-4 • LTE FDD Bands: 1, 2, 3, 4, 5, 7, 8, US8[1], 12, 13, 14, 18, 19, 20, 25, 26, 28 • UMTS/DC-HSPA+ Bands: 1, 2, 4, 5, 6, 8, 19 • 2G/GSM/GPRS Band: 2, 3, 5, 8	3G	AT&T, Verizon, Bell, Anterix Active™ , FCC, ISED, PTCRB	150†/50	Yes	Yes
4GB 4G LTE-A Pro, 3G FirstNet Ready™, CBRS, US	Yes	Yes	• LTE-A Pro Cat-12 • LTE FDD Bands: 1, 2, 3, 4, 5, 7, 8, 9, 12, 13, 14, 18, 19, 20, 26, 29, 30, 32, 66 • LTE TDD Bands (Cat-6): 41, 42, 43, 46, 48 • UMTS/DC-HSPA+ Bands (42/11 Mbps): 1, 2, 4, 5, 6, 8, 9, 19	3G	AT&T, Verizon, CBRS, FCC, ISED, PTCRB FirstNet Ready™	600†/150†	Yes	Yes
4GD 4G LTE/3G/2G EMEA / LATAM	No	Yes	• LTE Cat-4 • LTE FDD Bands: 1, 2, 3, 4, 5, 7, 8, 12, 13, 18, 19, 20, 25, 26, 28 • LTE TDD Bands: 38, 39, 40, 41 • UMTS/DC-HSPA+ : 1, 2, 4, 5, 6, 8, 19 • GSM/GPRS/EDGE Bands: 850/900/1800/1900MHz	2G/3G	CE, GCF, Anatel, RCM	150†/50	Yes	Yes
4GF 4G LTE Cat 4 EMEA / LATAM	Yes	Yes	• LTE Cat-4 • LTE FDD Bands: 3, 7, 20, 31, 72 • For 450 MHz Private LTE	-	CE, GCF Planned: Anatel	150†/50	Yes	No
4GG 4G LTE Cat 4 EMEA / LATAM	Yes	Yes	• LTE Cat-4 • LTE FDD Bands: 3, 20, 87 • For 410 MHz Private LTE	-	CE, GCF Planned: Anatel	150†/50	Yes	No
4GB + 4GY To be replaced by 4GB + 4GC**	No	Yes	• Dual active modem: see supported bands above	3G	AT&T, Verizon, CBRS UE, Anterix, FCC, ISED, PTCRB* Planned: FirstNet	See above	Yes (3 SIM)	Yes
4GD + 4GD	No	Yes	• Dual active modem: see supported bands above	2G/3G	CE, GCF, Anatel, RCM	See above	Yes (3 SIM)	Yes
M1A LTE-M 450MHz	Yes	Yes	• LTE Cat-M1 • Bands @25-26dBm: 31, 72, 73 @23dBm: 1, 3, 5, 8, 20, 28, 87, 88	N/A	CE, GCF Planned: Anatel	590 kbps/ 1.1Mbps	Yes	Yes
M1B LTE-M Australia	Yes	Yes	• LTE Cat-M1 • Bands: 1-5, 8, 12, 13, 18-20, 25, 26, 28, 66, 85	N/A	RCM Planned: Telstra	590 kbps/ 1.1Mbps	Yes	Yes

*** 4GB + 4GC has not been authorized as required by the rules of the Federal Communications Commission. This device is not, and may not be, offered for sale or lease, until authorization is obtained.*

** Check with local sales representative for availability*

† Max system rate ~90Mbps

[1] LTE b8 supports US 39MHz duplexing and is interoperable with b106

Technical Specifications

NETWORKING

- Routing IPv4 static routing with failover OSPF, RIPv2, VRRP
- Ethernet IEEE 802.3, 802.1Q/VLANs, IGMP, STP, 64 VLANs
- Concurrent bridging & routing
- Tunneling layer 2 (Ethernet) and layer 3 GRE
- High availability failover between any two wireless/ Ethernet interfaces, performance based failover (latency and packet loss)
- 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 HTTP and HTTPS, SSH
- Serial TCP server, Modbus/TCP, Modbus RTU, TCP client, UDP Unicast and Multicast, BSAP, and DNP3
- SCADA / Automation Protocols: Modbus RTU, Modbus ASCII, DNP3, Allen-Bradely DF1, BSAP, IEC 101, Modbus TCP, Modbus via TCP, Modbus, UDP, DNP3, IEC 104
- Dual APN, VRF, Open VPN, FlexVPN, and VPN DPD*

CYBERSECURITY

- IPSec VPN Server (responder) and Client (initiator)
- Authentication public key, EAP TLS, Pre-Shared, Ike 1-2
- Encryption 3DES, AES 128/192/256, CBC, CTR, CCM, GCM, 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, Magnetometer Tamper Detection
- Certificate Management X.509, PEM, DER, RSA, and SCEP with auto renewal/re-enrollment
- EN18031-1 Common security requirements for radio equipment
- User Authentication Local RBAC, AAA/RADIUS
- FIPS 140-2 (Level 2) compliant mode available*

WIFI

IEEE 802.11 b/g/n 2.4 GHz option:

- 1×1 SISO (single antenna/radio chain)
- Scalability up to 2 SSIDs, up to 7 clients/stations
- Max transmit power (adjustable): up to 20dBm
- Operating modes: Access Point (AP), Station, Station bridging
- Security: WPA/WPA2 PSK, Enterprise
- Applications:
  - Local configuration and management using Wi-Fi devices
  - Station/client connecting to a 2.4GHz AP in outdoor LOS environment
  - Small-scale 2.4GHz AP operating in outdoor LOS environment

IEEE 802.11 a/b/g/n Dual-Band 2.4/5 GHz option:

- 2×2 MIMO (dual antenna/radio chain)
- Scalability up to 2 SSIDs, up to 32+ clients/stations
- Max transmit power (adjustable): up to 26dBm
- (23dBm per antenna/chain) for 2.4GHz and 23dBm (20dBm per antenna/ chain) for 5GHz
- 5GHz (U-NII-1 and U-NII-3 bands supported)
- Operating modes: Access Point, Station, Station bridging, Access-Point-Station (simultaneous AP and Station operation)
- Security: WPA/WPA2 PSK, Enterprise
- Applications:
  - Local configuration and management using Wi-Fi devices
  - Station/client connecting to a 2.4GHz AP in outdoor LOS environment
  - Small-scale 2.4GHz AP operating in outdoor LOS environment

NETWORK MANAGEMENT

- Secure device management via HTTP/HTTPS (GUI) and Juniper-style CLI via SSH or local console
- Support for MDS LaunchNET with 'Zero-touch' or 'One-touch' for easy field provisioning
- Event logging, Syslog over TLS
- Iperf throughput diagnostic
- NETCONF
- SNMPv1/v2c/v3, MIB-II, Enterprise MIB
- MDS PulseNET NMS Support

ELECTRICAL & POWER CONSUMPTION

- Input Voltage 10 to 60 VDC
- Orbit ECR and MCR Power Consumption Calculations (with nominal 25C)

With 4G LTE	Power	13.8V
Connected (Idle)	4.0W	292mA
Typical download	4.3W	310mA

With 4G LTE + WiFi	Power	13.8V
Connected (Idle)	4.8W	350mA
Typical download	5.5W	400mA

PHYSICAL INTERFACES

- 1000BASE-X SFP
- 10/100 Ethernet RJ45
- RS-232/RS-485 Serial RJ45
  - ECR: 1 Ethernet + 1 Serial
  - MCR: 2 Ethernet + 1 Serial; OR 1 Ethernet + 2 Serial; OR 4 Ethernet + 2 Serial; OR 2 Ethernet + 2 Serial + 1 SFP OR 6 Ethernet
- USB Management: 1 x Mini-USB 2.0 port on MCR and ECR
- Antenna Connectors
  400 MHz/900 MHz licensed: TNC900
  ISM: TNC | WiFi: RP-SMA
  Cellular: SMA | GPS: SMA fem
- LEDs PWR, ETH, COM, NIC1, NIC2

AGENCY APPROVALS/STANDARDS

- FCC Part 15, 90, 80, 101, 27, 95 and ISED
- ETSI / CE, EN 300.113, EN302.561
- IEEE 1613**
- IEC 62368-1 CB Scheme
- CSA Class 1, Div. 2, CSA C22.2 No. 142-M1987 & 213-M1987
- ANSI/ISA 12.12.01 2015, UL 916, 5th Ed., EN60950
- EMC EN 301 489-5, EN 301 489-1
- EMP: MIL-STD-461G, RS105 Electro Magnetic Pulse
- 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
- IEC 60068-2-1 Cold; IEC62262 & IEC60068-2-75 Shock; IEC 60068-2-2 Dry Heat; IEC 60068-2-2-38 Composite temperature/humidity cyclic

ENVIRONMENTAL & MECHANICAL

- Operating Temp -40º to +70º C (-40º 158ºF)
- Storage Temp -40º to +85º C (-40º 185ºF)
- Humidity 95% at 60º C (140ºF) non-condensing
- Case die cast aluminum
- Mounting Options Integrated DIN Rail mount, Standard mounting bracket or Horizontal DIN mount.
- No Fans, No Moving Parts
- HALT & HASS Testing
- MCR Dimensions:
  - 1.75 H x 8.0 W x 4.8 D inches
  - 4.5 H x 20.3 W x 12.2 D cm
- MCR Weight 2lbs (0.91 Kg)
- ECR Dimensions:
  - 2.1 H x 4.3 W x 4.6 D inches
  - 5.4 H x 10.9 W x 11.7 D cm
- ECR Weight 1.45lbs (0.66 Kg)

GPS

- Available with cellular models
- GNSS, GPS, Glonass
- Maximum 30 channels (16 GPS, 14 GLONASS), simultaneous tracking
- NMEA 0183 V3.0
- Acquisition Time: Hot start 1s, Warm start 29s, Cold start 32s
- Accuracy: Horizontal < 2 m (50%); < 5 m (90%) Altitude: < 4 m (50%); < 8 m (90%); Velocity: < 0.2 m/s

WARRANTY

- 5-year standard manufacturer warranty

** Check with local sales representative for availability.*

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

GE VERNOVA

For more information
visit **gevernova.com/grid-solutions**

GEA35356A
English
250409