Grid Solutions

# 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 increase application availability. They must provide a comprehensive framework of security to guard against the intensified waves of cyber attacks. Finally, the wireless networks must enable advanced performance to scale and support modern TCP/IP applications.

The 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, 400Mhz, 200Mhz* and 100Mhz* 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 MDS SD Series or legacy MDSx710 radios to seamlessly expand or migrate networks
- Decrease network downtime with dual radio uplinks and other redundancy features
- Protect network and assets against intrusion with powerful cybersecurity 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

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

**Water & Wastewater**
- Monitoring and Control
- Maintenance Workforce Mobility

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

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

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

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### Exceptional Network Performance

- Up to 64QAM of modulation enables newer applications in narrowband networks
- Superior performance in challenging environments with adaptive power control
- 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 Security and Networking

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

### Platform Flexibility

- Backward-compatibility with 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
- EMP hardened per MIL-STD-461G, RS105
- 3rd party Certified for IEEE1613, IEC61850-3, 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 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

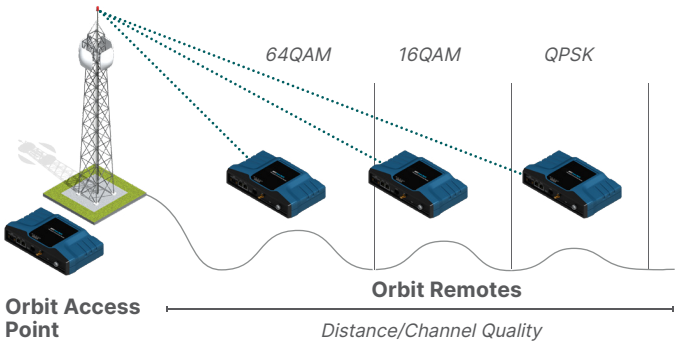
### Enhanced QAM Modulations

The MDS Orbit platform implements QAM modulation to achieve raw data rates up to 6 times faster than traditional FSK modulations variants typically utilized in legacy narrowband networks. With QAM modulation significant improvements in gross data rates can be achieved and can be improved even further with Orbit's real-time compression on application data and underlying transport protocols such as IP.

| CHANNEL SIZE | LEGACY SPEED | QPSK | 16QAM | 32QAM | 64QAM | ORBIT ADVANCED MAC MODE THROUGHPUT[1] |
|---|---|---|---|---|---|---|
| 6.25 kHz | 4.8 kbps | 9.6 kbps | 19.2 kbps | 24 kbps | 28.8 kbps | 174 kbps |
| 12.5 kHz | 9.6 kbps | 20 kbps | 40 kbps | 50 kbps | 60 kbp | 400 kbps |
| 25.0 kHz | 19.2 kbps | 40 kbps | 80 kbps | 100 kbps | 120 kbps | 758 kbps |
| 50.0 kHz | 38.4 kbps | 80 kbps | 160 kbps | 200 kbps | 240 kbps | 1.37 Mbps |

*[1] Maximum TCP Throughput measured with Orbit configured for Advanced MAC Mode with Adaptive FEC, Adaptive Coded Modulation, Ethernet Header Compression, RHOC TCP, UDP, IP Compression, LZO Data Compression, Packet Concatenation, Iperf TCP Server.*

### Bi-Directional Adaptive Modulation




Bi-Directional Adaptive modulation increases 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.

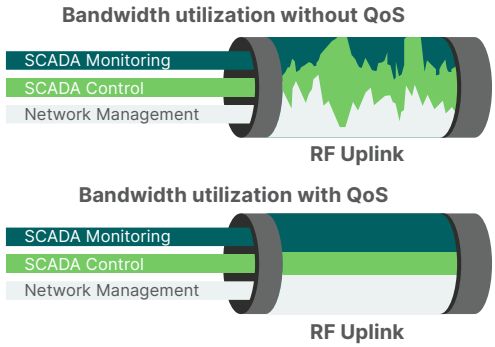
## Advanced Security & Networking

### Enterprise Class Security

The MDS Orbit platform is built on a comprehensive cybersecurity framework to enable the deployment of highly secure industrial applications. It offers standards-based IPSec VPN and DM VPN 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 to improve 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 standardizes operations, reduces cost and learning curves.

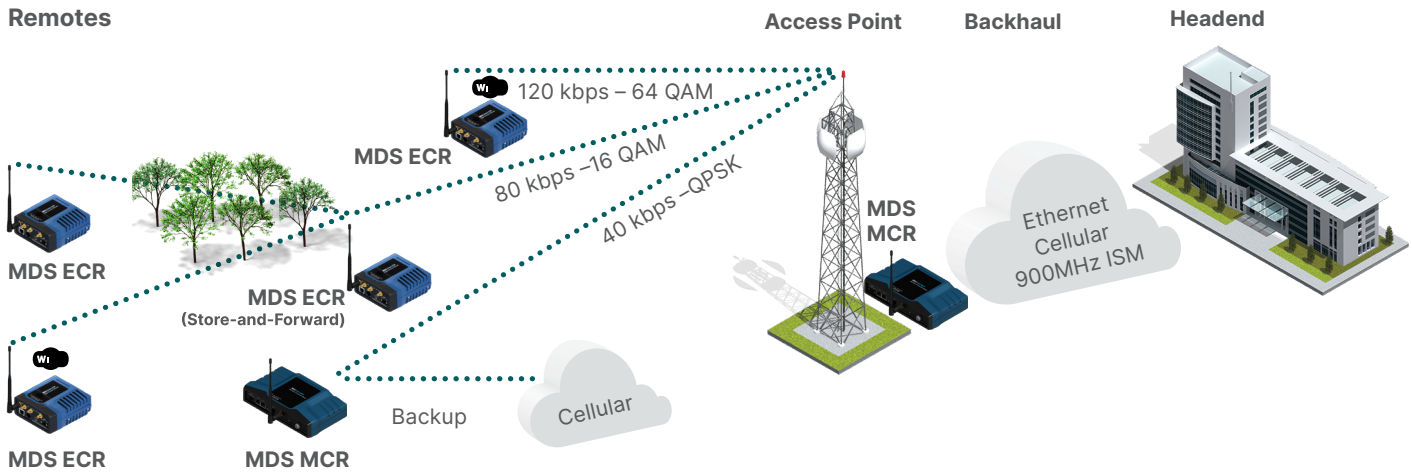
### Backward Compatibility with MDS SD and x710

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 highest 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 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  | 135-155 MHz, 150-174 MHz,<br>216-235 MHz, 220-222 MHz,<br>330-406 MHz, 406-470 MHz,<br>450-520 MHz, 757-758 & 787-788 MHz,<br>800-870 MHz, 896-960 MHz | 2.4GHz Wi-Fi, 2G/3G/4G LTE<br>Unlicensed 900 MHz (some combinations not supported) | Option A: 2 Ethernet, 1 Serial, 1 USB<br>Option B: 1 Ethernet, 2 Serial, 1 USB<br>Option C: 4 Ethernet, 2 Serial, 1 USB<br>Option D: 6 Ethernet, 1 USB<br>Option E: 1 SFP, 2 Ethernet, 2 Serial, 1 USB | Integrated DIN Rail mount, Standard Mounting bracket, or Horizontal DIN Mount |
| ECR  | 135-155 MHz, 150-174 MHz,<br>216-235 MHz, 220-222 MHz,<br>330-406 MHz, 406-470 MHz,<br>450-520 MHz, 757-758 & 787-788 MHz,<br>800-870 MHz, 896-960 MHz | 2.4GHz WiFi | 1 Ethernet, 1 Serial, 1 USB | Integrated DIN Rail mount or Standard Mounting bracket |

## Specifications

### ORBIT LICENSED NARROWBAND TECHNOLOGY

| | |
|---|---|
| Module Configuration | Single |
| Frequency | Configurable |
| Duplex Modes | Half duplex |
| Modulation | CPFSK, QPSK, 16QAM, 32-QAM, 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

| Frequency Bands | Region | Channel Size |
|---|---|---|
| L1B: 150 - 174 MHz | Global | 12.5, 25kHz |
| L1C: 135 - 156 MHz | CE | 12.5, 25, 50 kHz |
| L2B: 220 - 222 MHz | US | 5 KhZ |
| L2X: 216 - 237 MHz | NAM | 12.5, 25, 50 kHz |
| L4A: 330 - 406 MHz | CE, MX | 12.5, 25, 50 kHz |
| L4C: 450 - 520 MH | Global | 12.5, 25, 50 kHz |
| L4E: 406.1 - 470 MHz | Global | 6.25, 12.5, 25kHz |
| L7A:757-758 / 787-788 MHz | US | 12.5, 25, 50 kHz |
| L9A: 800 - 870 MHz | AU/NZ | 12.5, 25 kHz |
| L9C: 896 - 960 MHz | NAM | 12.5, 25, 50 kHz |

### GROSS DATA RATES (ALL FREQUENCIES)

| Channel | 32QAM | 64QAM | Orbit Advanced MAC Mode[2] |
|---|---|---|---|
| 6.25 kHz | 24 kbps | 28.8 kbps | 174 kbps |
| 12.5 kHz | 50 kbps | 60 kbps | 400 kbps |
| 25 kHz | 100 kbps | 120 kbps | 758 kbps |
| 50 kHz | 200 kbps | 240 kbps | 1.37 Mbps |

*[2]Maximum TCP throughput measured with Orbit configured for Advanced MAC Mode with Adaptive FEC, Adaptive Coded Modulation, Ethernet Header Compression, RHOC TCP, UDP, IP Compression, LZO Data Compression, Packet Concatenation, Iperf TCP Server.*

### TRANSMITTER CHARACTERISTICS

| | |
|---|---|
| Frequency Stability | +/- 0.5 ppm |
| Peak Carrier Power | +40 dBm 330-470 MHz<br>+39.5 dBm 896-9160 MHz |
| Average Power (Programmable) | QPSK: +36 dBm<br>16QAM: +33 dBm<br>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 | 60 dB nominal |
| Sensitivity (Actual) | @ 1×10-6 BER, No FEC |

| Channel | QPSK | 16QAM | 64QAM |
|---|---|---|---|
| 12.5 kHz | -112 dBm | -104 dBm | -94 dBm |
| 25 kHz | -107 dBm | -99 dBm | -91 dBm |

Sensitivity (Actual) @ 1×10-6 BER, FEC On

| Channel | QPSK | 16QAM | 64QAM |
|---|---|---|---|
| 12.5 kHz | -119 dBm | -111 dBm | -103 dBm |
| 25 kHz | -114 dBm | -106 dBm | -98 dBm |

### AGENCY APPROVALS / STANDARDS

- FCC Part 15 and ISED equivalent
- ETSI / CE, EN 300.113, EN 302.561
- PTCRB, GCF
- IEEE 1613**, IEC 61850-3
- CSA Class 1, Div. 2, UL 508, UL 1604
- ATEX approval for EU on MCR
- EN 60079-0:2012, EN 60079-15:2010
- 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

** Planned future release. Roadmap items subject to change.*

*** 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
- SCADA / Automation Protocols: Modbus RTU, Modbus ASCII, DNP3, Allen-Bradely DF1, BSAP, IEC 101, Modbus TCP, Modbus via TCP, Modbus, UDP, DNP3, IEC 104

## 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
- 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
- Designed to FIPS 140-2 (Level 2)
- EN1 8031-1 Common security requirements for radio equipment

## MANAGEMENT

- 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.<br>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.<br>5.33 H x 10.92 W x 11.68 D cm |
| Weight ECR | 1.45 lbs., .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

## SECONDARY RADIO OPTIONS

**Unlicensed 900MHz ISM**

- Frequency Bands: 902-928 MHz FHSS
- Bandwidth 152 to 1320 kHz, up to 80 channels
- Modulation: 2, 4-level GFSK, Adaptive
- Raw Data Rates: 125kbps, 250kbps, 500 kbps, 1000 kbps, 1250 kbps
- Latency of < 5 msec
- TX Power: 1 watt, configurable

**Cellular**

- 3G/4G LTE North America with GPS:. Verizon, AT&T, T-Mobile, Bell Canada, Rogers, Telus
- 2G/3G/4G LTE EMEA & APAC with GPS
- 2G/3G/4G LTE Australia Telstra with GPS
- LTE Private Band 26

**Wi-Fi**

- 802.11 b/g/n operating at 2.4 GHz
- Up to 52 Mbps of throughput
- Operating Modes: AP, Client/Station

## MECHANICAL

| | |
|---|---|
| **MCR Option A** | (2) 10/100 Ethernet, RJ5<br>(1) RS232/485 Serial, RJ45<br>(1) mini USB 2.0 |
| **MCR Option B** | (1) 10/100 Ethernet, RJ45<br>(2) RS232/485 Serial, RJ45<br>(1) mini USB 2.0 |
| **MCR Option C** | (4) 10/100 Ethernet, RJ45<br>(2) RS232/485 Serial, RJ45<br>(1) mini USB 2.0 |
| **MCR Option D** | (6) 10/100 Ethernet, RJ45<br>(1) mini USB 2.0 |
| **MCR Option E** | (1) SFP fiber interface<br>(2) 10/100 Ethernet, RJ5<br>(2) RS232/485 Serial, RJ45<br>(1) mini USB 2.0 |
| **ECR** | (1) 10/100 Ethernet, RJ45<br>(1) RS232/485 Serial, RJ45<br>(1) mini USB 2.0 |
| **Antenna Connectors** | Licensed NB:TNC<br>900MHz Unlic: TNC<br>Wi-Fi: RP-SMA<br>Cellular: SMA<br>GPS: SMA female |

## ELECTRICAL & POWER CONSUMPTION

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

| **With 4G LTE** | **Power** | **13.8V** |
|---|---|---|
| Connected (Idle) Typical<br>download | 4.0W<br>4.3W | 292mA<br>310mA |

| **With 4G LTE + Wi-Fi** | **Power** | **13.8V** |
|---|---|---|
| Connected (Idle) Typical<br>download | 4.8W<br>5.5W | 350mA<br>400mA |

| **With 900MHz ISM** | **Power** | **13.8V** |
|---|---|---|
| Typical<br>Maximum | 3.2 W<br>5.3 W | 232mA<br>385mA |

| **With Licensed NB** | **AP** | **Remote** |
|---|---|---|
| Idle<br>50% Duty Cycle | 910 mA<br>950 mA | 350 mA<br>780 mA |

** check with sales for availability*

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