

Roadrunner™ Series 5G mmWave Repeater



User Guide

Version 0.4





1 Federal Communication Commission Interference Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

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

This equipment has been tested and found to comply with the limits for a Class 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. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

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

FCC Caution:

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

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

WARNING. This is **NOT** a **CONSUMER** device. It is designed for installation by **FCC LICENSEES** and **QUALIFIED INSTALLERS**. You **MUST** have an **FCC LICENSE** or express consent of an FCC Licensee to operate this device. Unauthorized use may result in significant forfeiture penalties, including penalties in excess of \$100,000 for each continuing violation.



2 RF Exposure Statement

To comply with FCC RF exposure compliance requirements, the antenna used for this transmitter must be installed to provide a separation distance of at least 32 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.



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4 Chapter 1. Introduction

This chapter includes a list of items included with the Roadrunner 5G Repeater and a description of the user interface and ports on the device.

4.1 Unboxing Information

Inside the product package for the Roadrunner 5G Repeater, you should find the following items:

- Service Unit (SU)
- Donor Unit (DU)
- 4 LMR-200 interconnect cables
- 7 pin round connector with power plug for final installation
- 7 pin round connector with power plug and USB for checking status of the Service Unit (SU)
- 8 pin round connector with USB for checking status of Donor Unit (DU)

4.2 Included in the Package



Figure 4-2. Donor Unit

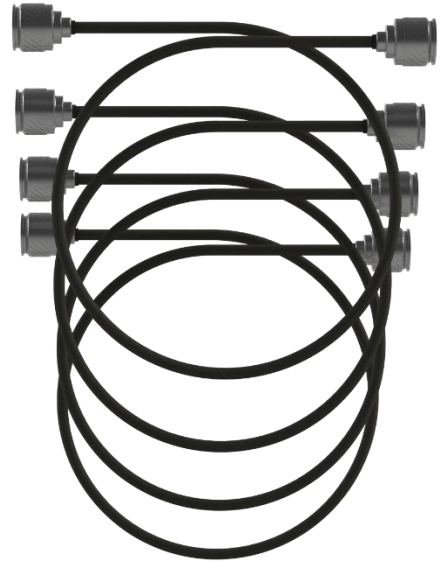


Figure 4-1. LMR-200 Cable (x4)



Figure 4-4. Service Unit



ED2-0009-001402 - EXTERNAL POWER CABLE

Figure 4-3. 7-Pin Power Cable



ED2-0009-021499 - SERVICE UNIT TEST CABLE

Figure 4-5. USB and Power To 7-Pin Cable



ED2-0009-031499 - DONOR UNIT TEST CABLE

Figure 4-6. USB to 8-Pin Cable



4.3 Control GUI Panel

The ED2 SU DU Testing GUI is a Graphical User Interface that is provided for accessing the status and functionality of the repeater system. The sections below outline the use and installation of the GUI. The GUI is compatible with Microsoft Windows 10 operating systems and only requires one USB port. The SU and DU need to be accessed separately, meaning two separate USB connections will be made by user to setup entire system.

Note: the GUI can only handle one USB connection at a time. The user may wish to have two separate computers running the same GUI - one for the SU, one for the DU. The sections below outline the use and installation of the GUI.

4.3.1 Installing GUI Drivers and Setup

The GUI uses a COM port style connection over USB. Virtual COM Port (VCP) Drivers are required for connection to be established to the repeater.

Please run the following executable before use of the ED2 SU DU Testing GUI.

- VCP_V1.5.0_Setup_x64_64bits.exe

4.3.2 Initial Configuration

The GUI is a single Windows Executable file. After installing drivers, open the GUI using the following file:

- SUDU_RoadRunner_Testing_GUI.exe

HPA calibration is ____

The HPA calibration happens the first time the amplifier is turned on. The amplifier is turned on under max attenuation, then powered off after waiting at least 2 seconds. This gives ample time for the bias circuit to complete the calibration process. The unit will automatically configure for continuous use after the calibration procedure is completed. The default attenuations are set to 0 dB (min) but it can be changed by using the scroll box or the buttons for max or min during the SU and DU system status check steps below.

4.3.3 Service Unit System OK Check

The status of the SU can be checked by connecting a laptop computer to the USB connector on the SU USB and power to 7 pin cable utilizing the GUI control panel described in section 4.3. See screen image below for an example of the system status of the service unit. Depending upon the installation, the repeater attenuators may have to be adjusted to avoid saturating the mmW signals.

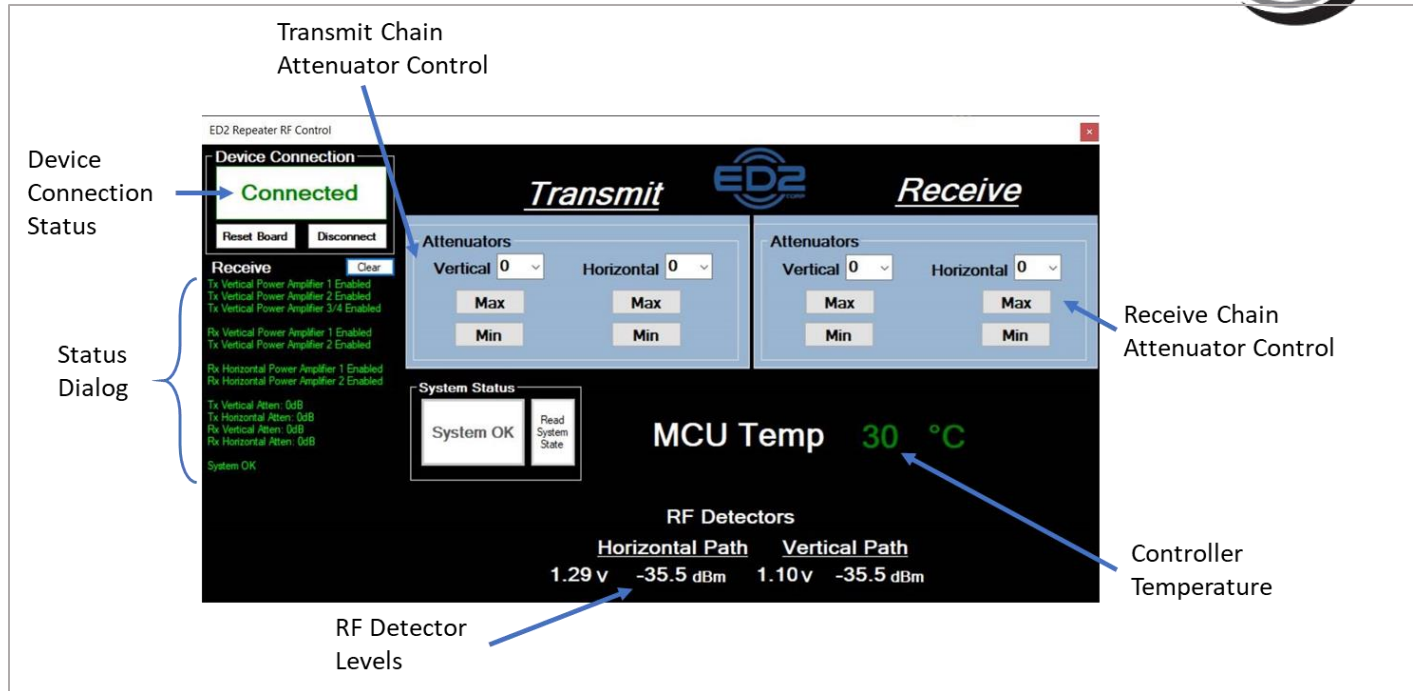


Figure 4-7. SU System Status

Figure 4-8. Donor Unit System Check GUI Interface Description

4.3.4 Donor Unit (DU) System OK Check

The status of the Donor Unit (DU) can be checked by connecting a laptop computer to the USB connector on the DU USB to 8-pin cable utilizing the GUI control panel described in section 4.3. See

screen image below for an example of the system status of the SU. Depending upon the installation, the repeater attenuators may have to be adjusted to avoid saturating the mmW signals.

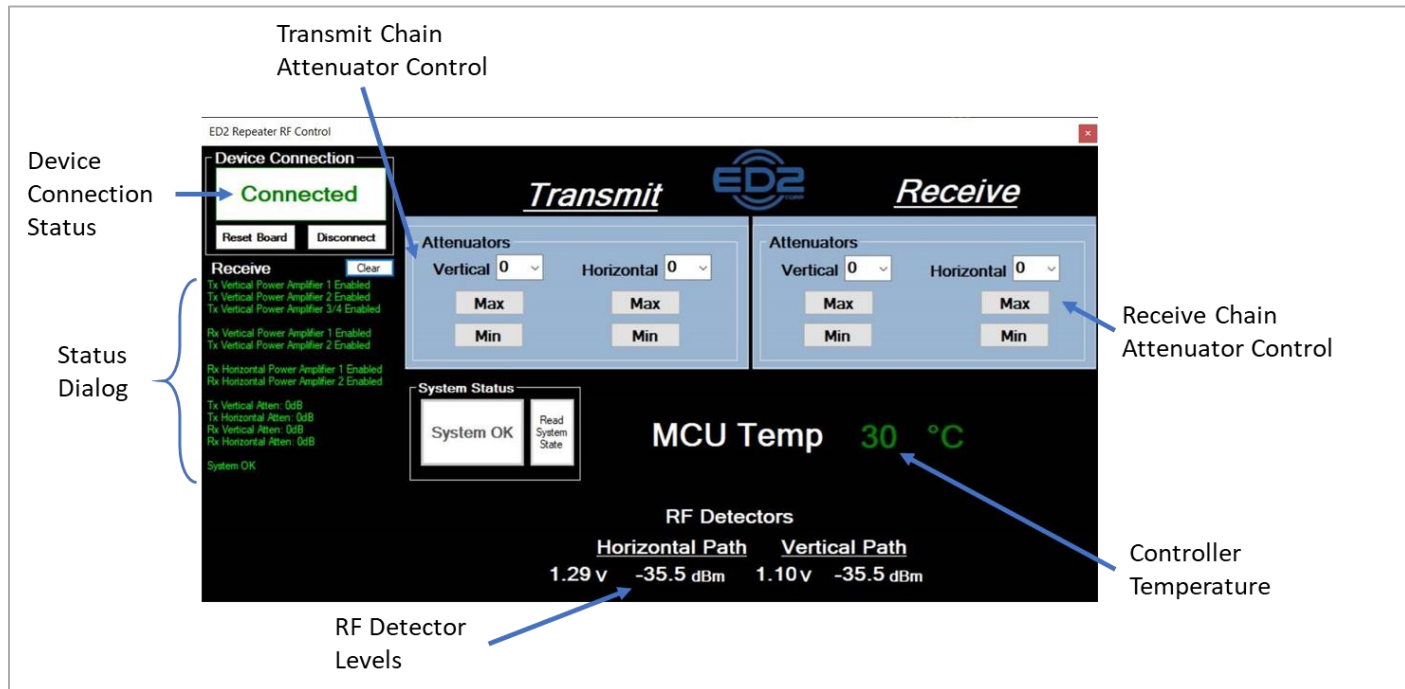
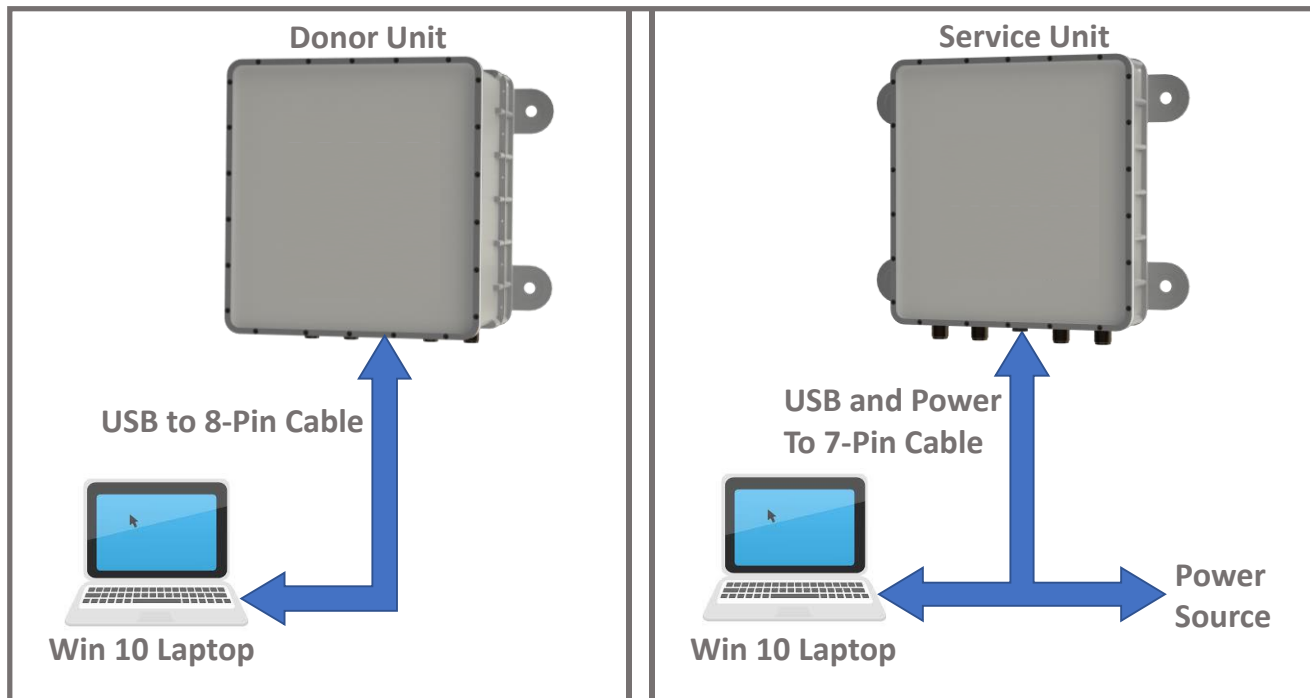


Figure 4-9. Service Unit System Check GUI Interface Description

4.4 Setup Guide

The setup connection diagram is shown in Figure 4-10 below for reference. The SU & DU can be monitored via the GUI panels on connected laptop computers. The SU and DU are required to be connected together and power applied as outlined in section 5.2 Connecting the Donor Unit and Server Unit.

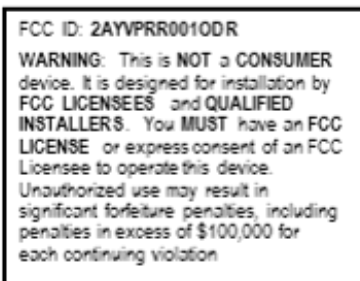


Note: Connections between SU and DU required as shown in Figure 5-2 in order to properly status

Figure 4-10. Unit Connections For GUI Display

4.5 Side Panel

Side panel features the FCC label as shown below.



4.6 Product Label (x2)



4.7 Bottom Panel

The bottom panels for both SU and DU are shown below in Figure 4-11 with the connector ports labeled. Refer to section 5.2 Connecting the Donor Unit and Server Unit for connection details.

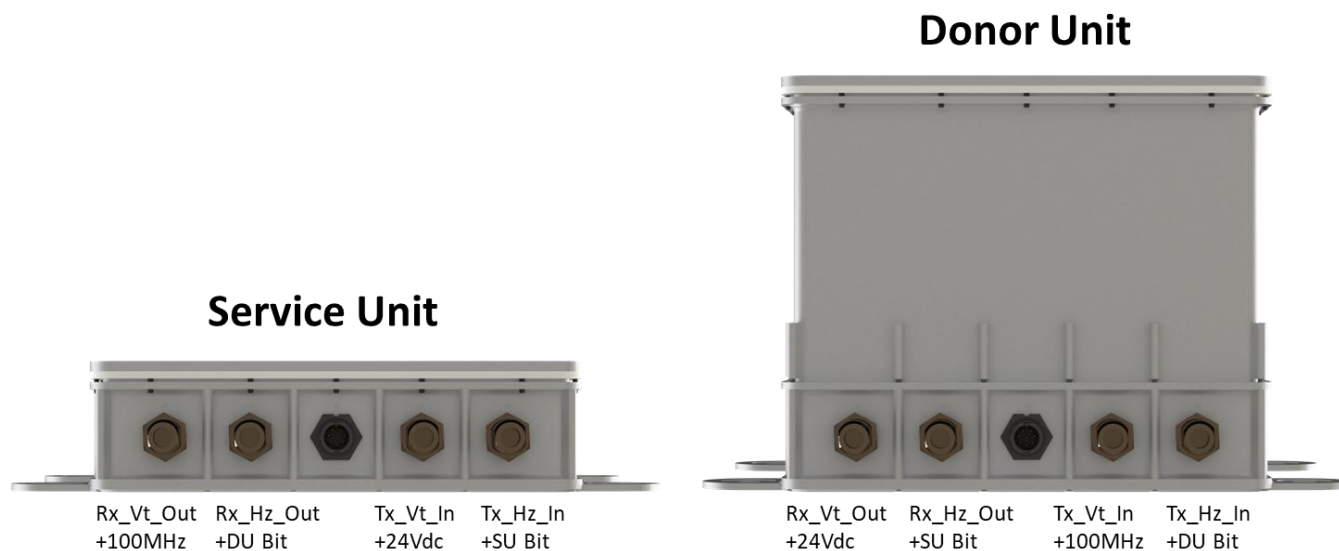


Figure 4-11. Service and Donor Unit Bottom Panel Connector Labels

4.8 Mounting Equipment

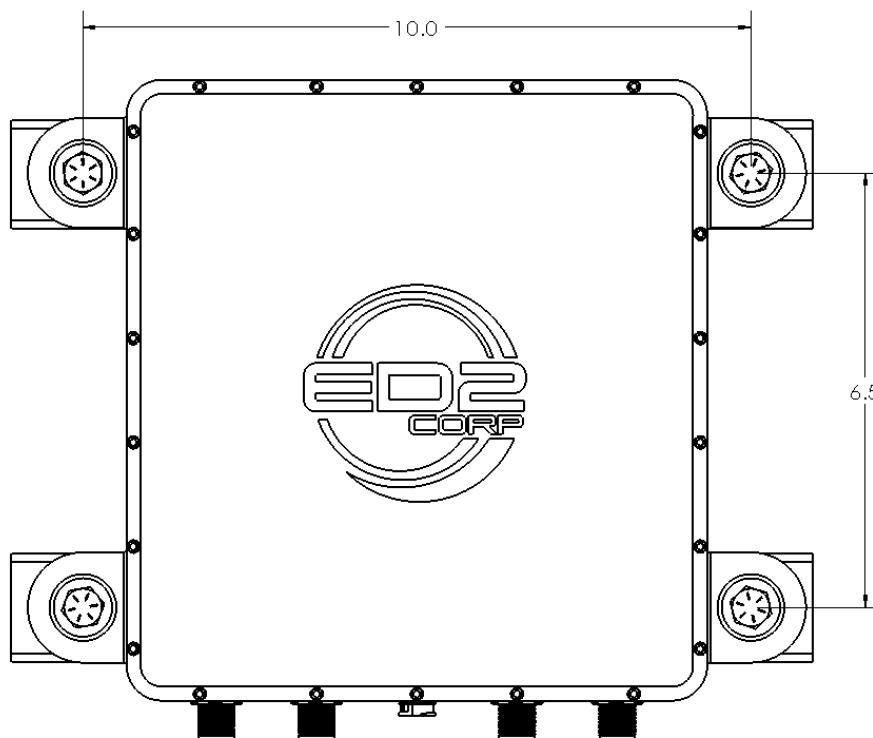
The SU and DU are designed to be mounted to standard universal strut channel (Unistrut) mounting brackets. The units are typically mounted on a pole but can be mounted to any surface that enables a direct line of sight to the gNB for the DU and a direct line of sight to the service area requiring extended coverage for the SU. Details for mounting the repeater system are found in paragraph 5 Mounting the ODR Repeater.

5 Mounting the ODR Repeater

The Roadrunner Repeater is designed for outside use, pole-mounting (or similar).

The donor and service units are designed to be pole-mounted with a minimal amount of mounting hardware. See diagrams within this section below for proper SU/DU interconnects.

Note: The housing has a 10" X 6.5" hole pattern as shown below.



5.1 Mounting the Repeater

Note: The donor unit needs to have a direct line of sight to the servicing gNB.

Note: The service unit needs to have a direct line of sight to the intended area requiring 5G mmW coverage

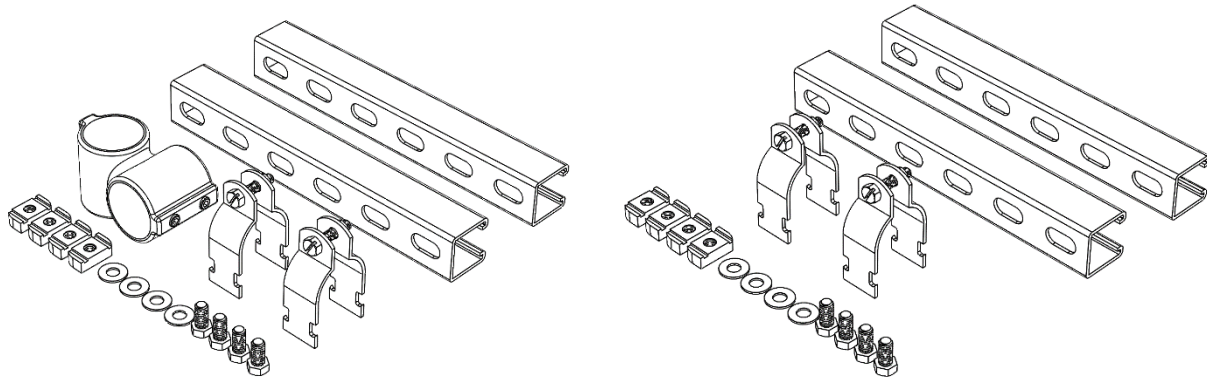
Two example mounting configurations are pictured below.

In the first case, both elevation and azimuth are adjustable.

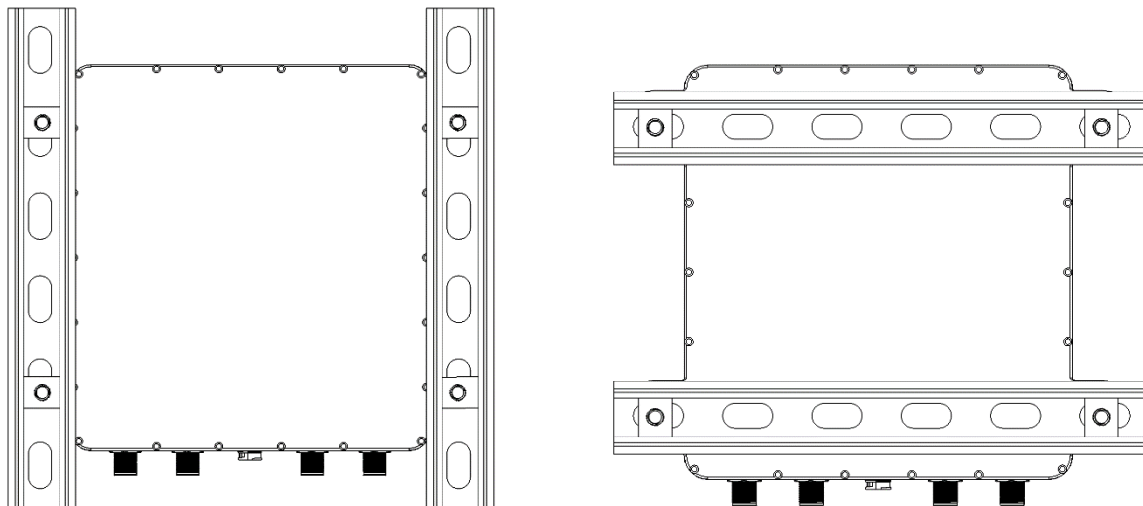
In the second case, elevation is fixed, and azimuth is adjustable.

In a third (not pictured) case, the repeater can be mounted directly to a wall for fixed elevation and azimuth.

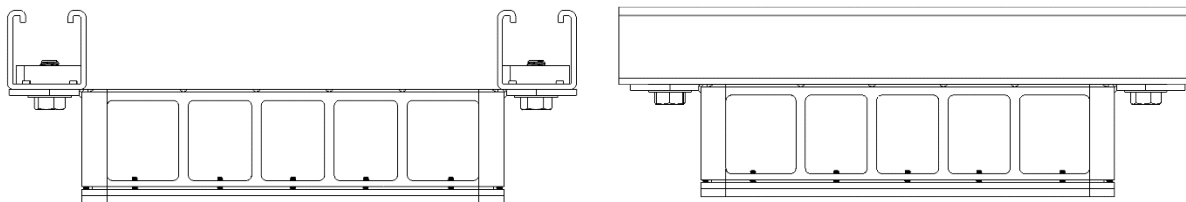
Note: The donor unit is mounted using two 12" sections of standard profile Unistrut along with 4X 3/8"-16 bolts, 4X 3/8"-16 strut channel nuts, and 4X washers.



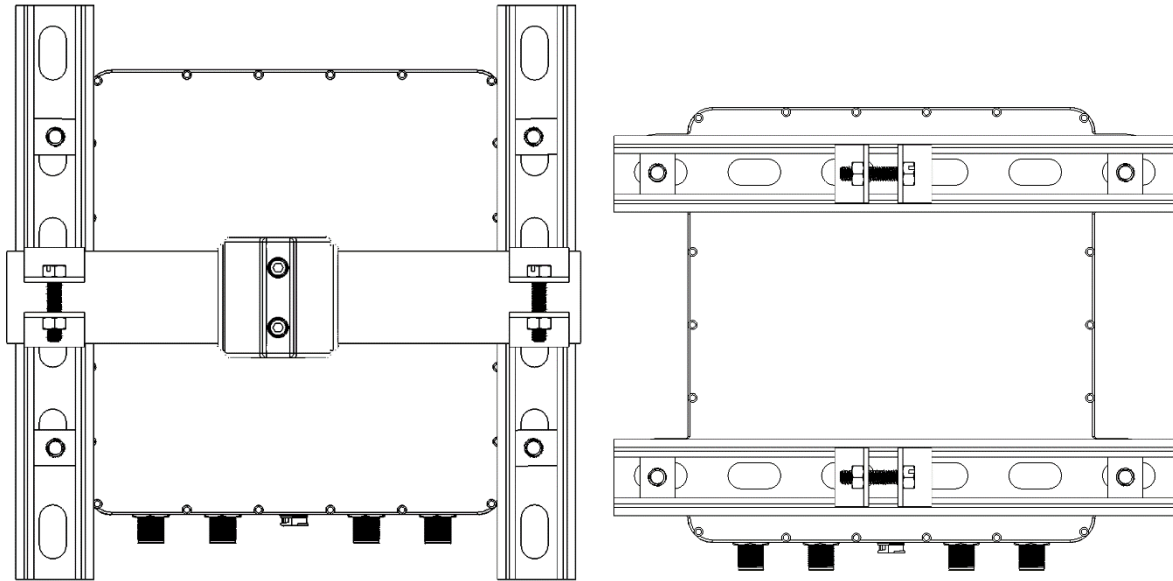
Step 1) Fasten the 12" Unistrut sections to the rear of the repeater housing using with 4X 3/8"-16 bolts, 4X 3/8"-16 strut channel nuts, and 4X washers.



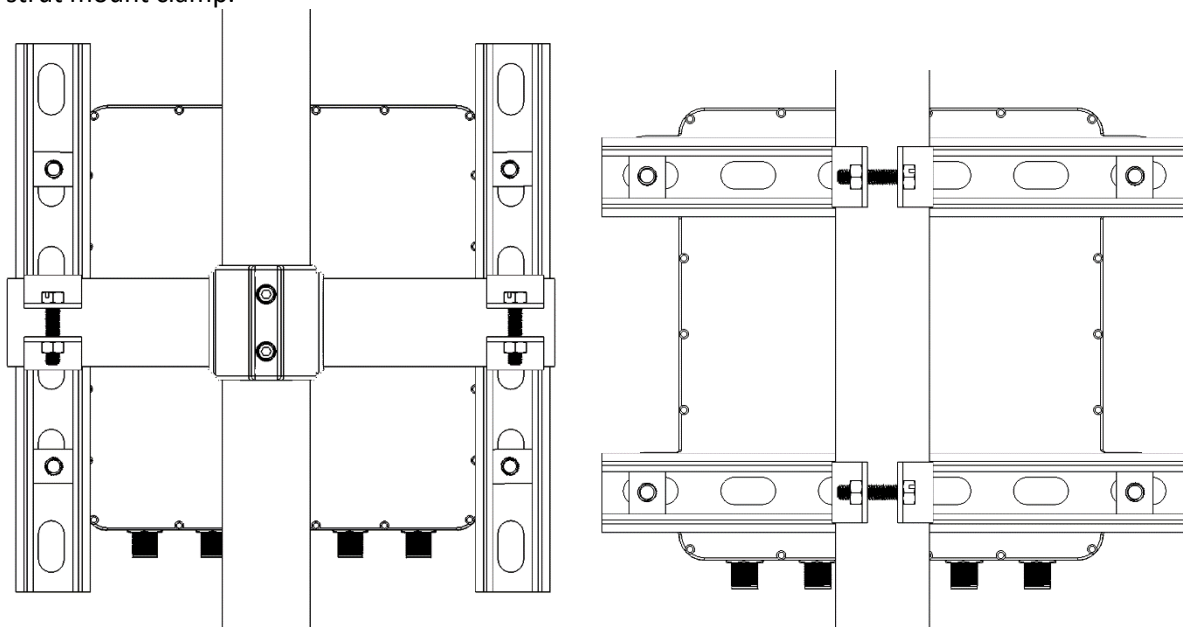
Note: The "closed" side of the Unistrut should rest flat against the back of the repeater housing.



Step 2) Once the 12" rail sections are attached, one strut mount routing clamp is attached to the reverse side of each 12" section, which allows the unit to be mounted to a pole. If elevation adjustment is required, slide the slip-on framing crossover fitting onto horizontal pole prior to inserting both ends into the strut mount clamps.



Step 3) The system is now ready to be attached to a vertical pole, fasten by tightening the bolt on each strut mount clamp.



Note: The horizontal pole can be mounted such that the vertical pole is centered (as shown in Figure 5-1), or with the vertical pole offset to one side to allow a greater elevation angle to offset from vertical.

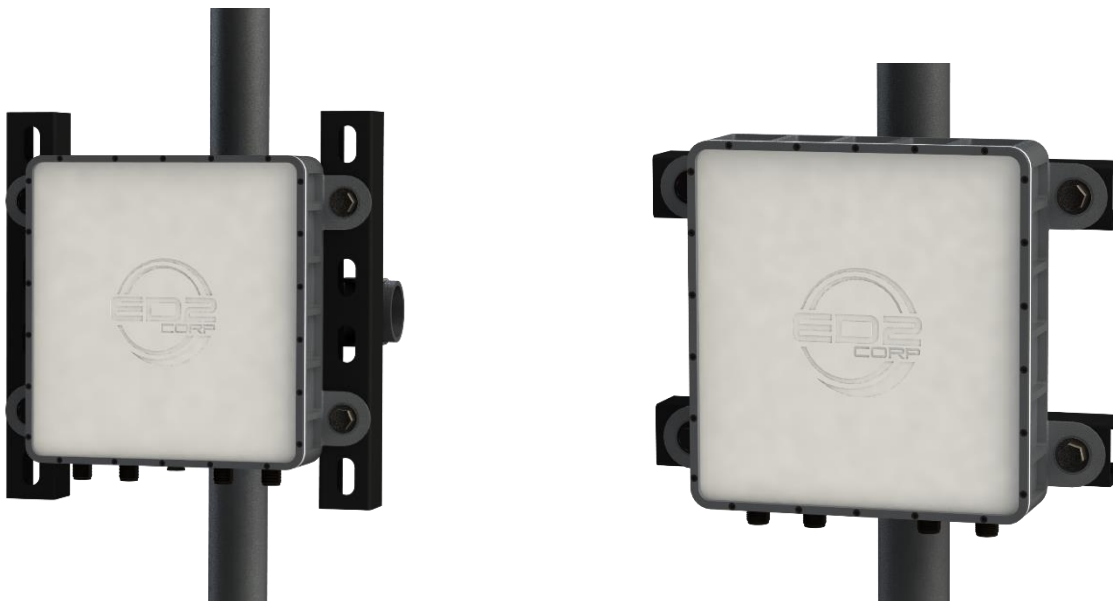


Figure 5-1. SU Mounting Illustration

5.2 Connecting the Donor Unit and Server Unit

The donor and service units come with 4 LMR-200 cables. See Figure 5-2 below for the proper connections between the service and donor units.

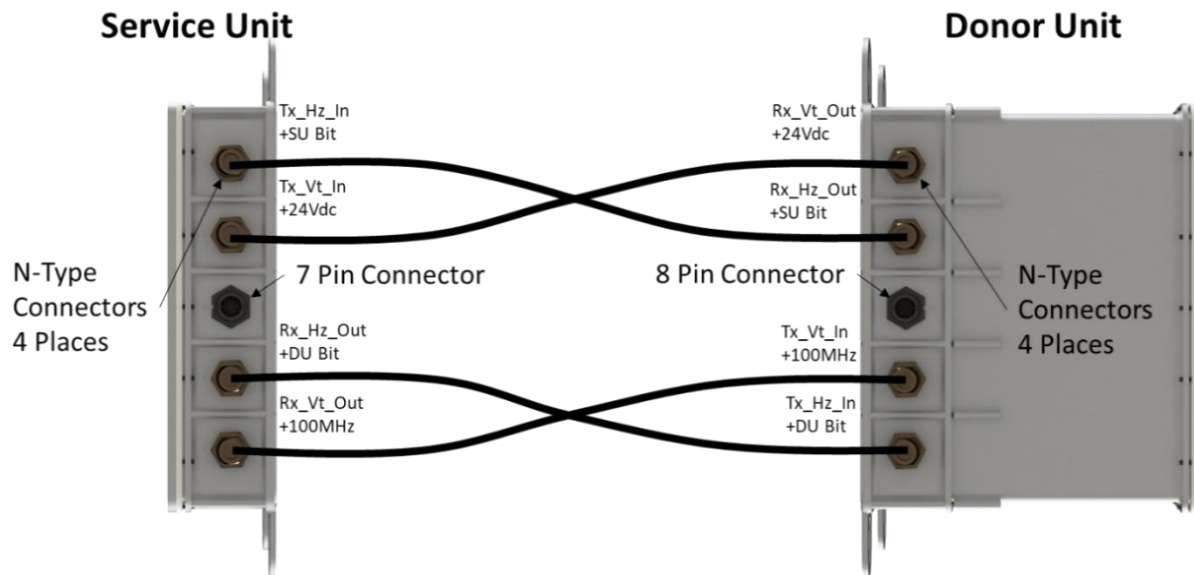


Figure 5-2. Service and Donor Unit Interconnects



DU Port Name	Connects to	SU Port Name	Secondary Function
Rx_Vt_Out	→	Tx_Vt_In	Carries +24 V from SU
Rx_Hz_Out	→	Tx_Hz_In	Carries SU Receive Bit
Tx_Vt_In	←	Rx_Vt_Out	Carries 100 MHz Reference
Tx_Hz_In	←	Rx_Hz_Out	Carries DU Receive Bit

6 Product Specifications

The SU DU pair mated together comprises a repeater system. The system specifications are found in section 6.1 System Specifications.



6.1 System Specifications

Parameter	Specification
Frequency range	27.5 – 28.35 GHz
Max. EIRP – DL (SU to UE) – Narrow/Wide Beam	50/40 dBm
Max. EIRP – UL (DU to gNB) – Dielect. Ant.	50 dBm
Eff. Isotropic Sensitivity Factor (EISF) – DU/SU	-17/-7 dB (NF – Ant Gain)
HPBW – azimuth & Elevation for DU antenna	16.5°
HPBW – azimuth for SU antenna	16.5° (dialect. ant.), 60° (wide beam ant.)
HPBW – elevation for SU antenna	16.5° (dialect. ant.), 40° (wide beam ant.)
DU antenna gain	20 dBi
SU antenna gain	20 dBi (dialect.), 10 dBi (wide beam)
Max NF (UL/DL)	3 dB
Range of tunable gain – DL/UL	50 dB Minimum
Max. electronic gain – DL/UL	90 dB
In-band ripple (per 100 MHz band)	2 dB p/p
IP rating	IP65
Supported MCS	All 5G NR schemes (Waveform agnostic)
Power consumption	80 Watts Typical
Dimensions DU	8.7" W x 9.3" H x 7.3"
Dimensions SU	8.7" W x 9.3" H x 2.3"
Polarization Type	Dual-polarized
Cross-polarization ratio	20 dB minimum
Operating Temperature	-40° to 55°
Weight (DU)	6.5 lb
Weight (SU)	5.5 lb
Configuration / management interface	Optional wireless & cloud-based
Mounting	Brackets to Pole mount
Power method	AC adaptor for SU, DU powered by SU
SU/DU connectivity	Coax. (3 ft)



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