Matrix® PS
Public Safety System

airHost PS | hdHost PS | hd33 PS | Matrix Console PS

INSTALLATION & COMMISSIONING GUIDE

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Document: DW-MAN-036
Rev 06
Software Version 2.3.0

REGULATORY COMPLIANCE

FCC

The following FCC compliance statement applies to the 150 MHz and 450 MHz frequency bands described in Appendix A.

This device complies with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. 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.

Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

Caution
Any changes or modifications not expressly approved by Dali Wireless, Inc. could void compliance with regulatory rules, and thereby your authority to operate this equipment.

Caution
Do not use this equipment with unauthorized antennas, cables, and/or coupling devices not conforming with ERP/EIRP and/or indoor-only restrictions.

WARNING. This is NOT a CONSUMER device. It is designed for installation by FCC LICENSEES and QUALIFIED INSTALLERS. You MUST have a FCC LICENSE or express consent of an FCC Licensee to operate this device. You MUST register Class B signal boosters (as defined in 47 CFR 90.219) online at www.fcc.gov/signal-boosters/registration. Unauthorized use may result in significant forfeiture penalties, including penalties in excess of $100,000 for each continuing violation.

FCC licensee is required to register the installed Class B devices at https://signalboosters.fcc.gov/signal-boosters/

This device complies with FCC Part 90.219 as a Class B Signal Booster. The selection and installation of an antenna must comply with the FCC RF exposure requirements. The FCC regulation mandates that the ERP of type B signal boosters should not exceed 5 Watt. In addition there are limitations on radiated intermodulation products and re-radiated noise.

The Class B device described in this Installation and Commissioning Guide only has a composite output power of 33 dBm. With a typical antenna gain of 5 dB and distribution loss of cable and passive components, it will not exceed the 5 Watt ERP limit. See Signal Booster Installation Guidelines shown below.

Signal Booster Installation Guidelines

In general, the ERP of the output noise within the pass band should not exceed the level of -43 dBm in 10 kHz measurement bandwidth. The ERP of the output noise outside of the passband by more than 1 MHz should not exceed the level of -70 dBm in 10 kHz measurement bandwidth. The ERP of intermodulation products should not exceed -30 dBm in 10 kHz measurement bandwidth.

The device shall NOT exceed the 5 Watt (37dBm) ERP limit. In order to achieve this 37dBm ERP limit, the “Maximum Power Output” of the device minus the “Distribution Loss” plus the “Antenna Gain” MUST be smaller than 37dBm. In other words, once an antenna is selected with certain gain, installer must calculate the minimum Distribution Loss required not to exceed the 37dBm limit. Distribution Loss is defined as the loss in cables and splitters combiners. The sections below provides examples on how the minimum “Distribution Loss” is calculated for different Power Output and Antenna Gain.

Calibration Modes

Units are calibrated for 2 W or 5 W depending on the output power required:

- Mode A: 2 W
- Mode B: 5 W

TYPE 1 CHASSIS

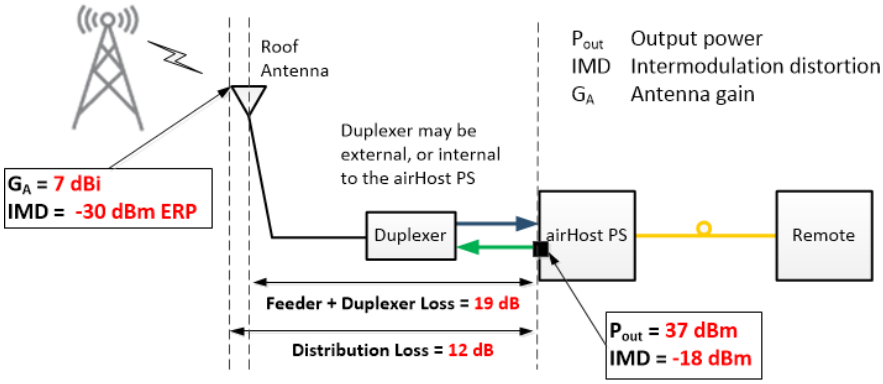
Intermodulation

airHost33 PS Dual Band Uplink

150 MHz Band, Mode B (5 W)

Example

- 12 dB of minimum distribution loss when 1-Carrier composite power is 37 dBm



Distribution Loss = Feeder + Duplexer Loss – G_A

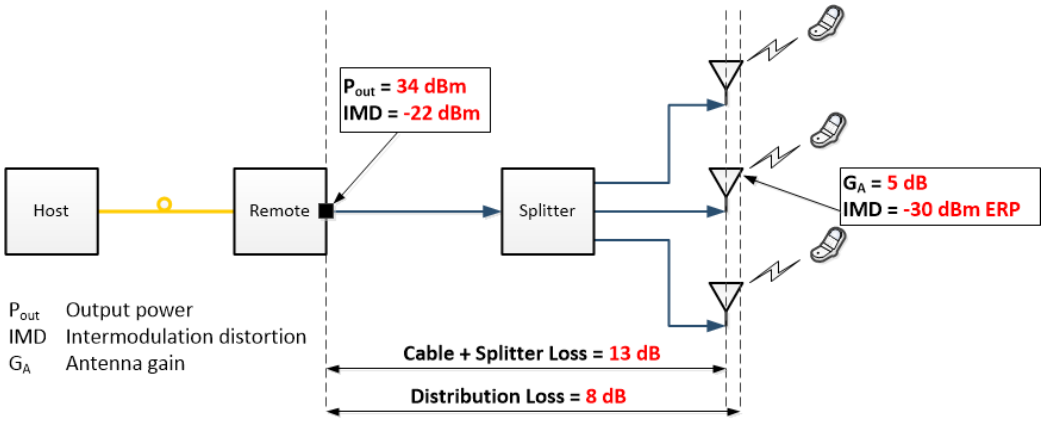
12 dB = 19 dB – 7 dB

hd33 PS Dual Band Downlink

150 MHz Band, Mode A (2 W)

Examples

- 8 dB of minimum distribution loss when 2-Carrier composite power is 34 dBm



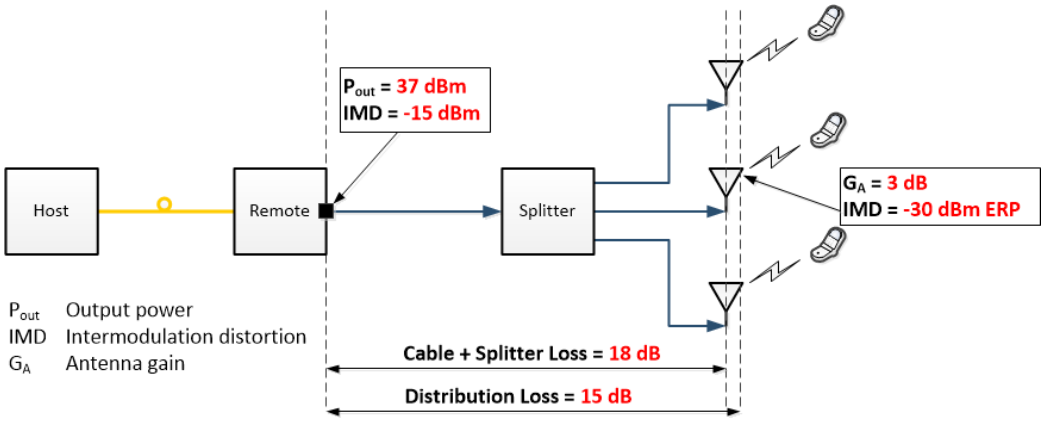
Distribution Loss = Cable + Splitter Loss – G_A

8 dB = 13 dB – 5 dB

150 MHz Band, Mode B (5 W)

Examples

- 15 dB of minimum distribution loss when 1-Carrier composite power is 37 dBm



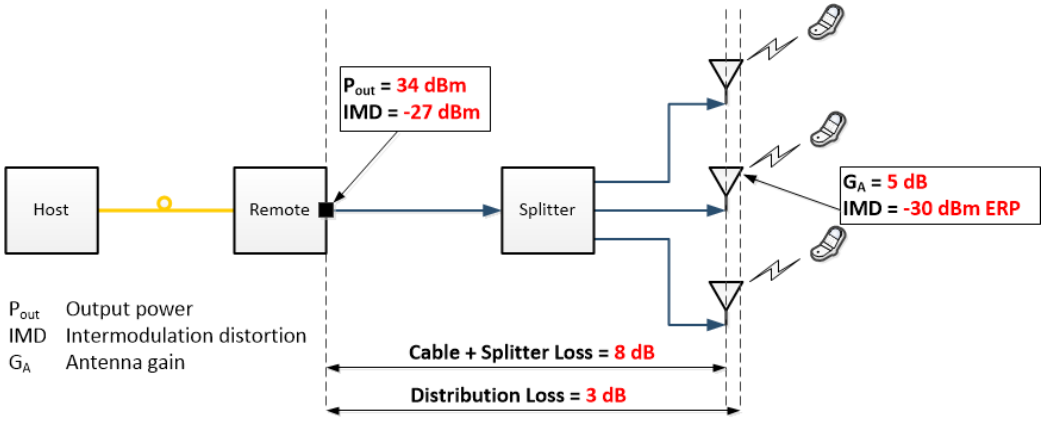
Distribution Loss = Cable + Splitter Loss – G_A

15 dB = 18 dB – 3 dB

450 MHz Band, Mode A (2 W)

Examples

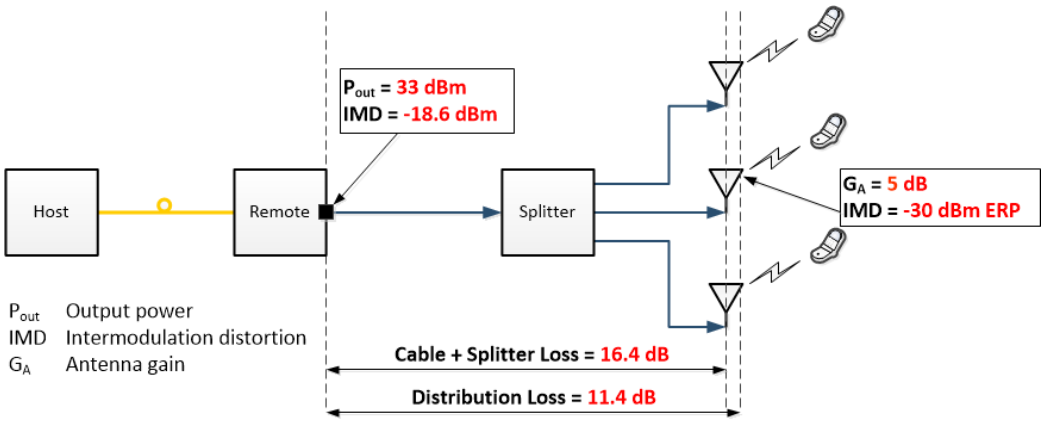
- 3 dB of minimum distribution loss when 2-Carrier composite power is 34 dBm



Distribution Loss = Cable + Splitter Loss – G_A

3 dB = 8 dB – 5 dB

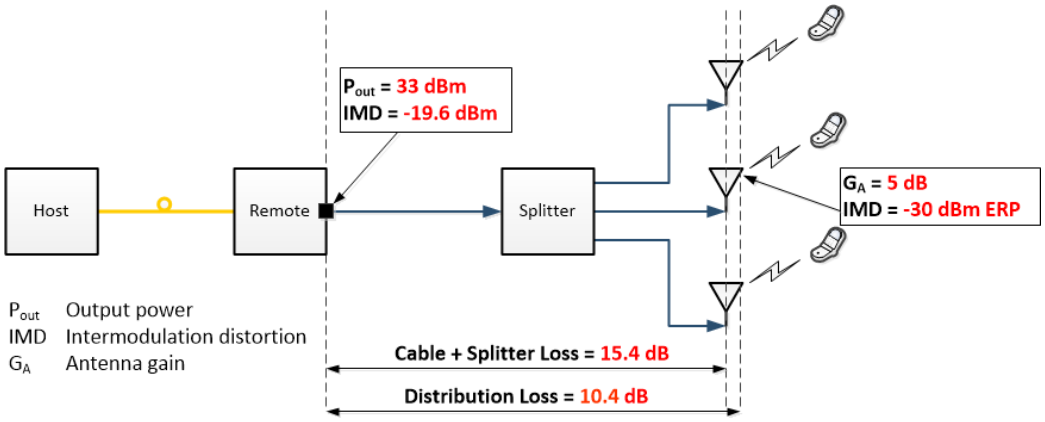
800 MHz Band, Mode A (2 W)



Distribution Loss = Cable + Splitter Loss – G_A

11.4 dB = 16.4 dB – 5 dB

900 MHz Band, Mode A (2 W)



Distribution Loss = Cable + Splitter Loss – G_A

10.4 dB = 15.4 dB – 5 dB

RF Exposure

According to FCC Part 1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines. More information on evaluating compliance with these limits can be found in the FCC's OST/OET Bulletin Number 65, "Evaluating Compliance with FCC-Specified Guidelines for Human Exposure to Radiofrequency Radiation".

All maximum Conducted Output Power + Max Antenna Gain (dBi) shown below is less than the 37dBm ERP limit. In real deployment, there will be distribution loss due to cable and splitter combiners between the output of device and antenna to ensure radiated power is under 37 dBm ERP limit.

RF Exposure Evaluation Distance Calculation

$$d = \sqrt{(EIRP/4\pi S)}$$

Where:

- d = Distance to the center of radiation of the antenna (cm) for the allowable Power Density
- S = Allowable Power Density Limit (mW/cm2)
- EIRP = Equivalent isotropically radiated power (mW) = $10^{[\text{TX Power (dBm) + Ant Gain (dBi)}/10]}$

airHost33 PS Dual Band

150 MHz Band, Mode B (5 W)

In the Frequency Range of 30 to 300 MHz, the maximum power density limit for the occupational/controlled exposures is 1 mW/cm2 for an average time of 6 minutes. In the Frequency Range of 30 to 300 MHz, the maximum power density limit for the general population/uncontrolled exposures is 0.2 mW/cm2 for an average time of 30 minutes.

The antenna connected to the product is specific to the deployment. The worst case scenario occurs when using a high gain antenna. A typical outdoor antenna is shown in the following example:

The highest conducted output power is 37 dBm. To avoid exceeding 37 dBm ERP, the unit output power can be backed off to 30 dBm. With a donor antenna gain of 7 dBi, the EIRP is 37 dBm.

The maximum power density safe exposure level for general population/uncontrolled exposure of 30 minutes for the frequency of 152 MHz is 0.2 mW/cm2.

Conducted Output Power (dBm)	Max Antenna Gain (dBi)	Max EIRP (mW)	Power Density Limit Allowed (mW/cm^2)	Safe Distance (cm)

30	7	5012	0.2	45

As shown above, the minimum safe distance where the MPE limit is reached is 45 cm from the unit with a 3 dBi antenna and no distribution loss.

If the antenna will be positioned closer to end users than 45 cm, then the installer must calculate the safe distance for a given installation using the formulas provided.

hd33 PS Dual Band

150 MHz Band, Mode A (2 W)

In the Frequency Range of 30 to 300 MHz, the maximum power density limit for the occupational/controlled exposures is 1 mW/cm^2 for an average time of 6 minutes. In the Frequency Range of 30 to 300 MHz, the maximum power density limit for the general population/uncontrolled exposures is 0.2 mW/cm^2 for an average time of 30 minutes.

The antenna connected to the product is specific to the deployment. The worst case scenario occurs when using a very high gain outdoor/indoor antenna. However a typical indoor antenna is shown in the following example:

The highest expected output power is 34 dBm at 157.5MHz. For an output level of 34 dBm with an indoor antenna gain of 3 dBi, the EIRP is 37 dBm.

The maximum power density safe exposure level for general population/uncontrolled exposure of 30 minutes for the frequency of 157.5 MHz is 0.2 mW/cm^2.

Conducted Output Power (dBm)	Max Antenna Gain (dBi)	Max EIRP (mW)	Power Density Limit Allowed (mW/cm^2)	Safe Distance (cm)
34	3	5012	0.2	45

As shown above, the minimum safe distance where the MPE limit is reached is 45 cm from the unit with a 3 dBi antenna and no distribution loss.

If the antenna will be positioned closer to end users than 45 cm, then the installer must calculate the safe distance for a given installation using the formulas provided.

150 MHz Band, Mode B (5 W)

In the Frequency Range of 30 to 300 MHz, the maximum power density limit for the occupational/controlled exposures is 1 mW/cm^2 for an average time of 6 minutes. In the Frequency Range of 30 to 300 MHz, the maximum power density limit for the general population/uncontrolled exposures is 0.2 mW/cm^2 for an average time of 30 minutes.

The antenna connected to the product is specific to the deployment. The worst case scenario occurs when using a very high gain antenna. However a typical indoor antenna is shown in the following example:

The highest conducted output power is 37 dBm. To avoid exceeding 37 dBm ERP, the unit output power can be backed off to 34 dBm. With an indoor antenna gain of 3 dBi, the EIRP is 37 dBm.

The maximum power density safe exposure level for general population/uncontrolled exposure of 30 minutes for the frequency of 152 MHz is 0.2 mW/cm^2.

Conducted Output Power (dBm)	Max Antenna Gain (dBi)	Max EIRP (mW)	Power Density Limit Allowed (mW/cm^2)	Safe Distance (cm)
34	3	5012	0.2	45

As shown above, the minimum safe distance where the MPE limit is reached is 45 cm from with a 3 dBi antenna and no distribution loss.

If the antenna will be positioned closer to end users than 45 cm, then the installer must calculate the safe distance for a given installation using the formulas provided.

450 MHz Band, Mode A (2 W)

In the Frequency Range of 300 to 1500 MHz, the maximum power density limit for the occupational/controlled exposures is f/300 mW/cm^2 for an average time of 6 minutes. In the Frequency Range of 300 to 1500 MHz, the maximum power density limit for the general population/uncontrolled exposures is f/1500 mW/cm^2 for an average time of 30 minutes.

The antenna connected to the product is specific to the deployment. The worst case scenario occurs when using a very high gain indoor/outdoor antenna. However a typical indoor antenna is shown in the following example:

The highest expected output power is 34 dBm at 481MHz. For an output level of 34 dBm with an indoor antenna gain of 2 dBi, the EIRP is 36 dBm.

The maximum power density safe exposure level for general population/uncontrolled exposure of 30 minutes for the frequency of 481 MHz is 0.321 mW/cm^2.

Conducted Output Power (dBm)	Max Antenna Gain (dBi)	Max EIRP (mW)	Power Density Limit Allowed (mW/cm^2)	Safe Distance (cm)
34	2	3981	0.321	32

As shown above, the minimum safe distance where the MPE limit is reached is 32 cm from the unit with a 2 dBi antenna and no distribution loss.

If the antenna will be positioned closer to end users than 32 cm, then the installer must calculate the safe distance for a given installation using the formulas provided.

800 MHz Band, Mode A (2 W)

In the Frequency Range of 300 to 1500 MHz, the maximum power density limit for the occupational/controlled exposures is f/300 mW/cm^2 for an average time of 6 minutes.

In the Frequency Range of 300 to 1500 MHz, the maximum power density limit for the general population/uncontrolled exposures is f/1500 mW/cm^2 for an average time of 30 minutes.

The antenna connected to the product is specific to the deployment. The worst case scenario occurs when using a very high gain outdoor/indoor antenna. However a typical indoor antenna is shown in the following example:

The highest expected output power is 33.6 dBm at 856MHz. For an output level of 33.6 dBm with an indoor antenna gain of 3 dBi, the EIRP is 36.6 dBm.

The maximum power density safe exposure level for general population/uncontrolled exposure of 30 minutes for the frequency of 856 MHz is 0.571 mW/cm^2.

Conducted Output Power (dBm)	Max Antenna Gain (dBi)	Max EIRP (mW)	Power Density Limit Allowed (mW/cm^2)	Safe Distance (cm)
33.6	3	4571	0. 571	26

As shown above, the minimum safe distance where the MPE limit is reached is 26 cm from the unit with a 3 dBi antenna and no distribution loss.

If the antenna will be positioned closer to end users than 26 cm, then the installer must calculate the safe distance for a given installation using the formulas provided.

900 MHz Band, Mode A (2 W)

In the Frequency Range of 300 to 1500 MHz, the maximum power density limit for the occupational/controlled exposures is f/300 mW/cm^2 for an average time of 6 minutes.

In the Frequency Range of 300 to 1500 MHz, the maximum power density limit for the general population/uncontrolled exposures is f/1500 mW/cm^2 for an average time of 30 minutes.

The antenna connected to the product is specific to the deployment. The worst case scenario occurs when using a very high gain indoor/outdoor antenna. However a typical indoor antenna is shown in the following example:

The highest expected output power is 33.2 dBm at 937.5MHz. For an output level of 33.2 dBm with an indoor antenna gain of 3 dBi, the EIRP is 36.2 dBm.

The maximum power density safe exposure level for general population/uncontrolled exposure of 30 minutes for the frequency of 937.5 MHz is 0.625 mW/cm^2.

Conducted Output Power (dBm)	Max Antenna Gain (dBi)	Max EIRP (mW)	Power Density Limit Allowed (mW/cm^2)	Safe Distance (cm)
33.2	3	4169	0. 625	24

As shown above, the minimum safe distance where the MPE limit is reached is 24 cm from the unit with a 3 dBi antenna and no distribution loss.

If the antenna will be positioned closer to end users than 24 cm, then the installer must calculate the safe distance for a given installation using the formulas provided.

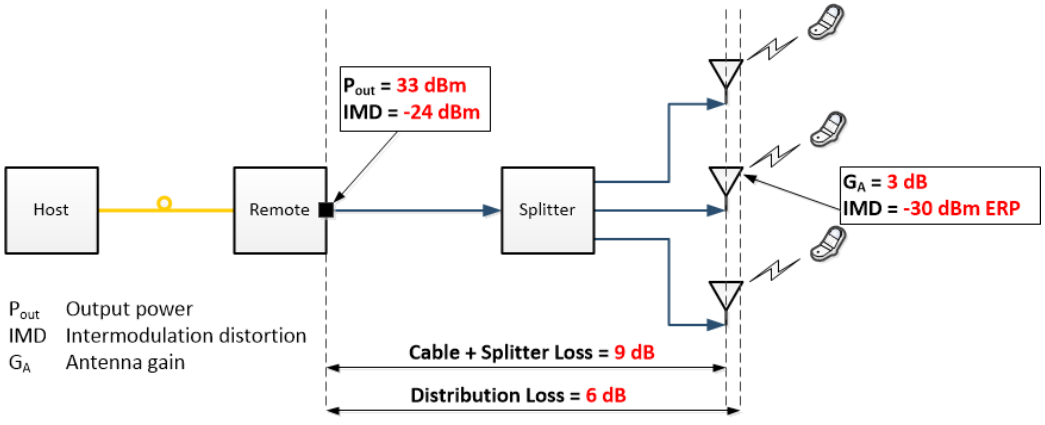
TYPE 2 CHASSIS

Intermodulation

hd33 PS Quad Band Downlink

450 MHz, 700 MHz, 800 MHz, 900 MHz band, Mode A (2W)

Example: 6 dB of minimum distribution loss when 2-carrier composite power is 33 dBm



Distribution Loss = Cable + Splitter Loss – G_A

6 dB = 9 dB – 3 dB

RF Exposure

hd33 PS Quad Band

Band 1: 450 MHz

In the Frequency Range of 300 to 1500 MHz, the maximum power density limit for the occupational/controlled exposures is f/300 mW/cm^2 for an average time of 6 minutes.

In the Frequency Range of 300 to 1500 MHz, the maximum power density limit for the general population/uncontrolled exposures is f/1500 mW/cm^2 for an average time of 30 minutes.

The antenna connected to the product is specific to the deployment. The worst case scenario occurs when using a very high gain outdoor/indoor antenna. However a typical indoor antenna is shown in the following example:

The highest expected output power is 35 dBm at 511.9875MHz. For an output level of 35 dBm with an indoor antenna gain of 3 dBi, the EIRP is 38 dBm.

The maximum power density safe exposure level for general population/uncontrolled exposure of 30 minutes for the frequency of 511.9875 MHz is 0.341 mW/cm^2.

Conducted Output Power (dBm)	Max Antenna Gain (dBi)	Max EIRP (mW)	Power Density Limit Allowed (mW/cm²)	Safe Distance (cm)
35	3	6310	0.341	39

As shown above, the minimum safe distance where the MPE limit is reached is 39 cm from the unit with a 3 dBi antenna and no distribution loss.

The antenna used in the above table is a Galtronics PEAR S5491i with 3dBi gain in the 450 MHz band.

If the antenna will be positioned closer to end users than 39cm, then the installer must calculate the safe distance for a given installation using the formulas provided.

Band 2: 700 MHz

In the Frequency Range of 300 to 1500 MHz, the maximum power density limit for the occupational/controlled exposures is f/300 mW/cm^2 for an average time of 6 minutes.

In the Frequency Range of 300 to 1500 MHz, the maximum power density limit for the general population/uncontrolled exposures is f/1500 mW/cm^2 for an average time of 30 minutes.

The antenna connected to the product is specific to the deployment. The worst case scenario occurs when using a very high gain outdoor/indoor antenna. However a typical indoor antenna is shown in the following example:

The highest expected output power is 35.1 dBm at 772MHz. For an output level of 35.1 dBm with an indoor antenna gain of 2.5 dBi, the EIRP is 37.6 dBm.

The maximum power density safe exposure level for general population/uncontrolled exposure of 30 minutes for the frequency of 772 MHz is 0.515 mW/cm^2.

Conducted Output Power (dBm)	Max Antenna Gain (dBi)	Max EIRP (mW)	Power Density Limit Allowed (mW/cm^2)	Safe Distance (cm)
35.1	2.5	5754	0.515	30

As shown above, the minimum safe distance where the MPE limit is reached is 30 cm from the unit with a 2.5 dBi antenna and no distribution loss.

The antenna used in the above table is a Galtronics PEAR S5491i with 2.5 dBi gain in the 700 MHz band.

If the antenna will be positioned closer to end users than 30 cm, then the installer must calculate the safe distance for a given installation using the formulas provided.

Band 3: 800 MHz

In the Frequency Range of 300 to 1500 MHz, the maximum power density limit for the occupational/controlled exposures is f/300 mW/cm^2 for an average time of 6 minutes.

In the Frequency Range of 300 to 1500 MHz, the maximum power density limit for the general population/uncontrolled exposures is f/1500 mW/cm^2 for an average time of 30 minutes.

The antenna connected to the product is specific to the deployment. The worst case scenario occurs when using a very high gain outdoor/indoor antenna. However a typical indoor antenna is shown in the following example:

The highest expected output power is 35.5 dBm at 860.9875MHz. For an output level of 35.5 dBm with an indoor antenna gain of 3.5 dBi, the EIRP is 39 dBm.

The maximum power density safe exposure level for general population/uncontrolled exposure of 30 minutes for the frequency of 860.9875 MHz is 0.574 mW/cm^2.

Conducted Output Power (dBm)	Max Antenna Gain (dBi)	Max EIRP (mW)	Power Density Limit Allowed (mW/cm²)	Safe Distance (cm)
35.5	3.5	7943	0.574	34

As shown above, the minimum safe distance where the MPE limit is reached is 34 cm from the unit with a 3.5 dBi antenna and no distribution loss.

The antenna used in the above table is a Galtronics PEAR S5491i with 3.5 dBi gain in the 800 MHz band.

If the antenna will be positioned closer to end users than 34 cm, then the installer must calculate the safe distance for a given installation using the formulas provided.

Band 4: 900 MHz

In the Frequency Range of 300 to 1500 MHz, the maximum power density limit for the occupational/controlled exposures is f/300 mW/cm^2 for an average time of 6 minutes.

In the Frequency Range of 300 to 1500 MHz, the maximum power density limit for the general population/uncontrolled exposures is f/1500 mW/cm^2 for an average time of 30 minutes.

The antenna connected to the product is specific to the deployment. The worst case scenario occurs when using a very high gain indoor/outdoor antenna. However a typical indoor antenna is shown in the following example:

The highest expected output power is 34.8 dBm at 935.0125MHz. For an output level of 34.8 dBm with an indoor antenna gain of 3.5 dBi, the EIRP is 38.3 dBm.

The maximum power density safe exposure level for general population/uncontrolled exposure of 30 minutes for the frequency of 935.0125 MHz is 0.623 mW/cm^2.

Conducted Output Power (dBm)	Max Antenna Gain (dBi)	Max EIRP (mW)	Power Density Limit Allowed (mW/cm²)	Safe Distance (cm)
34.8	3.5	6761	0.623	30

As shown above, the minimum safe distance where the MPE limit is reached is 30 cm from the unit with a 3.5 dBi antenna and no distribution loss.

The antenna used in the above table is a Galtronics PEAR S5491i with 3.5 dBi gain in the 900 MHz band.

If the antenna will be positioned closer to end users than 30 cm, then the installer must calculate the safe distance for a given installation using the formulas provided.

Disclaimer

Dali Wireless, Inc. assumes no responsibility for errors or omissions that may appear in this publication. Dali reserves the right to make changes this publication at any time without notice as part of our continuing effort to improve our products.

CONTENTS

PREFACE

The **Dali Matrix PS System Installation and Commissioning Guide** describes how to install and commission the Matrix® PS public safety system.

This guide is for technicians, installers, and integrators responsible for installing the airHost PS off-air host unit, hdHost PS base station host unit, and the hd33 PS remote, and Matrix Console PS.

This document is part of a supporting set of documents which include:

- **Dali Matrix PS System Overview**
  This document describes Matrix host and remote units. This document is intended as an introduction for installers and system integrators.
- **Dali Matrix SNMP & Alarm Reference Guide**
  This guide describes the Matrix Management Information Base (MIB) including the object identifiers (OIDs), SNMP alarms, and states for integrating Matrix PS with a third party Network Management System (NMS).

Contacting Dali Customer Service

For information specific to the installation, refer to the site installation plan. For equipment that is missing or damaged during shipment, contact Dali Customer Service.

Dali Customer Service:

778-945-5081
Toll-Free: 1-855-250-5081
support@daliwireless.com

1 OVERVIEW

The Matrix PS public safety system is a digital-over-fiber distributed antenna system that delivers mobile coverage and capacity in all types of environments.

The Matrix PS system ensures that public safety communications function reliably and without interruption within commercial and residential buildings, airports, government establishments, tunnels and metros.

This chapter introduces the Matrix PS system, including:

- Matrix PS system architecture
- hdHost PS base station host unit
- airHost PS off-air host unit
- hd33 PS remote radio unit
- Matrix Console PS system controller

1.1 Matrix PS System Architecture

The modular architecture of a Matrix PS public safety system means that mobile operators and enterprises can handle expansions and upgrades as they grow. Antenna points can be provisioned with the appropriate amount of network resources, and multiple cellular carriers can share the network infrastructure within a given site or facility.

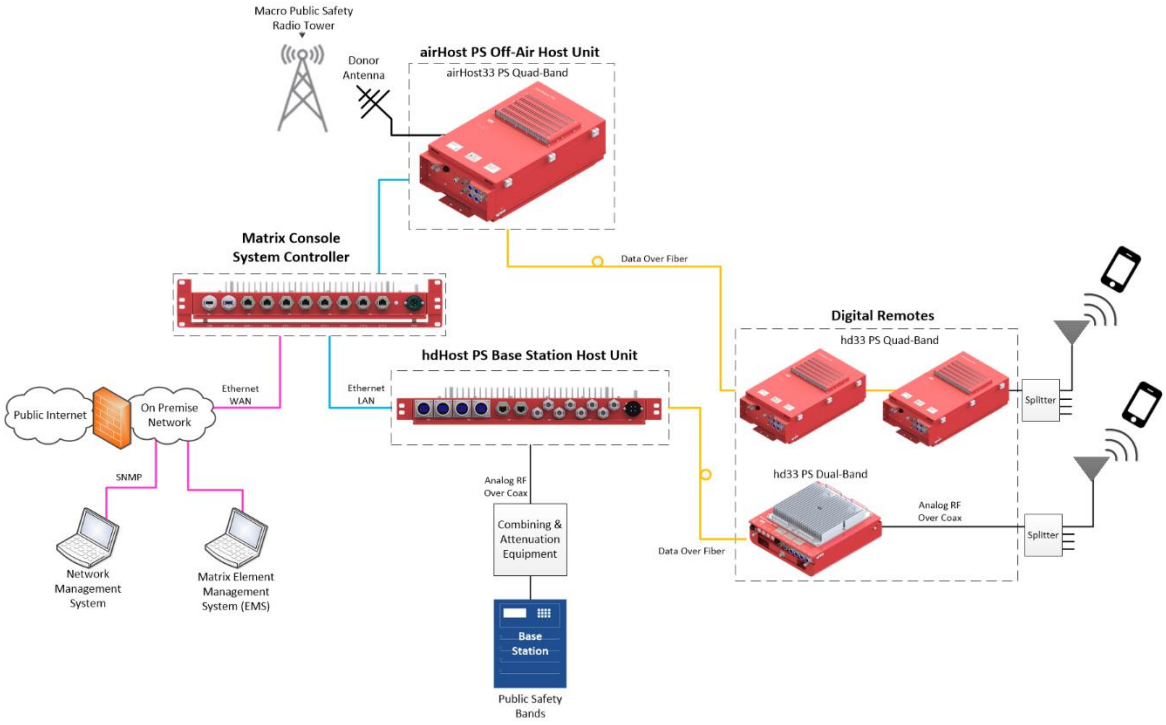


Figure 1-1: Matrix PS System Architecture

The Matrix PS system consists of the following host units, digital remote radio units, and system controllers.

- hdHost PS base station host and airHost PS off-air host
- hd33 PS remote radio
- Matrix Console PS system controller

1.2 Public Safety Band Selection

The supported public safety frequency bands are:

- VHF or 150 MHz (150-174 MHz, bandwidth: 24 MHz, 2 W)
- UHF or 450 MHz (450-512 MHz, bandwidth: 62 MHz, 2 W)
- 700 MHz (bandwidth: 17 MHz, 2 W)
- 800 MHz (bandwidth: 18 MHz, 2 W)
- 900 MHz (bandwidth: 6 MHz, 2 W)

For single channel frequency bands, airHost PS and remote units support up to 5 W output power, type 2 chassis only. Up to four public safety bands can be deployed. Band selection is pre-configured by Dali Wireless.

1.3 hdHost PS Base Station Host Unit

The hdHost PS is a quad-band host unit that connects directly to base stations or bi-directional amplifiers (BDAs) over an analog RF interface to process up to four public safety RF bands simultaneously.

On the downlink (DL) path the hdHost PS translates analog RF content into a digital data stream, and then transports it to remote units over one to eight optical links, each operating at a data rate of 10 Gbps. Because all radio signals are processed and combined in the digital domain, no passive intermodulation (PIM) is introduced. The aggregated content is then sent over optical fiber to the remotes.

On the uplink (UL) path the hdHost PS performs the reverse functions. It delivers digitally transported uplink signals to corresponding base stations as analog RF signals and IP data from remotely connected IP devices to the Internet or other devices in the cloud.

The hdHost PS also supports 1 Gbps Ethernet backhaul for additional IP devices such as security cameras and Wi-Fi access points located close to remote units.

Figure 1-2: hdHost PS Base Station Host Unit

Features	Description
Band frequencies	VHF/150 MHz, UHF/450 MHz, 700 MHz, 800 MHz, 900 MHz
RF modules	Up to 4 RF modules with digital conversion to/from analog RF
Data rate	10 Gbps per wavelength
DL Input power	–10 to +10 dBm per band
Bandwidth	Up to 320 MHz aggregated uplink/downlink per wavelength
Optical interfaces	8 x 10 Gbps optical interfaces with standard SFP+ optical transceivers
Ethernet interfaces	2 x 1 Gbps Ethernet interfaces
Power	48 VDC power interface <95 W power consumption
Configuration, control, and monitoring	Remote control and monitoring via Matrix EMS web application, third party NMS, and SNMP

For a complete list of specifications, see Appendix A.

1.4 airHost PS Off-Air Host Unit

The airHost PS is a dual or quad-band off-air fed host unit. The airHost PS accepts DL analog RF signals from off-air donor antennas and transmits UL RF signals back to the macro towers at 2 W or 5 W depending on the number of bands.

The dual band unit supports one or two bands in a sealed type 1 pluggable module chassis. The quad-band unit supports up to four bands in a type 2 sealed chassis with door.

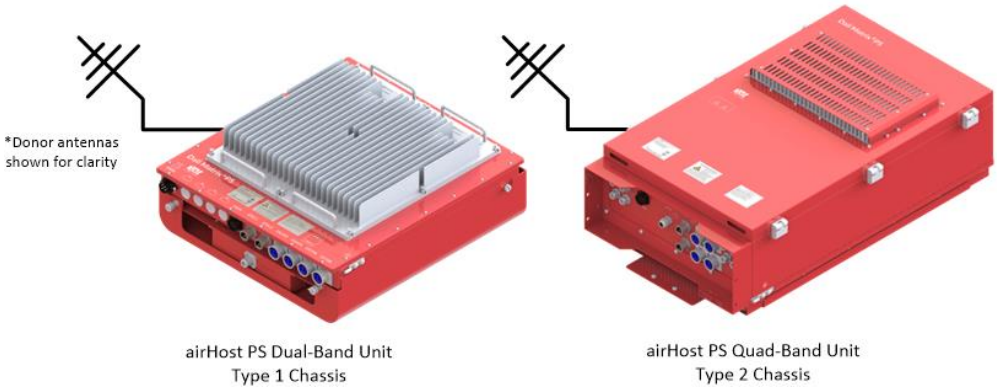


Figure 1-3: airHost PS Dual Band and Quad Band Off-Air Host Unit

On the DL path, the airHost PS translates analog RF content into a digital data stream, and then transports the data stream to remote units on one to eight optical links, each operating at 10 Gbps. Because radio signals are processed and combined in the digital domain, no passive intermodulation (PIM) is introduced.

On the UL path the airHost PS does the reverse. It receives data streams from the remotes, which are then converted back to analog RF. The signals are filtered and amplified to a composite power of 2 W per band, and then delivered back to the macro towers through outdoor directional antennas. For single channel frequency bands, airHost PS supports up to 5 W output power, type 2 chassis only.

The airHost PS also supports 1 Gbps Ethernet backhaul for transporting the data from IP devices such as security cameras and Wi-Fi access points located close to remote units.

Features	Description
Band frequencies	VHF (150 MHz), UHF (450 MHz), 700 MHz, 800 MHz, 900 MHz
RF interfaces	Simplex interfaces for VHF and UHF bands Donor antenna ports for each band
Multiplexer	Internal mutiplexer for 700, 800, 900 MHz bands
RF modules	Type 1 chassis: one or two RF modules Type 2 chassis: one to four RF modules
Data rate	10 Gbps per wavelength
UL output power	2 W per band Up to 5 W per band, type 2 chassis only, for single channel frequency bands
Optical interfaces	8 x 10 Gbps optical interfaces with standard SFP+ optical transceivers
Ethernet interfaces	2 x 1 Gbps Ethernet interfaces
Power	48 VDC power interface Type 1 chassis: 195 W Type 2 chassis: 340 W
Configuration, control, and monitoring	Remote control and monitoring via Matrix EMS web application, third party NMS, and SNMP

For a complete list of specifications, see Appendix A.

1.5 hd33 PS Remote Radio Unit

The hd33 PS is a dual-band or quad band remote radio unit (RRU) that provides 2 W or 5 W of output power depending on the number of bands.

The dual-band unit supports one or two bands in a sealed type 1 pluggable module chassis. The quad-band unit supports up to four bands in a type 2 sealed chassis with door.

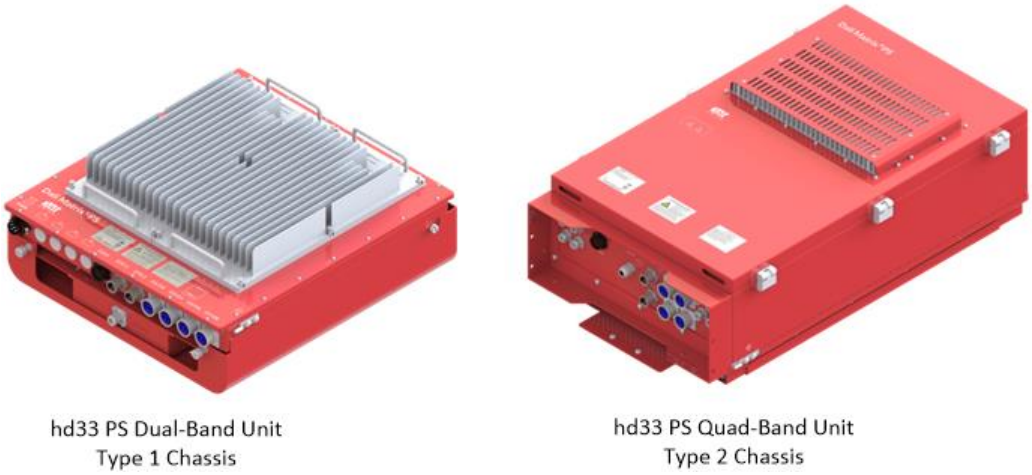


Figure 1-4: hd33 PS Remote, Dual-Band and Quad-Band

On the downlink path, the hd33 PS remote receives an aggregated stream of digitized RF signals from an hdHost PS or airHost PS, which it then converts into analog RF signals.

Depending on the frequency band, the signal is either amplified in the RF module and then sent out through simplex RF ports to an external filter, or sent to an internal multiplexer and then out through N-type antenna ports.

On the UL path the hd33 PS remote receives analog RF signals for the RF band, either from an external VHF/UHF filter or directly from the antenna network. The RF signals are converted into a digital data stream and then delivered over optical fiber to an hdHost PS or airHost PS.

The hd33 PS remote also accommodates a 1 Gbps Ethernet backhaul for transporting the data from nearby IP devices such as security cameras and Wi-Fi access points.

Features	Description
Band frequencies	Up to four bands supported Frequencies: VHF or 150 MHz, UHF or 450 MHz, 700 MHz, 800 MHz, 900 MHz
RF interfaces	Simplex interfaces for VHF and UHF bands Donor antenna ports for each band
Multiplexer	Internal mutiplexer for 700, 800, 900 MHz bands
RF modules	Type 1 chassis: 1 to 2 RF band modules Type 2 chassis: 1 to 4 RF band modules
Data rate	10 Gbps per wavelength
DL output power	2 W per band Up to 5 W output power, type 2 chassis only, for single channel frequency bands
Optical interfaces	Type 1 chassis: 4 x 10 Gbps optical interfaces Type 2 chassis: 8 x 10 Gbps optical interfaces
Ethernet interfaces	4 x 1 Gbps Ethernet interfaces
Power	48 VDC power interface Type 1 chassis: 195 W Type 2 chassis: 340 W
Configuration, control, and monitoring	Remote control and monitoring via Matrix EMS web application, third party NMS, and SNMP

For a complete list of specifications, see Appendix A.

1.6 Matrix Console PS

Matrix Console PS is a 1RU system controller unit that manages Matrix devices from a central location. Matrix Console PS software, called the system controller, stores configuration settings, monitors alarms, displays performance data, and provides access to the Matrix Element Management System (EMS) web application.

The system controller also hosts a Simple Network Management Protocol (SNMP) client that enables SNMP traps and monitoring messages to be sent from the system controller to an SNMP Manager at the network operations center.

Matrix Console PS provides the following additional features:

- 1 Gbps Ethernet interfaces for connecting to the internal Matrix IP network and the customer IP network.
- Remote maintenance link for troubleshooting with Dali Customer Service
- Front panel power and alarm LEDs
- NEMA/IP66 compliant enclosure

Figure 1-5: Matrix Console PS

PART 1
INSTALLATION

Part 1 of this guide is intended for RF designers and field installers responsible for planning and installing Matrix equipment.

Use this guide in conjunction with the site-specific deployment documents, including: the RF design, fiber plan, rack layout plan, clock distribution plan, network design document, and gain lineup plan.

This section contains the following chapters:

2 INSTALLATION REQUIREMENTS

This chapter describes the prerequisites for installing the Matrix PS system, including:

- Matrix PS installation and commissioning workflow
- Documentation requirements
- System level requirements
- Installation requirements

2.1 Matrix PS Installation and Commissioning Workflow

Figure 2-1 describes the recommended workflow for installing and commissioning the hdHost PS, airHost PS, and remote radio units.

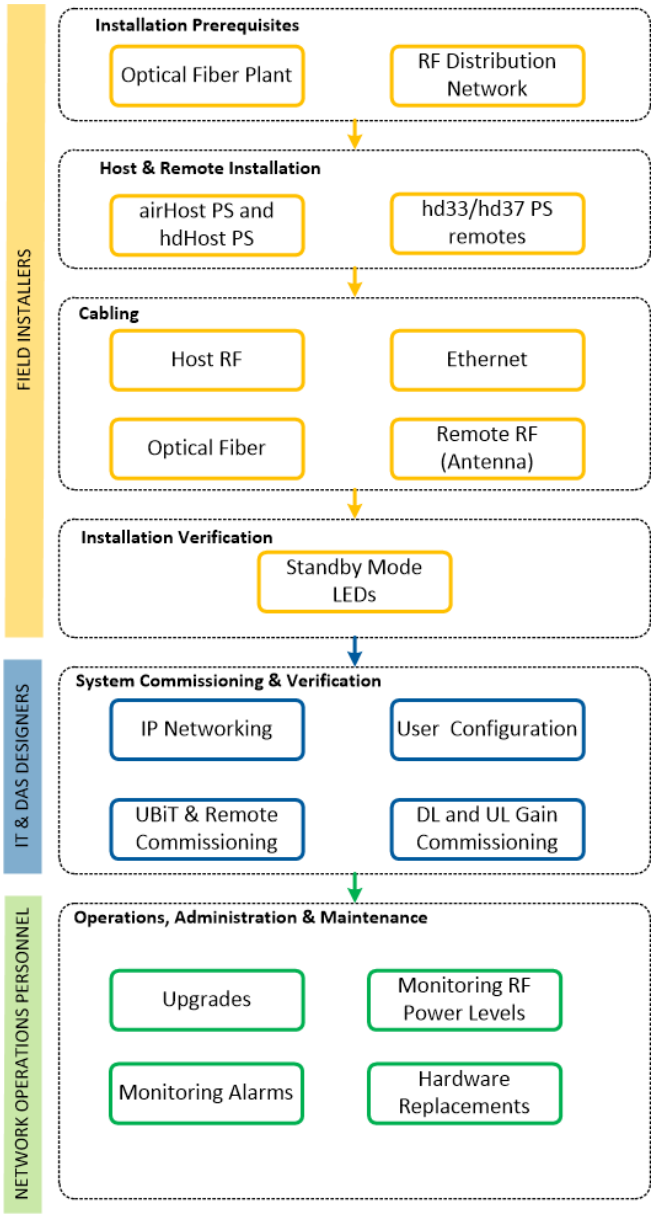


Figure 2-1: Matrix PS Installation and Commissioning Flow

2.2 Documentation Requirements

In addition to this Installation and Commissioning Guide, the following site-specific documents are recommended. These documents are created by Matrix-certified RF designers and system integrators.

- System design & RF plan describing detailed installation prerequisites and the logical layout of optical fiber
- Fiber plan describing the labelling of fiber runs, installation of optical fiber, and physical routing of optical fiber
- Rack layout plan describing the layout and interconnection of rack mounted units
- Clock distribution plan describing the master clock sources used for optical clock synchronization
- Network design plan for IP planning, VPN planning, and NMS integration
- Gain lineup spreadsheet containing base station gain settings

2.3 System Level Requirements

2.3.1 Safety Warnings

Before installing and commissioning components of the Matrix PS system, there are a number of important preparation tasks that will ensure the process goes safely and smoothly.

Make sure you:

- Heed all safety and electrical warnings, especially when working with electricity and electrical equipment.
- Follow any applicable regulations and Matrix PS system recommendations for equipment rack specifications, placement, and layout.
- Ensure the Matrix units come with all components and mounting hardware out of the box.
- Ensure you have all the required tools and the adequate number of trained personnel on hand before commencing.

All safety precautions should be read and understood prior to installing and commissioning the components of the Matrix PS system.

	• This equipment is to be installed in a Restricted Access Area.
	• This equipment contains components that emit laser radiation which can seriously damage the retina of the eye. • Do not look into the ends of any optical fiber. • Do not look directly into the optical transceiver of any digital unit to avoid eye damage. • Place a protective cap or lid immediately over any radiating transceiver or optical fiber connector to avoid potential damage caused by radiation exposure. This practice also prevents dirt particles entering the openings.
	• Always allow sufficient fiber length to permit routing or patch cords and pigtails without severe bends. • Fiber optic patch cords or pigtails may be permanently damaged if bent or curved to a radius of less than 2 inches (50 mm).
	• Cables attached to rack mounted units must use top and bottom cable management trays.
	• Matrix host and remote units are powered by DC POWER ONLY. For sites with AC power source equipment, use a Matrix AC/DC power supply. • To prevent electrical shock when installing or maintaining the unit, disconnect the wiring at the power source before working with un-insulated wires or terminals.
	• Static electricity can severely damage and corrupt essential circuitry within the equipment if not handled carefully. • Parts on the printed circuit boards as well as other parts in the equipment are sensitive to electrostatic discharge. • Never touch the printed circuit boards or un-insulated conductor surfaces unless absolutely necessary. • If the printed circuit boards must be handled, always use ESD protective devices or first touch the enclosure with your hand and then do not move your feet.
	• Wet locations and conditions will increase the risk of electrical shock when installing or using electrical powered equipment. • To prevent electrical shock, never install or use electrical equipment in wet locations or during lightning storms.
	• This equipment is intended to be installed only by professionally qualified and trained personnel.

2.3.2 Equipment Room Preparation

Item	Description
Equipment room temperature	• The maximum ambient temperature (Tma) in the equipment room should be no higher than 50°C (122°F), and/or 55°C (131°F) for 4 hours.
Network plan	• Site and host configuration planning documentation
Network addresses	• List of network address information

2.3.3 Rack Specifications and Installation

Item	Description
General rack specifications	• A standard equipment rack is nominally 19 inches wide (including mounting hardware) and follows a standard set by the Electronics Industry Alliance (EIA) • The 19-inch rack standard is called EIA-310-D, which is essentially equivalent to IEC-60297-3-100 or DIN 41494 in other regions.
4-post rack specifications	• Open 4-post equipment rack with adjustable intermediate rail or 2-post rack can be used for mounting the hdHost PS, airhost PS or hd33 PS remote • Racks may be open or closed • Racks must be secured with floor or ceiling according to appropriate local building or seismic codes. • Reinforce equipment racks with support brackets or rails as necessary to accommodate the weight of units
Rack mounting and clearances	• The rack should be mounted to the floor and levelled. Adhere to any applicable local or seismic guidelines for equipment installation. • Allow a minimum clearance of 24 in (610 mm) at the rear of the rack for access to grounding lug and cooling fans.
Rack grounding	• Install a ground bar bus on the rack to accept the ground wires from each unit in the rack. • Use #10 AWG ground cable from the main facility ground to the rack grounding bus bar.
Rack cable management	• Install 1RU cable management trays above and below units in the rack and vertical cable management trays for managing RF, optical, and Ethernet cables

2.3.4 Fiber Plant

The fiber plant for single mode fiber and LC connectors can be terminated in the equipment room to accommodate fiber patch cables from hdHost PS modules in the chassis and the network of digital remotes.

Additional fiber distribution panels can be interconnected to accommodate connections to distant remotes.

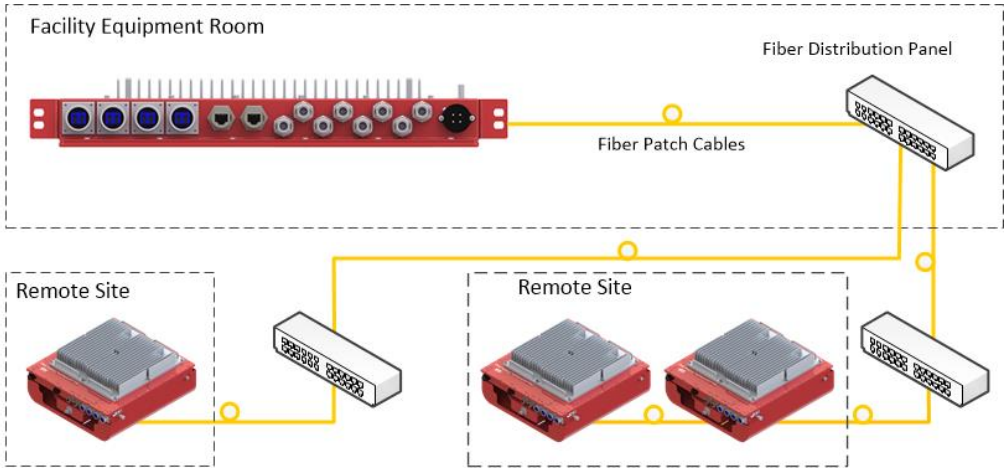


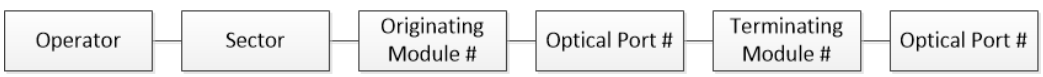
Figure 2-2: Fiber Optic Runs and Distribution Panels

2.3.5 Cable Labeling

When labeling cables, include standard information that will aid field technicians troubleshoot cable connection problems.

For clarity and consistency in installation and maintenance, use a cable labeling scheme that logically corresponds to standardized naming scheme.

For example:



Cable labeling can correspond with the names attached to remotes or to RF feed names. See Naming Units and RF Feeds.

2.3.6 RF Antenna Infrastructure

The planning and installation of antennas and supporting infrastructure, including optical fiber and RF cables, filters, splitters, couplers, and hybrid combiners, is beyond the scope of this document, but this should be completed in advance of connecting any distribution network to a Matrix remote.

When validating the Matrix PS system design for an indoor or outdoor venue, crosscheck antennas and passive components to ensure they have been installed in the right locations, with proper orientation of ports and cabling, and appropriate terminations.

The entire infrastructure should be fully line-tested for:

- Insertion loss and VSWR (reflected power), or return loss using sweeping
- Passive Intermodulation (PIM) testing
- Distance to fault using Frequency Domain Reflectometry (FDR)

2.4 Installation Requirements

This section does not include the tools and equipment required to assemble and install the equipment rack itself.

2.4.1 Tools and Equipment

Tool or Equipment	Description
#2 Phillips screwdriver and small flat screwdriver	Used for or installing Matrix units and DC power connectors
Wire cutters and strippers	Used for preparing DC power and grounding cables
Llaptop with internet browser, and Ethernet cables	Used for commissioning and system monitoring
Cable and antenna analyzer	Used for cable testing and cable sweeps
Multimeter	Used for testing the of voltage of DC power feeds before connection to the hdHost PS
Optical power meter	Used for testing fiber optic cables before installation
Fiber cleaning equipment	Used for cleaning fiber optic cables before installation

2.4.2 Shipping Contents

Ensure that all shipping containers are received and inspected for visible signs of damage. Unpack each shipping container while checking contents for damage and verifying shipped contents against packing slip for each Matrix PS component.

Contact Dali Customer Service if the box contents do not match the packing list or if any equipment appears damaged.

Unit	Packing List
hdHost PS	• 2RU chassis • Mounting bracket and hardware • DC power cable assembly • Optical connector assembly and optical fiber adapter kit • RJ-45 connectors • Optional AC/DC power supply • Optional rack mounting kit
airHost PS, type 1 chassis	• Dual-band off-air host unit with RF modules installed • Mounting bracket and hardware • DC power cable assembly • Optical connector assembly and optical fiber adapter kit • RJ-45 connectors • Optional AC/DC power supply • Optional rack mounting kit

Unit	Packing List
airHost PS, type 2 chassis	• Quad-band off-air host unit with RF modules installed • Mounting bracket and hardware • DC power cable assembly • Optical connector assembly and optical fiber adapter kit • RJ-45 connectors • Optional AC/DC power supply
hd33 PS remote , type 1 chassis	• Dual-band remote radio unit with RF modules installed • Mounting bracket and hardware • DC power cable assembly • Optical connector assembly and optical fiber adapter kit • RJ-45 connectors • Optional AC/DC power supply • Optional rack mounting kit
hd33 PS remote, type 2 chassis	• Quad-band remote radio unit with RF modules installed • Mounting bracket and hardware • DC power cable assembly • Optical connector assembly and optical fiber adapter kit • RJ-45 connectors • Mounting bracket and hardware • Optional AC/DC power supply • Optional rack mounting kit
Matrix Console PS	• 2RU chassis • Mounting bracket and hardware • AC power cable • RJ-45 connectors

2.4.3 Power Supply and Grounding

The requirements for power supply and grounding will vary according to the nature and size of the system deployment, as well as the required adherence to local, state, and federal regulations.

Item	Description
Grounding	Use #10 AWG from the rack grounding bus bar to chassis ground. Make a chassis ground wire for each host installed in the rack. There is no earthed conductor connected between the input terminals and other earthed parts of the host.
Circuit protection	Circuit protection in the form of a fuse panel with 48 VDC power protection installed between the DC power plant and the host unit. A fuse panel with a 1RU profile can be installed at the top of the rack for power distribution to the chassis. GMT fuses shall be 20A.
Power supply	Each host requires 48 VDC input power. Power supply cables must have a minimum temperature rating of 65° C.

Item	Description
Disconnect device	The host is considered as permanently connected device. A readily accessible disconnect device shall be incorporated external to the equipment.

2.4.4 Cables

The cable requirements for Matrix PS units will vary according to the nature and size of the system deployment, as well as the required adherence to local, state, and federal regulations.

The following cables need to be fabricated on site.

Item	Description
Host DC power cable	Required only if not using a Matrix AC/DC power supply. Use 2-wire or 3-wire multi-conductor AWG #12, #14, or #16 stranded bare copper with unshielded outer jacket to connect the fuse panel and the host.
Remote DC power cable	Required only if not using Matrix AC/DC power supply. Use 2-wire or 3-wire multi-conductor AWG #12, #14, or #16 stranded bare copper with unshielded outer.
RF cable	1/2-inch, or 7/8-inch coaxial cable Always consider the minimum bend radius provided by the cable manufacturer for the cable used.
Ethernet cable	CAT 5 Ethernet cables with RJ-45 connectors
Optical fiber	Single-mode optical fiber (SMF 9/125 µm)

3 HDHOST PS INSTALLATION

This chapter describes how to:

- Install the hdHost PS in a 2–post or 4–post equipment rack
- Ground the hdHost PS
- Set up, connect, and verify the DC power feed
- Install the hdHost PS modules if required
- Power on the hdHost PS

3.1 Preparing for Installation

Before installing the hdHost PS, become familiar with the following power consumption, and warnings. For Declaration of Conformity, FCC compliance and Safety Information, see Regulatory Compliance at the beginning of this manual.

3.1.1 Power Consumption

The power consumption of the hdHost PS is 87 W from 48 VDC nominal (40 to 58 VDC).

Unit	Voltage	Maximum Power
hdHost PS with 4 RF modules	48 VDC	87 W

3.1.2 Rack Mounting Requirements

The hdHost PS should be installed in a restricted access location. Before installing the unit, be familiar with the following rack mounting requirements:

- Elevated Operating Ambient: If installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack environment may be greater than room ambient. Give consideration to installing the equipment in an environment compatible with the maximum ambient temperature (Tma) of 55°C.
- Reduced Air Flow: Installation of the equipment in a rack should be such that the amount of air flow required for safe operation of the equipment is not compromised.
- Mechanical Loading: Mounting of the equipment in the rack should be such that a hazardous condition is not achieved due to uneven mechanical loading.
- Circuit Overloading: Consideration should be given to the connection of the equipment to the supply circuit and the effect that overloading of the circuits might have on overcurrent protection and supply wiring. Appropriate consideration of equipment nameplate ratings should be used when addressing this concern.
- Reliable Grounding: Reliable grounding of rack-mounted equipment should be maintained. Particular attention should be given to supply connections other than direct connections to the branch circuit (e.g. use of power strips).

3.1.3 Warnings

	Ensure the unit is fully grounded before connecting the power supply.
	Ensure the DC power supply circuit is disconnected before connecting to power to the unit.
	hdHost PS is considered a permanently connected device. Ensure a readily accessible disconnect device is incorporated external to the unit.

3.1.4 Weight

Always disconnect all external cables before lifting or moving the unit.

Unit	Weight
hdHost PS with 4 RF modules	31 lbs (14.1 kg)

3.2 Rack Mounting the hdHost PS

Before rack mounting the hdHost PS, you need:

- Mounting bracket and hardware
- #2 Phillips screwdriver

To mount the unit in a 2-post or 4-post equipment rack:

1. Attach the bracket to the rack using four fasteners appropriate for the rack type.

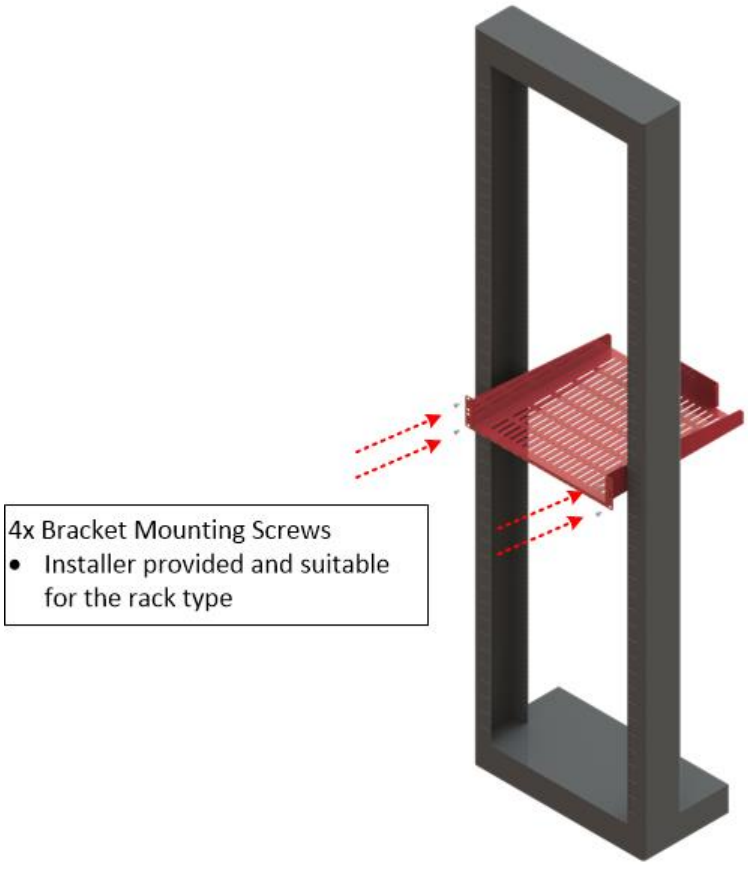


Figure 3-1: hdHost PS Bracket Installation

2. Slide the unit into the bracket from the front of the rack, until the front mounting brackets (ears) are flush with the front rack posts.

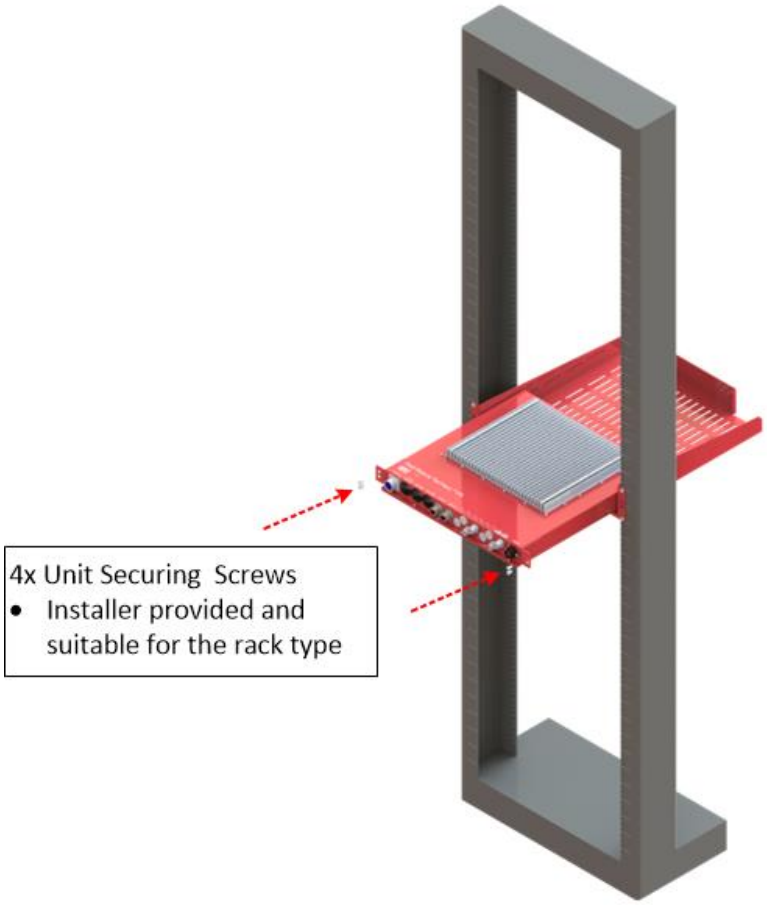


Figure 3-2: hdHost PS Unit Installation in Rack

3. Secure the chassis to the bracket using four fasteners appropriate for the rack type.

3.2.1 Installing Cable Management Trays

Install horizontal cable management trays and vertical cable management channels to manage base station feed, optical fiber, power, and Ethernet cabling.

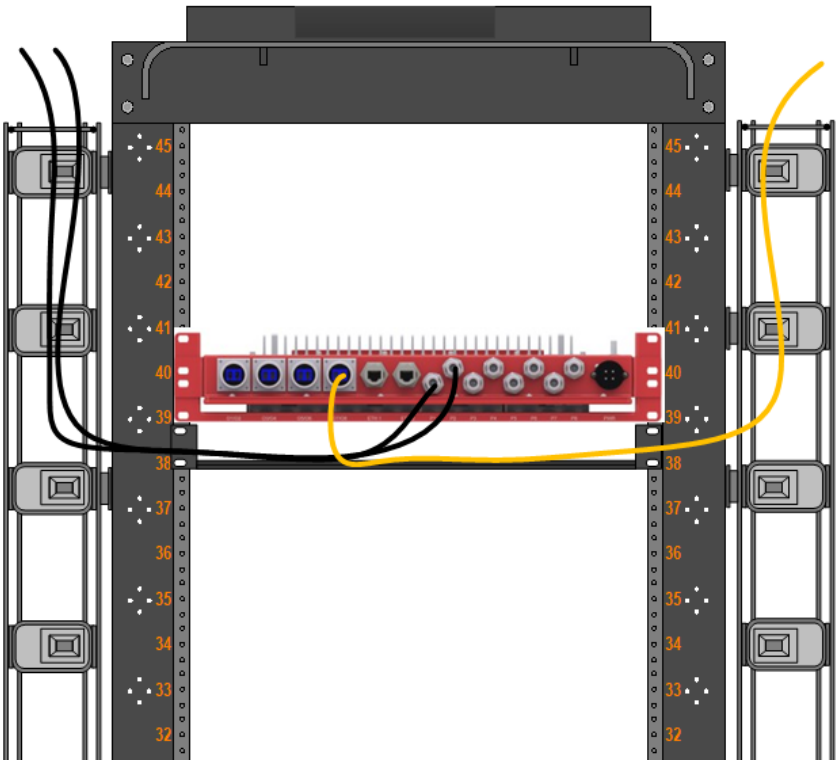


Figure 3-3: Installed Cable Management Trays

3.3 Grounding the hdHost PS

Before grounding the hdHost PS:

- Ensure the rack is grounded to the main facility ground
- Ensure the rack has a ground bar bus installed

3.3.1 Attaching the Chassis Ground

The ground lug for the hdHost PS is located at the rear of the unit.

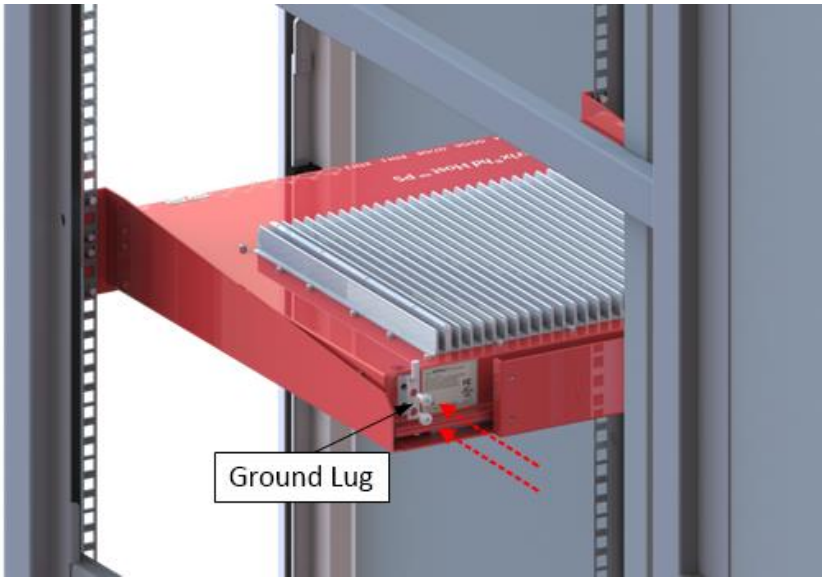


Figure 3-4: hdHost PS Ground Connction

To ground the hdHost PS:

1. Use a #2 Phillips screwdriver to remove ground lug from the chassis.
2. Insert a #10 AWG ground wire into the ground lug, and crimp using a #10 AWG die.
3. Reattach the ground lug to the chassis and tighten both screws (M4 screws provided).

3.3.2 Connecting hdHost PS Ground to Rack Ground

Connect the unit ground wire to the rack ground bus bar.

> Ground the hdHost PS to the rack ground bus bar before connecting any host cables.

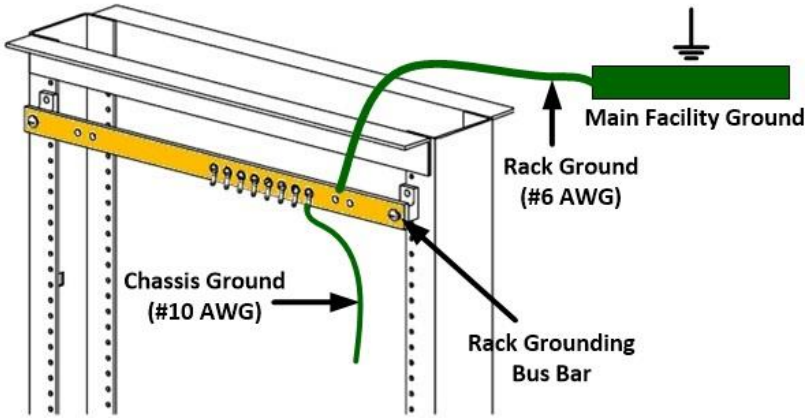


Figure 3-5: hdHost PS Ground to Rack Ground Bus Bar

3.4 Connecting DC Power

The hdHost PS requires an uninterrupted 48 VDC power supply.

There are two options for connecting power:

- Connect DC power directly to the unit from the fuse panel using the DC power connector and cable
- Use the Matrix AC/DC power supply if the power source is AC power

3.4.1 Option 1: Using a DC Power Connector and Cable

If the power source equipment is supplying DC power, use a DC cable at a suitable gauge given the distance from the fuse panel to the host, and assemble the provided DC power connector onto the cable.

Figure 3-6: DC Power Connector

The following table describes the maximum distance between the power source equipment and the unit. The values assume a maximum recommended loss of 3%. The voltages shown are voltages at the power sourcing equipment.

AWG	42 V (3% loss)	48 V (3% loss)	56 V (3% loss)
#12	162 ft (49 m)	211 ft (64 m)	287 ft (88 m)
#14	102 ft (31 m)	133 ft (40 m)	181 ft (55 m)
#16	64 ft (19 m)	83 ft (25 m)	114 ft (35 m)

Use a 2 or 3-wire cable with stranded bare copper wire with unshielded outer jacket. The nominal voltage required at the host is 48 VDC (with a range of 40 VDC to 58 VDC).

3.4.1.1 Assembling and Connecting the DC Power Cable

Before connecting DC power to the hdHost PS, verify that the power source supplies 48 VDC to the unit, and that any intermediate connections are secure.

To assemble the DC power cable, you need:

- DC cable connector (provided)
- Multi-conductor #12 AWG to #16 AWG stranded bare copper with unshielded outer jacket
- Stripping tool
- Flat head screwdriver

Stripping Lengths	
Outer jacket	0.78 inch (20 mm)
Wire	0.35 inch (9 mm)

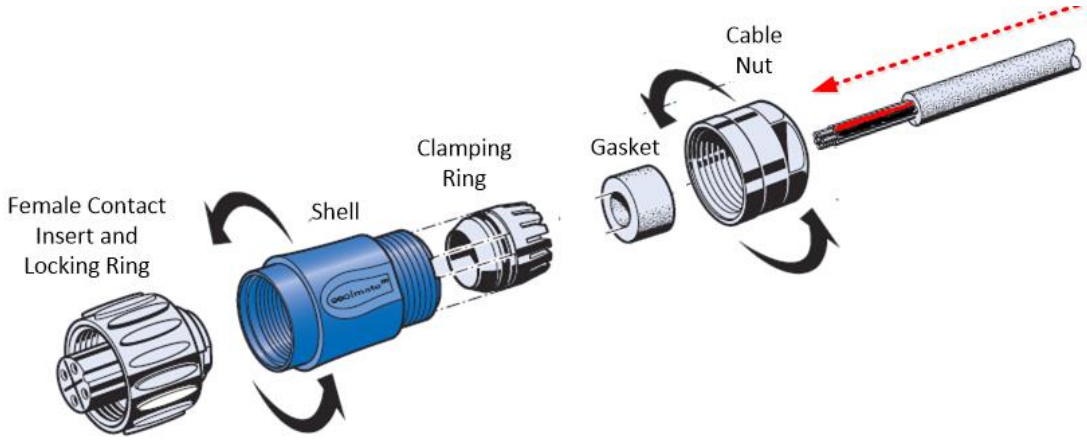
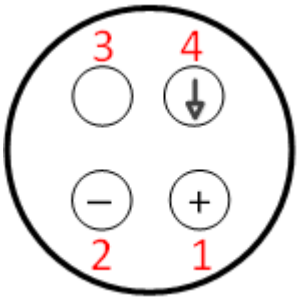


Figure 3-7: DC Power Cable Assembly

Ensure that wire leads on DC-input power wires are not exposed. DC-input power can conduct harmful levels of electricity.

To assemble the DC power cable:

1. Unscrew the cable assembly components.
2. Feed the positive and negative wires through the cable nut, gasket, clamping ring, and shell.
3. Attach the wires to the terminals in the contact insert using a small flat screwdriver. Pinouts are numbered on the contact insert:



1 = Positive
2 = Negative
3 = Not used
4 = Power source ground

Only connect power source ground if the power supply equipment is located in a different facility than the host.

4. Re-assemble the DC power connector by following the assembly drawing.

To attach the DC power cable to the unit

1. Connect the power cable to the DC power interface on the unit and tighten the locking ring. The fit should be snug. Do not overtighten.

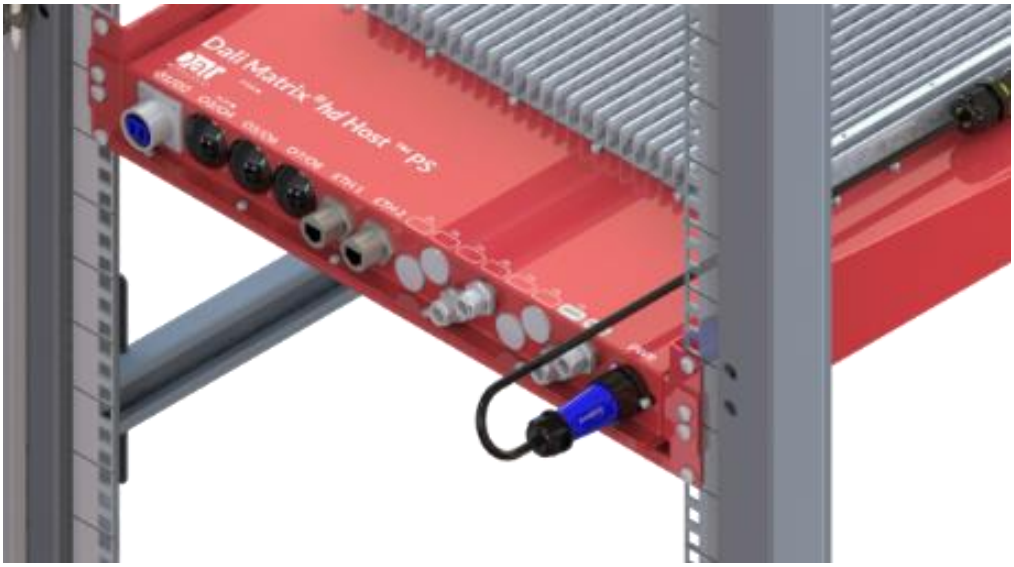


Figure 3-8: hdHost PS DC Power Connection

3.4.2 Option 2: Using the Matrix AC/DC Power Supply

If you have an AC power source, use the AC/DC power supply with attached AC cable and plug, and DC cable and connector.

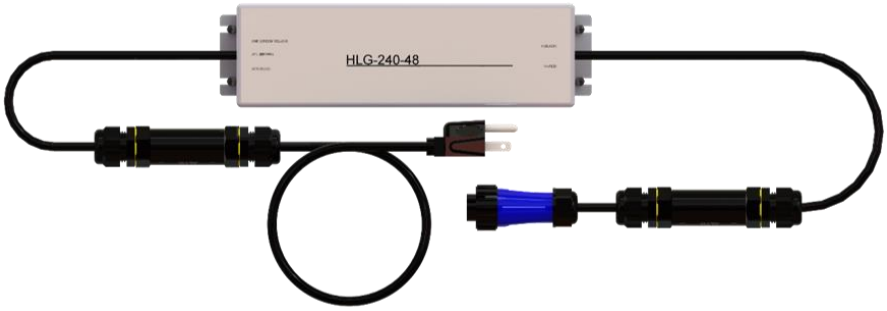


Figure 3-9: AC/DC Power Supply for the hdHost PS

To mount the AC/DC power supply:

1. Attach the power supply to the plate at the back of the bracket using the mounting hardware provided.

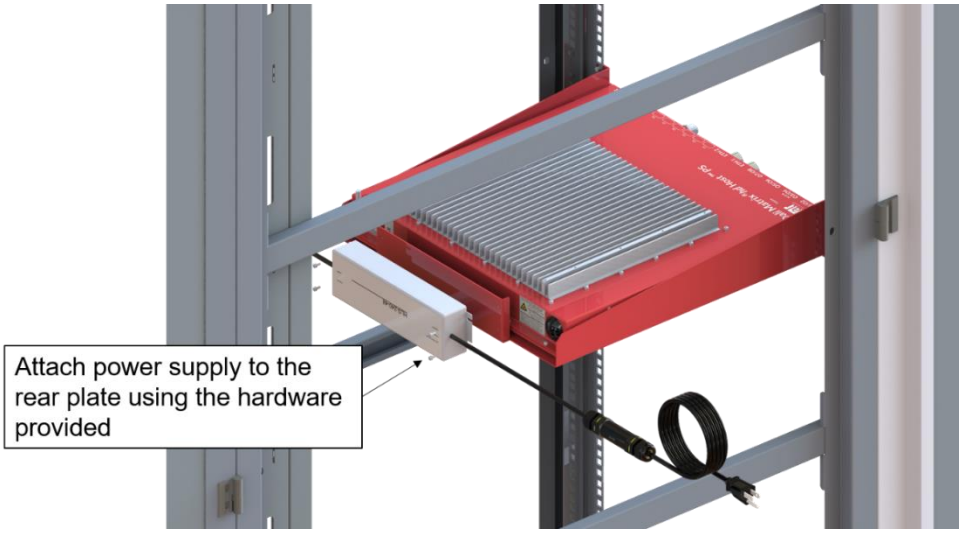


Figure 3-10: AC/DC Power Supply Installation for the hdHost PS

2. Plug the AC cable into the power source. And connect the DC connector to the Power interface on the front panel. Insert the connector, and turn the black locking ring clockwise to tighten.

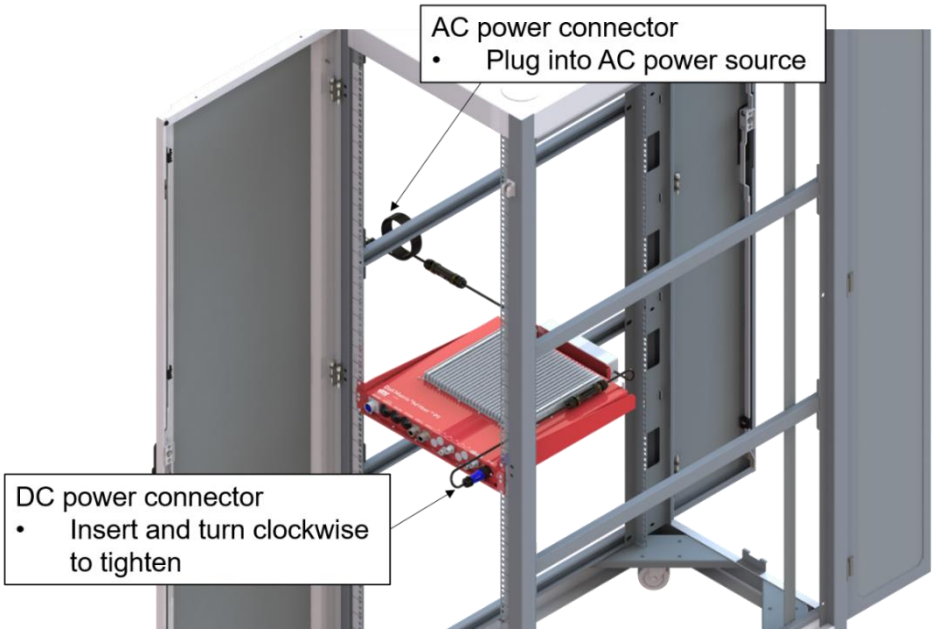


Figure 3-11: DC Power Cable Installation for the hdHost PS

3.5 Verifying Power and Standby Mode

After the power is connected to the grounded hdHost PS, confirm the unit starts up and enters Standby mode. Power and Alarm LEDs on the top left of the unit report a startup sequence. See Installation Verification.

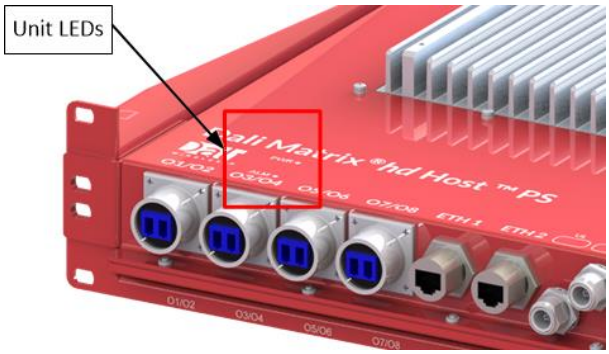


Figure 3-12: hdHost PS Unit LEDs

To verify power at the hdHost PS:

1. Apply power at the AC or DC power source.
2. Wait about two minutes while the startup sequence completes.
3. Confirm that the unit is in Standby mode. In Standby, the hdHost PS is powered, but not passing active RF signals. In Standby mode, the unit LEDs are:
   - **Pwr** LED: green
   - **Alm** LED: green or orange
4. If the unit LEDs do not indicate Standby mode, check the power supply and connections.

4 HDHOST PS RF CABLING

This chapter describes how to:

- Verify RF cable power and performance
- Connect base station RF feeds to the hdHost PS

4.1 Connecting Base Station Uplink and Downlink Feeds

Base station feed cables terminated at the hdHost PS should be 1/2-inch and 7/8-inch coaxial cable. Always consider and respect the minimum bend radius provided by the cable manufacturer

4.1.1 Verifying RF Cable Power and Performance

First, verify that power levels on the RF feeds are within the specified range. For the hdHost PS, the base station power level range is -10 dBm to +10 dBm.

Excessive RF power levels can cause severe damage to the hdHost PS.

Next, verify base station feed cable performance and test each RF coaxial cable for return loss.

To verify base station feed cable power levels

1. Connect the base station feed to an external spectrum analyzer, and then turn on power to the base station.
2. Check the RF power levels on each feed, and adjust base station power levels as required.
3. Label the base station feed cables appropriately.

4.1.2 Connecting RF Cables to the hdHost PS

The hdHost PS has up to eight, N-type simplex RF interfaces for connecting a maximum of four public safety bands. For each band, connect the uplink (UL) and downlink (DL) feed cable.

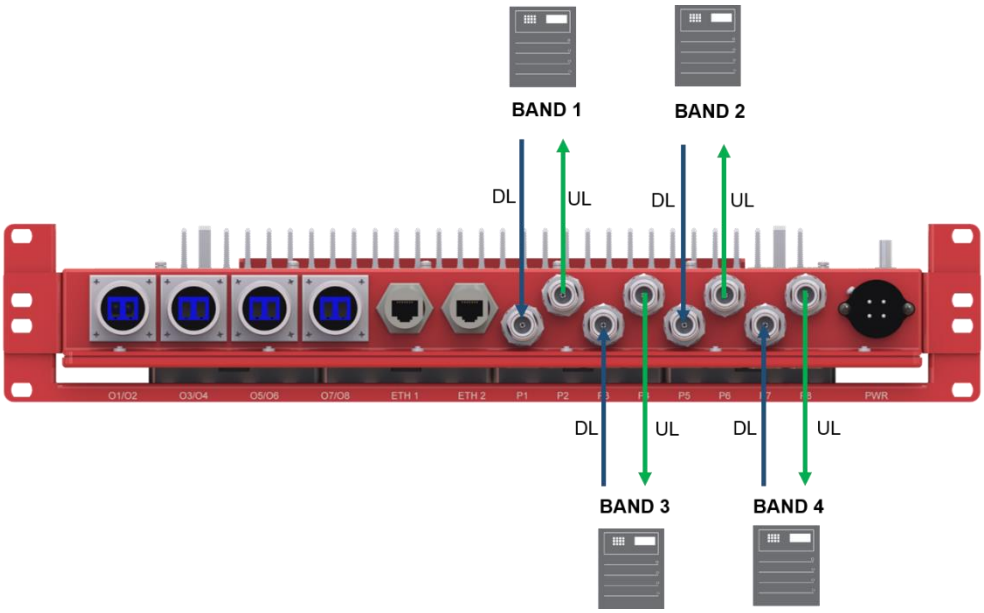


Figure 4-1: hdHost PS RF Intefaces and Connections

5 AIRHOST PS & REMOTE TYPE 1 CHASSIS INSTALLATION

This chapter describes how to:

- Prepare for installation
- Wall mount the unit
- Rack mount the unit
- Ground the unit
- Connect DC power
- Verify power

5.1 Type 1 Chassis Specifications

The airHost PS and remote are the same physical unit.

Unit	Description
	• Available for airHost33 PS and hd33 PS remote units • Dimensions (H x W x D): 16.9 x H 18.4 x D 7.6 inches (430 x 466 x 194 mm) • Max. weight: 50 lbs (22.7 kg) • NEMA 4/IP 66 compliant enclosure • Integrated cover and mounting bracket • Exterior-facing pluggable RF modules • Internal multiplexer option (shown) • Convection cooled • 1 or 2 RF modules

5.2 Preparing for Installation

Before installing the units, be familiar with the following installation workflow, power consumption, and warnings.

For Declaration of Conformity, FCC compliance and Safety Information, see Regulatory Compliance at the beginning of this manual.

5.2.1 Power Consumption

The maximum power consumption of the type 1 unit is 195 W. For thermal load and power consumption details per RF module, see Appendix D.

5.2.2 Warnings

	This equipment is to be installed in a Restricted Access Area. When installed in a wet, outdoor area, turn power off prior to unit modifications.
	This equipmen is considered a permanently connected device. A readily accessible disconnect device shall be incorporated external to the equipment.

5.2.3 Weight

Remotes weigh up to 50 lbs (22.7 kg). Take appropriate safety measures when handling remotes.

5.2.4 Remote Orientation

The unit remote must be oriented on the wall with the physical interfaces facing down to reduce dust and prevent damage to the connectors.

Do not orient the remote with the interfaces facing up, sideways on the wall, or horizontal with the ground (such as on the floor or shelf), as this will reduce the operational temperature range.

5.3 Wall Mounting

The type 1 chassis can be wall mounted. The removable cover, or shell, serves as both a protective enclosure and a mounting bracket for the unit. The bracket depth depends on the RF interface options available. For unit dimensions, see Appendix B.

To wall mount the type 1 chassis, you need:

- Type 1 bracket/cover (provided)
- 9 screws suitable for the type of wall material
- #2 Phillips screwdriver

Figure 5-1: Type 1 Chassis Wall Mounting

To install the bracket on a wall:

1. Position the bracket in the desired location and mark the position of the nine mounting screws. The unit requires room for connection cabling below the interface panel. Do not install the bracket so that the physical interfaces are not accessible.
2. Orient the bracket so that the open notch is at the bottom, and the air vents are at the top.

Figure 5-2: Type 1 Chassis Mounting Bracket

3. Confirm that there will be sufficient space to connect cables, and to inspect and maintain the unit after it is mounted.
4. Pre-drill pilot holes for the bracket installation screws.
5. Use screws suitable for the type of wall to secure the bracket to the surface.
6. With the back of the unit facing the bracket, insert the shoulder bolts into the notches on the bracket, and slide the unit down so that it locks in place.

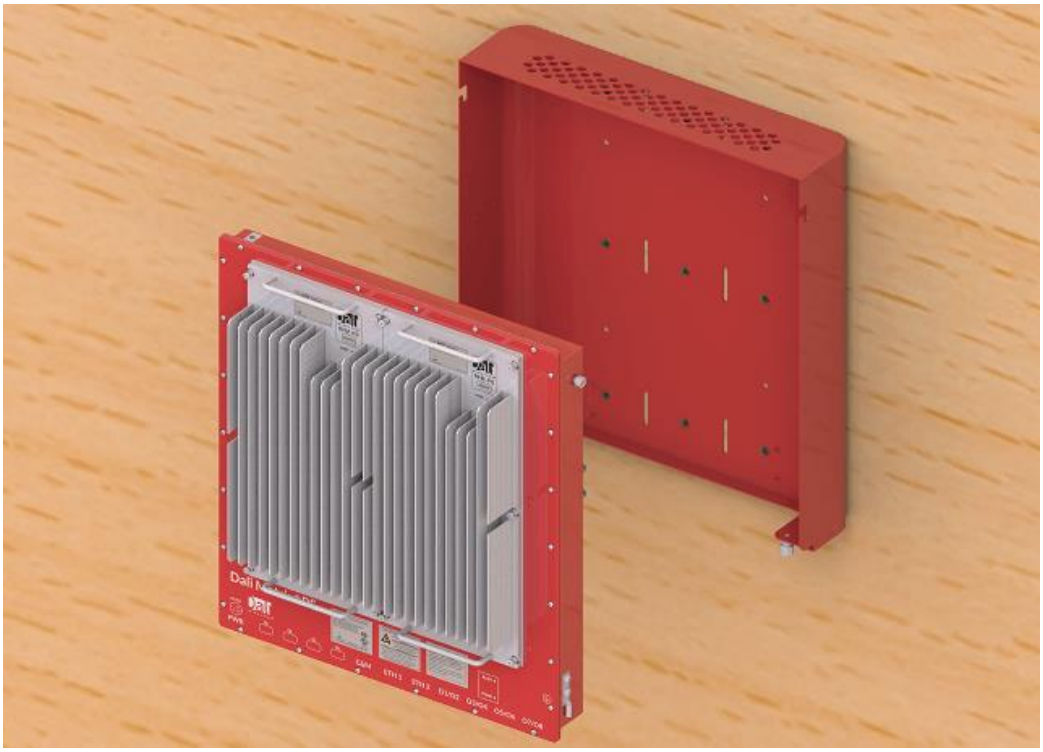


Figure 5-3: Type 1 Chassis Wall Mounting Installation

7. Using a #2 Phillips screwdriver, tighten the locking screws on both sides of the unit to secure the unit to the bracket.

Figure 5-4: Type 1 Chassis Securing Screws

5.4 Rack Mounting

For mounting the type 1 chassis on a 2-post or 4-post 19" rack, a standard rack mount kit is available.

To rack mount the type 1 chassis, you need:

- Type 1 bracket/cover (provided)
- Standard rack kit, with mounting bars and hardware (provided on request)
- 8 screws suitable for the rack type
- #2 Phillips screwdriver

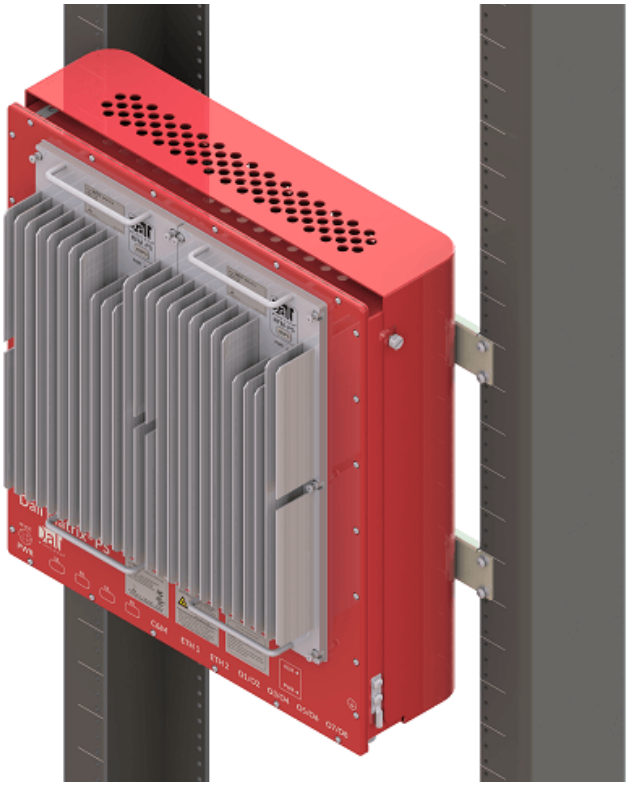


Figure 5-5: Type 1 Chassis Rack Mounting Option

The type 1 standard rack kit mounts the unit in front of the rack posts and comes with two flat mounting bars, four pre-installed snap-in nuts, and mounting hardware:

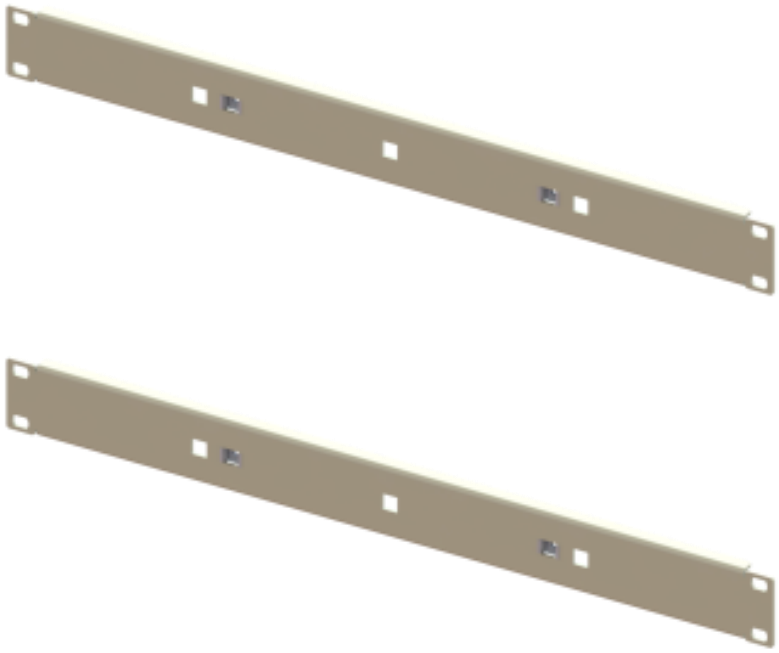


Figure 5-6: Type 1 Chassis Standard Rack Mounting Kit

To rack mount the unit:

1. Ensure the equipment rack has adequate support and is bolted to the floor and ceiling, as required by local regulatory authorities.
2. Attach the bars to the bracket using the hardware provided. Once installed, the bars are spaced 5RU apart. Ensure any rack-specific mounting hardware is installed in the rack at the appropriate spacing.

Figure 5-7: Type 1 Bracket and Bar Assembly

3. With the bars attached, mount the bracket assembly to the rack using hardware appropriate for the rack type.

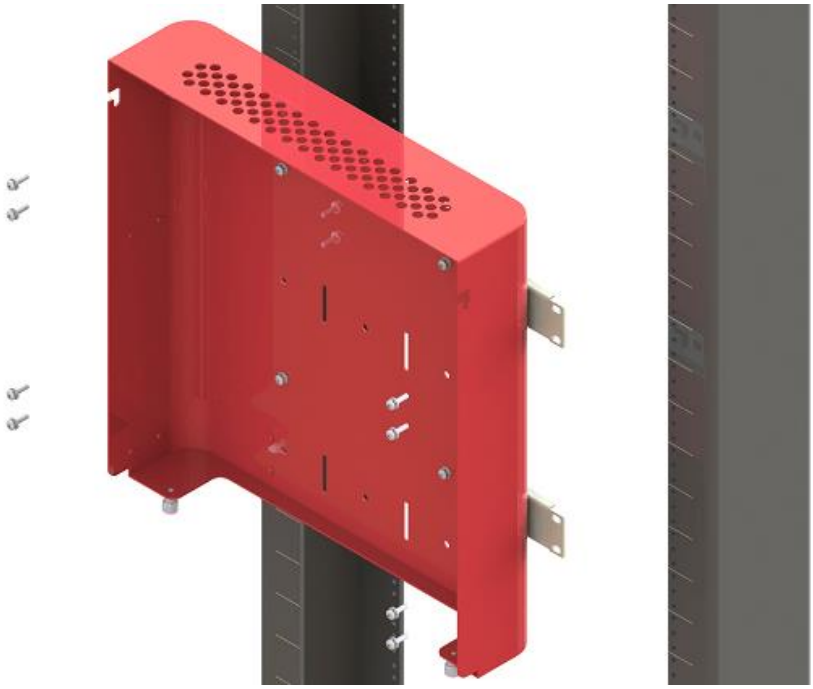


Figure 5-8: Type 1 Bracket and Bar Assembly Installation

4. With the back of the unit facing the bracket, insert the shoulder bolts into the slots on the bracket, and slide the unit down so that it locks in place.

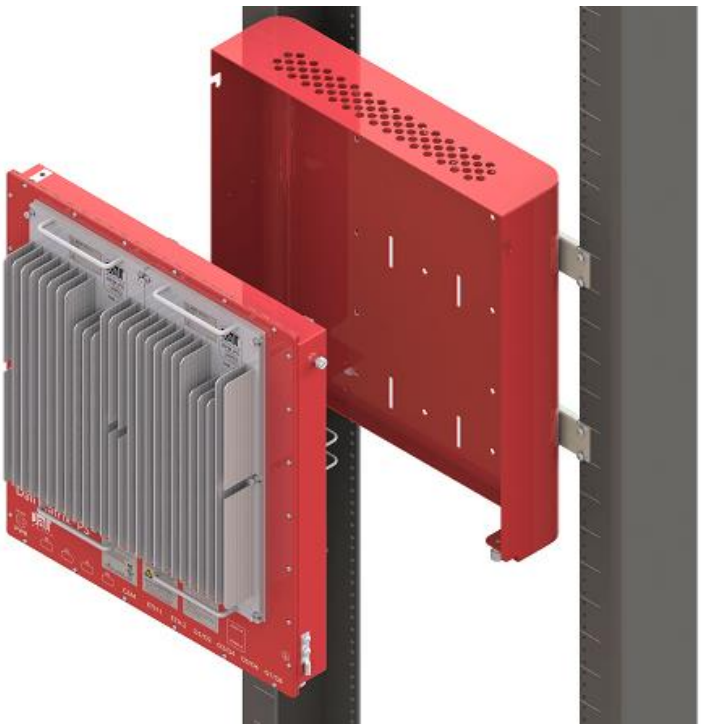


Figure 5-9: Type 1 Chassis Rack Mounting Installation

5. Finger tighten the locking screws to secure the unit to the bracket.

5.4.1 Other Rack Mounting Options

A recessed rack kit is also available for mounting the unit inside a cabinet or enclosed rack.

Figure 5-10: Type 1 Recessed Rack Mounting Kit

5.5 Grounding

To ground the type 1 chassis, you need:

- Ground lug (provided on the unit)
- #2 Phillips screwdriver
- #10 AWG ground wire and crimping tool

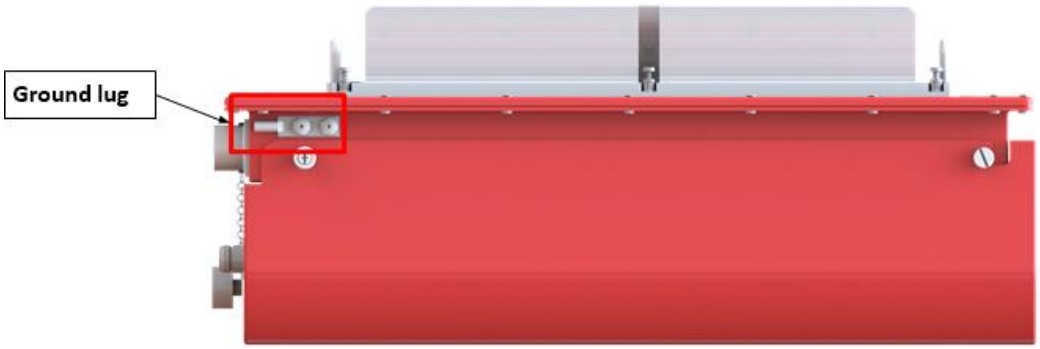


Figure 5-11: Type 1 Chassis Ground Connection

To ground the unit:

1. Use a #2 Phillips screwdriver to remove the ground lug.
2. Insert #10 AWG ground wire into the ground lug and crimp.
3. Reattach the ground lug to the remote and tighten both screws.
4. Run the ground wire to the facility grounding point for the unit and secure it.

5.6 Connecting DC Power

The airHost PS and remote type 1 units require an uninterrupted 48 VDC power supply.

There are two options for connecting power:

- Connect DC power directly to the unit from the fuse panel using the DC power connector and cable
- Use the Matrix AC/DC power supply if the power source is AC power

5.6.1 Option 1: Using a DC Power Connector and Cable

If the power source equipment is supplying DC power, use a DC cable at a suitable gauge given the distance from the fuse panel to the remote, and assemble the provided DC power connector onto the cable.

To assemble the DC power cable, see Assembling and Connecting the DC Power Cable for instructions.

Figure 5-12: DC Power Connector

5.6.2 Option 2: Using the Matrix AC/DC Power Supply

If you have an AC power source, use the AC/DC power supply with attached AC cable and plug, and DC cable and connector.

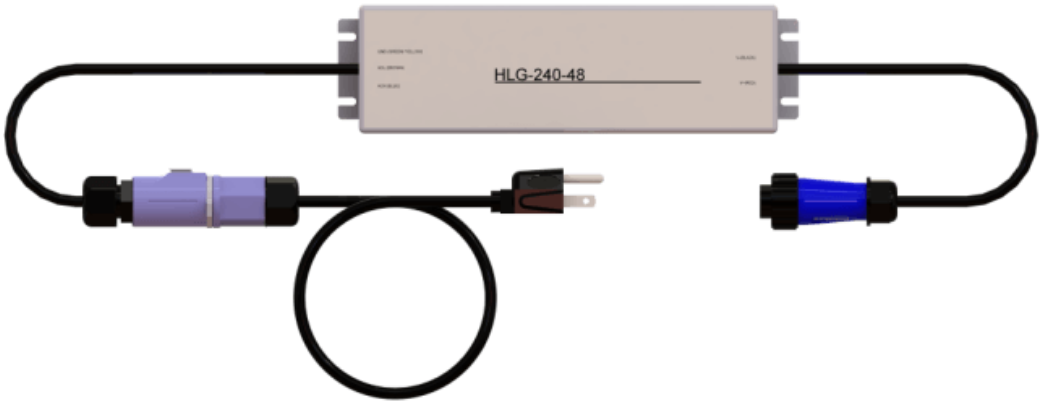
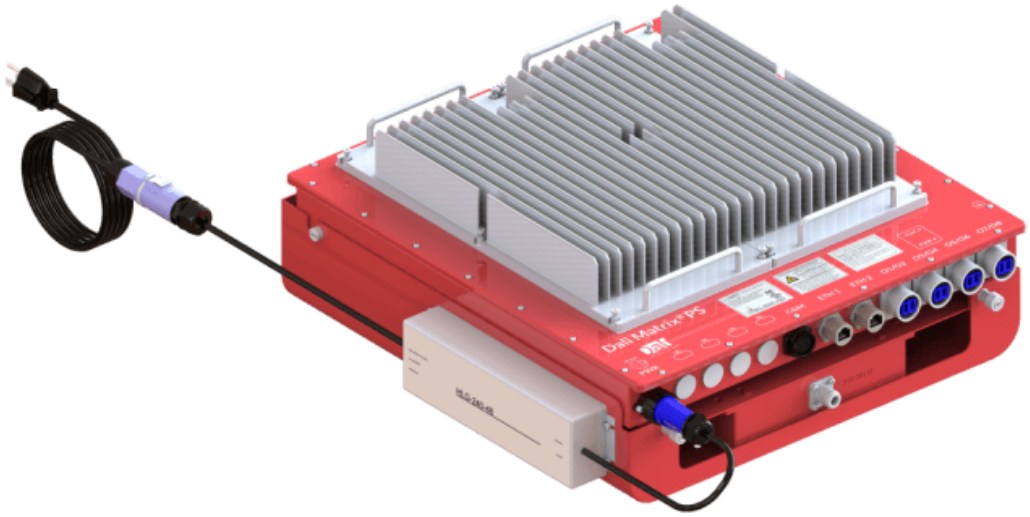


Figure 5-13: AC/DC Power Supply for the Type 1 Chassis

To mount the AC/DC power supply:

1. Attach the power supply to the predrilled holes on the side of the unit using the mounting hardware provided.



2. Plug the AC cable into the power source.
3. Connect the DC connector to the Power interface on the front panel. Insert the connector, and turn the black locking ring clockwise to tighten.

5.7 Verifying Power and Standby Mode

Confirm the unit powers on in Standby mode. In Standby, the unit does not receive or transmit analog RF signals.

To power on the type 1 unit:

1. Turn on DC power at the power source equipment.
2. Observe the LED startup sequence. See Installation Verification. If the unit fails to power on, check the DC power supply and connections.

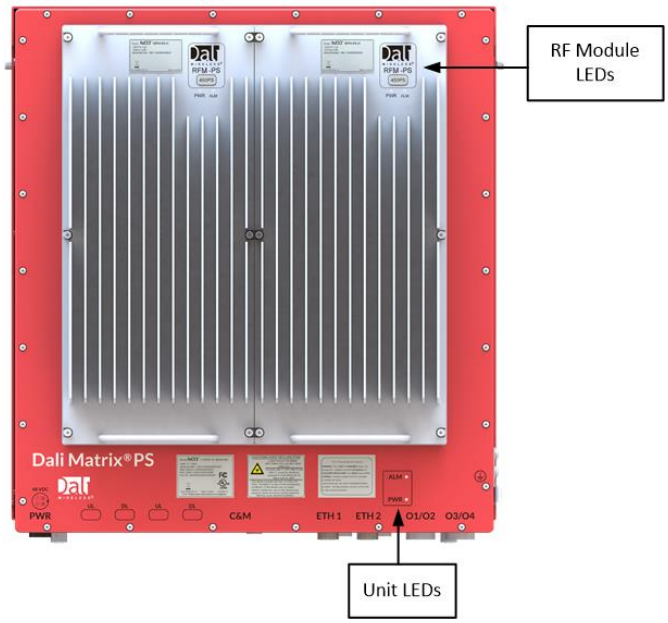


Figure 5-14: Type 1 Chassis LEDs

Unit LEDs	Color	Description
Pwr	● Green	Power is on
Alm	● Orange	Minor alarm indicating no RF signal detected

RF LEDs	Color	Description
Pwr	● Red	RF signals are not being sent or received
Alm	● Orange	Minor alarm indicating no RF signal detected

6 AIRHOST PS & REMOTE TYPE 2 CHASSIS INSTALLATION

This chapter describes how to:

- Prepare for installation
- Wall or post mount the unit
- Rack mount the unit
- Ground the unit
- Connect DC power
- Verify power

6.1 Type 2 Chassis Specifications

The airHost PS and remote are the same physical unit.

Unit	Description
	• Available for airHost PS and remote units • Dimensions (H x W x D): 17.1 x 27.4 x 8.7 inches (434 x 696 x 220 mm) • Max weight: 59.5 lbs (27 kg) • NEMA/IP 66 compliant enclosure • Locking door • External mounting bracket (provided) • Interior pluggable RF modules • Internal duplexer/multiplexer option • Fan cooled • Up to 4 RF modules

6.2 Preparing for Installation

Before installing the unit, become familiar with the following installation workflow, power consumption, and warnings.

For FCC compliance and Safety Information, see the FCC statements at the beginning of this document.

6.2.1 Power Consumption

The maximum power consumption of the type 2 unit is 340 W. For thermal load and power consumption details per RF module, see Appendix D.

6.2.2 Input Power Requirements

The units have the following input power requirements:

- Power supply cables with a minimum temperature rating of 65° C
- Building power input protection of maximum 28 A

6.2.3 Warnings

	This equipment is to be installed in a Restricted Access Area. When installed in a wet, outdoor area, turn power off prior to unit modifications.
	This equipmnet is considered a permanently connected device. A readily accessible disconnect device shall be incorporated external to the equipment.

6.2.4 Weight

No. RF Modules	Weight
4	59.5 lbs (27 kg)

6.2.5 Remote Orientation

Do not mount the remote in a horizontal or an inverted vertical orientation, as this will impair fan operation and reduce the operational temperature range. Contact Dali Customer Service for more information.

6.3 Wall or Post Mounting

The type 2 chassis can be wall mounted to a wall or post using the mounting bracket provided. For unit dimensions, see Appendix B.

To wall mount the type 2 chassis, you need:

- Wall mounting: 9 screws suitable for the type of wall material
- Post mounting: metal strapping for mounting on a 3.5-inch to 6.5-inch post
- Type 2 bracket and 2 x M6 screws (provided)
- #2 Phillips screwdriver

Figure 6-1: Type 2 Chassis Wall Mounting

To install the bracket on a wall:

1. Position the bracket in the desired location and mark the position of the nine screws. Ensure there is sufficient space to connect cables, and to inspect and maintain the unit after mounting.
2. Orient the bracket so that the flange is on the bottom.

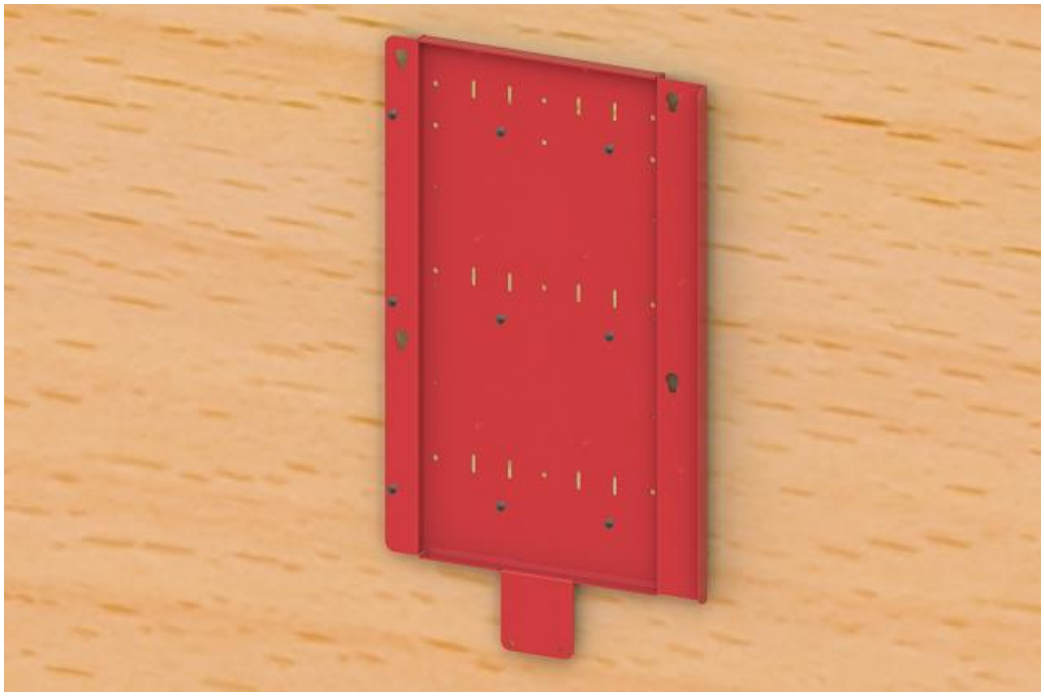


Figure 6-2: Type 2 Chassis Mounting Bracket

1. Pre-drill pilot holes for the bracket installation screws.
2. Use screws suitable for the type of wall to secure the bracket to the surface.

To install the bracket on a post:

1. Ensure the post has a solid foundation.
2. Position the bracket in the desired location and mark the top of the bracket on the pole. Ensure there will be sufficient space to cable the remote and to inspect and maintain it after it is mounted.
3. With another person assisting, hold the bracket in the desired position and thread strapping through the top slots and around the post.

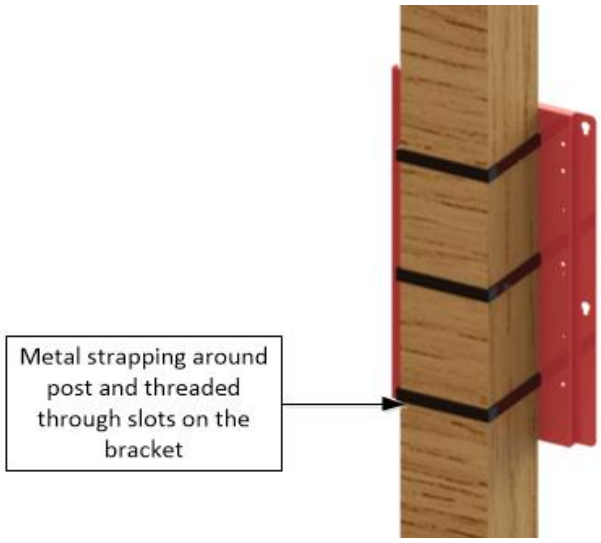


Figure 6-3: Type 2 Bracket Post Mounting

4. Tension the strapping firmly, but not enough to bend the bracket, and then crimp. Ensure that the bracket is level and vertical, with the securing flange on the bottom.

5. Repeat for the remaining middle and bottom strapping slots.

To attach the remote to the bracket:

1. With the back of the unit facing the bracket, insert the shoulder bolts into the slots, and slide the unit down so that it locks in place.

Figure 6-4: Type 2 Chassis Wall or Post Mounting Installation

2. Install the two M6 screws through the front of the unit into the bracket flange, and tighten with a Phillips screwdriver.

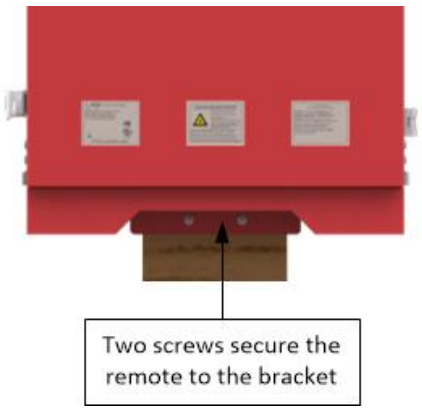


Figure 6-5: Type 2 Unit Securing Screws

6.4 Rack Mounting

For mounting the type 2 chassis on a 2-post or 4-post 19-inch rack, a standard rack mount kit is available.

To rack mount the type 1 chassis, you need:

- Type 2 bracket and 2 x M6 screws (provided)
- Standard rack kit, with mounting bars and hardware (provided on request)
- 8 screws suitable for the rack type
- #2 Phillips screwdriver

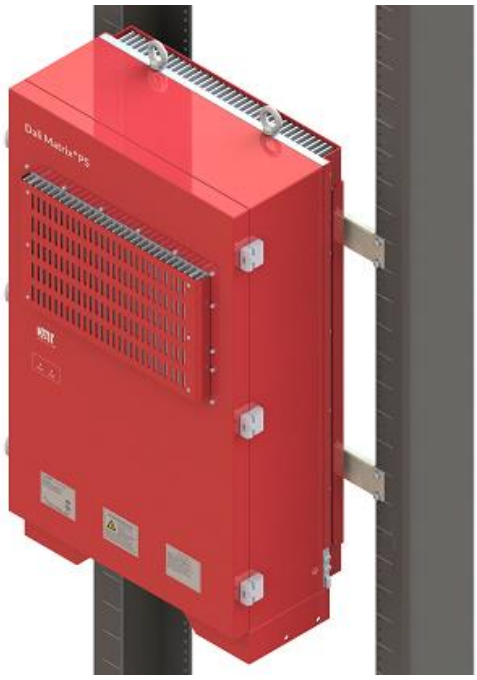


Figure 6-6: Type 2 Rack Mounting Option

The type 2 standard rack kit mounts the unit in front of the rack posts and includes two flat mounting bars, six pre-installed snap-in nuts, and mounting hardware.

Figure 6-7: Type 2 Chassis Standard Rack Mounting Kit

To rack mount the unit:

1. Ensure the equipment rack has adequate support, and is bolted to the floor and ceiling as required by local regulatory authorities.
2. Attach the bars to the bracket using the hardware provided. One installed, the bars are spaced 9RU apart. Ensure any rack-specific mounting hardware is installed in the rack at the appropriate spacing.

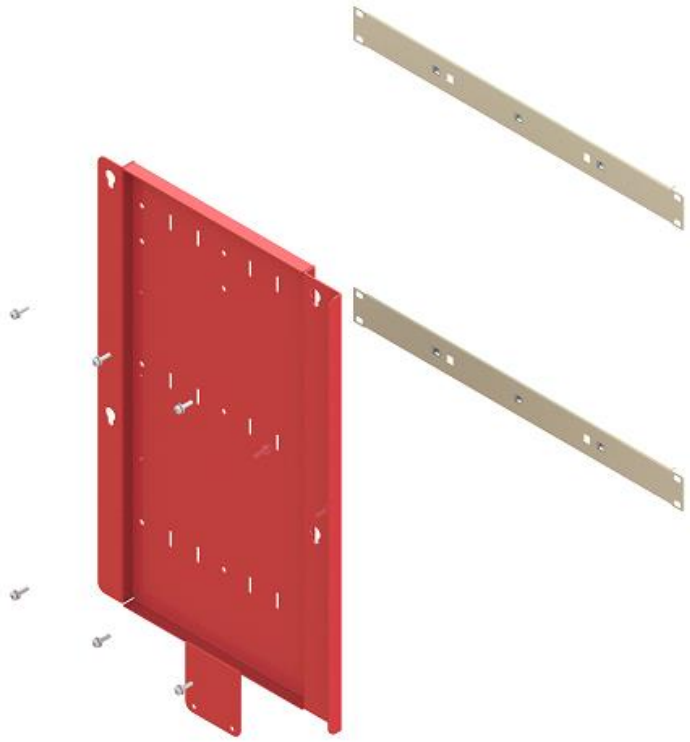


Figure 6-8: Type 2 Chassis Bracket and Bar Assembly

3. Mount the bracket assembly to the rack using hardware appropriate for the rack type.

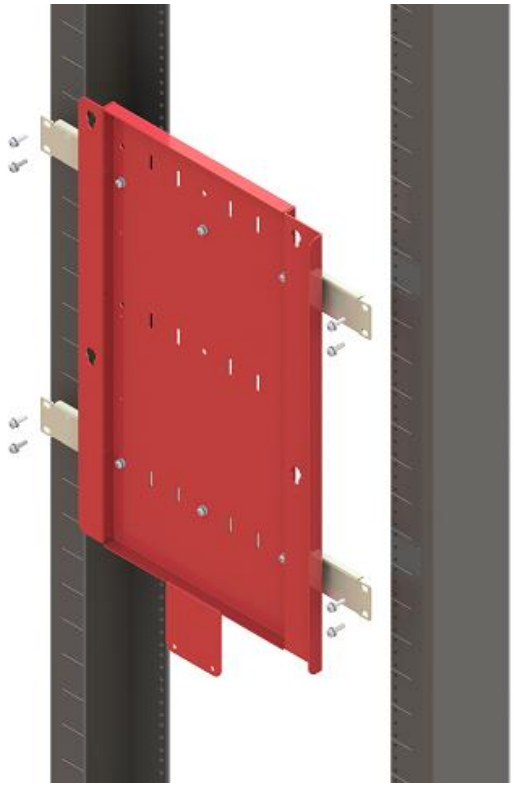


Figure 6-9: Type 2 Bracket Bracket and Bar Assembly Installation

4. With the back of the unit facing the bracket, insert the shoulder bolts into the slots, and slide the unit down so that it locks in place.

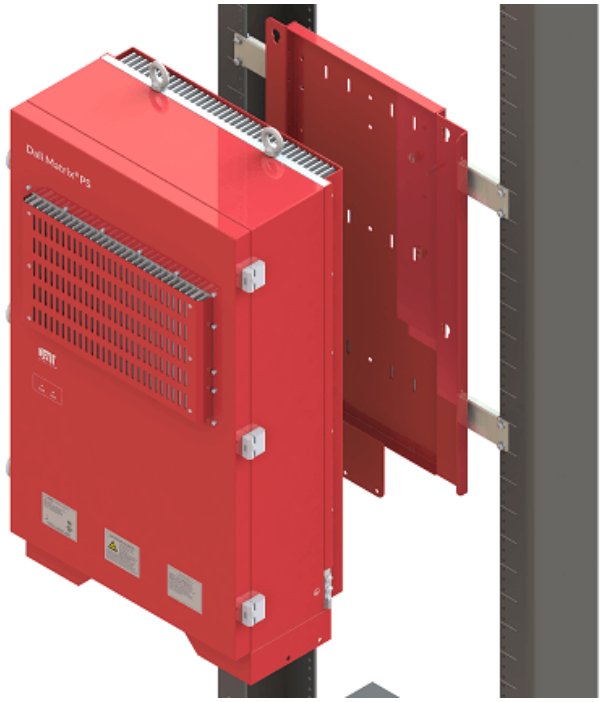


Figure 6-10: Type 2 Chassis Rack Mounting Installation

5. Install the two M6 screws through the front of the unit into the bracket flange, and tighten with a Phillips screwdriver.

6.5 Grounding

To ground the type 2 chassis, you need:

- Ground lug (provided on the unit)
- #2 Phillips screwdriver
- #10 AWG ground wire and crimping tool

Figure 6-11: Type 2 Chassis Ground Connection

To ground the unit:

1. Use a #2 Phillips screwdriver to remove the ground lug.
2. Insert #10 AWG ground wire into the ground lug and crimp.
3. Reattach the ground lug to the remote and tighten both screws.
4. Use a zip tie or other fastener to secure the ground wire to a post or other cable management.
5. Run the ground wire to the facility grounding point and secure it.

6.6 Connecting DC Power

The airHost PS and remote type 2 units require an uninterrupted 48 VDC power supply.

There are two options for connecting power:

- Connect DC power directly to the unit from the fuse panel using the DC power connector and cable.
- Use the Matrix AC/DC power supply if the power source is AC power

6.6.1 Option 1: Using a DC Power Connector and Cable

If the power source equipment is supplying DC power, use a DC cable at a suitable gauge given the distance from the fuse panel to the remote, and assemble the provided DC power connector onto the cable.

To assemble the DC power cable, see Assembling and Connecting the DC Power Cable for instructions.

Figure 6-12: DC Power Connector

The following table describes the maximum distance between the power source equipment and the unit. The values assume a maximum recommended loss of 3%. The voltages shown are voltages at the power sourcing equipment.

AWG	42 V (3% loss)	48 V (3% loss)	56 V (3% loss)
AWG #10	47 ft (14 m)	61 ft (19 m)	83 ft (25 m)

These values assume the following:

- Maximum power consumption is 340 W (with PoE ports in use)
- Wire gauge is AWG #10 stranded bare copper
- Maximum recommended loss of 3%

6.6.2 Option 2: Using the Matrix AC/DC Power Supply

If you have an AC power source, use the AC/DC power supply with attached AC cable and plug, unterminated DC cable, and mounting plate.

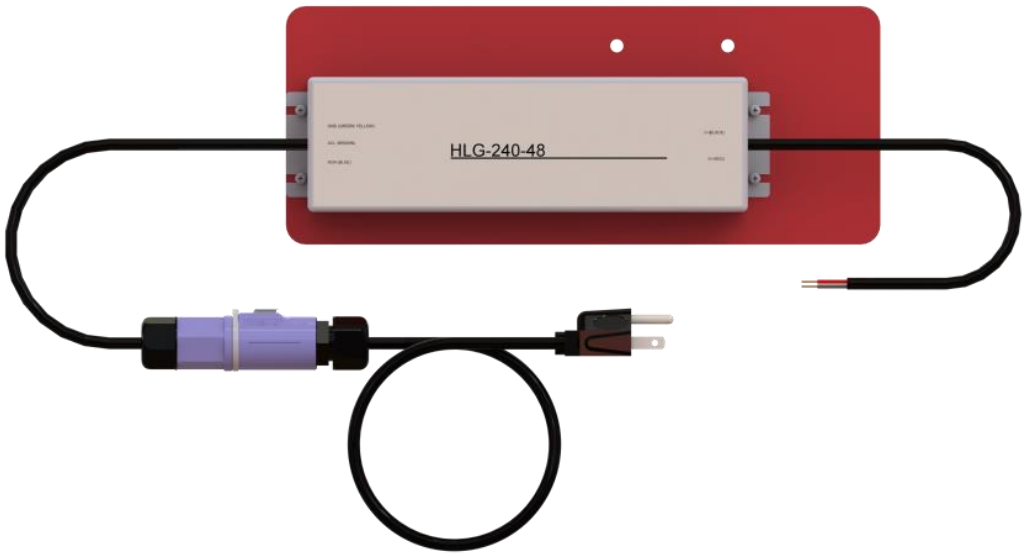


Figure 6-13: AC/DC Power Supply for the Type 2 Chassis

To mount the AC/DC power supply:

1. Attach the power supply to the mounting plate using the hardware provided.
2. On the bottom flange of the unit, remove the two screws securing the unit to the bracket.
3. Line up the holes on the mounting plate with the holes on the bracket flange, and reattach the screws.

Figure 6-14: AC/DC Power Supply for the Type 2 Chassis

4. Plug the AC cable into the power source.
5. Connect the bar DC cable to the terminal block inside the unit, as described in Connecting the DC Power Cable.

6.6.2.1 Connecting the DC Power Cable

The connection point for input power is a clamp-style terminal block inside the unit. See Figure 6-15.

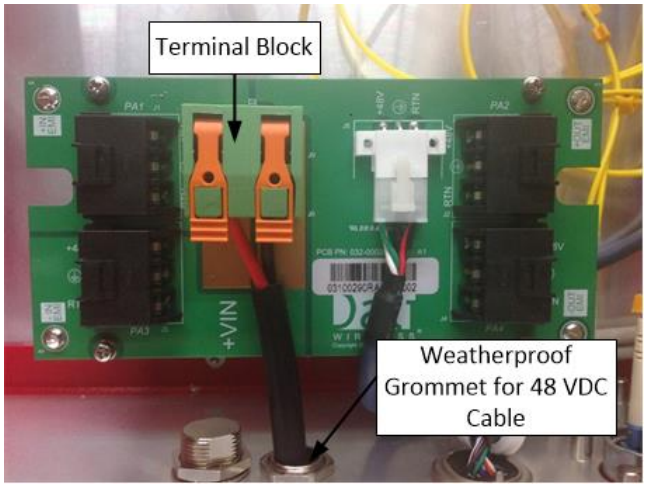


Figure 6-15: Terminal Block Inside the Type 2 Chassis

To connect the power cable to the terminal block:

1. Open the door to the unit, and then open the orange clamps on the terminal block.
2. Insert the DC cable through the grommet on the interface panel.
3. Insert the wire leads into the terminal block, making sure positive and negative wires match the labels.
4. Close the clamps to lock the wires to each terminal.
5. Tighten the grommet on the interface panel to create a weatherproof seal around the cable.

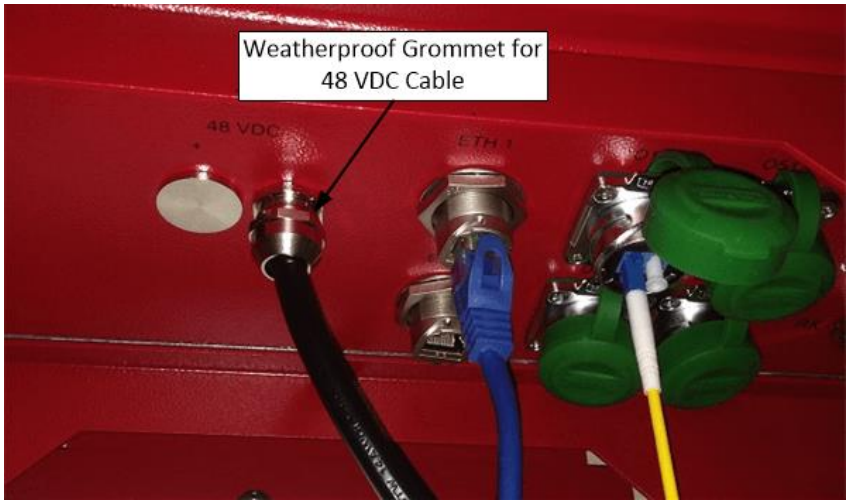


Figure 6-16: Type 2 Chassis DC Power Interface

6.7 Verifying Power and Standby Mode

Confirm the unit powers on in Standby mode. In Standby, the unit does not receive or transmit analog RF signals.

To power on the type 2 unit:

1. Turn on DC power at the power source equipment.
2. Confirm Standby mode by observing the unit LEDs. For a description of the LED startup sequence, see Installation Verification.

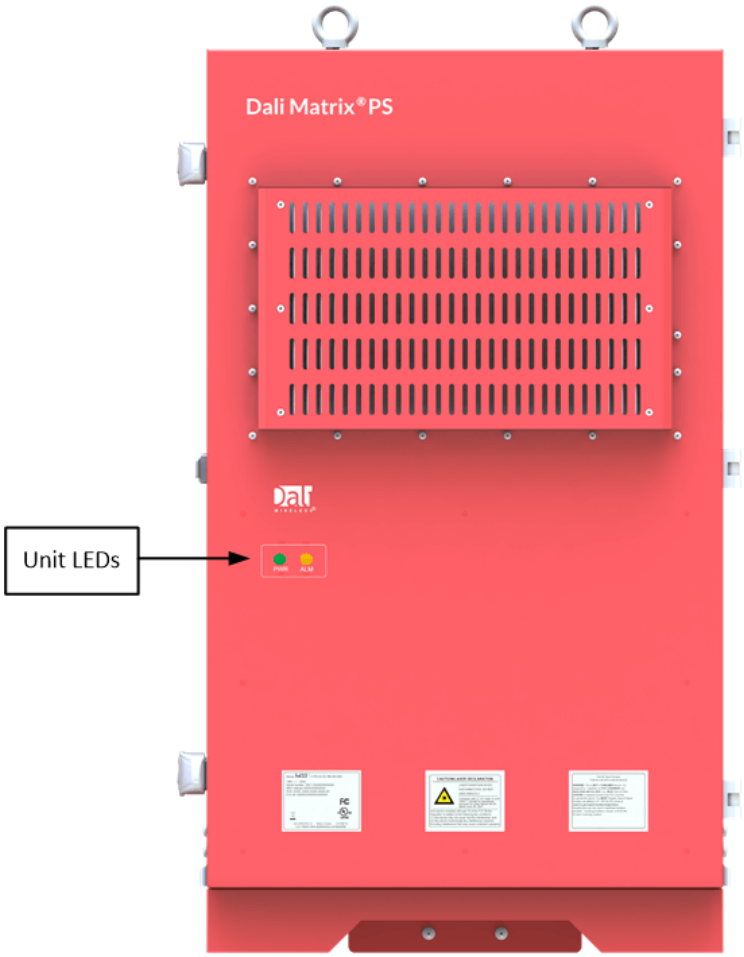


Figure 6-17: Type 2 Chassis LEDs

Unit LEDs	Color	Description
Pwr	● Green	Power is on
Alm	● Orange	Minor alarm indicating no RF signal detected

6.8 Locking the Unit

The type 2 chassis is equipped with a locking door to restrict access. Keys are common to all units.

Figure 6-18: Type 2 Chassis Lock

7 AIRHOST PS & REMOTE RF CABLING

The airHost PS and remote have a number of RF interface options for connecting to public safety signal sources. Depending on the system design and public safety frequency bands being used, an external pass-band filter may be required.

If an external filter is required, the unit is equipped with a number of simplex RF interfaces. If there is no filter, the RF feed connects directly to an internal duplexer or multiplexer.

The number of RF interfaces available on the unit depends on the RF design. This chapter describes airHost PS and remote units with the maximum number of interfaces for each type 1 and type 2 chassis

This chapter describes how to:

- Connect RF feeds to units with simplex interfaces and connected to an external filter
- Connect RF feeds to units with an internal duplexer or multiplexer

7.1 RF Cabling Requirements

- If a pass-band filter is used, ensure the equipment is installed according to manufacturer instructions.
- Terminate coaxial cables with N-type male connectors.
- Apply 12-15 in-lbs (136 N-cm) torque to secure the cables.

7.2 Connecting RF Feed Cables: Simplex RF Interface Option for Low Frequency Bands

For units connected to an external pass-band filter, connect the downlink and uplink RF cables to the N-type RF interfaces. This option is suitable for low frequency public safety bands, such as 150 MHz and 450 MHz.

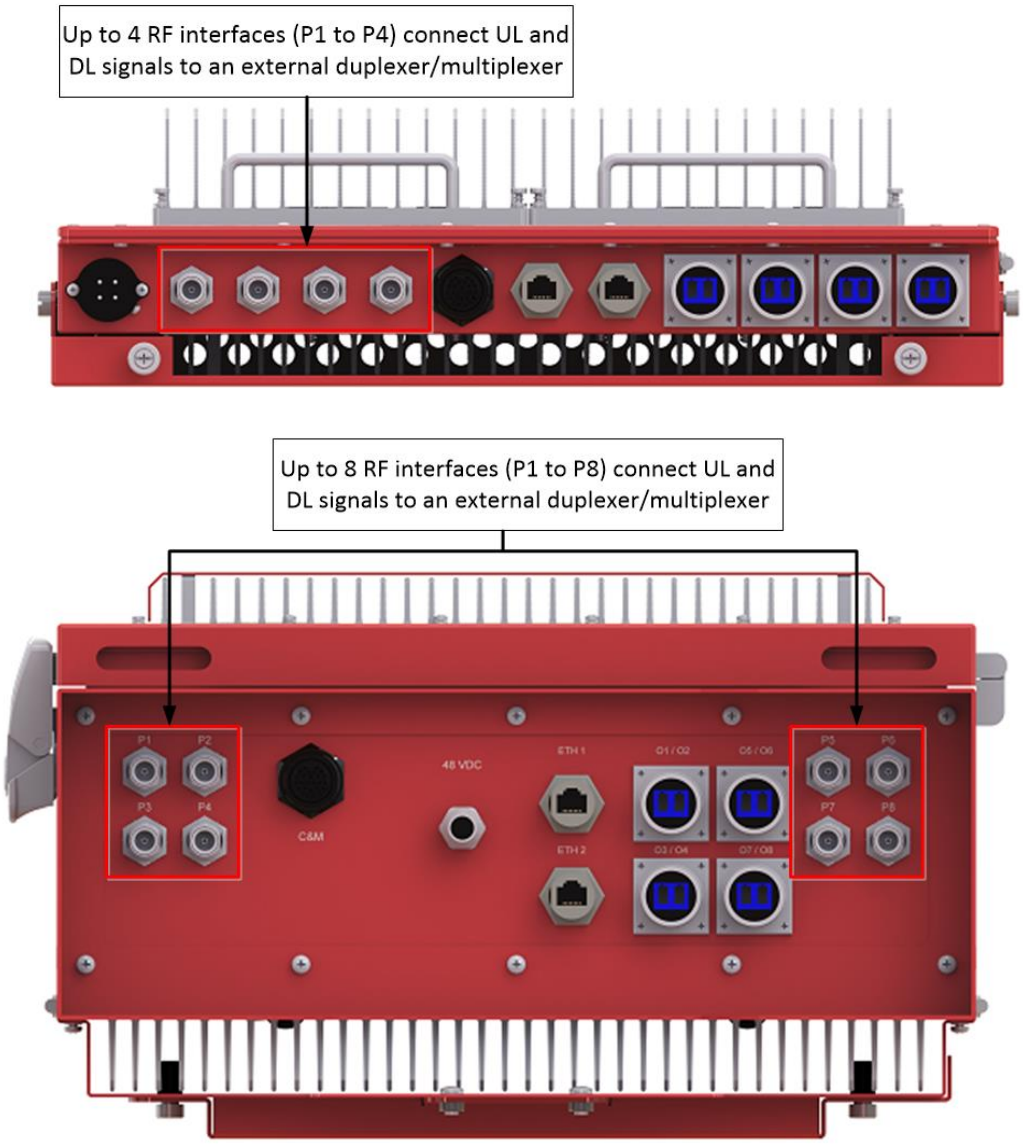


Figure 7-1: Simplex RF Connections for Low Frequency Bands

7.3 Connecting RF Feed Cables: Internal Duplexer/Multiplexer Option

For units with an internal duplexer or multiplexer, connect the RF cable coming from antennas or RF combining equipment to a single N-type RF port.

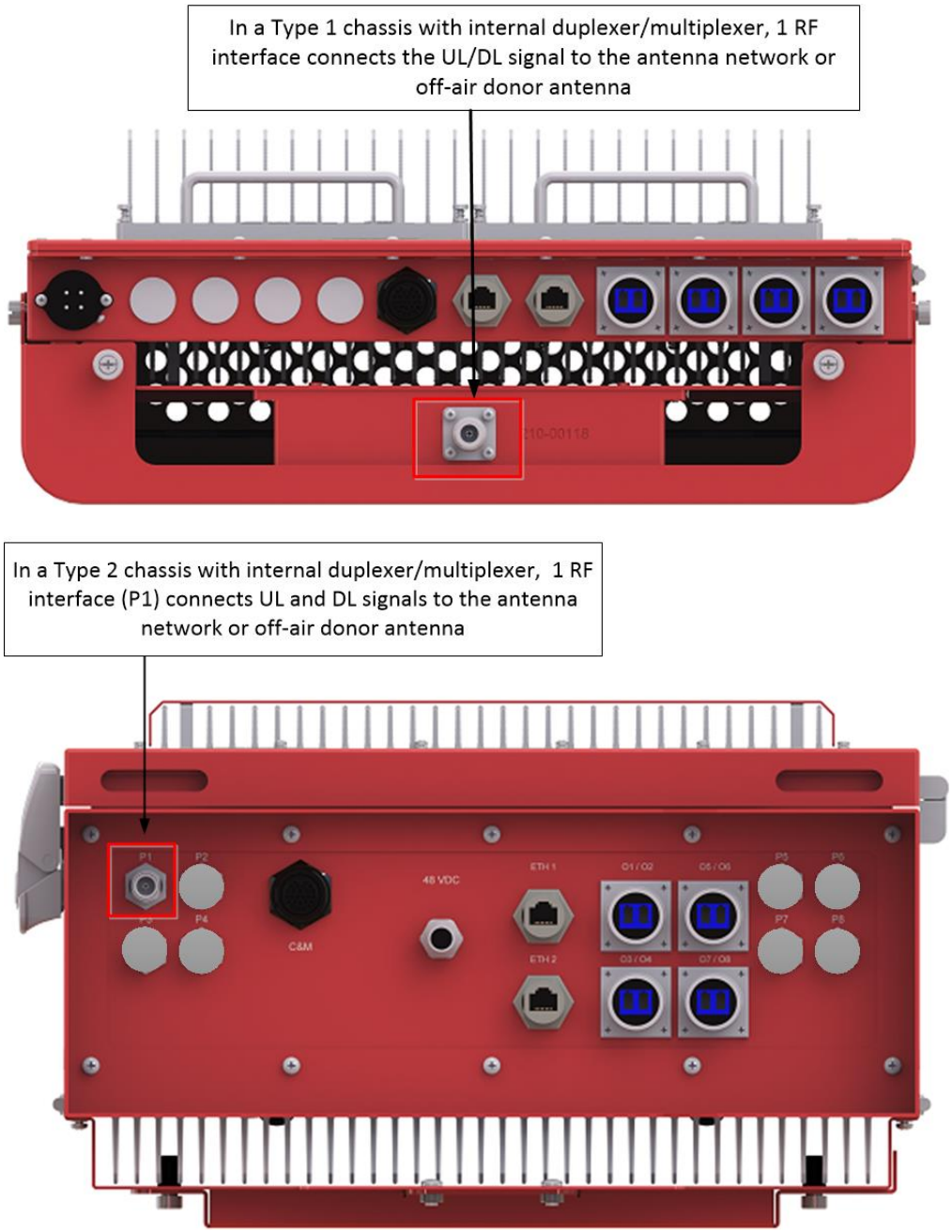


Figure 7-2: RF Connections with the Internal Duplexer/Multipexer Option

8 REMOTE ETHERNET CABLING

Remotes have two Power over Ethernet (POE) interfaces for connecting Wi-Fi equipment:

- Use **ETH 1** to connect a local laptop for logging into the EMS on site.
- Use **ETH 2** connect Wi-Fi access points, security cameras, and other network appliances.

Total PoE power is 68 W with a maximum 32 W per interface.

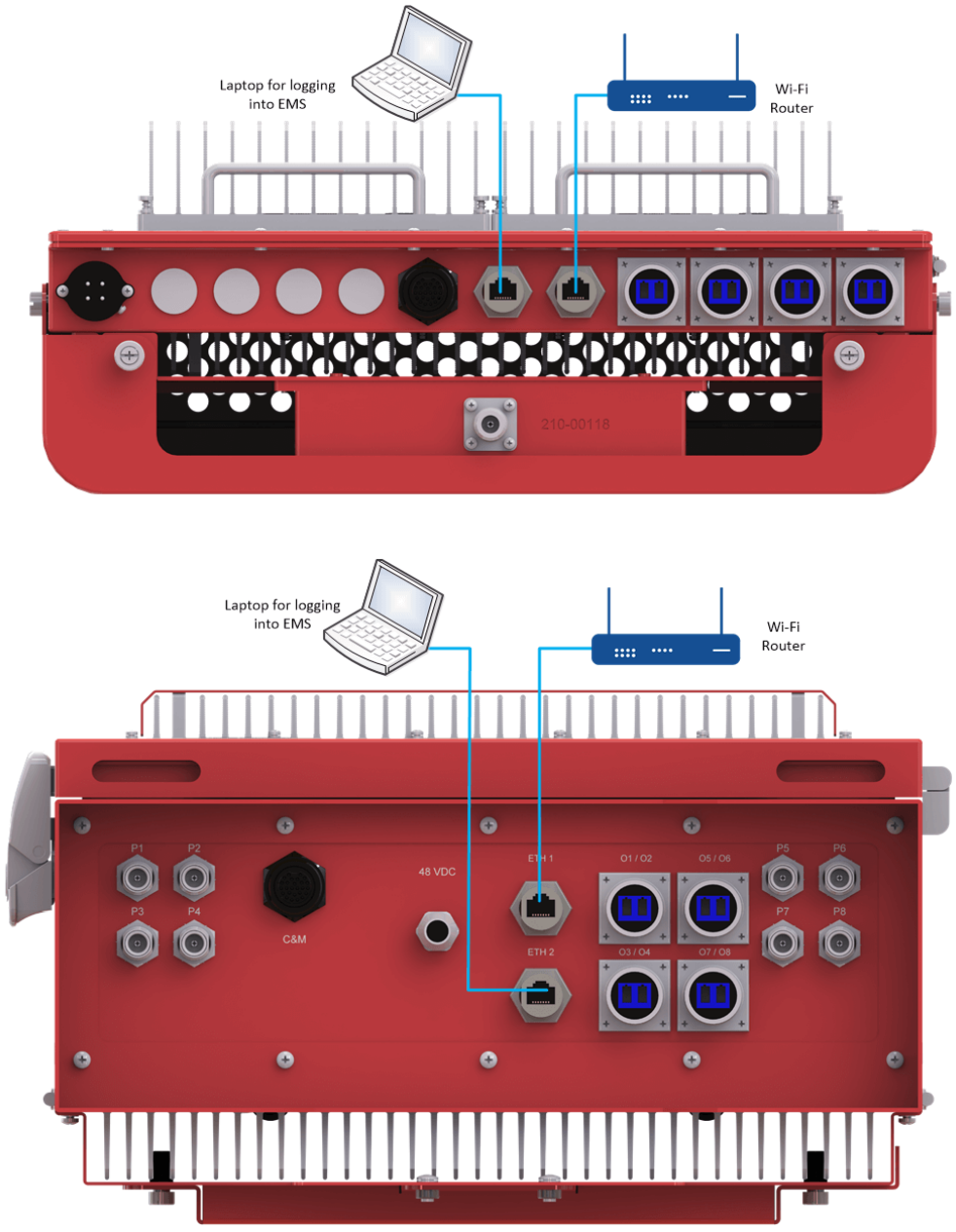


Figure 8-1: airHost PS and Remote Ethernet Connections

Ethernet cables are connected to the unit using a weatherproof, field installable RJ-45 connector assembly provided by Dali Wireless. Installers are required to provide the Ethernet cable and crimping tool.

Figure 8-2: Weatherproof RJ-45 Connector

For remotes installed in Europe, Middle East, and Africa (EMEA), connect ferrite cores to the Ethernet cables. Ferrites are provided by Dali Wireless. Wrap each cable four times through the center of the core.

To connect an Ethernet cable to the unit:

1. Assemble the Ethernet cable and RJ-45 connector, including ferrite core.
2. Plug the connector into the interface on the remote, and finger tighten the locking ring to secure.

9 OPTICAL FIBER INSTALLATION

This chapter describes how to:

- Prepare for installing optical fiber
- Understand optical fiber topologies
- Connect single mode fiber between hosts and remotes
- Daisy chain hosts and remotes

9.1 Preparing for Installation

9.1.1 Safety Overview

Adhere to the following occupation safety recommendations when installing optical fiber:

- Wear safety glasses with side shields, or other eyewear that complies with relevant occupational safety regulations. Follow the manufacturer's installation instructions.
- Dispose of fiber scraps properly in a safe, marked container and wash hands thoroughly after handling, splicing or cleaning. Also ensure the area is thoroughly cleaned from the floor and work areas.
- Do not look directly into the end of any optical fiber unless you are certain no light is present in the fiber, including light invisible to the human eye.
- When installing fiber optic cables in areas already installed with electrical cables and hardware, take care to avoid contact with these cables or have the power disconnected during installation.

9.1.2 Installation Requirements

The general installation requirements for installing fiber optic cable should follow the *NECA/FOA 301 Standard for Installing and Testing Fiber Optic Cables*, including receiving and handling fiber optic cables on site, support structures, fiber stopping, and grounding.

The specific requirements for installing fiber for the Matrix PS system are:

- Install premises cabling in cable trays, ladder racks, j-hooks, or other appropriate support structures.
- Install outside and inside plant cables in conduit (yellow) or plenum protected innerduct (bright orange) to identify fiber optic cable and protect it from damage.
- Follow the NECA/FOA 301 standard for fiber optic splicing and termination hardware.
- Do not install fiber optic cable in conduit or duct that already contains cabling (such RF, Ethernet, or power).
- Ensure properly installed support structures and patch panels for fiber optic cable are available for routing cable from hdHost PS and airHost PS to remotes.

9.1.3 Testing Requirements

After installation, verify each fiber in all fiber optic cables by performing the following tests:

- Continuity testing to ensure that the fiber routing is correct
- Insertion loss testing using an OLTS power meter and source. Use TIAEIA 527-7 for single mode fiber.
- OTDR testing (optional) to verify cable installation performance

9.2 Fiber Installation

Refer to the system design for the exact fiber floorplan.

9.3 Fiber Topologies

Remotes can be connected to the host units in a number of different fiber topologies: star, daisy-chain, and hybrid.

9.3.1 Star Configuration

In a star configuration, each remote connects to a different optical port on the host unit. Each host unit supports seven optical ports for directly connecting seven remotes, and one optical port reserved for connecting to another host unit (see Daisy-Chained Host Configuration).

Star configured topologies are the most robust because each remote receives a dedicated optical link from the host.

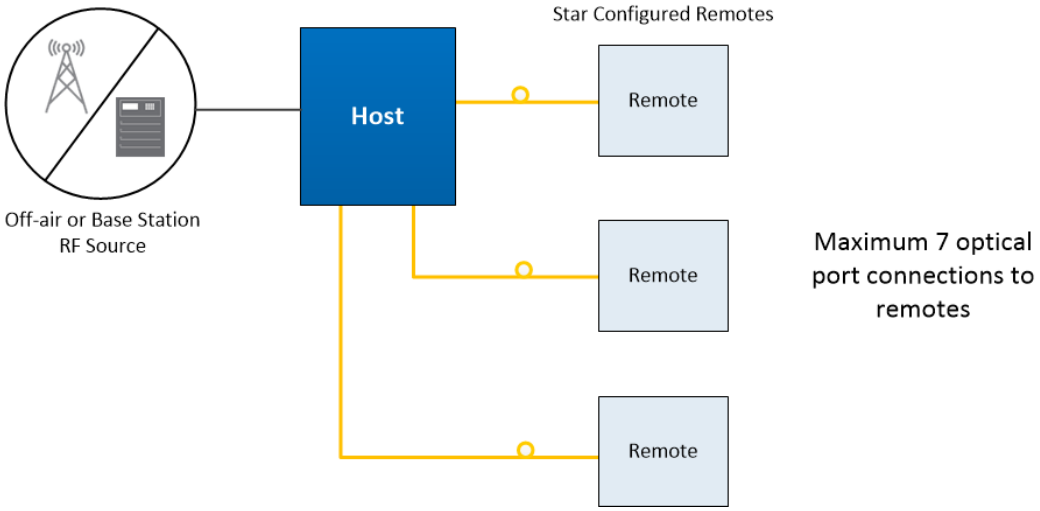


Figure 9-1: Remotes Connected in Star Configuration

9.3.2 Daisy Chain Configuration

In a daisy-chain configuration, the first remote in the chain is connected to the host. The first remote connects to a second remote, and the second to a third, and so on.

When remotes are daisy-chained, the failure of one remote in the chain can cause the downstream remotes to lose signal. A Dali optical bypass switch ensures the continuity of signal flow by rerouting the signal from the failed unit to the next remote in the chain. Contact Dali Customer Service about installation and configuration of this option.

The number of daisy-chained remotes depends on maximum round trip delay between the host and the furthest remote. For example, an office building with a dedicated base station could support 20 or more daisy-chained remotes.

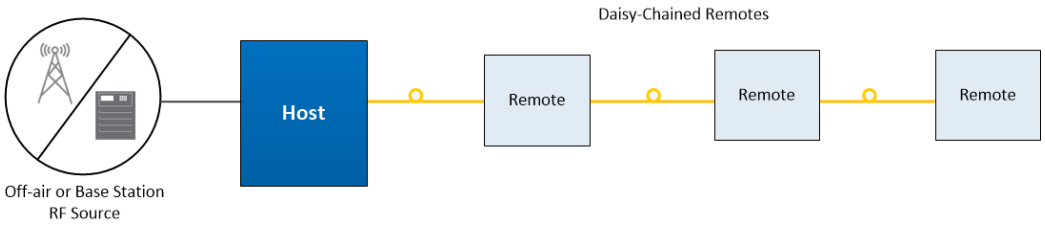


Figure 9-2: Remotes Connected in Daisy-Chain Configuration

Host units can also be daisy chained, for more optical port capacity.

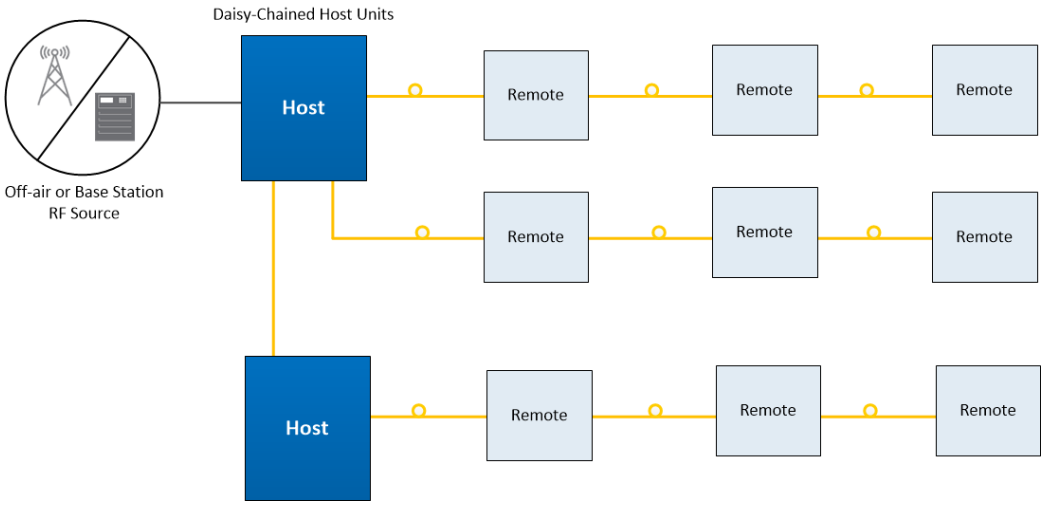


Figure 9-3: Hosts Connected in Daisy-Chain Configuration

9.3.3 Hybrid Configuration

In a hybrid configuration, multiple daisy-chains of remotes connect to different optical ports on the host. The total number of remotes supported depends on maximum round trip delay and maximum allowed noise contribution.

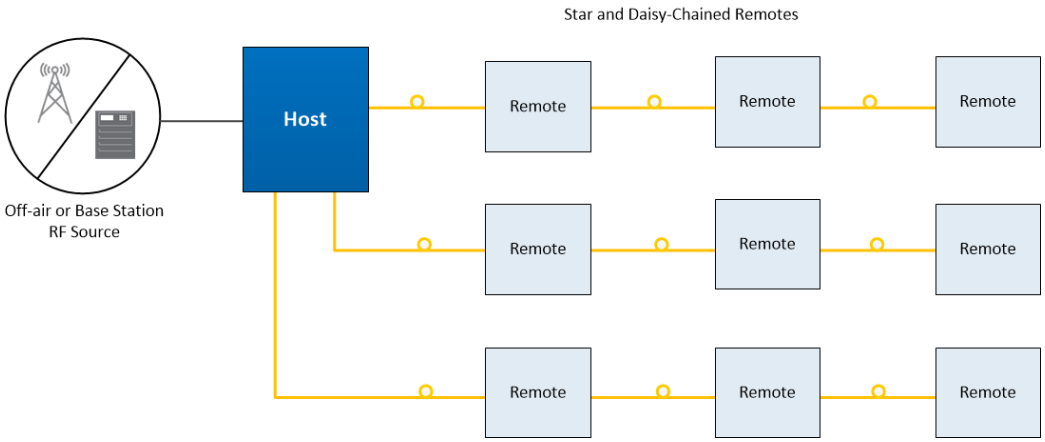


Figure 9-4: Remotes connected in Hybrid Star and Daisy-Chain Configuration

9.4 Connecting Single Mode Fiber

Optical connections between hosts and remotes are made using single mode fiber, or patch cords, terminated with LC/UPC type connectors.

For connecting optical fiber, use the weatherproof, field-installable optical connector assembly provided. The optical cable assembly consists of a three foot long duplex optical cable with a weatherproof locking optical connector on one end, and on the other, two LC/UPC optical connectors.

Figure 9-5: Optical Cable Assembly

The dual LC/UPC optical interface on the hdHost PS, airHost PS and remote is housed in an environmentally sealed adaptor with protective screw-on cover.

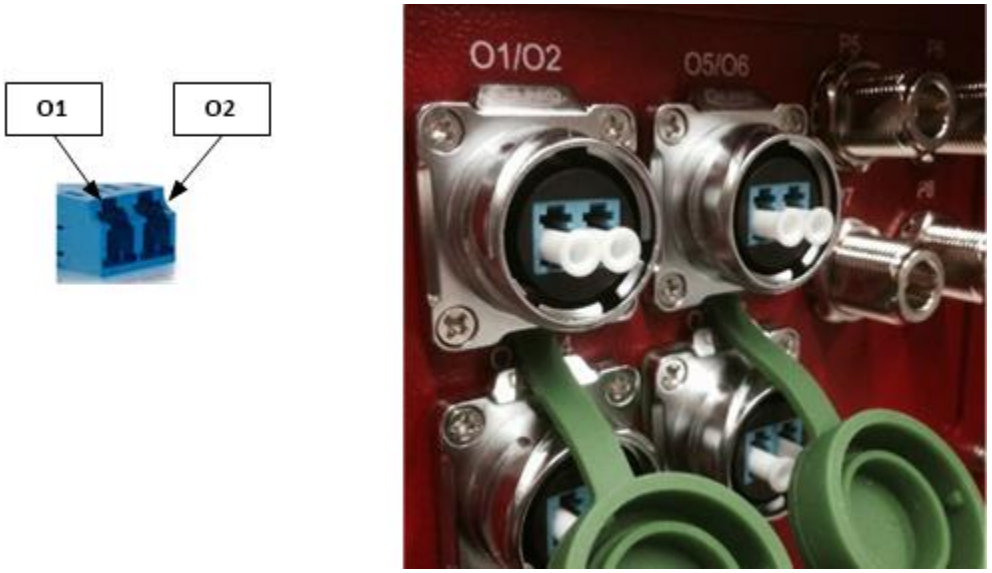


Figure 9-6: hd30 Optical Port Inteface

IMPORTANT

Before connecting the optical cable, remove all dust plugs from both the optical interface on the unit, and from the cable.

Failure to remove the dust plugs can can seriously damage the interface or cable.

To connect the optical cable to the remote:

1. Remove the dust plugs from both the optical connector and remote optical interface and store them for future use.
2. Insert the connector into the optical interface and quarter turn the locking ring to secure.

Figure 9-7: Optical Connector Assembly

9.4.1 Optical Fiber Adapter Kit

If your optical terminations are either SC/APC, FC/APC, use the Matrix optical adapter kit. The adapter kit comes with an LC adapter and a patch cord pre-fitted with the desired termination.

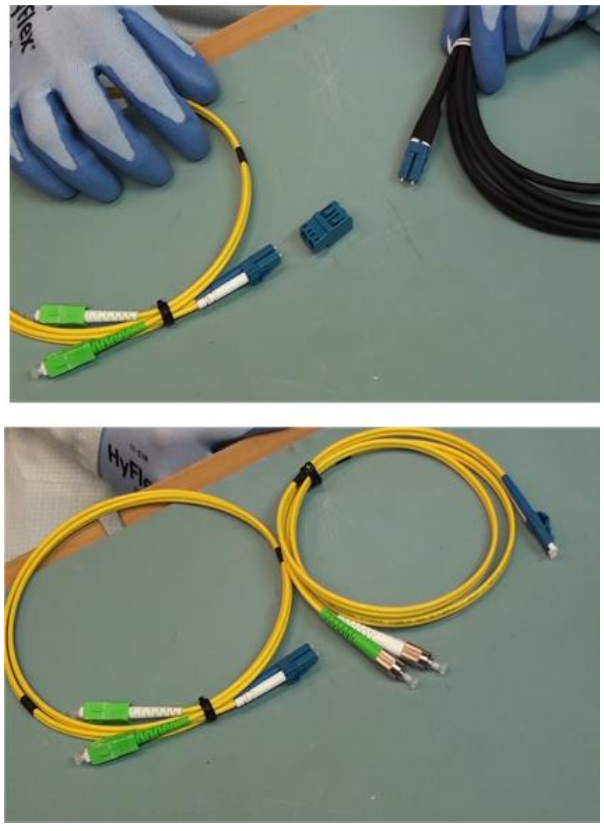


Figure 9-8: Optical Fiber Adapter Kit

9.5 Daisy Chaining Hosts and Remotes

You can connect host and remote units in daisy-chain configuration to expand the optical port capacity of the system. Signals from of multiple bands are combined and sent over single fiber to the remote location. See Figure 9-9.

On both hosts and remotes, optical port O1 is reserved for the connecting to an upstream unit. Note that *upstream* refers to the unit nearest the base station or off-air signal source, and *downstream* refers to the unit that is farthest away.

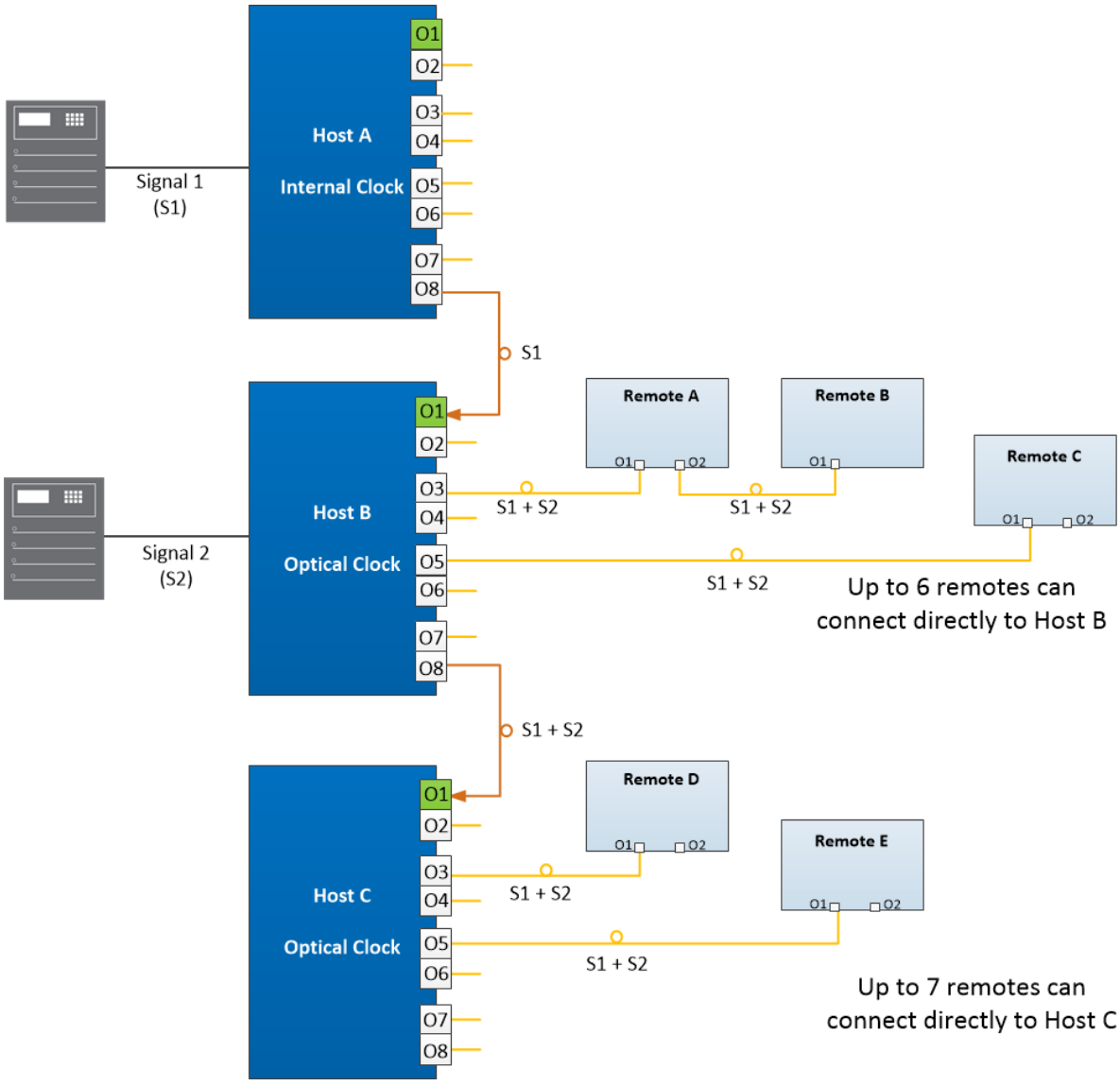


Figure 9-9: Daisy-chained Hosts and Remotes

To daisy chain host units:

- On the upstream host, use optical ports O2 to O8) to connect to the downstream host port O1
- Use O2 to O8 to connect remotes
- Do not connect O1 to remotes
- Set the reference clock for the first host in the chain to **Internal** (Host A in Figure 9-9)
- Set the reference clock to **Optical** for all downstream hosts (Host B, C and D in Figure 9-9)

To daisy chain remote units:

- Connect O1 on the first daisy-chained remote to the host
- Connect O2 on a daisy chained remote to O1 on the next downstream remote

The number of daisy-chained remotes depends on the optical delay of the system. See Configuring Optical Delay Compensation.

For example, in Figure 9-9, only Host B and C deliver both signal S1 and S2 to remotes. With the additional optical port capacity provided by Host C, the system allows for a total of 13 remotes connected directly to hosts carrying both signals.

To further increase the number of remotes, the example also shows how remotes can be daisy chained. Remote A and B, and Remote D and E are daisy-chained remotes, each connected to a single host optical port. The combined signal coming from the host, is fed over one fiber to each remote in the chain.

For information on alarms reported for failed optical fiber links between daisy-chained host and remote units, see Monitoring Alarms for Broken Optical Links.

10 MATRIX CONSOLE PS INSTALLATION

This chapter describes how to:

- Rack mount the Matrix Console PS
- Connect Ethernet cables to the unit per the IP networking plan
- Power on the Matrix Console PS

10.1 Preparing for Installation

Before installing the Matrix Console PS, become familiar with the following installation workflow, power consumption, and warnings. For FCC compliance and Safety Information, see the FCC statements at the beginning of this document.

10.1.1 Power Consumption

The Matrix Console PS consumes 50 W. For power consumption details, see Appendix D.

10.1.2 Warnings

	This equpment is considered as permanently connected device. A readily accessible AC disconnect device shall be incorporated external and close to the equipment.
	This equipment is to be installed in a Restricted Access Area. When installed in a wet, outdoor area, turn power off prior to unit modifications.

10.1.3 Firewall Protection

To protect Matrix system from cyber-attacks, the customer network must be protected from the public Internet through a firewall.

> ⚠ Do not connect Matrix Console PS to your IP network without a firewall in place.

10.2 Rack Mounting

The Matrix Console PS is a 2RU unit designed to fit in a standard, 19-inch equipment rack.

Before rack mounting the hdHost PS, you need:

- Mounting bracket and securing screws (included)
- Rack mounting hardware suitable for the rack type
- #2 Phillips screwdriver

To mount the unit in a 2-post or 4-post equipment rack:

1. Attach the bracket to the rack using four fasteners appropriate for the rack type.

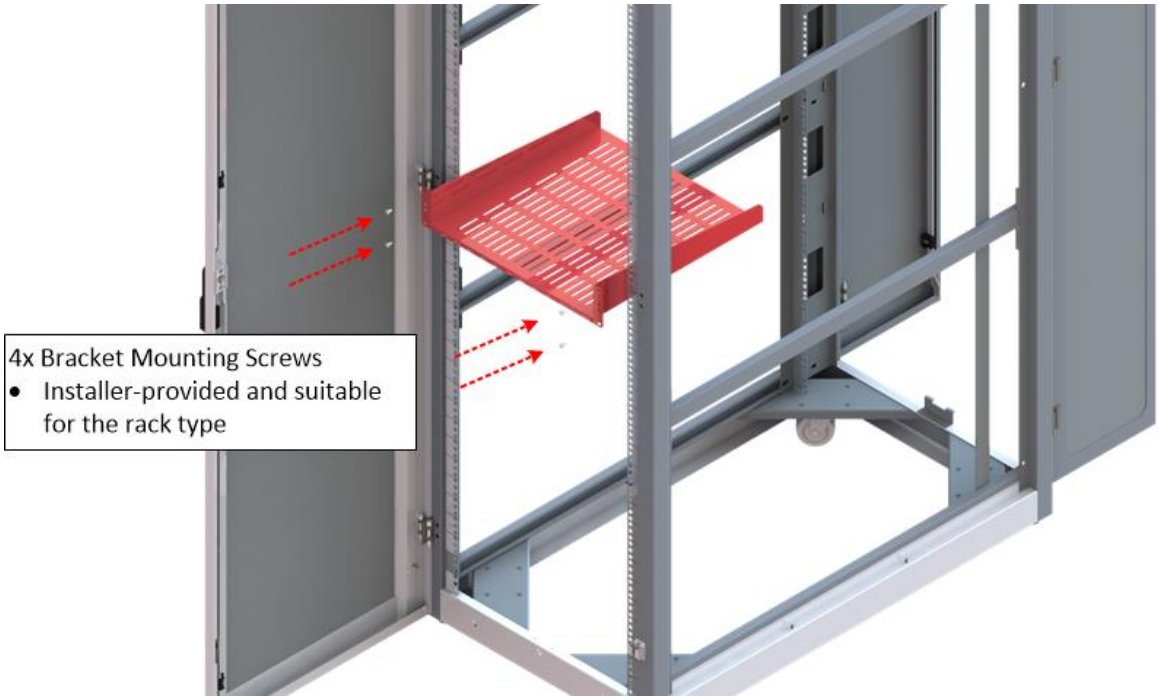


Figure 10-1: hdHost PS Bracket Installation

2. Slide the unit into the bracket from the front of the rack, until the front mounting brackets (ears) are flush with the front rack posts.

Figure 10-2: hdHost PS Unit Installation in Rack

3. Secure the chassis to the bracket using four fasteners appropriate for the rack type.

10.3 Connecting Ethernet Cables

The Matrix Console PS has eight RJ-45 Ethernet ports for connecting to local and wide area networks. Use **WAN1** for connecting to the customer IP network, and **ETH1** for connecting to the hdHost PS or airHost PS. For more information, see IP Network Configuration.

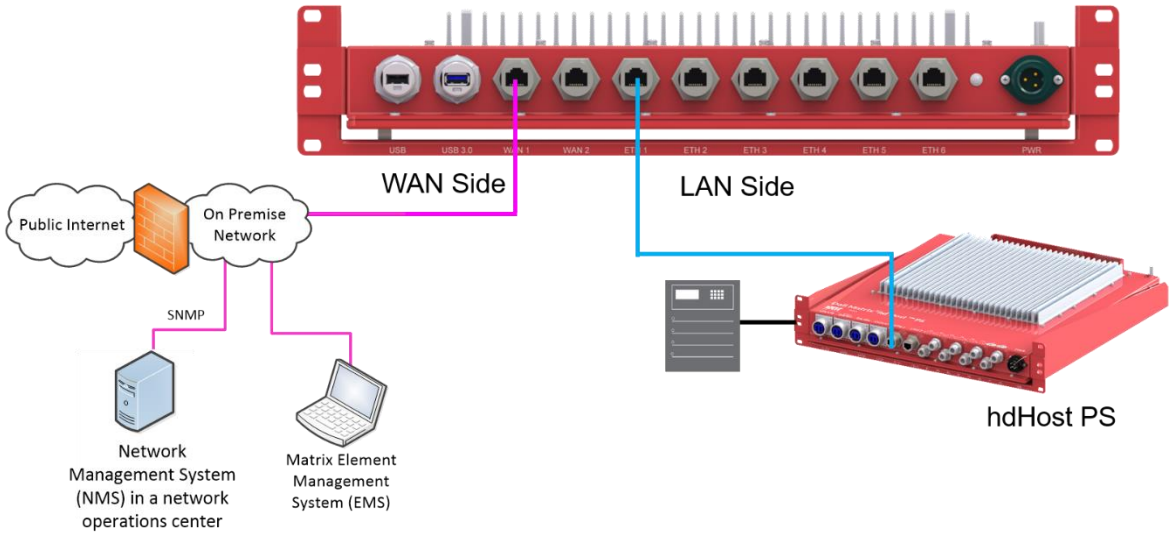


Figure 10-3: Matrix Console PS Ethernet Connections

Ethernet cables are connected to the unit using a weatherproof, field installable RJ-45 connector provided by Dali Wireless. Installers are required to provide the Ethernet cable and crimping tool.

> For units installed in Europe, Middle East, and Africa (EMEA), connect ferrite cores to the Ethernet cables. Ferrites are provided by Dali Wireless. Wrap each cable four times through the center of the core.

To connect an Ethernet cable to the unit:

1. Assemble the Ethernet cable and RJ-45 connector, including ferrite core.
2. Plug the connector into the interface on the remote, and finger tighten the locking ring to secure.

Figure 10-4: Weatherproof RJ-45 Connector

10.3.1 Connecting to Multiple Host Units

If the system has more than one host, connect the host units to the Matrix Console PS using available Ethernet interfaces. For example, connect **ETH2** on the first host unit, to **ETH2** on the second host.

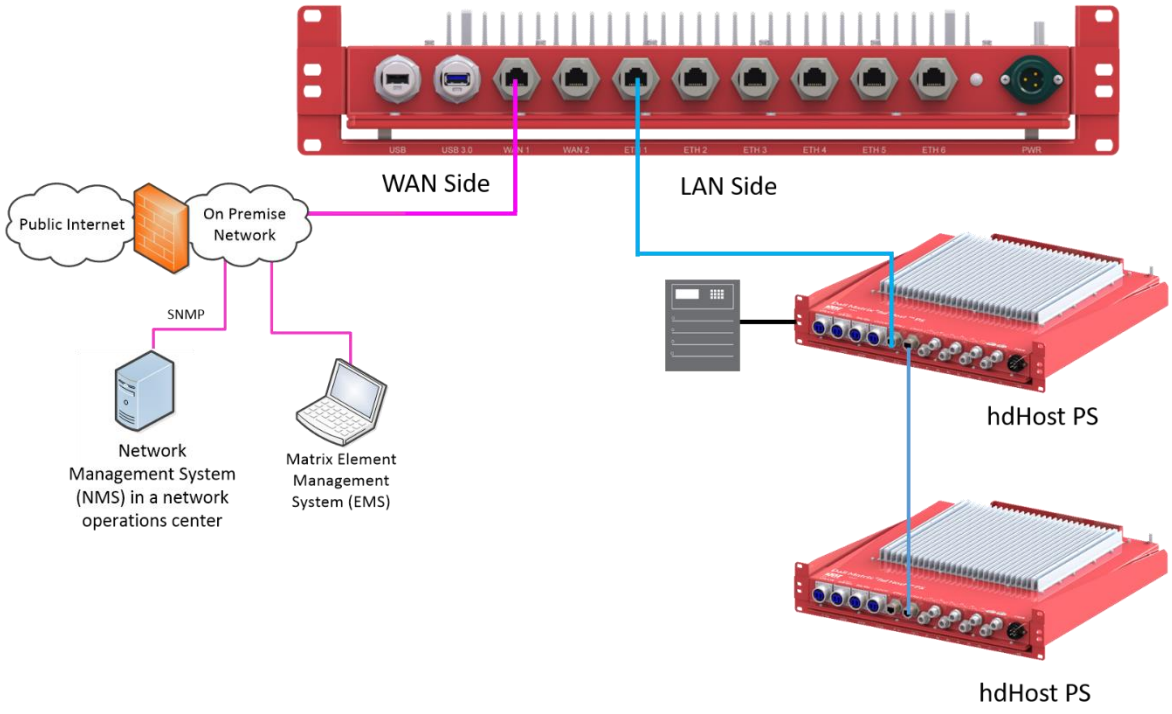


Figure 10-5: Matrix Console PS with Multiple Host Units

10.3.2 Connecting Redundant System Controllers

For uninterrupted monitoring and control of hosts and remote units, you can install redundant system controllers: a Primary controller for managing configuration changes through the EMS, and a Secondary controller, or backup unit. If a Primary controller fails, you can manually switch to the Secondary controller.

For more information, see Redundant Matrix Console Configuration.

10.4 Powering on the Unit

The Matrix Console PS requires AC power. To power on the unit, plug the power cable provided into a protected AC power source.

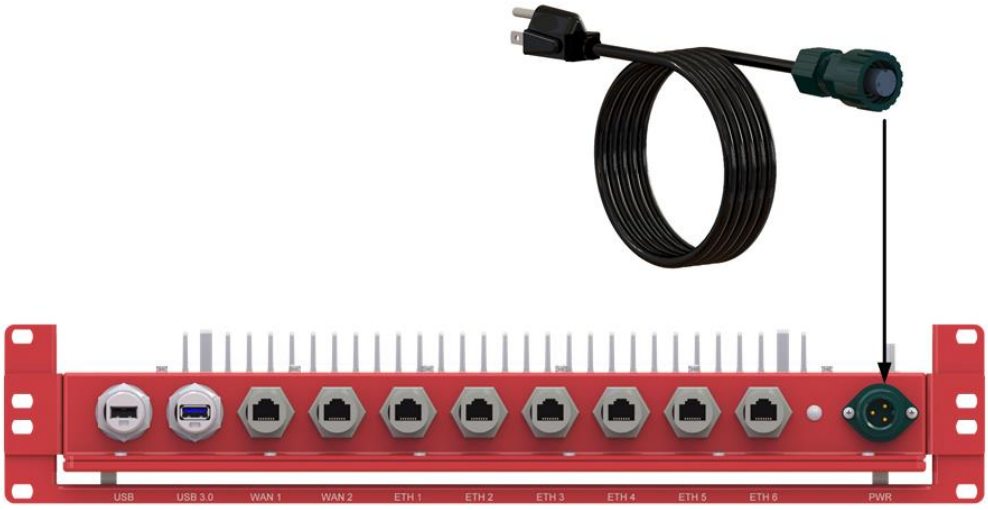


Figure 10-6: Matrix Console PS AC Power Interface

11 INSTALLATION VERIFICATION

This chapter describes:

- Startup LED sequence
- Standby LEDs
- Troubleshooting for LED alarms

When the Matrix PS system is powered on after installation, the host units and remotes are automatically placed in Standby. If there is an alarm, the LEDs indicate an alarm condition to be reviewed or resolved.

If a unit does not power on into Standby, resolve the problem before commissioning the system.

In Standby, units and modules meet following conditions:

- Host units and remotes are powered on, with LEDs indicating Standby mode
- RF modules are not available transmitting or receiving RF signals
- Optical ports are active but not transmitting or receiving the data stream

11.1 Startup LED Sequence

When DC input power is applied, the LEDs display the following sequence, indicating the Matrix PS application software is starting, loading, and then finally running.

The startup sequence lasts approximately two minutes.

Power LED	Alarm LED	Description
● Red	Off	Application software is starting
✸ Orange flashing	Off	Application software is loading
● Green	● Orange	Application software is running Unit is in Standby mode

11.2 Standby LEDs

11.2.1 hdHost PS

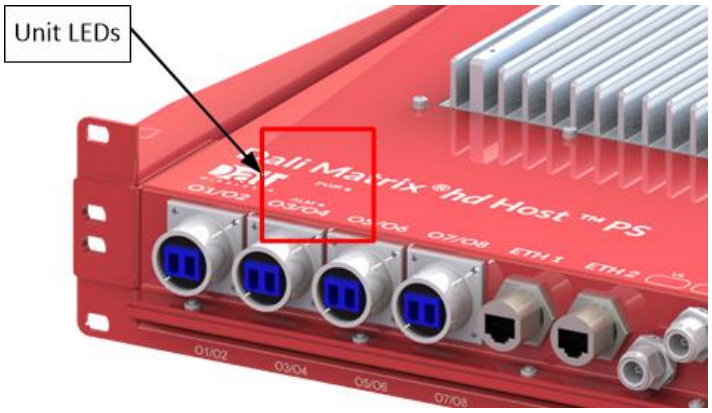


Figure 11-1: hdHost PS LEDs

Unit LEDs	Color	Description
PWR	● Green	Power is on
ALM	● Orange	Minor alarm indicating no RF signal detected

11.2.2 airHost PS & Remotes

11.2.2.1 Type 1 Chassis

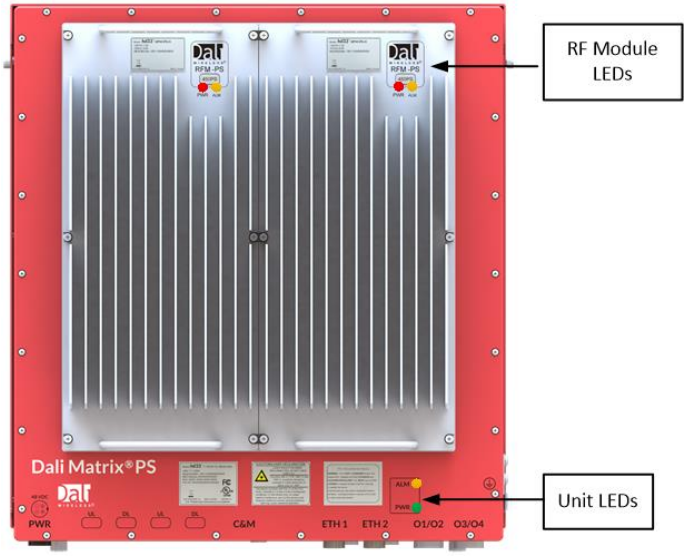


Figure 11-2: Type 1 Chassis LEDs

Unit LEDs

LED	Color	Description
PWR	Green	Power is on
ALM	Orange	Minor alarm indicating no RF signal detected

RF Module LEDs

LED	Color	Description
PWR	Red	RF module is not sending or receiving RF signal
ALM	Orange	Minor alarm indicating no RF signal detected

11.2.2.2 Type 2 Chassis

The type 2 chassis does not display RF module LEDs.

Figure 11-3: Type 2 Chassis LEDs

LED	Color	Description
PWR	● Green	Power is on
ALM	● Orange	Minor alarm indicating no RF signal detected

11.3 Troubleshooting LED Alarms

11.3.1 Alarm LED

ALM LED	Possible Alarm Conditions
Green	No alarm
Orange	Minor • Standby mode • Downstream optical link failure causing a downstream unit to be offline/disconnected • Single fan failure • RF signal power is below the configured threshold • Reflected power (VSWR) threshold exceeded
Orange flashing	Major • RF signal power is above the rated power (Input Path ALC Active alarm)
Red/Orange alternating	Critical • Upstream optical link failure causing this unit to be offline or disconnected
Red	Major • High temperature • Multiple fan failure
Red flashing	Critical • Shutdown due to high RF power

11.3.2 Power LED

PWR LED	Possible Alarm Conditions
Green	No alarm
Orange	Minor • DC voltage is marginal
Orange flashing	Minor • See Startup LED Sequence
Red	Major • RF module in Standby • Shutdown of RF module due to high power • Shutdown of RF module due to upstream optical path failure • DC voltage is out of range
Red flashing	Critical • See Startup LED Sequence

PART 2
SYSTEM COMMISSIONING

Part 2 of this guide is intended for IT and system integrators responsible for commissioning an installed Matrix PS system.

Use this guide in conjunction with the site-specific deployment documents, including: RF design, fiber plan, rack layout plan, clock distribution plan, IP network design and, gain lineup documents.

This section contains the following chapters:

12 IP NETWORK CONFIGURATION

This chapter describes how to:

- Understand system controller software as part of Matrix Console PS
- Understand the Matrix IP network
- Set up IP addresses
- Log into the EMS
- Configure SNMP trap receivers and download the Dali MIB
- Configure redundant system controllers

12.1 What is the System Controller?

The system controller is software running on the Matrix Console PS that manages all Matrix units from a central location.

The system controller is responsible for:

- Tracking units as they are added or removed from the system and maintaining a system-wide inventory
- Maintaining configuration settings for each unit
- Collecting and monitoring alarm and performance data
- Providing access to the Matrix Element Management System (EMS) web application
- Remote monitoring through Simple Network Management Protocol (SNMP)

12.2 Matrix Internal and External IP Networks

The IP network for the Matrix system consists of the internal Matrix IP network (LAN), and the customer IP network (WAN).

In Figure 12-1, you can see the system controller is the central access point for the WAN and LAN sides of the network. NMS servers and Dali Customer Support (through a firewall) connect to the WAN bridge interfaces, WAN1 and WAN2. On the LAN side, Matrix host units connect to the ETH bridge interface.

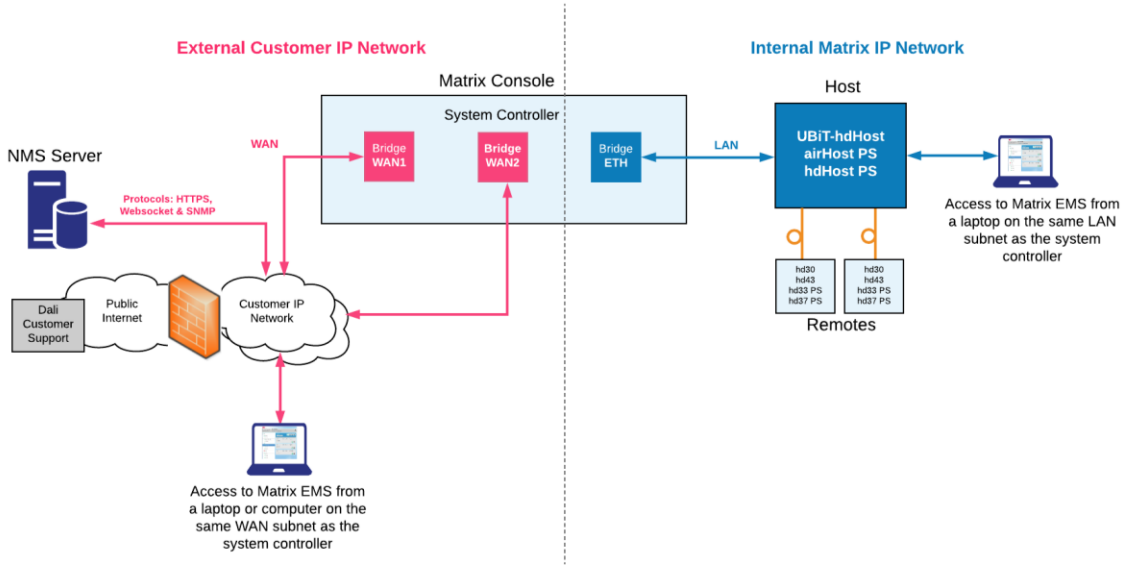


Figure 12-1: Customer IP Network and Matrix IP Network

12.2.1 Customer IP Network Requirements

Ensure the external customer IP network meets the following requirements:

- Implements firewall protection
- Does not connect Matrix equipment directly to the public IP network
- Separates Matrix equipment from other customer equipment (guest Wi-Fi generally meets all of these requirements)

12.2.2 Matrix IP Network Requirements

Ensure the internal Matrix IP network meets the following requirements:

- System controller is link local to all Matrix units in the system
- No routing or L3 switch functionality between the system controller and the other units
- All units, including the system controller, are on the same broadcast domain

12.2.3 Ports

Depending on the intended use of the system, the following firewall ports must be open. Most users only require web access. Advanced monitoring with a NMS may require SNMP access.

For this access	Open this port
Web access	Port 80
SNMP monitoring (polling)	UDP Port 161
Outgoing SNMP traps	UDP Port 162

12.3 System Controller IP Addresses

The system controller supports eight IP addresses: three default IPv6 link-local addresses pre-configured by Dali Wireless, and up to five IP addresses assigned by the network administrator.

The following default IPv6 link-local addresses are read-only:

- WAN1 IPv6 link-local: IP address for connecting to the external, customer IP network
- WAN2 IPv6 link-local: a second customer IP address, used only when there are multiple external IP networks
- ETH1 IPv6 link-local: IP address for connecting to the internal Matrix IP network

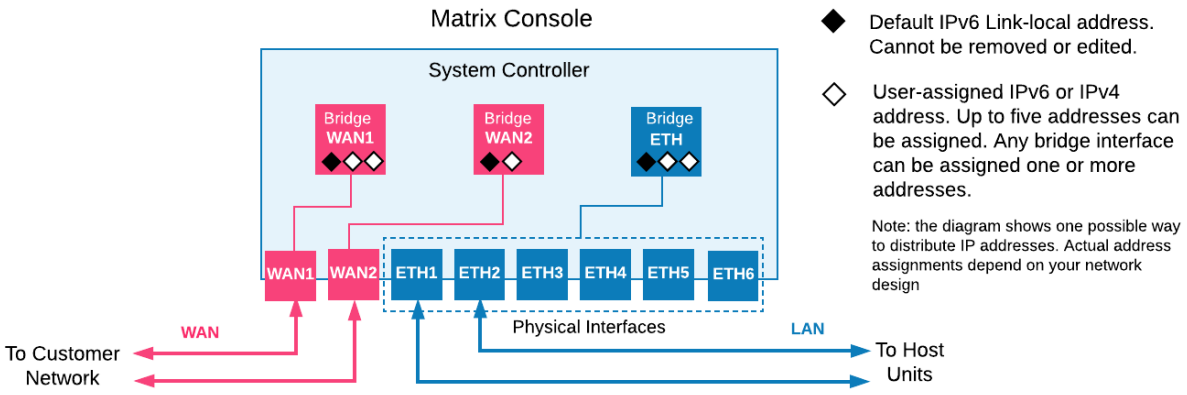


Figure 12-2: System Controller IP Addresses

The following table lists the possible IP address configurations for each bridge interface.

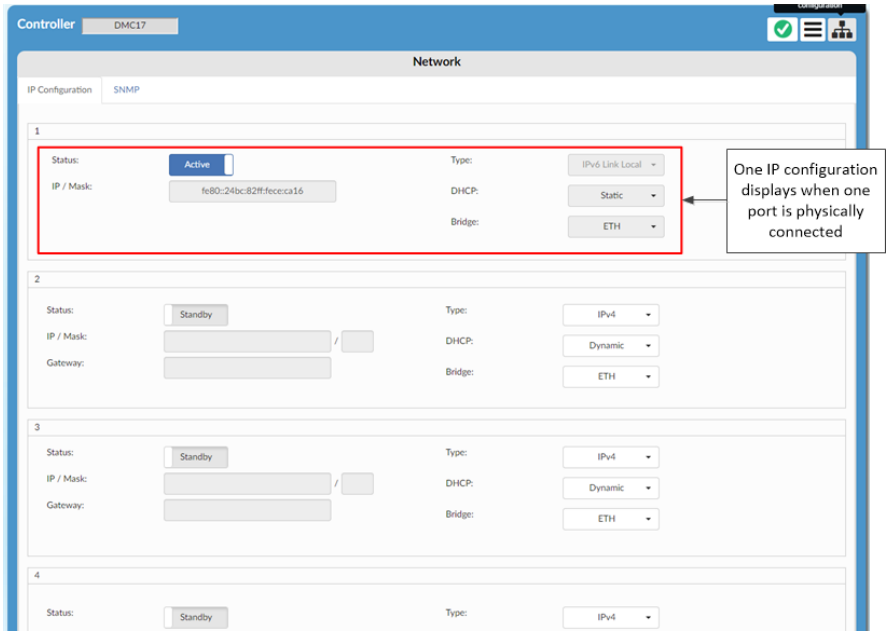
Bridge Interface	Address Type	Static/Dynamic	Physical Port
WAN1	Default IPv6 Link-local (read-only) User-assigned IPv4 or IPv6	Static or Dynamic	WAN1
WAN2	Default IPv6 Link-local (read-only) User-assigned IPv4 or IPv6	Static or Dynamic	WAN2
ETH	Default IPv6 Link-local (read-only) User-assigned IPv4 or IPv6	Static only	ETH1 to ETH6

You can configure IP addresses for the system controller in the Network view. Select the system controller in the tree and click  . For a description of fields, see Network Configuration Fields.

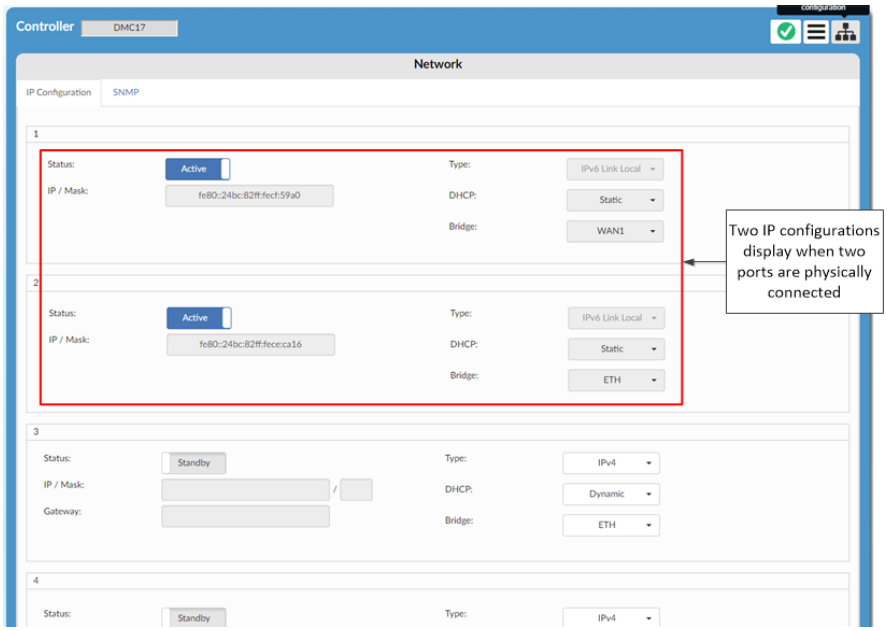
12.3.1 How Default IPv6 Link-local Addresses are Displayed

The EMS displays the link-local addresses for ports that have a physical Ethernet cable connected. Even if a link-local address is not displayed in the Network view, you can use it for logging into the unit.

For example, if the unit has one Ethernet cable plugged into an ETH port, the Network view displays the ETH IPv6 link-local address. The WAN1 and WAN2 addresses are still available, but not visible in the user interface.



Likewise, if there are cables plugged into WAN1 and ETH1, then the Network view lists WAN1 IPv6 link-local and ETH IPv6 link-local. If an Ethernet cable is connected later, the EMS updates the Network view automatically to show the link-local address of the associated port.



12.4 Configuring IP Addresses

The process of configuring IP addresses involves first logging into the EMS using the default IPv6 link-local addresses found on the unit label, and then adding and verifying each WAN and ETH IP address.

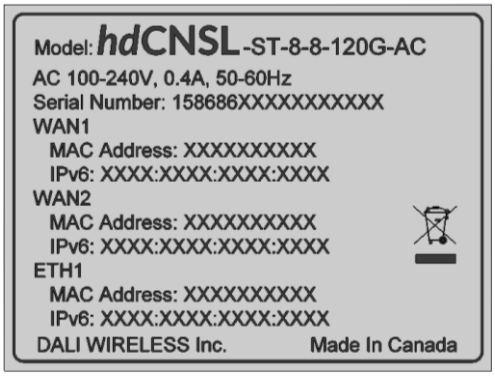
You can assign up to five IP addresses (total).

12.4.1 Logging in Using IPv6 Link-local Addresses

To begin, log into the EMS using one of the default IPv6 link local addresses.

To log into the EMS using an IPv6 link local address:

1. Find the system controller link-local IPv6 addresses on the unit label.



2. Record the IP addresses. Any one of these addresses can be used to log into the EMS when a laptop is connected directly to the system controller.
3. Turn off your laptop Wi-Fi so that the laptop doesn't connect to other wireless networks in the area.
4. Connect the laptop to a WAN or ETH port on the system controller. If you're connecting to an ETH port, it doesn't matter which one you use. All ETH ports use the same ETH IPv6 link-local address.
5. In a browser window, enter the link-local IP address in square brackets. For example: **[fe80::9a5d:adff:fe47:cc12]**. If this method does not launch the EMS, you may need to add a static route to the IPv6 address on your PC Ethernet interface. See Setting up a Laptop for IPv6 Access.
6. In the login screen, enter username **admin**, and password **dali1234**.

12.4.2 Adding Static IP Addresses

You can add a static IPv4 or IPv6 address to the WAN1, WAN2, and ETH bridge interface.

To add a static IP address:

1. Select the system controller in the system tree and click the Network button .
2. Scroll down to an empty address block, and select **IPv4** or **IPv6** as the type of IP address.
3. Select **Static**.
4. Select the bridge interface to use: **WAN1**, **WAN2**, or **ETH.**
5. Enter the **IP/Mask** address, and a **Gateway** address if available. The EMS saves the field values automatically when you click anywhere outside the field you're editing, or when you press Tab to advance to the next field. The field outline turns green to indicate the data has been saved but not activated.
6. Activate the IP address by toggling the Status button to **Active**.

You can log into the EMS only when the IP addresses are Active. Configured addresses that are in Standby are not available.

12.4.3 Adding Dynamic IP Addresses

You can add a dynamic IPv4 or IPv6 address to the WAN1 and WAN2 bridge interface. Dynamic IP addresses are not supported on ETH.

To add a dynamic IP address:

1. Select the system controller in the system tree and click the Network button  .
2. Scroll down to an empty address block, and select **IPv4** as the type of IP address.
3. Select **Dynamic**. The **IP/Mask** address, and **Gateway** address fields become grayed out and can't be edited.
4. Select the bridge interface to use: **WAN1** or **WAN2**. Dynamic addresses are not supported on **ETH**.
5. Activate the IP address by toggling the Status button to **Active**.
6. Wait 5 to 10 seconds for the EMS to display the addresses provided by the DHCP server. If the addresses do not appear, it means the DHCP server is offline or there could be a networking issue. See Troubleshooting IP Address Configurations.

You can log into the EMS only when the IP addresses are Active. Configured addresses that are in Standby are not available.

12.4.4 Verifying Network Connections

After configuring IP addresses, verify the network connections by logging in using each one.

To verify the WAN network addresses:

1. Log out of the EMS.
2. Connect the laptop to the WAN, or customer IP network.
3. Log into the EMS using the WAN1 IP address (or WAN2 address, if used).

To verify the ETH network address:

1. Log out of the EMS.
2. Connect the laptop directly to an ETH port on the system controller or host unit.
3. Log into the EMS using the ETH IP address.

For more detail about of logging in with IPv4 and IPv6 addresses, see Logging Into the EMS.

12.4.5 Troubleshooting IP Address Configurations

Problem	Solution
Status button toggles back to **Standby** when activating Or, the Status button has a red outline	There is a problem with the address format. • Verify that all IP values are correct. There is a mismatch between the type of address selected (IPv6 or IPv4) and the actual address entered. • Verify the IP address matches the address type. You tried to configure a dynamic IP address on ETH. • Dynamic IPv4 and IPv6 addresses are not supported on ETH. Configure dynamic addresses on WAN1 or WAN2. You've tried to add both static and dynamic IPv6 addresses on the same bridge interface. For example, on WAN1, you tried to add a static IPv6 address, and a dynamic IPv6 address. • Choose either Static, or **Dynamic**. Do not mix static and dynamic IPv6 configurations on the same bridge interface.
IP/Mask or **Gateway** field has a red outline	You entered an incorrect IP address format. • Delete the address completely (the field should be blank), and retype the correct address. Press **Tab** or click the anywhere outside the field. If the address is in the correct format, the field outline turns green for 5 to 10 seconds indicating the the configuration is saved.
IP addresses do not appear when activating a dynamic IP address Or, the IP address fields are blank even though the Status button is **Active**	The DHCP server is offline or there is a networking issue. The Status button displays **Active**, but the IP address is not available for accessing the EMS. • Once the DHCP server is back online, the EMS automatically retrieves the IP addresses from the server and saves them. While you do not need to do anything further, the Network view may not display the retrieved IP addresses right away. If you're not sure if the DHCP server has provided the requested IP addresses, try placing the address in **Standby**, and then re-setting to **Active**.
You can't log in using a IPv6 link-local address	The system controller may be restarting. Wait two minutes for startup to complete.
Selecting an item in a drop down list causes the Network view to collapse	Restart your computer.

12.5 Logging Into the EMS

Before logging into the EMS:

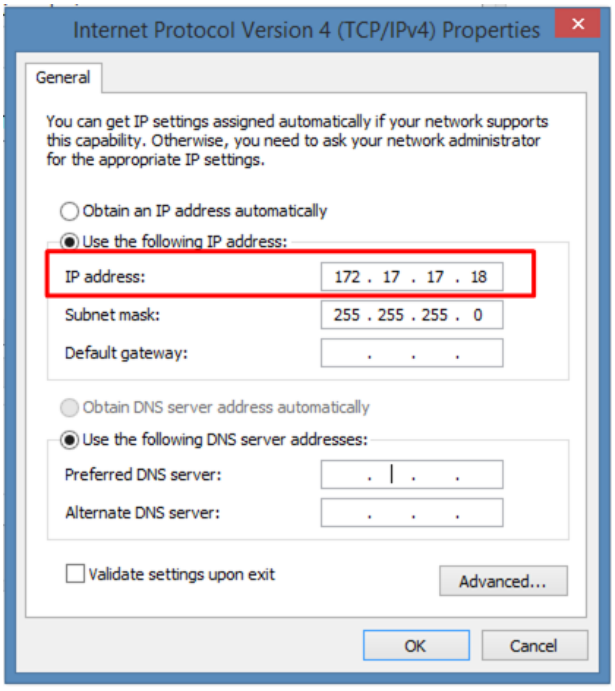
- If you are using a static IPv4 address, make sure the laptop computer is assigned to the same LAN or WAN subnet as the system controller
- If you are using an IPv6 address, make sure the laptop or computer has IPv6 protocol enabled
- Make sure Wi-Fi on the computer is turned off

12.5.1 Setting up a Laptop for IPv4 Access

If you're logging into the EMS with a static IP4 address, make sure the laptop is on the same subnet as the system controller.

To assign the laptop a fixed IPv4 address in the same range as the system controller:

1. In Windows, open Control Panel, and then Network and Sharing Center.
2. Select **Change adapter settings**.
3. Right-click your local adapter and select **Properties**.
4. Highlight Internet Protocol Version 4 (TCP/IPv4) and click **Properties** button.
5. Select **Use the following IP address** and enter the IP address you want to use:



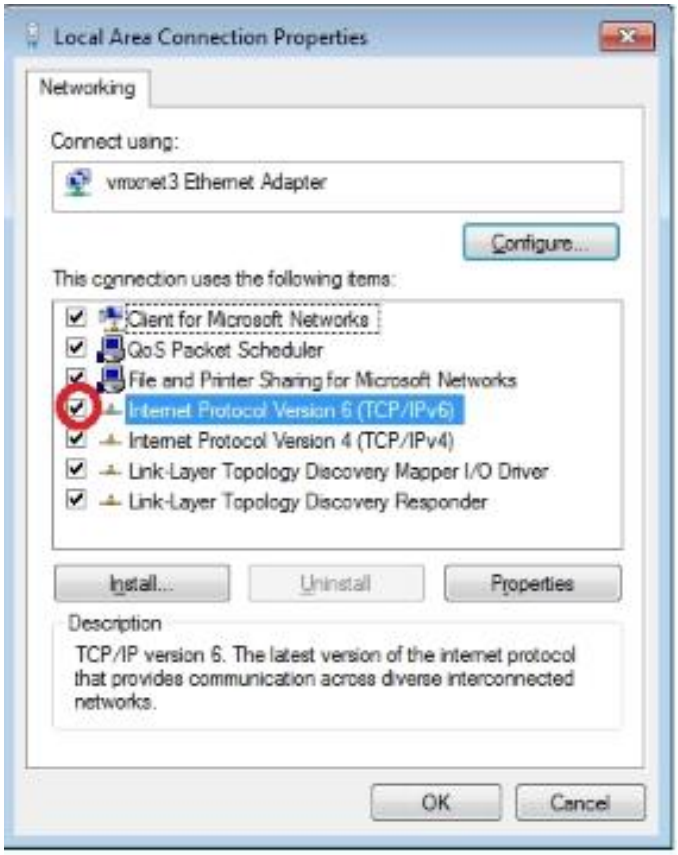
6. Click **OK** to save settings, and then **Close** to exit the properties window and wait while Windows runs network diagnostics.
7. Ensure the laptop is connected with a CAT5 cable to the **ETH** port on a host or remote.
8. Open a web browser, and enter the IPv4 address to connect to the system controller and start the EMS.

12.5.2 Setting up a Laptop for IPv6 Access

If you're logging into the EMS using a static IPv6 address, make sure IPv6 protocol is enabled on the laptop or computer and add a static route if necessary.

To enable IPv6 protocol on the laptop and add a static route:

1. In Windows, open Control Panel, and then Network and Sharing Center.
2. Select **Change adapter settings**.
3. Right-click your local adapter and select **Properties**.
4. Select Internet Protocol Version 6 (TCP/IPv6), and then click **OK**.



5. Ensure the laptop is connected to the system controller through the customer IP network.
6. Open a web browser and enter the link local IPv6 address in square brackets (**[ ]**) to connect to the controller.

   For example*:* **[fe80::9a5d:adff:fe47:cc12]**

   If this method does not launch the EMS, you may need to add a static route to the IPv6 address on your PC Ethernet interface. See the procedure following from step 7 below.
7. Open a command prompt window and run the following command to locate the interface number of your network card:

   netsh interface ipv6 show interfaces

   For example:

```
U:\>netsh interface ipv6 show interfaces

Idx     Met      MTU          State            Name
---  -------  ----------   ------------  -------------------

  1     75     4294967295   connected       Loopback Pseudo-Interface 1

 11     50           1500   connected       Wi-Fi

 10      5           1500   disconnected    Ethernet

 16     65           1500   disconnected    Bluetooth Network Connection
```

8. In the first column (Idx), find the number of the network card you are connected to.
9. Create the route by entering the following command:

   netsh interface ipv6 add route <*IPv6 address*>/**128 interface**=<*x*>

   where <*IPv6 address*> is the address configured in the Network view, and <*x*> is your network card interface number.

   For example:

```
netsh interface ipv6 add route fe80::9a5d:adff:fe45:909c/128 interface=11
```

10. Open a web browser and enter the IPv6 address in square brackets ([ ]) to connect to the system controller and start the EMS.

12.5.3 Logging in with the Default Username and Password

Use the following default EMS username and password:

- Username: **admin**
- Default password: **dali1234**

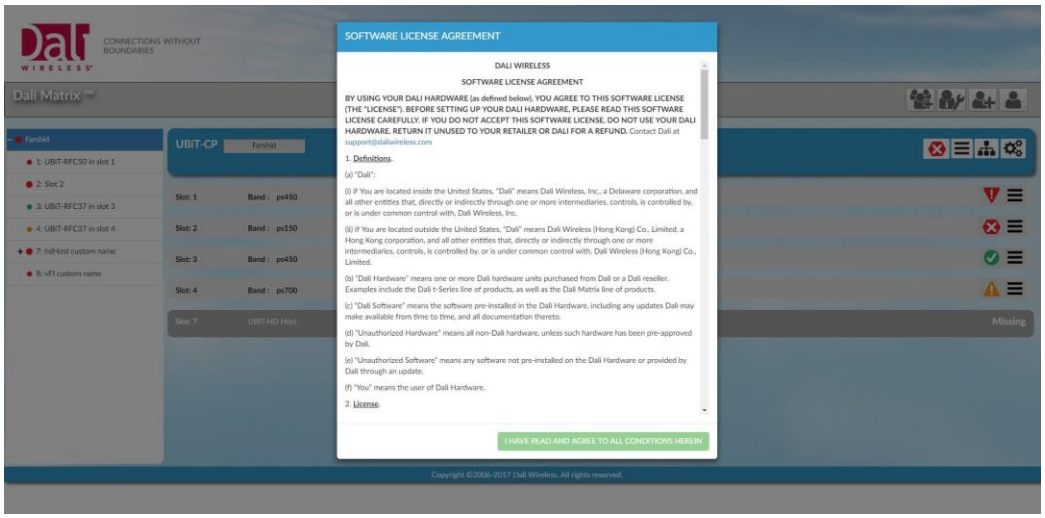
The default username cannot be changed. To change the password, see Changing the Password.

To log into the EMS:

1. In a web browser, enter the IP address provided by Dali Customer Service. If using the link-local IPv6 address, enter the address between square brackets ([ ]).
2. Enter the username **admin**, password **dali1234**, and click **Submit**.

12.5.3.1 License Agreement

The software license agreement displays the first time you log into the EMS. Read the agreement and click the **Agree** button to dismiss the dialog box and continue.



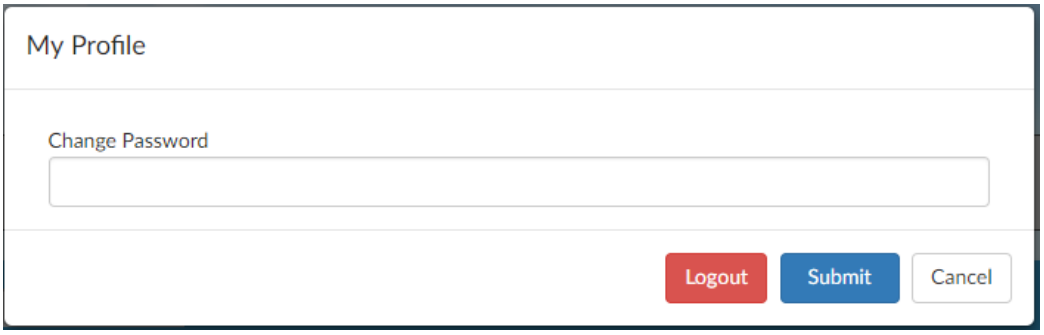
12.5.4 Changing the Password

You can change the default password after logging in.

To change the default password:

1. Click the **My Profile** button.

2. Enter a new password and click **Submit**.



12.6 Configuring SNMP

For system monitoring and fault management, Matrix supports SNMP Version 3 and works with SNMP network management systems.

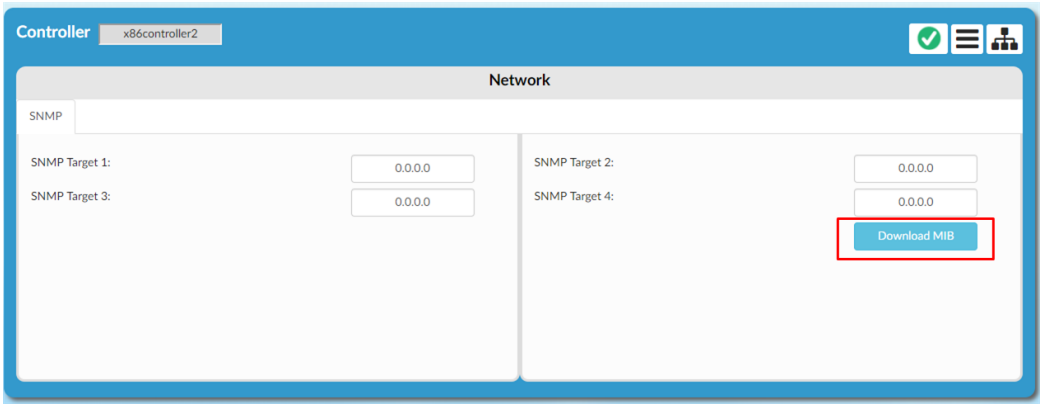
To configure the system controller to send SNMP traps to an NMS, install the Dali MIB file in your NMS, and assign the IP addresses of up to four SNMP trap receivers.

12.6.1 Downloading the Dali MIB File

To integrate Matrix with your NMS, download the DALI MIB file and then upload the MIB to your NMS. For information on using SNMP, see the **Matrix SNMP & Alarm Reference Guide**.

To download the Dali MIB file:

1. In the system tree, select the system controller.
2. Click the Network Configuration icon  .



3. Click **Download MIB** to save the file *DALI-10G-MIB.mib* to a hard drive.
4. Install the MIB in a location used by the NMS, or through SNMP command line tools, such as `snmpset` and `snmpget`.
5. Ensure the following common MIB files are also installed:

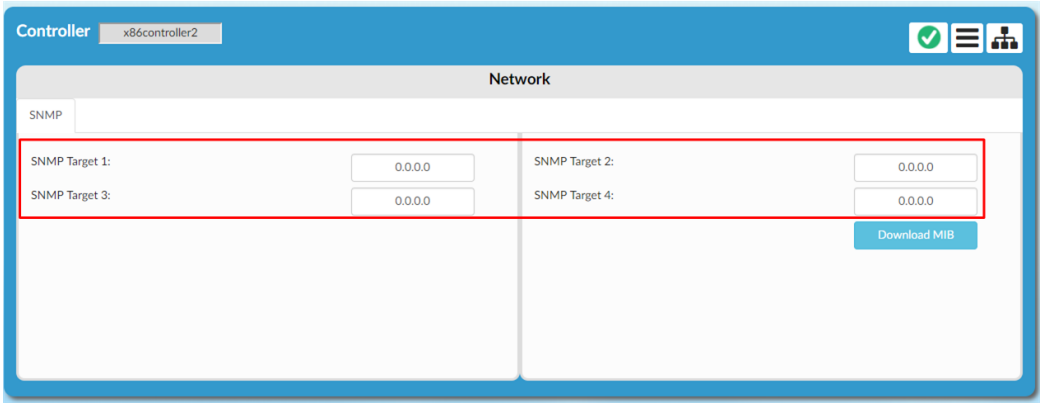
   - *RFC-1212*
   - *SNMPv2-SMI*
   - *SNMPv2-TC*
   - *IPV6-TC*
   - *SNMPv2-CONF*

12.6.2 Configuring SNMP Trap Receivers

In addition to uploading the Dali MIB file to your NMS, you must configure the network addresses of the SNMP trap receivers.

To set up SNMP receivers:

1. In the Network Configuration view , enter up to four SNMP receiver addresses.



12.7 Configuring Redundant System Controllers

For large Matrix systems requiring network redundancy, you can install Primary and Secondary system controllers to provide uninterrupted monitoring, control, and visibility of hosts and remote units.

A Primary controller can make configuration changes through the EMS, while a Secondary, or backup controller provides a read-only view. If a Primary controller fails, you can manually switch to the Secondary controller. The Secondary controller becomes the Primary so that you can continue managing all host and remote units.

Redundant system controllers adhere to the following rules:

- System controllers are unaware of each other and do not communicate directly
- Failed system controllers that have been recovered will restart in the Primary or Secondary role last used
- Only one system controller appears in the EMS system tree at a time. For example, log into the Primary controller to see it at the top of the tree. The Secondary controller is not visible

If a system controller fails and you can't log into the EMS, RF signals can still be transmitted and received on the uplink and downlink path as long as there are no Critical alarms.

12.7.1 Installing Redundant Controllers

In general, there are several ways to deploy redundant system controllers. A specific network design for your system is provided by your DAS integrator.

12.7.1.1 Without Ethernet Switches - Up to Six Hosts

In this example, controller redundancy is achieved by connecting up to six host units directly to the Primary and Secondary controllers. In this configuration, there's no single point of failure. All six LAN ports are used on each system controller, meaning that a maximum of six host units can be connected.

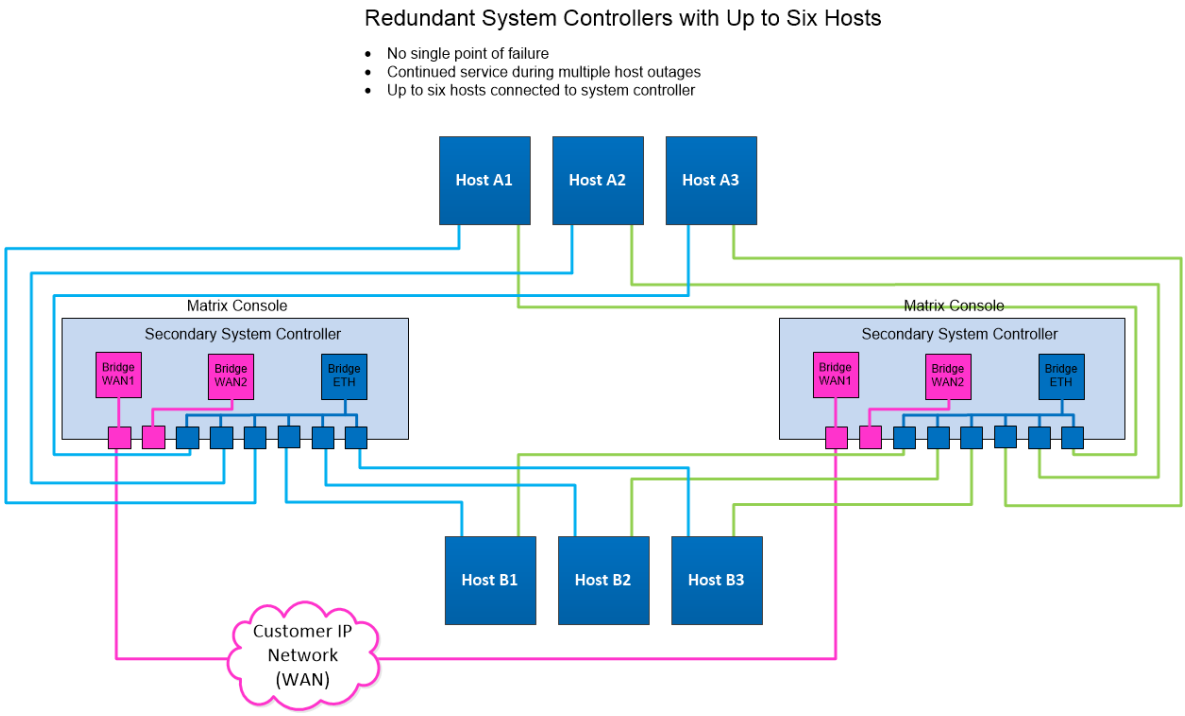


Figure 12-3: Redundant Controllers with Six Host Units

12.7.1.2 Includes Ethernet Switches - More than Six Hosts

In this example, two Ethernet switches supporting STP (spanning tree protocol), extend the number of hosts connected to the Matrix IP network. In this configuration, there is no single point of failure. If a host unit experiences an outage, the system continues service.

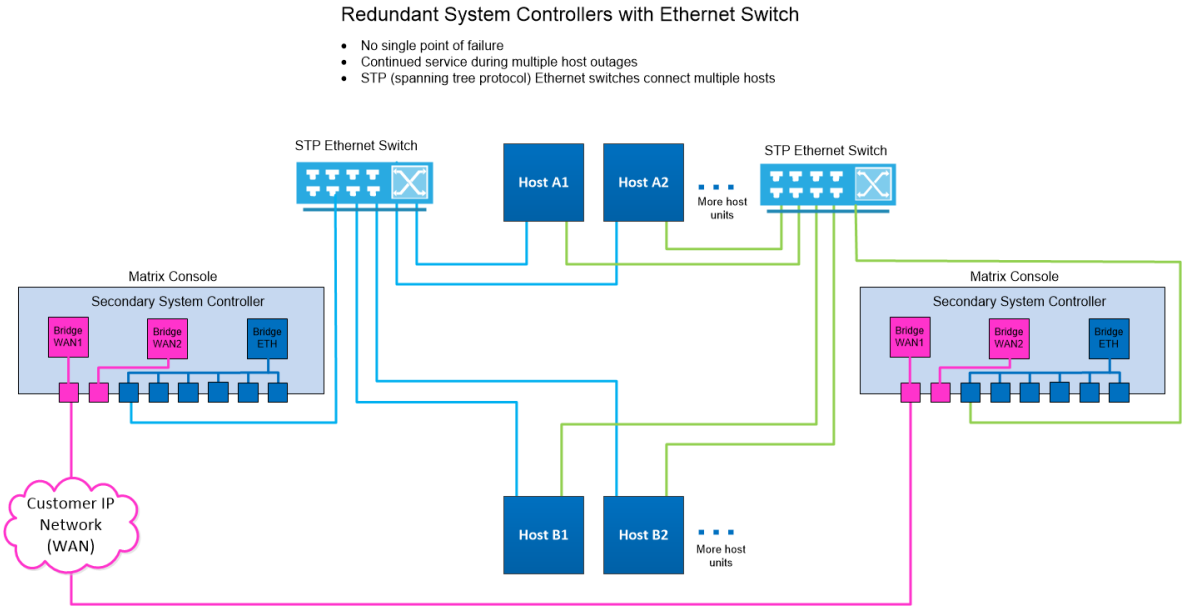


Figure 12-4: Redundant Controllers with Ethernet Switches – More than Six Host Units

12.7.2 Turning On Redundant Controllers after Installation

For information on installing Matrix Console hardware, see Matrix Console Installation.

When turning on redundant controllers, start the Secondary controller first, followed by the Primary controller.

To turn on redundant controllers:

1. Make sure both system controllers are disconnected from the external and internal Matrix IP networks. All Ethernet cables should be unplugged from the units.
2. Make sure controllers are labeled as Primary and Secondary. Units are usually pre-provisioned and labeled at the factory.
3. Turn on the Secondary controller first by plugging the AC cable into an AC power source, followed by the Primary controller. There is no power switch. The unit is on when the LED on the front panel is green.
4. Connect Ethernet cables to both system controllers, following the network plan provided by your DAS integrator. See also Matrix Console PS Installation.
5. Verify that you can log into both Primary and Secondary controller and display the EMS.

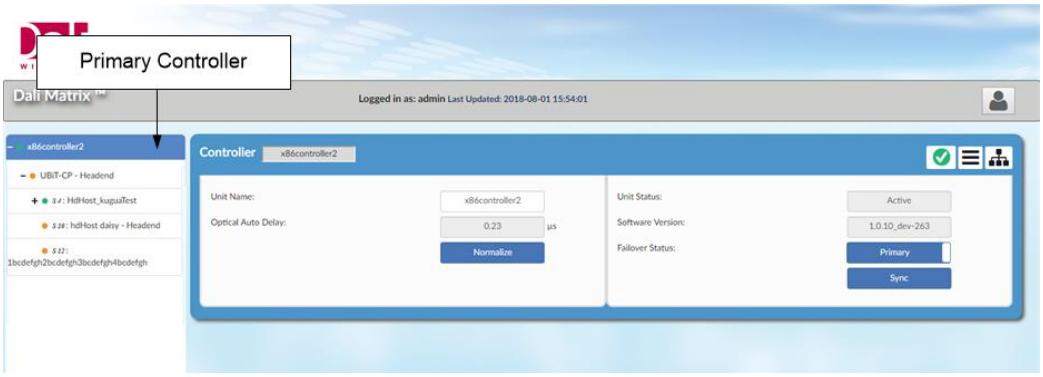
12.7.3 Logging into Primary and Secondary Controllers

Primary and Secondary controllers do not appear together in the EMS system tree and do not communicate directly. The tree displays only the controller you are logged into. When logged into the Primary controller, you can make configuration changes to all units in the system. When logged into the Secondary controller you have read-only access.

To log into a Primary or Secondary controller:

1. Locate the IPv6 link-local addresses of the system controller on the unit label.
2. Change the IP configuration of your laptop to be on the same subnet as the IP address of the port you're going to use.
3. Turn laptop Wi-Fi off.
4. Connect a laptop to a WAN or ETH port on the controller.
5. In a browser window, enter the IP address.
6. In the login screen, enter username **admin**, and password **dali1234**.

When you are logged into the Primary controller, the EMS shows the Primary unit in the system tree, and allows you to make changes to host and remote unit and band configurations.



When you are logged into the Secondary controller, the EMS displays a banner in the Unit view. All fields are grayed out, and read-only.

12.7.4 Identifying System Controller Failures

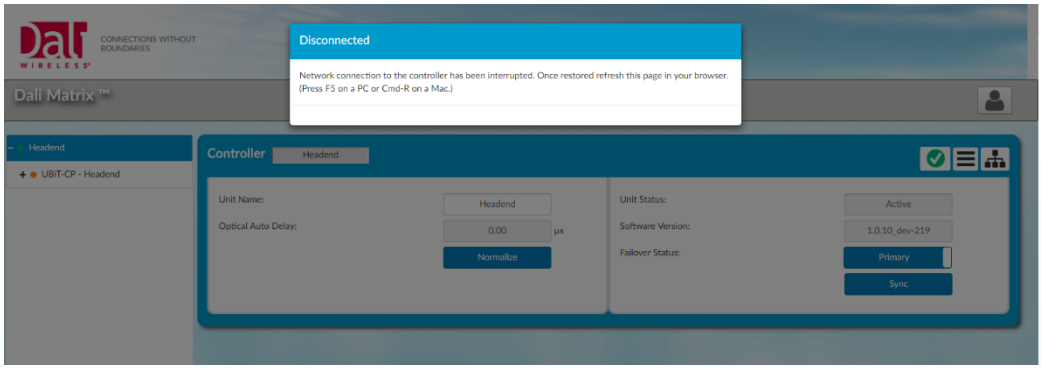
A system controller outage can occur as a result of hardware and software failures. Some indicators of a failure are:

- EMS displays a Disconnected dialog box
- Power cycling the system controller does not recover the unit

12.7.4.1 Disconnected Dialog Box

The Disconnected dialog box means the system controller is not communicating with host and remote units.

Before you assume the system controller has failed, refresh the browser window and try logging in again. If you still can't log in to the EMS after several attempts, the system controller has likely failed. If the unit is the Primary controller, manually fail over to the Secondary controller.



12.7.4.2 Power Cycling Does not Recover the System Controller

If the system controller does not start up correctly, or fails to turn on after power is applied, suspect a hardware issue. If the unit is a Primary controller, manually switch to the Secondary controller.

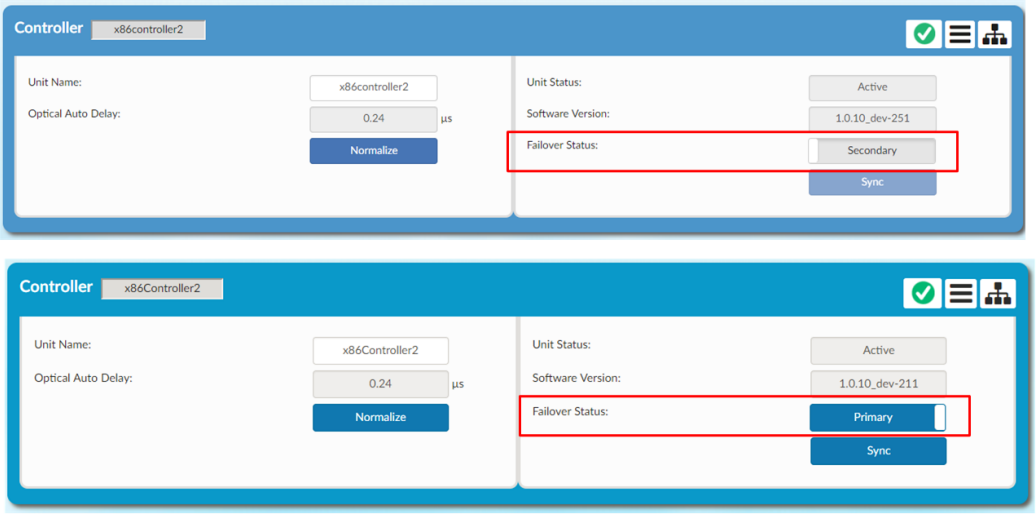
12.7.5 Managing Primary Controller Failures

If the Primary controller fails, you can manually initiate a failover. The Secondary controller becomes Primary, allowing you to continue changing or managing host and remote configurations without interruption.

12.7.5.1 Switching to the Secondary Controller

To switch to the Secondary controller when the Primary unit fails:

1. Log into the Secondary controller.
2. Select the system controller in the tree, and display the Unit information view .
3. Click the Failover Status button to toggle from **Secondary** to **Primary**. The Secondary controller becomes the Primary.



4. Make configuration changes as necessary on the new Primary controller. Changes are sent immediately to the host and remote units.

Example

For example, in Figure 12-5, the Primary controller (P) maintains the system configuration settings (XYZ) and pushes them to the host and remote units. The host and remote units acknowledge the settings to the Primary and Secondary controller (S), keeping configuration data up to date on all units.

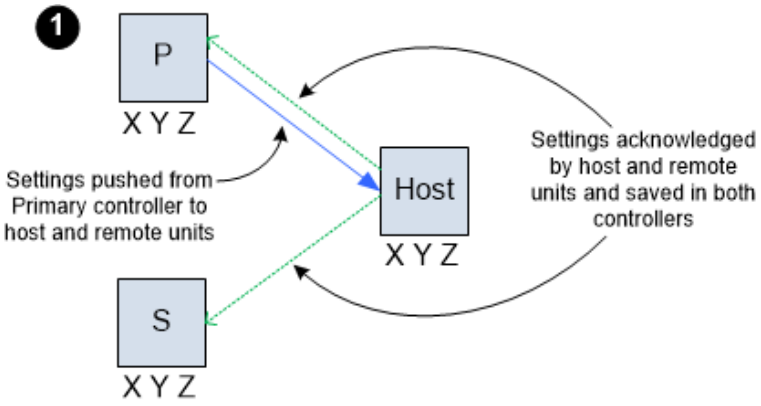


Figure 12-5: Settings Maintained by the Primary Controller

If the Primary controller fails, as in Figure 12-6, there's no communication with host and remote units. By switching the Secondary controller to Primary, you maintain full management and control of the system. The new Primary controller is able to push configuration changes to host and remotes.

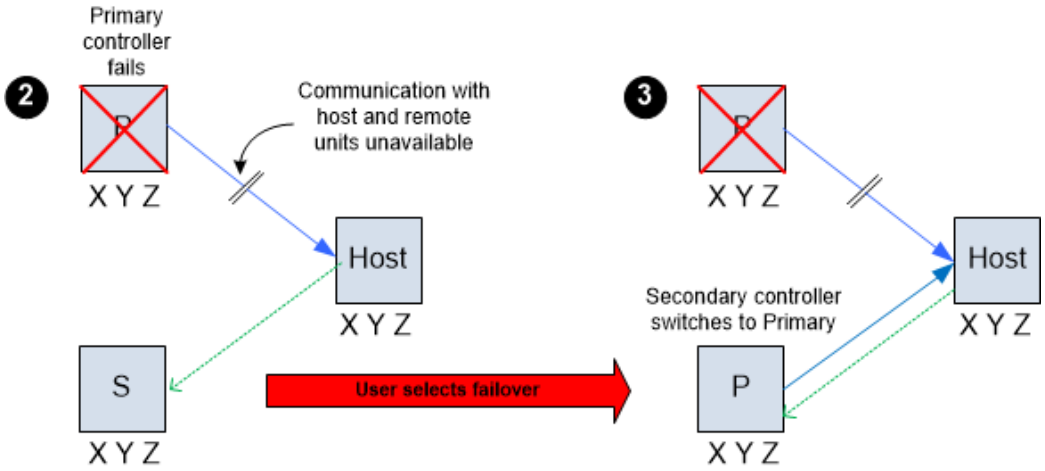


Figure 12-6: Primary Controller Failure

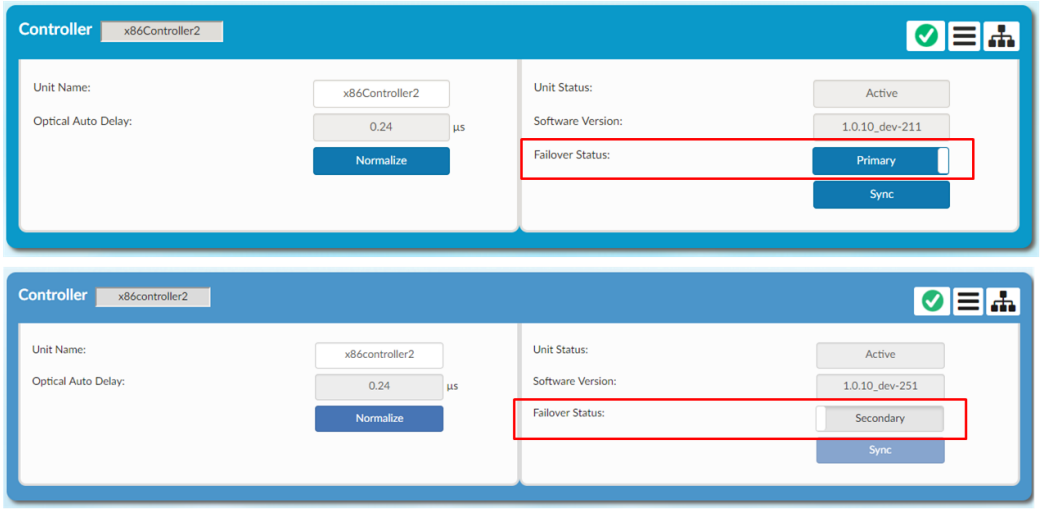
12.7.5.2 Recovering a Failed Primary Controller

Once you fail over to the Secondary controller, you can continue operating normally. Both system controllers are identical in network and system management capabilities. However, to recover the failed unit, you may have to replace or service the controller, and then restart it. Once you've recovered the failed controller, you need to initiate a sync (synchronization) to ensure configuration data is up to date on both units.

If you don't sync the system controllers, the recovered Primary controller may push out-of-date configuration data to the host and remotes. Any configuration changes you made while the failed controller was offline will be lost.

To recover a Primary controller after a failover:

1. Disconnect the failed system controller from the network.
2. Replace or service the unit, and then restart it by plugging in the AC cable into an AC power source. There is no power switch. The controller starts up as Primary, but is offline because it is disconnected from the network.
3. Log into the offline Primary controller.
4. Select the system controller in the tree, and display the Unit information view .
5. Click the Failover Status button to toggle the unit to **Secondary**.

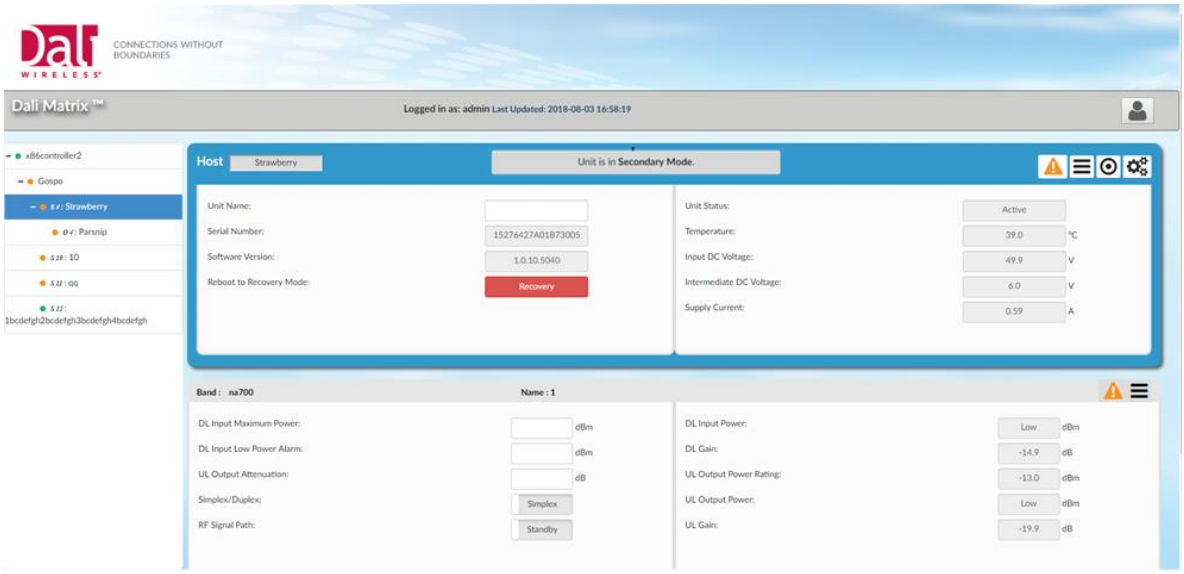


6. Continue to Syncing Primary and Secondary Controllers.

12.7.5.3 Syncing Primary Controller and Secondary Controllers

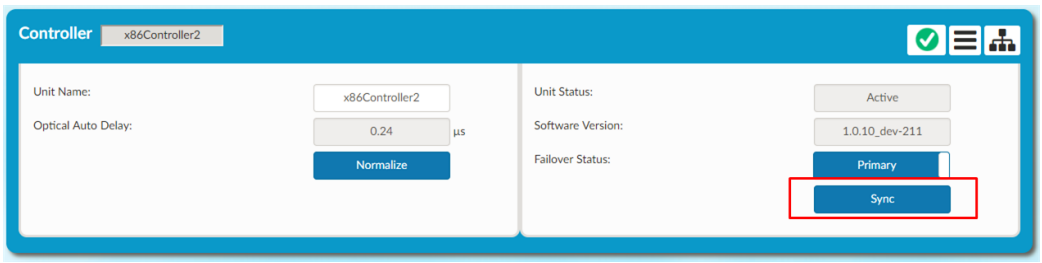
When an offline controller is reconnected to the network, its configuration data may be out of date. Syncing controllers ensures both Primary and Secondary controllers have the latest configuration.

One way to know if a Secondary controller requires syncing is to look at the configuration fields in the EMS. If some fields appear grayed out and blank, you should sync controllers.



To sync system controllers:

1. Make sure the offline controller is set to Secondary.
2. Reconnect the Secondary controller the network.
3. Log into the Primary controller.
4. In the Unit information view, click **Sync** to update the Secondary controller with the latest configuration data.



Example

For example, in Figure 12-7, the online Primary unit has pushed configuration changes to host and remote units. The configuration in the failed controller is out of date.

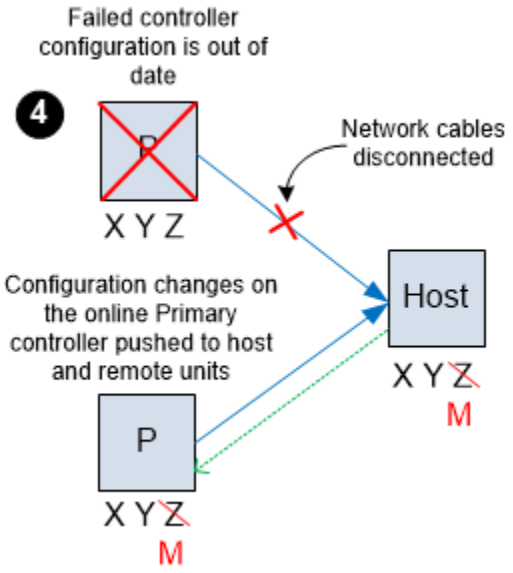


Figure 12-7: Failed Controller is Out of Date

Once the failed Primary controller is recovered, you can switch it to Secondary. Then, reconnect the network, as you see in Figure 12-8. Now, you're ready to sync system controllers.

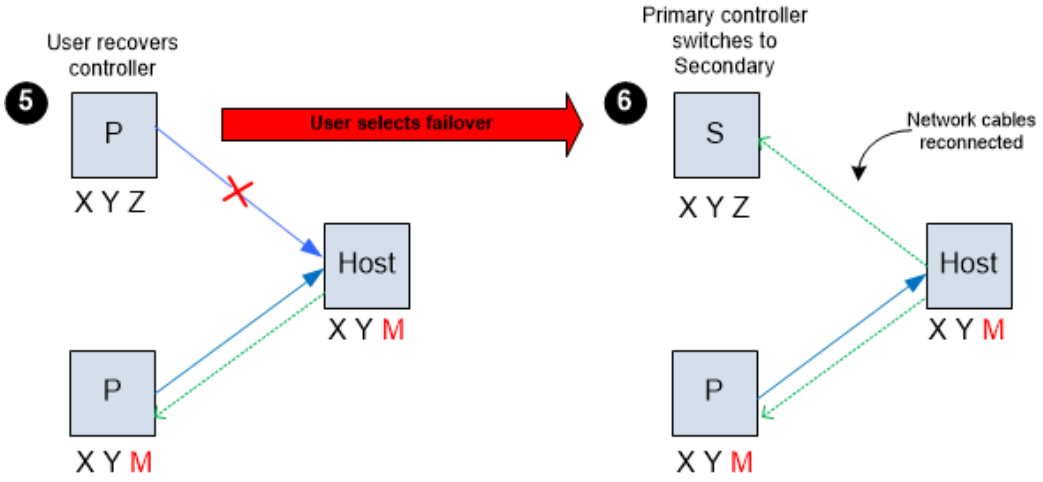


Figure 12-8: Recovering a Failed Primary Controller

When you select **Sync** on the Primary controller, as in Figure 12-9, the configuration data from Primary is pushed to the host and remote units. The host and remotes then acknowledge, or send the updates back to both controllers to be saved.

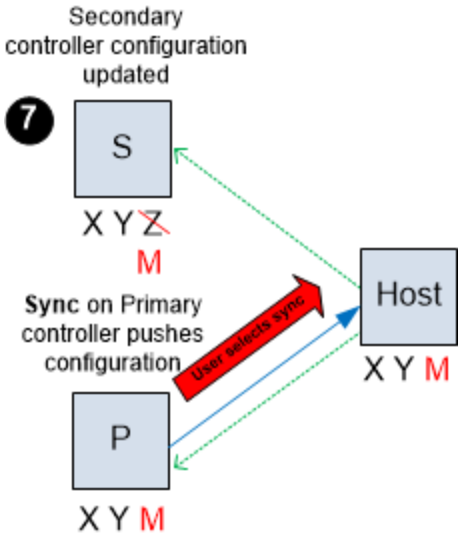


Figure 12-9: Syncing Primary and Secondary Controllers

The final step in recovering a failed Primary controller after syncing both units is to either continue using the system as is, or to switch controllers back to the original roles. Figure 12-10 shows both options. To switch system controllers back the original Primary-Secondary roles, switch the Secondary controller to Primary, and the Primary controller to Secondary.

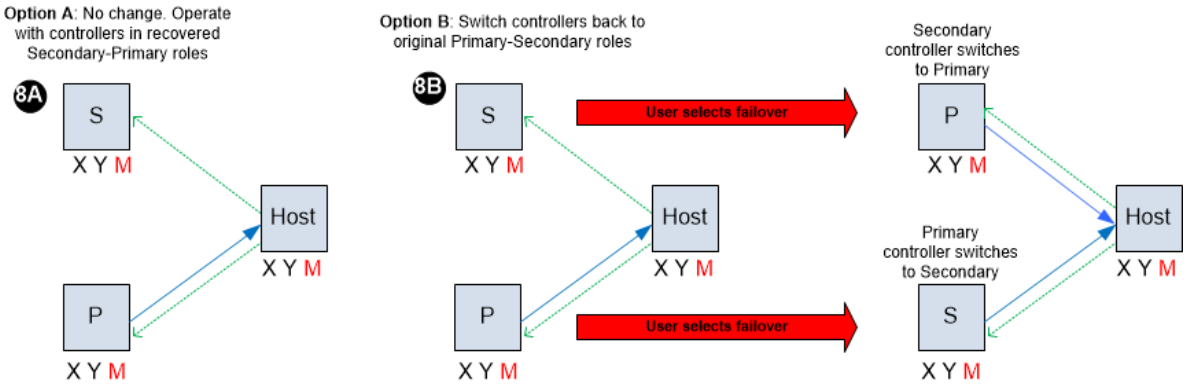


Figure 12-10: Recovered Primary and Secondary Controller Roles

12.7.6 Managing Secondary Controller Failures

If the Secondary controller fails, no failover is required since the Secondary controller is considered the backup unit. However, after recovering the failed unit, you should sync controllers to ensure the configuration data is up to date on both units.

12.7.6.1 Recovering a Secondary Controller

To recover a Secondary controller:

1. Disconnect the failed Secondary controller from the network.
2. Replace or service the unit, and then restart it by plugging in the AC cable into an AC power source. There is no power switch. The controller starts up as Secondary, but is offline because it is disconnected from the network.
3. Reconnect the offline Secondary controller to the network.
4. Continue to Syncing a Recovered Secondary Controller.

12.7.6.2 Syncing a Recovered Secondary Controller

Sync a recovered Secondary controller the same way as a Primary controller. See Syncing Primary and Secondary Controllers.

Example

For example, in Figure 12-11, when the Secondary controller fails, the configuration changes in the Primary controller are not updated on the Secondary unit.

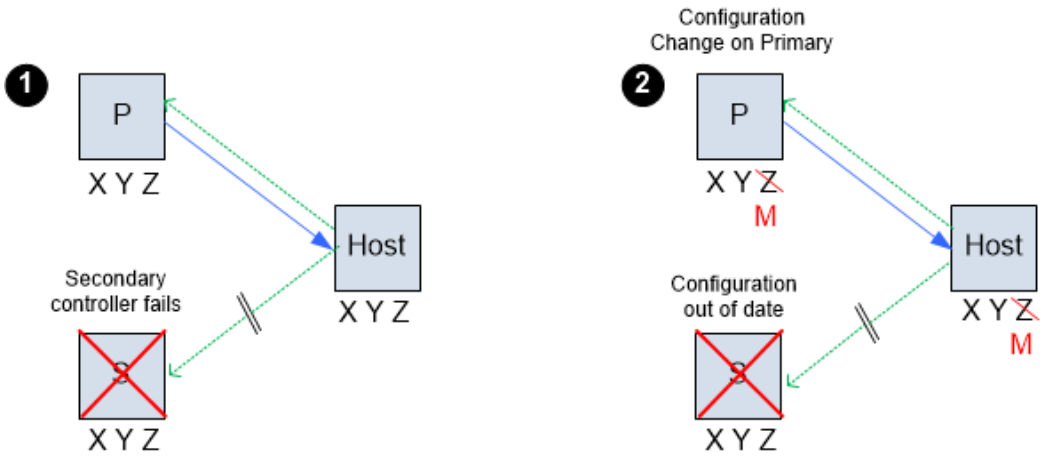


Figure 12-11: Secondary Controller Failure

After recovering the Secondary controller, you can sync controllers, as shown in Figure 12-12. The latest configuration data sent from the Primary controller to the host and remote units, is then saved on both controllers.

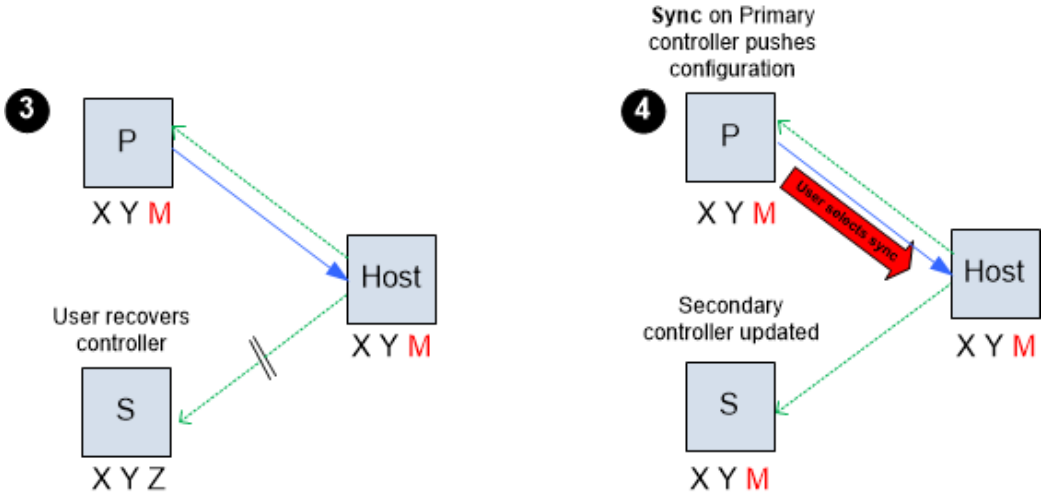


Figure 12-12: Recovering a Failed Secondary Controller

13 MATRIX EMS OVERVIEW

This chapter describes how to:

- Log into Matrix EMS
- Work with EMS screens
- Display information about units, RF modules, and optical ports
- Display the status of units, RF modules, and optical ports
- Place RF modules and optical ports in Standby
- Activate RF modules or optical ports

13.1 EMS Terms and Definitions

This manual uses the following terms to refer to different Matrix units in the EMS.

Term	Refers to
Unit	• System controller (Matrix Console PS), host, or remote
Host	• hdHost PS base station host unit • airHost PS off-air host unit
Remote	• hd33 PS remote
System controller	• System controller software on the Matrix Console PS
UBiT-CP	• Matrix Commercial Cellular systems only
RF module	• Band-specific RF module in a hdHost PS, airHost PS, or remote

13.2 Browser Support and Troubleshooting

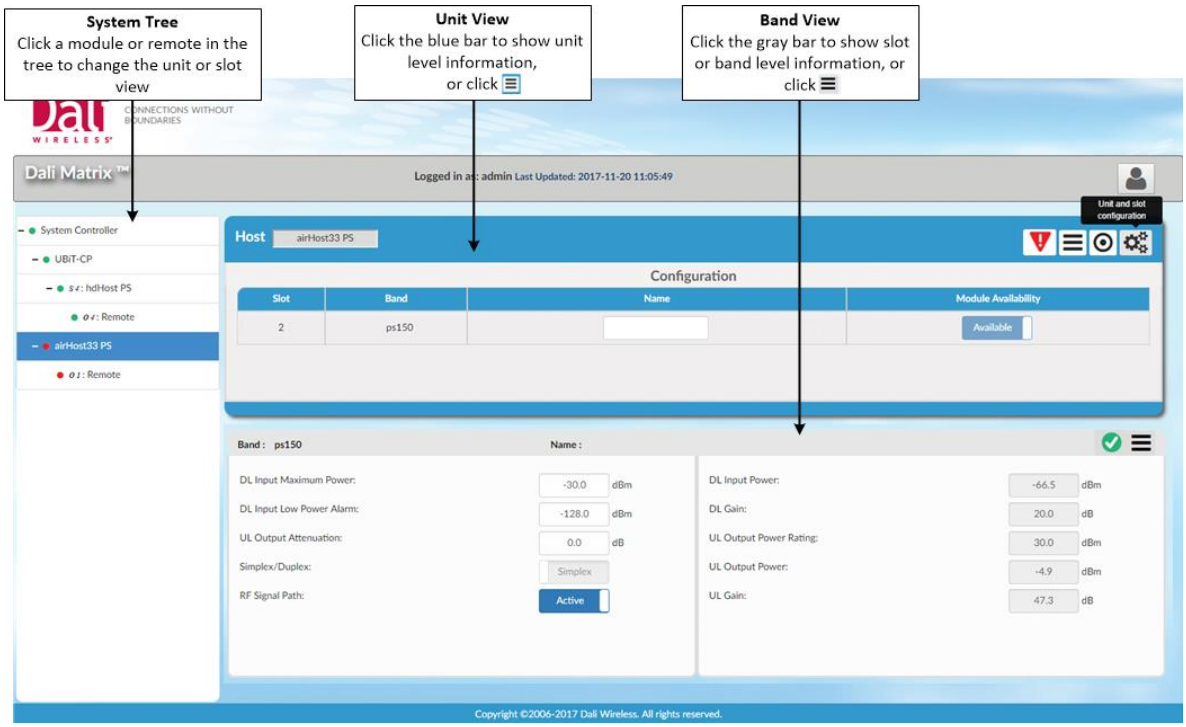
The EMS supports the latest version of the following Windows browsers:

- Chrome, version 48 or later
- Firefox, version 45 or later
- Internet Explorer 11 or later

If the EMS seems slow to respond to mouse-clicks or text entry, try clearing the Windows browser cache.

13.3 EMS Screens

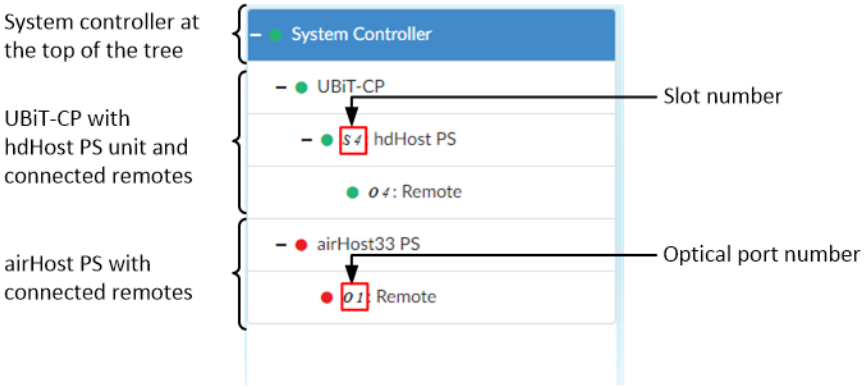
The EMS consists of a hierarchical tree for displaying all the elements in the system, and a number of views for displaying unit and slot configuration, alarms, and network information.



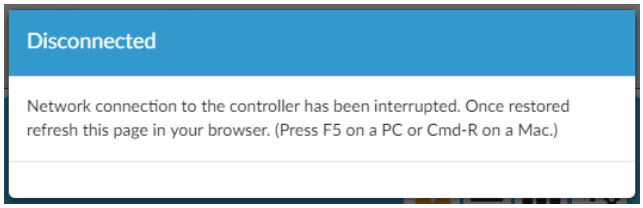
13.3.1 System Tree

The system tree displays hierarchical list of Matrix equipment. At the top of the tree sits the system controller, with the host and remote units nested below it. Remotes appear below the host they are connected to.

To expand the tree to see all modules and remotes, click the + icon.



If a unit is missing in the tree, the hardware is either not installed correctly or the EMS is no longer communicating with the system controller or unit (in which case a Disconnected dialog appears).



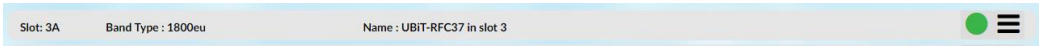
For more information about missing units, see Managing Missing Units, RF Modules and SFPs.

13.3.2 Unit and Band Information Views

The EMS provides configuration options for units and bands. Unit views contain information about the hdHost PS, airHost PS, and hd33 PS. Band views contain information about RF modules.

The unit information view has a blue title bar with the unit name, and icons for displaying alarm, unit, networking, optical, and RF configuration options. Click the title bar to expand or collapse the view.

Band information views have a gray title bar with the slot name, band type, user-assigned name, and icons for displaying alarm and RF configuration options. Click the title bar to expand or collapse the view.



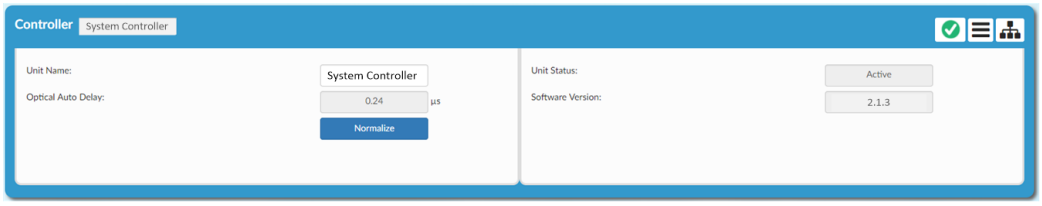
13.4 Field Descriptions

The EMS displays information on units, RF modules, and optical ports.

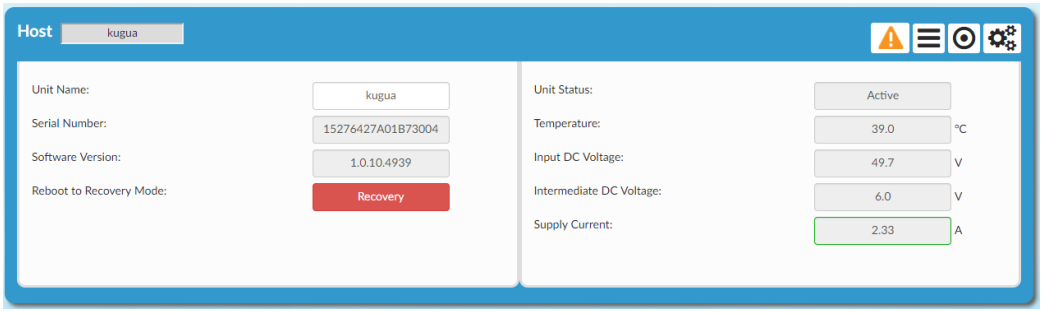
13.4.1 Unit Information Fields

Unit information is available by clicking the blue title bar or the Unit Information icon .

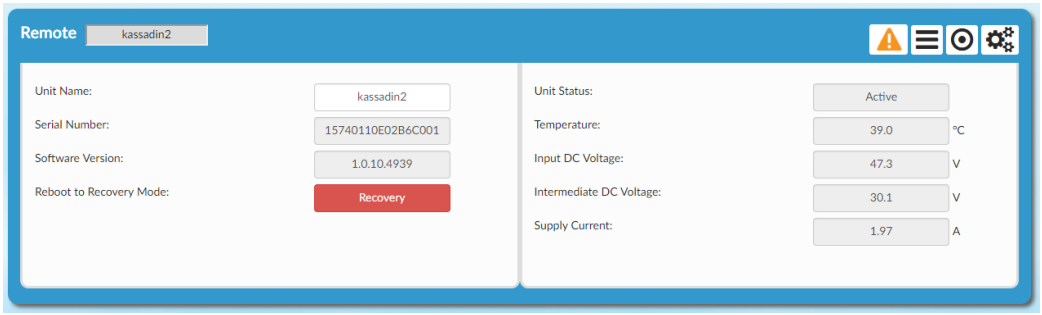
System Controller



Host


Host
kugua
Unit Name:
kugua
Serial Number:
15276427A01B73004
Software Version:
1.0.10.4939
Reboot to Recovery Mode:
Recovery
Unit Status:
Active
Temperature:
39.0
℃
Input DC Voltage:
49.7
V
Intermediate DC Voltage:
6.0
V
Supply Current:
2.33
A

Remote

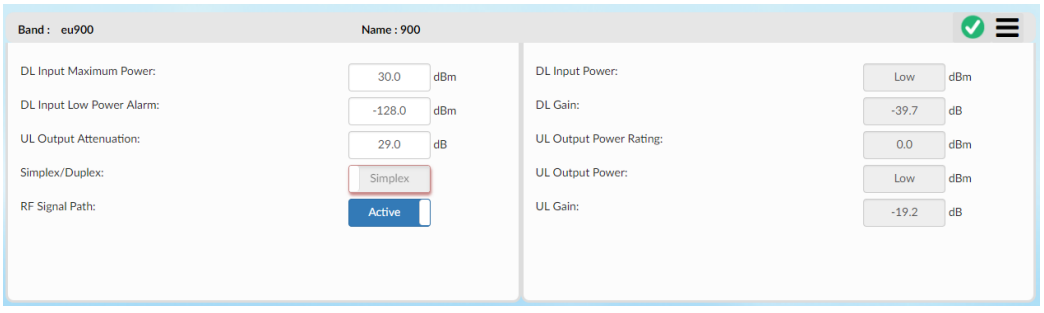

Remote
kassadin2
Unit Name:
kassadin2
Serial Number:
15740110E02B6C001
Software Version:
1.0.10.4939
Reboot to Recovery Mode:
Recovery
Unit Status:
Active
Temperature:
39.0
℃
Input DC Voltage:
47.3
V
Intermediate DC Voltage:
30.1
V
Supply Current:
1.97
A

Field	Description
Serial Number	Displays the serial number located on the side of the module or unit.
Software Version	Displays the unit level software version.
Unit Name	Configures a user-defined name for identifying the unit by operator or location.
Optical Auto Delay	System controller only Displays the highest sum of optical delay from the hdHost PS to the farthest remote.
Normalize	System controller only Automatically normalizes all optical delays in the system.
Unit Status	Displays the status of the system controller, hdHost PS, or remote. For more information, see Unit Status.
Temperature	Displays the internal temperature of the unit.
Input DC Voltage	Displays the external supply voltage to the unit. For the hdHost PS this is a measurement of the backplane voltage.
Intermediate Voltage	For remotes this is the power amplifier (PA) voltage to the RF module. For hosts this is the RF module voltage.
Backplane DC Voltage	Displays the external supply voltage to the unit. For the hdHost PS, this is a measurement of the backplane voltage.
Supply Current	Displays the cumulative current drawn by RF modules.
Recovery button	Displays the Recovery Console for rebooting the unit of upgrading software.

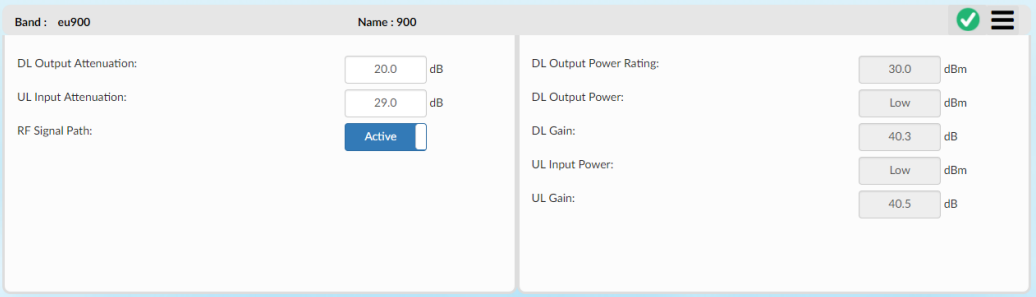
13.4.2 RF Module Fields

Information about RF modules is available by clicking the gray title bar or the Band Information icon ☰.

Host



Remote



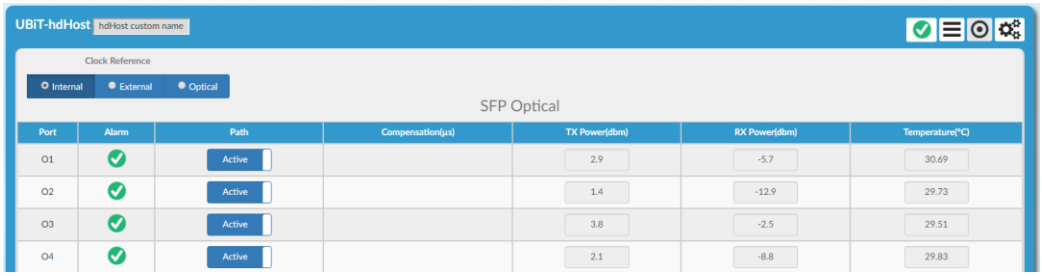
Field	Description
DL Input Maximum Power	Sets the maximum downlink RF power allowed from the signal source to the airHost PS or hdHost PS. hdHost PS range: -10 dBm to 10 dBm airHost PS range: -95 dBm to -10 dBm
DL Input Low Power Alarm	Sets a threshold for the low input power alarm. To disable the alarm, set to -128.00 dBm.
DL Output Attenuation	**Remote** Adds downlink attenuation to the remote. Range: 0 to close to 30 dB
UL Output Attenuation	**Host** Adds uplink attenuation to the RF module to lower the UL power to the signal source. Range: 0 to close to 30 dB
UL Input Attenuation	**Remote** Adds uplink attenuation to the remote to adjust the UL power for individual remotes. Range: 0 to close to 30 dB
Simplex/Duplex	**Host** Simplex only available. Configures the presence of simplex or the duplex connections.
RF Signal Path	Activates the the RF module and displays the status of the slot. For more information, see RF Module Status.
DL Input Power	Displays the measured downlink power from the signal source to the airHost PS or hdHost PS.
DL Output Power	**Host** Displays the downlink power from the airHost PS or hdHost PS to the remote. **Remote** Displays the downlink power from the remotes to the RF distribution network.

Field	Description
DL Output Power Rating	Displays the maximum output power the RF module is capable of handling.
DL Gain	**Host** Displays the gain of the downlink path at the airHost PS or hdHost PS as configured in the UL Input Attenuation field or DL Input Maximum Power field. **Remote** Displays the gain of the downlink path at the remote as configured by the UL Output Attenuation field.
UL Output Power Rating	Displays the maximum output power the RF module is capable of handling.
UL Input Power	**Host** Displays the uplink power to the airHost PS or hdHost PS. **Remote** Displays the uplink power to the remote from the RF distribution network.
UL Output Power	Displays the uplink power to the base station from the airHost PS or hdHost PS.
UL Gain	**Host** Displays the gain of the uplink path at airHost PS or hdHost PS as configured by UL Output Attenuation field. **Remote** Displays the gain of the uplink path at the remote as configured by UL Input Attenuation field.

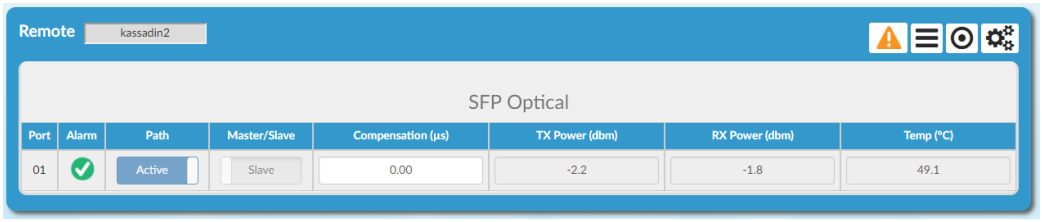
13.4.3 Optical Port Fields

Optical port information for host units and remotes is available by clicking the blue title bar for the unit, and the Optical Information icon .

Host



Remote

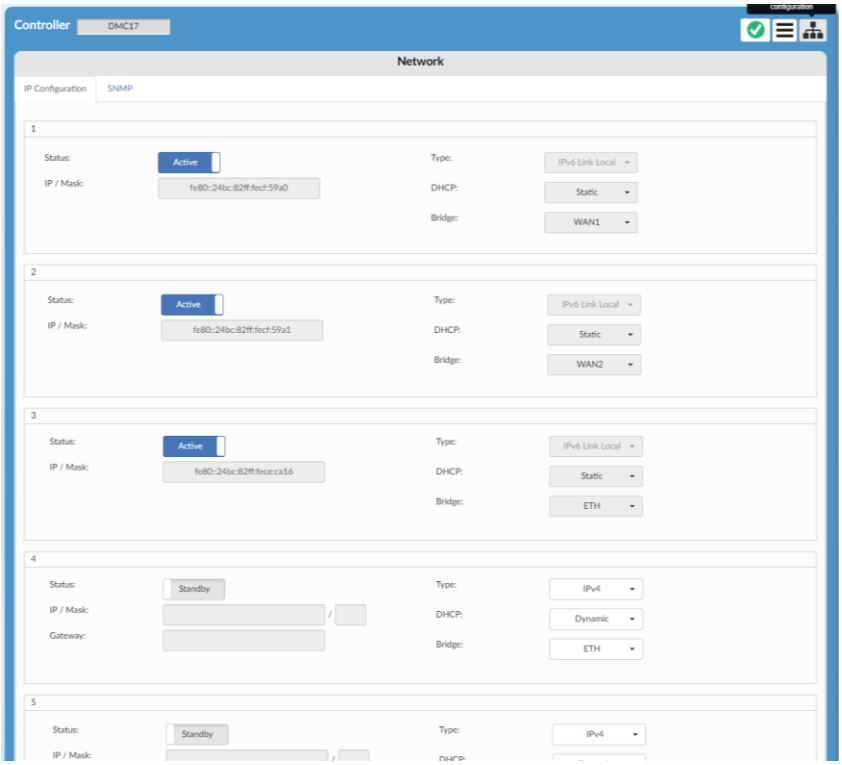


Field	Description
Port	Displays the optical port number. Host Port O1 is reserved for connecting to an upstream host unit. Do not use Port O1 on a host to connect to a remote. Remote Port O1 on a downstream remote connects to an upstream host or remote. Port O2 on an upstream remote connects to a downsream remote. Disable Port O2 on the last remote in a daisy-chain.
Alarm	Displays the alarm status for the unit. No alarm, Minor, Major, Critical For a list of alarms, see Appendix E.
Path	Displays the status of the optical path. For more information, see Optical Port Status.
Compensation	Displays the delay compensation applied to this optical link. For more information, see Configuring Delay Compensation.
Tx Power (dBm)	Displays the transmit power for the SFP. Compare to Rx Power on the other end of the optical link to determine fiber loss.

Field	Description
Rx Power (dBm)	Displays the receive power for the SFP. Compare to Tx Power on the other end of the optical link in order to determine fiber loss.
Temperature (°C)	Displays the SFP optical transceiver temperature.

13.4.4 Network Configuration Fields

Configured IP addresses for the system controller appear in the Network Configuration view. Select the system controller in the tree and click  .



Field	Description
Status button	Activates or places an IP address in Standby. When Active, an IP configuration is applied on the host. In Standby, the IP configurations are not applied on the host. IP configurations that are in Standby are not available for accessing the system controller.
IP/Mask	Assigns a static IP address and network mask. For IPv6 addresses, only the address field is available
Gateway	Assigns a default gateway for a static IP address. Not available for IPv6 addresses.
Type	Selects **IPv4** or **IPv6** addresses. IPv6 Link-local is displayed in the list but not available for user-assigned IP addresses.

Field	Description
DHCP	Selects **Static** or **Dynamic**. When **Static** is selected, either an IPv4 or IPv6 addresses can be specified. When **Dynamic** is selected, DHCP is enabled for the interface and IP addresses will be assigned by a DHCP server. The address fields become grayed out and unavailable for editing.
Bridge	Selects the bridge interface for the IP address: • **WAN1**: most commonly used interface for accessing the external, customer IP network • **WAN2**: an optional, second WAN interface for customers with multiple external networks • **ETH**: LAN interface for direct access to the system controller

13.5 Status Descriptions

The EMS displays a number of status modes. The status tells you at a glance if an RF module or optical port is passing RF signals or digital data stream.

13.5.1 Unit Status

The following table describes the status modes for host and remote units.

Unit Status	Description
Standby	• Unit has powered on successfully. • Unit is not carrying RF signals. All the RF modules in the unit are also Standby. • Unit is ready for configuration or servicing (including upgrades or restarts).
Active	• Unit is carrying RF signals. At least one RF module in the unit is Active. • Minor or major alarms may be present.
Failed	• Unit is reporting a critical alarm. • If the unit cannot recover from the failure automatically and return to Active status, the unit can be placed in Standby manually by placing all RF modules in Standby.
Missing	• Unit has since lost communication with the system controller because of disconnection of the Ethernet cable or loss of the optical link. Always accompanied by missing unit critical alarm. • May change to Standby if the unit is replaced. • If the missing unit alarm is acknowledged by the operator, the unit is removed from the system tree. • If the unit is reconnected in the same location or moved to another location in the Matrix PS system, then the missing unit alarm is cleared and the unit re-establishes the connection with the system controller.
Not Ready	• May be seen briefly during the boot sequence. The unit changes to Standby once the application software is running.
No Link	• All optical links on a remote are also showing No Link. See Optical Port Status. • RF modules are deactivated to prevent damaging optical signals from being passed over the optical link. • When optical links have been restored, the modules return to Active or Failed status.
In Service	• Unit is physically present but communication is not possible due to servicing (such as calibration, debug mode or software update). • Always accompanied by a minor alarm. • Unit returns to Standby automatically when servicing is complete. • Unit cannot be configured while in service.

13.5.2 RF Module Status

The EMS displays a number of status modes for the RF module. The status is displayed on the RF Signal path button in the Band Information view  .

RF Module Status	Description
Standby	• RF module has powered on successfully. • RF module is not sending or receiving RF signals. • RF module is ready for configuration or servicing (such as upgrades or restarts). • Clicking Standby activates the module, changing the status to Active.
Active	• RF module is sending or receiving RF signals. • Minor or major alarms may be present. • Clicking Active deactivates the module, changing the status to Standby.
Failed	• A module critical alarm has occurred and the RF path has been deactivated. • Always accompanied by a critical alarm which indicates the cause of the failure • RF module may recover and return to Active automatically. If the RF module cannot recover, then the module can be placed in Standby manually. • Clicking Failed deactivates the module, changing the status to Standby.
Activating	• RF module is changing from Standby to Active (displays briefly
Missing	• RF module has been physically removed. • Always accompanied by an associated critical alarm. • May change to Standby if the module is replaced. • If the module is replaced elsewhere or the slot is reused, the critical alarm is cleared. • RF module cannot be configured while Missing.
No Link	• All optical links on a remote are also showing No Link. For more information, see Optical Port Status. • RF modules are deactivated to prevent damaging optical signals from being passed over the optical link. • When all optical links have been restored, the modules return to Active or Failed status.

13.5.3 Optical Port Status

The EMS displays a number of status modes for optical ports. By default, optical ports are Active.

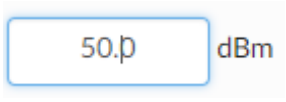
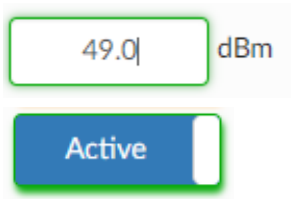
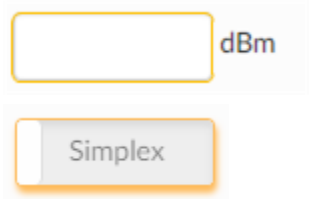
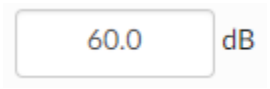
If an optical port has a status of Standby or Failed, make sure the SFPs are installed and optical fiber is connected. Re-install if necessary. If an optical port is in Standby, then activate it. If the port status is No Link, then check the optical fiber. If the port status is Failed, then check the SFP. It may be an incompatible type or not fully inserted.

The following table describes types of status modes for optical ports.

Port Status	Description
Active	• SFP lasers are active. • Critical alarms that affect the optical link may be present. • Minor or major alarms that only affect the SFP may be present. • Clicking Active deactivates the SFP and changes the optical port status to Standby.
Standby	• Optical signal path and SFP has been deactivated due to user request or critical alarm. • Clicking Standby activates the SFP and changes the optical port status to Active.
Failed	• Optical signal path cannot activate and SFP lasers are disabled. • Always accompanied by a critical alarm indicating the cause of the failure. • Indicates that the SFP may be incompatible SFP or not fully inserted. • Clicking Failed deactivates the SFP and returns the optical port status to Standby.
Missing	• SFP was present but is now missing, causing a critical alarm. • May change to Standby if the SFP is replaced.
Activating	• SFP is changing from Standby to Active status (displays briefly).
No Link	• Optical link to the far end device is unable to carry optical signals. • Accompanied by a minor optical alarm if the port is unable to send optical signal to a downstream remote (master port). • Accompanied by a critical optical alarm if the port is unable to receive optical signal from an upstream hdHost PS or remote (slave port). • SFP changes to Active or Failed when optical link has been restored.

13.6 Field and Slider Button Colors

When you edit a field or click a slider button, the outline color tells you if your changes have been applied successfully.

Field Color	Description
	Blue (on click) Indicates the field can be edited.
	Green Indicates the EMS has applied the changes successfully. Includes read-only fields.
	Red Indicates the EMS could not apply the changes because a problem occurred. Enter a different value to retry. Note that if the value is invalid or out of range, the EMS displays an Error dialog box.
	Orange Indicates the EMS is waiting to verify that the changes have been applied. Once the changes are verified, the orange outline disappears.
	Gray followed by Disconnected dialog box Indicates the EMS did not receive the changes and has timed out.

13.7 Activating RF Modules or Optical Ports

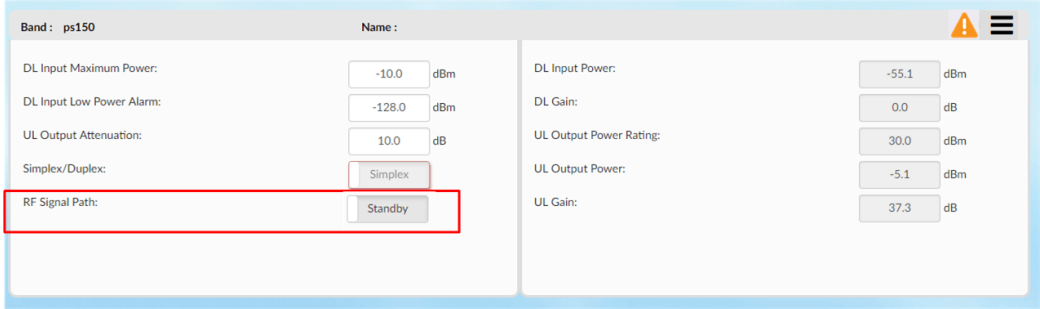
You can manually activate the signal path for RF modules and optical ports when they are in Standby or Failed status modes.

Activate RF modules to pass RF signals, and activate optical ports to turn on SFP lasers and pass the digital data stream over the optical link.

To activate an RF module:

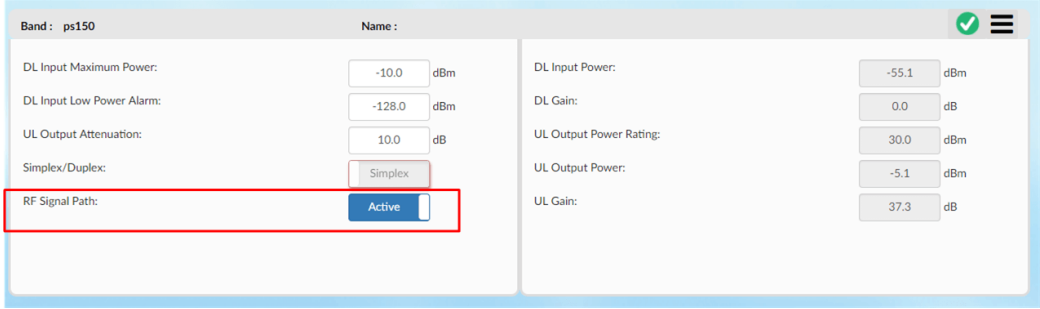
1. Select the airHost PS, hdHost PS, or remote in the system tree.

2. Click ☰ to display the Band Information view. The RF Signal Path button for a deactivated module is gray and labeled Standby.



3. If the button is red and Failed, a critical alarm has occurred. See If a RF Module or Optical Port Cannot Activate.

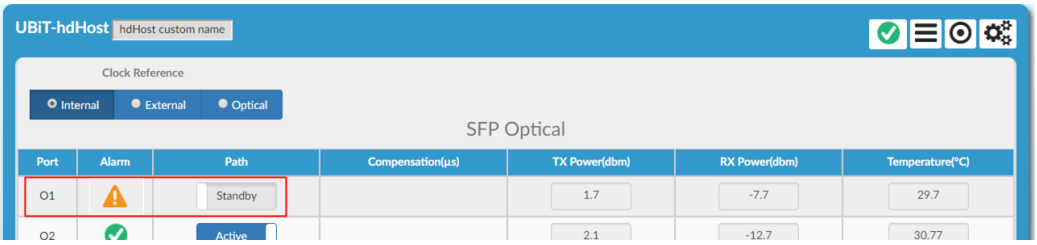
4. Click **Standby**, and wait 6 to 10 seconds for the module to change from Standby to Active.



To activate an optical port:

1. Select the airHost PS or hdHost PS in the system tree.

2. Click ◎ to display the list of optical ports. The Path button for the deactivated optical port is gray and labeled Standby.



3. Click **Standby** and wait 6 to 10 seconds for the optical port to change to Active.

13.7.1 If an RF Module or Optical Port Cannot Activate

If the module or optical port cannot activate, the RF module or optical port changes to Failed or No Link.

Failed

For RF Modules:

- A critical alarm has occurred and the RF path has been deactivated.
- RF module may recover and return to Active automatically. If the RF module cannot recover, then the module can be placed in Standby manually.
- Click **Failed** to place the RF module in Standby, and then click **Standby** again to activate. If the Failed status persists, contact Dali Customer Service.

For optical ports:

- There is a problem with the SFP associated with the optical port.
- Click **Failed** to place the port in Standby, and then click **Standby** again to activate. If the Failed status persists, contact Dali Customer Service.

No Link

For optical ports:

- There is a problem with the optical fiber between an hdHost PS and remote, or between remotes.
- RF modules and SFP are deactivated to prevent damaging optical signals from being passed over the fiber.
- Repair the fiber link, following all safety procedures for working with optical fiber.
- Click **No Link** to place the port in Standby, and then click **Standby** again to activate. If the No Link status persists, contact Dali Customer Service.

13.8 Placing RF Modules or Optical Ports in Standby

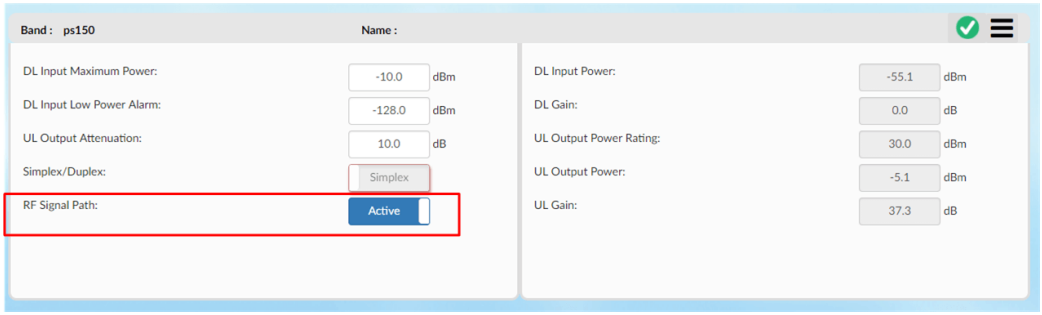
You can deactivate the signal path for each frequency band by placing RF modules and optical ports in Standby.

RF modules are placed in Standby for configuration, software upgrades, module replacements, and system restarts. Optical ports are placed in Standby for safety reasons, if a port is not being used, and to clear any associated alarms if the SFP is not connected to optical fiber.

> You cannot deactivate optical port O1 on a remote because it provides the only digital path to an upstream host or other remote.

To place an RF module in Standby:

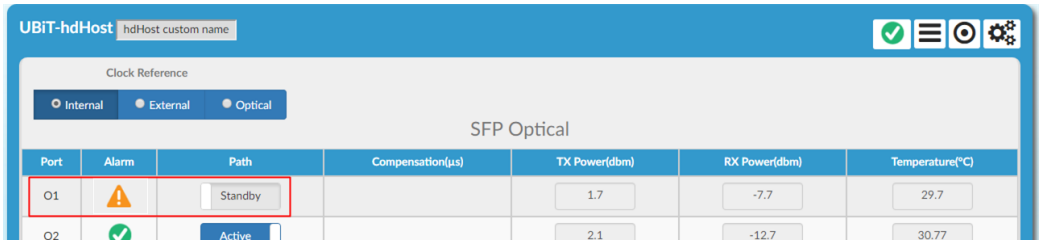
1. Select the airHost PS or hdHost PS in the system tree.
2. Click ☰ to display the Band Information view, or click the gray bar. The RF Signal Path button is blue and labeled Active.



3. Click **Active** and wait 6 to 10 seconds for the RF module to change to Standby. The button changes color from blue to gray.

To place an optical port in Standby:

1. Select the airHost PS or hdHost PS in the system tree.
2. Click  to display the optical ports. The Path button is blue, and labeled Active.
3. Click **Active**, and wait 6 to 10 seconds for the optical port to change to Standby. The button changes color from blue to gray.



14 HOST AND REMOTE CONFIGURATION

This chapter describes how to:

- Configure the reference clock source
- Verify optical connectivity
- Name host units, remotes and RF feeds for easy identification in the EMS
- Normalize the optical delay between all hosts and remotes
- Configure RF signal thresholds

14.1 Configuring the Reference Clock

Each host in the Matrix system needs a clock source to synchronize the RF signal between host and remotes. Matrix PS supports the following reference clocks:

Reference Clock	Description
Internal (default)	10 MHz internal clock source provided by the airhost PS or hdHost PS.
Optical	Reference clock recovered from an upstream clock source.
External	10 MHz clock source from a GPS, base station, or standalone unit.

For systems with one host, use Internal. No additional configuration is required.

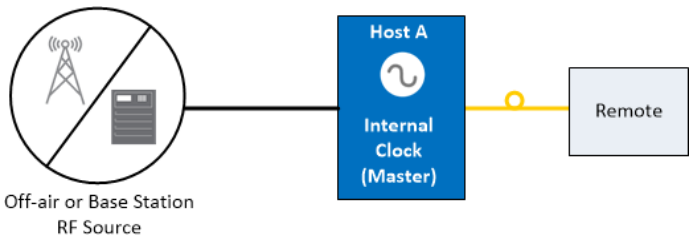


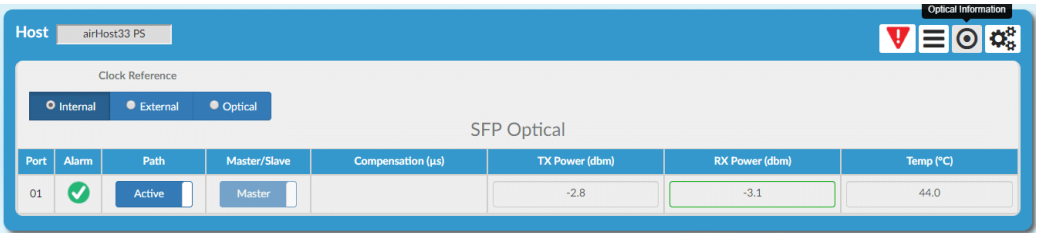
Figure 14-1: Internal Clock Source with One Host

14.1.1 Selecting the Host Reference Clock

Configure the clock reference for each host. Remotes automatically acquire a clock source over optical fiber and do not require configuration in the EMS.

To select the reference clock:

1. Select the host in the system tree.
2. Click  to display the list of optical ports.



3. Select one of the following Clock Reference options:

   - **Internal**: host is providing the clock signal (default for single host)
   - **Optical**: host requires an optical clock signal from upstream source
   - **External**: host requires an external clock signal

14.1.2 Verifying Clock Synchronization

If the reference clock is not properly configured, the RF signal between the host and remotes cannot synchronize. The result is either an optical path failure alarm or an outage condition.

Use the following rules to verify clock synchronization:

- There can be only one master clock
- A standalone clock source such as a GPS, base station, or third-party clock can be used as a master clock
- A host configured with **Internal** clock can be used as a master clock
- A host configured with **External** must receive the reference clock from a standalone clock source or from another hdHost PS
- A host configured with **Optical** must receive the reference clock over optical fiber from another upstream clock source

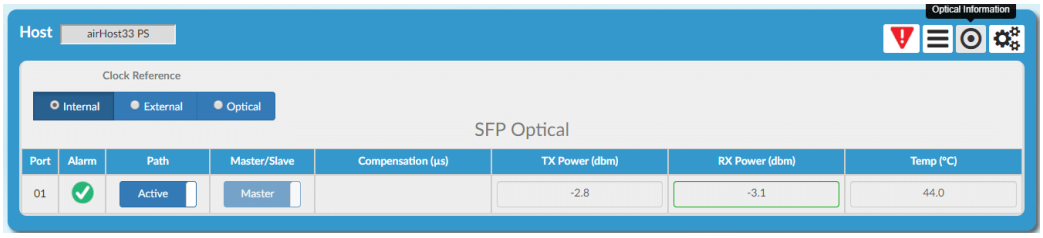
14.2 Verifying Optical Ports

Unlike RF modules, optical ports are Active by default after the unit is powered on.

To verify the status of optical ports:

1. Select the host or remote in the system tree, and click  to display the Optical Information view.
2. For each optical port:

   - Verify all optical ports in use are Active.
   - If the port displays a different status, verify that the SFP is installed correctly.
   - Place any unused optical ports in Standby. See Placing RF Modules or Optical Ports in Standby.



14.3 Reviewing and Resolving Alarms

Once the reference clock is configured and optical ports are active, review any alarms displayed in the system tree. For Major and Critical alarms, address the cause and continue commissioning only when the alarm is cleared. If the alarms are Minor, you can continue commissioning without affecting service. However, be aware that alarms can escalate to Critical if left unaddressed.

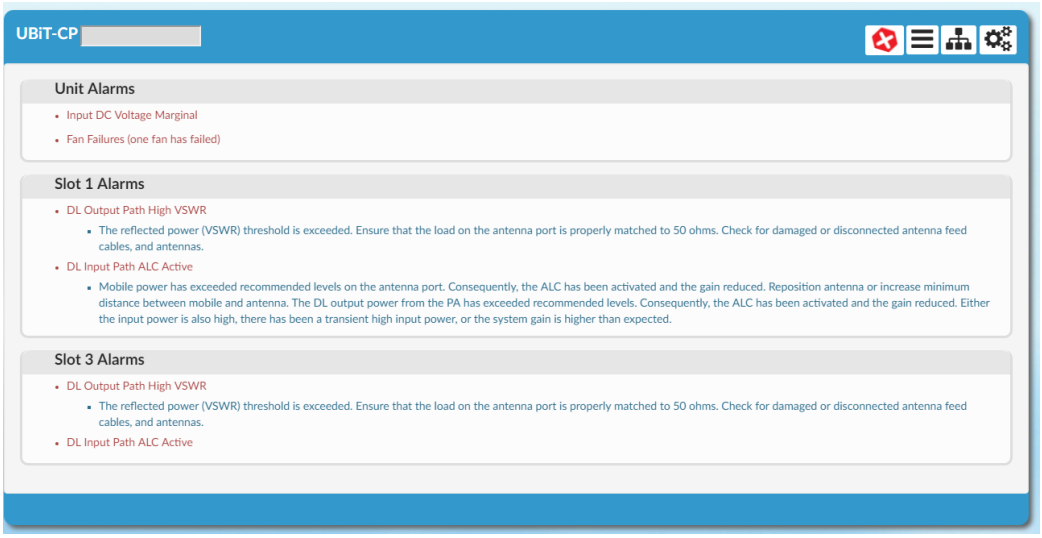
The following table describes the alarm state colors.

Alarm Color (system tree)	Alarm Icon (title bar)	Alarm State	Description
Red vibrating		Critical	Any service-affecting failure. A site visit may be required. On the physical device, the LED is red flashing.
Red		Major	A failure condition that is not service-affecting but must be addressed. Major alarms can escalate to critical if not resolved.
Orange		Minor	Warnings for planned outages or minor failures that don't prevent continued operation. For example, Low Power or RF path not active. However, some optical failure alarms for daisy-chained hosts display as Minor but should be addressed as Critical. See Optical Link Failure Alarms on Daisy-chained Hosts.
Green		No alarm	No alarm.

14.3.1 Displaying the Alarm Summary

For information about the current alarms for each unit, display the Alarm Summary by clicking the alarm icon in the blue bar of a host or remote. Click each alarm link to display a description and corrective action.

The alarm summary lists unit alarms, slot alarms for RF modules, and optical port alarms by unit.



14.3.2 Displaying Alarms by Slot

To display alarms for RF modules, click the alarm icon in the gray bar of any RF module.

14.3.3 Clearing Alarms

Non-critical alarms are cleared automatically when the alarm condition is resolved. Critical alarms require a user action to clear, such as re-activating an RF module or acknowledging a missing unit.

Major and Critical alarms can resolve to Minor alarms, which do not impact commissioning or affect continued service.

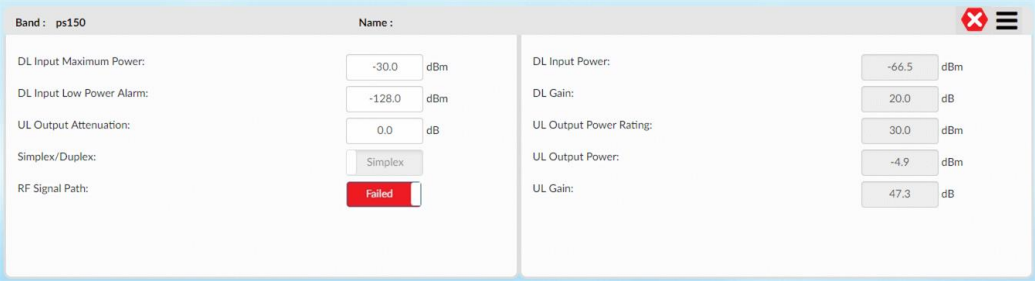
14.3.4 Resolving Critical Alarms

For Critical alarms caused by a missing unit, see Managing Missing Units, RF Modules and Optical Ports.

For Critical alarms that result in a deactivated the RF path, a red **Failed** RF Signal Path is displayed in the Band Information view.

To clear a Critical alarm on the RF signal path:

1. Click ☰ to display the Band Information view.
2. Click **Failed** to place the RF module in Standby.



3. Resolve the problem causing the alarm, and then click **Standby** to re-activate the RF path. If the Failed status persists, contact Dali Customer Service.

14.4 Managing Missing Units, RF Modules and Optical Ports

In addition to reviewing alarms, you need to verify that the system tree displays all the installed RF modules, optical ports, hdHost PS units, and remotes.

If an installed device does not appear in the system tree:

- Wait 6 to 10 seconds for the EMS to update the system tree.

- Check all cabling connections and power, then refresh your browser or wait for the system tree to update.
- If a unit still does not appear in the tree, disconnect and re-install the unit.

14.4.1 Missing Host or Remote

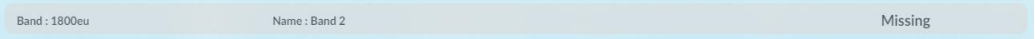
If a host or remote is removed from the system, or stops communicating with the system controller, the unit's status changes to Missing, the blue bar cannot be expanded, and a Critical alarm is raised. Click the **Remove** button to remove the unit from the system tree and clear the alarm.

For missing hosts, contact Dali Customer Service.

For missing remotes, deactivate and re-activate the optical port the remote is connected to on the host. To do this, use the **Active/Standby** Path button in the Optical Information view. See Placing RF Modules or Optical Ports in Standby.

14.4.2 Missing RF Modules

When an RF module in a host or remote no longer communicates with the system controller, the module's status changes to **Missing** and the gray bar of a missing module cannot be expanded.



To re-establish connection to the system controller, disable the RF module by making it Unavailable, and then re-enable it. See Making an RF Module Unavailable.

If an RF module is missing because of maintance activities, you can also use the Module Availability feature to hide the module and its associated alarms in the EMS. RF Modules in Standby and Failed states can also be made Unavailable.

14.4.3 Missing Optical Ports or SFPs

Optical ports or SFPs that are not responding also change status to Missing and cause a Critical alarm. To clear a missing optical port alarm, click **Remove**.

14.4.4 Unavailable and Available RF Modules

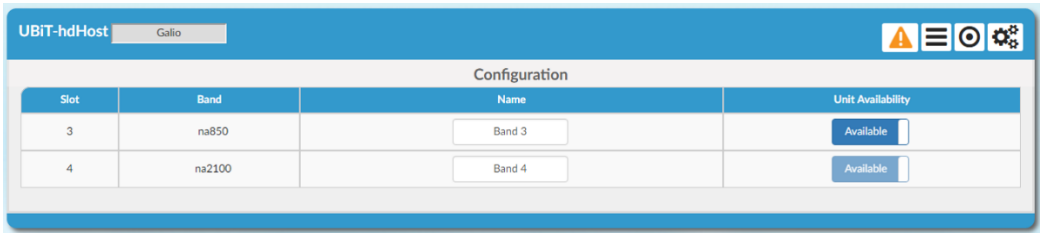
If you don't want to display a RF module in the EMS, you can hide, or disable the module by making it Unavailable. When an RF module is Unavailable, its alarms are hidden and the module is removed from the system tree and slot view.

Use the Unavailable option to hide an RF module when you are aware of an issue and don't need to see the associated major and critical alarms filling the Alarm Summary.

Only RF modules with Missing, Standby, or Fail status can be made Unavailable.

To make an RF module Unavailable:

1. Click ☰ to display the Band Information view.
2. If the RF module is not already in Standby or Failed status, place the module in Standby. See Placing RF Modules in Standby.
3. Click ⚙ to display the Configuration view.



4. In the Configuration view, click the blue **Available** button for the RF module. Wait 6 to 10 seconds until the button changes to blue Unavailable.
5. If the button is dimmed and can't be clicked, it means the RF module is Active. Only RF modules with Missing, Standby or Failed status can be made Unavailable.

To make an RF module Available:

1. In the Configuration view, click the **Unavailable** button for the RF module.
2. Wait 6 to 10 seconds until the button changes to blue **Available.**

> An RF module that has returned to Available is not Active. To Activate the RF module, open the Band Information view and click **Standby**. Wait 6 to 10 seconds until the button changes to Active.

14.5 Naming Units

At the start of commissioning, the system tree lists system controllers, hosts and remotes without custom names or identifiers. Create names for each unit that identify the type of unit, location or owner, band or frequency.

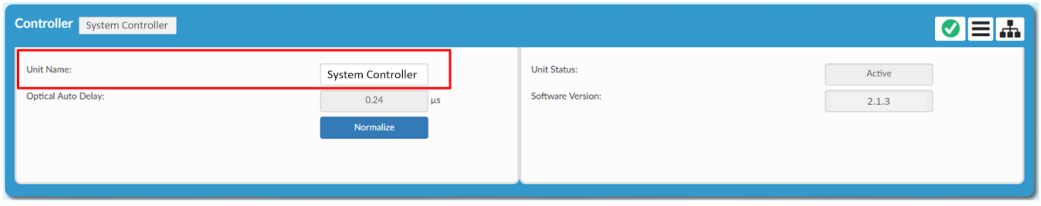
All name fields are limited to 31 characters.

14.5.1 Naming System Controllers

Give the system controller a name that identifies the unit type or location.

To enter a name for each unit:

1. Select the system controller in the system tree, and click to display the Unit Information view.
2. In the Unit Name field, enter a name that describes the unit's location, either the location in the rack or a geographical location.

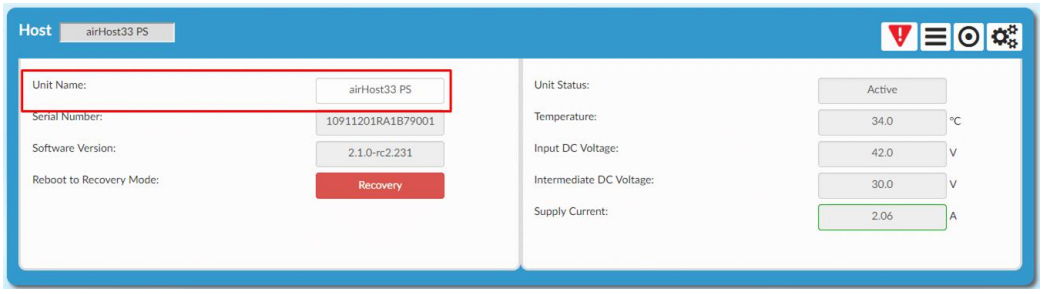


14.5.2 Naming Host Units and RF Modules

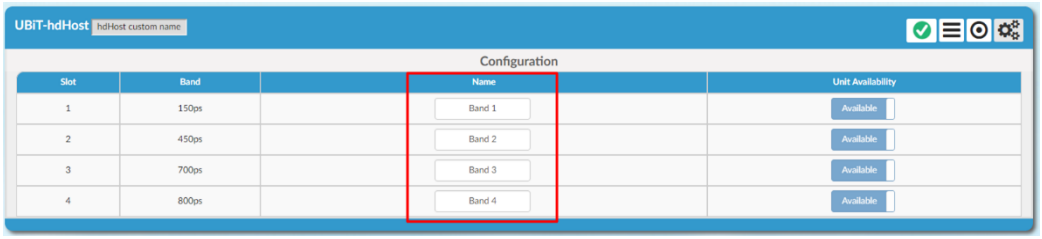
Give the host units names that identify the unit type and location. Give the host RF modules names that reflect the band frequency or operator.

To enter a name for a host unit and band:

1. Select the host in the system tree, and click to display the Unit Information view.



2. Enter a name in the Unit Name field.
3. Click  to display the Configuration view.
4. For each RF module or band, enter a descriptive name.

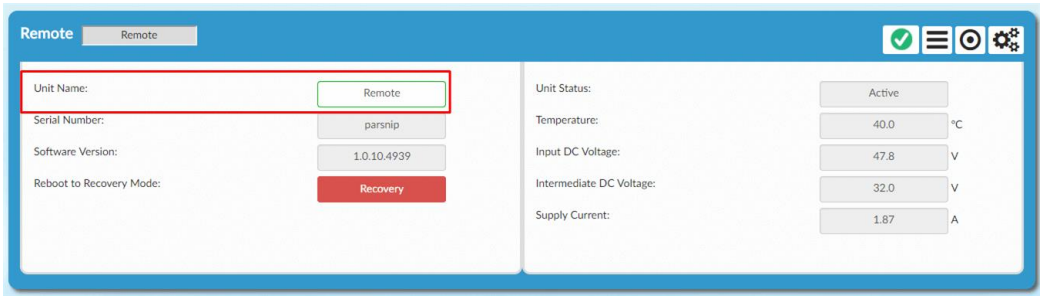


14.5.3 Naming Remotes and RF Modules

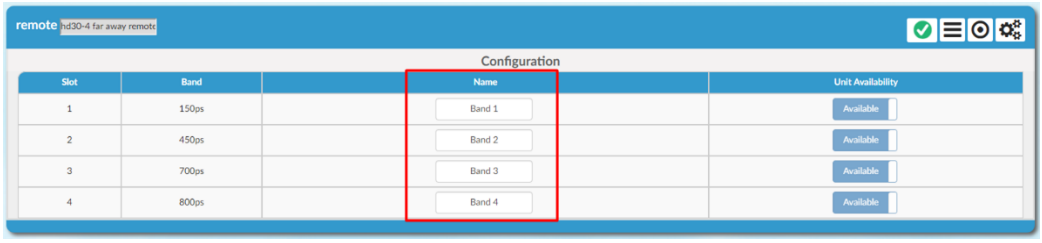
Give remote units names that identify the unit type and location. Give the remote RF modules names that reflect the band frequency or operator.

To enter a name for a remote:

1. Select the remote in the system tree, and click  to display the Unit Information view.
2. Enter a name for the remote in the Unit Name field.



3. For each RF module or band, enter a descriptive name.



14.6 Configuring Optical Delay Compensation

The optical delay between the hdHost PS and the remote varies depending on the length of the optical fiber and the number of daisy-chained remotes.

Optical delay compensation ensures the downlink (DL) signal from the originating hdHost PS is received by multiple remotes at the same time. It also ensures the uplink (UL) signal from multiple remotes is received by hdHost PS at the same time.

In Figure 14-2, the offset timing added at each remote causes the delay to equalize across all remotes.

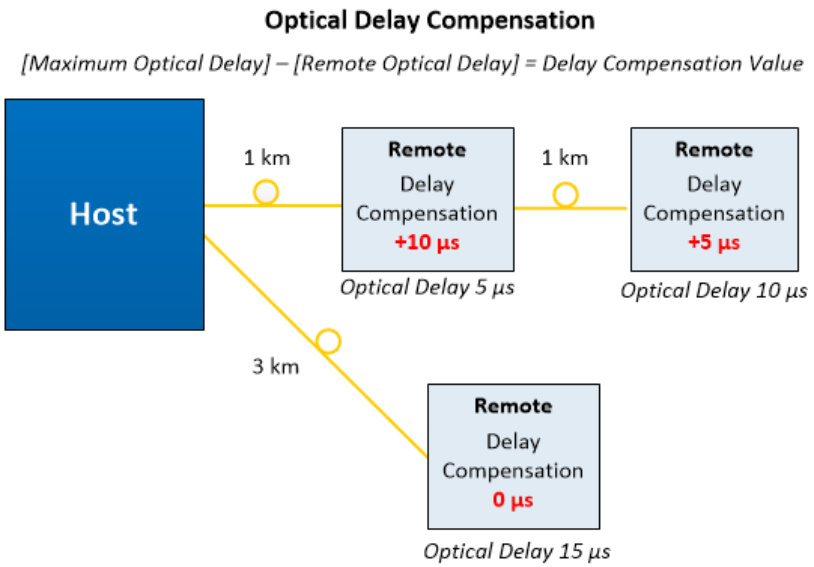
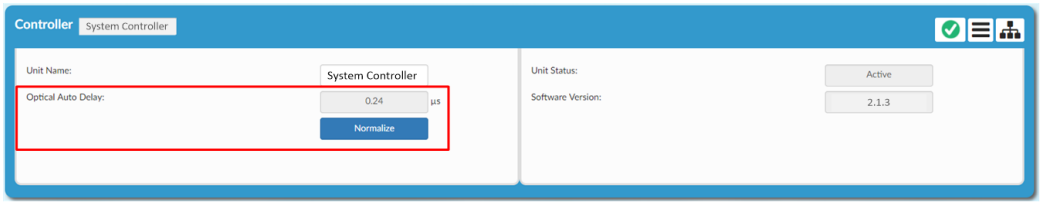


Figure 14-2: Maximum Optical Delay and Delay Compensation

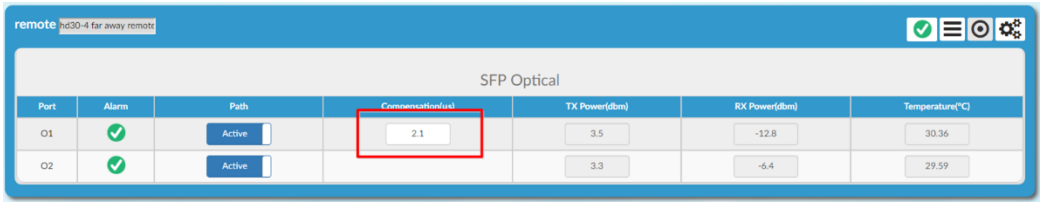
To configure delay compensation automatically for all remotes:

1. Select the system controller in the system tree, and click  to display the Unit Information view.
2. Click **Normalize**.



To display the offset value applied to a remote:

1. Select the hdHost PS in the system tree, and click  to display the list of optical ports.
2. Note the compensation value for each remote.



14.7 Configuring RF Input Power and Low Power Thresholds

Before activating RF modules in the host, you must set the maximum input power supplied by the off-air signal source or base station. This value should match the signal source power after the attenuation equipment. The maximum downlink (DL) input power is based on the power when all channels in a frequency band are active.

For information on applying attenuation once the RF modules are active, see DL and UL Gain Commissioning.

For each RF module in the hdHost PS or airhost PS, configure the following RF settings.

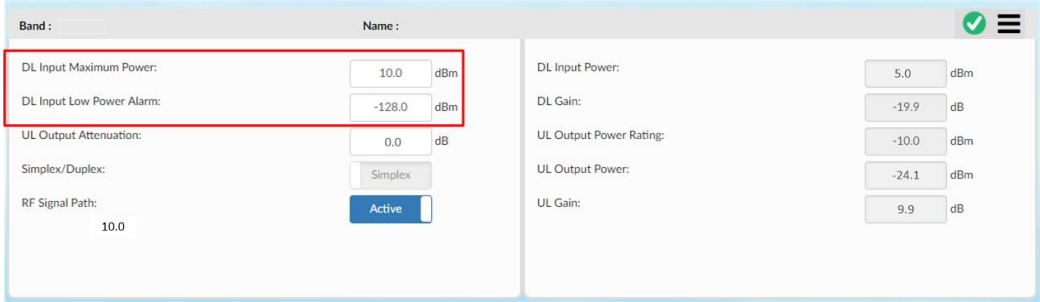
Field	Description	Range
DL Input Maximum Power	Sets the maximum downlink RF power supplied from the base station or off-air source	hdHost PS: -10 to +10 dBm airHost PS: -95 to -10 dBm
DL Input Low Power Alarm	Sets a threshold for the low input power alarm. When the input power falls below this threshold, the RF module displays a low power alarm	-128.00 dBm disables the alarm
Simplex/Duplex	Sets the connection type	Simplex

First, configure the attenuation equipment to reduce the base station or off-air power to the appropriate levels. Next, for each band in the host, set the maximum composite DL input power level to the expected maximum level from the base station or off-air source. This value should match the power levels after the attenuation equipment.

For example, if the maximum composite value after the attenuation equipment is 0 dBm, then set the **DL Input Maximum Power** value to 0 dBm.

To configure the maximum DL input power and low power thresholds:

1. Select an hdHost PS or airHost PS in the system tree and click ☰ to display the Band Information view.



2. Enter the maximum power from the signal source in the **DL Input Maximum Power** field, calculated when all channels are active.

    - hdHost PS: -10 to +10 dBm
    - airHost PS: -95 to -10 dBm

3. Enter a value in the **DL Input Power Low Alarm** field. The recommended value for this threshold is a marginal value (such as 5 dB) below the **DL Input Maximum Power** setting. Enter -**128** to disable the alarm.

15 DL AND UL GAIN CONFIGURATION

This chapter describes how to:

- Understand the process for setting DL and UL gain
- Activate the RF signal path
- Configure the downlink path
- Configure the uplink path

15.1 Gain Commissioning Process

The process for setting the gain is to activate the RF signal path one band at a time, and then add attenuation where necessary to adjust and balance DL and UL gain.

For each band, turn on the RF signal path first in the host followed by the remote. After each band is activated, check for alarms and expected signal levels on the power meters.

The steps in this chapter should be performed in conjunction with the operator and on-site base station personnel.

15.2 Activating the RF Signal Path

Before activating the RF signal path, address all major and critical alarms. The system tree should show only green or orange alarm indicators.

To activate the RF signal path for each frequency band:

1. Select a host or remote in the system tree and click ☰ to display the Band Information view.

2. Click the **RF Signal Path** button to change the RF path from Standby to Active. See also Activating RF Modules or Optical Ports.

If the RF module cannot activate, the button displays **Failed**. Click the alarm icon to display the alarm description. Click **Failed** to place the module in Standby. Next, resolve the alarm condition, and click **Standby** to activate the module. If the Failed status persists, call Dali Customer Service.

15.3 Configuring the Downlink Path

The downlink (DL) path is configured to provide a full power output at the remote during loaded or busy periods.

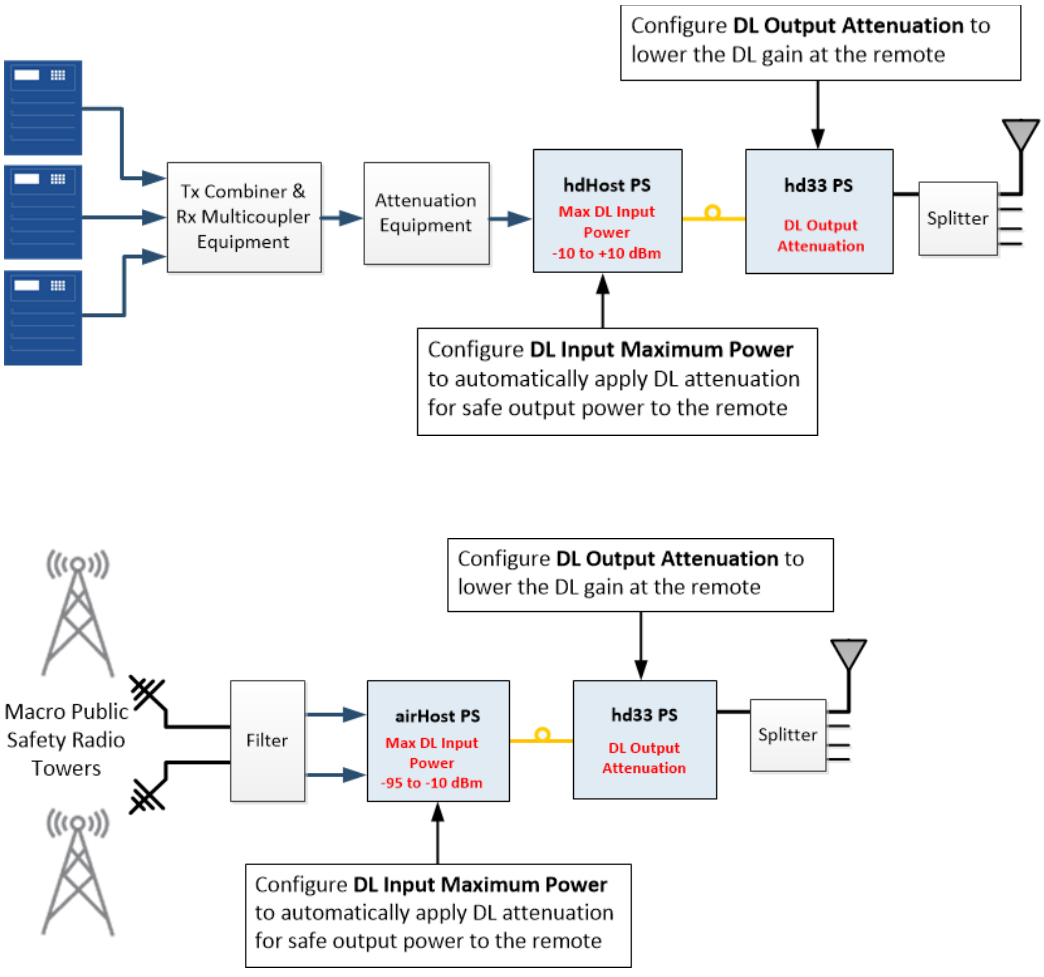
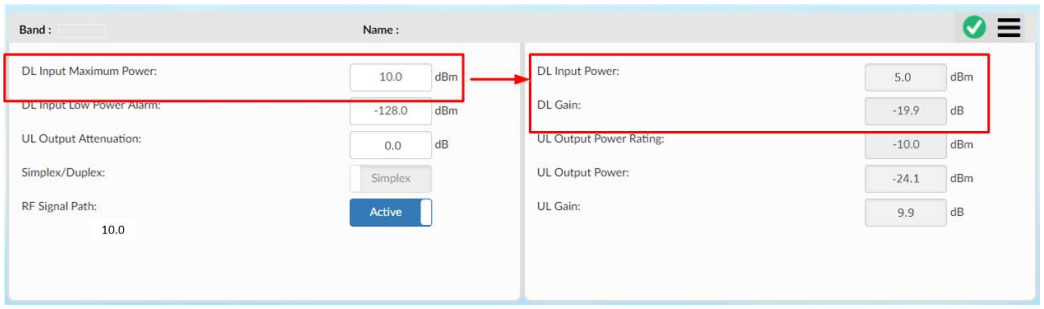


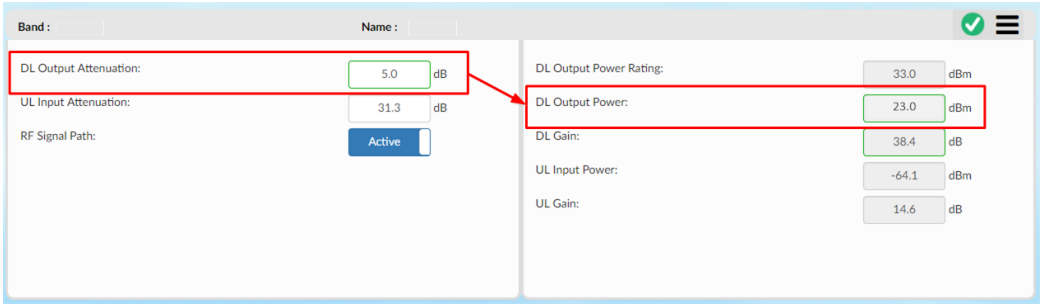
Figure 15-1: Host DL Attenuation

To achieve the appropriate DL output power at the remote:

1. Select the host in the system tree, and click ☰ to display the Band Information view.
2. Change **DL Input Maximum Power** to be the power expected at the input to the system. This value should have already been configured as described in Configuring Maximum DL Input Power & Low Power Thresholds. Adjust if necessary.



3. In the system tree, select the remote connected to the host, and click ☰ to display the band information view.
4. Enter an attenuation value in the **DL Output Attenuation** field to lower the DL output power at the remote to adjust the gain to meet FCC guidelines (see below). Wait 6 to 10 seconds for the EMS to update the RF power measurements.



15.3.1.1 Adjusting Gain to Meet FCC Signal Booster Guidelines

In general, the ERP of the output noise within the pass band should not exceed the level of -43 dBm in 10 kHz measurement bandwidth. The ERP of the output noise outside of the passband by more than 1 MHz should not exceed the level of -70 dBm in 10 kHz measurement bandwidth. The ERP of intermodulation products should not exceed -30 dBm in 10 kHz measurement bandwidth.

Calibration Modes

Units are calibrated for 2 W or 5 W depending on the output power required:

- Mode A: 2 W
- Mode B: 5 W

airHost33 PS Dual Band Uplink Intermodulation

This example is for airHost33 PS dual band units in the type 1 chassis style.

150 MHz Band, Mode B (5 W)

Example

- 12 dB of minimum distribution loss when 1-Carrier composite power is 37 dBm

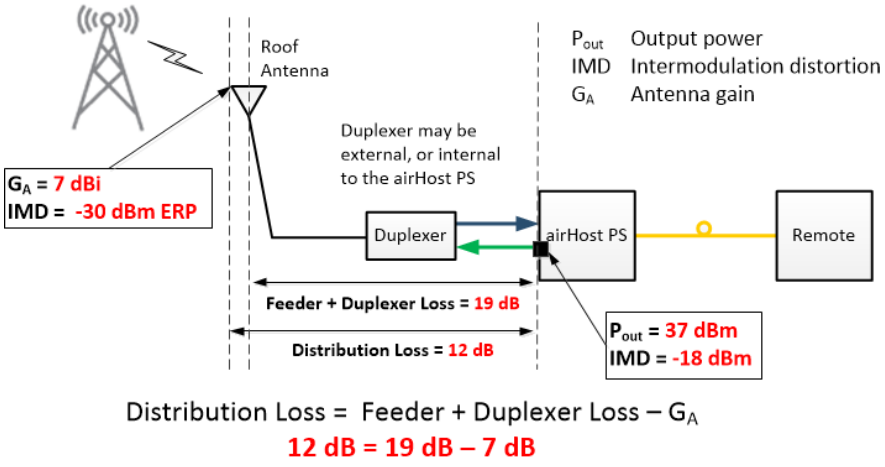


Figure 15-2: Type 1 Chassis airHost33 Uplink, 150 MHz, 5 W

hd33 PS Dual Band Downlink Intermodulation

These examples are for hd33 PS dual band units in the type 1 chassis style.

150 MHz Band, Mode A (2 W)

Examples

- 8 dB of minimum distribution loss when 2-Carrier composite power is 34 dBm
- 0 dB of minimum distribution loss when 2-Carrier composite power is 28 dBm

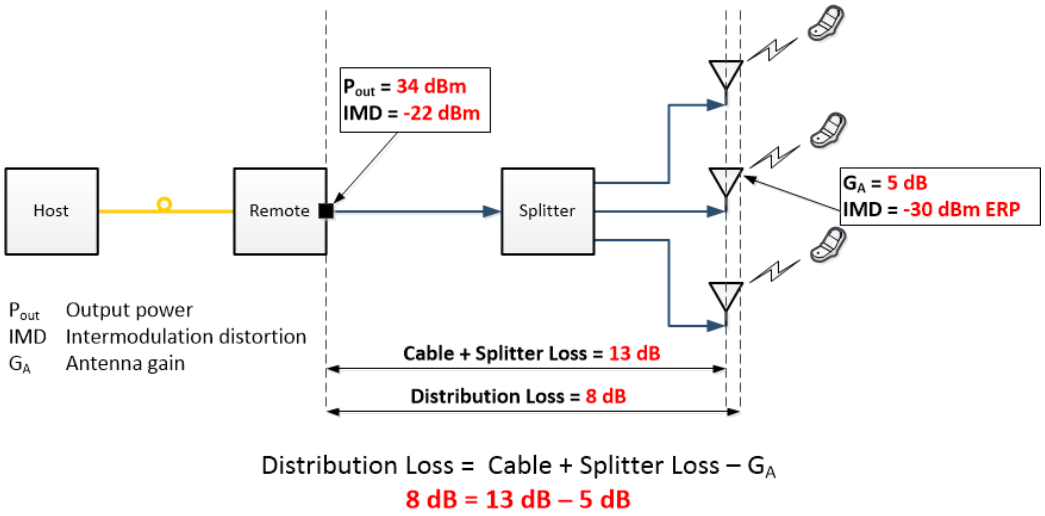


Figure 15-3: Type 1 Chassis hd33 Downlink, 150 MHz, 2 W

150 MHz Band, Mode B (5 W)

Examples

- 15 dB of minimum distribution loss when 1-Carrier composite power is 37 dBm

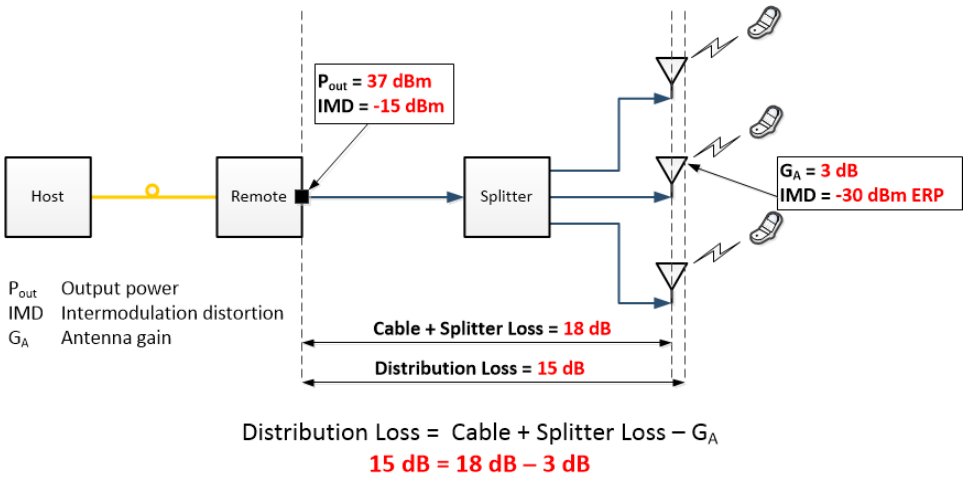
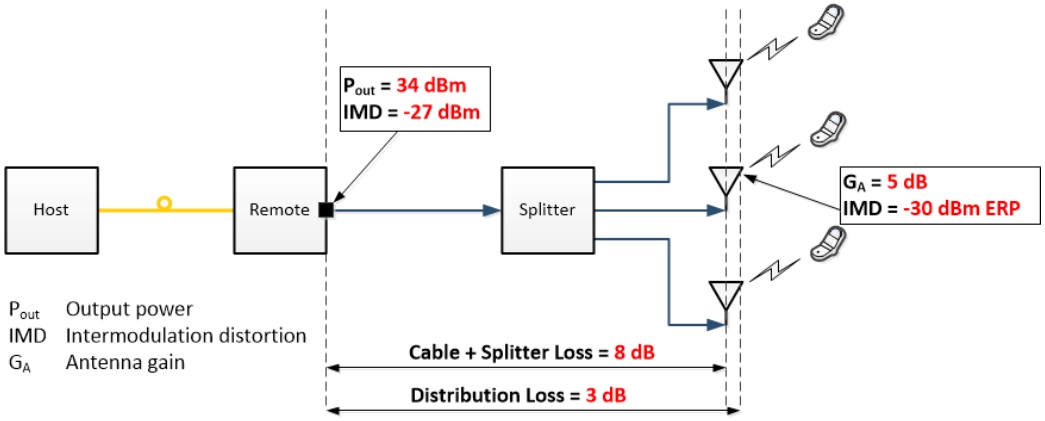


Figure 15-4: Type 1 Chassis hd33 Downlink, 150 MHz, 5 W

450 MHz Band, Mode A (2 W)

Examples

- 3 dB of minimum distribution loss when 2-Carrier composite power is 34 dBm
- 0 dB of minimum distribution loss when 2-Carrier composite power is 29 dBm

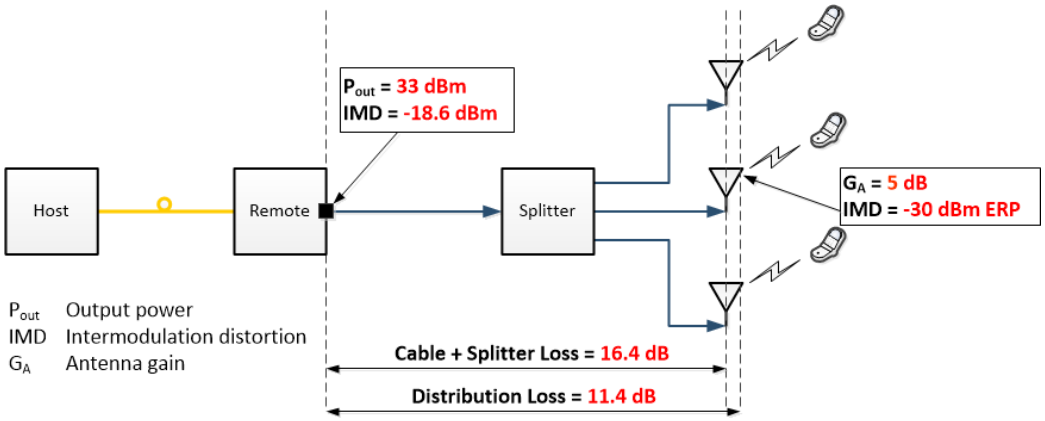


Distribution Loss = Cable + Splitter Loss – G_A

3 dB = 8 dB – 5 dB

Figure 15-5: Type 1 Chassis hd33 Downlink, 450 MHz, 2 W

800 MHz Band, Mode A (2 W)



Distribution Loss = Cable + Splitter Loss – G_A

11.4 dB = 16.4 dB – 5 dB

Figure 15-6: Type 1 Chassis hd33 Downlink, 800 MHz, 2 W

900 MHz Band, Mode A (2 W)

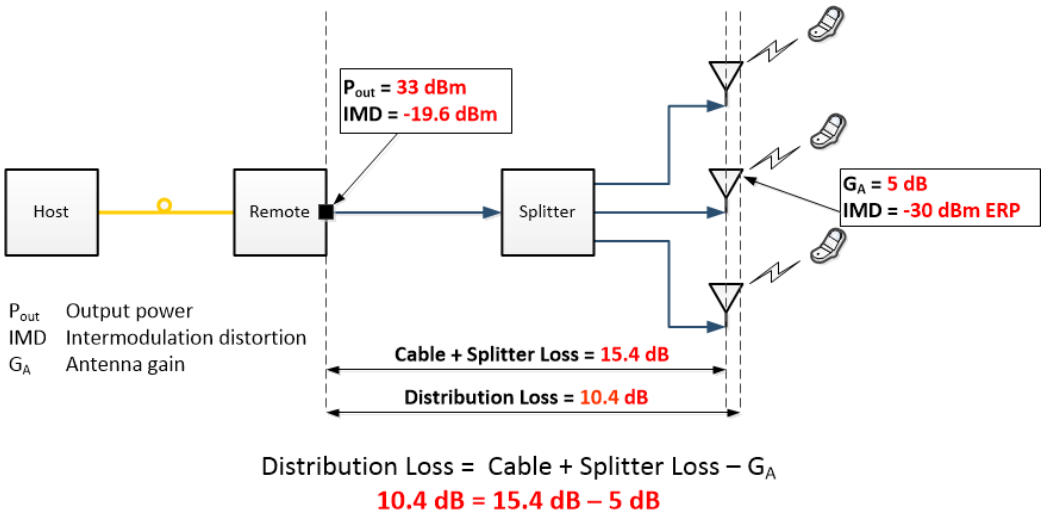


Figure 15-7: Type 1 Chassis hd33 Downlink, 900 MHz, 2 W

hd33 PS Quad Band Downlink Intermodulation

This example is for hd33 PS quad band units in the type 2 chassis style.

450 MHz, 700 MHz, 800 MHz, 900 MHz band, Mode A (2W)

Example: 6 dB of minimum distribution loss when 2-carrier composite power is 33 dBm

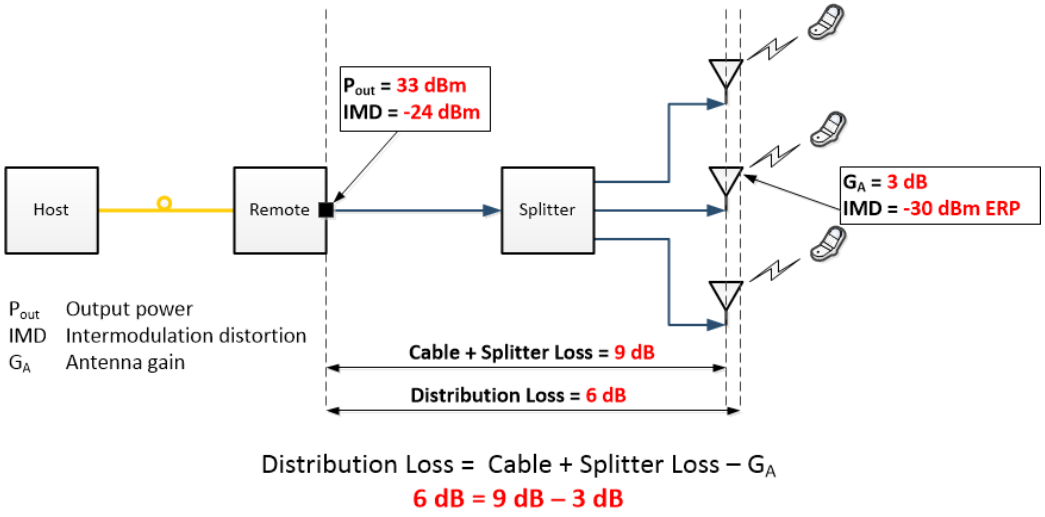


Figure 15-8: Type 2 Chassis hd33 Downlink, 450 MHz, 700 MHz, 800 MHz, 900 MHz

15.4 Configuring the Uplink Path

The goal of the uplink (UL) path is ensure UL power to the base station or off-air signal source meets the public safety system requirements. By default, the UL gain is at maximum and UL output attenuation is zero.

Guidelines for configuring the UL path:

- Overall system gain is equal to the Matrix gain minus the loss between the base station and the input to the host (Loss 1), and the loss between remotes and the antenna output (Loss 2). See Figure 15-9.
- Overall system gain should be 0 dB.

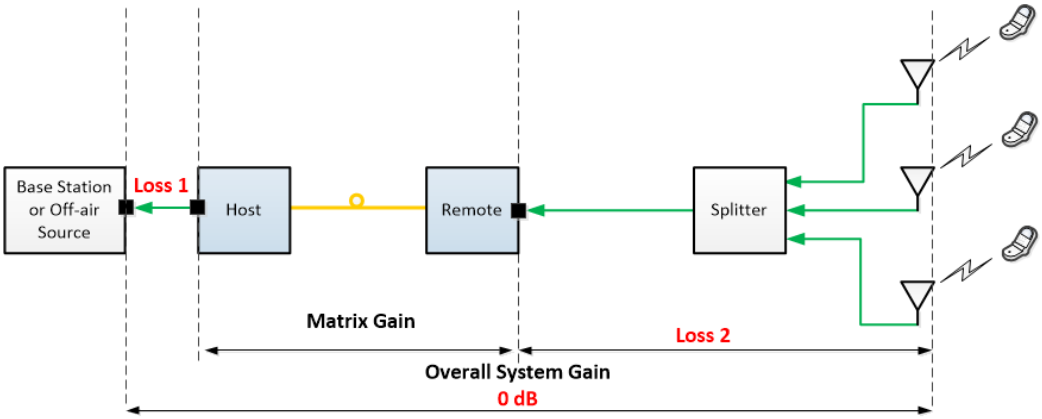


Figure 15-9: Overall System Gain

15.4.1 hdHost PS

The expected UL gain of the hdHost PS when 0 dB of attenuation is applied is close to 10 dB.

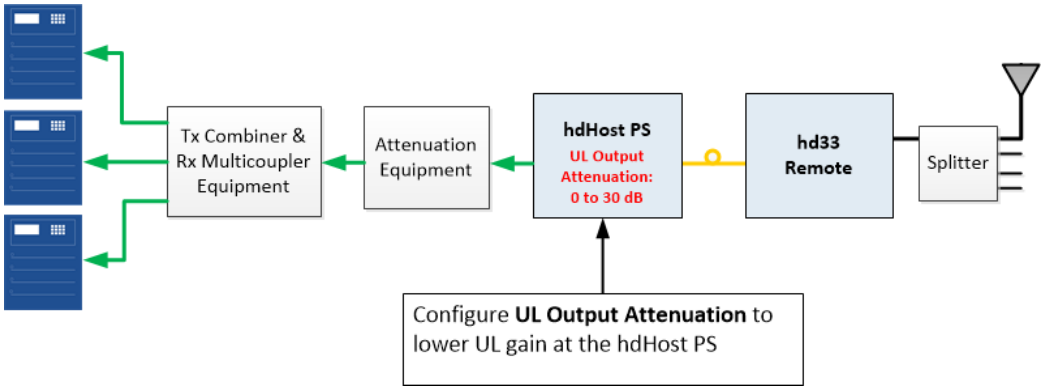
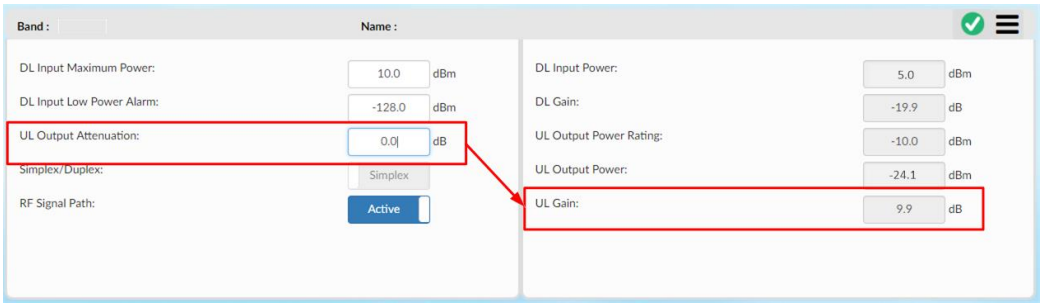


Figure 15-10: UL Attenuation – hdHost PS

To add UL attenuation to the hdHost PS:

1. Select an hdHost PS in the system tree and click ☰ to display the Band Information view.
2. Enter a value in the **UL Output Attenuation** field to decrease UL gain.



3. Wait 6 to 10 seconds for the EMS to update the RF power measurements.
4. Ensure the **UL Output Power** and **UL Gain** in the right column match expected gain lineup values.

15.4.2 airHost PS

The expected, and maximum UL gain of the airHost PS when 0 dB of attenuation is applied is 47 dB.

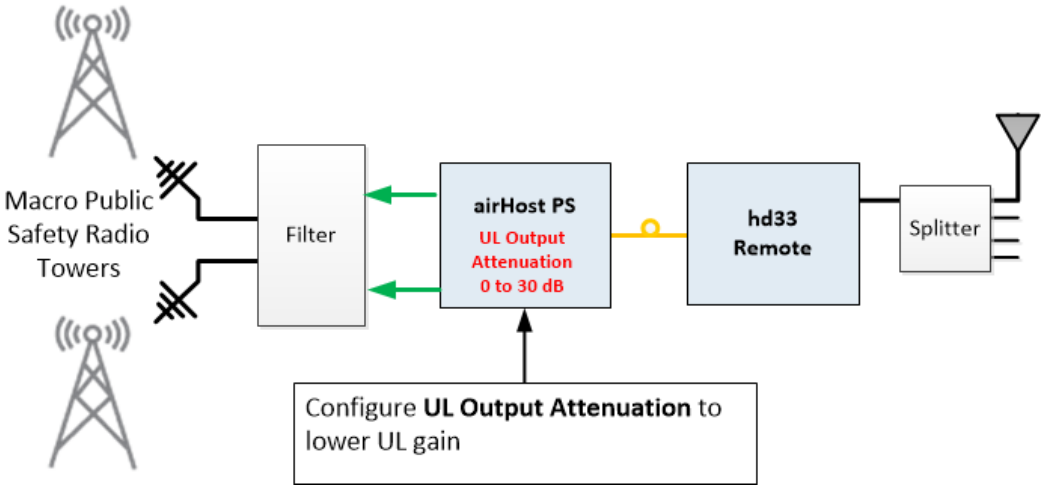
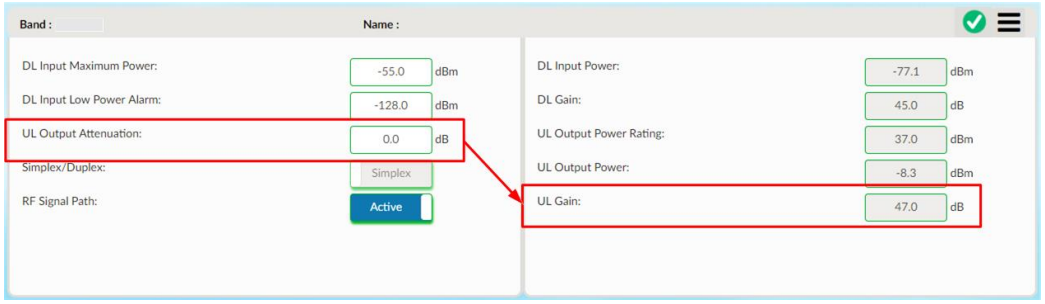


Figure 15-11: UL Attenuation – airHost PS

To add UL attenuation to the airHost PS:

1. Select an hdHost PS in the system tree, and click ☰ to display the Band Information view.
2. Enter a value in the **UL Output Attenuation** field to decrease the UL gain.



3. Wait 6 to 10 seconds for the EMS to update the RF power measurements.
4. Ensure the **UL Output Power** and **UL Gain** in the right column match expected gain lineup values.

15.4.3 Remote

In extreme cases, additional uplink attenuation can be applied using the attenuator in the remote. However, is not advisable since the uplink noise figure will be adversely affected.

16 REDUNDANT SYSTEM CONTROLLER CONFIGURATION

For large Matrix systems in which network redundancy and visibility is critical, redundant system controllers provide uninterrupted monitoring and control of hosts and remote units.

A Primary controller can display and make configuration changes through the EMS, while a Secondary, or backup controller provides a read-only view. If a Primary controller fails, you can manually switch to the Secondary controller.

Redundant system controllers adhere to the following rules:

- System controllers are unaware of each other and do not communicate directly
- Failed system controllers that have been recovered will restart in the Primary or Secondary role last used
- Only one system controller appears in the EMS system tree at a time. For example, log into the Primary controller to see it at the top of the tree. The Secondary controller is not visible

If a system controller fails and you can't log into the EMS, RF signals can still be transmitted and received on the uplink and downlink path as long as there are no Critical alarms.

16.1 Connecting Redundant Controllers

There are several ways to design a network with redundant controllers. You can connect up to six hosts directly to each Primary and Secondary controller. Or, if the system requires more than six hosts, you can use Ethernet switches to increase the network capacity.

16.1.1 Direct Connections to Up to Six Hosts

In this example, controller redundancy is achieved by connecting host units directly to the Primary and Secondary controllers. There is no single point of failure. All six LAN ports are used on each system controller.

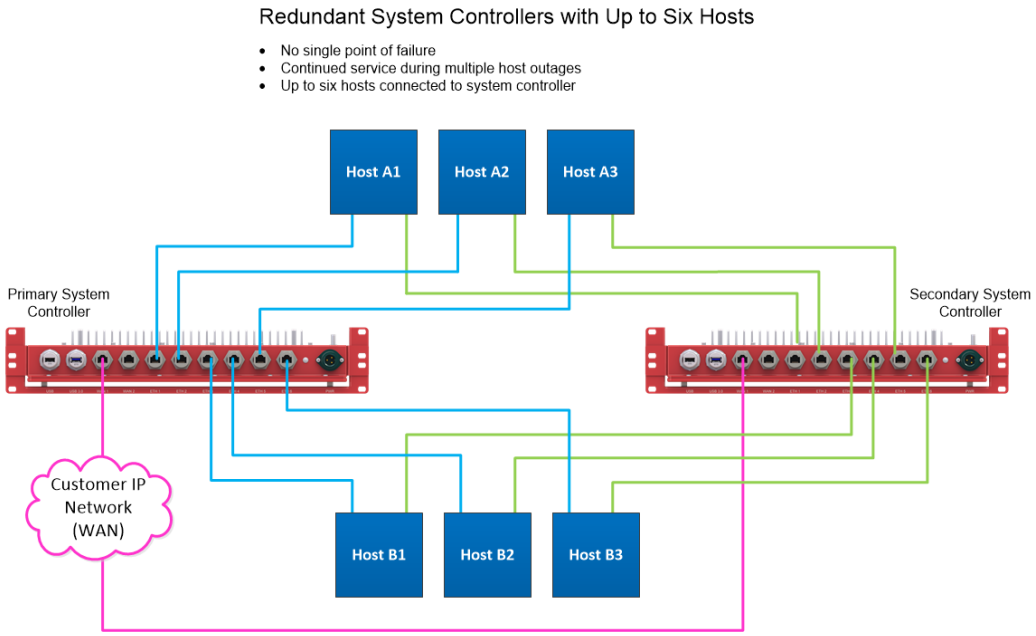


Figure 16-1: Redundant System Controllers Connected Directly to Six Hosts

16.1.2 Connections to More than Six Hosts Using Ethernet Switches

To expand the number of hosts connected to the IP network, you can use two Ethernet switches supporting STP (spanning tree protocol). If a host unit experiences an outage, the system continues service.

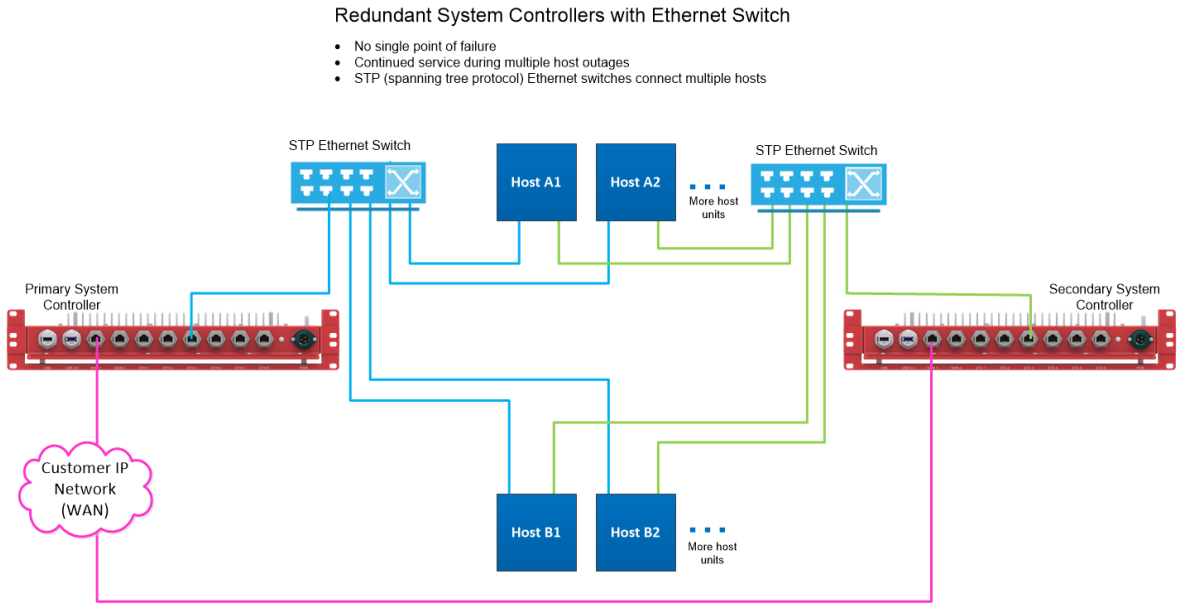


Figure 16-2: Redundant System Controllers

16.2 Turning On Redundant Controllers

When turning on redundant controllers the first time, start the Secondary controller first, followed by the Primary controller.

To turn on redundant controllers:

1. Make sure both system controllers are disconnected from the customer and Matrix IP networks. All Ethernet cables should be unplugged from the units.
2. Make sure controllers are labeled as Primary and Secondary.
3. Turn on the Secondary controller first by plugging the AC cable into an AC power source. There is no power switch. The unit is on when the LED on the front panel is green.
4. Turn on the Primary controller.
5. Connect Ethernet cables to both system controllers, following the network plan provided by your DAS integrator.

6. Verify that you can log into both Primary and Secondary controller and display the EMS.

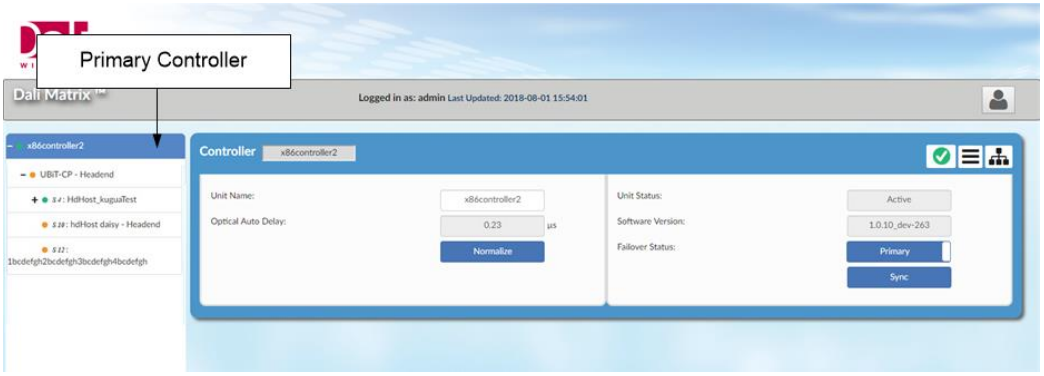
16.3 Logging into Primary and Secondary Controllers

Primary and Secondary controllers do not appear together in the EMS system tree and do not communicate directly. The tree displays only the controller you are logged into. When logged into the Primary controller, you can make configuration changes to all units in the system. When logged into the Secondary controller you have read-only access.

To log into a Primary or Secondary controller:

1. Locate the IP address of the system controller on the unit label. The system controller is configured with three default IPv6 link local addresses: WAN1, WAN2, and LAN. The LAN IP address is used for connections to ports ETH1 to ETH6.
2. Change the IP configuration of your laptop to be on the same subnet as the IP address of the port you're going to use.
3. Turn laptop Wi-Fi off.
4. Connect a laptop to a WAN or LAN port on the controller.
5. In a browser window, enter the IP address.
6. In the login screen, enter username **admin**, and password **dali1234**.

When you are logged into the Primary controller, the EMS shows the Primary unit in the system tree. You can make changes to host and remote unit and band configurations.



When you are logged into the Secondary controller, the EMS displays a banner in the Unit view. All fields are grayed out, and display only.

16.4 Identifying System Controller Failures

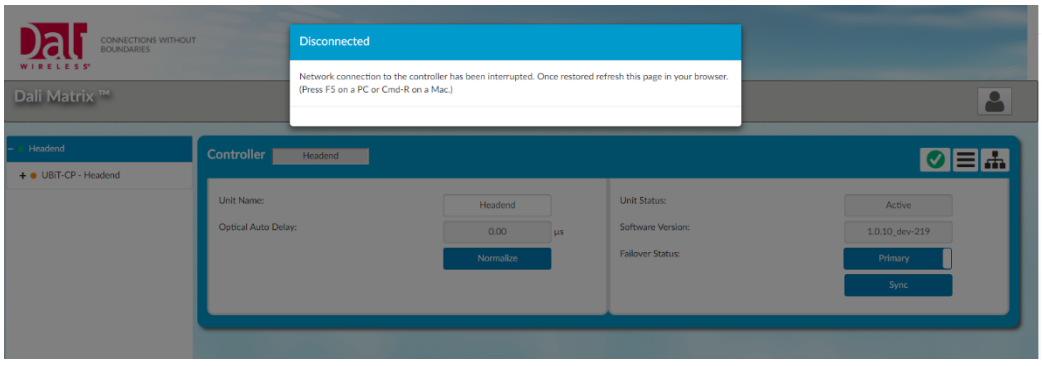
A system controller outage can occur as a result of hardware and software failures. Some indicators of a failure are:

- EMS displays a Disconnected dialog box
- System controller does not recover after power cycling

16.4.1 Disconnected Dialog Box

The Disconnected dialog box indicates the system controller is not communicating with host and remote units.

To resolve the issue, you can try refreshing the browser window and logging in again. If you still can't log in to the EMS after several attempts, the system controller has likely failed. If the unit is the Primary controller, manually switch over to the Secondary controller.



16.4.2 System Controller Does Not Recover After Power Cycling

If the system controller does not start up correctly, or fails to turn on after several attempts to apply power, suspect a hardware issue. If the unit is a Primary controller, manually switch to the Secondary controller.

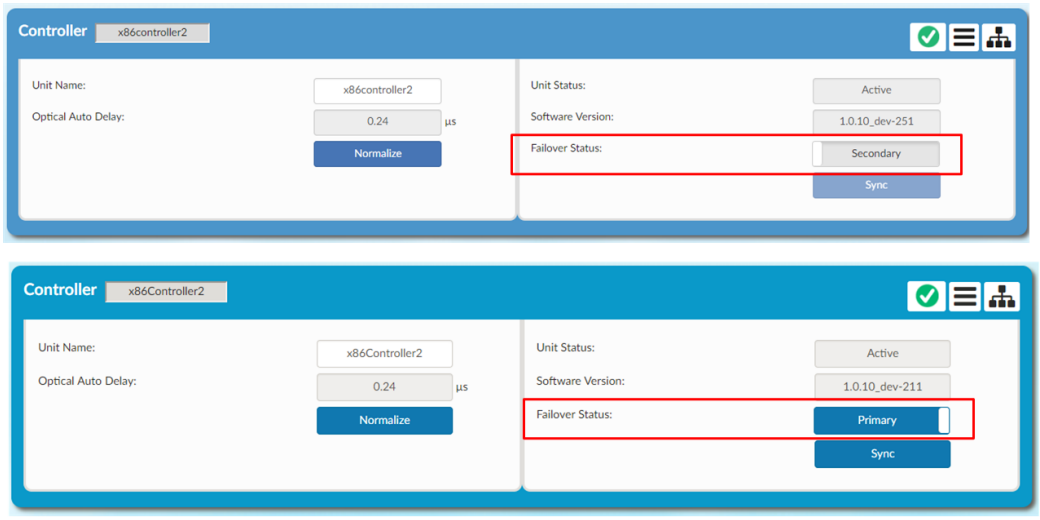
16.5 If the Primary Controller Fails

If the Primary controller fails, you can initiate a failover. The Secondary controller becomes Primary, allowing you to continue changing or managing host and remote configurations without interruption.

16.5.1 Switching to the Secondary Controller

To switch to the Secondary controller when the Primary unit fails:

1. Log into the Secondary controller.
2. Select the system controller in the tree, and display the Unit information view .
3. Click the Failover Status button to change the unit from **Secondary** to **Primary**.



4. Make configuration changes as necessary on the new Primary controller. Changes are sent immediately to the host and remote units.

Example

For example, in Figure 16-3, the Primary controller (P) maintains the configuration settings (XYZ) and pushes them to the host and remote units. The host and remote units acknowledge the settings to the Primary and Secondary controller (S), keeping configuration data up to date on all units.

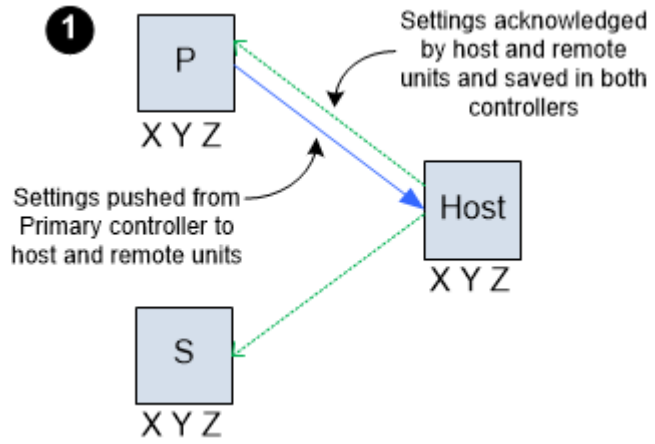


Figure 16-3: Primary Controller Management of Configuration Settings

If the Primary controller fails (Figure 16-4), there's no communication with host and remote units. By switching the Secondary controller to Primary, you maintain full management and control of the system. The new Primary controller is able to push configuration changes to host and remotes.

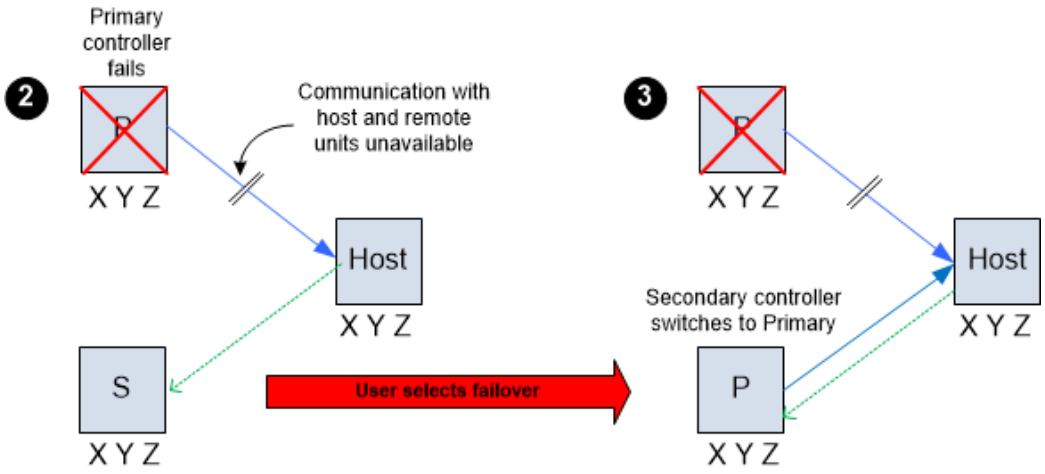


Figure 16-4: Secondary Controller Failover after Primary Controller Fails

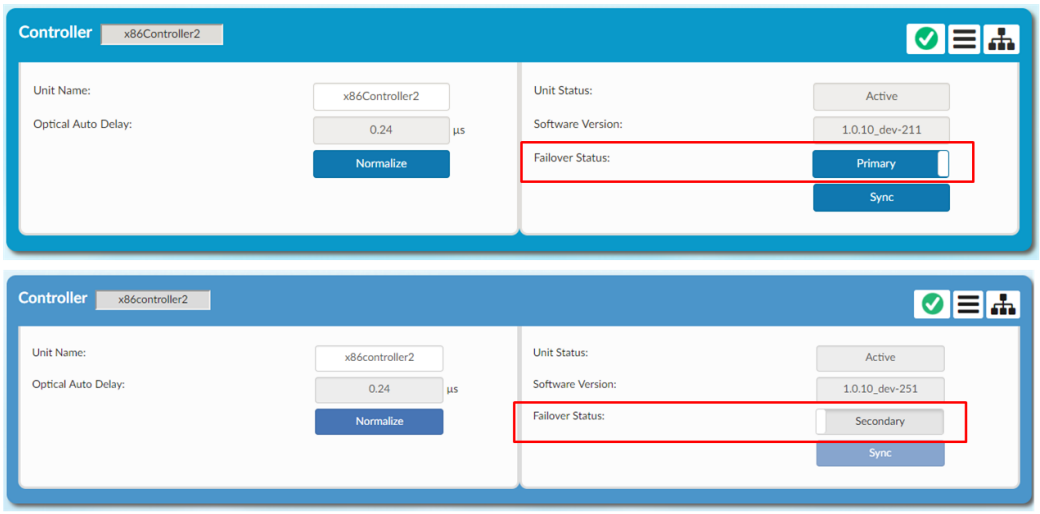
16.5.2 Recovering a Failed Primary Controller

Once you fail over to the Secondary controller, you can continue operating normally. Both system controllers are identical in network and system management capabilities. However, to recover the failed unit, you may have to replace or service the controller, and then restart it. Once you've recovered the failed controller, you need to initiate a Sync (synchronization) to ensure configuration data is up to date on both units.

Note: If you don't sync the system controllers, the recovered Primary controller may push out-of-date configuration data to the host and remotes. Any configuration changes you made while the failed controller was offline will be lost.

To recover a Primary controller after a failover:

1. Disconnect the failed system controller from the network.
2. Replace or service the unit, and then restart it by plugging in the AC cable into an AC power source. There is no power switch. The controller starts up as Primary, but is offline because it is disconnected from the network.
3. Log into the offline Primary controller.
4. Select the system controller in the tree, and display the Unit information view .
5. Click the Failover Status button to toggle the unit to **Secondary**.

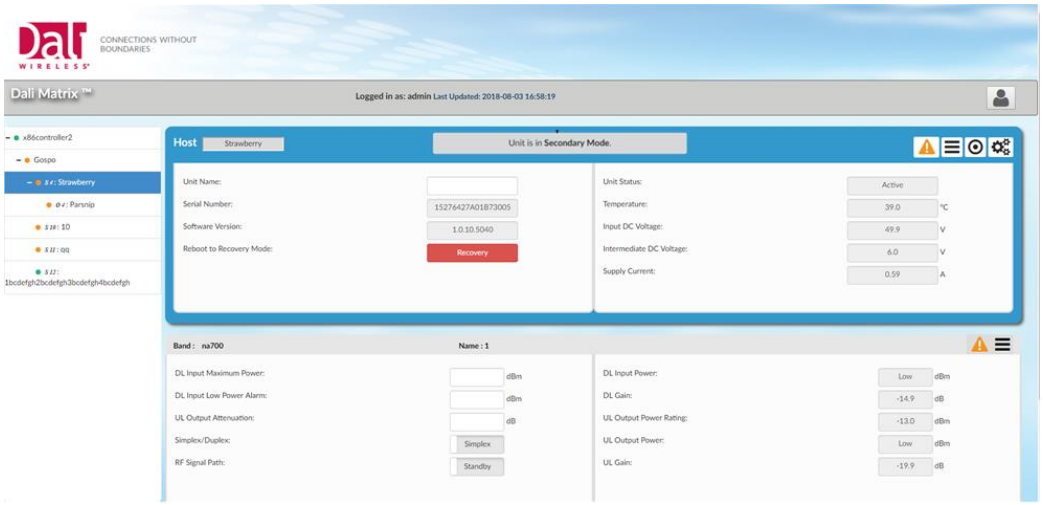


6. Continue to Syncing Primary and Secondary Controllers.

16.5.3 Syncing Primary Controller and Secondary Controllers

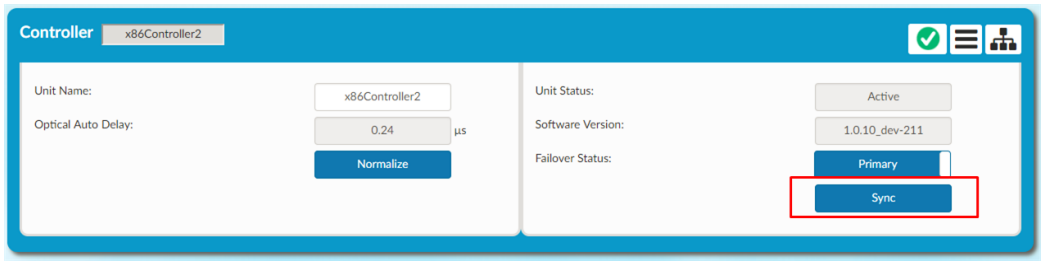
When an offline controller is reconnected to the network, its configuration data may be out of date. Syncing controllers ensures both Primary and Secondary controllers have the latest configuration.

One way to know if a Secondary controller requires syncing is to look at the configuration fields in the EMS. Fields that can be configured appear grayed out and blank. Other fields that report measurements, status or unit information may contain information from the last update when the controller was online.



To sync system controllers:

1. Make sure the offline controller is set to **Secondary**.
2. Reconnect the Secondary controller the network.
3. Log into the Primary controller.
4. In the Unit information view, click **Sync** to update the Secondary controller with the latest configuration data.



Example

For example, in Figure 16-5, the online Primary unit has pushed configuration changes to host and remote units. The configuration in the failed controller is out of date.

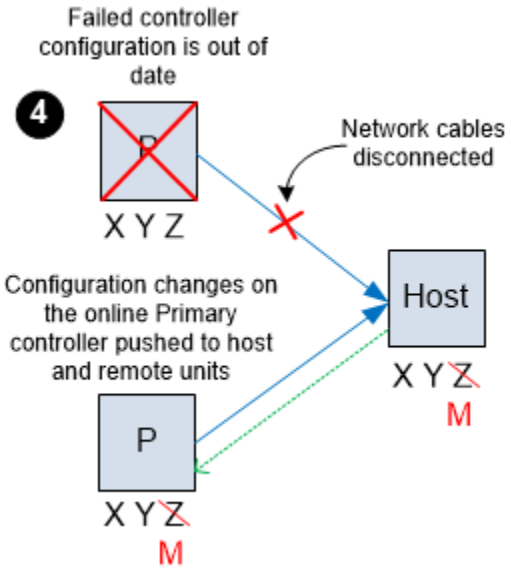


Figure 16-5: Out-of-date Configuration Settings on Failed Controller

By switching the recovered Primary controller to Secondary (Figure 16-6), and then reconnecting the recovered unit to the network, the system controllers can be synced.

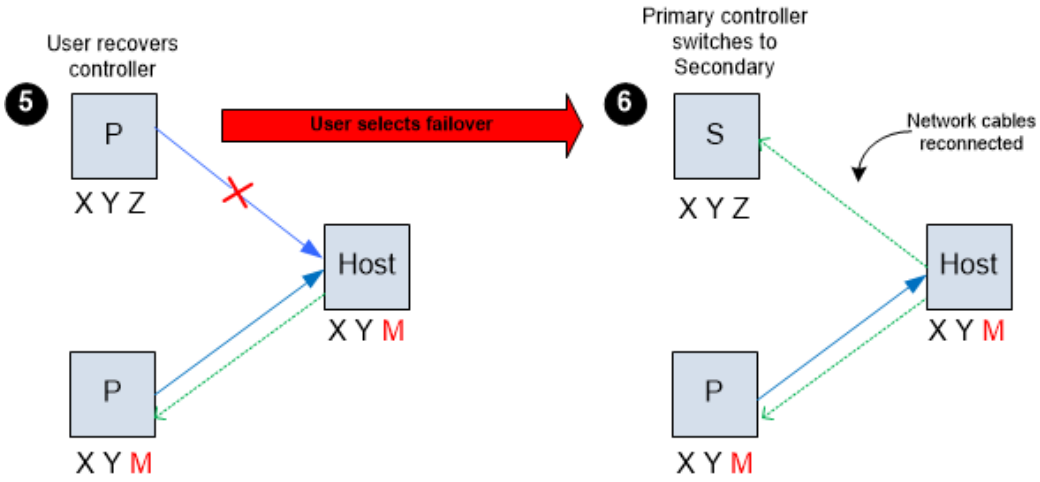


Figure 16-6: Primary Controller Recovery

When you select **Sync** on the Primary controller (Figure 16-7), the configuration data from the Primary controller is pushed to the host and remote units. The host and remotes then acknowledge, or send the updates back to both controllers to be saved.

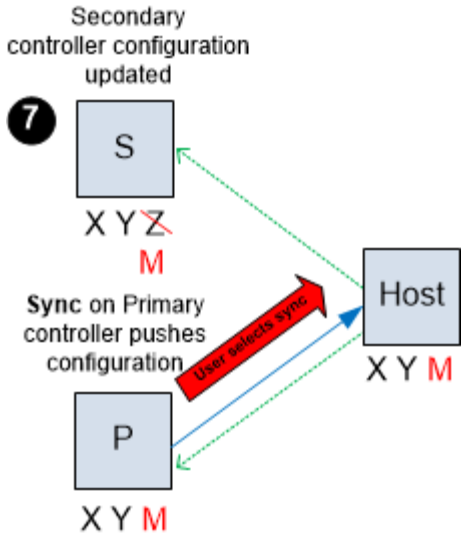


Figure 16-7: Syncing Primary and Secondary Controllers

The final step in recovering a failed Primary controller after syncing both units is to either continue using the system as is, or switch controllers back to the original roles (Figure 16-8). To switch system controllers back the original Primary-Secondary roles, fail over the Secondary controller to Primary, and the Primary controller to Secondary.

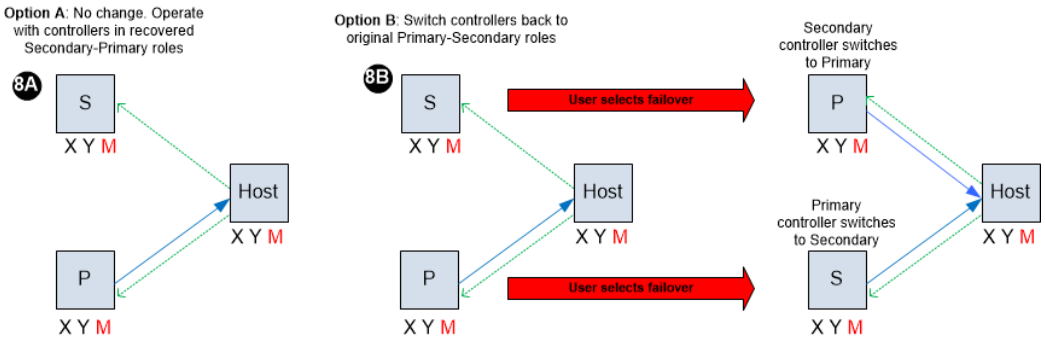


Figure 16-8: Primary Controller Recovery Options

16.6 If the Secondary Controller Fails

If the Secondary controller fails, no failover is required since the Secondary controller is considered the backup. However, after recovering the failed unit, you should sync controllers to ensure the configuration data is up to date on both controllers.

16.6.1 Recovering a Secondary Controller

To recover a Secondary controller:

1. Disconnect the failed Secondary controller from the network.
2. Replace or service the unit, and then restart it by plugging in the AC cable into an AC power source. There is no power switch. The controller starts up as Secondary, but is offline because it is disconnected from the network.
3. Reconnect the offline Secondary controller to the network.
4. Continue to Syncing a Recovered Secondary Controller.

16.6.2 Syncing a Recovered Secondary Controller

Sync a recovered Secondary controller the same way as a Primary controller. See Syncing Primary and Secondary Controllers.

Example

For example, in Figure 16-9 when the Secondary controller fails, the changes to the Primary controller are not updated on the Secondary unit.

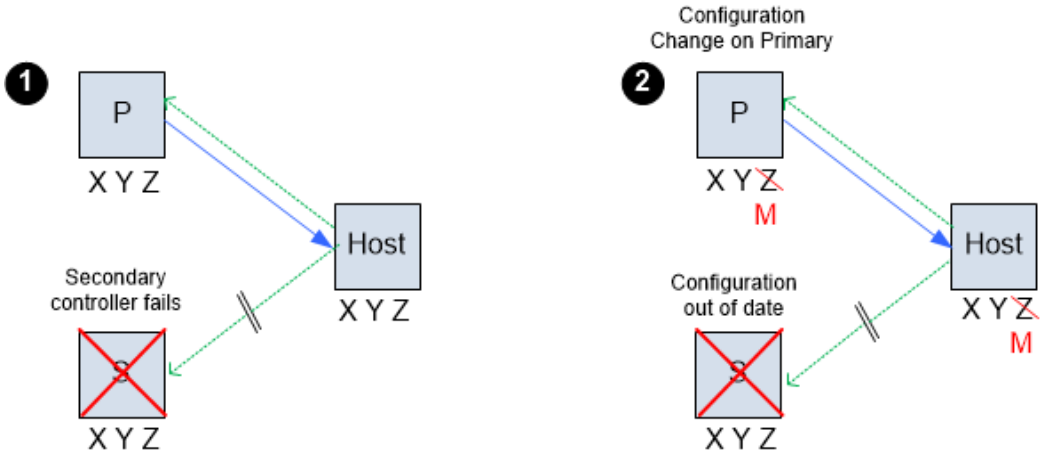


Figure 16-9: Secondary Controller Failure

After recovering the Secondary controller, you can select **Sync**. The latest configuration sent from the Primary controller to the host and remote units, is then saved on both controllers (Figure 16-10).

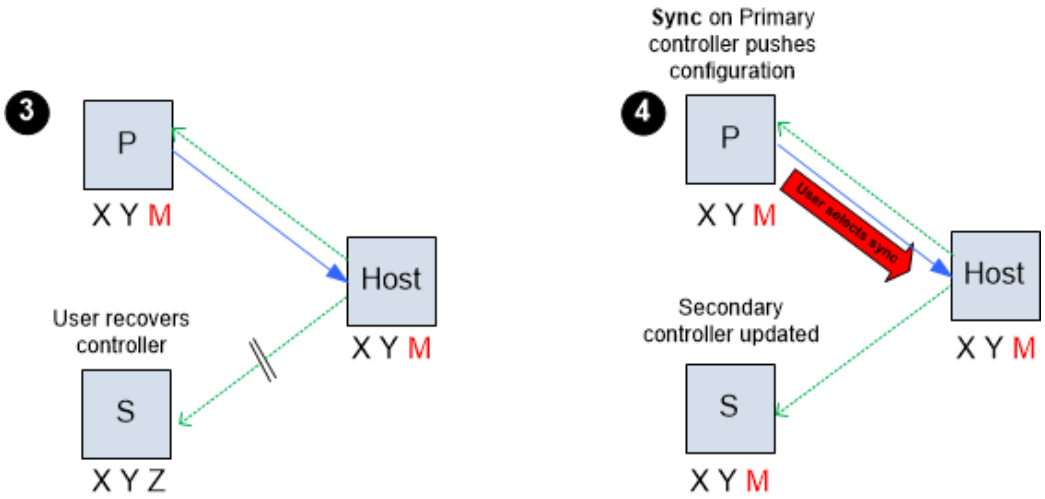


Figure 16-10: Secondary Controller Recovery

PART 3 OPERATIONS, ADMINISTRATION & MAINTENANCE

Part 3 of this guide is intended for operations personnel responsible for the day-to-day monitoring and maintenance of the Matrix PS system.

This section contains the following chapters:

17 UPGRADING UNITS

Contact Dali Customer Service.

778-945-5081
Toll-Free: 1-855-250-5081
support@daliwireless.com

18 SYSTEM MONITORING AND PERFORMANCE

This chapter describes how to:

- Monitor alarms
- Monitor RF power levels
- Clear alarms

18.1 Monitoring Alarms

You can assess system performance using the Matrix EMS or an NMS. If you are using SNMP to integrate with an NMS, see the **Matrix SNMP & Alarm Reference Guide**.

To monitor alarms, review the system tree and look for any Major and Critical alarms (red). The exception is monitoring alarms for daisy-chained hosts.

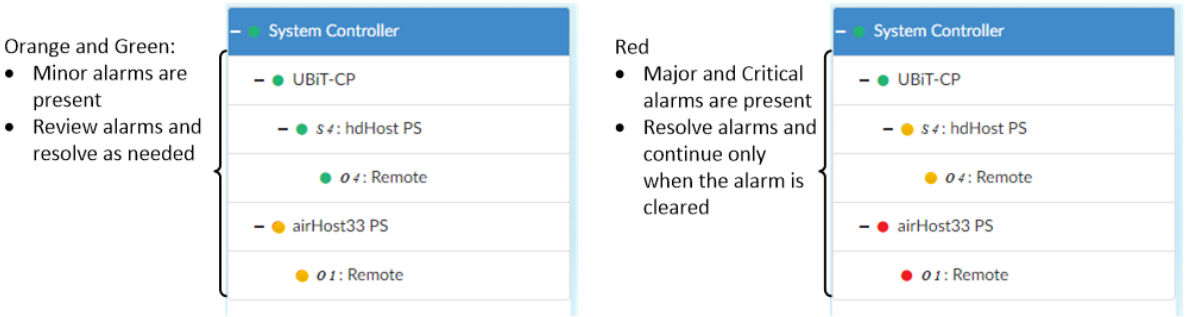


Figure 18-1: System Tree Alarm States

Next, open the Alarm Summary or alarms per band to see alarm details.

For information about displaying and clearing alarms, see Reviewing and Resolving Alarms.

18.2 Monitoring Alarms for Broken Optical Links

There are several types of broken optical link alarms for both host units and remotes.

In the following table, *upstream* refers to units or optical links closest to the base station or off-air signal source, and *downstream* refers to units or optical links farthest away. For example, in Figure 18-2 Host A is the upstream unit, and Host B is the downstream unit. Remote A is the upstream unit relative to Remote B, but also the downstream remote relative to Host A.

Alarm Name	Description	Severity	Alarm LED
Sync Loss on Downstream Optical Link	Displays on an upstream unit when there is a downstream optical link failure causing the downstream unit to be offline or disconnected. For downstream host units, this means all connected remotes are offline. Critical action may be required. See Optical Link Failure Alarms on Daisy-chained HostsOptical Link Failure Alarms on Daisy-chained Hosts	Minor 	Orange
Sync Loss on Upstream Optical Link	Displays on a downstream unit when there is an upstream optical link failure causing this unit to be offline or disconnected.	Critical 	Red/Orange alternating

Alarm Name	Description	Severity	Alarm LED
CRC Errors on Downstream Optical Link	Displays on an upstream unit when the fiber signal could not be properly decoded (most likely due to a data rate mismatch), the received power levels are marginal, or the fiber is dirty and requires cleaning.	Minor	Orange
CRC Errors on Upstream Optical LInk	Displays on a downstream unit when he fiber signal could not be properly decoded or is incompatible, the received power levels are marginal, or the fiber is dirty and requires cleaning.	Critical	

18.2.1 Optical Link Failure Alarms on Daisy-chained Hosts

When an upstream host unit that reports a Sync optical failure on a downstream host, the EMS reports a Minor alarm. On the unit, the alarm LED is solid orange. While this failure does not affect the remotes connected to the upstream host, the optical link to the remotes connected to the downstream host is broken, causing those units to be offline.

For daisy-chained host units, the downstream optical link Minor alarm should be addressed as a Critical service affecting issue.

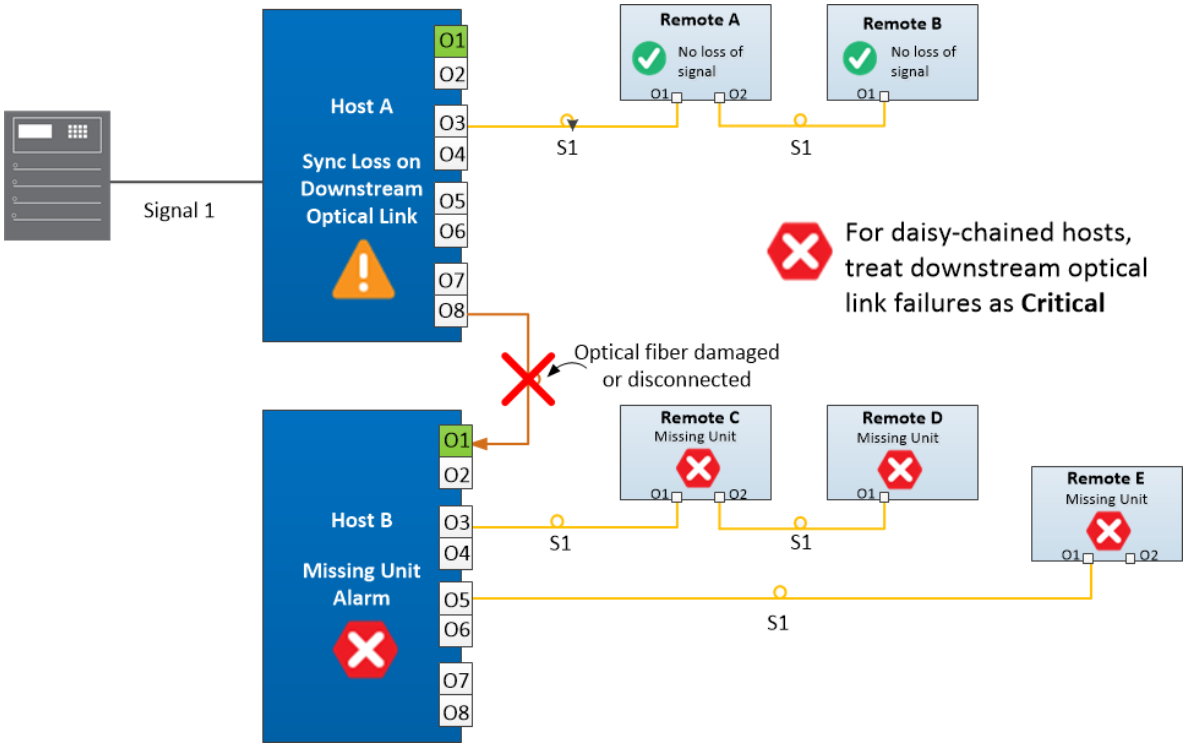


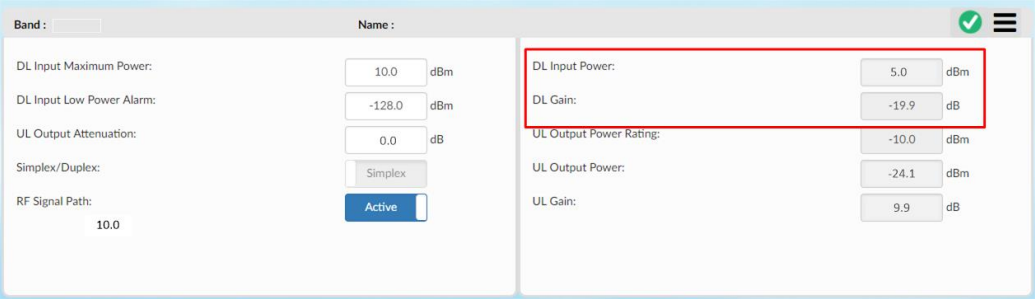
Figure 18-2: Optical Link Failure Alarms on Daisy-chained Hosts

18.3 Monitoring RF Power Levels

To monitor the downlink and uplink power levels for the host and remotes, select the host in the system tree, and click ☰ to display the Band Information view.

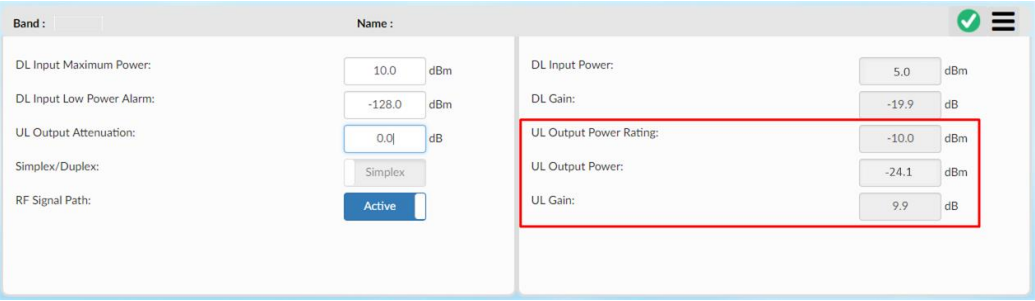
18.3.1 Host

18.3.1.1 Downlink



- **DL Input Power**: Downlink power from the signal source to the host
- **DL Gain**: Gain of the downlink path at the host as configured by the DL Input Maximum Power field

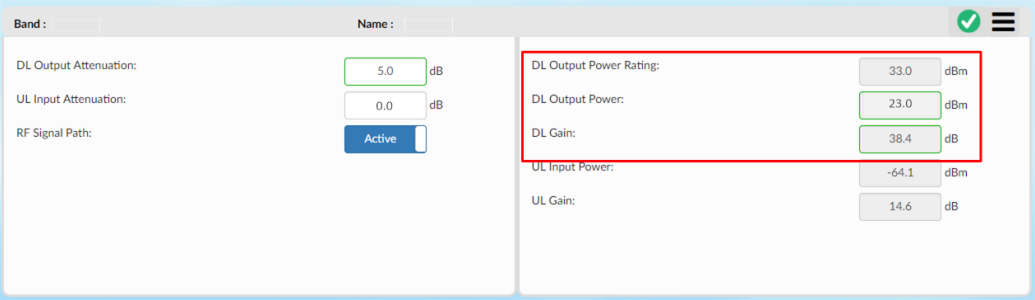
18.3.1.2 Uplink



- **UL Output Power Rating**: Maximum output power the RF module in the host can receive
- **UL Output Power**: Uplink power sent to the signal source from the host
- **UL Gain**: Gain of the uplink path at the host as configured by the UL Output Attenuation field

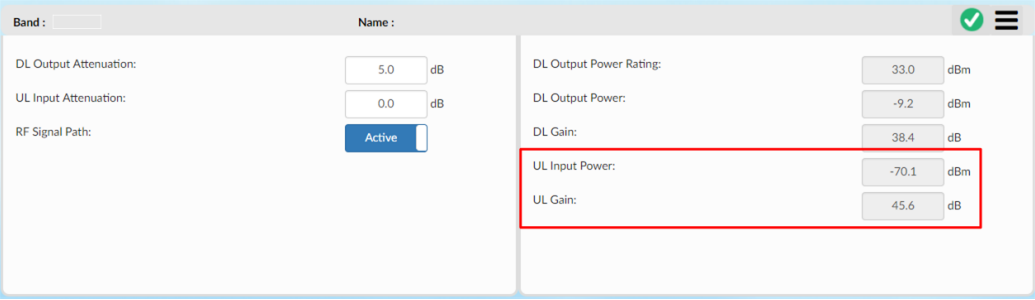
18.3.2 Remote

18.3.2.1 Downlink



- **DL Output Power Rating**: Maximum output power of the RF module
- **DL Output Power**: Downlink power of remote to the RF distribution network
- **DL Gain**: Gain of the downlink path at the remote as configured by the UL Output Attenuation field.

18.3.2.2 Uplink



- **UL Input Power**: Uplink power to the remote from the RF distribution network
- **UL Gain**: Gain of the uplink power at the remote as configured by the UL Input Attenuation field

19 HARDWARE MAINTENANCE

This chapter describes how to:

- Replace remote RF modules
- Replace airHost PS or hd33 PS remote multiplexers

19.1 Replacing Remote RF Modules

Both the airhost PS and remote have pluggable, RF band modules. RF modules can be replaced or added in the field without system downtime.

19.1.1 Type 1 Chassis

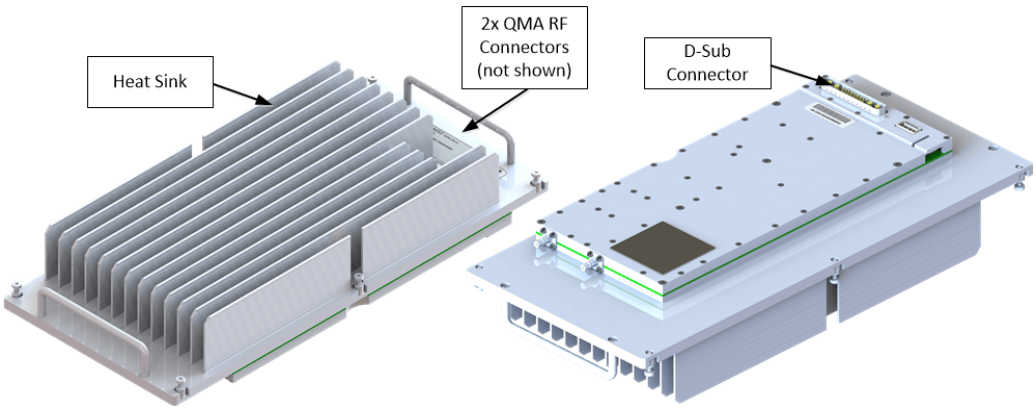


Figure 19-1: hd33 PS RF Modules

To remove an RF module

1. In the EMS, place the RF module in Standby. See Placing RF Modules or Optical Ports in Standby.
2. Loosen the six screws securing the module to the chassis.

3. Grasp the top and bottom handles, and gently pull to disconnect the module from the D-sub interface on the chassis.

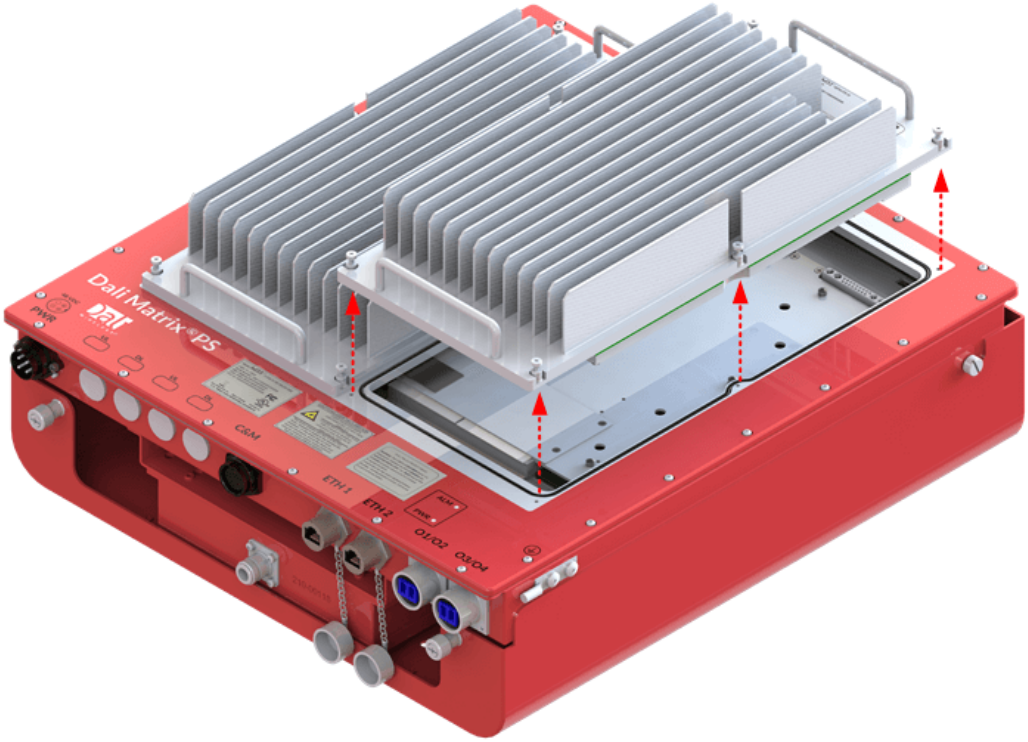


Figure 19-2: Removal of hd33 PS RF Modules

4. Disconnect the QMA RF connectors.
5. Place the module in an antistatic bag for storage, or return to Dali Wireless for servicing.

To replace an RF module

1. Ensure the band label on the RF module matches the band label on the slot. See Appendix A for information on the band sets supported by your Matrix PS system.
2. Orient the module so that the Dali label is at the top of the unit.
3. Connect the QMA RF connectors to the RF interfaces on the unit.
4. Line up the D-sub connector and interface, and press firmly to seat the module in the slot.
5. Secure the RF module with the six captive screws provided.

To activate a replaced module:

1. In the EMS, refresh the browser. Replaced RF modules are automatically placed in Standby mode.

2. Make changes to the configuration as needed before activating the module. For example, give the frequency band a name for easy identification in the EMS, configure RF thresholds, and configure downlink and uplink attenuation.

3. Click ☰ to display the Band Information view, and then click Standby. Wait 6 to 10 seconds for the band to transition to Active. See Activating RF Modules or Optical Ports.

19.2 Replacing Multiplexers

Some airHost PS and hd33 PS units include a factory sealed and field-replaceable duplexer or multiplexer. By detaching the base unit from the cover/mounting bracket, you can replace the multiplexer without shipping the whole remote unit to Dali Customer Service.

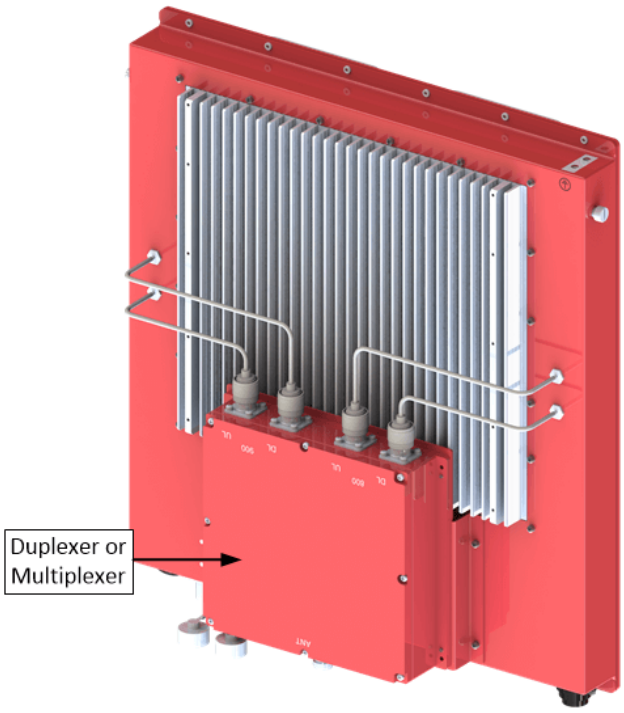


Figure 19-3: Type 1 Chassis Duplexer or Multiplexer

To remove the remote from the mounting bracket:

1. Log into the EMS, and place all the RF modules in Standby. See Placing RF Modules or Optical Ports in Standby.

2. Disconnect the DC power source.

3. Disconnect RF cables, optical-fiber, and Ethernet cables, taking care to observe all safety precautions. For example, replace dust caps on LC fiber connectors.

4. Loosen the two locking screws on either side of the unit.
5. Lift the remote up and slide towards you to free the chassis from wall bracket.

To disconnect the multiplexer:

1. Unscrew the four N-type RF connectors connected to multiplexer.
2. Unscrew the four M3 screws securing the multiplexer to the unit.
3. Remove the multiplexer and place in an antistatic bag. Return to Dali Wireless for servicing.

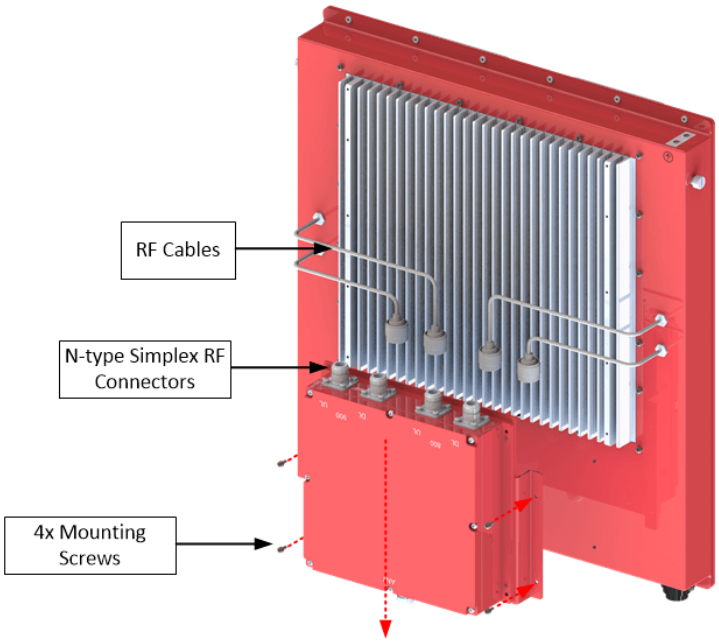


Figure 19-4: Type 1 Multiplexer Connections

To replace the multiplexer:

1. Position the replacement multiplexer by aligning the RF connectors and cables.
2. Mount the multiplexer to the unit using the four M3 screws.
3. Tighten RF connectors.
4. Mount the remote to the bracket, and reconnect RF cables, optical fiber, Ethernet, and DC input power.

APPENDIX A: PRODUCT SPECIFICATIONS

hdHost PS

Optical	**hdHost 150-450-700-800-900 PS** (053018CH)
Wavelength	1270 nm and 1330 nm
Maximum Optical Loss	15 to 30 dBo (SFP dependent)
Optical Ports	8 x LC/UPC
Optical Fiber	SMF 9/125 µm | MMF
Optical Transport Data Rate	9.8304 Gbps
Radio Frequency (RF)	B1 B2 B3 B4 B5
Frequency UL band	130-174 | 380-450/450-512 | 788-805 | 806-817 | 896-902 MHz
Frequency DL band	130-174 | 380-450/450-512 | 758-775 | 851-862 | 935-941 MHz
Instantaneous Bandwidth	44 | 70/62 | 17 | 11 | 6 MHz
Number of bands/channels per unit	4
Air Interfaces Supported	Analog FM, EDACS, P25 Phase I and II, LTE
Channalization - number of BP filters[1]	36
Available filter BW's[1]	12.5 kHz, 25 kHz, 75 kHz, 100 kHz, 200 kHz, 1 MHz
DL Maximum Input Power	-10 dBm to +10 dBm
UL Output Power	≤ 0 dBm
Maximum RF Gain	DL: 0 dB | UL: 10 dB
Attenuation: Range | Step	DL: ≤25 dB | 0.5 dB | UL: ≤45 dB | 0.5 dB
In-band Ripple	≤ ±0.8 dB full band
VSWR	≤1.5
Radio Frequency (RF) Connector	8 x N female
Monitoring and Control (M & C)	
Interface Local / Remote	Ethernet / Ethernet 2 x RJ45
Interface Local	Dry Contact interface to Control Panel
Power Supply	
Operating Power	48 VDC | 110/220 VAC with additional AC-DC converter
Power Consumption	≤ 87 W
Environmental	
Operating Temperature	-30 to +50 °C
Relative Humidity	≤95 %
Enclosure	IP66 / NEMA 4
Standards	UL and FCC certified | NFPA[1] and IFC510 compliant
Mechanical	
Size (W x H x D)	19" x 3.5" x 21.7" | 482 x 89 x 550 mm
Weight	<31 lbs / 14.1 kg

airHost PS

150 MHz, Mode B (5 W)

Optical	**airHost33 150 PS**
Wavelength	1270 nm and 1330 nm
Maximum Optical Loss	15 to 30 dBo (SFP dependent)
Optical Ports	8 x LC/UPC
Optical Fiber	SMF 9/125 µm | MMF
Optical Transport Data Rate	9.8304 Gbps
Radio Frequency (RF)	
Frequency UL band	130-174 MHz
Frequency DL band	130-174 MHz
Instantaneous Bandwidth	44 MHz
UL Maximum Output Power *(single carrier at antenna port)*	+37 dBm
UL Maximum Output Power Per Carrier (multicarrier at antenna port)	2 4 8
P25 P1	30 dBm 26 dBm 21 dBm
UL Intermodulation level at antenna port	≤ -20 dBm (10 dB distribution loss to EIRP required)
Air Interfaces Supported	P25 Phase I and II
DL Maximum Input Power	-10 dBm
DL Noise Figure (system level with DPX)	≤ 10 dB
System Delay (without propagation delay)	≤ 5 us
Maximum RF Gain	UL: 47 dB | DL: 45 dB
Maximum Digital Gain	DL: 35 dB
Attenuation: Range | Step	DL: ≤ 30 dB | 0.5 dB | UL: ≤ 35 dB | 0.5 dB
In-band Ripple	≤ ±0.8 dB full band
VSWR	≤ 1.5
Radio Frequency (RF) Connector	1 x N type female
Monitoring and Control (M & C)	
Interface Local / Remote	Ethernet / Ethernet 2 x RJ45
Power Supply	
Operating Power	48 VDC | 110/220 VAC with additional AC-DC converter
Power Consumption	≤ 130 W
Environmental	
Operating Temperature	-30 to +50 ℃
Relative Humidity	≤ 95 %
Enclosure	IP66 / NEMA 4
Standards	UL and FCC certified
Mechanical	
Size (W x H x D)	type 2: 17.1" x 27.4" x 8.7" | 434 x 696 x 220 mm
Weight	type 2: < 80.3 lbs / 36.5 kg

Type 1 hd33 PS Remote

150 MHz, 450 MHz Mode A (2 W)

Optical	**hd33 150-450 PS**
Wavelength	1270 nm and 1330 nm
Maximum Optical Loss	15 to 30 dBo (SFP dependent)
Optical Ports	8 x LC/UPC
Optical Fiber	SMF 9/125 µm | MMF
Optical Transport Data Rate	9.8304 Gbps
Radio Frequency (RF)	
Frequency UL band	130-174 | 450-512 MHz
Frequency DL band	130-174 | 450-512 MHz
Instantaneous Bandwidth	44 | 62 MHz
DL Maximum Output Power *(single carrier at antenna port)*	+33 dBm
DL Maximum Output Power Per Carrier (multicarrier at antenna port)	2 4 8
P25 P1	30 dBm 26 dBm 21 dBm
DL Intermodulation level at antenna port	≤ -20 dBm (10 dB distribution loss to EIRP required)
Air Interfaces Supported	Analog FM, EDACS, P25 Phase I and II
UL Maximum Input Power	-55 dBm to -25 dBm
UL Noise Figure	4 dB typical with max. UL Gain
System Delay (without propagation delay)	≤ 5 us
Maximum RF Gain	UL: 45 dB | DL: 47 dB
Attenuation: Range | Step	DL: ≤ 30 dB | 0.5 dB | UL: ≤ 35 dB | 0.5 dB
In-band Ripple	≤ ±0.8 dB full band
VSWR	≤ 1.5
Radio Frequency (RF) Connector	4 x N type female
Monitoring and Control (M & C)	
Interface Local / Remote	Ethernet / Ethernet 2 x RJ45
Power Supply	
Operating Power	48 VDC | 110/220 VAC with additional AC-DC converter
Power Consumption	≤ 150 W w/o PoE
Environmental	
Operating Temperature	-30 to +50 °C
Relative Humidity	≤ 95 %
Enclosure	IP66 / NEMA 4
Standards	UL and FCC certified
Mechanical	
Size (W x H x D)	type 1: 16.9" x 18.4" x 7.6" | 430 x 466 x 194 mm
Weight	type 1: < 50 lbs / 22.7 kg

150 MHz, Mode B (5 W)

Optical	**hd33 150 PS**
Wavelength	1270 nm and 1330 nm
Maximum Optical Loss	15 to 30 dBo (SFP dependent)
Optical Ports	8 x LC/UPC
Optical Fiber	SMF 9/125 µm | MMF
Optical Transport Data Rate	9.8304 Gbps
Radio Frequency (RF)	
Frequency UL band	130-174 MHz
Frequency DL band	130-174 MHz
Instantaneous Bandwidth	44 MHz
DL Maximum Output Power *(single carrier at antenna port)*	+37 dBm
DL Maximum Output Power Per Carrier (multicarrier at antenna port)	2 4 8
P25 P1	30 dBm 26 dBm 21 dBm
DL Intermodulation level at antenna port	≤ -20 dBm (10 dB distribution loss to EIRP required)
Air Interfaces Supported	P25 Phase I and II
UL Maximum Input Power	-55 dBm to -25 dBm
UL Noise Figure (system level with DPX)	≤ 10 dB
System Delay (without propagation delay)	≤ 5 us
Maximum RF Gain	UL: 45 dB | DL: 47 dB
Attenuation: Range | Step	DL: ≤ 30 dB | 0.5 dB | UL: ≤ 35 dB | 0.5 dB
In-band Ripple	≤ ±0.8 dB full band
VSWR	≤ 1.5
Radio Frequency (RF) Connector	1 x N type female
Monitoring and Control (M & C)	
Interface Local / Remote	Ethernet / Ethernet 2 x RJ45
Power Supply	
Operating Power	48 VDC | 110/220 VAC with additional AC-DC converter
Power Consumption	≤ 130 W
Environmental	
Operating Temperature	-30 to +50 ℃
Relative Humidity	≤ 95 %
Enclosure	IP66 / NEMA 4
Standards	UL and FCC certified
Mechanical	
Size (W x H x D)	type 2: 17.1" x 27.4" x 8.7" | 434 x 696 x 220 mm
Weight	type 2: < 80.3 lbs / 36.5 kg

800 MHz, 900 MHz Mode A (2W)

Optical	**hd33 800-900 PS**
Wavelength	1270 nm and 1330 nm
Maximum Optical Loss	15 to 30 dBo (SFP dependent)
Optical Ports	8 x LC/UPC
Optical Fiber	SMF 9/125 µm | MMF
Optical Transport Data Rate	9.8304 Gbps
Radio Frequency (RF)	
Frequency UL band	806-817 | 896-902 MHz
Frequency DL band	851-862 | 935-941 MHz
Instantaneous Bandwidth	11 | 6 MHz
DL Maximum Output Power *(single carrier at antenna port)*	+33 dBm
DL Maximum Output Power Per Carrier (multicarrier at antenna port)	2 4 8
P25 P1	30 dBm 26 dBm 21 dBm
DL Intermodulation level at antenna port	≤ -20 dBm (10 dB distribution loss to EIRP required)
Air Interfaces Supported	Analog FM, EDACS, P25 Phase I and II
UL Maximum Input Power	-55 dBm to -25 dBm
UL Noise Figure	6 dB typical with max. UL Gain
System Delay (without propagation delay)	≤ 5 us
Maximum RF Gain	UL: 45 dB | DL: 43 dB
Attenuation: Range | Step	DL: ≤ 30 dB | 0.5 dB | UL: ≤ 35 dB | 0.5 dB
In-band Ripple	≤ ± 0.8 dB full band
VSWR	≤ 1.5
Radio Frequency (RF) Connector	1 x N type female
Monitoring and Control (M & C)	
Interface Local / Remote	Ethernet / Ethernet 2 x RJ45
Power Supply	
Operating Power	48 VDC | 110/220 VAC with additional AC-DC converter
Power Consumption	≤ 150 W w/o PoE
Environmental	
Operating Temperature	-30 to +50 °C
Relative Humidity	≤ 95 %
Enclosure	IP66 / NEMA 4
Standards	UL and FCC certified
Mechanical	
Size (W x H x D)	type 1: 16.9" x 18.4" x 7.6" | 430 x 466 x 194 mm
Weight	type 1: < 50 lbs / 22.7 kg

Type 2 hd33 PS Remote

Optical	**hd33 150-450-700-800-900 PS** (053018CH)
Wavelength	1270 nm and 1330 nm
Maximum Optical Loss	15 to 30 dBo (SFP dependent)
Optical Ports	8 x LC/UPC
Optical Fiber	SMF 9/125 µm | MMF
Optical Transport Data Rate	9.8304 Gbps
Radio Frequency (RF)	B1 (VHF) B2 (UHF) B3 B4 B5
Frequency UL band	130-174 | 380-450/450-512 | 788-805 | 806-817 | 896-902 MHz
Frequency DL band	130-174 | 380-450/450-512 | 758-775 | 851-862 | 935-941 MHz
Instantaneous Bandwidth	44 | 70/62 | 17 | 11 | 6 MHz
Number of bands/channels per unit	2 (dual-band) typ 1 | 4 (quad-band) type 2
DL Maximum Output Power *(single carrier at antenna port)*	+37 dBm
DL Maximum Output Power Per Carrier (multicarrier at antenna port)	2 4 8
P25 P2	30 dBm 27 dBm 24 dBm
LTE (700 only)	34 dBm 31 dBm 27 dBm
DL Intermodulation level at antenna port	≤ -20 dBm (10 dB distribution loss to EIRP required)
Air Interfaces Supported	Analog FM, EDACS, P25 Phase I and II, LTE
Channalization - number of BP filters[1]	36
Available filter BW's[1]	12.5 kHz, 25 kHz, 75 kHz, 100 kHz, 200 kHz, 1 MHz
UL Maximum Input Power	≤ -50 dBm
UL Noise Figure	4 dB typical
Maximum RF Gain	UL: 40 dB | DL: 47 dB
UL Digital Gain range[1]	-20 dB to +60 dB
Attenuation: Range | Step	DL: ≤ 25 dB | 0.5 dB | UL: ≤ 25 dB | 0.5 dB
In-band Ripple	≤ ± 0.8 dB full band
VSWR	≤ 1.5
Radio Frequency (RF) Connector	1 to 4 x N type female
Monitoring and Control (M & C)	
Interface Local / Remote	Ethernet / Ethernet 2 x RJ45
Interface Local	Dry Contact interface to Control Panel
Power Supply	
Operating Power	48 VDC | 110/220 VAC with additional AC-DC converter

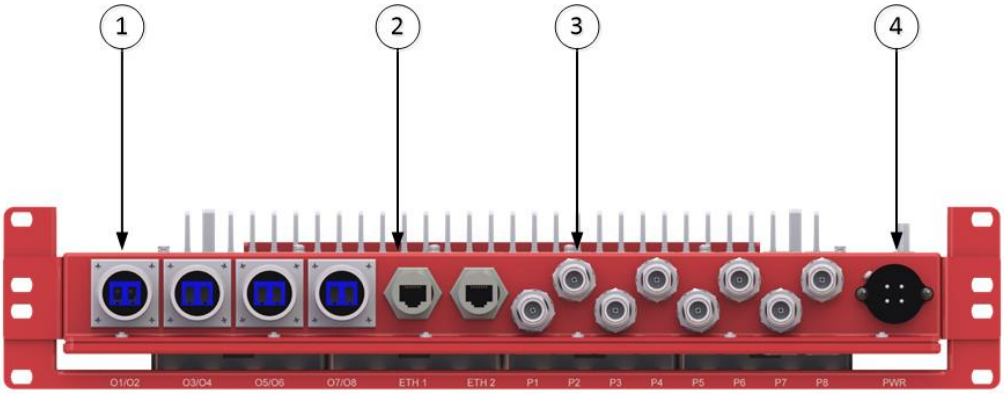
Power Consumption	type 2: < 340 W
Environmental	
Operating Temperature	-30 to +50 °C
Relative Humidity	< 95 %
Enclosure	IP66 / NEMA 4
Standards	UL and FCC certified
Mechanical	
Size (W x H x D)	type 2: 17.1" x 27.4" x 8.7" | 434 x 696 x 220 mm
Weight	type 2: < 59.5 lbs / 27 kg

Matrix Console PS

Interfaces	Matrix Console PS (060618)
Web Based GUI	Supports current Chrome and Firefox as well as IE11 and newer.
	Formatted for PC, tablet or handheld device.
SNMP	SNMP v3 Gets, Sets and Traps. All transactions secured.
Dali API	Websocket API provided for system integration.
Northbound Networking to NOC / NMS	
Required Ports	80, 443
Network Performance	Transport over open internet with any reasonable latency and packet loss is supported.
Security	External firewall is required.
Southbound Networking to Dali Units	
Required Ports	8088, 5555
Network Performance	Low latency, low loss link required to each unit.
	Minimum 100Mbps link speed.
	Compatible with L2 Ethernet switching is ok but no L3 routing should exist on this link.
	All units to be link local.
Security	User traffic may share this link. External firewall is required.
Physical Interfaces	
Display	No display provided; all external interactions conducted over IP
External Interfaces	1 x USB 3.0; 1x USB 2.0 1 Gbps Ethernet; 8 x RJ45
Power Supply	
Operating Power	48 VDC | 110/220 VAC with additional AC-DC converter
Power Consumption	$\leq$ 50 W
Environmental	
Operating Temperature	-5 to +50 °C
Relative Humidity	$\leq$ 85 %
Enclosure	IP66 / NEMA 4
Standards	UL and FCC certified
Mechanical	
Size (W x H x D)	19” x 1.75" x 18.3” | 482 x 44 x 465 mm
Weight	< 15.4 lbs / 7 kg

APPENDIX B: EXTERNAL INTERFACES

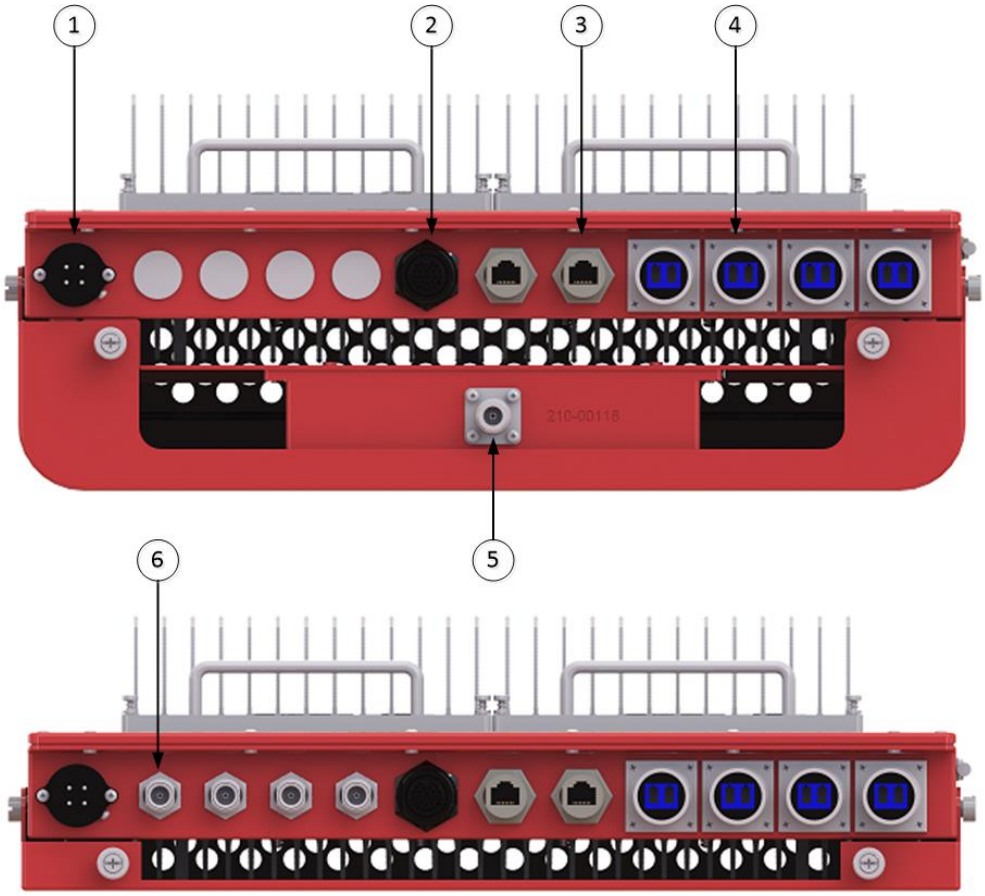
hdHost PS



#	Label	Interface	Description
1	O1 to O8	LC/UPC Duplex	Dual LC/UPC optical ports for single mode fiber up to 8 optical ports available
2	ETH1, ETH2	RJ-45	1 Gbps Power over Etherent (POE) interfaces. Total POE power is 68 W with maximum 32 W per channel
3	P1 to P8	N-type	Maximum 8 simplex RF interfaces. The number of RF interfaces depends on the band configuration of the unit
4	PWR	DC Input Power Assembly	48 VDC input power

airHost PS | hd33 PS

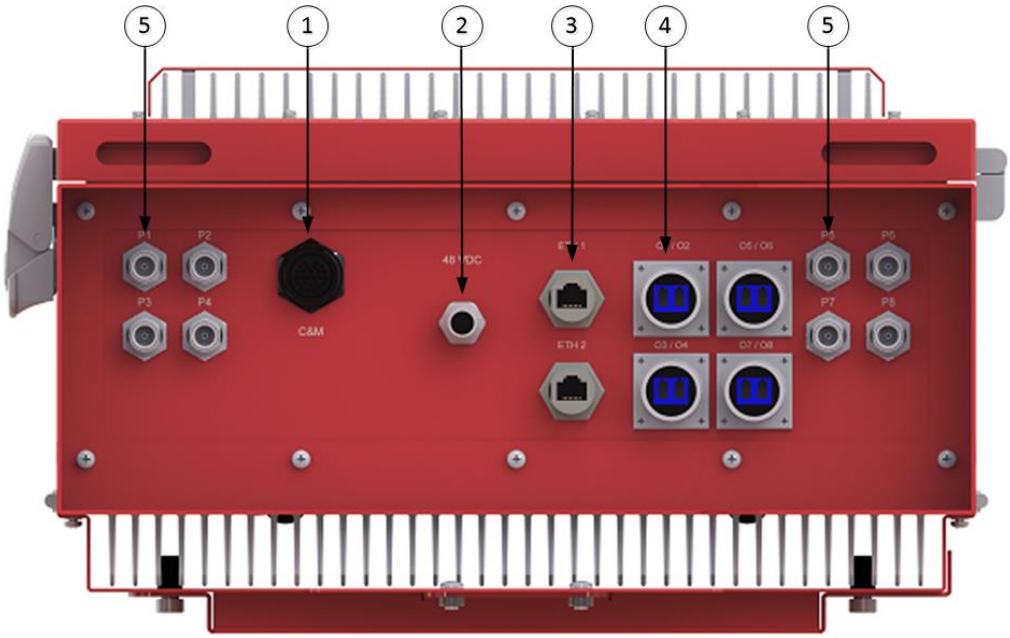
Type 1 Chassis



Labeling for the type 1 chassis is located on the front of the unit so they are visible when the unit is mounted. The grounding lug and LEDs are located on the side and front of the unit.

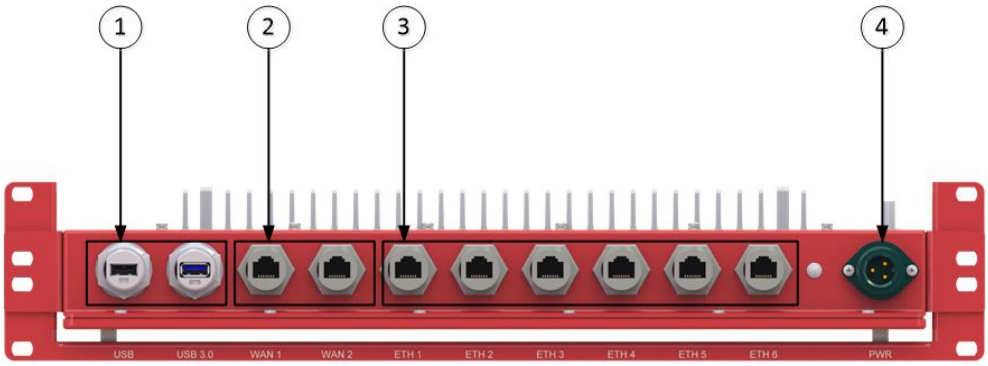
#	Label	Interface	Description
1	PWR	DC Input Power Assembly	48 VDC input power
2	C&M		Not used
3	ETH1, ETH2	RJ-45	1 Gbps Power over Etherent (POE) interfaces. Total POE power is 68 W with maximum 32 W per channel.
4	O1 to O8	LC/UPC Duplex	Dual LC/UPC optical ports for single mode fiber • airHost PS: up to 8 optical ports available • hd33 PS: 4 optical ports available
5	ANT	N-type	Single RF interface for internal duplexer or multiplexer
6	P1 to P4	N-type	Maximum 4 simplex RF interfaces. The number of RF interfaces depends on the band configuration of the unit

Type 2 Chassis



#	Label	Interface	Description
1	C&M	Dry Contact	Not supported. Contact Dali Customer Service
2	48 VDC	DC Input Power Assembly	48 VDC input power
3	ETH1, ETH2	RJ-45	1 Gbps Power over Etherent (POE) interfaces Total POE power is 68 W with maximum 32 W per channel
4	O1 to O8	LC/UPC Duplex	Dual LC/UPC optical ports for single mode fiber • airHost PS: up to 8 optical ports available • hd33 PS: 4 optical ports available
5	P1 to P8	N-type	Maximum 8 simplex RF interfaces. The number of RF interfaces depends on the band configuration of the unit

Matrix Console PS



#	Label	Interface	Description
1	USB, USB 3.0	USB 2, USB 3 (blue)	Not used
2	WAN1 to WAN2	RJ-45	Ethernet ports for connecting to the customer IP network • WAN 1 connects to customer IP network • WAN 2 not used
3	ETH1 to ETH6	RJ-45	Ethernet ports for connecting to the internal Matrix IP network • ETH 1 connects to Matrix IP network • ETH 2 to 6 not used
4	PWR	3-pin AC	AC power interface

APPENDIX C: MATRIX AC/DC POWER SUPPLY

The hdHost PS, airHost PS, and hd33 PS require a protected 48 VDC dual power supply.

However, if you are installing units in a location with AC power, Dali Wireless provides a 100-240 VAC (4.0A) to +48V (5.0A) AC to DC power supply. Contact Dali Customer Service for more information.

Depending on your host or remote configuration, the following power supplies are available:

Unit	Power Supply	Description
		hdHost PS • 1 ft + 4.9 ft (0.3 m + 1.5 m) extended AC power cable with plug • 1 ft (0.3 m) DC power cable with female DC connector
		Type 1 chassis, airHost PS or hd33 PS • 1 ft + 4.9 ft (0.3 m + 1.5 m) extended AC power cable with plug • 1 ft (0.3 m) DC power cable with female DC connector
		Type 2 chassis, airHost PS or hd33 PS • 1 ft + 4.9 ft (0.3 m + 1.5 m) extended AC power cable with plug • 1 ft (0.3 m) DC power cable • Mounting plate

Mounting the AC/DC Power Supply

The mounting location of the power supply is based on the host and chassis type.

Type 1 Chassis

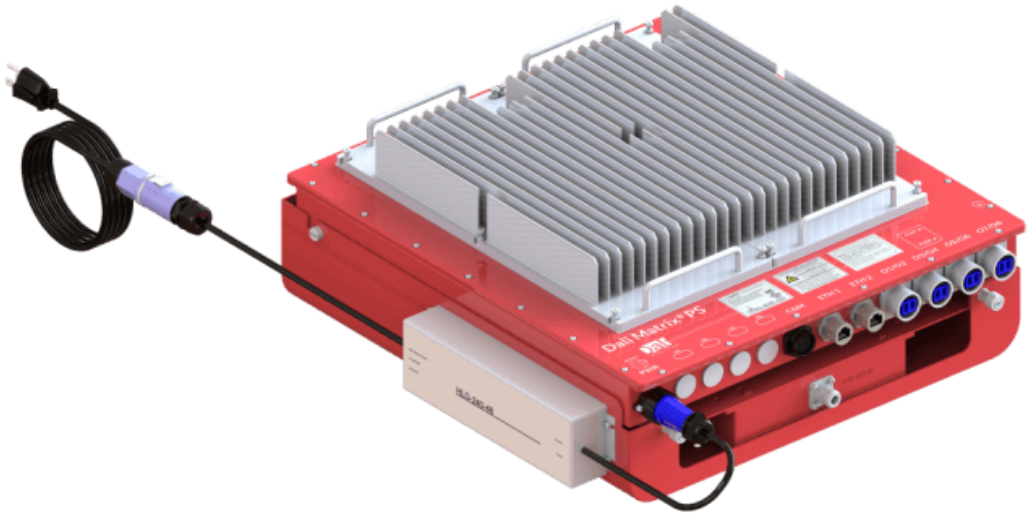


Figure 19-5: Type 1 Chassis Mounted Power Supply

For the type 1 chassis, mount the power supply on the side of the unit. Attach the power supply to the mounting plate and then to the side of the chassis with the screws provided.

Type 2 Chassis

Figure 19-6: Type 2 Chassis Mounted Power Supply

For the type 2 chassis, mount the power supply below the interface panel. Attach the power supply to the mounting plate and then to the bracket flange using the existing two M6 securing screws.

hdHost PS

Mount the power supply to the rear plate on the bracket using the hardware provided

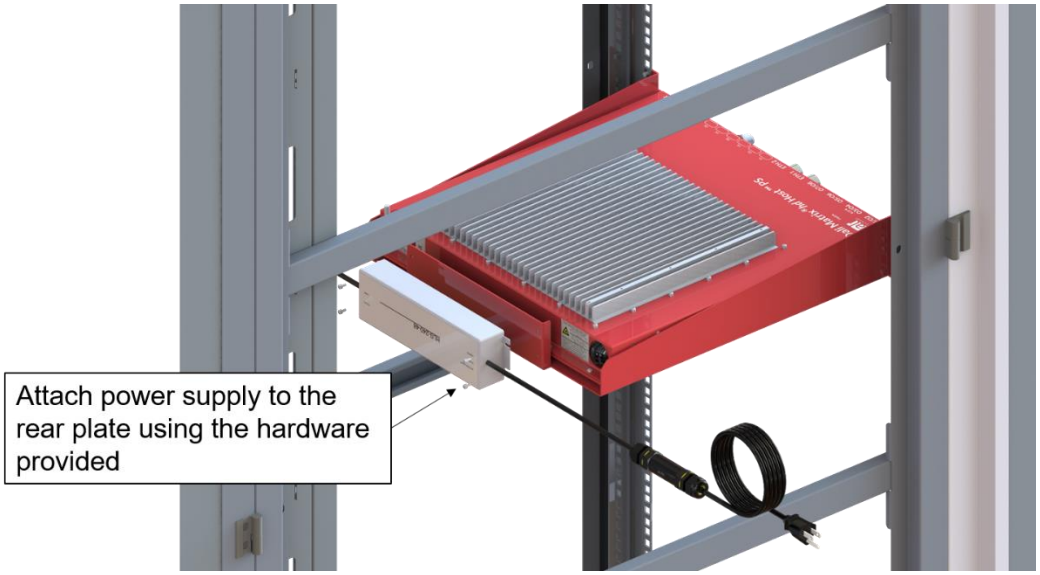


Figure 19-7: hdHost PS Mounted Power Supply

Connecting the AC/DC Power Supply

The AC/DC power supply comes with an assembled AC cable and plug for connecting to the power source, and an attached DC cable. Connect the DC cable to the unit according to the *Connecting DC Power* instructions in this manual:

- hdHost PS
- airHost PS & Remote Type 1 Chassis
- airHost PS & Remote Type 2 Chassis

APPENDIX D: POWER CONSUMPTION

This appendix lists the power consumption specifications for Matrix PS hardware. For a description of chassis types, see Type 1 Chassis Specifications and Type 2 Chassis Specifications.

hdHost PS

Unit	Voltage	Maximum Power
hdHost PS with 4 RF modules	48 VDC Nominal (40 to 58 VDC)	87 W

airHost33 PS | hd33 PS Type 1

Unit	Voltage	Thermal Load	Max Power no PoE	Max Power incl. PoE
RF Module only	48 VDC	-	50 W	-
Chassis only	48 VDC	-	40 W	-
Chassis + 1 RF module	48 VDC	-	90 W	
Chassis + 2 RF modules	48 VDC	512 Btu/h	140 W	195 W

airHost33 PS | hd33 PS Type 2

Unit	Voltage	Thermal Load	Max Power no PoE	Max Power incl. PoE
RF Module only	48 VDC	-	60 W	-
Chassis only	48 VDC	-	40 W	-
Chassis + 1 RF module	48 VDC	-	100W	160 W
Chassis + 2 RF modules	48 VDC	955 Btu/h	160 W	220 W
Chassis + 3 RF modules	48 VDC		220 W	280 W
Chassis + 4 RF moduels	48 VDC		280 W	340 W

Matrix Console PS

Unit	Voltage	Max Power
Matrix Console PS	100/240 VAC	50 W

APPENDIX E: ALARMS

Alarm	Description and Tips	Severity
Backplane hardware failure	• Backplane cannot be configured for proper operation.	CRITICAL
Card inserted in the slot is not ready to communicate with the controller.	• The Controller detects a card inserted in the slot, but the card is not yet responding to commands. • A host may take several minutes to boot. • Wait for the NOT READY alarm to clear or to progress to ERROR.	MAJOR
Card inserted in the slot is not responding to commands.	• The Controller detects a card inserted in the slot, but the card has not responding to commands for several minutes. • Check that the card is properly inserted, that power is applied to the slot, and that the card's LEDs indicate that it is functioning.	MAJOR
Configuration Database Parsing Failure	• Unit operation is not recommended. • The unit may be recoverable by Dali service personnel. • A software update will not resolve this issue.	CRITICAL
CRC Errors on Upstream Optical Link	• Fiber signal could be properly decoded. • Fiber signal format could be incompatible. • Received power levels may be marginal. • Dirty fiber may cause poor signal levels, ensure fiber ends are clean.	CRITICAL
CRC Errors on Downstream Optical Link	• Fiber signal could be properly decoded. • Fiber signal format could be incompatible. • Received power levels may be marginal. • Dirty fiber may cause poor signal levels, ensure fiber ends are clean.	MINOR
DL Input Path Low Power	• Input power is below what is configured for Input Power Low Alarm Threshold. • Check source power and cable connections. • If input power is as expected then adjust alarm threshold.	MINOR
Failed to Initialize a Critical SPI Device	• Operation may not be possible. • Attempt to recover by power cycling the unit.	CRITICAL

Alarm	Description and Tips	Severity
Failed to Initialize Data Clock	• Operation is not possible.	CRITICAL
Failed to Initialize PWM	• No user intervention necessary.	INFORMATION
Failed to Initialize RF Module Communication	• Operation is not possible. • Attempt to recover by power cycling the unit. • Disconnect RF modules to determine if one of them is causing the failure.	CRITICAL
Failed to initialize the I2C Controller	• Operation is not possible. • Attempt to recover by power cycling the unit. • Disconnect RF Modules to determine if one of them is causing the failure.	CRITICAL
Fan Control Failure	• Communication failure to fan controller. • Operation may be possible if the fans are still running. Verify this manually. • Monitor unit temperatures. Temperature alarm will indicate the need to shutdown if necessary.	MAJOR
Fan Failures (one fan has failed)	• A fan is not operating as expected. • Monitor the unit temperature and replace fan at your convenience. • Fans are field replaceable without service interruption.	MINOR
Fan Failures (two or more fans have failed)	• More than one fan is not operating as expected. • Monitor the unit temperature and replace fans as soon as possible. • Fans are field replaceable without service interruption.	MAJOR
FPGA Initialization Failure	• Operation is not possible • Attempt to recover by power cycling the unit. • Rewriting the FPGA image with a software update may repair the unit.	CRITICAL
Hardware Initialization Failure	• Only limited operation may be possible.	MAJOR
Hardware Initialization Failure (Other)	• Operation may be possible.	MAJOR

Alarm	Description and Tips	Severity
High Temperature	• May be caused by unit or remote fan failures. • Check the ambient temperature to ensure it is not above the rated temperature. • Ensure that airflow from the bottom of the heat sink and above the fans is not obstructed. • Ensure unit is positioned correctly.	MAJOR
Input DC Voltage Marginal	• Unit input voltage is close to exceeding acceptable range. • Check the reported input voltage. • Adjust input voltage or repair power feed as necessary.	MINOR
Input DC Voltage Out of Range	• Unit input voltage has exceeded acceptable range. • Check the reported input voltage. • Adjust input voltage or repair power feed as necessary.	MAJOR
Input Path ALC Active	• Input path power has exceeded recommended levels on the RF port. Consequently, the ALC has been activated and the gain reduced. • When occurring on air interface consider repositioning antenna or increasing minimum distance between mobile and antenna. • When occurring on conducted interface reduce power of feed. The DL output power from the PA has exceeded recommended levels. Consequently, the ALC has been activated and the gain reduced. Either the input power is also high, there has been a transient high input power, or the system gain is higher than expected.	MAJOR
Input Path ALC Range Exceeded	• Input path power has exceeded safe levels and consequently the RF path has been deactivated. • Adjust input power setting or add external attenuation if input power is above the rated level. • Once the cause has been addressed, reactivate the RF path.	CRITICAL

Alarm	Description and Tips	Severity
Input Path High Power	• Input path power has exceeded safe levels and consequently the RF path has been deactivated. • Adjust input power setting or add external attenuation if input power is above the rated level. • Once the cause has been addressed, reactivate the RF path.	CRITICAL
Input Path LO Out of Lock	• Module has been deactivated. • Ensure unit is operating within valid temperature range. • Attempt to recover the LO lock by disabling and re-enabling module.	CRITICAL
Intermediate Current Out of Range	• DC current consumption by RF modules is outside the acceptable range. • For shelf controllers this may be corrected by removing modules to reduce power draw. Refer to documentation for maximum shelf load. • For hosts or remotes this indicates a failure condition with an RF module.	MAJOR
Intermediate Voltage Out of Range	• DC voltage to the RF modules is outside the acceptable range. • It may be affected by external conditions. Check input voltage to the unit. • Disconnect RF modules to determine if one of them is drawing high current.	MAJOR
Mixed Signal Failure	• Mixed signal operation has failed on this slot. • Unit will continue to function on other slots.	CRITICAL
One of the main board PLLs has lost lock.	• Check for optical or FPGA failures.	CRITICAL
Optical Transceiver is Missing	• SFP optical transceiver has failed or has been intentionally removed. • Replace with a functional SFP.	CRITICAL
Output Path ALC Active	• Output path power has exceeded recommended levels. Consequently the ALC has been activated and the gain reduced. • The input path power may also be high or there has been a transient high input power. • The system gain may be higher than expected.	MAJOR

Alarm	Description and Tips	Severity
Output Path ALC Range Exceeded	• The output path power has exceeded safe levels and consequently the RF path has been deactivated. • The input path power may also be high or there has been a transient high input power. • The system gain may be higher than expected. • Once the cause has been addressed reactivate the RF path.	CRITICAL
Output Path High Power	• The output path power has exceeded safe levels and consequently the RF path has been deactivated. • The input path power may also be high or there has been a transient high input power. • The system gain may be higher than expected. • Once the cause has been addressed reactivate the RF path.	CRITICAL
Output Path High VSWR	• The reflected power (VSWR) threshold is exceeded. Ensure that the load on the antenna port is properly matched to 50 ohms. • Check for damaged or disconnected cables or antennas.	MINOR
Output Path LO Out of Lock	• Module has been deactivated. • Ensure unit is operating within valid temperature range. • Attempt to recover the LO lock by disabling and re-enabling module.	CRITICAL
Output Path Low RF Module Gain	• An element in the path is not providing sufficient RF gain • This may be the RF module or mixed signal portions of the unit • Ensure DC power is available by checking the input voltage reported by module • If it is field replaceable try an alternate module	MAJOR
Output RF Path Low Gain	• RF path gain is lower than expected. • RF levels may be out of range. • Module may be damaged.	MAJOR
POE Initialization Failure	• Operation is possible except for use of POE. • Alternate power sources for POE devices will be required.	MINOR

Alarm	Description and Tips	Severity
Reboot to Recovery Console failed	• Check FPGA status on hosts and remotes. Reduce system load and try again.	CRITICAL
RF Module Activating Error	• Error received when activating RF module. • Attempt to recover by deactivating and reactivating module.	MAJOR
RF Module Being Serviced	• RF module is physically present but regular communication is not possible due to servicing. • Wait for software upgrade to complete for up to 5 or 10 minutes. • An interruption of software upgrade due to power loss may cause RF module to remain in this state. • Remote servicing of unit will put module in this state.	MAJOR
RF Module Communications Failure	• RF module was detected but communication to the module has failed.	MAJOR
RF Module Deactivated Itself	• RF Module has deactivated itself for an unknown reason. • Attempt to recover by reactivating module. • Power to RF module may have been interrupted due to high load. • RF module may have been reset.	CRITICAL
RF Module is Missing	• An RF module has failed or has been intentionally removed. • Replace with a functional RF module. • To clear this alarm, either replace a module in this slot, or mark the slot as Unavailable.	CRITICAL
RF Module Not Ready	• Wait for boot process to complete and PLL to lock.	MAJOR
RF Path Deactivated by User	• The user has intentionally deactivated the RF path • Reactivate the RF path as needed • To permanently deactivate the RF path without alarm, set the slot to Unavailable.	MINOR

Alarm	Description and Tips	Severity
Sync Loss on Downstream Optical Link	• The received laser power level is too low to achieve optical connection. • Fiber may have been disconnected or damaged. • Dirty fiber may cause poor signal levels, ensure fiber ends are clean. • Failure could also be caused by SFP failure or loss of power on unit at far end of fiber link. • If this alarm is displayed on a daisy-chained host, address as Critical. See Optical Link Failure Alarms on Daisy-chained Hosts	MINOR
Sync Loss on Upstream Optical Link	• The received laser power level is too low to achieve optical connection. • Fiber may have been disconnected or damaged. • Dirty fiber may cause poor signal levels, ensure fiber ends are clean. • Failure could also be caused by SFP failure or loss of power on unit at far end of fiber link.	CRITICAL
Temperature Sensor Failure	• Failed to initialize unit temperature sensor. • Operation is possible but unit temperature should be monitored manually.	MAJOR
Unit config.db does not contain a serial number or database is missing.	• Create and install the configuration database. (Dali Customer Service only.)	CRITICAL
Unit is Missing	• A unit has failed or has been intentionally removed. • Check network connectivity to the unit. • To clear this alarm mark the unit as Unavailable.	CRITICAL
Voltage to RF module is Out of Range	• An internal voltage is out of range. • It may be affected by external conditions. Check input voltage to the unit.	MINOR

APPENDIX F: OPTICAL CONNECTOR CLEANING PROCEDURE

Connector contamination due to fiber mishandling is the single greatest point of failure in many fiber-optic networks. The optical connectors used in deploying the hdHost PS must be clean and free of contaminants prior to connection.

This appendix describes the recommended procedures for cleaning and handling fiber-optic cable, including:

- Laser Safety Warnings
- Fiber Handling Guidelines
- Bend Radius Guidelines
- Inspecting Fiber-Optic Connectors
- Cleaning Fiber-Optic Connectors

Laser Safety Warnings

	This equipment uses a Class 1 Laser according to FDA/CDRH rules. This equipment contains components that emit laser radiation which can seriously damage the retina of the eye. Do not look into the ends of any optical fiber. Do not look directly into the optical transceiver of any digital unit or exposure to laser radiation may result. Place a protective cap or lid immediately over any radiating transceiver or optical fiber connector to avoid potential damage caused by radiation exposure. This practice also prevents dirt particles entering the openings.
	An optical power meter should be used to verify active fibers. A protective cap or hood MUST be immediately placed over any radiating transceiver or optical fiber connector to avoid the potential of dangerous amounts of radiation exposure. This practice also prevents dirt particles from entering the adapter or connector.
	Always allow sufficient fiber length to permit routing or patch cords and pigtails without severe bends. Optical fiber patch cords or pigtails may be permanently damaged if bent or curved to a radius of less than 2 inches (50mm).

Safety Guidelines

- Observe all local carrier and manufacturer-suggested safety practices concerning fiber handling and preservation.
- Observe all local carrier and manufacturer-suggested requirements for safety on the job.

- Point all fibers away from yourself and others at all times.

Do not look into the ends of fibers, or point fibers at others. Most laser energy is invisible to the human eye and yet can be at very damaging power levels to the human eye.

Fiber Handling Guidelines

Poor fiber handling practices and bends in the fiber cable cause signal attenuation. Adhere to the following guidelines for handling fiber-optic cable:

- Do not step on or set anything on top of fiber-optic cable
- Do not twist fiber-optic cables
- Do not pull on fiber-optic cable (pull on strength members only)
- Do not pull on connectors
- Do not look at connectors and end faces (unless both cable ends are in hand)
- Do not look into equipment ports housing lasers

Inspecting Optical Connectors

An important part of the recommended cleaning procedure for optical connectors is inspecting the end face of the connector.

Optimally, the end face must be clean and free from cracks, scratches, edge chips, hackles, pits and other anomalies.

Using a fiberscope with at least 200X magnification, inspect the optical connectors before and after cleaning. Follow the fiberscope manufacturer instructions.

Always turn the lasers off before beginning the inspection.

Figure 19-8 shows images of contaminated and poorly cleaned optical fibers.

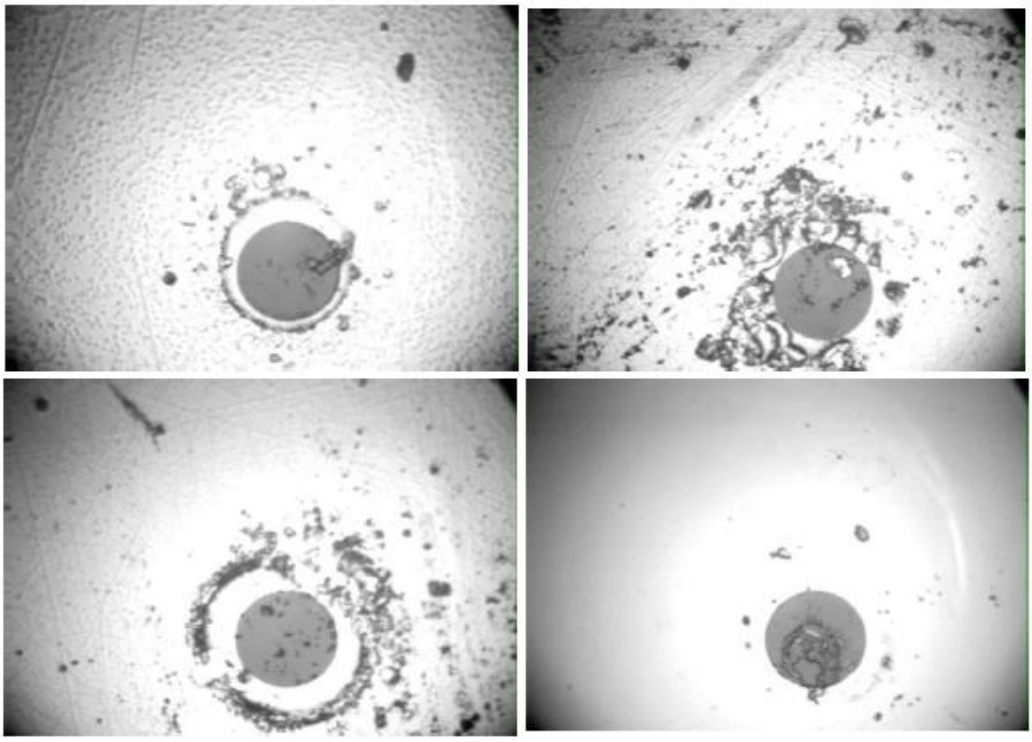


Figure 19-8: Poorly Cleaned Fiber-Optic Endfaces

Figure 19-9 shows a properly cleaned endface.

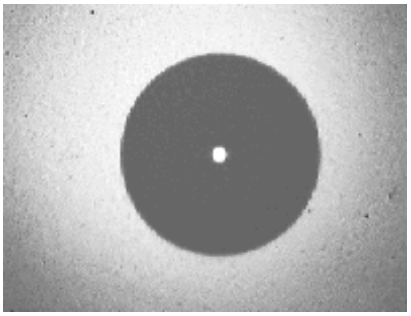


Figure 19-9: Clean Fiber-Optic Endface

Fiber Bend Radius Guidelines

All fiber-optic cables have a minimum bend radius, which is the minimum curve radius allowed while bending the fiber cable during installation or in its final resting position.

The bend radius is specified by the fiber manufacturer. You can make larger curves but never smaller than specified.

Macrobend—a bend in the fiber cable which exceeds the minimum bend radius.

- The minimum bend radius for fiber-optic cables should not be less than 10x the outer diameter of the fiber cable jacketing or 2 inches, whichever is larger.
- Radius Limiters are designed to eliminate macrobends.

Microbend—a small nick in the cladding of an optical fiber.

Cleaning Fiber-Optic Connectors

The importance of clean fiber-optic connectors cannot be overstated. Ensuring fiber-optic connectors are free of face debris and damage will eliminate the vast majority of reported problems in the DAS.

Improperly cleaned, a contaminated optical connector can:

- Damage the end-face of a mating connector.
- Turn end-face debris into plasma which can permanently damage the end-face polish or form.
- Cause back reflections damaging optical fiber terminal equipment.

Cleaning Guidelines

Here are a few simple and easy to implement tips for avoiding contaminated junctions:

- Keep environment as clean, dry, and dust free as possible.
- Wash hands immediately prior to fiber work.
- Keep all connectors and jacks properly CAPPED until use.
- Clean connectors using ONLY approved cleaning kits.
- Learn and master appropriate steps to clean junctions.
- Inspect connections with a 200X fiber scope when installed.
- Record and validate “as-built” F.O. link budget information.
- Always clean fiber connectors prior to mating.

Do not use of canned air because it is ineffective on oils, residues, and small static charged particles.

Types of Fiber-Optic Cleaning Procedures

There are three main methods of cleaning fiber-optic connectors:

- Cassette Cleaning Method
- Wet to Dry Method
- Dry Method

Depending on the method used, always use the appropriate cassettes, swabs, washers and wipes that come with the fiber cleaning kit. Under no circumstances use canned air, clothing, tissues or other material not designed for fiber cleaning.

Cassette Cleaning Method (Recommended)

Dali Wireless recommends the Cletop cassette cleaning system for cleaning fiber-optic connectors. See Figure B-3.

Figure 19-10: Cletop Fiber Cleaning System

http://www.cletop.com/

To use Cletop cassette cleaners, follow the manufacturer's instructions to advance the tape to a clean section and clean the end face. Remember to uncap the optical connector just prior to cleaning, and then recap immediately after.

Wet-to-Dry Cleaning Method

The wet-to-dry cleaning method requires 99% isopropyl alcohol solution and optical grade lint-free tissues.

To clean optical connectors using the wet to dry method:

1. Ensure the lasers are turned off before you begin, and inspect the connector through a fiberscope.
2. Fold a lint-free tissue into a 1 ½-inch square (refolding approximately four to six times).
3. Spray a small amount (a drop) of isopropyl alcohol on the wipe.
4. Clean the edge of the connector by gently rolling the tip along the edge of the wipe. See Figure 19-11.

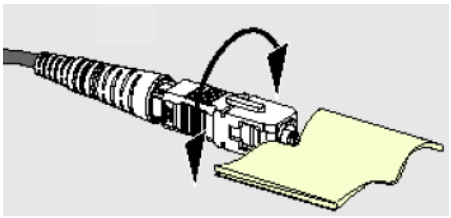


Figure 19-11: Cleaning the Connector Edge

5. Clean the tip of the connector by gently swiping the end face in one direction only along the wipe. See Figure 19-12.

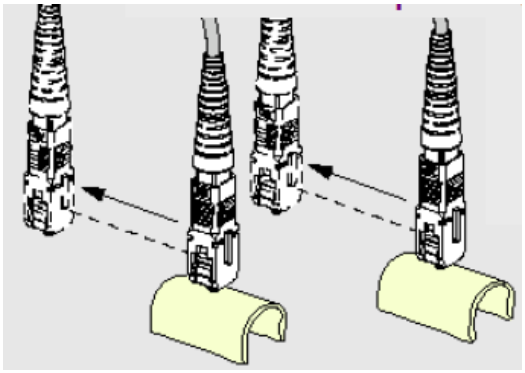


Figure 19-12: Cleaning the Connector Endface

6. Discard the wet wipe and obtain a dry one. Fold the dry wipe as described in step 2.
7. Repeat steps 4 and 5 with a dry wipe to clean the connector edge and end face.
8. Inspect the connector again with a fiberscope.

9. Repeat the process as necessary until the end face is free from contamination.
10. Replace the end caps on the connector if not connecting immediately.

Dry Cleaning Method

The dry cleaning method requires lint-free optical grade tissues.

To clean optical connectors using the dry method:

1. Ensure the lasers are turned off before you begin, and inspect the connector through a fiberscope.
2. Fold a lint-free tissue into a 1 ½-inch square (refolding approximately four to six times).
3. Clean the connector end face by moving the tip in a figure-eight motion on the wipe.
4. Inspect the connector again with a fiberscope.
5. Repeat the process as necessary until the end face is free from contamination.
6. Replace the end caps on the connector if not connecting immediately.

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Document: DW-MAN-036
Rev 06