



EtherHaul-5500FD™

Gigabit Ethernet Wireless Solution

Installation Manual



EH-5500FD-INST-01, Issue 2

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Safety and Regulatory Notices

The following are mandatory notices for installation and operation of EtherHaul Wireless Backhaul Link. Indications appearing here are required by the designated government and regulatory agencies for purposes of safety and compliance.

General

Do not install or operate this System in the presence of flammable gases or fumes. Operating any electrical instrument in such an environment is a safety hazard.

European Commission

This product has been designed to comply with CE markings in accordance with the requirements of European Directive 1995/5/EC.

This product has been designed to comply with the requirements of European Directives.

This equipment must be permanently earthed for protection and functional purposes. To make a protective earth connection, use the grounding point located on the System ODU using a minimum amount of 16AWG grounding cable or according to local electrical code.

This apparatus is intended to be accessible only to authorized personnel. Failure to prevent access by unauthorized personnel will invalidate any approval given to this apparatus.

This product is in full compliance with the following standards:

- RF EN 302 217-3 1.3.1
 E-Band FCC part 101
- EMC EN 301 489-4
- Safety IEC 60950
- Operation EN 300 019-1-4 Class 4.1E
- Storage EN 300 019-1-1 Class 1.2
- Transportation EN 300 019-1-2 Class 2.2

FCC/IC Regulatory Statements

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules and IC RSS standards. These limits are designed to provide reasonable protection against harmful interference in a residential 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 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.

Note:



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

Caution:



Outdoor units and antennas should be installed **ONLY** by experienced installation professionals who are familiar with local building and safety codes and, wherever applicable, are licensed by the appropriate government regulatory authorities. Failure to do so may void the product warranty and may expose the end user or the service provider to legal and financial liabilities. Siklu LTD and its resellers or distributors are not liable for injury, damage or violation of regulations associated with the installation of outdoor units or antennas.

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About this Document

This document is the Installation Manual for the EtherHaul-5500FD wireless Link.

It provides product overview and details the installation and initial setup.

For instructions how to use the product's features, refer to the "EtherHaul Operation, Administration and Maintenance Manual".

Note:



Features and functionality described in this document may be available for specific product models or starting from specific SW version.

Please review the individual product's release notes to verify if a specific feature is supported in the product you use.

Applicable Products and Releases

- E-Band
 - EH-5500FD, minimum SW release 7.2.0

Audience

This document assumes a working knowledge of wireless backhaul platforms and their operating environments.

This document is intended for use by all persons who are involved in planning, installing, configuring, and using the EtherHaul system.

Conventions

The following conventions are used in this document in order to make locating, reading, and using information easier.

Special Attention

Hint:



Informs you of a helpful optional activity that may be performed at the current operating stage.

Note:



Provides important and useful information or describes an activity or situation that may or will interrupt normal operation of the EtherHaul system, one of its components, or the network.

Caution:



Describes an activity or situation that requires special attention.

Text Conventions

Document References

Italicized text is used to reference sections or chapters in this document. In many cases, references use clickable hypertext links that enable immediate access to referenced objects.

Command Input

Monospace text is used to help delineate command line user input or text displayed in a command window.

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1 Introduction to the EtherHaul System

This chapter provides a brief overview of the EtherHaul product line.

The EtherHaul-5500FD product line delivers high power, carrier-grade wireless point-to-point multi-gigabit Ethernet services utilizing the light-licensed 71-76GHz and 81-86GHz E-band spectrum (FDD).

The EtherHaul is based on Siklu's revolutionary integrated-silicon technology, which results in a highly reliable, zero footprint, and low-cost radio.

The EH-5500FD brings 5Gbps full duplex throughput for demanding networks in the metro, aggregation and trunking applications.

1.1 Main Features

Siklu's EtherHaul wireless backhaul radio link operates in the E-band spectrum, which provides clear technological and economic advantages over the existing lower frequency bands. Taking advantage of the new spectrum, the EtherHaul enables easy migration to support Gigabits throughput, enabling operators to enhance bandwidth capacity on a "pay as you grow" basis. Supporting point-to-point, daisy-chain, ring, and mesh configurations, the EtherHaul system offers carrier class availability and services.

The following are some of the main features of the EtherHaul (availability of features depends on platform):

All-Outdoor Packet Radio

- Operates in the light-licensed 71-76/81-86 GHz E-Band
- Up to 5 Gbps full duplex throughput
- High gain narrow beam-width directional antenna
- Low latency

Spectral Efficiency

- 1250 MHz channel bandwidth
- Advanced hitless/errorless Adaptive Bandwidth, Coding and Modulation (ABCM) for a large dynamic range
- Configurable center frequency across the entire band

Carrier Grade:

- CLI, SNMP and web-based local and remote management
- Extremely high reliability with very high MTBF
- Designed for ultra-low MTTR without the need for antenna realignment

Green Design:

- Zero footprint, all-outdoor, extremely light weight

- low power consumption
- IEEE 802.3at compliant Power over Ethernet

Quick and Easy Installation

- Rapid and flexible deployment
- Precise antenna alignment
- Minimal site preparation

Adaptive Bandwidth, Coding and Modulation

The EtherHaul family implements hitless/errorless adaptive bandwidth, coding and modulation adjustment to optimize the over-the-air transmission and prevent weather-related fading from disrupting traffic on the link. The EtherHaul can gain up to 22 dB in link budget by dynamically adapting the modulation profile.

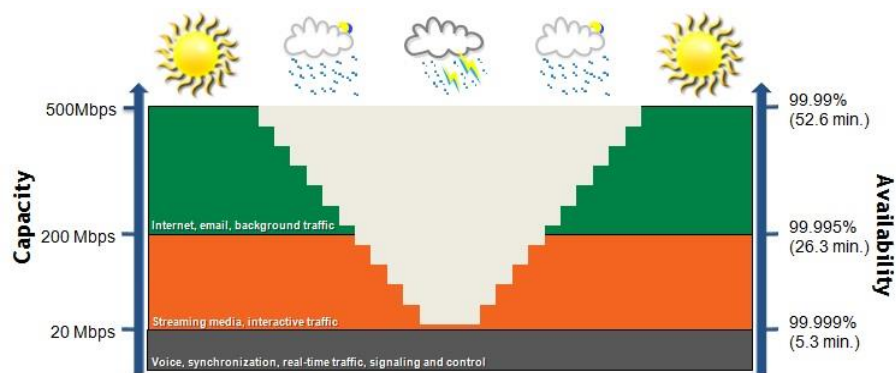


Figure 1-1 Hitless Adaptive Bandwidth, Coding and Modulation

1.2 Functional Description

The EtherHaul is an all-outdoor system comprised of the following functional blocks:

- RFIC: Siklu's integrated Silicon Germanium (SiGe) transceiver operating at 71-76/81-86 GHz.
- Modem/Baseband ASIC: modem/baseband ASIC includes the modem and FEC engines
- Interfaces: The network interface consists of 1 integrated 100/1000 Ethernet port (PoE in and management) and 1 integrated SFP+ for 10G
- Host processor (CPU) the host processor controls the system responsible for the control plane, and the antenna alignment.
- Antenna: Siklu's self-designed 1ft innovative antenna, as well as 2ft antenna option for longer range higher availability.

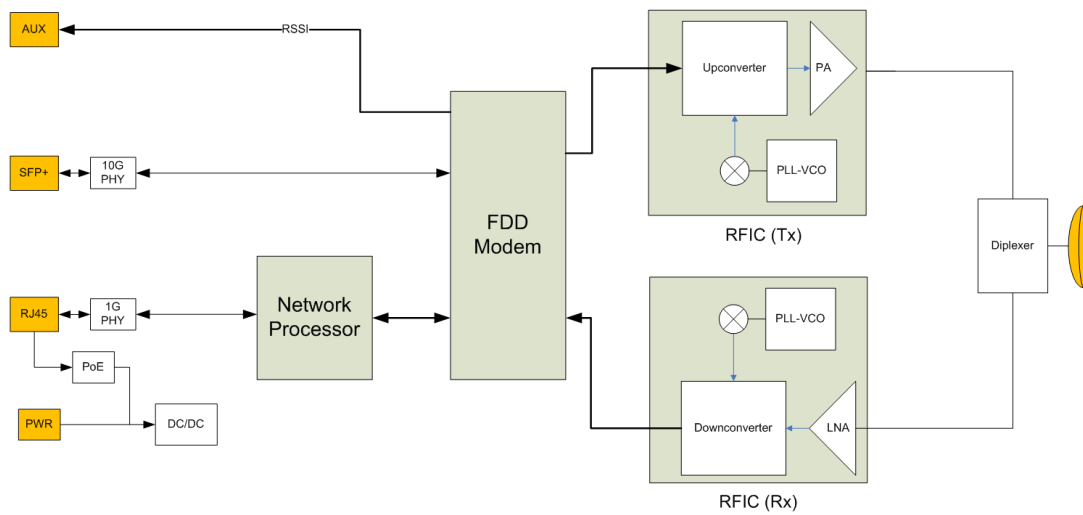


Figure 1-2 EH-5500FD Functional Block Diagram

1.3 Technical Specifications

For detailed technical specifications please refer to the datasheet.
For detailed supported features list please refer to the product's release notes.

1.4 Management

You can manage an EtherHaul system using a Web-Based Element Management System (Web EMS) or a Command Line Interface (CLI). The CLI is compatible with SNMP.

The system supports out-of-band management only. To manage the radio, use the 100/1000 RJ45 port.

2 Installing the EtherHaul System

This chapter describes how to install and perform the basic setup for EtherHaul outdoor unit (ODU) in an EtherHaul wireless network, including:

- Preparing the Site
- EtherHaul Package Content
- Unpacking the EtherHaul
- Required Tools
- Preparing for Installation
- Mounting the EtherHaul
- Installing the ODU with a Two-Foot Antenna
- Connecting the Cables
- System LEDs
- Aligning the Antenna
- Link Up Verification

The installation of the EtherHaul system is followed by initial system setup that will be described in the next chapter.

Caution:



The installation and maintenance of the EtherHaul link should only be done by service personnel who are properly trained and certified to carry out such activities.

Caution:



It is the responsibility of the installer to insure that when using the outdoor antenna kits in the United States (or where FCC rules apply), only those antennas certified with the product are used. The use of any antenna other than those certified with the product is expressly forbidden in accordance to FCC rules CFR47 part 15.204.

2.1 Preparing the Site

Carefully select and prepare each EtherHaul ODU site to make device installation and configuration as simple and trouble-free as possible. During site selection and preparation, always consider the long-term needs of both your network and your applications.

2.1.1 Physical and Environmental Requirements

Each EtherHaul ODU site should adhere to the following requirements:

- There must be a clear, unobstructed line-of-sight between ODU.
- The EtherHaul ODU should be mounted on a fixed, stable, permanent structure. A reinforced steel mounting pole is required, with a diameter measuring from 2-4 inches (1ft antenna) or 2-4.5 inches (2ft antenna).

Caution:



Do not mount the EtherHaul device on a structure that is temporary or easily moved. Doing so may result in poor service or equipment damage.

- You must mount the EtherHaul ODU in a site that is easily accessible to authorized personnel, and only authorized personnel.
- Operating temperature: between -45° and +55°C.
- Relative humidity: 0 to 100%.
- Maximum altitude: 4,500m.
- Ingress Protection rating: IP67.

2.1.2 Cabling Requirements

- Ensure that your power connection cable matches the EtherHaul power connector pin-outs.
- Install the EtherHaul ODU where network connections are ready for operation and easily accessible.
- All cabling connected to the ODU should be outdoor-grade, with UV protection.
- You should use shielded outdoor Cat5e cables terminated with metallic RJ45 connectors.
- In order to protect indoor equipment, you must install surge protection circuits on all copper cables on their entrance to the building.
- Install the EtherHaul ODU in a location where proper electrical outdoor grounding is readily available. Typically, the grounding connection is attached directly to the mounting pole. If not already present, then suitable structure-to-earth grounding connections must be created before installation. Ground the ODU using a minimum quantity of 16AWG grounding cable or according to local electrical code.

Caution: Improper electrical grounding can result in excessive electromagnetic interference or electrical discharge.



Siklu will not be held responsible for any malfunction or damage in the event that the ODU is not properly grounded.

2.2 EtherHaul Package Content

An EtherHaul link consists of two ODUs, two antennas and two mounting assemblies.

The EtherHaul packages include the following components:

Package	Description	Quantity
EtherHaul ODU		
	EtherHaul ODU with external antenna interface	1
	Connecting cable All-Weather shells	3
	Unit grounding cable (90 cm)	1
	DC cable terminal block connector	1

2.3 Unpacking the EtherHaul

The EtherHaul package content should be examined carefully before installation.

When you unpack the components of the EtherHaul, it is important to use care so as to avoid damaging or scratching the antenna radome:

- Do not touch the radome when unpacking the ODU.
- Do not rest the ODU face down or touch the radome. It is crucial to prevent contact between the radome and other objects.

2.4 Required Tools

Ensure that you have the following tools with you when performing an EtherHaul installation:

- Standard handheld digital voltage meter (DVM) with probes
- Standard open-end wrench, 13 millimeter
- 8mm Allen key for ODU installation with 2ft antenna

- Philips screwdriver, medium size head for grounding connection
- Cable ties (for securing network and optional power cables)
- Cutter
- Cable labeling

2.5 Preparing for Installation

The expected receive signal strength should be calculated prior to installing the link for each antenna ODU (read from the DVM) prior to installation, based on the network link budget.

Calculating the expected RSSI:

$$\text{RSSI} = P_{\text{tx}} + G_{\text{ant1}} - \text{LFS} - \text{Att}_{\text{atm}} + G_{\text{ant2}}$$

Where:

- P_{tx} – ODU's Tx Power (typically +5dBm)
- G_{ant1} – Gain of antenna 1 (typically 35dBi)
- G_{ant2} – Gain of antenna 2 (typically 35dBi)
- LFS – Loss of Free Space = $92.45 + 20 * \log(D_{\text{km}} * F_{\text{GHz}}) +$
 - D - Link distance in Km
 - F – Frequency in GHz
- Att_{atm} – Attenuation due to Atmospheric Gases (dB/Km)

For E-band links, the Attenuation due to Atmospheric Gases is typically 0.5dB/Km.

For V-band links, the Attenuation due to Atmospheric Gases is significantly higher (up to 15dB/Km) and depends on the specific channel used and the exact geographical location.

Refer to EtherHaul Link Budget Calculator for on-line calculation of expected availability and expected RSSI.

2.6 Installing the ODU with a 1ft (31cm) Antenna

2.6.1 Attaching the ODU to the Antenna

1. Unpack the ODU, place it on a clean unobstructed work surface area, and remove the plastic cap protecting the waveguide interface.
2. Unpack the antenna, keeping the plastic protective cover in place, and remove the plastic cap protecting the antenna feed.
3. Place the antenna on top of the ODU while aligning the guiding pin on the antenna to the guiding hole on the ODU.
4. Gently rotate the antenna till you notice the guiding pin is in place.
5. Turn the locking ring clock-wise, securing the antenna to the ODU.

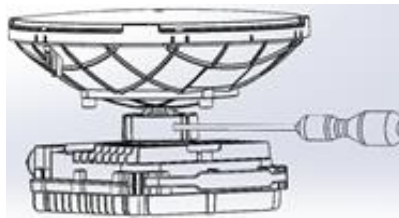


Figure 2-1 Attaching the ODU to the Antenna

6. Use medium-size screwdriver to tighten the locking ring is place.
7. Flip the ODU, placing it on the antenna plastic protecting cover.
8. Use 7mm Hex screwdriver to attach the quick release plate to the back of the ODU using 4x 7mm screws.
9. The arrow on the quick release plate should point to "V" on the back of the ODU, indicating vertical polarization. You may chose Horizontal polarization if required.

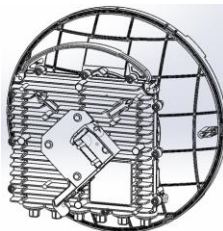
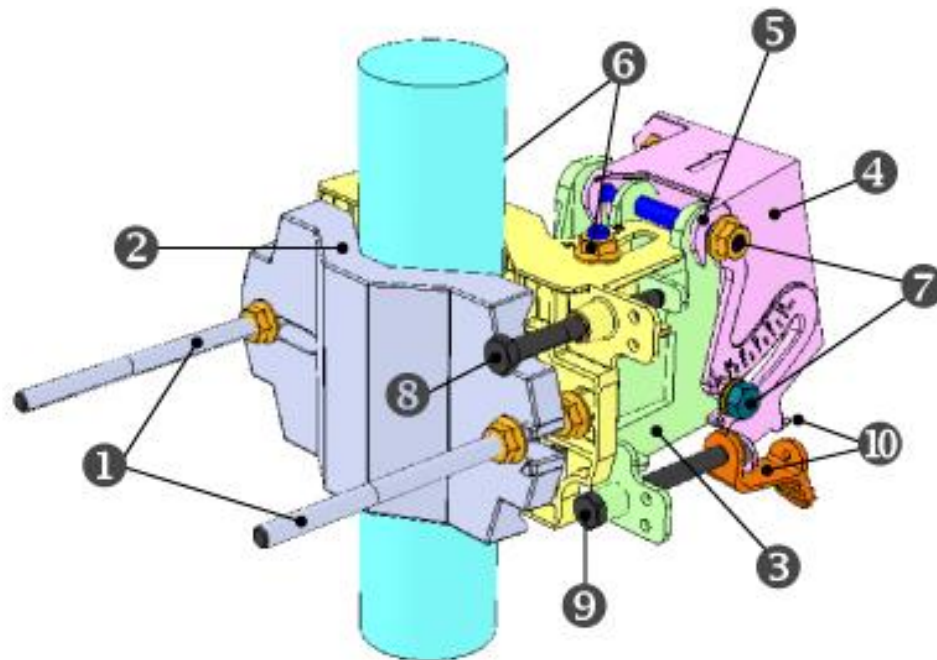


Figure 2-2 Setting ODU Polarization

2.6.2 Mounting the ODU using the 1ft Mounting Bracket



- | | |
|--|---|
| 1. Unit mounting screws and bolts | 6. Azimuth adjustment lock bolts |
| 2. Back mounting bracket | 7. Elevation adjustment lock bolts |
| 3. Front mounting bracket | 8. Azimuth fine adjustment screw ($\pm 8^\circ$) |
| 4. Quick release plate (attached to ODU) | 9. Elevation fine adjustment screw ($\pm 16^\circ$) |
| 5. Quick release hooks | 10. Elevation screw tension band and pin |

Figure 2-3 EtherHaul Mounting Assembly Components

Note:



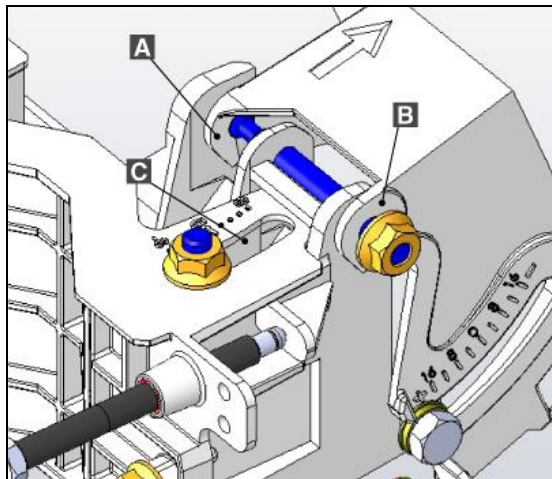
- Torque level for tightening the nuts and bolts is 8nm.

1. Prior to mounting, unpack the mounting kit package and attach the two unit mounting screws (❶) to the front mounting bracket (❸), securing them with mounting bolts.
2. Assemble the back (❷) mounting bracket to the front (❸) mounting bracket using one bolt and separate them by about 120 degrees so that the assembly can be attached to the mounting pole.

3. Place the assembly on the mounting pole and rotate the front and back mounting brackets to close the assembly on the pole. Replace the unit mounting bolt that was removed.
4. Ensure that both front and back mounting brackets are attached evenly to the pole, and are completely level.
5. Use the 13mm open wrench to tighten the nuts on both unit mounting bolts. Temporarily tighten the unit mounting bolts at this stage to keep the unit from moving freely.
6. By default, the ODU is delivered with the quick release plate (4) securely attached in a vertical polarization. If necessary, change the ODU polarization to match the orientation of the remote ODU by removing the quick release plate, changing its orientation, and reattaching. For ease of reference, the markings V (vertical) and H (horizontal) are engraved on the back side of the ODU.
7. Examine the position scales of both the Azimuth adjustment lock bolts (6) and the elevation adjustment lock bolts (7), found on the front mounting bracket, and ensure that they are positioned at 0 degrees (in the middle of the scale).
8. Position the quick release hooks (5) onto the top elevation adjustment lock bolt (7) and carefully set the ODU in place on the front mounting bracket and slide it firmly inwards.

Mount the ODU by attaching the interior quick release hook (A) in place **before** attaching the exterior hook (B). The interior hook is the one located farthest from the tightening nut, as shown below.

Hint:



A. Interior Quick Release Hook B. Exterior Quick Release Hook C. Elevation Position Slot

Figure 2-4 Quick Release Hooks

9. **Unlock** the Azimuth adjustment lock bolts (6) and the elevation adjustment lock bolts (7).
10. Stretch the elevation screw tension band (10) slightly and connect it to its mating tension pin, located on the quick release plate.

2.7 Installing the ODU with a 2ft (65cm) Antenna

2.7.1 Attaching the 2ft Adapter to the ODU

1. Unpack the ODU, place it on a clean unobstructed work surface area, and remove the plastic cap protecting the waveguide interface.
2. Unpack the cross-shaped metal adapter plate and attach it to the ODU using the supplied Phillips-head screws.
3. Note that the 3 longer screws go on the outer perimeter while the 3 shorter ones go next to the feeder.

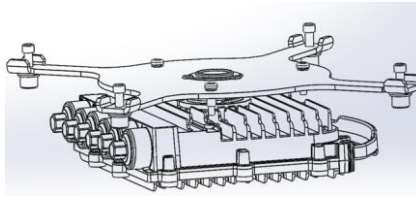


Figure 2-5 2ft Adapter

2.7.2 Mounting the ODU to a 2ft Antenna

1. Unpack the antenna and place it on a clean unobstructed work surface area with its protective housing.
2. Use care to avoid damaging or scratching the antenna radome.
3. Remove the protective tape on the antenna feed.
4. Unpack the antenna mounting kit and assemble it according to the antenna mounting kit installation instructions that can be found on the mounting kit package.
5. Position the Azimuth and Elevation Adjustment Lock Bolts at 0 degrees (in the middle of the scale) and unlock them to allow free movement during alignment.
6. Mount the antenna on a fixed reinforced steel mounting pole with 2-4.5 inches diameter.
7. Install the 2ft antenna according to the antenna installation instructions that can be found on the mounting kit package.
8. Attach the ODU to the antenna and tight the 4 locking bolts using 8mm Allen key.
9. Make sure you install the ODU with the required polarization (note the polarization arrow on the back of the ODU).

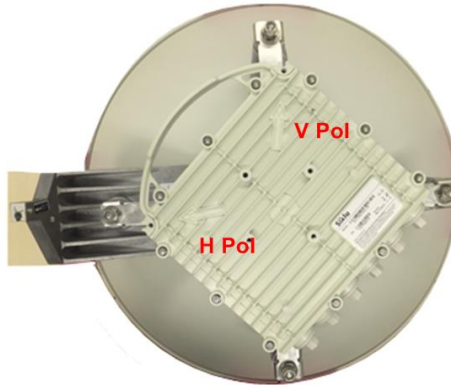


Figure 2-6 EtherHaul ODU installed on 2ft Antenna

10. Pluck the plastic plug at the very bottom of the antenna (drain hole).

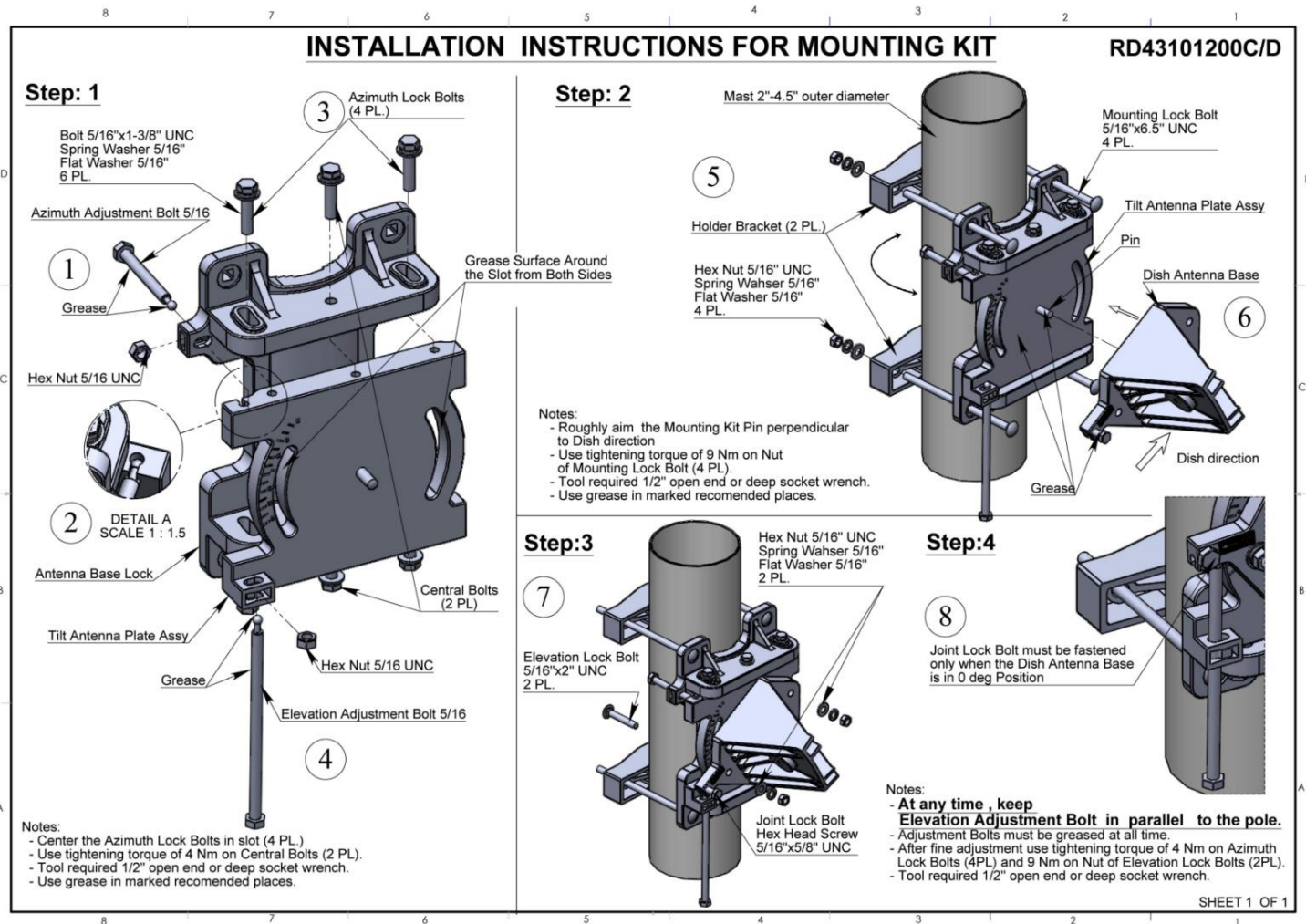


Figure 2-7 Antenna Option #1: Mounting Instructions for 2ft Antenna (EH-ANT-2ft)

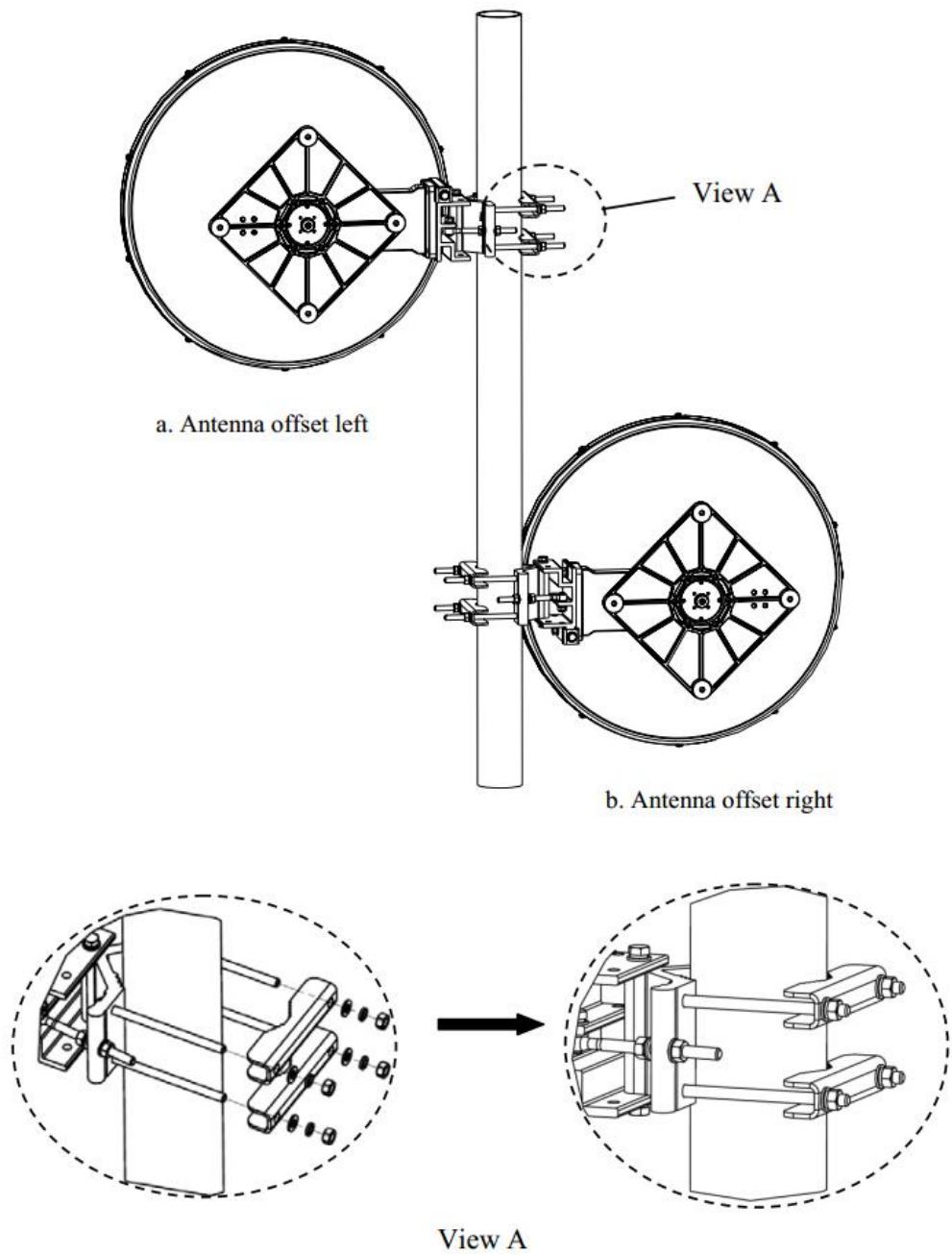
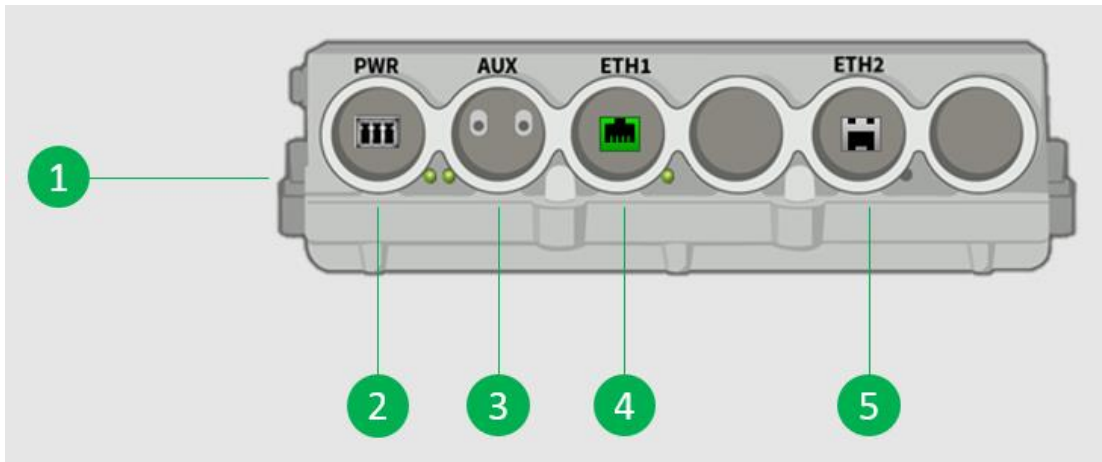


Figure 2-8 Antenna Option #2: Mounting Instructions for 2ft Antenna (EH-ANT-2ft-A)

2.8 Connecting the Cables

The following Figure shows the ODU interfaces. There are two interfaces available:

- Eth1 – Electrical 100/1000 RJ45 for PoE In and out of band management
- Eth2 – SFP+ slot for 10G



- | | |
|--|------------------------------------|
| 1. Electrical Ground (GND) | 4. Ethernet port #1 RJ45 (PoE In) |
| 2. DC In | 5. Ethernet port #2 10G Fiber/SFP+ |
| 3. DVM Probe Interface (AUX), Reset Button | |

Figure 2-9 EtherHaul Connection Panel Details

2.8.1 DC Power Supply Notes

The DC power input range of the ODU is 36 - 57 VDC.

- The DC supply should be limited to two ampere to avoid surges and possible damage to the ODU. For that, use limited power supply or circuit breaker (fast-blow fuse). The circuit-breaker is the disconnecting device, and should be readily accessible.
- When connecting the ODU to a MAINS DC distribution system, use a two ampere circuit breaker to enable the central DC system to isolate the ODU in an emergency case.
- Use one poly circuit breaker and should connect it on the live voltage: (+) or (-). The other poly should be grounded.
- Connect the circuit breaker to the (+) or (-) live voltage.
- The DC input is floating, so either (+) or (-) can be connected to the GND on the power supply side. For the sake of consistency with other systems, Siklu recommends that you connect the (+) to the GND.

Use a two-wire cable (14-18 AWG) to connect the power supply to the ODU. On the ODU DC terminal, connect only the (+) and (-) wires. Do not connect to the ODU's GND input.

Caution:



This system may have more than one power supply cable. To reduce the risk of electrical shock, a trained service technician may need to disconnect all power supply cables before servicing the system.

2.8.2 Grounding the EtherHaul

1. Connect one end of the grounding cable to the ground outlet on the left side of the ODU using the grounding cable lug.
2. Tighten the lug securely in place.
3. Connect the opposite end of the grounding cable to the earth connection, typically located on the mounting pole. If the earth connection is out of reach of the grounding cable, install an alternative cable.

To make a protective earth connection, use the grounding point located on the System ODU using a minimum amount of 16AWG grounding cable or according to local electrical code.

It is recommended to use Lightning Surge Protector on every Ethernet cable to protect the indoor networking equipment. The Lightning Surge Arrestor should be installed indoor next to the cable's point-of-entry and should be properly grounded.

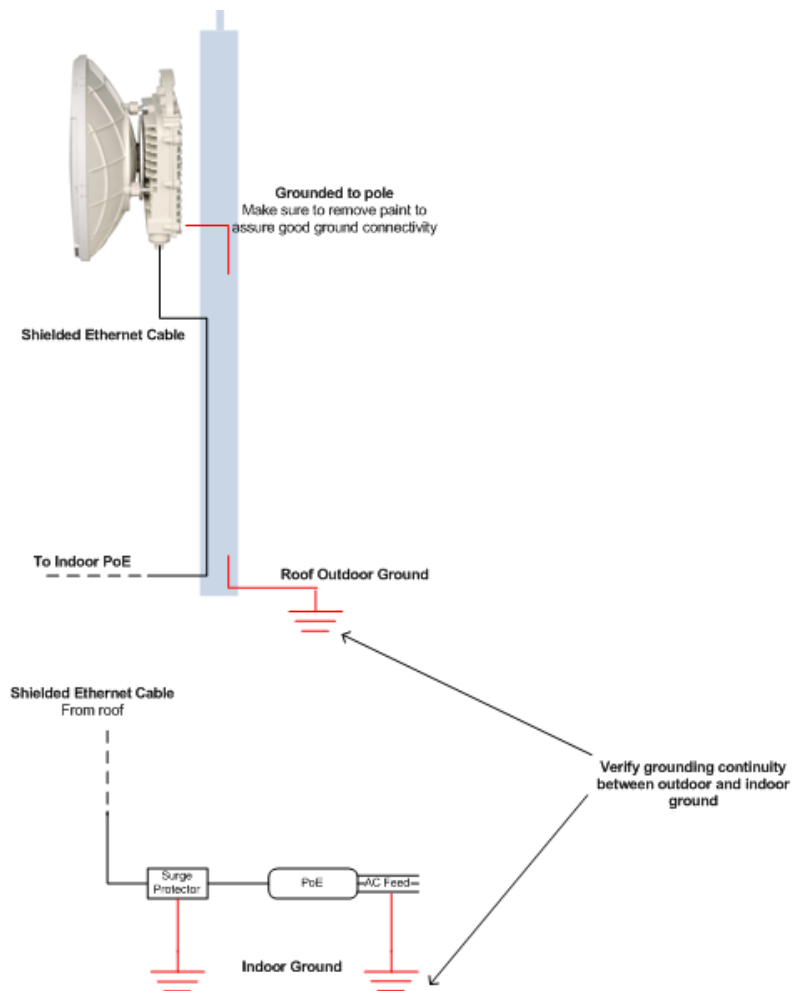


Figure 2-10 Grounding Scheme

2.8.3 Preparing the Cables

Before inserting a cable connector into the ODU, you must first enclose the cable connector in a protective All-Weather shell. Three sets of All-Weather shells are provided with the ODU for the ODU interfaces.

The provided protective All-Weather Shells fit cables from 3.5mm to 9.0mm diameter.

1. Thread the cable and tight the shell to the ODU firmly by hand (do not use tools).
2. Insert the rubber gasket snugly and tight the connector lock
3. When removing the All-Weather Shell, unlock the gland first before removing the shell.



Figure 2-11 All-Weather Connecting Cable Shell Assembly

2.8.4 Powering up the ODU

1. Connect power cable (DC or PoE)
2. Insert the power connector into the port. The PWR LED color indicator turns red for one second, then blinks green indicating that the ODU is powered on.
3. Wait for the EtherHaul ODU to boot up (about two minutes). When the ODU is fully rebooted, the PWR LED color indicator turns green (during power-up the PWR LED blinks green) and the RF LED color indicator turns off, indicating that the link is down.

2.9 System LEDs

LED	Color	Description
PWR (Power)	Green – Power OK	Blink Green – Device boot (~90 sec)
	Red – Power Failure	
	Off – ODU off	
RF	Green – Link Up	
	Orange – Alignment Mode	
	Off – Link Down	
ETH1-2:	Green – Link (Carrier 1000/10G	Blink Green – 1G activity (Eth1 only)
	Orange – Link (Carrier) 10/100	Blink Orange – 10/100 activity (Eth1 only)
	Off – No Link (Carrier)	

2.10 Aligning the Antenna

The ODU antenna must be aligned on both local and remote ODUs. You must first perform coarse alignment on each ODU, followed by fine alignment. Accurate alignment of the ODU is critical for achieving the strongest possible receive signal.

To perform antenna alignment, the ODU must be in Alignment mode.

The ODU has three modes of operation:

- **Alignment** – Carrier Wave transmission. Used for antenna alignment.
- **Adaptive** – Operational mode used with adaptive bandwidth, code, and modulation.
- **Static** – Operational mode used with a fixed modulation profile.

ODUs are shipped from the factory in Adaptive mode.

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- **Alignment** – Carrier Wave transmission. Used for antenna alignment.
- **Adaptive** – Operational mode used with adaptive bandwidth, code, and modulation.
- **Static** – Operational mode used with a fixed modulation profile.

ODUs are shipped from the factory in Adaptive mode.

2.10.1 Setting the ODU to Alignment Mode

Switch the EtherHaul ODUs to Alignment mode by inserting the DVM probes into the AUX Interface sockets. The RF LED color indicator turns orange, indicating the ODU is in Alignment mode.

The ODU remains in Alignment mode even if the DVM probes are ejected, until the ODU is rebooted.

2.10.2 Performing the Alignment

Note:



These instructions are for aligning a one-foot antenna. For instructions on aligning a two-foot antenna, refer to the relevant section

To perform an alignment

1. Verify that the ODU is in Alignment Mode.

Coarse Alignment (Azimuth Only)

2. Loosen the unit mounting bolts (❶) slightly to allow the ODU some freedom of movement.
3. Perform a coarse ODU alignment using a line-of-sight visual check with the remote EtherHaul ODU. Lock the unit mounting bolts (❶) using the 13mm open wrench.
4. Repeat steps 1 to 3 above on the remote ODU.

Fine Alignment

Note:



When aligning an antenna, the antenna in the remote node must remain completely stationary. Perform Fine alignment first on the local antenna, and only afterwards on the remote antenna.

The optimum alignment may require several adjustment iterations between the local and remote antennas.

5. Connect the DVM to the ODU by inserting both red and black probes into their appropriate positions in the AUX port.

Throughout the alignment procedure, you must compare the actual receive signal strength indication (RSSI) to the expected RSSI that was calculated during network link budget preparation (refer to *Preparing for Installation* on page 16).

Read the receive level (RSSI) using the DVM. The voltage reading will be between 0 to 1V, indicating the RSSI in dBms. For example, a DVM reading of 0.45V is equivalent to -45 dBm.

6. Align the fine Azimuth axis. Use the hexagonal wrench to adjust the Azimuth fine adjustment screw (❸). Be sure to sweep the complete range of the Azimuth in order to determine the maximum received signal strength position.

When the optimum axis is achieved, tighten both Azimuth adjustment lock bolts (❹).

7. Align the fine elevation axis. Use the hexagonal wrench to adjust the elevation fine adjustment screw (❺). Be sure to sweep the complete range of the elevation in order to determine the maximum received signal strength position.

When the optimum axis is achieved, tighten both elevation adjustment lock bolts (❻).

8. Perform steps 6 and 7 for the remote ODU.
9. Repeat steps 6 and 7 for the local ODU.
10. Use the DVM to verify maximum received signal strength on both local and remote ODUs. For best performance, measured RSSI should be within ± 4 dB of the calculated value.
11. Once the optimum position has been achieved for the ODU pair, tighten the Azimuth adjustment lock bolts (Ⓔ) on one ODU (torque of 8 nM), being very careful not to move the ODU while tightening.
12. Tightening the Azimuth adjustment lock bolts will tilt the ODU, so realign the elevation again for optimum position.
13. Once the optimum position has been achieved for the ODU pair, tighten the elevation adjustment lock bolts (Ⓕ) on the ODU (torque of 8 nM), being very careful not to move the ODU when tightening.
14. Repeat steps 11 through 13 for the second ODU.
15. Use the DVM to verify that the received signal strength has not changed on either the local or the remote ODU after final tightening of the brackets.

Antenna alignment is now complete.

2.11 Link Up Verification

1. Disconnect the DVM probes.
2. Reboot both ODUs by shortly pressing the ODU Reset Button or alternatively disconnect/reconnect the power.
3. This action will return the ODU to Adaptive Mode (ODU's default operational mode). Following this action, and after the ODU has finished rebooting, the RF LED color indicator on both ODUs will turn Green, indicating that the radio link is up.

The EtherHaul link can now pass traffic between ETH2 10 SFP+ ports and over the radio link.

Use the Web-based management or Command Line Interface for radio link configuration and monitoring. Note that only Out of Band

3 Performing Basic Setup Using the Web-Based Management

This chapter describes how to perform basic setup using the web-based management.

The scope of this installation manual is basic setup and monitoring of the radio link.

- For full configuration and maintenance procedures, refer to the “EtherHaul Operation, Administration and Maintenance Manual”.
- The “EtherHaul Operation, Administration and Maintenance Manual” also details the configuration, monitoring and maintenance procedures using the Command Line Interface.

This chapter includes the following topics:

- Connecting to the ODU using the Web-Based Management
- Main Page
- General Configuration Commands
- Quick Configuration Wizard
- Radio Page
- Default Bridge Configuration
- Applying and Saving Configuration Changes

3.1 Connecting to the ODU Using the Web-Based Management

1. Launch an Internet Browser and enter **https://** followed by the ODU's IP address.
The ODU's default IP address is **192.168.0.1**.

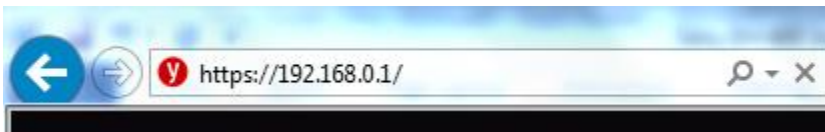


Figure 3-1 Launching the Web-Based Management

2. When prompted, enter the username and password. Default: **admin** and **admin**.



Figure 3-2 Entering Username and Password

3. Once loaded, the Web-Based Management Main page is displayed.

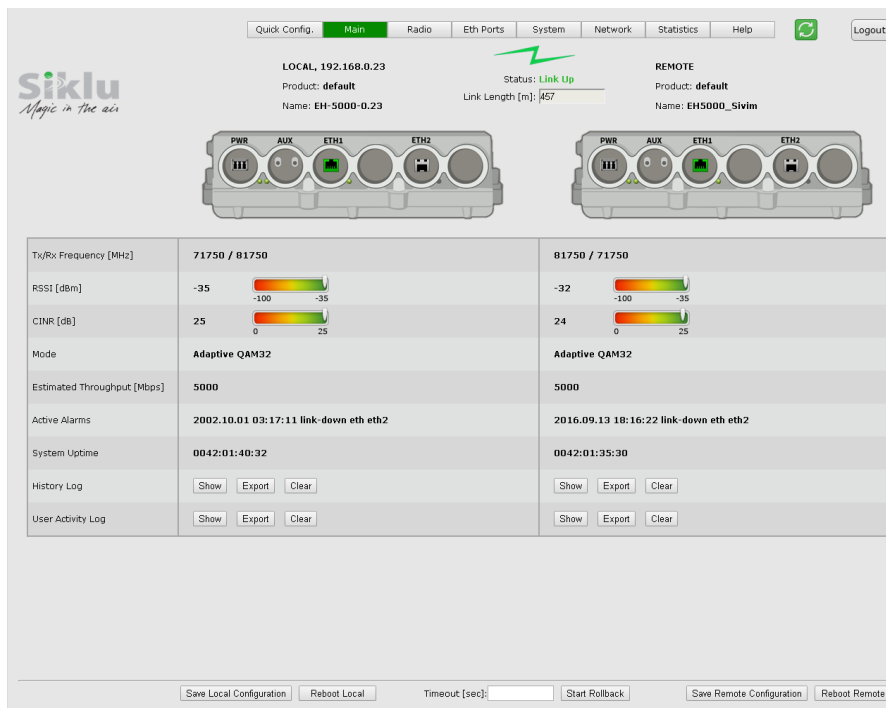


Figure 3-3 Web-Based Management Main Page

3.2 Main Page

The Web-Based Management provides link view, presenting both local and remote configuration and monitoring.

Although the local and remote systems IP address is identical (default IP address 192.168.0.1), the remote will be available as well as the EtherHaul uses dedicated communication channel for local-remote communication that is not IP-based.

It is recommended, however, to assign dedicated IP address for local and remote systems.

Note:



Depending on your station's screen size and resolution, you may need to scroll the screen vertically or horizontally in order to view all options for local + remote.

Alternatively, you may change the change the Internet's Browser display distance (Zoom out, using Ctrl+Minus).

The Web-Based Management Main page is a read-only page and displays the following information:

- Link Status – Link up or down (with visual indication)
- Link Length [m] – link calculated distance between the local and remote systems (air distance) based on propagation time.
- Tx/Rx frequency [MHz]
- RSSI [dBm] – Receiver Signal Strength Indicator. Current receive level.
- CINR [dB] – Carrier to Interference + Noise ratio. Indicates the current radio link's signal quality. In normal conditions, $CINR \geq 23$ indicates a good signal quality.
- Mode – Current operational mode of the link:
 - Alignment – Carrier Wave transmission. Used for antenna alignment. No data over the radio link.
 - Static – Fixed modulation profile. If you select Static, you must select from a list of pre-configured modulation profiles in the Modulation field.
 - Adaptive – Adaptive Bandwidth, Code, and Modulation. The system will work on the highest modulation profile based on the CINR values of the both sides and will present the current modulation profile.
- Estimated Throughput [Mbps] – based on the current modulation profile.
 - For FDD systems – value is Full Duplex.

Note:



Actual Layer 1 throughput depends on product's specs. Refer to the EtherHaul Release Notes for exact specifications.

- Current Alarms – list of currently active alarms and date&time raised.
- History Log – System alarms and events history log.
- User Activity Log – All configuration changes are logged, including user and date&time (presented in the form of CLI commands).

Note:



To view logs, pop-ups must be enabled and allowed on your Internet Browser.

3.3 General Configuration Commands

3.3.1 Apply

Any configuration change is executed upon clicking **Apply**.

The Local-Remote concept of the Web-Based Management allows configuring both local and remote systems of the link.

The **Apply** button is available at the bottom of each configuration page (one button for both local and remote systems).

When clicking **Apply**, the configuration changes will be sent to remote system first and then to the local system. If multiple parameters changed on the page before clicking **Apply**, all parameters are sent in bulk to the system and then executed locally in order to avoid losing management connection.

3.3.2 Save Configuration

Any configuration change applied should be saved using the **Save Configuration** button.

The system has two configuration banks:

1. Running Configuration – the currently active configuration. Every time **Apply** is clicked, the Running Configuration is updated.
2. Startup Configuration – the configuration the system will come up with after the next reboot. This configuration may be different than the currently active configuration (Running Configuration).

In order to save the applied configuration changes, click **Save Configuration** so changes will be saved to the startup configuration. If changes are not saved to the startup configuration, they will be lost the next time the system reboots.

Save Configuration buttons are available for local and remote systems.

3.3.3 Rollback

A safety measure that allows recovering from system configuration changes that caused loss of communication.

When Rollback is used, a timer runs (and restarts) whenever a management (or CLI) command is entered. In the event that no command is entered within the timeout period, the system automatically reboots and comes up with the saved startup configuration.

A Rollback timeout is especially recommended when configuring remote elements that are being managed over the link.

Rollback is activated for both local and remote systems.

3.3.4 Reboot

Separate buttons for local and remote reboot. The system will reboot and come up after initialization (~120 seconds).

Note that any unsaved changes will be lost.

3.3.5 Copy To Remote

You can find the **Copy To Remote** button next to some configuration parameters or sections. This function copies configuration to remote system based on the changes on the local system.

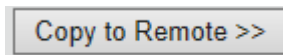


Figure 3-4 Copy To-Remote icon

Matching configuration may be of two types:

- Identical configuration – exactly same configuration will be copied from the local to remote system. It can be found for parameters that normally requires identical configuration for both local and remote units.
For example, Encryption configuration.
- Matching configuration – for parameters that require matching but opposite configuration.

3.4 Quick Configuration Wizard

Use the Quick Configuration wizard to configure the basic system parameters. It holds the basic minimal configuration required to start using the link.

The Quick Configuration wizard should be used for the initial system setup after installation. For monitoring and advanced configuration, please refer to the dedicated configuration pages of the Web-Based Management.

To access the Quick Configuration wizard, go to the **Quick Config** page.

3.4.1 Quick Configuration: Step 1 – System

The image shows a web-based configuration wizard interface. On the left, there is a vertical sidebar with four steps: 'step 1 System' (highlighted with a green circle), 'step 2 Radio', 'step 3 Eth Ports', and 'step 4 Network'. The main area is divided into two columns for 'EH-5000-Local' and 'EH-5000-Remote'. Each column has fields for 'Date' (set to 2016.10.01) and 'Time' (set to 14:57:28). A 'Copy to Remote >>' button is located between the two columns. At the bottom right of the main area, there is a green 'Next' button.

Figure 3-5 Quick Config Page: Step 1 - System

The first section allows configuring the following parameters:

- Name – you can give a name for each system
- Date – [YYYY.MM.DD]
- Time – [HH:MM:SS]

Click **Next** to continue.

3.4.2 Quick Configuration: Step 2 – Radio

Channel Bandwidth [MHz]	1250	1250
Tx Frequency [MHz]	71750	81750
Rx Frequency [MHz]	81750	71750
Tx Power [dBm]	16	16
Alignment Status	Inactive	Inactive
Mode	QAM32	QAM32

☒ Adaptive
 ☐ Alignment
 ☐ Static
 Copy to Remote >>

Back Next

Figure 3-6 Quick Config Page: Step 2 - Radio

This section allows configuring the following parameters:

- Channel Bandwidth [MHz] – 1250 MHz.
- Tx Frequency [MHz] – transmit frequency.
- Rx Frequency [MHz] – R/O field, updated based on Tx frequency.
- Tx Power [dBm] – ODU's transmit power. Default is the max power, based on product's specs. Minimum configurable Tx power is -35dBm (note that actual minimum Tx power is based on product's specs).

Note:



Adjust Tx Power so the RSSI at the remote end will not exceed -35dBm (overload threshold).

The Tx power value sets the transmit power for the highest modulation profile. In case lower modulation profile(s) has higher max Tx power (based on product's specs), the Tx power will be increased automatically without indication in RF configuration menu.

- Mode – operational mode of the link:
 - Alignment – Carrier Wave transmission. Used for antenna alignment. No data over the radio link.

Note:



When exiting Alignment mode, perform system reboot to allow proper operation of the radio link.

- Static – Fixed modulation profile. If you select Static, you must select from a list of pre-configured modulation profiles in the Modulation field.
- Adaptive – Adaptive Bandwidth, Code, and Modulation.

The ODU will work on the highest modulation profile based on the CINR values of the both sides and will present the current modulation profile.

Adaptive mode is the normal and recommended mode of the radio link.

- Alignment Status – R/O field, indicating that the ODU is currently in Alignment mode (by configuration or by inserting DVM probes).

Click **Next** to continue or **Back** to return to previous section.

3.4.3 Quick Configuration: Step 3 – Eth Ports

	Eth1	Eth2	Eth1	Eth2
Port Type	<input type="radio"/> RJ45 <input type="radio"/> SFP	<input type="radio"/> RJ45 <input type="radio"/> SFP	<input type="radio"/> RJ45 <input type="radio"/> SFP	<input type="radio"/> RJ45 <input type="radio"/> SFP
Port Enable	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Auto-Negotiation	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Speed/Duplex	1000FD		1000FD	

Back Next

Figure 3-7 Quick Config Page: Step 3 – Eth Ports

This section allows configuring the following parameters:

- Port status visual display (Green – port is up).
- Port Type – RJ45 or SFP
- Port Enable – checkbox to enable the port.
- Auto Negotiation – checkbox to enable auto-neg.
- Speed/Duplex – speed (10/100 or 1000) and duplex (half/full) setting:
 - When Auto Negotiation Enabled – R/O field indicating the current speed/duplex
 - When Auto Negotiation Disabled – allows configuring the speed/duplex.

- R/O field indicating the current speed/duplex (note that for SFP+ port, only 10G speed is available).

Click **Next** to continue or **Back** to return to previous section.

3.4.4 Quick Configuration: Step 4 – Network

The screenshot displays the 'Quick Config' page for Step 4 – Network. The interface includes a top navigation bar with tabs: Quick Config, Main, Radio, Eth Ports, System, Network, Services, Advanced Config, Statistics, and Help. The main content area is divided into sections for LOCAL and REMOTE configurations. The LOCAL section shows 'LOCAL, 192.168.0.1' and 'Name: EH-1200F'. The REMOTE section shows 'REMOTE' and 'Name: EH-1200F'. The 'IP Address' section contains two tables, one for LOCAL and one for REMOTE. Each table has columns for #, Type, IP Address, Prefix-length, and VLAN. The LOCAL table has two rows: Row 1 with Type 'Static', IP Address '192.168.0.1', Prefix-length '24', and VLAN '0'; Row 2 with Type 'Static', IP Address '10.10.10.1', Prefix-length '24', and VLAN '0'. The REMOTE table has two rows: Row 1 with Type 'Static', IP Address '192.168.0.1', Prefix-length '24', and VLAN '0'; Row 2 with Type 'Static', IP Address '10.10.10.2', Prefix-length '24', and VLAN '0'. Below the IP Address section is the 'Default Gateway' section, which has fields for IP Address (10.10.10.250) and IPv6 Address. At the bottom is the 'SNMP Managers' section, which has a table with columns: #, IP Address, UDP-Port, Security Name, SNMP Ver, and Engin ID. The page also includes a sidebar with navigation icons for System, Radio, Eth Ports, and Network (Step 4). At the bottom right, there are 'Back' and 'Apply' buttons.

Figure 3-8 Quick Config Page: Step 4 – Network

This section allows configuring the following parameters:

- IP Address

The EtherHaul supports up to four IP addresses that can be associated with different VLANs. IPv4 or IPv6 can be configured. IP addresses may also be acquired by DHCP.

- # - Index (1-4)
- Type – Static or DHCP
- IP Address – Default is 192.168.0.1
- IP Prefix Length – Default is 24 (equivalent to Mask of 255.255.255.0)
- VLAN – 0 (not defined, meaning the IP is not associated with specific VLAN)

Click the Trash icon to clear an IP. Note you cannot clear the IP address you used to log in to the system.

- Default Gateway
- SNMP Managers

Up to five managers that will receive SNMP traps can be configured (SNMPv2c or SNMPv3).

- # - Index (1-5)
- IP Address – Destination IP Address
- UDP Port – port number for sending traps
- Security Name (community)
- SNMP Ver – SNMP version (SNMPv2c or SNMPv3)
- Engine ID – Used for SNMPv3

Click **Apply** to execute the configuration changes or **Back** to return to previous section.

3.5 Radio Page

The radio link parameters and radio link monitoring are managed in the **Radio** page.

This chapter includes the following topics:

- Settings
- Advanced Settings
- Maintenance
- Modulation Table
- Statistics

3.5.1 Settings

Settings	Channel Bandwidth [MHz]	1250	1250
Advanced Settings	Tx Frequency [MHz]	71750	81750
Maintenance	Rx Frequency [MHz]	81750	71750
Modulation Table	Tx Power [dBm]	16	16
Statistics	RSSI [dBm]	-35	-32
	CINR [dB]	25	24
	Alignment Status	Inactive	Inactive
	Mode	QAM32	QAM32
		<input checked="" type="radio"/> Adaptive <input type="radio"/> Alignment <input type="radio"/> Static	<input checked="" type="radio"/> Adaptive <input type="radio"/> Alignment <input type="radio"/> Static

Figure 3-9 Radio Page: Settings

This section allows configuring the following parameters:

- Channel Bandwidth [MHz] –1250MHz.
- Tx Frequency [MHz] – transmit frequency.
- Rx Frequency [MHz] – R/O field, updated based on Tx frequency.

- Tx Power [dBm] – ODU's transmit power. Default is the max power, based on product's specs. Minimum configurable Tx power is -35dBm (note that actual minimum Tx power is based on product's specs).

Note:



Adjust Tx Power so the RSSI at the remote end will not exceed -35dBm (overload threshold).

The Tx power value sets the transmit power for the highest modulation profile. In case lower modulation profile(s) has higher max Tx power (based on product's specs), the Tx power will be increased automatically without indication in RF configuration menu.

- Mode – operational mode of the link:
 - Alignment – Carrier Wave transmission. Used for antenna alignment. No data over the radio link.

Note:



When exiting Alignment mode, perform system reboot to allow proper operation of the radio link.

- Static – Fixed modulation profile. If you select Static, you must select from a list of pre-configured modulation profiles in the Modulation field.
- Adaptive – Adaptive Bandwidth, Code, and Modulation.

The ODU will work on the highest modulation profile based on the CINR values of the both sides and will present the current modulation profile.

Adaptive mode is the normal and recommended mode of the radio link.

- Alignment Status – R/O field, indicating that the ODU is currently in Alignment mode (by configuration or by inserting DVM probes).

3.5.2 Advanced Settings

Settings	Lowest Modulation	BPSK1	BPSK1
Advanced Settings			
Maintenance			
Modulation Table			
Statistics			

Figure 3-10 Radio Page: Advanced Settings

This section allows configuring the following parameters:

- **Lowest Modulation** – Lowest modulation profile. When modulation drops below this threshold, radio link will be down. It is used to limit the minimal modulation profile of the link. Default is QPSK 1 (lowest available).

3.5.3 Maintenance

Settings	RF Loopback	<input checked="" type="checkbox"/> Timeout [sec]: 60	Modulation: QAM32	<input type="checkbox"/> Timeout [sec]: 60	Modulation:
Advanced Settings	Mute	<input type="checkbox"/> Timeout [sec]: 60		<input type="checkbox"/> Timeout [sec]: 60	
Maintenance					
Modulation Table					
Statistics					

Figure 3-11 Radio Page: Maintenance

This section allows configuring the following parameters:

- **RF Loopback** – checkbox to enable the internal RF loopback, set the timeout for clearing the loopback in seconds and select the modulation the ODU will be tested at.

Note that it will take the ODU to stabilize after loopback up to 3 minutes so set the loopback timeout accordingly (recommended 600 seconds).

Mute remote transmitter first to avoid interference with the loopback operation.

Loopback is done with MAC addresses swap.

Refer to the *Diagnostics* chapter of the *EtherHaul Operation, Administration and Maintenance Manual* for detailed description of the system's loopbacks.

- **Mute** – checkbox to mute the transmitter with timeout in seconds. When muted, the ODU will not transmit.

3.5.4 Modulation Table

Settings	Modulation Table	Channel-width	Name	CINR Low	CINR High	Backoff	Capacity	Channel-width	Name	CINR Low	CINR High	Backoff	Capacity
Advanced Settings		1250Mhz	BPSK1	-128	13	7	200	1250Mhz	BPSK1	-128	13	7	200
Maintenance		1250Mhz	BPSK2	9	16	7	520	1250Mhz	BPSK2	9	16	7	520
Modulation Table		1250Mhz	QPSK1	12	21	7	2100	1250Mhz	QPSK1	12	21.5	7	2100
Statistics		1250Mhz	QAM16	18	22.5	9	4000	1250Mhz	QAM16	18.5	23	9	4000
		1250Mhz	QAM32	21.5	127	9	5000	1250Mhz	QAM32	22	127	9	5000

Figure 3-12 Radio Page: Modulation Table

The modulation table presents the available modulation profiles. The radio can be configured only to one of the profiles available in the table.

- CINR Low – Lower threshold for stepping down in modulation profile (Adaptive Mode).
- CINR High – Upper threshold for stepping up in modulation profile (Adaptive Mode).

Note that different modulation tables may apply according to product used, the frequency channel used and ARQ status.

The modulation profiles and thresholds are optimized and should not be modified (can be configured via CLI only after consulting Siklu support).

3.5.5 Statistics

Radio link's performance can be monitored using the advanced statistics counters.

Refer to the *Statistics* chapter of the *EtherHaul Operation, Administration and Maintenance Manual* for detailed description of the system's statistics.

3.6 Default Bridge Configuration

The radio will allow, out-of-the-box, over the air transparent connection to the user traffic over Eth2 (10G SFP+). This is a Layer 1 connection therefore carried transparently over the link.

4 Commissioning and Acceptance Procedure

This chapter presents the recommended commissioning and acceptance procedure to be performed following the installation of each EtherHaul radio link.

The commissioning and acceptance procedure verifies the correct installation and the proper, safe, and robust operation of the EtherHaul RF link.

This chapter includes the following topics:

Installation Verification and Testin

- Installation Verification and Testin
- EtherHaul Commissioning and Acceptance Form

4.1 Installation Verification and Testing

Inspect the following components and confirm their adherence to requirements that are detailed in the accompanying checklist.

4.1.1 Physical Installation Verification

This inspection verifies the physical installation of the ODU, in accordance with the EtherHaul's installation procedure and requirements.

1. Pole mount installation
2. ODU installation
3. Weatherproofing the cables
4. Cables installation
5. Grounding

4.1.2 RF Link Test

This inspection verifies the RF link status.

1. RF LED is green.
2. Management/CLI indication: "RF Operational – Up".
3. Receive Signal Strength Indication (RSSI) achieved in Alignment mode is within +/-4dB of the expected value.
4. Carrier to Interference + Noise Ratio (CINR) is 23 or higher.
5. Highest modulation achieved
6. Link configuration is in accordance with plan requirements.

4.1.3 Link Errors Test

This inspection verifies frame-loss-free operation of the radio link.

1. No ARQ losses on the RF Statistics counters.

4.1.4 Ethernet Services Test [Optional]

This inspection verifies correct Ethernet services flow and error-free operation.

1. Connect a packet analyzer to the GbE port and verify that no packets are lost.

4.1.5 Management Verification

This inspection verifies proper management of the link.

1. Verify correct management/CLI connection to both local and remote ODUs.
2. Verify management access from remote NMS stations.

4.1.6 Recording ODU Configuration

Perform the following steps after the EtherHaul ODU is commissioned and accepted:

1. Copy the Running Configuration (currently active) to Startup Configuration.
2. Save the configuration file for future records and backup.

4.2 EtherHaul Commissioning and Acceptance Form

EtherHaul™ Commissioning and Acceptance Form		
Customer Details		
Customer		
Project/link name		
Physical Installation Verification	<u>Local Site</u>	<u>Remote Site</u>
Site name & address		
Mount type	<input type="checkbox"/> Roof-top <input type="checkbox"/> Mast/Tower <input type="checkbox"/> Other _____	<input type="checkbox"/> Roof-top <input type="checkbox"/> Mast/Tower <input type="checkbox"/> Other _____
ODU mount above ground	Meters	meters
Clear line-of-sight	<input type="checkbox"/> Yes <input type="checkbox"/> No _____	

ODU safely mounted using Siklu's bracket correctly installed	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
Pole diameter according to mount specs	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
Bracket's mounting bolts securely tightened	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
ODU grounding	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
Cables/Fibers connections (mark all cables connected)	<input type="checkbox"/> Eth1 Cat5 <input type="checkbox"/> Eth1 Fiber <input type="checkbox"/> Eth2 Cat5 <input type="checkbox"/> Eth2 Fiber <input type="checkbox"/> Eth3 Cat5 <input type="checkbox"/> Eth3 Fiber <input type="checkbox"/> Eth4 Cat5 <input type="checkbox"/> Eth4 Fiber <input type="checkbox"/> DC	<input type="checkbox"/> Eth1 Cat5 <input type="checkbox"/> Eth1 Fiber <input type="checkbox"/> Eth2 Cat5 <input type="checkbox"/> Eth2 Fiber <input type="checkbox"/> Eth3 Cat5 <input type="checkbox"/> Eth3 Fiber <input type="checkbox"/> Eth4 Cat5 <input type="checkbox"/> Eth4 Fiber <input type="checkbox"/> DC
Overall cables/fibers length	meters	meters
Cables/Fibers securely routed and fixed properly using cable ties	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
Cables/Fibers are properly weatherproofed using the appropriate glands	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
ODU DC source	<input type="checkbox"/> PoE <input type="checkbox"/> External DC	<input type="checkbox"/> PoE <input type="checkbox"/> External DC
PoE model and manufacturer		
Measured DC power (management reading)	Volts DC	Volts DC
RF Link Parameters		
ODU Model		
ODU P/N		
ODU S/N		
ODU running SW version		
Tx/Rx frequency	MHz	MHz

Channel-width	<input type="checkbox"/> 250MHz <input type="checkbox"/> 500MHz	<input type="checkbox"/> 250MHz <input type="checkbox"/> 500MHz
Role	<input type="checkbox"/> Auto <input type="checkbox"/> Master <input type="checkbox"/> Slave	<input type="checkbox"/> Auto <input type="checkbox"/> Master <input type="checkbox"/> Slave
Tx/Rx Link ID	0 (not used)	0 (not used)
Modulation/Mode Mode: modulation/sub-channel/repetitions/FEC	<input type="checkbox"/> Adaptive _____ <input type="checkbox"/> Static _____	<input type="checkbox"/> Adaptive _____ <input type="checkbox"/> Static _____
UL/DL Configuration	<input type="checkbox"/> Symmetric <input type="checkbox"/> Asymmetric (ratio) _____ %	
ODU polarization	<input type="checkbox"/> V <input type="checkbox"/> H	<input type="checkbox"/> V <input type="checkbox"/> H
Link distance	_____ meters	
RF Link Tests		
Expected RSSI	_____ dBm	_____ dBm
Measured RSSI	_____ dBm	_____ dBm
Measured CINR	_____ dB	_____ dB
Green "RF" LED	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
RF operational status Up	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
RF Statistics error counters clear	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
Ethernet Services Tests		
Frame-Loss test <input type="checkbox"/> Packet Analyzer <input type="checkbox"/> SW-based <input type="checkbox"/> EtherHaul Statistics	<input type="checkbox"/> No Frame-Loss Test duration _____	<input type="checkbox"/> No Frame-Loss Test duration _____
Management		
IP address	IP _____ VLAN _____	IP _____ VLAN _____
Prefix-Length / IP Mask		

Default IP Gateway		
Management of local and remote	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
NMS used	<input type="checkbox"/> _____	<input type="checkbox"/> _____
NMS management access	<input type="checkbox"/> OK <input type="checkbox"/> NOK <input type="checkbox"/> N/A	<input type="checkbox"/> OK <input type="checkbox"/> NOK <input type="checkbox"/> N/A
Traps received in NMS	<input type="checkbox"/> OK <input type="checkbox"/> NOK <input type="checkbox"/> N/A	<input type="checkbox"/> OK <input type="checkbox"/> NOK <input type="checkbox"/> N/A
Final Configuration Verification		
Copy running config to startup	<input type="checkbox"/> Done	<input type="checkbox"/> Done
Clear all statistics and logs	<input type="checkbox"/> Done	<input type="checkbox"/> Done
Configuration file saved and stored	<input type="checkbox"/> Done	<input type="checkbox"/> Done
Additional Info / Remarks		
I&C Details		
I&C Date		
Installation Team		