ORBIT LICENSED NARROWBAND

Suggested Tests

Laboratory and real-world testing of the Orbit Licensed Narrowband Radio

P/N: 05-4678A02 Rev. B

GE MDS Orbit Licensed Narrowband (LN) Bench Testing

1. Introduction

This documentation will cover a variety of bench tests for evaluation of the MDS™ Orbit Licensed Narrowband (LN) radio. These tests are designed to evaluate the radio's RF performance, throughput, latency, management, maintenance and diagnostics.

2. Background

The Orbit 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, 25, and 50* KHz channel sizes.

The LN Radio is available in the MCR (Multiservice-Connect Router), the ECR (Edge-Connect Router) or the MS (Master Station)* models to suit budget, space and application needs. At the time of this document's creation, the LN radio was available in the following frequency bands; L4A (330-406 MHz), L4E (406-470 MHz), and L9C (896-960 MHz). Additional frequency bands will be available in the future so please contact the factory for details.

* Please contact your sales representative for availability.

3. Scope

This document has been prepared for personnel that have some knowledge of the MDS Orbit platform. Basic networking and RF knowledge is expected.

For additional assistance with the MDS Orbit radio, please navigate to the official Orbit webpage at https://www.gegridsolutions.com/communications/catalog/MDSOrbit.htm and download the *MDS Orbit Technical Manual* (P/N: 05-6632A01) under the manual section or watch the Orbit product line training videos at https://www.youtube.com/channel/UCWEcxa9_FSdEqowzxNbNLsw/playlists.

4. Terminology

- **CLI** (Command Line Interface) – The text based interface of the radio, accessed mainly through the use of the serial console or SSH.
- **AP** (Access Point) – The radio that acts as the "master" or the "brains", controlling traffic to each of the Remote radios.
- **Remote** – The radio that acts as the "slave" which responds to requests from the Access Point or AP radio.

- **LN** – Abbreviation for Licensed Narrowband. Additional abbreviations for the Orbit radio could be LN4 (showing the LN radio frequency band) or LnRadio.
- **OTA** (Over-the-air) – Abbreviation that describes traffic that is sent through the RF link from the AP to the Remote radio.
- **Operational Mode** – Mode in the Orbit's CLI interface which is marked by a **>** at the beginning of each line. At this level of the CLI, typical commands are used to check the status of the radio. To enter configuration mode from this state, enter the command **configure** and then followed by the *Enter* key on the keyboard.
- **Configuration Mode** – Mode in the Orbit's CLI interface which is marked by a **%** at the beginning of each line. At this level of the CLI, typical commands are used to configure the radio. To enter operational mode from this state, enter the command **exit** and then followed by the *Enter* key on the keyboard.
- **Compressible Data** – data that is repetitive or easy to group together to form smaller amounts of data. Examples are '1111111111' or 'abdcabdc'.
- **Non-Compressible Data** – data that can only be slightly compressed or not at all. This data is typically random or already compressed such as JPEG images and videos.

5. Test Bench

5.1 Physical Setup

The general setup for the bench testing is shown below;
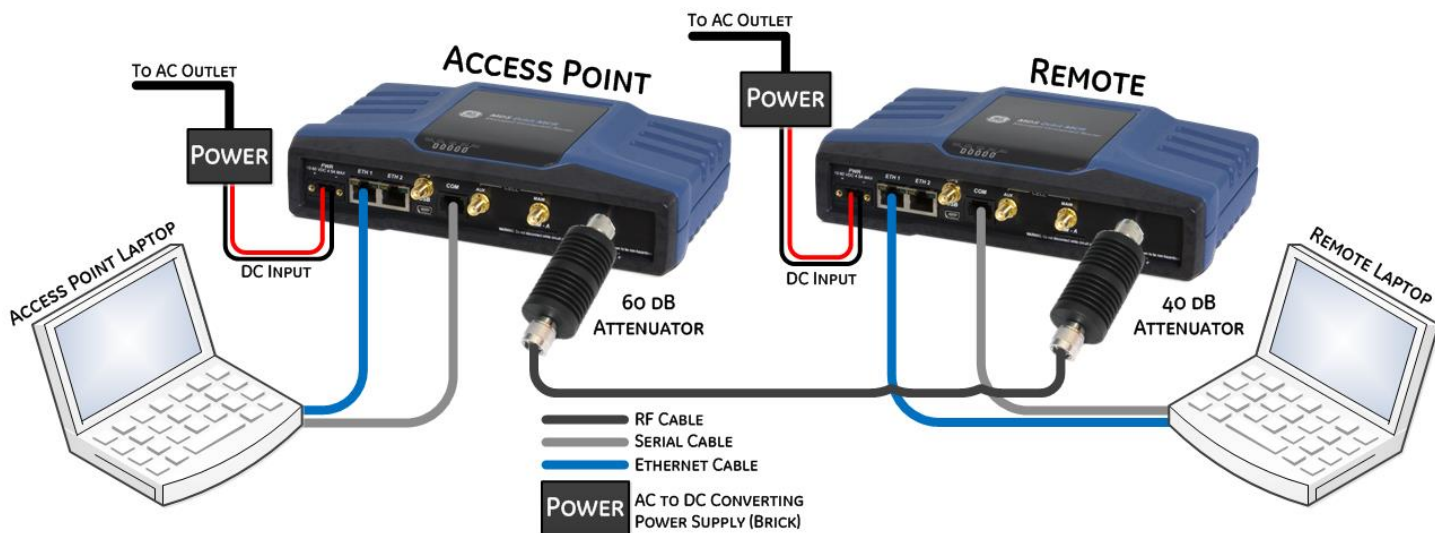
For the two radio network, the following equipment is used; two AC to DC power supplies, one 60 dB and 40 dB 10W TNC attenuators, one 5 ft RF TNC to TNC cable, two DB9 to RJ45 Connectors, 4 – 3 ft Ethernet cables and one USB cable. The mentioned items can be purchased from GEMDS with the part number 03-4678A02.

Connect the equipment as shown in the diagram. In a few test cases, two endpoint PCs are required; one connected to the AP and one connected to the Remote. One pair of Ethernet cables will be connected to the ETH port of the radios and connected to the endpoint PCs and the others will be connected to the COM port of the radios. At the end of the COM port Ethernet cable, connect to the DB9 to RJ45 converter (P/N: 73-2434A25) and then to the endpoint PCs. In the case that the PC does not have a serial port, USB to serial adapters are available at a variety of manufacturers for purchase.

CAUTION The LN Radios can output up to (and by default) 40 dBm, unlike other GE MDS products. It is highly recommended to use a 10 W or greater power rated attenuators with a minimum of 60 dB total attenuation for any directly cabled setups. This will avoid costly damage to the units.

5.2 Basic Radio Setup

Configurations for the radio setup in the upcoming sections will be performed via the command line interface. The MDS Orbit series also offers a web interface. To get to the command line interface (CLI), open up a terminal program (such as PuTTY, Tera Term, or ProComm) and choose the proper COM port. The terminal should be set to 115200 bps baud rate, 8N1 byte format and no flow control.

By default, the LN radio is set as a Remote, 12.5 kHz-10.0ksps channel, automatic modulation enabled, compression (header and data), and no frequencies set. For a clean start to testing, it is recommended to reset the radios back to factory defaults. To do this, enter the following command; **request system recovery rollback snapshot Factory**. Enter "**y**" for yes to perform the rollback. At this time, the radio will reset itself to factory defaults and reboot.

To get the radios communicating with each other, two things will have to be done; first is to make one of the radios into an access point and second is to configure the radios frequencies. To configure the access point radio use the CLI on the terminal program and enter **admin** into the username and then the password. Enter configuration mode by typing the command **configure** and then pressing enter. Use the following command; **set interfaces interface LnRadio ln-config device-mode access-point tx-frequency xxx.xxx rx-frequency zzz.zzz** where xxx.xxx and zzz.zzz are the approved TX and RX frequencies for the site. Then enter the command **commit** to set the changes to the radio.

For the Remote radio, enter the CLI like the Access Point radio and enter configuration mode with the command configure. Enter the command **set interfaces interface LnRadio ln-config tx-frequency zzz.zzz rx-frequency xxx.xxx** where zzz.zzz and xxx.xxx are the approved TX and RX frequencies for the site. Note that, in typical applications, the AP radio will transmit "high" and receive "low" with the Remote radio configured the opposite. Enter the command **commit** to set the changes to the radio.

To verify that the radios are associated, enter the command from the operational command line (begins with **>**, configuration mode is **%**. If in configuration mode, enter **exit** into the command line) **> show**

interfaces-state interface LnRadio ln-status. On the AP radio, look for **ln-status connected-remotes MAC ADDR** which will display the state, RSSI, stats and information about the associated Remote. On the Remote radio, look for **ln-status ap-info** for the state, RSSI, and information about the AP radio.

5.3 Basic IP Addressing Setup

The Orbit radios come configured with an IP address of 192.168.1.1/24 (or 255.255.255.0) and DHCP server enabled. For this demo setup, the radio can either be connected to an existing or isolated network. It is recommended to have the radios in an isolated network, like the image shown above to remove any abnormalities in the results. Do NOT connect the AP and Remote radios directly to the same network – this will cause problematic results.

In typical AP to Remote setups, it is recommended to have the DHCP server enabled on the AP side (either on the AP or on the endpoint connected to the AP). During this test bench setup, the AP radio will be configured with an IP address 192.168.1.1/24 and the DHCP server enabled, the Remote statically set with an IP address 192.168.1.11/24 and the endpoints set as DHCP clients.

Starting with the Remote radio, login to the console as admin. Enter configuration mode with the command **configure**. First, we will disable the DHCP client on the Remote radio because the AP will perform this functionality. Enter the command **% set services dhcp enabled false** followed by **% commit**. Next, we'll change the Remote's IP address from 192.168.1.1 to 192.168.1.11. Continuing in configuration mode, enter the following command **% rename interfaces interface Bridge ipv4 address 192.168.1.1 192.168.1.11**. Then enter the command **% commit**. Give the radio a moment to set the changes and then use the command **> show interfaces-state interface Bridge ipv4**. You should see the IP address 192.168.1.11 in the table.

The AP radio does not need any further configuration. At this time, assuming the radios have been configured properly and are associated, as done in the *Test Bench – Basic Radio Setup* section, a test ping can be performed. From the AP's operational mode command line, enter the command **ping 192.168.1.11** (i.e. the AP is pinging the Remote's IP address) and then hit the *Enter* key on the keyboard. As long as the radios are associated, the Remote radio should respond back to the Ping requests. The ping requests will be continuous until entering *Ctrl+C* on the keyboard. To test a ping from the Remote to the AP, enter **ping 192.168.1.1** on the Remote's operational command line. Stop the ping when desired.

Now that the radios have IP addresses and the over-the-air traffic has been verified, plug two Ethernet cables from each radio into their endpoint PC. Have each computer configured for DHCP client to get an IP addresses from the AP. Check that each computer has received an IP address from the AP in the range 192.168.1.2-192.168.1.10. From each radio, execute a ping command to test communication to each of the endpoint PC's.

5.4 Review

Fill in the following tables with the information configured in the previous sections to aid in the rest of the testing procedure.

Access Point Laptop	
IP Address and Subnet	/

Remote Laptop	
IP Address and Subnet	/

Access Point Radio	
IP Address and Subnet	/
TX Frequency (HI)	MHz
RX Frequency (LO)	MHz

Remote Radio	
IP Address and Subnet	/
TX Frequency (LO)	MHz
RX Frequency (HI)	MHz

6. Test Procedures

Each test case is designed to test certain functionality that many users desire with their radios. Note that additional equipment may be required in some test cases and will not be supplied from GE MDS. Software applications used in the following test cases can be used if desired but is not necessary. Instructions on how to configure the radio, if applicable, will be shown. Tests are performed using the highest bandwidth and modulation combination.

6.1 Throughput Tests

GE's MDS Orbit Platform has been designed with flexibility to allow use of different communication technologies to meet specific bandwidth, range, frequency, and geographic requirements of industrial applications. The CPU horsepower of an MDS Orbit device can be scaled to meet the application, network, and security performance requirements of a broad range of utility applications.

Licensed Narrowband modules provide robust long-distance communication in channel bandwidth sizes of 6.25 KHz, 12.5 KHz, and 25 KHz. Depending on bandwidth, raw data rates range from 20kbps to 120kbps. The radio is suitable to interface both Ethernet and Serial controllers such as PLCs, RTUs and SCADA systems while offering greater throughput then traditional FSK solutions.

All tests are conducted in the downstream direction, or from AP to Remote. To perform tests in the upstream direction, simply start or send data from the Remote's side. Sample compressible vs non-compressible files have been uploaded to the GE Orbit Platform Website. Use the **Product Lookup** tool to find the **Orbit Platform**. Then under the **Resources** header, click on **Support Docs / Bulletins**. There will be two files named *compressible.txt* and *noncompressible.txt*.

6.1.1 Serial Throughput

This test measures the over-the-air system throughput by passing serial data through the Orbit's COM1 port. Results are measured in quiet network environment, at room temperature, and with boundary conditions.

Purpose:
- Verify the ability to pass serial data over the RF link.
- Measure the serial throughput by sending compressible and non-compressible files.

Test Setup:
- Install Tera Term on the two testing laptops. Tera Term can be downloaded from https://en.osdn.jp/projects/ttssh2/releases/ free of charge.
- Use an SSH utility to access the two radios.
- Set both radio's modulation to 64QAM.
    - % *set interfaces interface LnRadio ln-config modulation qam64*

- Set both radio's maximum transmit power to 40dBm.
  - ⸓ *set interfaces interface LnRadio ln-config power 40*
- Set both radio's bandwidth to 25 KHz.
  - ⸓ *set interfaces interface LnRadio ln-config channel 25KHz-16ksps [For FCC]*
  - ⸓ *set interfaces interface LnRadio ln-config channel 25KHz-20ksps [For ETSI]*
- Disable both radios' security settings.
  - ⸓ *delete interfaces interface LnRadio ln-config security*
- Set the Access Point serial configuration.
  - ⸓ *set services serial terminal-server server COM1 mode udp mode point-to-point remote address 192.168.1.11*
  - ⸓ *set services serial ports COM1 baud-rate b230400 vmin 512* **Note change vmin to 256 for second test case**
- Set the Remote serial configuration.
  - ⸓ *set services serial terminal-server server COM1 mode udp mode point-to-point remote address 192.168.1.1*
  - ⸓ *set services serial ports COM1 baud-rate b230400*
- Apply the configuration to both units.
  - ⸓ *commit*

Test method:

1. Open Tera Term on each PC.
2. Select the serial port connected to each Orbit radio and click **OK**.
3. Click **Setup -> Serial port** and change the baud rate to 230400. Click **OK**.
4. Obtain the serial transfer test files located on the GEMDS Orbit website.
5. Click **File -> Send file…** on the Access Point's Tera Term session.
6. Select the non-compressible file and click **Open**.
7. The transfer speed is displayed on screen.
8. When the transfer is complete, record results in the results table below.
9. Repeat 5-8 using the compressible transfer file.
10. Configure the Access Point VMIN parameter to 256 bytes.
    - ⸓ *set services serial ports COM1 baud-rate b230400 vmin 256*
    - ⸓ *commit*
11. Repeat steps 5-9.

Results Table:

Test Number	Description	Result	Pass/Fail
6.1.1	Compressible data throughput	Packet size 512 bytes: _____ kbit/s Packet size 256 bytes: _____ kbit/s	
6.1.1	Non-compressible data throughput	Packet size 512 bytes: _____ kbit/s Packet size 256 bytes: _____ kbit/s	

6.1.2 Ethernet Throughput

This test measures the over-the-air system throughput by passing Ethernet data through the Orbit's ETH1 port. A larger number represents better performance as a user would be able to collect additional information about their system simultaneously. The following tests the downstream direction (AP to RM). To test the upstream direction, simply swap the JPERF Client and Server configurations on the laptops. Results are measured in quiet network environment, at room temperature, and with boundary conditions.

Purpose:

- Verify the ability to pass Ethernet data over the RF link.
- Use JPERF to measure the Ethernet throughput by sending compressible/non-compressible data.

Test Setup:

- Install JPERF SW on the two test laptops (JAVA is required: https://java.com/en/). JPERF SW can be downloaded from https://code.google.com/archive/p/xjperf/downloads free of charge.
- Use an SSH utility to access the two radios.
- Set both radio's modulation to 64QAM.
    - *set interfaces interface LnRadio ln-config modulation qam64*
- Set both radio's maximum transmit power to 40dBm.
    - *set interfaces interface LnRadio ln-config power 40*
- Set both radio's bandwidth to 25 KHz.
    - *set interfaces interface LnRadio ln-config channel 25KHz-16ksps [For FCC]*
    - *set interfaces interface LnRadio ln-config channel 25KHz-20ksps [For ETSI]*
- Disable both radios' security settings.
    - *delete interfaces interface LnRadio ln-config security*
- Apply the configuration to both units.
    - *commit*

Test Method:

1. Configure the JPERF server on the Remote laptop and click "Run".
2. Modify the JPERF client from default values:
    - ✓ Transmit = 30 sec
    - ✓ Report interval = 5 sec
    - ✓ Protocol = TCP
3. Select the appropriate test file via the Representative File field on the Client application.
4. In the Server address field, enter the IP address of the server. Then click "Run".
5. Copy the results displayed by JPERF in kbit/s in the results table below.

Results Table:

Test Number	Description	Result	Pass/Fail
6.1.2	JPERF compressible data throughput (AP to RM)	_____ kbit/s	
6.1.2	JPERF non-compressible data throughput (AP to RM)	_____ kbit/s	

6.1.3 Combined Throughput (Ethernet and Serial)

This test measures the combined over-the-air system throughput by passing both Ethernet and Serial data through the Orbit's ETH1 and COM1 ports simultaneously. Results are measured in quiet network environment, at room temperature, and with boundary conditions.

Purpose:

- Verify the ability to pass Ethernet and Serial data over the RF link simultaneously.
- Use JPERF to measure the Ethernet throughput by sending compressible/non-compressible data.
- Use Tera Term to measure the Serial throughput by sending compressible/non-compressible data.

Test Setup:

- Install Tera Term on the two testing laptops. Tera Term can be downloaded from https://en.osdn.jp/projects/ttssh2/releases/ free of charge.
- Install JPERF SW on the two testing laptops. JPERF SW can be downloaded from https://code.google.com/archive/p/xjperf/downloads free of charge.
- Use an SSH utility to access the two radios.
- Set both radio's modulation to 64QAM.
    - ⸎ *set interfaces interface LnRadio ln-config modulation qam64*
- Set both radio's maximum transmit power to 40dBm.
    - ⸎ *set interfaces interface LnRadio ln-config power 40*
- Set both radio's bandwidth to 25 KHz.
    - ⸎ *set interfaces interface LnRadio ln-config channel 25KHz-16ksps [For FCC]*
    - ⸎ *set interfaces interface LnRadio ln-config channel 25KHz-20ksps [For ETSI]*
- Disable both radios' security settings.
    - ⸎ *delete interfaces interface LnRadio ln-config security*
- Set the Access Point serial configuration.
    - ⸎ *set services serial terminal-server server COM1 mode udp mode point-to-point remote address 192.168.1.11*
    - ⸎ *set services serial ports COM1 baud-rate b230400 vmin 512*
- Set the Remote serial configuration.
    - ⸎ *set services serial terminal-server server COM1 mode udp mode point-to-point remote address 192.168.1.1*
    - ⸎ *set services serial ports COM1 baud-rate b230400*
- Apply the configuration to both units.
    - ⸎ *commit*

Test Method:

1. Prepare the serial test:
    a. Open Tera Term on each PC.
    b. Select the serial port connected to each Orbit radio and click **OK**.
    c. Click **Setup -> Serial port** and change the baud rate to 230400. Click **OK**.

d. Obtain the serial transfer test files located on the GEMDS Orbit website.

e. Click **File -> Send file...** on the Access Point's Tera Term session.

f. Select the 500Kbyte non-compressible file and click **Open**.

g. The transfer speed is displayed on screen.

h. When the transfer is complete, record results in the results table below.

2. Configure the JPERF server on the Remote laptop and click "Run".

3. Modify the JPERF client from default values:

   ✓ Transmit = 30 sec

   ✓ Report interval = 5 sec

   ✓ Protocol = TCP

4. Select the appropriate test file via the Representative File field on the Client application.

5. In the Server address field, enter the IP address of the server. Then click "Run".

6. Copy the results displayed by JPERF in kbit/s in the results table below.

7. Run both Ethernet and Serial throughput simultaneously and record the results in the table below.

Results Table:

Test Number	Description	Result	Pass/Fail
6.1.3	Serial throughput	Packet size 512 bytes: _____ kbit/s	
6.1.3	JPERF data throughput	_____ kbit/s	

6.1.4 Ping Latency Test

This test measures the over-the-air system latency by passing a standard windows sized ICMP message across the radio link. A lower number represents a better performance as the user intends to collect vital Serial or Ethernet data as fast as possible. Results are measured in quiet network environment, at room temperature, and with boundary conditions.

Purpose:

- Verify the ability to pass Ping messages over the RF link.
- Use Windows' cmd.exe, or a similar program to report the over-the-air system latency by sending a standard ping message to the Remote.

Test Setup:

- Connect the laptop to the Access Point via Ethernet Cable.
- Use Windows' cmd.exe utility, or a similar program.
- Set both radio's modulation to 64QAM.
  - ⸓ *set interfaces interface LnRadio ln-config modulation qam64*
- Set both radio's maximum transmit power to 40dBm.
  - ⸓ *set interfaces interface LnRadio ln-config power 40*
- Set both radio's bandwidth to 25 KHz.
  - ⸓ *set interfaces interface LnRadio ln-config channel 25KHz-16ksps [For FCC]*
  - ⸓ *set interfaces interface LnRadio ln-config channel 25KHz-20ksps [For ETSI]*
- Apply the configuration to both units.
  - ⸓ *commit*

Test Method:

Open command prompt (run "cmd.exe")

1. Run 50 ping requests by typing: **ping 192.168.1.11 -n 50**
2. Record the average latency response for the 32 byte ping responses in the results table below.

Results Table:

Test Number	Description	Result	Pass/Fail
6.1.4	Average ping response time	_____ ms	

6.2 RF and Basic Functional Tests

The Licensed Narrowband module utilizes QAM modulation, a highly efficient PA, and a direct conversion receiver to provide dependable wireless communications. An advanced Media Access Control provides advanced interference avoidance, error detection, retransmission, auto repeat, and guaranteed collision free data. 10-Watts of peak power and dynamic FEC extend coverage to up to 50 miles.

6.2.1 RSSI and Transmit Power

This test verifies the Remote's ability to update and report the RSSI parameter. As external conditions change in the real world environment (outside of the laboratory), it is important that the Remote periodically update the RSSI parameter so the user can determine if a problem exists. Changing the Access Point's transmit power can simulate this external condition and will be used to verify this test. Results are measured in quiet network environment, at room temperature, and with boundary conditions.

Purpose:
- Verify the ability to change the Access Point transmit power.
- Verify the Remote periodically updates the RSSI parameter.

Test Setup:
- Connect the laptops to both radios via Ethernet Cable.
- Use an SSH utility to access the two radios.
- Set both radio's maximum transmit power to 40dBm.
  - % *set interfaces interface LnRadio ln-config power 40*

Test Method:
1. From the Access Point laptop, open the Windows cmd.exe utility.
   a. Start a ping to the Remote with the command: **ping 192.168.1.11 -t**
2. Login to the two radios with SSH.
3. At Remote radio, check the RSSI value and record it in the table below.
   - > *show interfaces-state interface LnRadio ln-status ap-info rssi*
4. At the Access Point, change the transmit power to 35dBm, 30dBm, and 25dBm.
   - % *set interfaces interface LnRadio ln-config power 35 … 30 … 25*
   - % *commit*
     Note: Some PINGS may drop after changing the power level on the AP. This is normal behavior.
5. Check the RSSI on the Remote and record these values in the table below.
   - > *show interfaces-state interface LnRadio ln-status ap-info rssi*

Results Table:

Test Number	Description	Result	Pass/Fail
6.2.1	Read the RSSI between Remote and AP without the use of external equipment	AP Tx=40dBm, Remote RSSI reports: _____ AP Tx=35dBm, Remote RSSI reports: _____ AP Tx=30dBm, Remote RSSI reports: _____ AP Tx=25dBm, Remote RSSI reports: _____	
6.2.1	Remote RSSI updates when AP Transmit Power changes	Yes / No	

6.2.2 Remote Management

This test verifies the user's ability to read Remote system parameters. This test also verifies the ability for a user to update parameters on the Remote using an over-the-air management tool such as SSH. This allows a user to manage the Remote unit without having to be physically at the Remote's site.

Purpose:
- Verify the ability connect to a Remote with an over-the-air SSH session.
- Verify the ability to configure and read Remote parameters with an over-the-air SSH session.

Test Setup:
- Connect the laptop to the Access Point via Ethernet Cable.
- Use an SSH utility to access the two radios from a locally connected laptop.
- Set the Remote's radio name.
    - % *set system name <name>*
    - % *commit*

Test Method:
1. Connect to the Remote through the laptop connected to the Access Point by SSH. Ensure the following key diagnostic and configuration information is accessible, such as:
    - ✓ Device Name
        - % *show system name*
    - ✓ Current Device Mode
        - > *show interfaces-state interface LnRadio ln-status current-device-mode*
    - ✓ Current IPv4 Address
        - > *show interfaces-state interface Bridge ipv4 address*
    - ✓ Current Transmit Power
        - % *show interfaces interface LnRadio ln-config power*
    - ✓ Last RSSI Value
        - > *show interfaces-state interface LnRadio ln-status ap-info rssi*
    - ✓ Current Alarms
        - > *show interfaces-state interface LnRadio ln-status alarms*
2. Change the Remote Radio Name and Transmit Power. Commit the changes.
    - % *set system name <new_name>*
    - % *set interfaces interface LnRadio ln-config power <##>*
    - % *commit*
3. SSH to the remote if needed. Verify the Radio Name and Transmit Power has been changed.
    - > *admin@new_name hh:mm:ss* (located at the beginning of every command line entry)
    - > *show interfaces interface LnRadio ln-config power*
4. Record results in the table below.

Results Table:

Test Number	Description	Result	Pass/Fail
6.2.2	Ability to view the Remote radio parameters	Yes / No	
6.2.2	Remotely change the Remote radio parameters successfully	Yes / No	

6.3 Security Tests

A foundational building block for the MDS Orbit Licensed Narrowband is security, a core competency area for GE, and a critical consideration and requirement for evaluating wireless communications systems for customers across all industry types and geographies. By securing the device, the user, and the network with open standards-based algorithms and protocols, the MDS Orbit Platform provides the necessary functions and tools to enable utilities to meet cyber security requirements and regulations.

6.3.1 Ethernet Port Management

Securing the device, securing the user, and securing the network are the three different security perspectives that were developed into the Orbit Platform. Specifically this test secures the device by verifying the user's ability to physically disable the Orbit Ethernet Port. This test also verifies the ability for a user to update parameters on the Remote using an over-the-air management tool such as SSH. This allows a user to manage the Remote unit without having to be physically at the Remote's site.

Purpose:
- Verify the ability to shut down the Orbit Ethernet port; securing the device.
- Verify the ability to configure and Remote parameters with an over-the-air SSH session.

Test Setup
- Connect the laptops to both radios via Ethernet Cable.
- Use an SSH utility to access the two radios.

Test Method
1. From the Access Point laptop, open the Window's cmd.exe utility (or a similar program).
   a. Start a ping to the Remote laptop with the command: **ping 192.168.1.xx –t**
      i. Where *xx* is the IP Address of the Remote laptop.
2. Ensure the ping is successful.
3. Connect to the Remote through the laptop connected to the Access Point by SSH and disable the Ethernet port which is connected to the Remote laptop.
   - *set interfaces interface ETH1 enabled false*
   - *commit*
4. Ping the laptop connected to the Remote radio and verify the ping is unsuccessful.
5. Record results in the table below.

Results Table:

Test Number	Description	Result	Pass/Fail
6.3.1	Not able to ping the Remote laptop when the port is disabled	Yes / No	

6.3.2 HTTPS Management

Securing the device, securing the user, and securing the network are the three different security perspectives that were developed into the Orbit Platform. Specifically this test secures user management by verifying the user's ability to logically disable the Orbit HTTPS Web Server. This test also verifies the ability for a user to update parameters on the Remote using an over-the-air management tool such as SSH. This allows a user to manage the Remote unit without having to be physically at the Remote's site.

Purpose:
- Verify the ability to shut down the Orbit's HTTPS Web Server; securing the user.
- Verify the ability to configure and Remote parameters with an over-the-air SSH session.

Test Setup:
- Connect the laptops to both radios via Ethernet Cable.
- Use an SSH utility to access the two radios.

Test Method:
1. Connect to the Remote through the laptop connected to the Access Point by SSH and disable https setting.
   - % *set services web https enabled false*
   - % *commit*
2. Log out of the utility tool, re-login to the Remote radio via a web browser (Firefox and Chrome are recommended) by https and verify the https login is unsuccessful.
3. Record results in the table below.

Results Table:

Test Number	Description	Result	Pass/Fail
6.3.2	Not able to login to the Remote radio by HTTPS when HTTPS disabled	Yes / No	

6.3.3 Network Security

Securing the device, securing the user, and securing the network are the three different security perspectives that were developed into the Orbit Platform. Specifically this test secures the network by encrypting the user's over-the-air data by configuring the Licensed Narrowband radio to use AES Encryption.

Purpose:

- Verify the ability to configure AES Encryption on the Licensed Narrowband radio; securing the network.
- Verify the ability to successfully pass data over-the-air when configured for AES Encryption.

Test Setup

- Connect the laptops to both radios via Ethernet Cable.
- Use an SSH utility to access the two radios.

Test Method

1. Connect to the Access Point and Remote radios by SSH and disable all the security settings on the two radios.
   - ⸗ *delete interfaces interface LnRadio ln-config security*
   - ⸗ *commit*
2. From the laptop connected to the Access Point, ping the laptop connected to the Remote radio.
   a. Ensure the ping is successful.
3. Connect to the Access Point by SSH and enable the AES encryption on the Access Point.
   - ⸗ *set interfaces interface LnRadio ln-config security encryption aes128-ccm security-mode psk passphrase <passphrasehere>*
   - ⸗ *commit*
4. From the Access Point laptop, ping the Remote laptop again and check if the ping is unsuccessful.
5. Connect to the Remote by SSH from the locally attached laptop and enable the AES encryption.
   - ⸗ *set interfaces interface LnRadio ln-config security encryption aes128-ccm security-mode psk passphrase passphrasehere … [Use the same passphrase in step #3]*
   - ⸗ *commit*
6. From the Access Point laptop, Ping the Remote laptop again and check if the ping is successful.
7. Record results in the table below.

Results Table:

Test Number	Description	Result	Pass/Fail
6.3.3	The Ping is unsuccessful when the Access Point is configured for AES encryption only.	Yes / No	
6.3.3	The Ping is successful when the Access Point and Remote are both configured to use AES encryption.	Yes / No	

6.4 Maintenance and Diagnostics

6.4.1 LED Indication

Having LED indicators on the top of the chassis provides the user with a visual confirmation of the status of the Orbit. This test verifies the functionality of the front panel LED indicators for Ethernet (ETH) and Power (PWR). Additional LED states can be found in the *MDS Orbit Technical Manual* (P/N: 05-6632A01) located on the Orbit Series webpage.

Purpose:

- Verify the LED indicators on the top of the Orbit provide and accurate status of the system.

Test Setup:

- Connect the laptops to both radios via Ethernet Cable.

Test Method:

1. From the laptop connected to the Access Point continue to ping the laptop connected to the Remote radio with the command: **ping <192.168.1.xx> –t**, where <192.168.1.xx> is the Remote laptop IP address.
    a. Ensure the ping is successful.
2. Verify the PWR LEDs on the two radios are solid green.
3. Verify the ETH LEDs on the two radios are blinking.
4. Record results in the table below.

Results Table:

Test Number	Description	Result	Pass/Fail
6.4.1	Is the PWR LED solid green?	Yes / No	
6.4.1	Is the Ethernet LED blinking green?	Yes / No	

6.4.2 Event Log

An event is a notification that something meaningful occurred on the unit. Events contain information about the occurrence that may be useful for administrators. The event can be stored locally and/or transported to a remote server by using the log export feature and then clearing the log. This test will confirm that the Licensed Narrowband radio, when disconnected, will log an entry in the Event Log.

Purpose:

- Verify that when a Remote disconnects an entry is created in the Event Log.

Test Setup

- Connect the laptops to both radios via Ethernet Cable.
- Use an SSH utility to access the two radios.

Test method

1. From the laptop connected to the Access Point, ping the laptop connected to the Remote radio.
    a. Ensure the ping is successful.
2. Connect to the Access Point and Remote radios by SSH.
3. Disable the LN Interface on the Access Point.
    - % *set interfaces interface LnRadio enabled false*
    - % *commit*
4. Check the event log on the Remote radio from the locally attached laptop, and see if the link disconnection event was displayed in the latest event log. This may take up to 1 minute.
    - > *show logging event-log*
      ex: 24T20:34:16.809642+00:00   notice   link_down   success action disconnect,   interface_name LnRadio,
5. Record results in the table below.

Results Table:

Test Number	Description	Result	Pass/Fail
6.4.2	Did the latest event log show the link disconnection event?	Yes / No	