Installation Guide
Self-Backhaul UE Relay

Legal Notice

Table of Contents

Introduction

The guide documents the installation of the Kumu Self Backhaul UE Relay. It is intended for use by a qualified professional installer in compliance with local safety regulations and building codes in the country of installation.

Product Support: For Technical Support, email techsupport@kumunetworks.com.

Important Safety and Regulatory Information

Please read this section carefully and in full before attempting installation as important safety and regulatory information is enclosed.

Failure to do so may expose the user or service provider to legal and financial liability as well as injury or death.

IMPORTANT: See Installation Instructions Before Connecting to the Power Supply

Although tested and certified by relevant safety organizations, Kumu Networks Inc. assumes no liability for injury, damage or violation of regulations relating to the installation of the product.

Guidelines and Restrictions

- Before installation, read this guide in full and follow all safety and operations instructions.
- Only trained qualified personnel should install, service or replace the equipment.
- The device should not be modified in any way unless expressly approved in writing by Kumu Networks or one of its authorized agents. Any modifications could compromise device safety and void the legal operation of the device under local regulations.
- Install this device only in a Restricted Access Location.
- Use caution against excess RF exposure when installing external antennas (not included) and ensure that the overall EIRP is within regulatory limits. Refer to the spec sheet for the maximum output power of the RF ports.
- Do not exceed maximum limits for the interfaces as specified in the spec sheet.
- There is no user-serviceable equipment inside the relay box. Do not open or void the tamper-evidence seal.
- Properly provision the AC power load to the Kumu Relay as to not overload the supplying circuits. Provide access to the power connector on the box so that it can be disconnected at the unit if required.
- Do not place the Kumu Relay near a direct heat source; avoid placing unintended objects on the unit.
- Sections of the relay can exceed 70 degrees C so use proper care when handling the box to avoid burns.
- Do not install the Kumu Relay box in adverse environmental or weather conditions where the risk of electric shock or ignition/explosion of environmental objects can occur.
- Do not locate the unit too near power lines or other power sources where it can come

into accidental contact with these objects.

- Use only water or water-based detergents for cleaning. Do not immerse relay in water.
- Ground the unit to protect against power surges and static electricity; install this device in accordance with the local electrical codes.
- When installation is completed, the product must comply with all the Safety Standards and regulatory requirements of the country in which it is installed. Consult with appropriate regulatory agencies and inspection authorities to verify compliance.

Hazardous Voltage Warning

With AC installations, hazardous voltages exist. Use caution when working with or around AC power. Please remove jewelry or other metal objects that could accidentally come into contact with AC power.

- Connect the supplemental ground to the unit in accordance with the NESC. This is essential before connecting the input supply cable.
- The equipment coaxial cable shield must be connected to the grounding system of the building, as close to the point of cable entry as practical.

WARNING: This equipment must be grounded. If the cable strand is not grounded, you must ground this equipment by connecting a customer-supplied ground wire to the grounding lug on the chassis, and then connecting the other end to a reliable earth ground. If you are uncertain that suitable grounding is available, contact the appropriate electrical inspection authority or an electrician.

- This equipment requires a surge protector device (SPD) or UL Certified surge arrester as part of the installation to address transient over-voltages exceeding Overvoltage Category II, 2500 Vpk.
- The equipment is suitable for installation outdoors. The equipment is intended for installation and service by trained personnel only (no operator access).
- The bonding conductor used must be a minimum of AWG #6.

Hazardous Material Declaration

Note: This device does not contain hazardous substances (as per UK Control of Substances Hazardous to Health Regulations 1989 and the Dangerous Substances Regulations 1990). Consult with Kumu or **an** authorized representative to ensure that the product is disposed of in conformance with relevant regulatory requirements.

Human RF Exposure Warning

Use caution against excess RF exposure when installing external antennas (not included) and ensure that the overall EIRP is within regulatory limits. Refer to

the Absolute Maximum Ratings section of the Spec Sheet for maximum output power of the RF ports.

Radio Interference

The Kumu Self Backhaul UE Relay (Relay) transmits wireless signals and should only be used as instructed. Failure to use as instructed could expose the user to higher levels of radio emissions. The user should not try to alter the radio settings as provided by Kumu Networks. Changes or modifications not expressly approved by Kumu Networks Inc. could void the user's authorization to operate the equipment.

FCC Notice (United States):

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a commercial installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

CAUTION: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator & your body.

CE Notice (European Notice)

The Conformité Européne symbol found on this product indicates compliance to the EMC Directive of the European Union.

Kumu Networks Inc. hereby declares that this wireless device is in compliance with the essential requirements and other relevant provisions of the European Radio Equipment Directives. A copy of the EU Declaration of Conformity is available at www.kumunetworks.com/euro/compliance.

CE

European Union—Disposal Information

The symbol above means that according to local laws and regulations your product and/or its battery shall be disposed of separately from household waste. When this product reaches its end of life, take it to a collection point designated by local authorities. The separate collection and recycling of your product and/or its battery at the time of disposal will help conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment.

European Declaration of Conformity

KUMU NETWORKS

Declaration of Conformity

Kumu Networks, Inc. declares that the equipment described in this document is in conformance with the requirements of the European radio equipment directives 2014/53/EU, 2014/35/EU, and 2014/30/EU, listed below:

EN 301 489-1 v2.2.0
EN 301 489-24 v1.5.1
EN 301 908-13 v11.1.1 (2016-07)
EN 62311:2008
EN 60950-1

CE

All essential radio test suites have been carried out.

Product Description: **Self Backhaul UE Relay**
Model: **KU5B01LTE03-EU**

This declaration is issued under the sole responsibility of Kumu Networks, Inc. and, if applicable, their authorized representative(s)

March 8, 2017

DAVID CUTRER, CEO

Notified Body

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Preinstallation Requirements

Before installing the Kumu Relay, prepare the following information.

- Physical Installation Requirements
- RF Deployment Requirements
- Networking and LTE NAS Requirements
- Port Forwarding Requirements

Review and discuss this information with your Kumu representative while planning your installation.

Physical Installation Requirements

Determine the physical installation requirements by completing Table 1:

Table 1 - Deployment Location and Antenna Configuration

Module	Information Required	Value
Deployment Site and Position	Please provide photos	
Access Restrictions?	Regulatory, Power, Colocation, Permits, etc.	
Pole or Wall Mounting?	Pole or Wall	
Pole Material	Wood, Metal or other	
Pole Diameter (if pole used)	Pole diameter at Relay Mount If mounted with threaded screws - 1-1/2” minimum, 4” maximum pole diameter If mounted with straps - 4” minimum, 10” maximum pole diameter	
Pole Diameter (if pole used)	Pole Diameter at Backhaul Antenna Mount	
Access Antenna	Manufacturer and Model	
Access Antenna	Placement and Mounting Height	

Module	Information Required	Value
Backhaul Antenna	Manufacturer and Model (if required)	
Backhaul Antenna	Placement and Mounting Height	
Power	Voltage/Current Available	
Power	Connector Type	
Power Cable	Length of cable required	
RJ-45 ethernet	Connector on eNB?	Yes / No
Ethernet cable	Length of Ethernet cable required between eNB and relay	
Ethernet connections		
Site deployment diagram	Include wiring, etc.	Please attach, include photos of site if possible
Other RF Antennas?	Check wiring diagram to determine if any other RF transmitters are powered on within the deployment site	

RF Deployment Requirements

Prepare the RF deployment details by completing Table 2:

Table 2 – RF Deployment Details

Parameter	Notes	Value
LTE Band		
DLEARFCN		
eNB Transmit Power	at eNB Antenna Output	
Number of eNB Antennas		
Bandwidth		
Expected Backhaul UE Transmit Power		
Serving Cell Physical Cell ID		
Serving Cell RSRP at deployment location		
Neighboring Cell RSRP levels at deployment location		
Expected Backhaul Link SINR		
Small Cell Physical Cell ID		

Networking and LTE NAS Requirements

Prepare the Networking and LTE NAS requirements by completing Table 3:

Table 3 - Networking Configuration

Parameter	Notes	Value
eNB Transport IP		
Transport Gateway IP		
Backhaul APN	Provide special APN name for backhaul	
SIM Card CPIN	Provide if the SIM card has a CPIN	
Keepalive IP	Specify the IP the Kumu Relay should ping for connection status	
VLAN Requirements		
NAT-T Supported by Security Gateway?	NAT-T support required for deployment	Yes / No
IP Networking Diagram (Local / Core)	Attach to doc	

Port Forwarding Requirements

Determine the Port Forwarding requirements by completing Table 4:

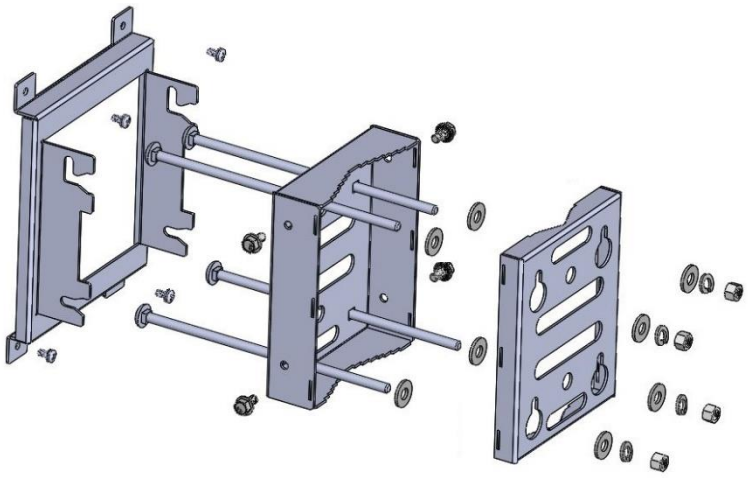
Table 4 - Network Port Forwarding

Parameter	Notes	Value
Is PTP/NTP/IEEE1588 required?		
Is SSH to the small cell required?	Specify port if SSH required	
Any other port-forwarding requirements to reach small cell?		

Hardware Contents

Before installing the Kumu Relay, make sure all parts are present:

- Pole Mount Kit
  - Pole bracket (2)
  - Relay mounting bracket
  - M6 hex head 12mm bolt (4)
  - M6 lock washer (4)
  - M8 latch bolts (4) - Part #91280A526
  - 8-10” threaded rod screw (4)
  - 3/8” nylon push nut washer (4)
  - 3/8” hex nut (4)
  - 3/8” lock washer (4)
  - 3/8” flat washer (4)
  - Metal pole mount strap (3) – McMaster Part #5420K8 (not shown)



- Kumu relay chassis
- M6 grounding screw (located on chassis)
- Ring terminal 6AWG
- 19mm inner diameter eye bolt (1) –McMaster Part #3040511
- Sealing caps
  - RJ45 (2)
  - Power (1)
  - N (6)
- Power connector – Part #SACC-MINFS-3CON-PG9
- Ethernet connector RJ45
- Waterproofing for power and ethernet connector (2) - IP67
- Lock washer

The following parts are also required but not included:

- Sim Card, Standard size (2FF), compatible with network
- Ethernet Cable
- Power cable (18 or 16 AWG)
- Ground wire (up to 6 AWG)

Tools Required for assembly (not included):

- M3 hex driver
- M6 hex driver
- M8 hex wrench
- 3/8” wrench
- Carabiner or hook compatible with 19mm inner diameter eye bolt; able to support the weight of the Kumu relay with mounting bracket attached (15.8kg)

Installation Instructions

This section outlines a representative installation scenario. The actual installation might vary depending on the end user's requirements. The major steps are:

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1. Remove Access Cover and Install SIM Card
2. Install Relay Mounting Bracket and Eye Bolt

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3. Install Pole Mount
4. Install the Kumu Relay Unit
5. Install Chassis Ground

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6. Connect Cables

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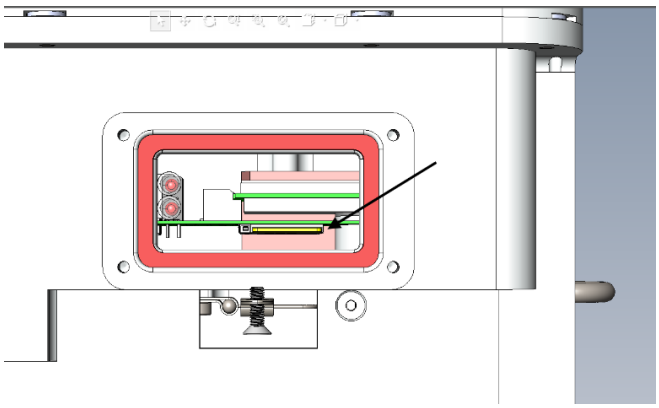
7. Connect to Relay and Perform Testing

WARNING! Only qualified installers should install the unit. Install in accordance with all local regulatory and safety requirements.

Remove Access Cover and Install SIM Card



1. Remove access panel cover from the side of the Kumu Relay by removing the 4 captive screws.
NOTE: Screw size is M3 hex.

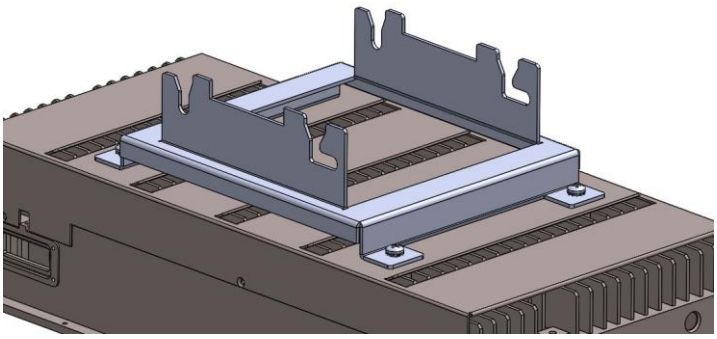
2. Install the SIM cart in the slot shown.
SIM card should be standard size and compatible with your network.

3. Replace the access panel cover and tighten the 4 screws.

NOTE: the SIM card is initialized on power up. If you need to reinstall the SIM card, you will have to power cycle the Kumu Relay.

Install Relay Mounting Bracket and Eye Bolt

1. Install the relay mounting bracket to the back of the Kumu Relay using M6 lock washers (4) and M6 hex head 12mm bolts (4).
2. Securely tighten the 4 bolts.
3. Attach Eye Bolt (1) to the top of the Kumu Relay.



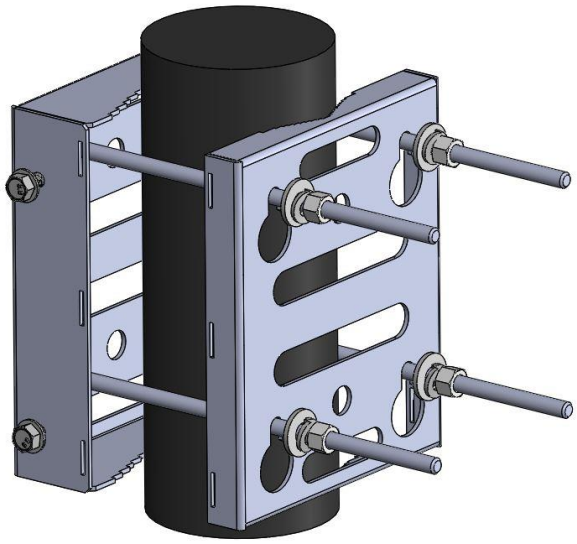
NOTE: The mounting bracket allows easy installation and removal of the unit from the pole mount. The eye bolt is used to tether and lift the Kumu Relay box up to the installation point on the pole.

Install Pole Mount

Depending on the material and thickness of the pole, you can install the pole mount in the following ways:

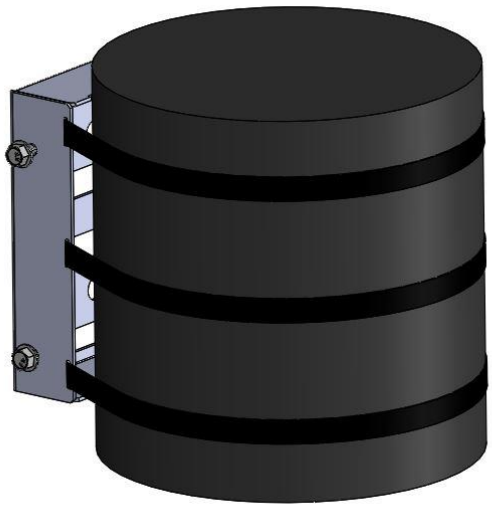
- Threaded rod screws (for metal pole with thickness between 1-1/2” and 4” in diameter)
- Pole mount clamps (for metal pole with thickness between 4” and 10” in diameter)

Install Using Threaded Rod Screws



1. Attach the (4) M8 latch bolts on the side of the pole mount bracket. Do not fully tighten the bolts.
2. Insert nylon push nut washers (4) onto threaded rod screws.
3. Place one piece of the pole mount bracket on each side of the pole.
   NOTE: Place the bracket with the latch bolts attached to it on the side of the pole where you plan to locate the Kumu Relay.
4. Connect the pole mount pieces using threaded rod screws (4), washers (4), lock washers (4), and nuts (4).
5. Securely tighten the 4 rod screws.

Install Using Pole Mount Clamps



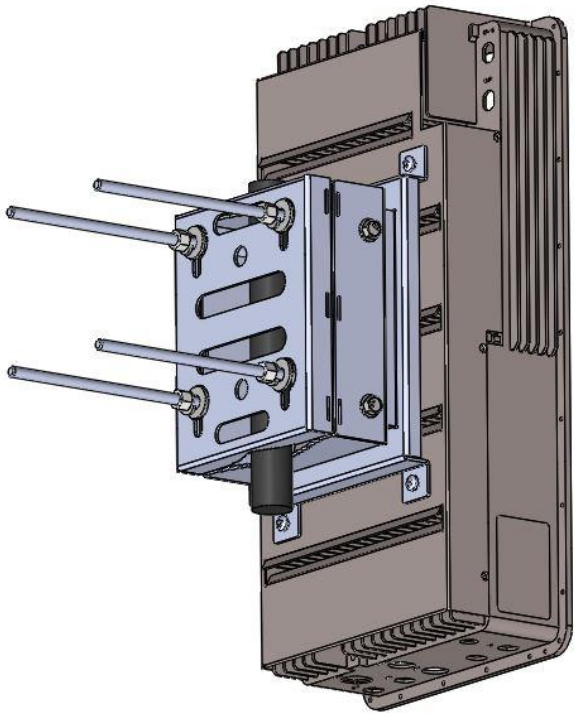
1. Install the (4) M8 latch bolts on the side of the pole mount bracket. Do not fully tighten the bolts.

2. Thread metal pole mount clamps (3) through slots on side of universal pole mount bracket.

3. Place pole mount bracket on the pole.
NOTE: Place the bracket on the side of the pole where you plan to locate the Kumu Relay.

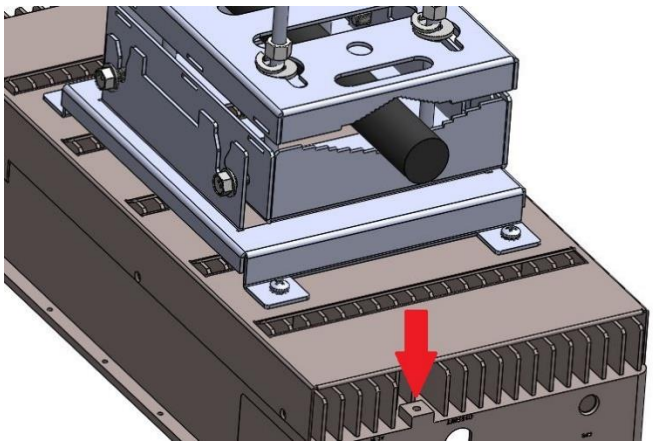
4. Securely tighten the pole mount clamps.

Install the Kumu Relay Unit



1. Connect a carabiner or hook (not provided) to the eye bolt on the top of the unit and safely tether the relay unit before installing.
You can also use the eye bolt to lift the Kumu Relay box up to the installation point on the pole.
2. Install the Kumu Relay unit onto the latch bolts on the side of the pole mounting bracket as shown.
3. Securely tighten the (4) latch bolts at the attachment point.

Install Chassis Ground



1. Install proper earth grounding for the chassis at the grounding point shown.

Required screw size is M6. Use a minimum of AWG #6 wire (not provided) with the AWG #6 ring terminal compliant to UL Listed KDER – Grounding and Bonding Equipment.

2. Verify that the grounding is correct and complies with your local regulatory and industry safety standards.

WARNING! Do not operate the Kumu Relay without proper chassis grounding installed as a device failure might lead to potential injury or death.

Connect Cables

NOTE: The connecting cable between this outdoor equipment and the other ITE devices should comply with Class 3 wiring methods as listed in NEC, Table 725.154(G) for Class 3 Cable Substitutions. Attached internal cables need to be compliant with the IP65 rating of the unit.

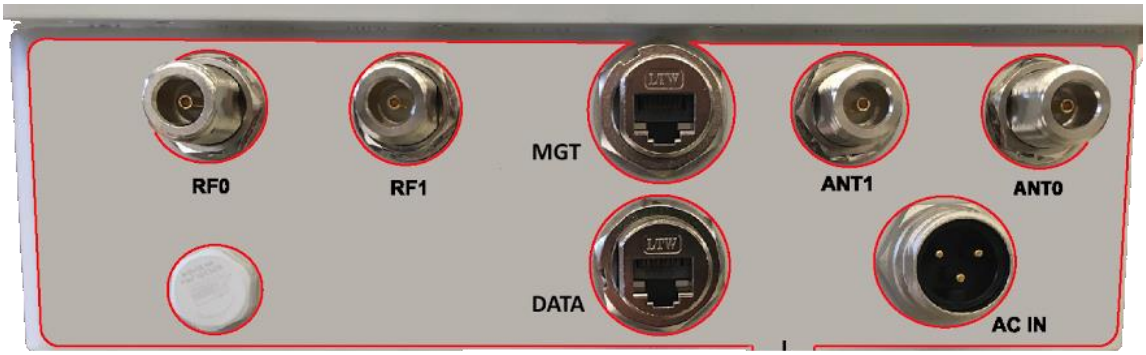
Backhaul Interface Connections

Connect the ports at the top back of the Relay to the Backhaul Antennas:

1. BANT0 - both transmit and receive
2. BANT1 - receive only

Access Interface Connections

Connect to the access interface connections on the bottom of the relay:



1. RF0 and RF1 - connect to the eNodeB antenna ports 0 and 1
2. MGT – can be used for configuring the Relay. Secure the sealing cap in place when not in use.
3. ANT1 and ANT0 - connect to the Access antennas.
4. DATA – connect to the eNodeB Ethernet port.
5. AC IN - connect the power port using the Power Connector and a customer-supplied power cable. Connect the wires as follows:

6. Attach IP67 waterproofing for AC IN and Data connections.
7. Seal any unused connections with the sealing caps provided.

Connect to Relay and Perform Testing

After the Kumu Relay is installed, follow these steps to connect and test the Relay:

IMPORTANT: Make sure to check the wiring diagram for other RF transmitters that could cause interference.

1. Turn on the power to the Kumu Relay. (eNodeB should be off.)
   There are two LEDs on the cover of the SIM card panel - one red and one green. The red LED will flash while the relay boots and then turn solid. The green LED will remain off.
2. Connect to the Relay via the MGT port by using a laptop. Open a browser and enter the IP address and port associated with the Relay. Refer to the Configuration Guide for details on connecting.
3. Configure the RF information. Refer to the Configuration Guide for details.
4. Configure the Backhaul information. Refer to the Configuration Guide for details.
   Make sure to enter the name of a commercial APN.
5. Select “apply” to save the configuration changes.
   The Red LED on the cover of the SIM Card panel will flash for 5 to 10 minutes while the relay restarts, and then, if there are no errors, turn off. A solid Green LED come on.
6. Position and adjust the Backhaul Antenna.
7. Measure the Serving Cell Reference Signal Received Power (RSRP) and Serving Cell Signal-to-Interference-Plus-Noise Ratio (SINR).
   RSRP and SINR values are located on the Metrics tab under UE RF Metrics.
   a. If the RSRP and SINR values are acceptable, run a speed test using the speedtest tool on the Utilities tab of the Kumu GUI.
      NOTE: RSRP of greater than -100dBm and SINR greater than 10dB are acceptable values.
   b. If the RSRP and SINR values are not acceptable, repeat steps 6 and 7.
8. Record the data rates for the appropriate LTE Channel listed in Table 5.
   Observed data rates should be greater than 50% of the maximum values listed.

Table 5 – Data Rates

LTE Channel Bandwidth	Maximum Download Data Rate	Observed Download Data Rate	Maximum Upload Data Rate	Observed Upload Data Rate
20 MHz	120 Mbps		45 Mbps	
15 MHz	105 Mbps		37 Mbps	
10 MHz	70 Mbps		25 Mbps	
5 MHz	35 Mbps		12 Mbps	

9. Check for Relay alarms. Alarms are listed under the Notifications tab.
   If any alarms are logged, refer to the Configuration Guide for details.
10. On the Backhaul tab, change the value in the APN field to the Relay APN.
11. Change the KeepAlive IP address to an address that will respond to an ICMP ping request.
    NOTE: An address that is reachable on the APN network is required.
12. Turn on the eNodeB and wait for it to come online.
13. Connect an end client device to the Relay eNodeB and run a speed test again using the speedtest tool on the Utilities tab of the Kumu GUI.
14. Record data rates for the appropriate LTE Channel again. Numbers should be greater than 80% of the values recorded in step 8.
15. Check for relay alarms. There should be no alarms listed.
    Alarms are listed under the Notifications tab.
    If any alarms are logged, refer to the Configuration Guide for details.
16. Disconnect the laptop from the Relay and reseal the MGT port.