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CORNING

5 Band Remote Access Unit (RAU5/RAU5x)

User Manual

Warranties

Hardware Warranty

Corning Optical Communications LLC (“Corning”) warrants to the original purchaser (“Customer”) that for the duration of the warranty period, one (1) year, commencing on the date of shipment of the Hardware, unless otherwise agreed in writing by Corning (the “Hardware Warranty Period”), the Hardware furnished by Corning shall be free in all material respects from defects in material and workmanship, and shall conform to the applicable portions of the Specifications, as defined below (the “Hardware Warranty”). If notified by Customer of any such defects in material or workmanship or nonconformity with applicable portions of the Specifications within the Hardware Warranty Period, Corning shall promptly, at its own election and expense, repair or replace any such Hardware proven to be defective under the terms of this Hardware Warranty. Such repair or replacement shall be Customer’s sole remedy and Corning’s sole obligation in the event this Hardware Warranty is invoked. If any components comprising a part of the Hardware are replaced or repaired during the Hardware Warranty Period, the Hardware Warranty Period for such repaired or replaced components shall extend to the longer of (i) the balance of the Hardware Warranty Period or (ii) three (3) months from the date of repair or replacement. For purposes of this Warranty, “Specifications” shall mean the specifications and performance standards of the Products as set forth in documents published by Corning and delivered to Customer which contain technical specifications or performance standards for the Products.

If Customer invokes this Hardware Warranty, it shall notify Corning promptly of the claimed defect. Customer will allow Corning to inspect the Hardware at Customer’s location, or to return the Hardware to Corning closest repair facility. For Hardware returned to Corning repair facility, Customer shall be responsible for payment of all transportation and freight costs (including insurance) to Corning’ repair facility, and Corning shall be responsible for all transportation and freight costs (including insurance) incurred in connection with the shipment of such Hardware to other repair facilities of Corning and/or its return to Customer.

Notwithstanding the foregoing, in no event will Corning be liable for damage to Products resulting from improper handling during or after shipment, misuse, neglect, improper installation, operation or repair (other than by authorized Corning personnel), alteration, accident, or for any other cause not attributable to defects in materials or workmanship on the part of Corning. Corning shall not reimburse or make any allowance to Customer for any labor charges incurred by Customer for replacement or repair of any goods unless such charges are authorized in advance in writing by Corning.

Software Warranty

Corning Optical Communications LLC (“Corning”) warrants to the original purchaser (“Customer”) that for the duration of the warranty period, one (1) year, commencing on the date of shipment of the Software, unless otherwise agreed in writing by Corning (the “Software Warranty Period”), the Software shall conform with, and perform the functions set forth in the Specifications, and shall be free from defects in material or workmanship (the “Software Warranty”). In the event the Software is proven to be defective under the terms of this Software Warranty, Corning shall correct such defects or failure and ensure that the Software conforms with, and performs the functions set forth in, the Specifications. Customer will allow Corning to inspect the Software at Customer’s location or to return it to Corning’s closest repair facility.

Notwithstanding the foregoing, Corning shall have no obligation under the Software Warranty if the Software is modified or used with hardware or software not supplied or approved by Corning or if the Software is subject to abuse, improper installation or application, accident, electrical or environmental over-stress, negligence in use, storage, transportation or handling.

Third-party software distributed with the Software may carry certain warranties which, to the maximum extent allowed by law, Corning hereby assigns, transfers and otherwise conveys to Customer, provided, however, that Corning itself provides no warranty of any kind, express, implied, statutory or otherwise, for any third-party software provided hereunder.

Corning does not warrant any hardware, software or services not provided by Corning.

THIS WARRANTY IS THE ONLY WARRANTY MADE BY CORNING AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. CORNING SHALL NOT BE LIABLE FOR ANY OTHER DAMAGE INCLUDING, BUT NOT LIMITED TO, INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF OR

IN CONNECTION WITH FURNISHING OF GOODS, PARTS AND SERVICE HEREUNDER, OR THE PERFORMANCE, USE OF, OR INABILITY TO USE THE GOODS, PARTS AND SERVICE.

CORNING SALES AGENTS OR REPRESENTATIVES ARE NOT AUTHORIZED TO MAKE COMMITMENTS ON WARRANTY RETURNS.

Returns

In the event that it is necessary to return any product against above warranty, the following procedure shall be followed:

1. Return authorization is to be received from Corning prior to returning any unit. Advise Corning of the model, Serial number, and discrepancy. The unit may then be forwarded to Corning, transportation prepaid. Devices returned collect or without authorization may not be accepted.
2. Prior to repair, Corning will advise the customer of our test results and any charges for repairing customer-caused problems or out-of-warranty conditions etc.
3. Repaired products are warranted for the balance of the original warranty period, or at least 90 days from date of shipment.

Limitations of Liabilities

Corning's liability on any claim, of any kind, including negligence for any loss or damage arising from, connected with, or resulting from the purchase order, contract, quotation, or from the performance or breach thereof, or from the design, manufacture, sale, delivery, installation, inspection, operation or use of any equipment covered by or furnished under this contact, shall in no case exceed the purchase price of the device which gives rise to the claim.

Except as expressly provided herein, Corning makes no warranty, expressed or implied, with respect to any goods, parts and services provided in connection with this agreement including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. Corning shall not be liable for any other damage including, but not limited to, indirect, special or consequential damages arising out of or in connection with furnishing of goods, parts and service hereunder, or the performance, use of, or inability to use the goods, parts and service.

Reporting Defects

The units were inspected before shipment and found to be free of mechanical and electrical defects. Examine the units for any damage that may have been caused in transit. If damage is discovered, file a claim with the freight carrier immediately. Notify Corning as soon as possible in writing.

Note: Keep all packing material until you have completed the inspection

Warnings and Admonishments

There may be situations, particularly for workplace environments near high-powered RF sources, where recommended limits for safe exposure of human beings to RF energy could be exceeded. In such cases, restrictive measures or actions may be necessary to ensure the safe use of RF energy.

The equipment has been designed and constructed to prevent, as far as reasonably, practicable danger. Any work activity on or near equipment involving installation, operation or maintenance must be, as far as reasonably, free from danger.

Where there is a risk of damage to electrical systems involving adverse weather, extreme temperatures, wet, corrosive or dirty conditions, flammable or explosive atmospheres, the system must be suitably installed to prevent danger.

Equipment provided for the purpose of protecting individuals from electrical risk must be suitable for the purpose and properly maintained and used. This covers a range of activities including lifting, lowering, pushing, pulling, carrying, moving, holding or restraining an object, animal or person from the equipment. It also covers activities that require the use of force or effort, such as pulling a lever, or operating power tools.

Where some of the above mentioned activities are required, the equipment must be handled with care to avoid being damaged.

Observe standard precautions for handling ESD-sensitive devices. Assume that all solid-state electronic devices are ESD-sensitive. Ensure the use of a grounded wrist strap or equivalent while working with ESD-sensitive devices. Transport, store, and handle ESD-sensitive devices in static-safe environments.

Regulatory Compliance Information



- This is **NOT** a **CONSUMER** device. It is designed for installation by **FCC LICENCEES** 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.
- **ANTENNAS:** Use only authorized and approved antennas, cables and/or coupling devices! The use of unapproved antennas, cables or coupling devices could cause damage and may be of violation of FCC regulations. The use of

unapproved antennas, cables and/or coupling devices is illegal under FCC regulations and may subject the user to fines. See section 3.6 of this document.

RF Safety

To comply with FCC RF exposure compliance requirement, adhere to the following warnings:

Warning! Antennas used for this product must be fixed mounted on indoor permanent structures, providing a separation distance of at least 50 cm from all persons during normal operation.

Warning! Each individual antenna used for this transmitter must be installed to provide a minimum separation distance of 50 cm or more from all persons and must not be co-located with any other antenna for meeting RF exposure requirements.

Warning! Antenna gain should not exceed 12.5 dBi.

Warning! The design of the antenna installation needs to be implemented in such a way so as to ensure RF radiation safety levels and non-environmental pollution during operation.



ATTENTION!

Compliance with RF safety requirements:

- Corning products have no inherent significant RF radiation
- The RF level on the downlink is very low at the downlink ports. Therefore, there is no dangerous RF radiation when the antenna is not connected.

CAUTION!

Use of controls, adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Laser Safety

- Fiber optic ports of the Corning optical network evolution (ONE™) solution elements emit invisible laser radiation at the 1310/1550 nm wavelength window.
- External optical power is less than 10 mW, Internal optical power is less than 500 mW.
- To avoid eye injury never look directly into the optical ports, patchcords or optical cables. Do not stare into beam or view directly with optical instruments. Always assume that optical outputs are on.
- Only technicians familiar with fiber optic safety practices and procedures should perform optical fiber connections and disconnections of the devices and the associated cables.
- Corning ONE has been tested and certified as a Class 1 Laser product to IEC/EN 60825-1 (2007). It also meets the requirements for a Hazard Level 1 laser product to IEC/EN 60825-2: 2004 to the same degree.
- Corning ONE complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to laser notice no. 50 (2007).

Care of Fiber Optic Connectors

- Do not remove the protective covers on the fiber optic connectors until a connection is ready to be made. Do not leave connectors uncovered when not connected.
- The tip of the fiber optic connector should not come into contact with any object or dust.

Company Certification

ISO 9001: 2000 and ISO 13485: 2003

Licensee Contact Information

Industrial Boosters may only be used by FCC licensees or those given express (individualized) consent of license. Corning Optical Communications Wireless certifies all of the VARs listed as licensed installers for Corning. For the list of licensed VARs, please contact the Tech Support Hotline: (US) 410-553-2086 or 800-787-1266.

Additional Relevant Documents

The following documents are required if the corresponding units are included in your system (these can be downloaded from the Corning partner portal).

Document Name	Part Number
5 band remote access unit datasheet	CE0009001 Rev A00 (RAU5x) CE0007202 Rev A00 (RAU5)
Corning optical network evolution (ONE™) system installation	709C011801 REV A01
Headend Control Module (HCM) and Web Management GUI User Manual	709C014205 Rev. A00 and higher

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1 Introduction

The five band remote access unit (RAU5/RAU5x) is a fiber fed, multi-service indoor coverage remote solution for the Corning Optical Network Evolution (ONE™) cellular solutions. It enables multiple wireless technologies and operator services to be distributed over a single broadband infrastructure. The remote access unit supports up to five SISO services (model dependent) in various combinations in addition to two MIMO services via an expansion module. The RF services are routed from the headend according to user defined service groups over single-mode fiber and converted for distribution by the specified remotes via an external broadband antenna

Note: RAU5/RAU5x can be ordered with a preassembled Corning external antenna or can be connected to external omni directional or directional antennas complying with the requirements specified in Section 3.6.1.

The remote unit can host two additional modules:

- Remote expansion unit (RXU) – provides MIMO support for LTE700, and AWS
- Gigabit Ethernet module (GEM) – provides Gigabit Ethernet support, enabling offload, expansion and effective use of Wi-Fi resources. Ethernet services from the corporate LAN (received via Ethernet Switch) are converted to optic signals by the CEU (Centralized Ethernet Unit) and routed over optic fibers towards the GEM units. The optical traffic is then converted to 1GbE by the GEM and distributed to two third party equipment such as access points, Ethernet switch, etc.

The remote access unit can be deployed alongside other Corning Optical Network Evolution (ONE™) Solutions remotes (e.g., mid-power remote unit – MRU), sharing a common headend and element management system. Management and configuration options are provided for each remote access unit service via a Web session to the headend control module (HCM).

1.1 Key Features and Capabilities

- Multi-frequency/ multi-service platform: supports five services: ESMR 800/CELL 850, LTE 700, AWS+AWS3* 1700, and PCS 1900
- Multi-operator optimized platform - services from a number of operators can be distributed by the same unit
- Operator grade performance - advanced signal handling, RF filtering and management ensures operator grade performance
- Optic fiber savings - all services are routed over a single optic fiber pair
- Seamless MIMO upgradeability - modular design supports expansion module (RXU) for additional LTE and AWS MIMO service
- Ethernet support - supports “plug in” GEM module providing support for connected IP devices (Wi-Fi APs, IP Phones, etc.) with Ethernet pass through and PoE
- Simple installation and maintenance - provided with easy-to-install mounting bracket; all interfaces located on front panel
- Array of mounting options – various accessory kits available to accommodate different mounting options: wall/ceiling mount, back-to-back wall mount, acoustic ceiling installations
- Management and control - alarm forward to NOC or standard EMS via SNMP, software controlled output power and optical link auto gain control

**RAU5 supports AWS; RAU5x supports AWS1/3*

1.2 General System Specifications and Requirements

1.2.1 Environmental and Regulatory Specifications

1.2.1.1 Temperature and Humidity

	Operating	Storage
Temperature	0°C to +50°C (32°F to 122°F)	-20° C to 85° C (-4°F to 185°F)
Humidity	95% (non-condensing)	95% (non-condensing)

Table 1-1. Temperature and Humidity Specifications

1.2.1.2 Safety and Regulatory Approvals

Regulation/Standard Category	Approval
Laser Safety	FDA/CE 21 CFR 1040.10 and 1040.11 except for deviations pursuant to laser notice no. 50 and IEC 60825-1
EMC	CE EN 301 489, EN55022, EN 61000 FCC 47 CFR Part 15, 22, 24, 27
Safety	UL 60950 IEC 60825-1:2007 IEC 60825-2:2010 CAN/CSA-C22.2 No.60950-1-03 Fire Safety UL 2043

Table 1-2. Safety and Regulatory Approvals

1.2.2 Power Specifications

Note: This section references RAU5x, however power specifications are the same for both RAU5 and RAU5x.

1.2.2.1 Power Input and Consumption

RAU5x + Add-On Modules	Max. Power Consumption	Power Input Range
RAU5x (alone)	44.5 V; 50 W	37 – 57 V DC
RAU5x + RXU	44.5 V; 76 W	
RAU5x + GEM	44.5 V; 52 W	
RAU5x + RXU + GEM	44.5 V; 78 W	

Table 1-3. RAU5 Power and Current Consumption for Main Power Input

Unit	Device	Input Range	Power Consumption
RAU5x	For two PoE ports of 802.3af	43- 57 V DC	46 V; 31.5 W
	For two PoE ports of 802.3at	52- 57 V DC	52.5 V; 62 W

Table 1-4. RAU5x Power and Current Consumption for Secondary Input

1.2.2.2 Cable Gauge Requirements

Table 1-5 provides the information required to calculate the required power supply for the remote units.

	RAU5x SISO (ft)	RAU5x SISO + GEM (ft)	RAU5x SISO + GEM Supporting PoE	RAU5x SISO + GEM Supporting PoE+ (ft)	RAU5x MIMO (ft)	RAU5x MIMO + GEM (no PoE) (ft)	RAU5x MIMO + GEM Supporting PoE (ft)	RAU5x MIMO + GEM Supporting PoE+ (ft)
22AWG	540	490	410	100	310	290	290	100
20AWG	870	780	650	160	500	460	460	160
16AWG	2200	1900	1600	400	1200	1100	1100	400
14AWG	3500	3100	2650	650	2010	1800	1800	650

Table 1-5. Required Cable Gauge

1.2.2.3 Power, Heat and Rack Specifications

Table 1-6 provides the power, heat and rack specifications for the remote end ceiling equipment.

Unit	Description	Min-Max Voltage (VDC)	Max Power Draw (Watts)	Heat (BTU/hr)	Dimensions (in)
RAU5x	5-Band remote access unit	37 - 57	50	171	Without mounting bracket: 3.2 x 12.9 x 9.8 in (82.1 x 337.3 x 249.4 mm) With mounting bracket: 5.25 x 13.1 x 13.1 in (133.35 x 332.74 x 332.74 mm)
RXU	Remote Expansion Unit	37 - 57	25	85	1.1 x 12.8 x 9.8
RAU5x + RXU	Remote Access Unit + Remote Expansion Unit	37 - 57	78	267	13.1 x 13.1 x 4
GEM	Gigabit Ethernet Module	37 - 57	4	14	1.3 x 3.8 x 5.9
GEM Supporting PoE	For two PoE ports of 802.3af: 43V; 30W				
	For two PoE ports of 802.3at: 52V; 62W				

Table 1-6. Power, Heat and Rack Specifications for Ceiling Equipment (Remote End)

1.2.2.4 Remote End Distance and Power Draw Matrix

Table 1-7, Table 1-8, Table 1-9 and Table 1-10 provide the distance and power draw specifications for the remote end units.

RAU5x SISO	
Composite 16 AWG Tether Distance (ft.)	Draw (Watts)
10 - 50	36
60 - 270	37
280 - 480	38
490 - 690	39
700 - 850	40
860 - 900	41

*Min/Max VDC = 37/57 @ 1.49 Amps, 85% efficiency

Table 1-7. Remote End Distance and Power Draw for (Standalone) RAU5x SISO

RAU5x+ RXU (MIMO)			
Composite 16 AWG Tether Distance (ft.)	Draw (Watts)	Composite 16 AWG Tether Distance (ft.)	Draw (Watts)
10 – 100	62	570 – 610	70
110 – 170	63	620 – 660	71
180 – 240	64	670 – 710	72
250 – 320	65	730 – 750	73
330 – 380	66	760 – 790	74
390 - 440	67	800 – 830	75
450 - 510	68	840 – 860	76
520 - 560	69	870 - 900	77

*Min/Max VDC = 37/57@ 1.49 Amps, 85% efficiency

Table 1-8. Remote End Distance and Power Draw for RAU5x + RXU (MIMO)

GEM Supporting PoE 802.3af	
Composite 16 AWG Tether Distance (ft.)	Draw (Watts)
10 - 40	31
50 - 340	32
350 - 660	33
670 - 890	34
900	35

*Min/Max VDC = 43/57 @ 1.49 Amps, 85% efficiency

Table 1-9. Remote End Distance and Power Draw for GEM w/PoE.3af

GEM Supporting PoE 802.3at			
Composite 16 AWG Tether Distance (ft.)	Draw (Watts)	Composite 16 AWG Tether Distance (ft.)	Draw (Watts)
10 - 80	64	590 - 620	73
90 - 170	65	630 - 670	74
180 - 230	66	680 - 710	75
240 - 300	67	720 - 750	76
310 - 370	68	760 - 790	77
380 - 420	69	800 - 820	78
430 - 470	70	830 - 850	79
480 - 530	71	860 - 890	80
540 - 580	72	900	81

*Min/Max VDC = 52/57 @ 1.49 Amps, 85% efficiency

Table 1-10. Remote End Distance and Power Draw for GEM w/PoE.3at

1.3 Architecture

The remote access units distribute the wireless and Ethernet services received over the fiber-optic infrastructure from the Corning optical network evolution (ONE™) solution headend.

The remote access units are service-specific modules supporting five SISO services that perform optical to RF conversion of signals received from the optical interface unit (OIU) at the headend. Signals are automatically filtered, amplified and distributed via external antennas. Uplink signals are then converted to optical signals before being transmitted back to the OIU.

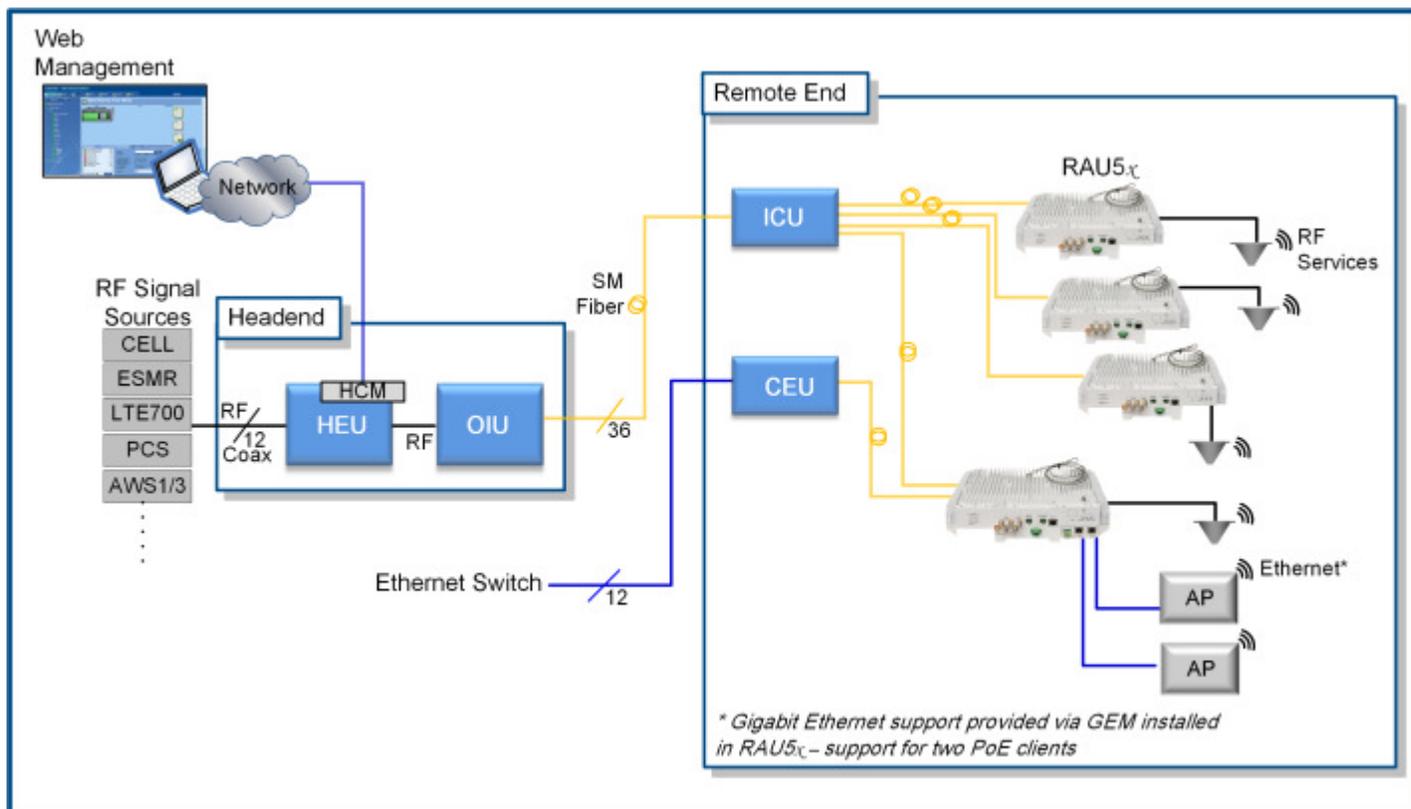


Figure 1-1. Corning ONE Basic Architecture

Acronyms
HEU = Headend unit
RAU5x = Five Band remote access unit
ICU = Interconnect unit
IHU = Integrated headend unit
CEU = Centralized Ethernet unit
OIU = Optical interface unit

Table 1-11. Acronyms in System Architecture

1.4 Web Management Application

The Corning Optical Network Evolution (ONE™) Solution headend control module (HCM) enables centralized, system-level element management and provides comprehensive end-to-end, single source setup and management of the active RF system components after their physical installation. Management capabilities are provided for both the RAU5x and installed RF expansion module.

Note: Refer to the Corning ONE™ HCM and management GUI user manual for a complete description of the web management application.

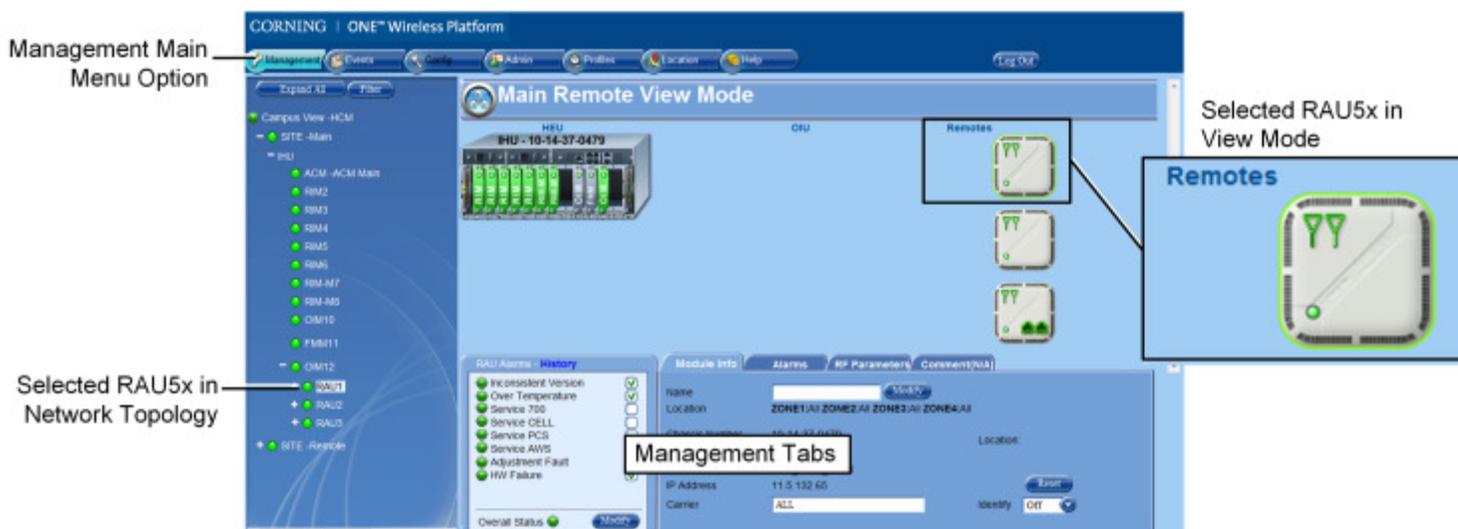


Figure 1-2. RAU5/RAU5x Management Window

The RAU5x Management tabs include the following:

Tab	Description
Device Alarms	Module specific alarms used for fault sourcing
Module Info	Provides device version and identification definition
Alarms	Service level alarms
RF Parameters	Includes configurable RF parameters such as output power and service on/off option.
Comments	Used to enter any information relevant to the selected device

Table 1-12. RAU5x Management Tabs

2 Interfaces

2.1 RAU5/RAU5x

Note the following:

- This section references RAU5x, however interfaces are the same for both RAU5 and RAU5x.
- The RAU5x can host two additional modules: RXU for MIMO support (e.g., LTE700 and AWS) and GEM for digital coverage. See relevant sections for details on these modules.
- Specific RAU5/RAU5x models are available with provided external antenna enclosure.

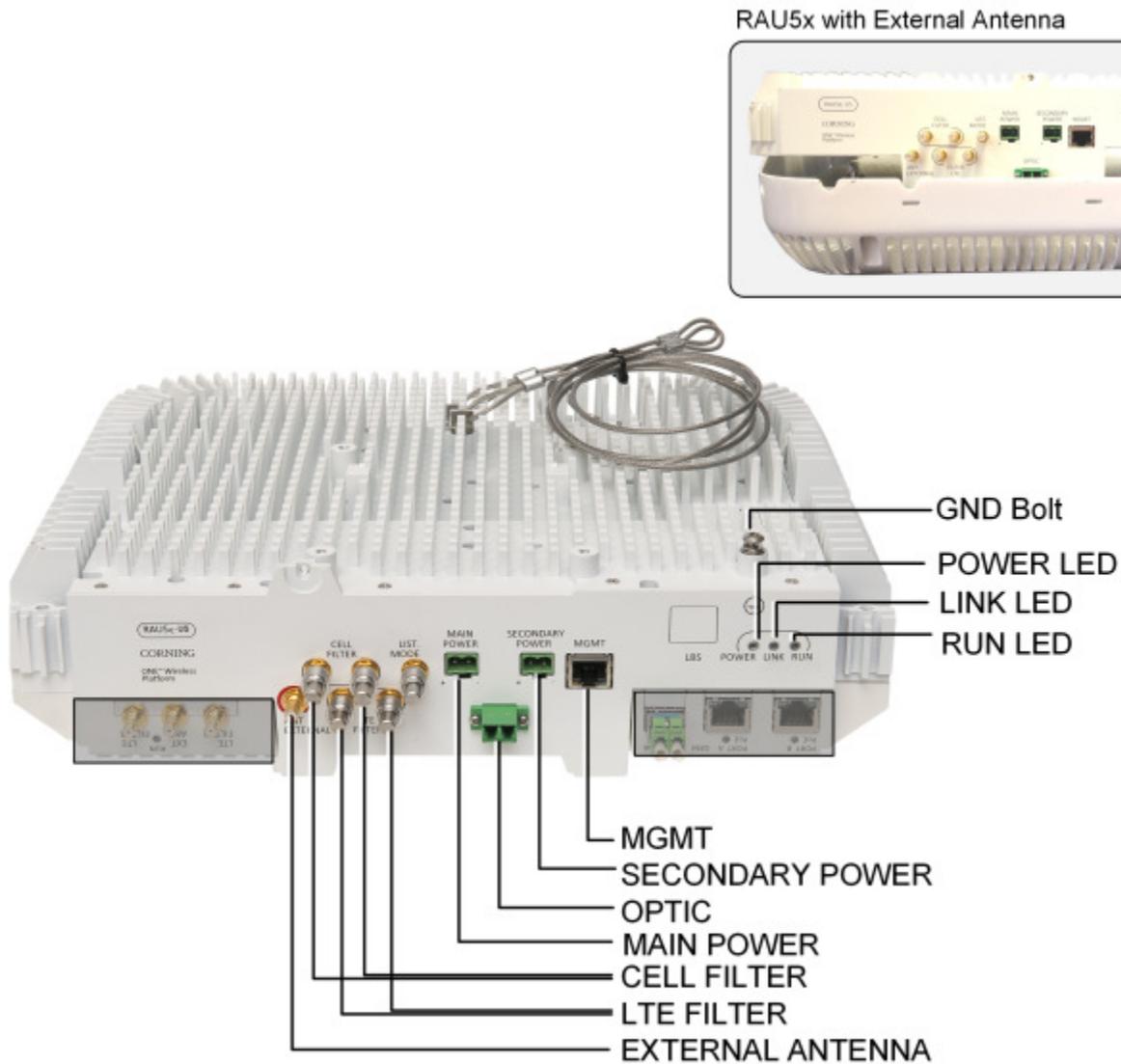


Figure 2-1. RAU5x Interfaces

Interface	Description
MGMT	RJ-45 local management connection
MAIN POWER	Main DC input; Input range: 37 – 57 VDC; DC power fed from composite cable; Refer to section 1.2.2.1 for power consumption
SECONDARY POWER	Secondary DC input required for use in addition to “MAIN POWER” with PoE clients (installations including GEM module); Refer to section 1.2.2.1 for power input per PoE port and consumption
LIST. MODE	N/A
EXTERNAL ANTENNA	QMA connector for external broadband antenna connection
CELL/LTE FILTER	Two QMA RF connectors (In/Out) per external cavity filter type (i.e. LTE and CELL)
OPTIC	LC APC SM connectors for UL and DL fiber optic connections
GROUNDING BOLT	8-32 x 3/8 grounding screw used for connecting RAU5x to earth ground

Table 2-1. Connection Interface Descriptions

LED	Description
POWER	Steady green - power input detected by remote unit Off - no power supplied to remote unit
LINK	Steady green – Optical link power to/from the remote unit is normal Blinking green – Optical power from remote is lower than required Off – no optical link is detected
RUN	Blinking green blinking – software initializing Steady green – boot up sequence complete and module software up and running Off – no power supplied to unit

Table 2-2. LED Descriptions

2.2 RxU

The RXU is an add-on module to the RAU5x which provides support for MIMO services (i.e. 700 MHz LTE, AWS).

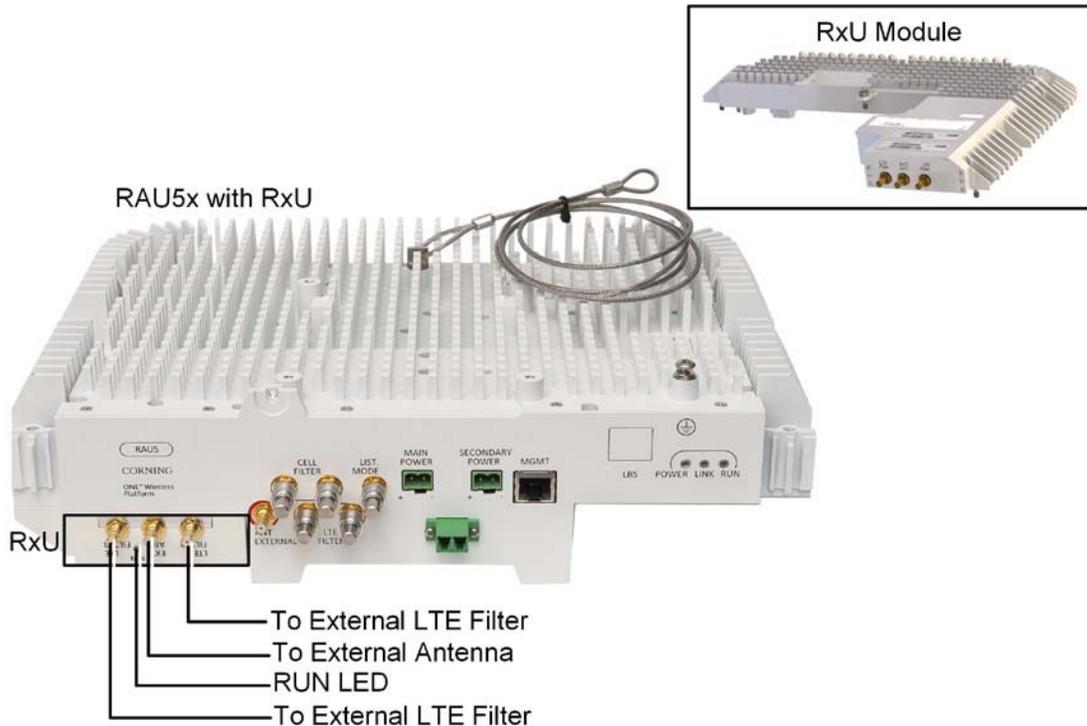


Figure 2-2. RxU Interfaces

Module	Description
External Antenna	RF Connection to external antenna. Antenna must have a return loss of 12 dB. (Both the RxU and the RAU5/RAU5x external antenna connections are used since this implements a MIMO configuration)
External RF Filters	QMA RF ports for external cavity filter use (if required by site planner). For CELL and LTE filters.
RUN LED	Indicates software is up and running.

Table 2-3. RxU Front Panel Interface Connections

2.3 RxU2325

The RxU2325 is an add-on module which plugs into the RAU5x and enables support for two additional bands: 2.3 GHz WCS and 2.5 GHz LTE (TDD).

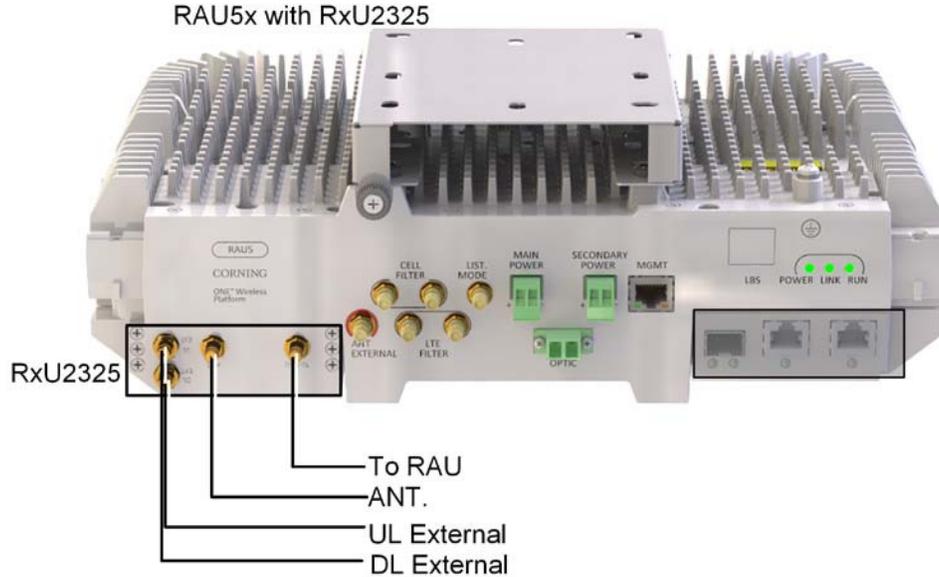


Figure 2-3. RxU2325 Interfaces

Module	Description
To RAU	QMA RF connector; Connects to RAU5x
ANT.	QMA RF connector; Connects to external antenna
UL/DL External	QMA RF ports for external cavity filter use (if required by site planner). For CELL and LTE filters.

Table 2-4. RxU2325 Interface Connections

2.4 GEM

The GEM is an add-on module that provides Gigabit Ethernet support - the received optical signal is converted to two Ethernet digital connections, which can then be routed along with PoE to third party equipment.

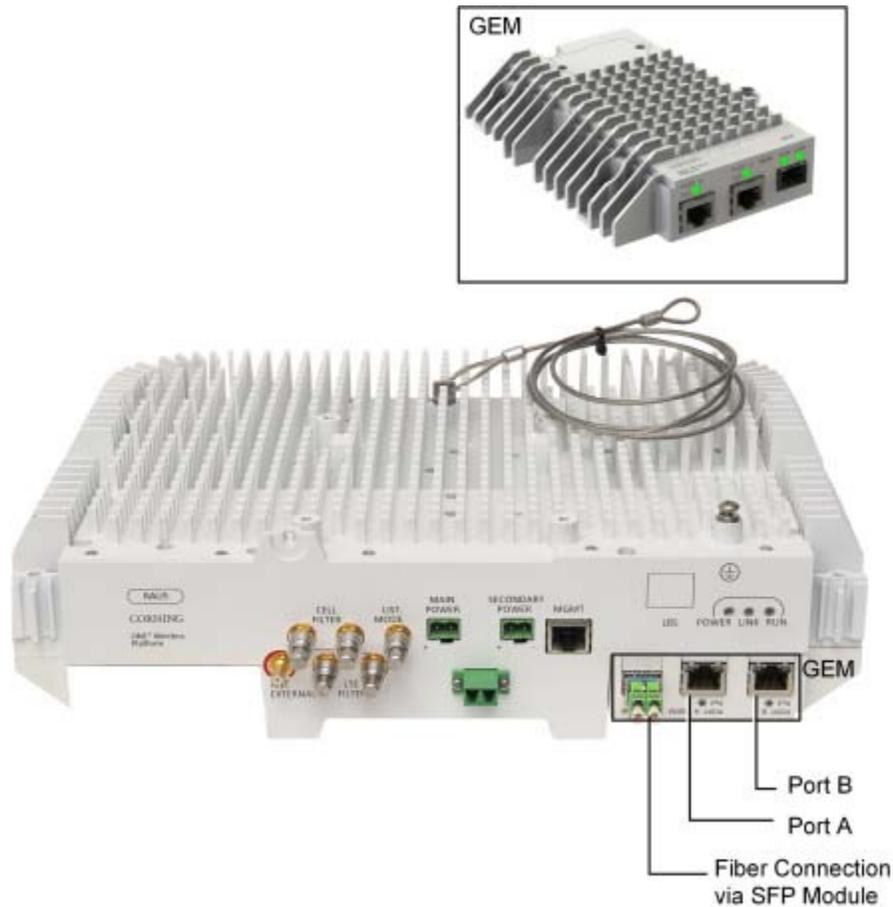


Figure 2-4. GEM Interfaces

Table 2-5 and Table 2-6 provide descriptions of the ports and LED indicators.

Port	Description
PORT A/PORT B	Two 10/100/1000Base-T copper interface with 802.3at compliant Power over Ethernet (PoE+) PSE ports capability for connections to remote access points
FC APC	One 1000BASE-X T Copper port to LC UPC fiber connectors (using SFP –small-form pluggable module) towards CEM module

Table 2-5. GEM Port Interfaces

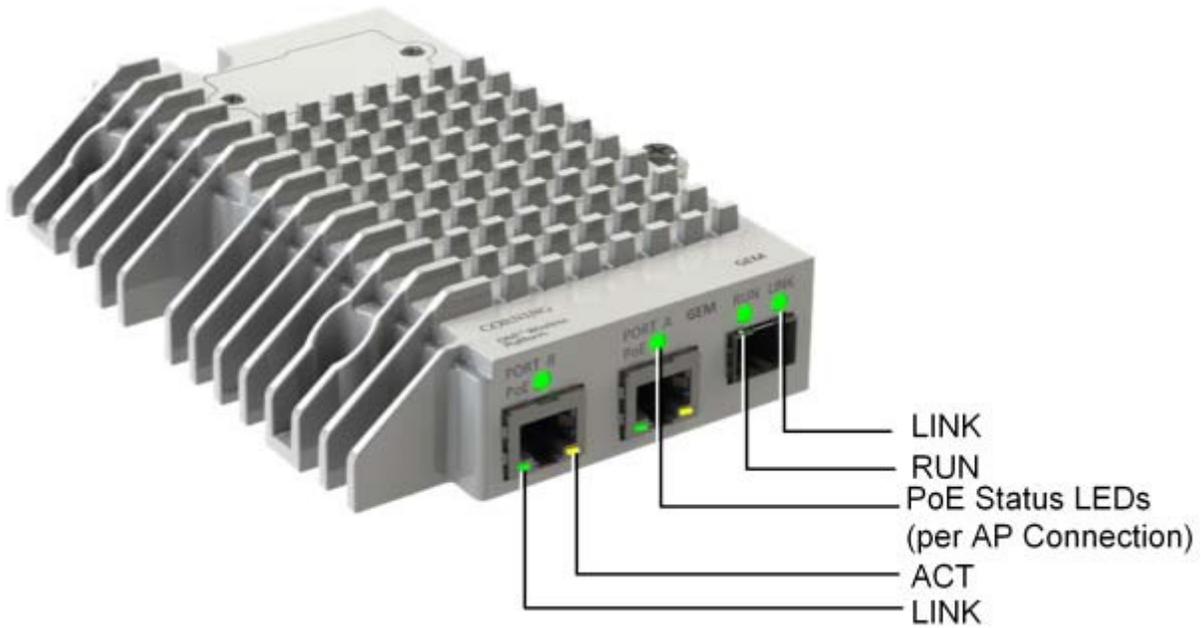


Figure 2-5. GEM LED Description

LED	Description
PoE (PORT A/PORT B)	<p>Steady Green: Indicates power supplied to connected AP; PoE enabled</p> <p>Steady Yellow: Indicates PoE fault</p> <p>Off: Off</p>
SFP LINK	<p>Steady Green: Optical link to/from the connected remote functions within the specifications in both directions.</p> <p>Blinking Green: Indicates activity over the optical link</p> <p>Off: No link</p>
RUN	<p>Steady Green with short blink every ~10 sec. (heartbeat): On/Normal</p> <p>Steady Yellow: GEM module fault</p>
LINK	<p>Steady Green: Link</p> <p>Off: No link</p>
ACTIVITY	<p>Blinking Yellow: Activity</p> <p>Off: No activity</p>

Table 2-6. GEM LED Indicator Descriptions

3 Installation Guidelines

The following installation assumes that site survey and installation planning (including power requirements) have been completed. This includes planning the distribution of antennas to provide the required coverage, as well as planning the layout of the devices and cables in the telecom closet or shaft.

3.1 Infrastructure Preparation

The following installation rules are based on the assumption that the site survey and installation planning (including power requirements) have been completed as well as the floor plan determining the distribution of the remote access units on each floor to provide the required coverage

3.2 Installation Location Requirements

- Mounting surface shall be capable of supporting the weight of the equipment.
- In order to avoid electromagnetic interference, a proper mounting location must be selected to minimize interference from electromagnetic sources such as large electrical equipment.
- Working space available for installation and maintenance for each mounting arrangement.
- Ensure unrestricted airflow.
- Ensure grounding connector is within reach of the ground wire.
- Ensure a power source is within reach of the power cord and the power source has sufficient capacity.
- Where appropriate, ensure unused RF connectors are terminated.
- Do not locate the equipment near large transformers or motors that may cause electromagnetic interference.
- Reduce signal loss in feeder cable by minimizing the length and number of RF connections.
- Ensure the equipment will be operated within the stated environment (refer to Appendix C: Specifications or unit datasheet).
- Where appropriate, confirm available of suitably terminated grade of RF and optical fiber.
- Observe handling of all cables to prevent damage.

3.3 Safety Guidelines

Before installing the equipment review the following safety information:

- Follow all local safety regulations when installing the equipment.
- Only qualified personnel are authorized to install and maintain the equipment.
- Ground specified equipment with the provided grounding bolt
- Do not use the grounding bolt to connect external devices.
- Follow electro-static discharge (ESD) precautions.
- Use low loss cables to connect the antennas

3.4 Power Requirements

This section summarizes the RAU5x power requirements.

Note: This section references RAU5x, however power requirements are the same for both RAU5 and RAU5x.

3.4.1 Power Safety Instructions

SAFETY WARNINGS! When installing or selecting the power supplies:

- Only use the power cables and any other relevant accessories provided with the unit to connect the power supply to the system components.
- Be sure to disconnect all power sources before servicing.
- Calculate the required power according to the requirements of the specific installation and then determine the configuration of the power supplies. The required DC cables will then be determined by the selected power supply configuration.
- Use only UL approved power supplies
- Install external over-current protective devices for the system according to the requirements described in section 1.2.2 - Power .

3.4.2 Circuit Breakers

Calculate the required fuse protection while referring to section 1.2.2 - Power . Also, take into account when installing fuse protections for the system that there may be other Corning system elements that require external fuse protection.

3.5 RF Coaxial Cable Guidelines

3.5.1 General Cable Installation Procedures

Note: The installer should be familiar with the ANSI/TIA/EIS-568 Cabling Standard guidelines.

Observe the general cable installation procedures that meet with the building codes in your area. The building code requires that all cabling be installed above ceiling level (where applicable). The length of cable from the risers to each antenna must be concealed above the ceiling.

The cable must be properly supported and maintained straight using velcro cable ties, cable trays and clamps or hangers every 10 feet (where practical above ceiling level). Where this is not practical, the following should be observed:

- The minimum bending radius of the supplied ½" coax cable should be 7".
- Cable that is kinked or has a bending radius smaller than 7" must be replaced.
- Cable runs that span less than two floors should be secured to suitably located mechanical structures.
- The cables should be supported only from the building structure.
- All cables shall be weather-resistant type.
- Cable length - determined by the system installation plan. When calculating the cable length, take into account excess cable slack so as not to limit the insertion paths.

3.5.2 RF Rules

- Use coax RG-223, 50 ohm, male-to-male N-type to QMA for RF connections from the RIMs to the BTS/RBS and to the RAU5xs.
- When using the Corning system in an environment in which other indoor coverage systems are installed, it is recommended (where possible) that the antennas are placed at least two meters apart
- When bending coax cables, verify that the bending radius does not exceed the coax specifications.
- Use a VSWR meter (i.e. Site Master or equivalent) for checking coax cables, including the antennas. (<2). The VSWR must be measured prior to terminating the RAU5xs at the remote locations

3.5.3 Coax Cable Lengths and Losses

Use coax 1/2", 50ohm, male-to-male QMA type, for connecting to RAU5x and external antenna ports.

Note: The required distance between the antennas (installed in the ceiling) depends on the infrastructure and calculated path-loss. For example, if there is free space-loss between the antennas, a minimum distance of 100 ft is required; if there are partitions (loss) between the antennas, a distance of less than 100 ft between them is allowed.

Coax Length	Coax Loss (900 MHz)	Connector Loss	Total Loss
30	0.7	1.5	2.2
40	0.9	1.5	2.4
50	1.1	1.5	2.6
60	1.3	1.5	2.8
70	1.5	1.5	3
80	1.7	1.5	3.2
90	1.9	1.5	3.4
100	2.1	1.5	3.6
110	2.3	1.5	3.8
120	2.5	1.5	4
130	2.7	1.5	4.2
140	2.9	1.5	4.4
150	3.1	1.5	4.6
160	3.3	1.5	4.8
170	3.5	1.5	5
180	3.7	1.5	5.2
190	3.9	1.5	5.4
200	4.1	1.5	5.6

Table 3-1. Coax Cable Lengths and Losses

3.6 Antenna Specifications and Guidelines

Determine the antenna installation configuration, according to the transmission and coverage requirements and the installation site conditions.

3.6.1 Authorized Antennas and Required Specifications

- RAU5x requires external broadband antenna - can be ordered with preassembled external antenna enclosure.
- External antennas - No limitation on any vendor of available external antennas with respect to the following requirements:
 - Omni Directional or Directional
 - Supported frequency range: wideband antennas supporting a range of 700 MHz to 2600 MHz
 - Gain: up to 12.5 dBi
 - Impedance: 50 Ohm
 - Return Loss: +12 dB
 - Number of antennas that can be connected (with cables/splitters) – it is not recommended to connect more than one antenna per connector since 1:1 connectivity is reduced with each split.
 - Types of couplers/splitters – depends on number of splits (not recommended)

3.6.2 General Installation Guidelines

- The RAU5x should be installed at a convenient location, free of metallic obstruction (can also be installed in plenum spaces).
- Install the RAU5x at the designated height and tune it roughly toward the service coverage area.
- Installation of this antenna must provide a minimum separation distance of 20 cm from any personnel within the area.
- Cable and jumper loss is at least 2 dB.

3.7 Fiber Optic Requirements

3.7.1 Authorized Optic Cables

The following specified optic cables are authorized for use with the RAU5/RAU5x:

- Composite Plenum Tether Assemblies
- Fiber: LC APC, 2 – 24 fibers
- Cu: 16AWG, 14AWG, 12AWG; 2 – 12 Conductors
- Armored, non-armored

3.7.2 Fiber Optic Rules

- Use only LC APC connectors
- UniCam connectors can be used for field termination
- Use only fusion splice for connecting two fibers
- Use minimum splicing/connectors to achieve minimum losses on the fibers (< 0.5 dB)
- Use precaution while installing, bending, or connecting fiber optic cables:
 - Fiber optic cable is sensitive to excessive pulling, bending and crushing forces. Consult the cable specification sheet for the cable you are installing.
 - Do not bend cable more sharply than the minimum recommended bend radius.
 - Do not apply more pulling force to the cable than specified.
 - Do not crush the cable or allow it to kink. Doing so may cause damage that can alter the transmission characteristics of the cable. The cable may have to be replaced.
- Use an optical power meter and light source for checking the fiber optic cables
- Make sure the environment is clean while connecting/splicing fiber optic cables

- All fiber optic connectors should be cleaned prior to connecting to the system
- Fiber connector protective caps should be installed on all non-terminated fibers and removed just before they are terminated.
- LC APC connectors – ensure that you hear a “click”, indicating a secure connection
- Never look directly into the end of a fiber that may be carrying laser light. Laser light can be invisible and can damage your eyes.

3.8 Power Safety Instructions



SAFETY WARNINGS

- When installing or selecting the power supplies:
 - Be sure to disconnect all power sources before servicing.
 - Calculate the required power according to the requirements of the specific installation and then determine the configuration of the power supplies. The required DC cables will then be determined by the selected PS configuration.
 - Use only UL approved power supplies
 - AC and DC power supply cables – only use the power cords supplied with the units
 - Install external over-current protective devices for the system according to the requirements described in section 1.2.2.

Types of Power Supplies

Corning supplies various enclosed power supplies (i.e. ICU and PSU6) that can be installed in a rack or mounted on a wall, depending on your configuration.

4 Installation

This chapter describes the installation of the RAU5/RAU5x. For specific guidelines on infrastructure planning, design and installation, please consult with a Corning product line manager or Corning approved Installer.

The remote end site (RF coverage) installation consists of installing the ICU and RAU5/RAU5x modules.

General Information

1. The remote access unit must always be mounted parallel to the ceiling (horizontal) or wall (vertical) with a 1-in clearance from the surface on the back and front to allow for proper cooling airflow and for heat dissipation.
2. Required ambient temperature:
 - Wall-mount installations (vertical): 45°C [113°F]
 - Ceiling-mount installations (horizontal): 50°C [122°F]
3. The RAU5 unit is provided with a standoff mount used for mounting on the wall or concrete ceilings (including above acoustic ceiling mounts). Additional mounting accessory kits are available (ordered separately):
 - BR-RAU5US-TOP: "Lift Bracket" for floating ceilings tile, mid-mount installation
 - BR-RAU5US-Wall: Wall-mount bracket; Supports up to two remote access units back-to-back
4. Weight:
 - RAU5x alone: 10 lbs (4.54 kg)
 - RAU5x + RXU + GEM: 14.39 lbs (6.5 kg)
 - External antenna: 3.7 lbs (1.7 kg)
5. A broadband antenna is required for RAU5x models ordered without a preassembled connected antenna (see Table 4-1 for RAU5x models).
6. External cavity filters are required for installations in which RAU5x/RXU modules supporting the corresponding CELL and LTE bands are deployed alongside units supporting the public safety service. Installation instructions are provided with each separately ordered filter (AK-CVT700; AK-CVT800).

4.1 Package Contents

Note: Check your package contents to verify that the items in the packing list are included. If any of the listed items are missing, contact your Corning representative.

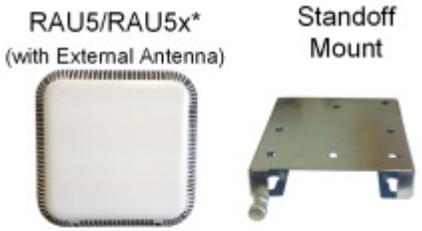
Item	Quantity	
5 Band Remote Access Unit (RAU5/RAU5x): <ul style="list-style-type: none"> • RAU5XUS • RAU5XUS-A* • RAU5XUS-E • RAU5XUS-AE* • RAU5US • RAU5US-E • RAU5US-ME • RAU5US-M • RAU5US-A* • RAU5US-AE* • RAU5US-AM* • RAU5US-AME* 	1	 
*RAU5/RAU5x model with preassembled external broadband antenna		
Standoff mount (preassembled on RAU5/RAU5x underside) Note: Standoff mount includes holes in various sizes and locations for flexible installation options. Screws for mounting on surface are not provided.	1	
Safety Cable – preconnected to the RAU5/RAU5x	1	

Table 4-1 Package Contents

4.2 Mounting

Note: This section references RAU5x, however mounting procedures are the same for RAU5 and RAU5x.

4.2.1 Standard Standoff Mount Installation

Note the following:

- The installation procedure for the standoff mount provided with the RAU5x refers to wall and concrete ceiling installations.
- When mounting the bracket on a wall the captive screw (indicated in Figure 4-1) should always be positioned in the same direction as the RAU5x connectors.
- In wallmount installations the connectors should face downwards.
- If installing above acoustic ceiling, allow for at least one inch above the acoustic ceiling for air flow cooling.

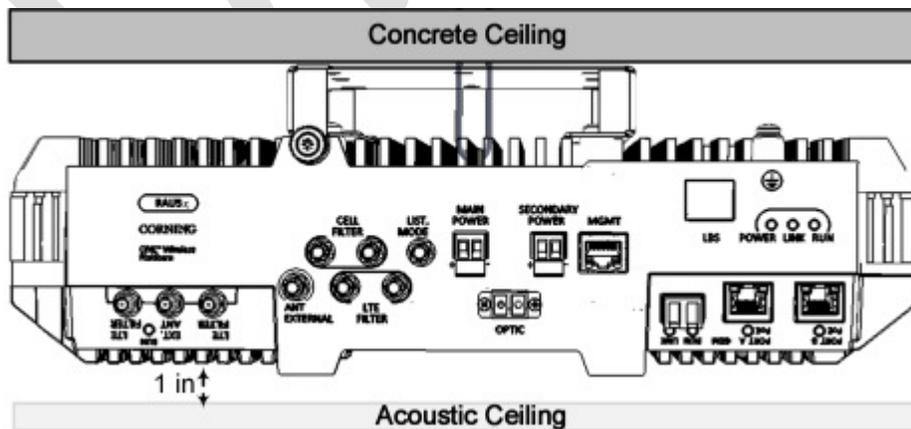


Figure 4-1. Example of (Concrete) Ceiling Installation of Mounting Bracket (RAU5x without External Antenna)

To mount the standoff mount

1. Remove the mount from the RAU5x underside and use to mark and drill appropriate holes for mounting the bracket on the wall or concrete ceiling. Refer to Appendix C for bracket dimensions.
2. Any of the applicable screw holes can be used.
3. Drill the appropriate screws (not provided) through the bracket installation holes and secure to surface.

Note: The RAU5x connectors should face the standoff mount captive screw.

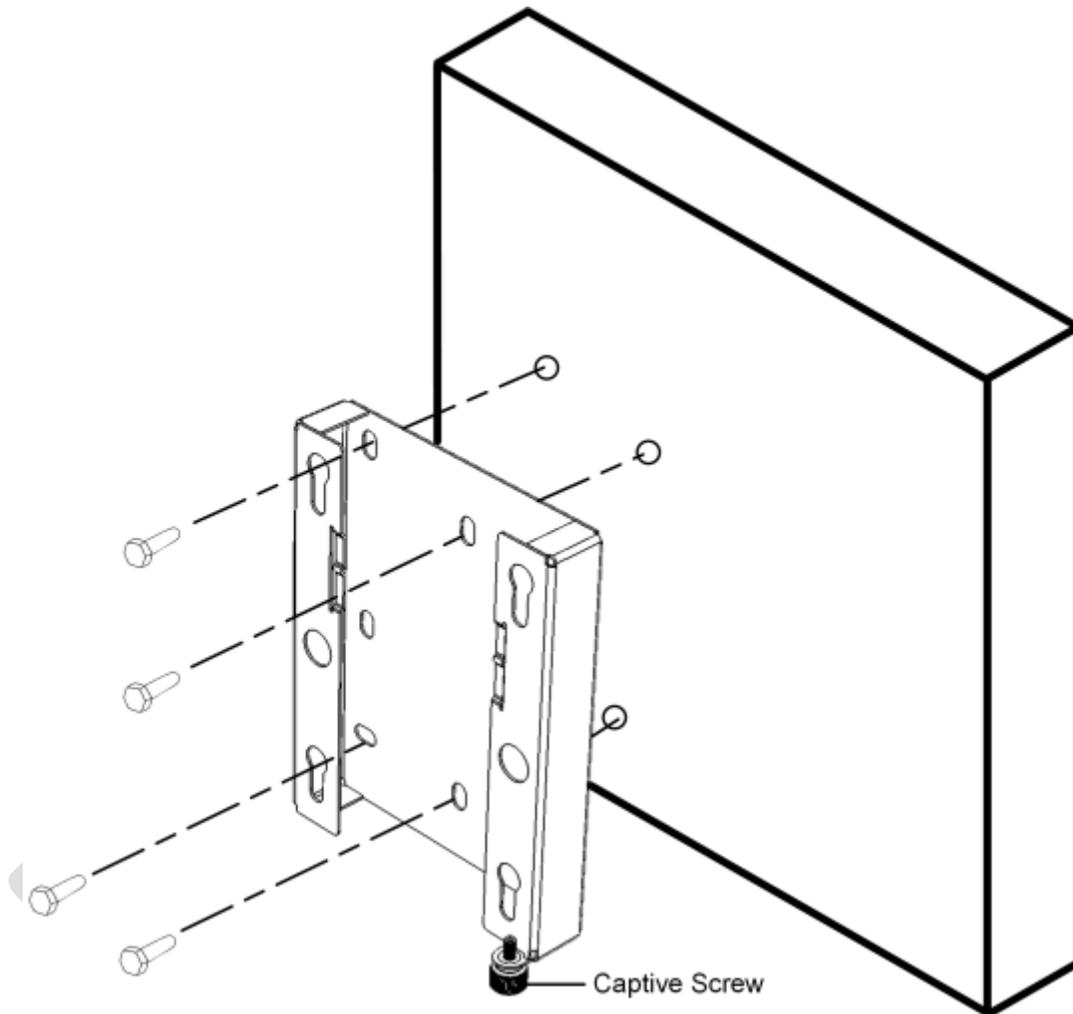


Figure 4-2. Example of Standoff Mount Installation on Wall

To mount the RAU5x onto the standoff mount

1. Insert the four RAU5x pins into the wide ends of the standoff mount key-holes.
2. Make sure that the captive screw fits into the designated half-slot on the RAU5x.
3. Lock RAU5x pins into the narrow ends of the standoff mount keyholes.

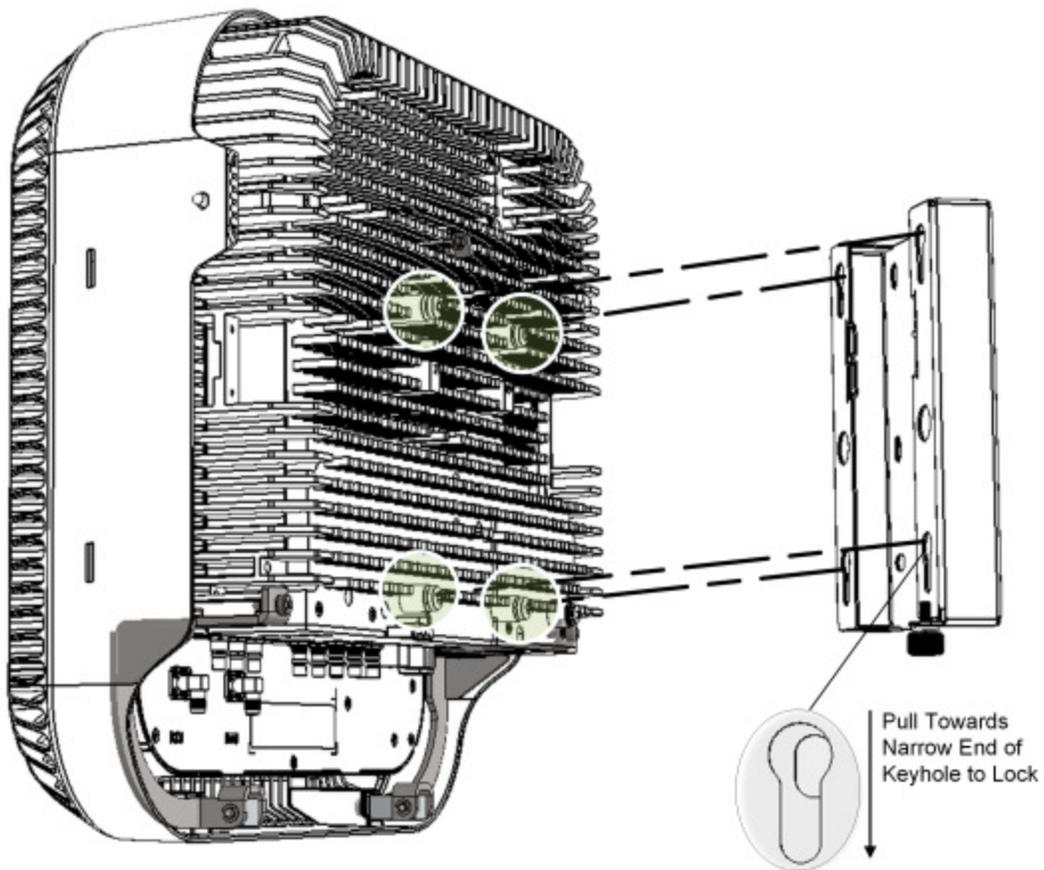


Figure 4-3. Mounting RAU5x onto Bracket

4. Close captive screw to secure RAU5x and standoff mount assembly. See Figure 4-4.

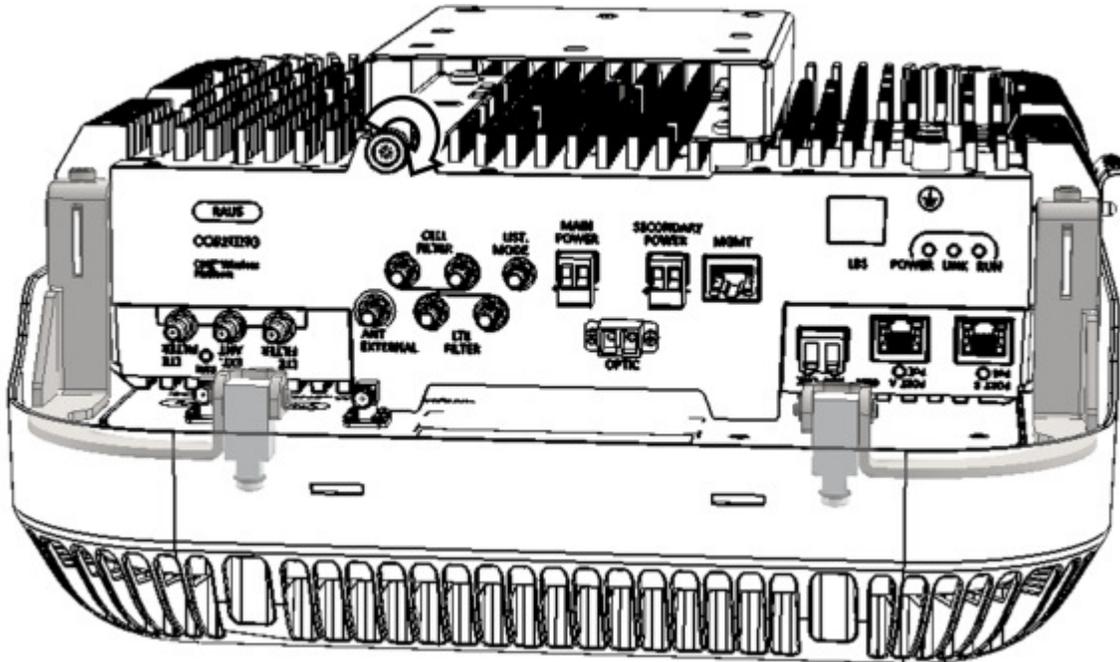


Figure 4-4. Closing Bracket Captive Screw

5. Using the supplied security cable, attach the RAU5x to a permanent structure within the ceiling (e.g. acoustic ceiling grid or concrete ceiling above).

4.2.2 Top Bracket (Mid Mount Installation)

This section provides instructions on how to assemble the RAU5 onto the mid-mount bracket and install the assembly in an acoustic ceiling.

ATTENTION!

- Both the RAU5x and bracket plate must be secured to a permanent structure using safety cables. The RAU5x unit is provided with an attached safety cable;
- A three inch clearance is required above and below the RAU5x unit from any object such as walls or ceiling to allow airflow cooling.

Note the following:

- The “Top Bracket” plate is designed to replace a standard acoustic ceiling tile.
- It is recommended to perform the RAU5x connections after the unit is secured to the “Lift Bracket” (refer to section 4.3 for cable connections).
- For RAU5x units without external antennas, a cap can be ordered separately and assembled onto the RAU5x and top bracket assembly. See Section 0.

4.2.2.1 Package Contents

The RAU5x “Top Bracket” kit (BR-RAU5-TOP) consists of a plate and Lift Bracket assembly. Refer to Appendix A:

Bracket Dimensions for “Top Bracket” dimensions.

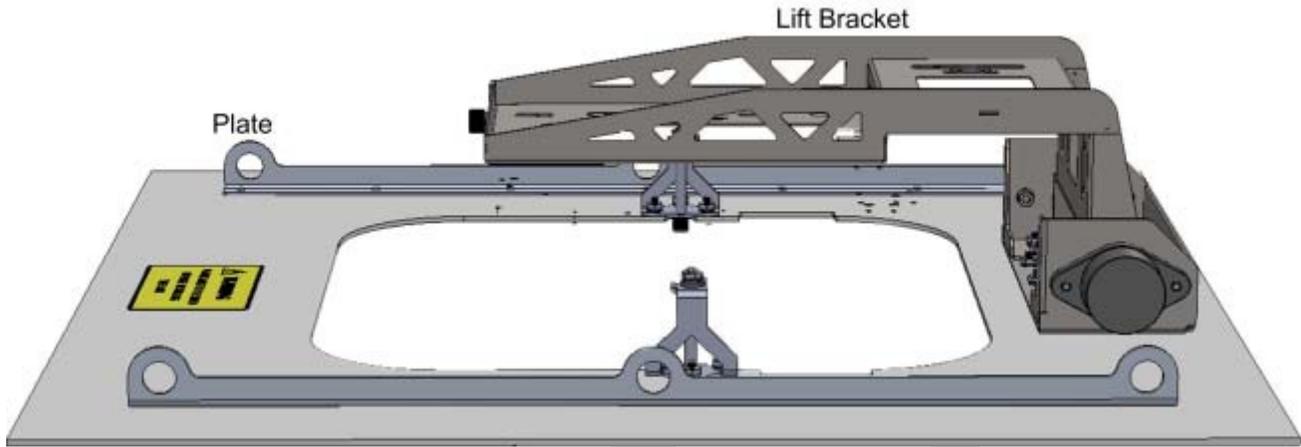


Figure 4-5. “Top Bracket” Assembly Lift Bracket and Plate

4.2.2.2 Installing Bracket Assembly and Mounting RAU5x

Note: The figures in this section, illustrate the top bracket installation with an RAU5 which includes the Corning external antenna.

To install bracket and mount RAU5x

1. Install the plate in the ceiling and using the two safety cables, pre-connected to the middle safety rings of the plate, secure to secure to a permanent structure.

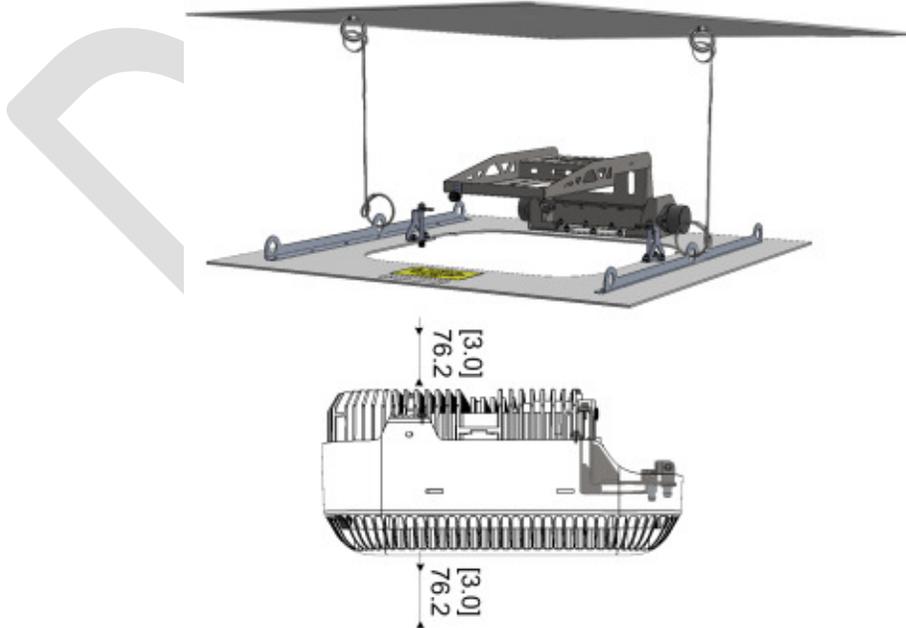


Figure 4-6. Installing “Top Bracket” Plate

ATTENTION!

- Plate must be secured before installing the RAU5x unit!
 - If the bracket is not secured via the two middle safety rings, it must be secured with safety cables via the four remaining safety rings.
 - A 3 in clearance is required from the surface above and below the RAU5x unit to allow for proper cooling airflow and for heat dissipation.
 - The installer is responsible for accommodating the installation to the surface type.
2. (After plate is installed in ceiling) Pull down the Lift Bracket to a vertical position.

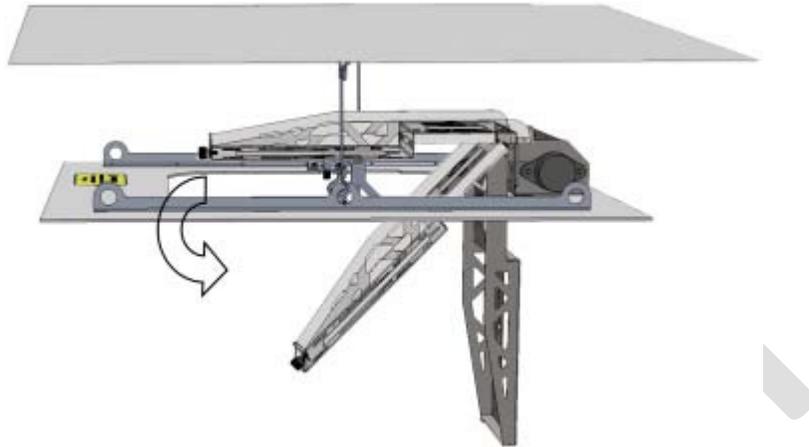


Figure 4-7. Lowering Lift Bracket

3. Referring to Figure 4-8, fit the four pins on the RAU5x underside into the wide end of “Lift Bracket” keyholes and pull down into narrow ends to lock in. Make sure that the RAU5x is secure.

Note: Lift Bracket captive screw must face the RAU5x connectors.



Figure 4-8. Mounting RAU5x onto Lift Bracket

4. Close Lift Bracket captive screw to secure RAU5x in place.

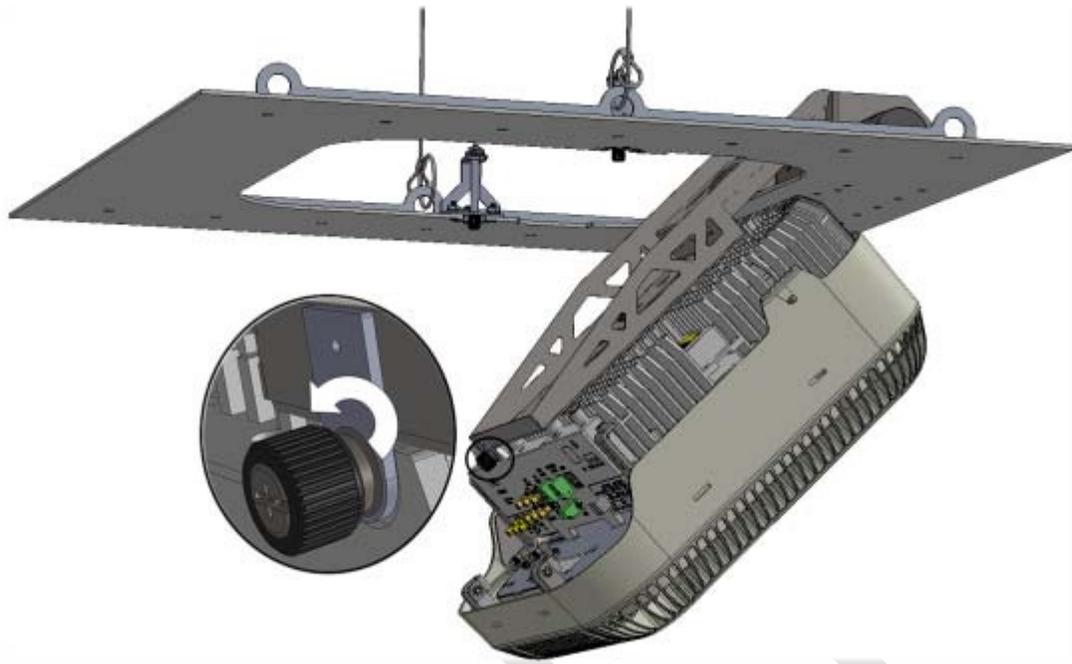


Figure 4-9 Closing Lift Bracket Captive Screw

Note: it is recommended to perform the RAU5x connections after the unit is secured to the Lift Bracket.

DRAFT

5. **MANDATORY!** Secure RAU5x using the attached safety cable to a permanent structure.

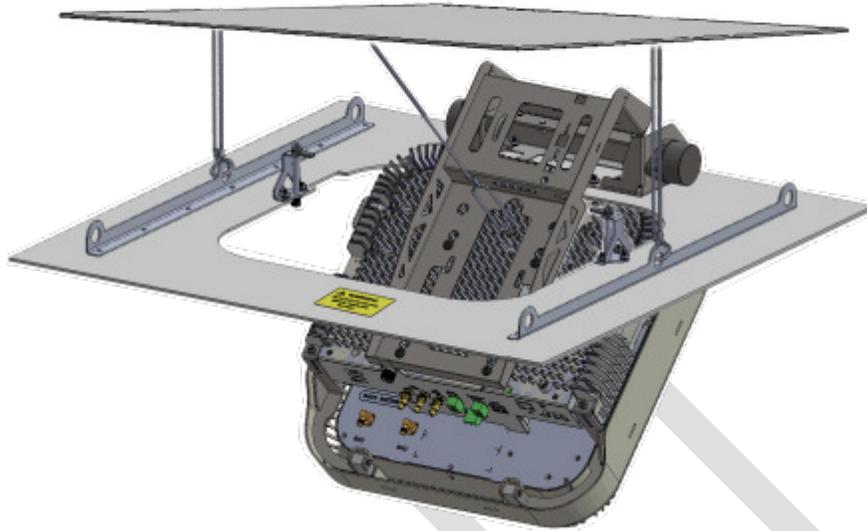


Figure 4-10. Securing RAU5x to Permanent Structure

6. Push up and pull down Lift Bracket into plate and verify that connection cables are not subject to kinking.

Note: The installer is solely responsible for proper cable wiring and routing of the RAU5x unit per instructions provided in relevant Corning documentation.

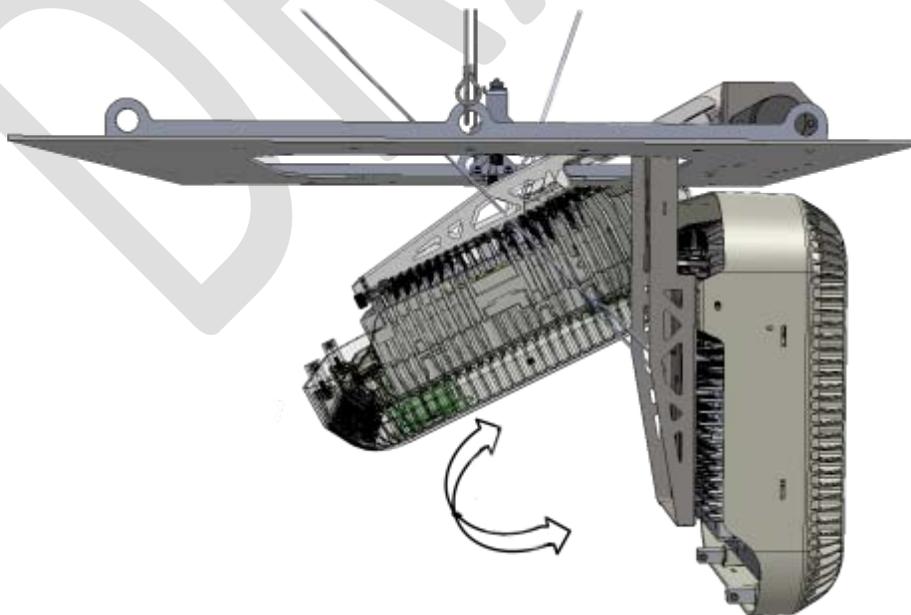


Figure 4-11 Verifying that Cable Path is not Obstructed

7. Lock "Lift Bracket" into plate - push RAU5x and Lift Bracket back up into plate and lock RAU5x into place by closing the rotary knobs in the indicated direction.

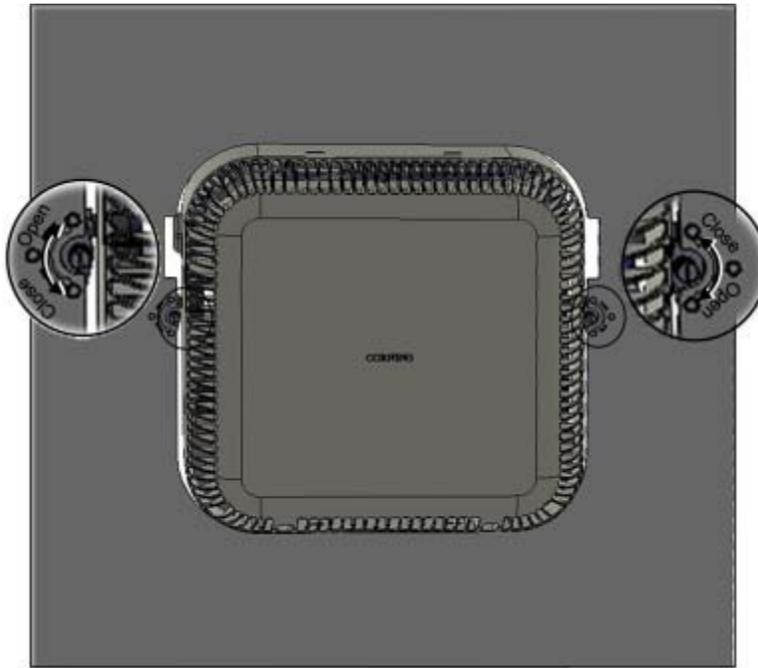


Figure 4-12. Closing Rotary Knobs

8. Fit antenna skirt onto RAU5x.

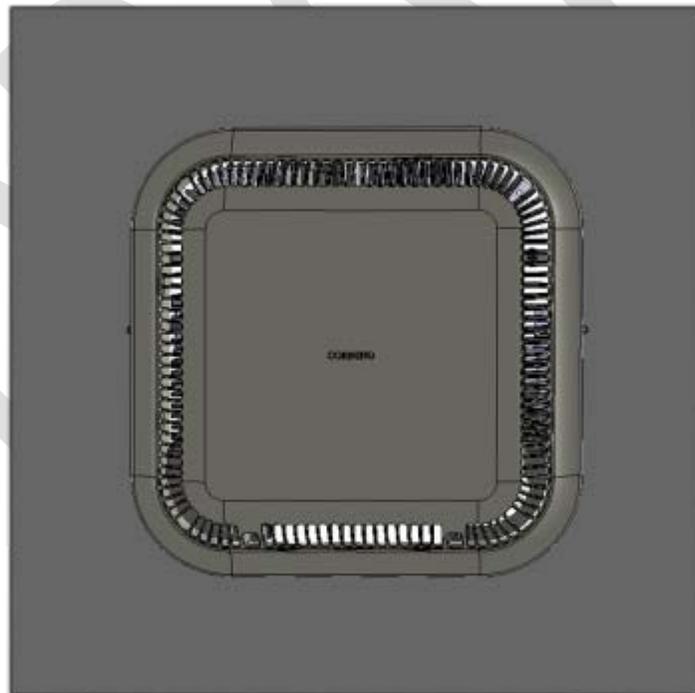


Figure 4-13. Complete Assembled RAU5x

Note: Refer to Section 4.2.2.3 for RAU5x top bracket cap assembly (kit ordered separately) for RAU5x units without Corning external antenna.

4.2.2.3 Top Bracket Cap Assembly

This section provides instructions on how to assemble the cap onto an installed RAU5x and “Top Bracket” assembly which does not include the Corning plug-in external antenna.

Note the following:

- Cap, RAU5x and Top Bracket are each ordered separately.
- **ATTENTION!** In addition to the RAU5x and Top Bracket, the cap must also be secured to a permanent structure using the provided safety cable!
- The cap complies with the 3-in clearance requirement above and below the RAU5x to allow airflow cooling.

Package contents

The BR-TOP-CAP kit consists of the cap for the RAU5x Top Bracket kit.

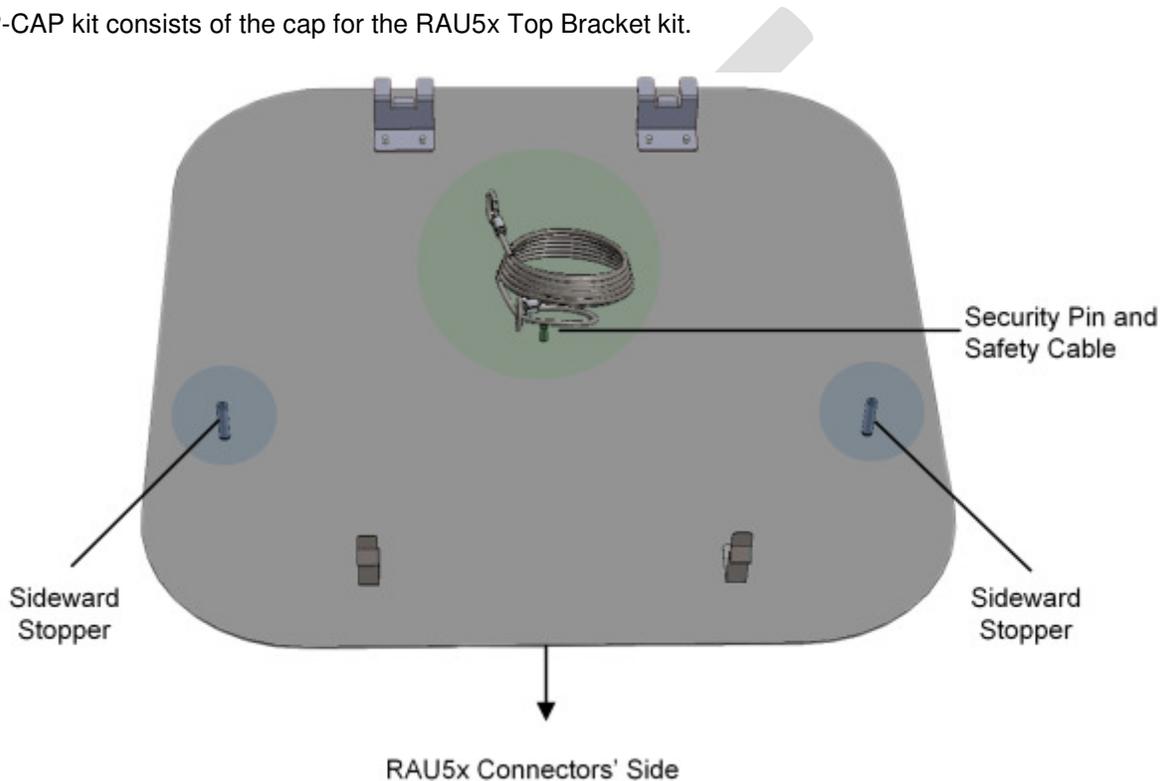


Figure 4-14. BR-TOP-CAP

Additional required items (not provided)

- RAU5x Top Bracket - for installing RAU5x in acoustic ceilings: BR-RAU5US-TOP (ordered separately)
- RAU5x without plug-in external antenna: RAU5XUS and RAU5XUS-E (ordered separately)

To assemble the cap

1. Hook wide fasteners onto top bracket plate. Note that the wide fasteners face towards the base of the lift bracket.

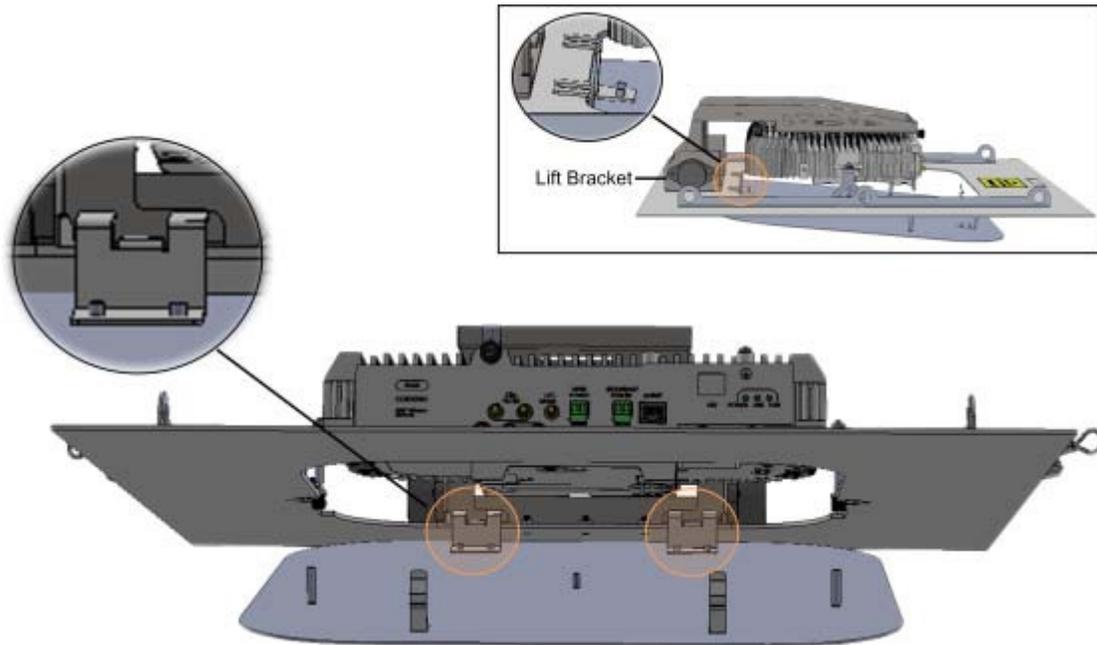


Figure 4-15. Hooking Cap to Top Bracket plate

2. Lift up cap and hook narrow fasteners onto top bracket plate.

IMPORTANT! Before closing cap make sure to secure it to a permanent structure in the ceiling!

⚠ ATTENTION! The site engineer or contracted installer is responsible for all safety issues and procedures on-site!

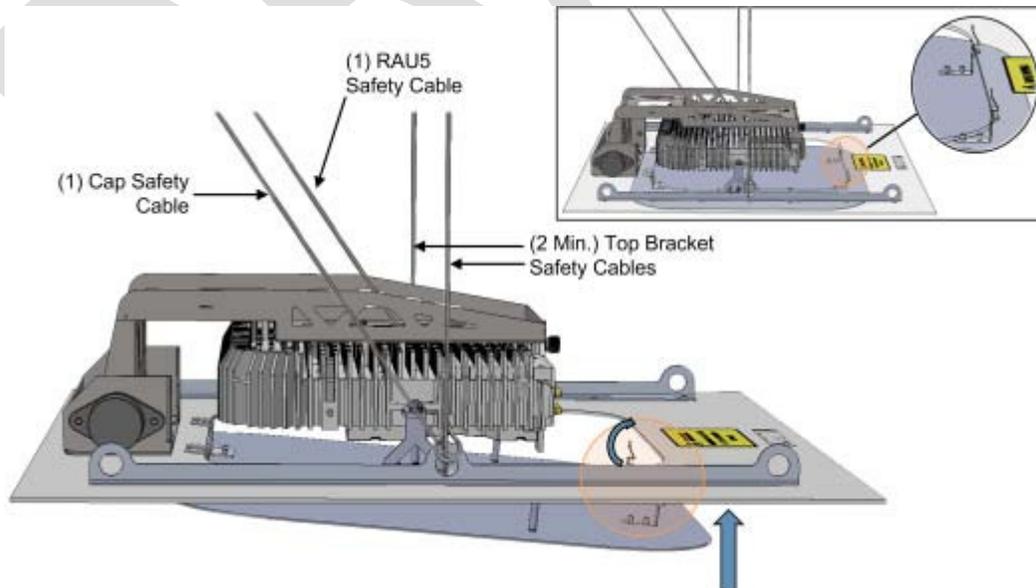


Figure 4-16. Hooking Narrow Fasteners in Place

To remove the cap

Refer to following figures for instructions on how to remove cap in order to access the RAU5x.

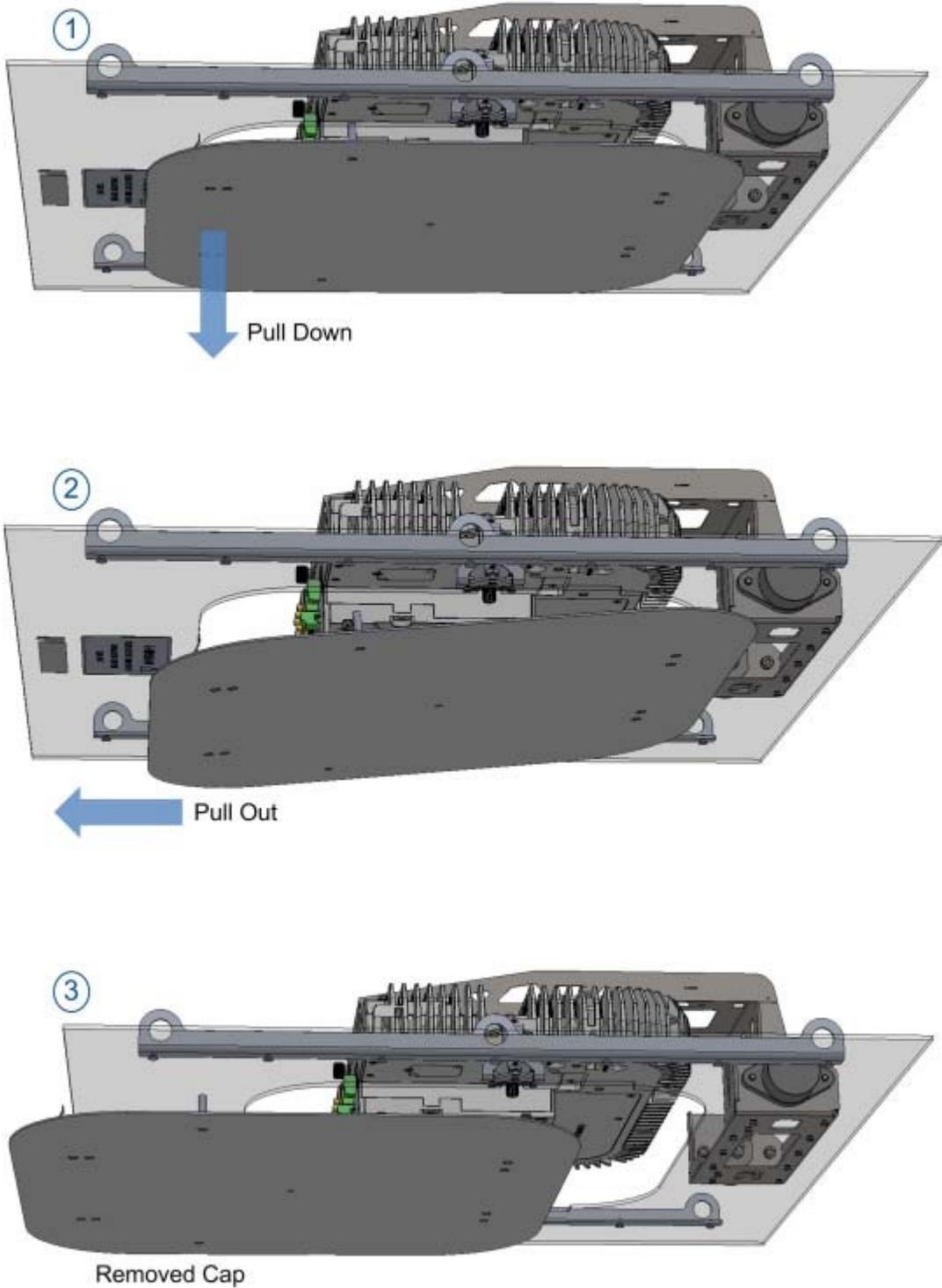


Figure 4-17. Removing Cap

4.2.3 Wall Mount

This section provides instructions on how to assemble up to two RAU5x units onto the wall-mount bracket and mount assembly onto wall.

General Information

- The instructions provided are intended for concrete/brick walls.
- The RAU5x wall-mount bracket is only used with RAU5x models not including the preassembled external antenna:
 - RAU5XUS
 - RAU5XUS-E

WARNING: The site engineer or contracted installer is responsible for all safety issues and procedures on-site.

4.2.3.1 Package Contents

The BR-RAU5US-WALL kit consists of the wall-mount bracket and two standard RAU5 brackets preassembled onto each side of the wall-mount bracket door.

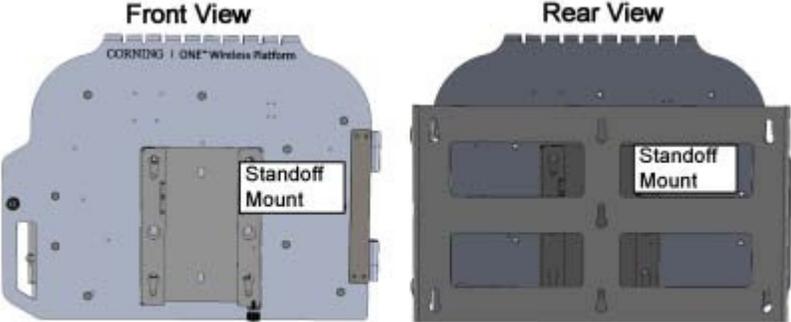
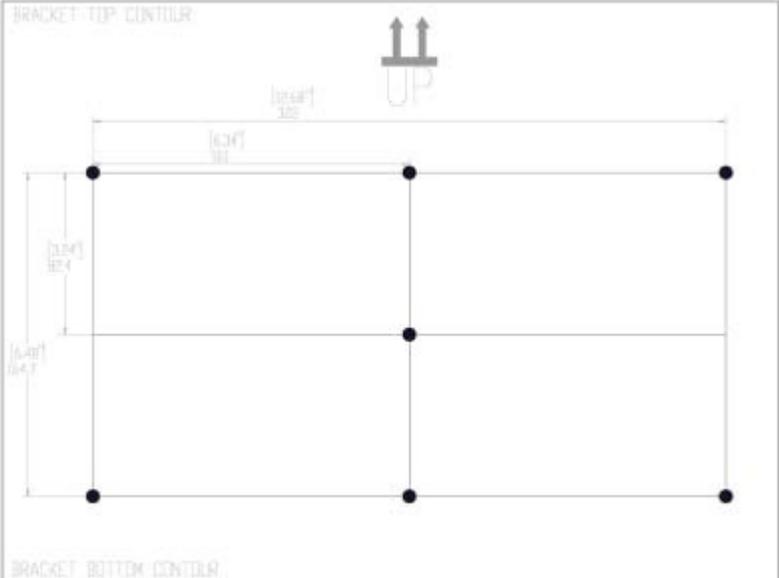
Item	Quantity	
Wall-mount bracket <i>Note: Refer to pg. 5 for wall-mount bracket dimensions.</i>	1	
Standoff mount (preassembled onto each side of the bracket door)	2	
Drilling template – used for marking holes for drilling	1	

Table 4-2. BR-RAU5US-WALL Kit Package Items

Additional required item (not included):

¼ in bolts (x7) for mounting bracket on wall

4.2.3.2 Installing Wall Mount Bracket and Mounting RAU5x

3. Using the provided drilling template, mark a minimum of four holes to mount the bracket (if drilling only four holes, mark the four outer corner holes).

*Note: Image of drilling pattern with required distances also appears in Appendix A: **Bracket** Dimensions.*

IMPORTANT! RAU5x requires 3 in clearing from the surface on the back and front, top and bottom to allow for proper cooling airflow and for heat dissipation.

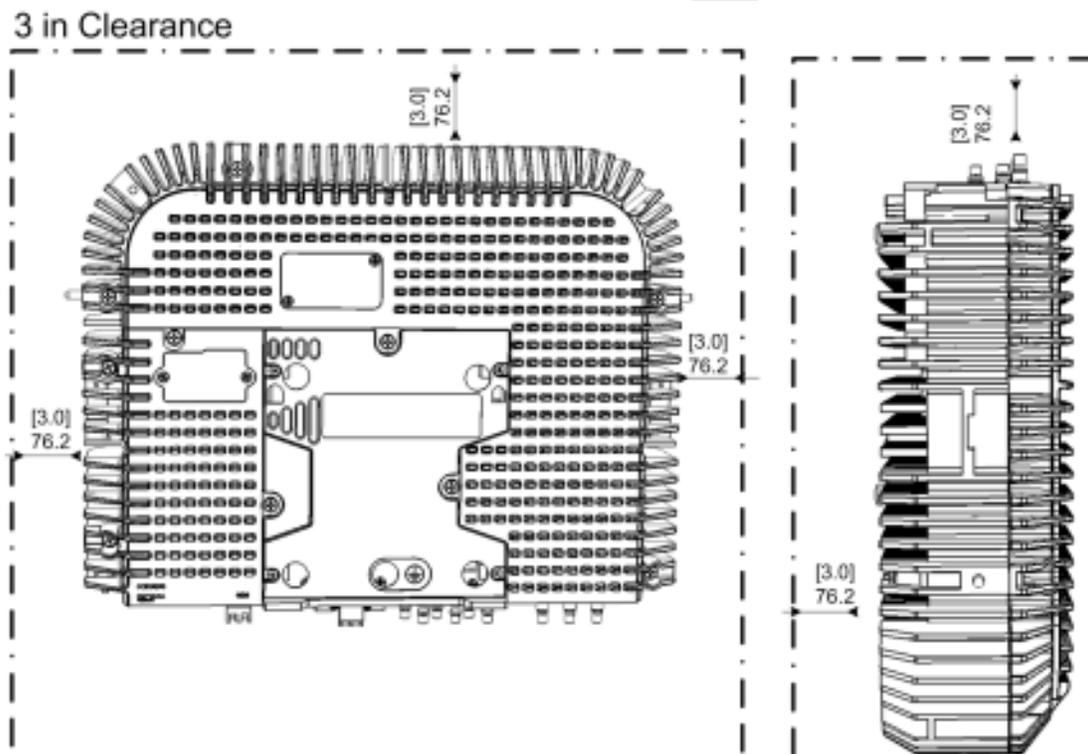


Figure 4-18. Required Three IN Clearance from Surface

4. Align bracket with marked holes and drill anchors through bracket keyholes.

ATTENTION! The installer is responsible for accommodating the installation to the surface type.

Note: Insert the bolts in anchors and tighten until bolt head is 0.5" in from surface of wall.

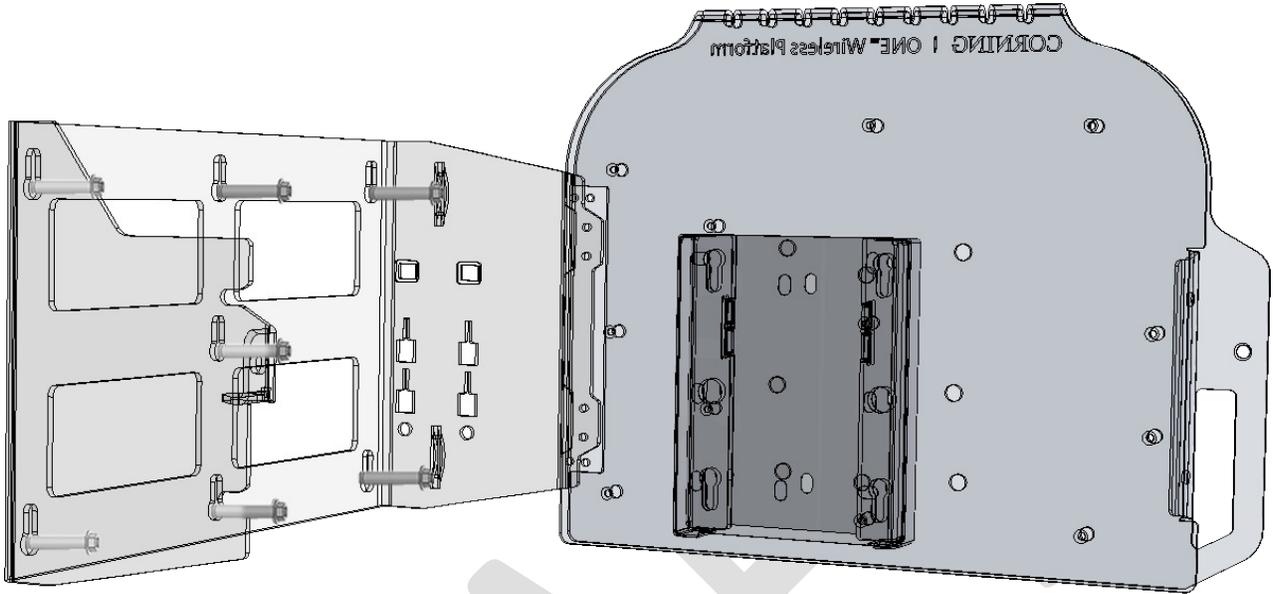


Figure 4-19. Drilling Anchors through Wall-Mount Bracket Keyholes

5. Hang bracket on anchors and tighten.

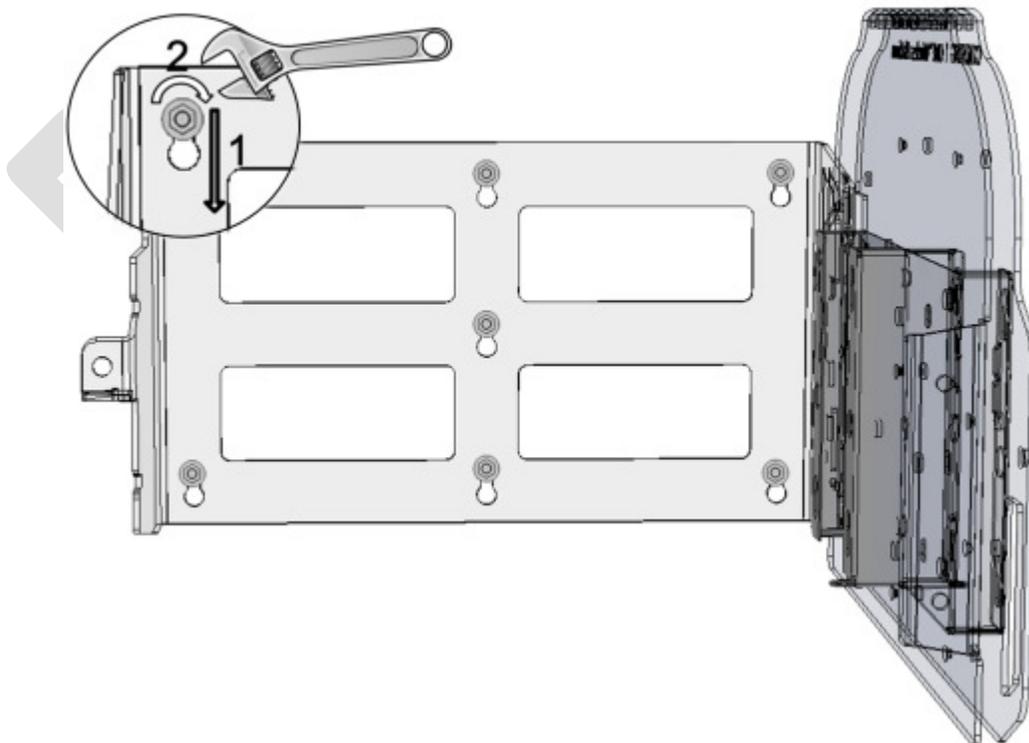


Figure 4-20. Mounting and Securing Bracket to Anchors

6. Mount RAU5x on standoff mount and close captive screw to secure RAU5x to bracket.

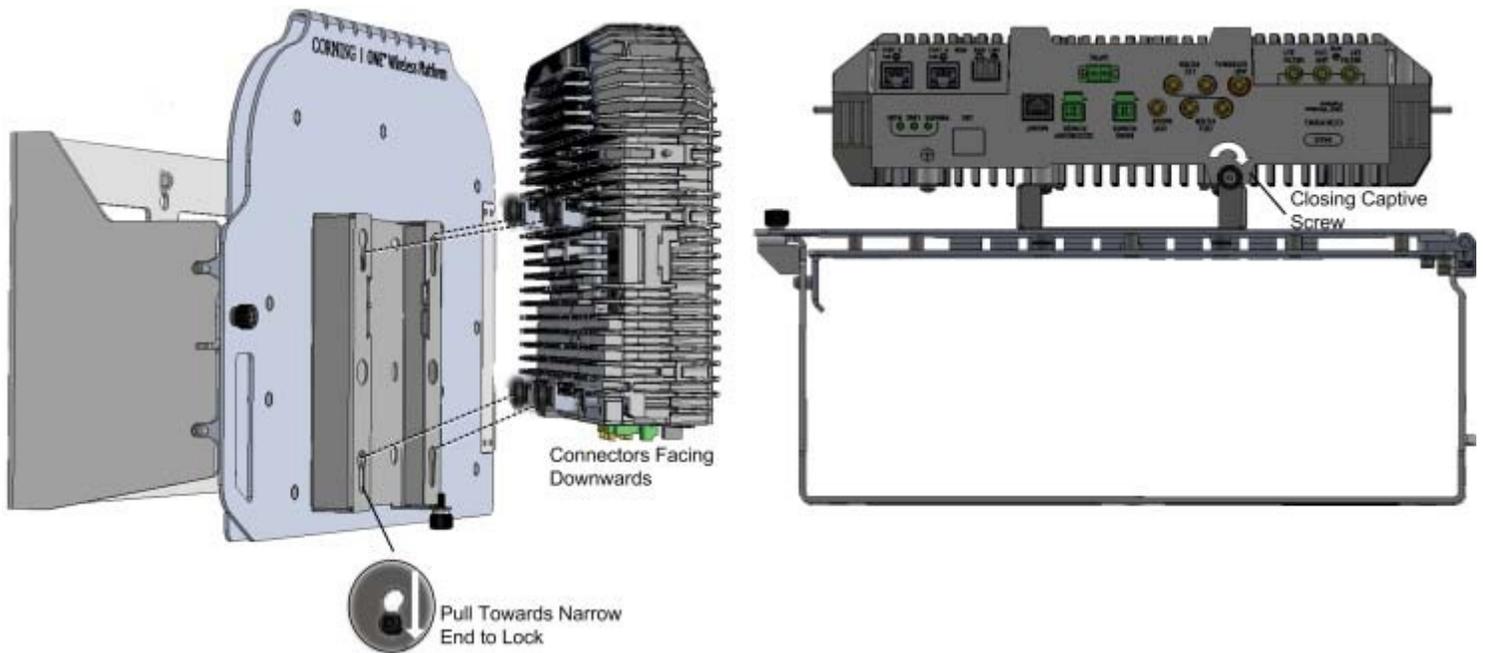


Figure 4-21. Mounting and Securing RAU5x Unit

7. For Second RAU5 – mount on second standoff mount and close captive screw to secure RAU5x to bracket.



Figure 4-22. Mounting and Securing Second RAU5x

8. Open and close bracket door to verify clearance for routing and connecting cables.

Note: Installer is solely responsible for proper cable wiring and routing of the RAU5x unit per instructions provided in relevant Corning documentation.

9. Lock wall-mount bracket door.

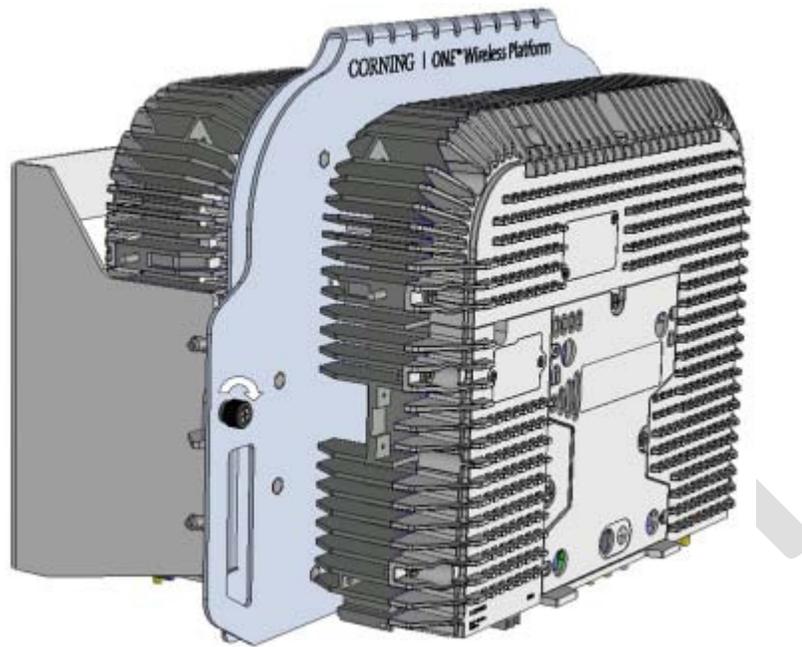


Figure 4-23. Locking Wall-Mount Bracket Door

4.3 Connections

Note: This section references RAU5x, however connections are performed the same for RAU5 and RAU5x models.

4.3.1 Locate Required Connection Cables

Locate the following connection cables leading from the cable infrastructure:

- DC wiring:
 - One pair for MAIN POWER connection
 - One pair for SECONDARY POWER connection (for RAUx models including GEM module)
- Fiber pairs (Corning SMF-28® fiber or compatible):
 - One fiber pair for RAUx module
 - One fiber pair for GEM module (for RAUx models including GEM)
- Grounding wire

For RAU5x models not including external antenna – RF jumper cables from installed external antenna

4.3.2 Cable Connections

Route the ground, RF and fiber cables located in Section 4.3 between the standoff mount bracket and the RAU5x towards the interface connectors.

4.3.2.1 Grounding Connection

Connect the earth ground to the RAU5/RAU5x 8-32 x 3/8 grounding screw. See Figure 4-28 for example of RAU5x ground connection.

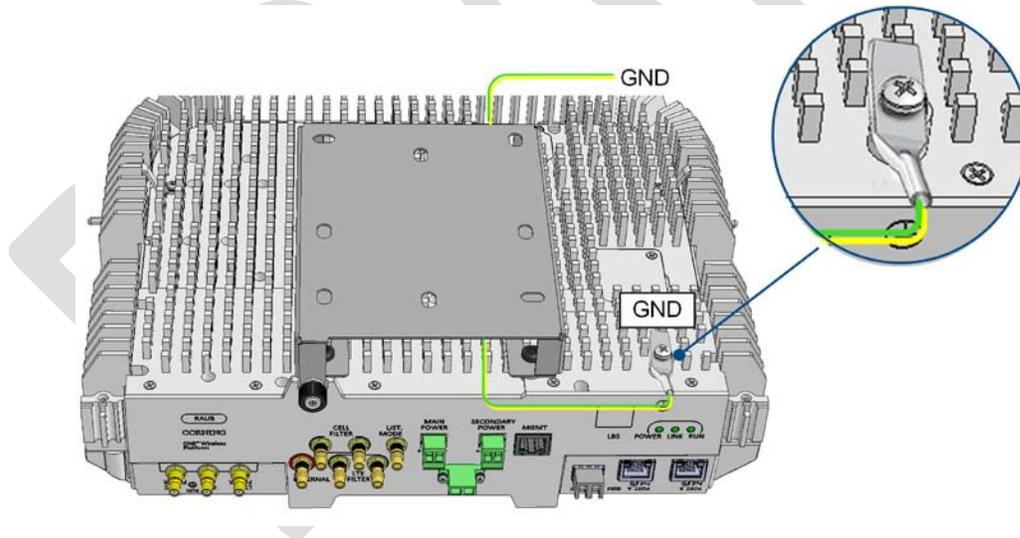


Figure 4-24. RAU5/RAU5x Grounding Connection

4.3.2.2 RF Connections

1. For RAU5x models not including Corning external antenna – connect the RAU5x QMA “Ext. Ant.” connector to the external antenna, as illustrated in Figure 4-25. Note that for RAU5x units installed with RxU2325, the external antenna is connected to the RxU2325 “ANT.” port.

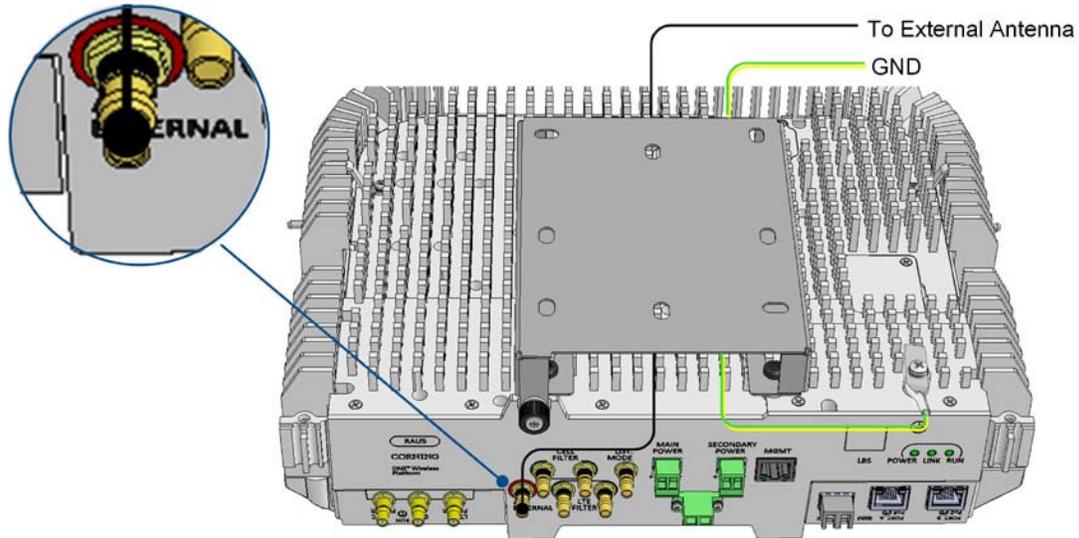


Figure 4-25. RAU5/RAU5x External Antenna Connection

Note: See Section 3.63.6.1 for supported external antenna types.

2. Add-on connections (i.e., RxU/RxU2325):

For RAU5/RAU5x with RxU:

- Connect RxU “Ext. Ant.” QMA port to external antenna

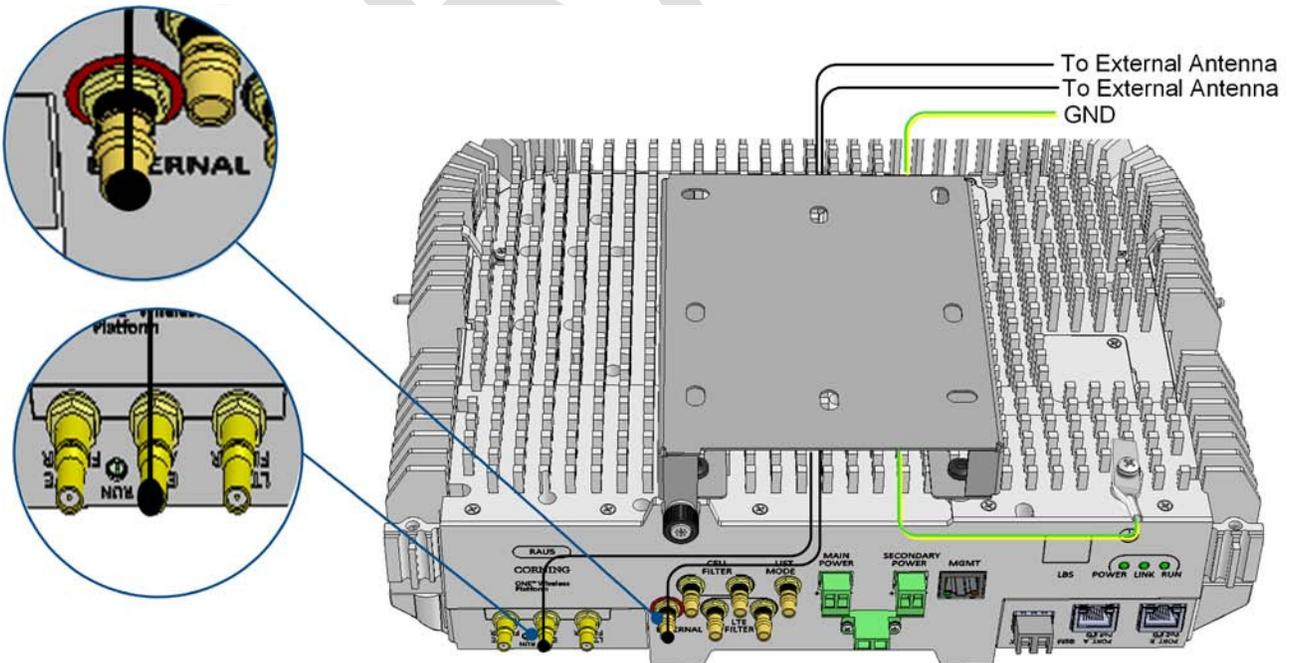


Figure 4-26. RAU5/RAU5x with RxU - External Antenna Connections

- If required by site planner – perform (QMA) connections to CELL and/or LTE external filters. Refer to Section 4.5 for details on filter connections.

For RAU5x with RxU2325:

- Connect the RxU2325 “ANT.” QMA connector to the external antenna.
- Using the RF jumper (P/N 705A052301), supplied with the add-on, connect the RxU2325 “To RAU” QMA connector to the RAU5x “ANT External” QMA connector.

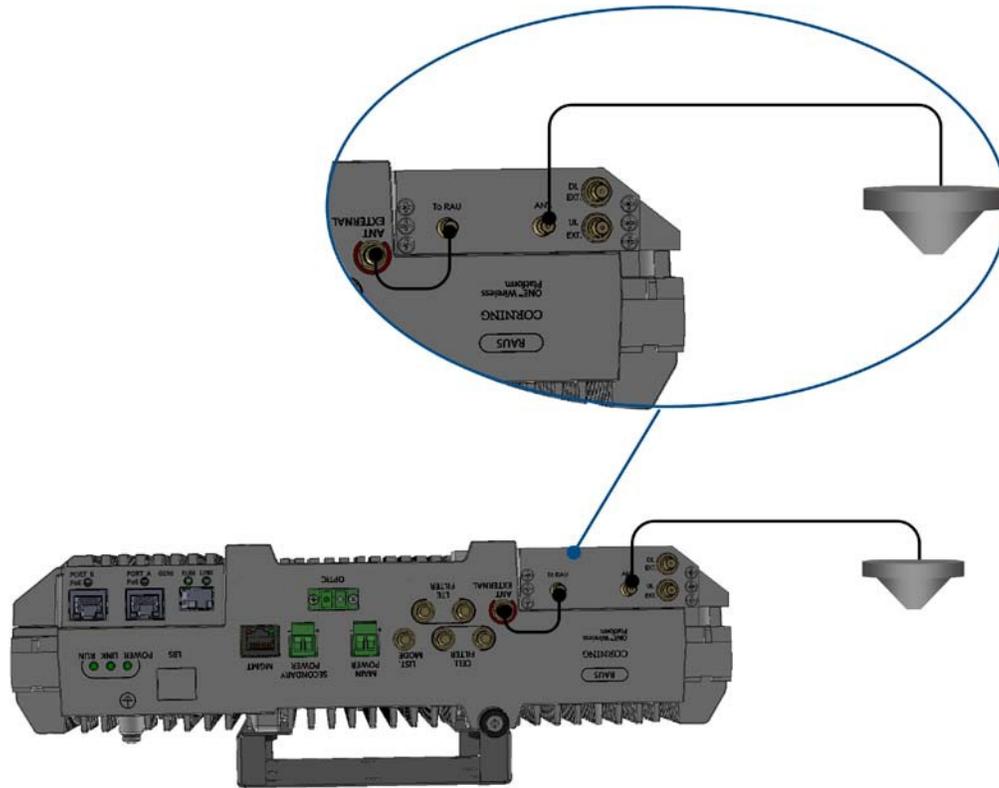


Figure 4-27. RF Connections for RAU5x with RxU2325

- If required by site planner – perform (QMA) UL/DL external connections to external filters.

4.3.2.3 Fiber Connections

Connect optic fiber pair to RAU5x module LC APC optic connector. See Figure 4-28.

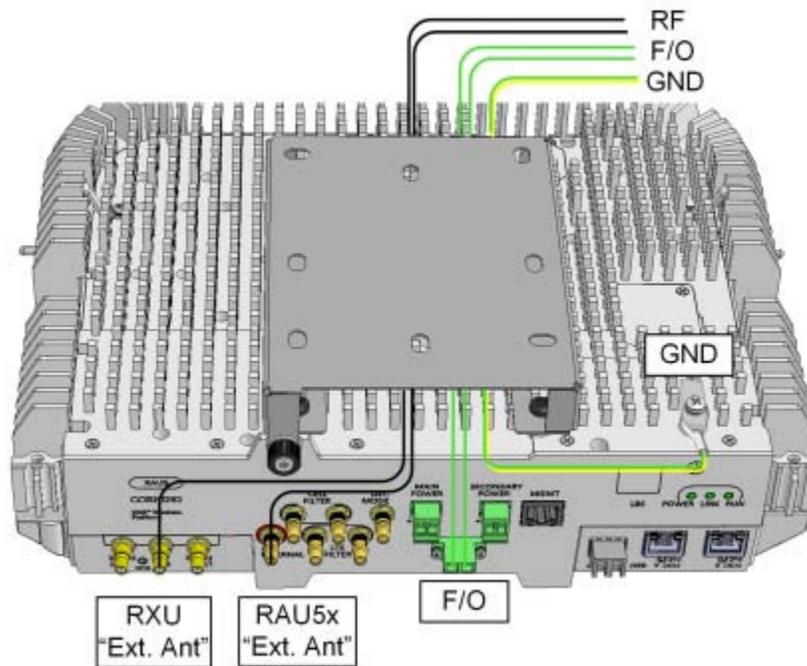


Figure 4-28. Ground, Fiber and RF Cable Connections for RAU5x

4.3.3 Main Power Connections

Note: The power consumption is the same for both RxU and RxU2325 modules.

RAU5x "MAIN POWER" (for RAU5x/RAU5x+RxU) DC input power connections (see Figure 4-29) – connect DC wire pair to the terminal block connector:

- Power input range: 37 to 57 VDC
- Wire size: 12-30 AWG
- Maximum consumption:
 - RAU5x: 44.5 V; 50 W
 - RAU5x + RXU: 44.5 V; 76 W

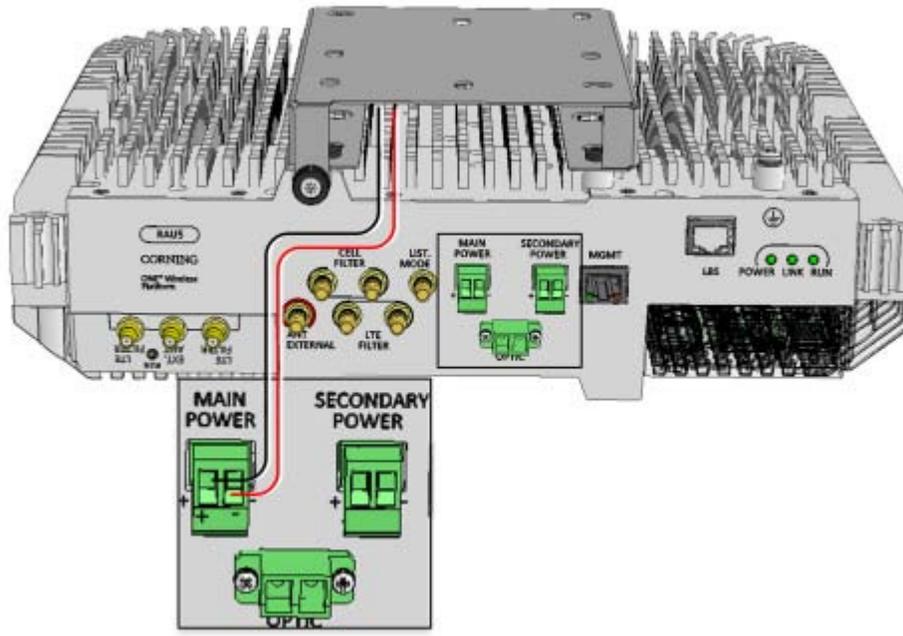


Figure 4-29 RAU5x Main Power DC Connections

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4.3.4 GEM Connections (for Configurations including GEMs)

1. Connect DC wire pair to the RAU5x Secondary Power DC input connector (see Figure 4-30):

- Wire size: 12-30 AWG
- Max. Consumption:
 - GEM: 4 W (RAU5: 44.5 V ; 52 W ; RAU5x + RXU + GEM: 44.5 V ; 78 W)
 - For 2 PoE ports of 802.3af: 43 V ; 31 W (Input range: 43 – 57 V DC)
 - For 2 PoE ports of 802.3af: 52 V ; 62 W (Input range: 52 – 57 V DC)

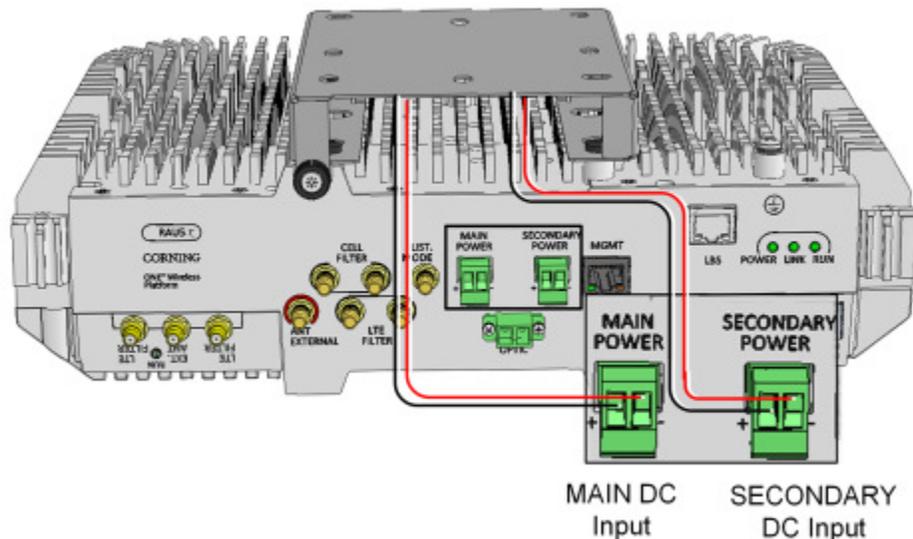


Figure 4-30. RAU5x MAIN and SECONDARY DC Input Connections

2. Connect fiber to SFP module ports as follows:

- If using fiber terminated with LC APC (green), connect to pre-inserted APC to UPC adapters
- If using fiber terminated with LC UPC connector (blue), remove pre-inserted APC to UPC adapters and connect directly to SFP module ports.

3. Connect the A and B Ethernet ports to the PoE clients using Ethernet cables.

Note: A and B ports – 10/100/1000 BASE-T with 802.3at compliant Power over Ethernet (PoE+) PSE ports.

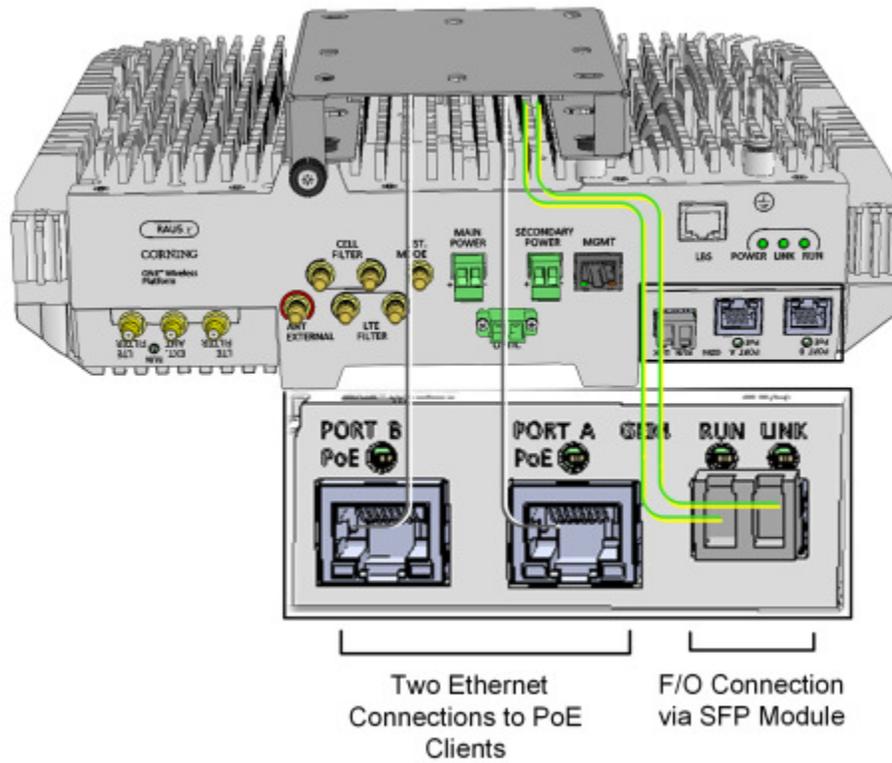


Figure 4-31. GEM Module Interfaces Connections

4.4 Verify Normal Operation

Referring to Figure 4-32 and Table 4-3 verify normal operation of RAU5x, RxU and GEM (if installed) modules.

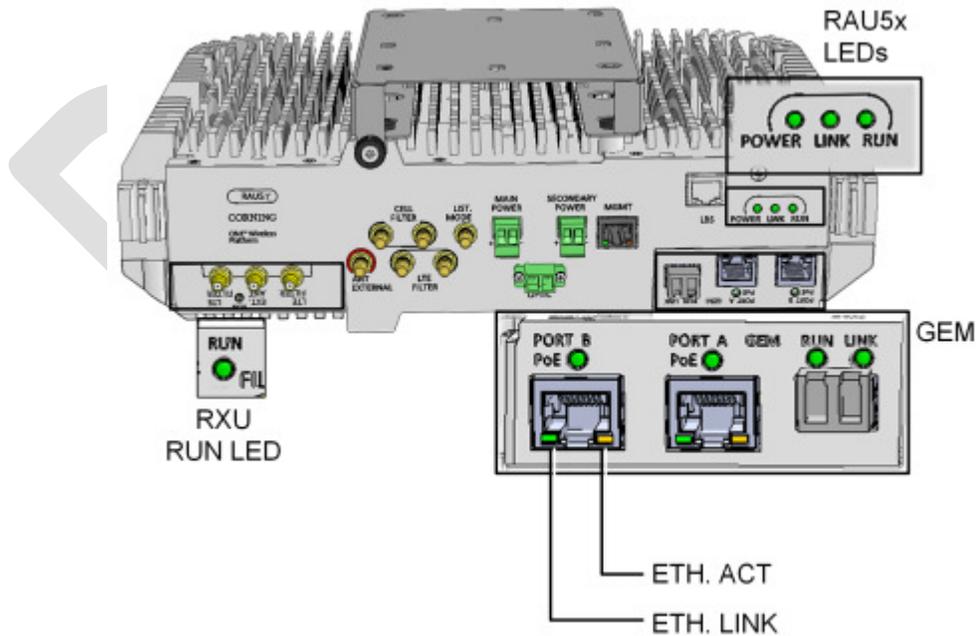


Figure 4-32. RAU5x, RxU and GEM LEDs

Module	LED	Description	
RAU5x	LINK	Steady Green:	Optical link power to/from the RAU5x is normal
		Blinking Green:	Optical power from remote is lower than required
		Off:	No optical link detected
	POWER	Steady Green:	Input power detected by RAU5x
		Off:	No power supplied to RAU5x
	RUN	Blinking Green:	RAU5x boot up sequence complete and module software up and running
Off:		No power supplied to the unit	
RXU	RUN	Blinking Green:	RXU boot up sequence complete and module software up and running
		Off:	No power supplied to the unit
GEM	(GEM) RUN/STATUS	Steady Green (with short blink every ~ 10 sec):	GEM On/Normal
		Steady Yellow:	GEM Fault
	ETHERNET LINK	Steady Green:	Link
		Off:	No link
	ETHERNET ACT	Blinking Yellow:	Activity
		Off:	No activity
	(SFP) LINK	Steady Green:	Link
		Blinking Green:	Activity
		Steady Yellow:	Fault
		Off:	No link
	(PortA/B) PoE	Steady Green:	PoE enabled
		Steady Yellow:	PoE fault
		Off:	PoE off

Table 4-3. Normal Operation LED Status Descriptions

The RxU2325 status LED is located on the top side of the module, as shown in Figure 4-33. Verify that the LED shows green, indicating power and normal operation

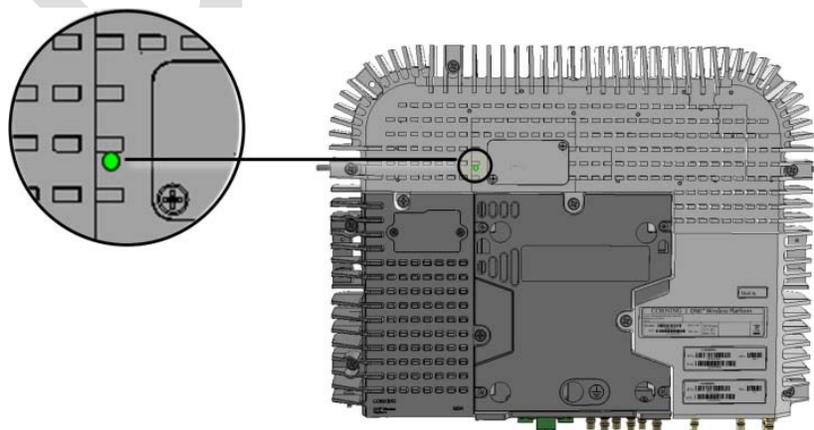


Figure 4-33. RxU2325 Status LED Location

4.5 RAU5x/RxU Cavity Filter Installation

Note: This section references RAU5x, however connections are performed the same for RAU5 and RAU5x models. The same applies to RxU2325 connections to RAU5/RAU5x.

The external cavity filters are required when the RF services modules supporting the corresponding CELL and LTE bands are deployed alongside units supporting the public safety service.

- The RAU5x supports connections to external CELL and LTE Filters
- The RXU supports connections to an external LTE Filter.
- In cases where an LTE External Filter is required and the RAU5x includes the RxU module – both modules must be connected to an external LTE filter.

Note the following:

- The cavity filter mounting bracket supports wall/ceiling/acoustic ceiling installations. See Figure 4-34.

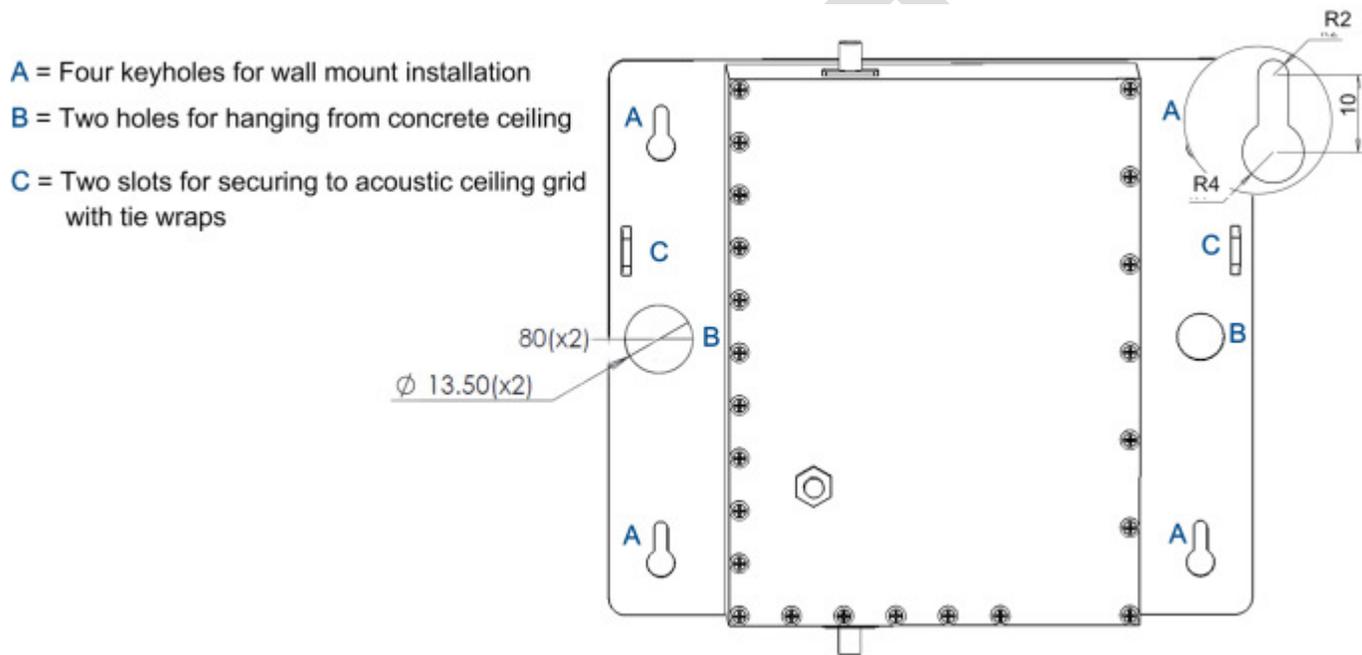


Figure 4-34. Cavity Filter Dimensions and Mounting Holes

- Consider the length of the RF jumpers (3 m) and the distance from the RAU5x when determining the installation location.
- For acoustic ceiling installations – use provided safety cable to secure the filter assembly to a permanent structure within the ceiling (e.g., acoustic ceiling grid or concrete ceiling above).

4.5.1 Package Contents

Check your package contents to verify that the items in the packing list are included. If any of the listed items are missing, contact your Corning representative.

Item	Description	Quantity	
Cavity Filter (depends on order)	CVT800 - 836.5MHz; 0.5W; 824-849MHz; IL=1.6 dB max.; SMA	1	
	CVT700 – LTE; 0.5W; 698-716MHz; 777-787MHz; IL=1.5 dB; SMA		
Mounting Bracket	Provides wall mount and ceiling mount installation options (pre-assembled with filter)	1	
Safety Cable	Required for acoustic ceiling installations	1	
RF Jumpers	SMA to QMA RF jumpers; L=3m; Used for RAUx/RXU filter connections	2	

Table 4-4. Cavity Filter Package Items

4.5.2 (Concrete) Ceiling Mounting Option

To mount Cavity Filter on Concrete Ceiling

1. Using the two holes (Item B in Figure 4-34) as a guide, mark the location of the holes to be drilled in the ceiling.
2. Drill the holes in ceiling corresponding to the diameter of the toggle anchors to be used (not provided).
3. Mount the Cavity Filter as shown in Figure 4-35.

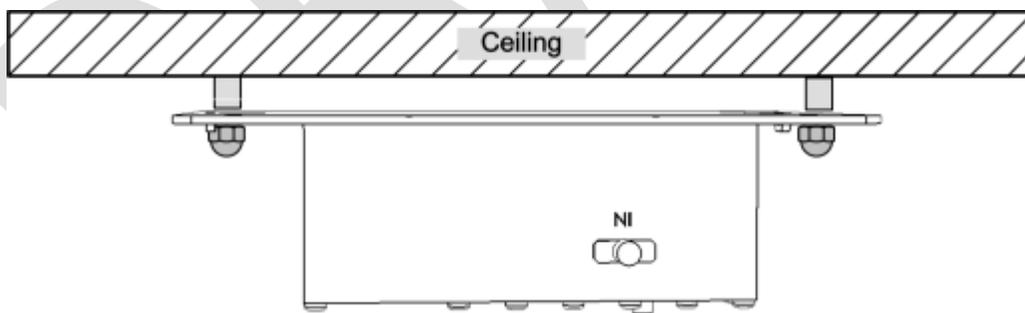


Figure 4-35. Illustration of Cavity Filter Mounted on Ceiling

4.5.3 Acoustic Ceiling Mount Installation

In acoustic ceiling mount installations, the Cavity Filter can be fastened to the grid by slipping tie wraps through slits on the bracket (Item C in Figure 4-34) and securing the assembly to the grid with the provided safety cable. Refer to Figure 4-36.

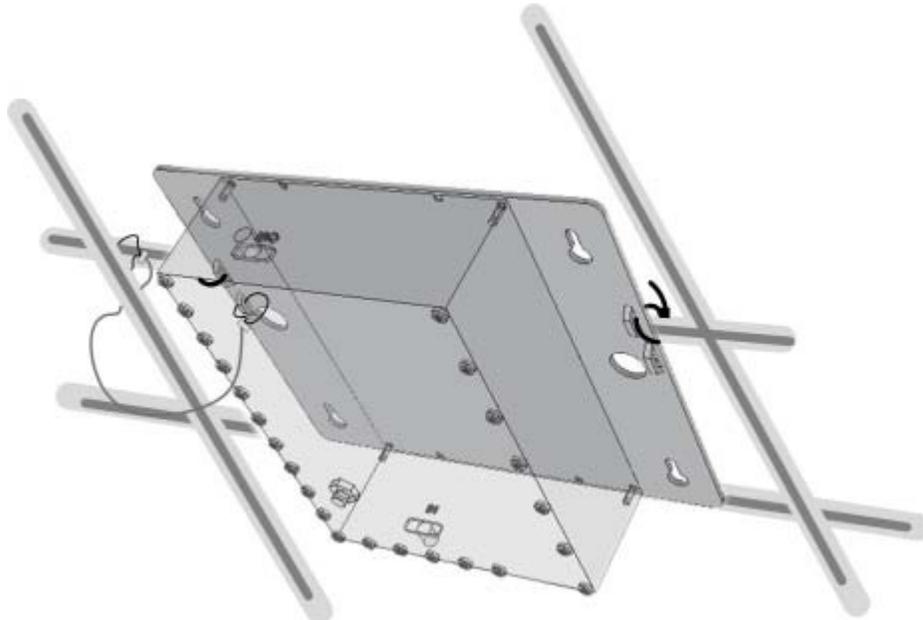


Figure 4-36. Illustration of Cavity Filter Mounted on Acoustic Ceiling Grid

4.5.4 Wall Mount Installation

To mount Cavity Filter on Wall

1. Using the four key holes (Item A in Figure 4-34) as a guide, mark the location of the holes to be drilled in the wall.
2. Drill the holes in the wall corresponding to the diameter of the anchors to be used (not provided).

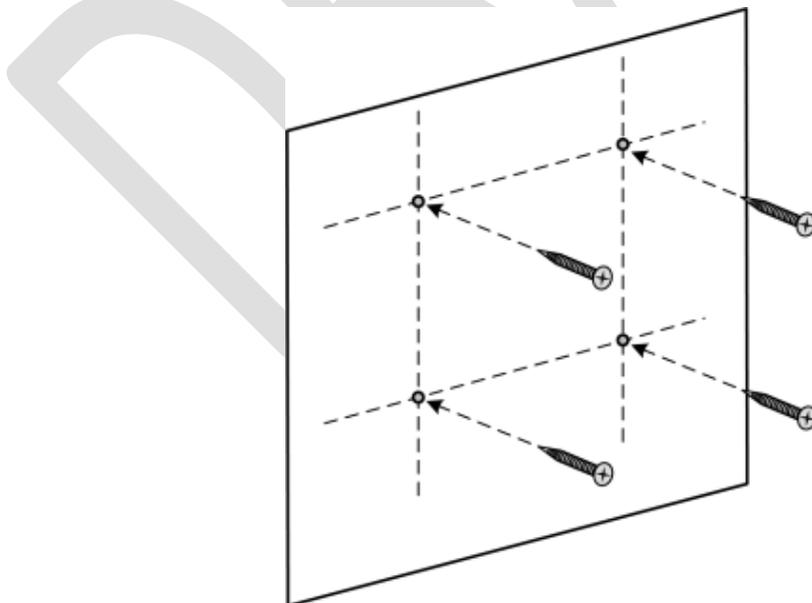


Figure 4-37. Marking and Inserting Anchors in Wall

3. Hang the Cavity Filter on the anchors/screws and pull down to lock in narrow end of key hole. Refer to Figure 4-38.

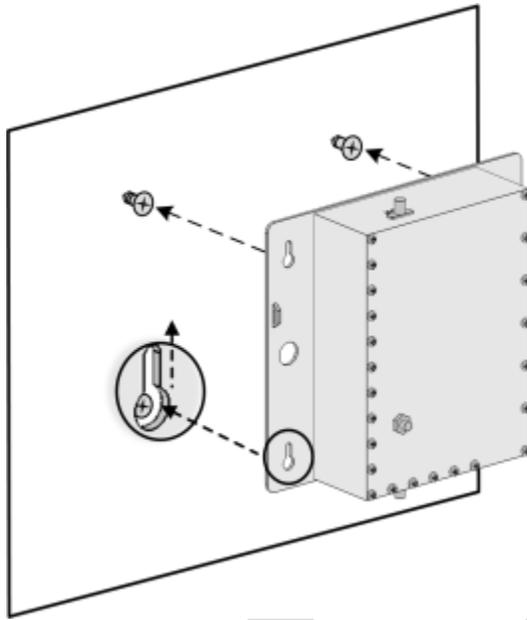


Figure 4-38. Mounting Cavity Filter on Wall

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4.5.5 Filter Connections

Using the provided SMA to QMA RF jumpers, connect the Cavity Filter IN and OUT QMA ports to the corresponding filter (CELL/LTE) SMA connectors on the RF module.

Note: In installations where additional units are deployed which support the 700 MHz band and the RAU5x is installed with an RXU – both RAU5x and RXU modules must be connected to an external LTE filter. See Figure 4-39 and Figure 4-40.

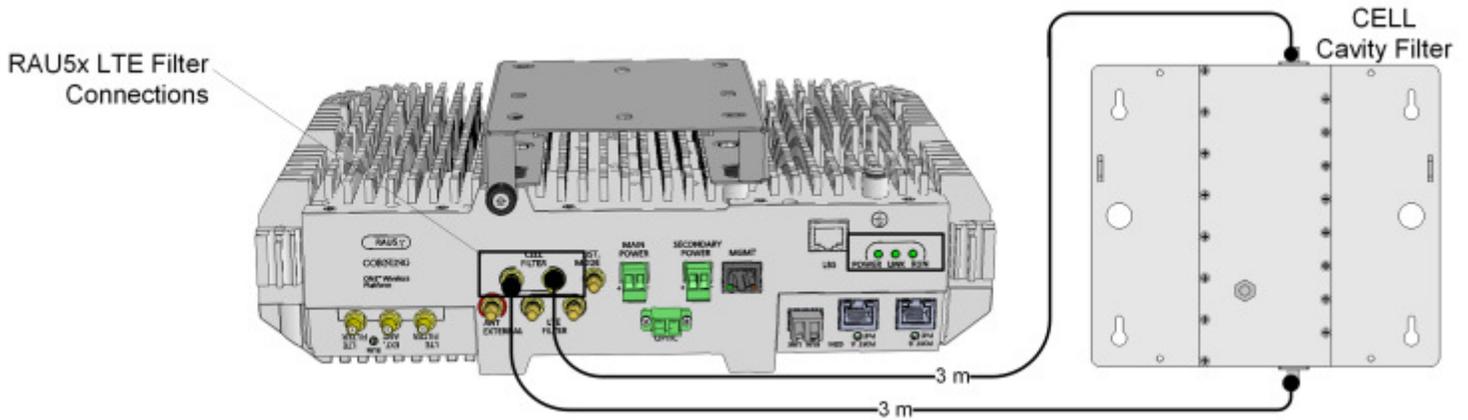


Figure 4-39. Example of RAU5x External CELL Filter Connections

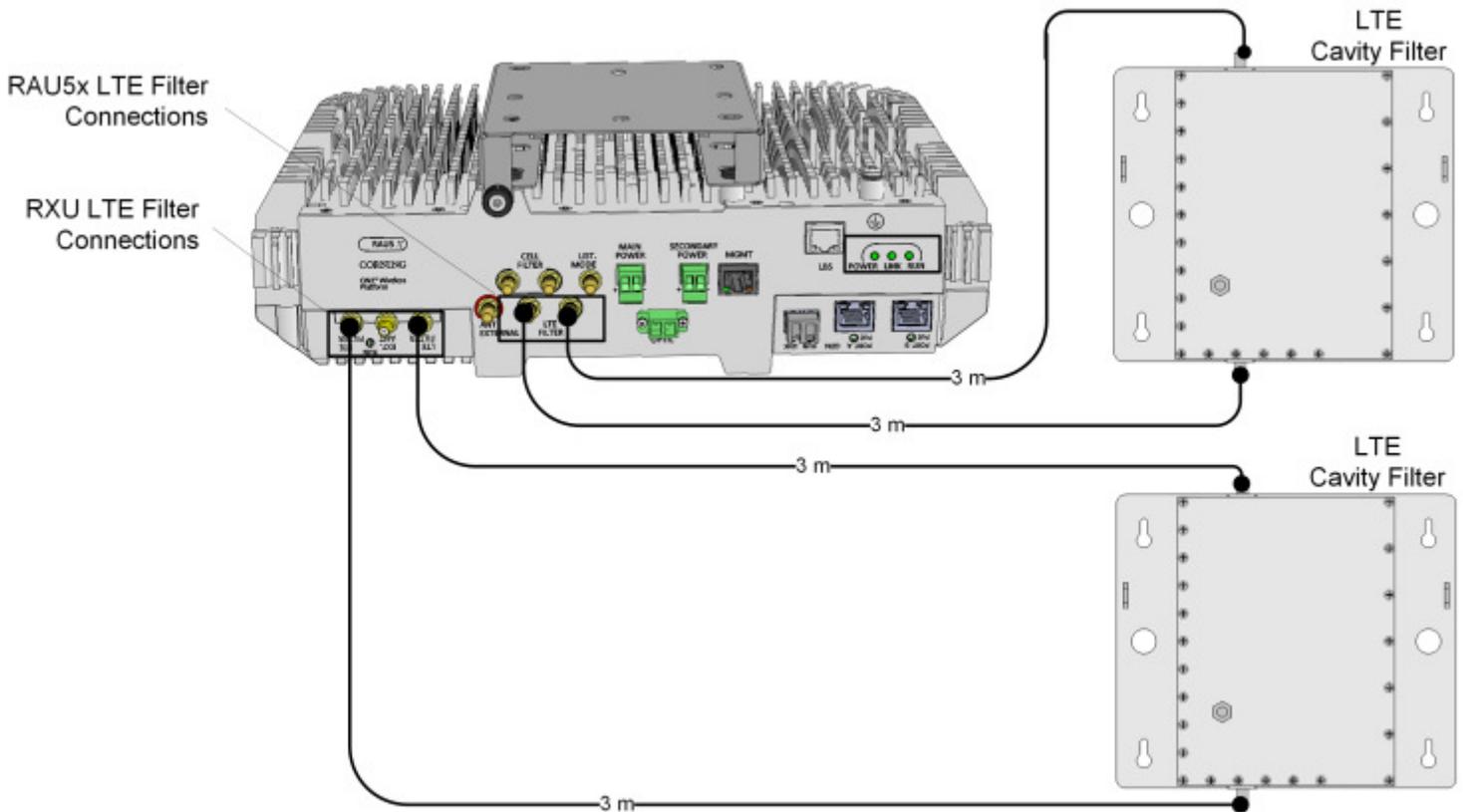


Figure 4-40. Example of RAU5x and RXU External LTE Filter Connections

5 Appendix A: Bracket Dimensions

Standoff Mount

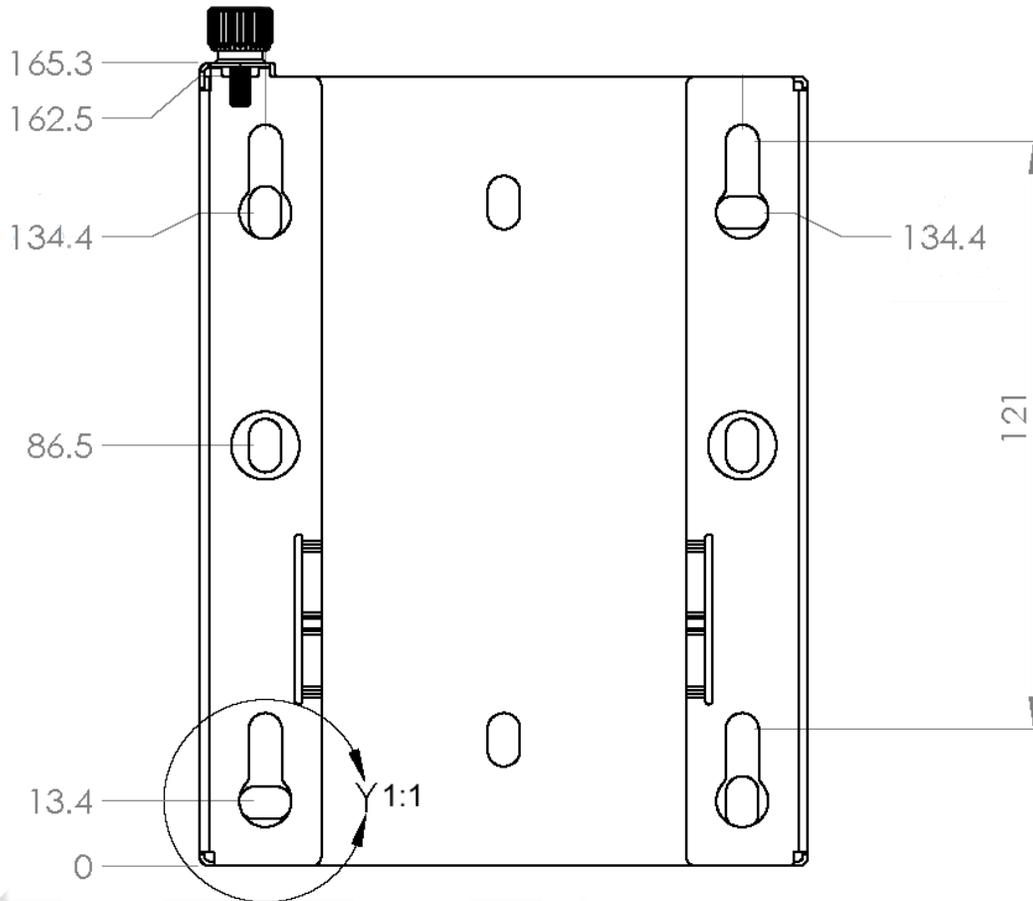


Figure 5-1. Standoff Mount Dimensions

Top Bracket

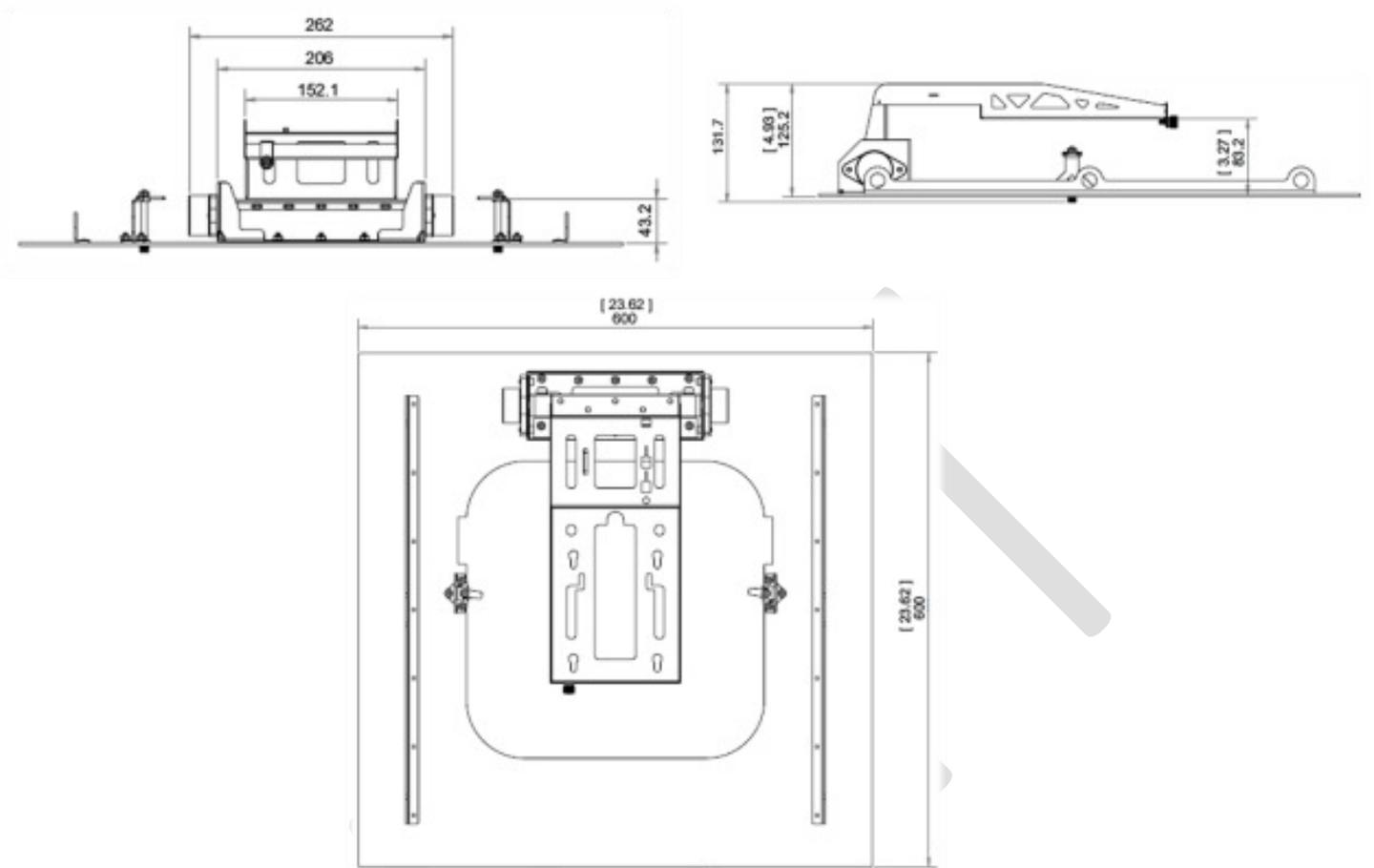


Figure 5-2 RAU5 Top Bracket Dimensions

Wall Mount Bracket

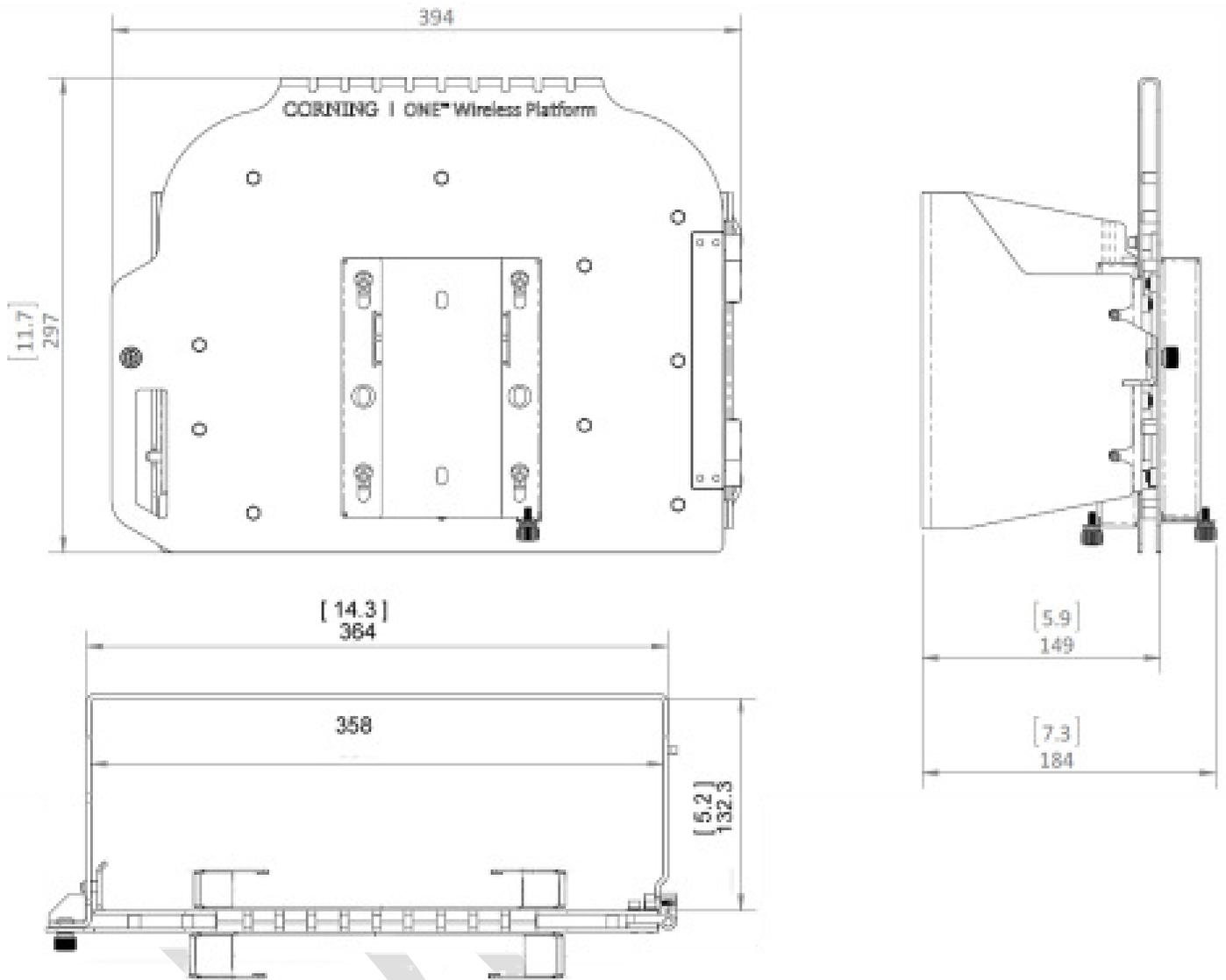


Figure 5-3. RAU5 Wall Mount Bracket Dimensions

Wall Mount Bracket - Drilling Pattern Dimensions

Note: The drilling pattern template is provided with the wall mount bracket kit (P/N: BR-RAU5US-WALL).

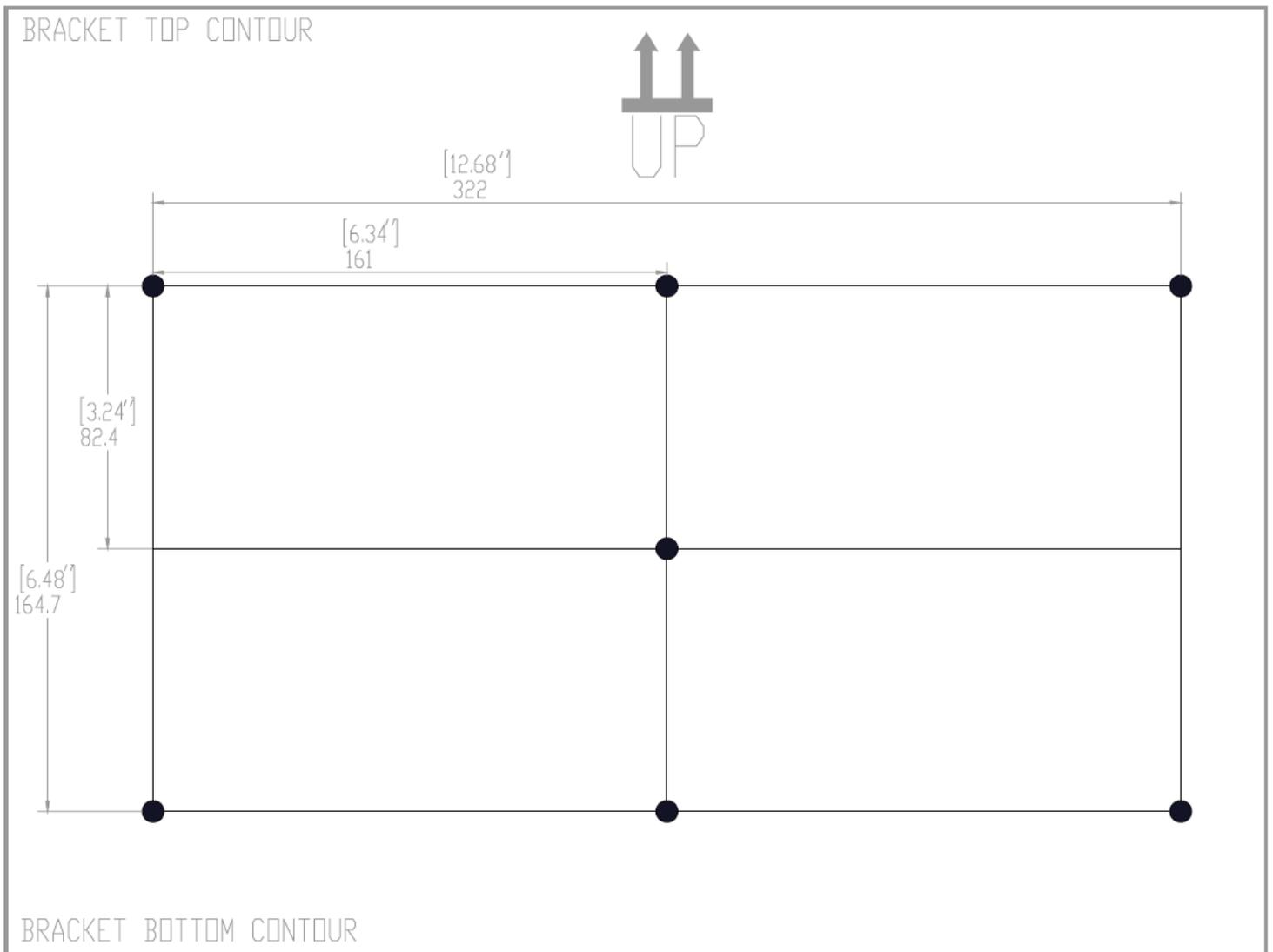


Figure 5-4. RAU5 Wall Mount Drilling Pattern Dimensions

6 Appendix B: Upgrades

This section describes how to upgrade the RAU5x (and RAU5) with an RxU, RxU2325, and/or GEM plug-in module for units' ordered initially without these modules installed.

6.1 Package Contents

Each plug-in module is ordered separately. Check the package contents for external damage.

Item	Quantity	Image
Remote Expansion Unit (RXU)	1	

Table 6-1. RXU Package Contents

Description	Quantity	Image
Gigabit Ethernet Module (GEM)	1	
SFP – Fiber UPC Module (pre-inserted)	1	
UPC to APC Adapter	2	

Table 6-2. GEM Package Contents

6.2 Installing the Plug-in Module in the RAU5x

General Information

- There is no need to dismount the RAU5x from mounting surface.
- The RxU/RxU2325 and GEM are hot-swappable and do not require disconnecting cables leading from the ceiling or power.

Before installing plug-in module

- For RAU5x units mounted with top bracket (described in Section 4.2.2):
 - For installations with cap – remove cap (refer to Section 4.2.2.3)
 - Pull the lift bracket down
- For RAU5x units with assembled broadband antenna – open antenna by pushing in on the pins on both sides of the antenna cover and pulling on the side handles, as show in Figure 6-1.

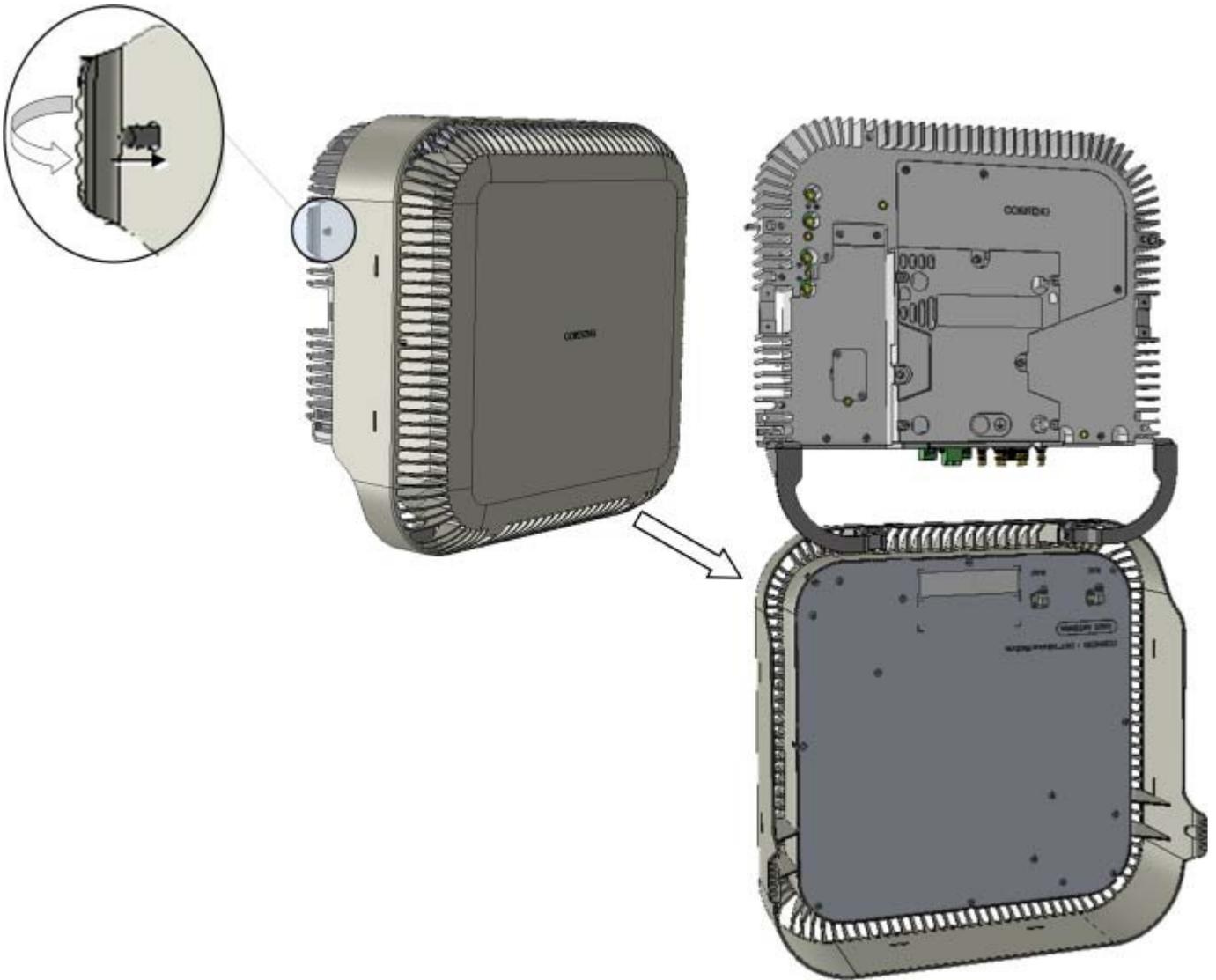


Figure 6-1. Opening RAU5x Antenna

To install plug-in module in RAU5x :

1. Plug-in module as follows:

- RxU/RxU2325 – plug-in RxU into right side of the RAU5x as indicated in Figure 6-2 (area highlighted in green in inset) and close the two screws to secure in place.
- GEM - plug-in GEM into left side of the RAU5x as indicated in Figure 6-2 (area highlighted in blue in inset) and close the screw to secure in place.

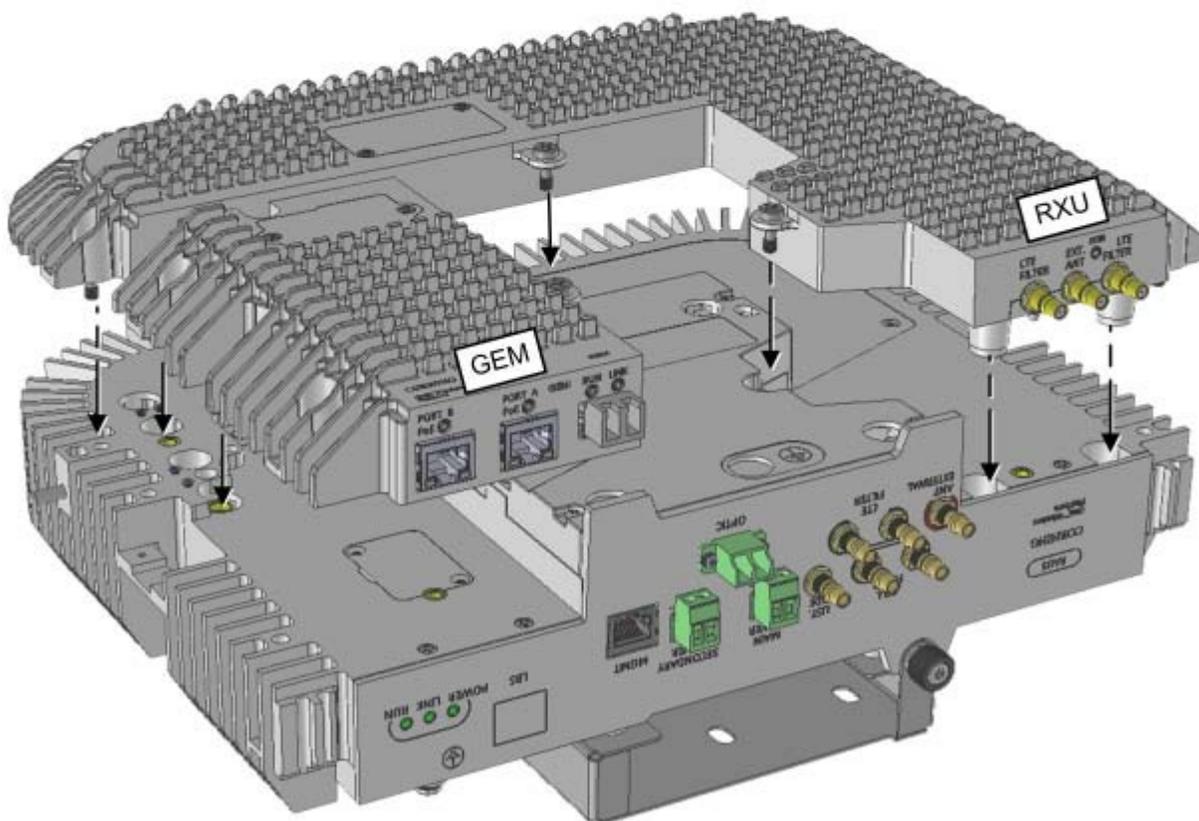
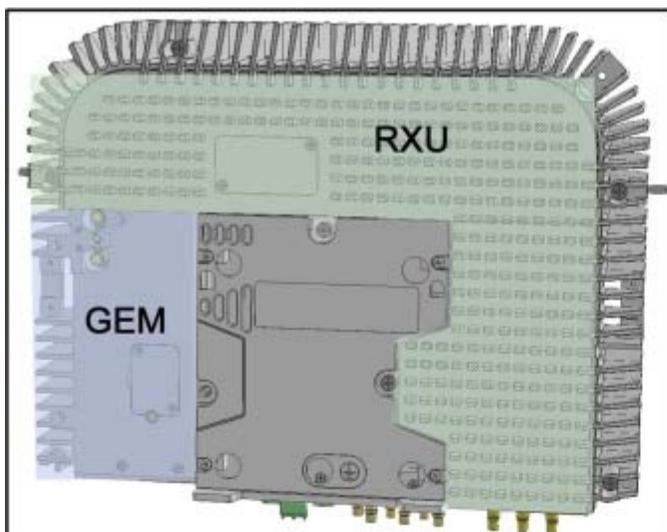


Figure 6-2. Plugging-in RxU and GEM

2. For units with broadband antenna – close antenna.

3. For RxU/RxU2325:

- With external antennas from other vendor - connect RxU “EXT. ANT.” QMA connector to an external antenna for MIMO coverage
- With Corning external antenna – connect RxU “EXT. ANT.” QMA connector to the external antennas’ “RXU” QMA port using RF jumper.

Note: If cavity filter connections are required for the LTE 700 MHz band – refer to Section 4.5 for relevant connections.

4. For GEM - refer to Section 4.3.4 for GEM connections.

5. Verify that RAU5x LEDs on front panel indicate normal operation status:

LED	Description
LINK	Steady green - Optical link power to/from the RAU is normal
	Blinking green - Optical power from remote is lower than required
	Off – No optical link detected
POWER	Steady green - Input power within required range detected
	Off – No power supplied to RAU
RUN	Blinking green – RAU boot up sequence complete and module SW up and running
	Off – No power supplied to unit

6. Table 6-3. RAU5x LED Descriptions

7. For units installed with top bracket – push lift bracket into place.

8. For units with top bracket cap – replace cap (see Section 4.2.2.3).

7 Appendix C: Specifications

Supported Services

Technology	Frequency Range (MHz)		
	Service/Band	Uplink (UL)	Downlink (DL)
LTE	700 MHz Lower ABC 700 MHz Upper C	698-716 777-787	728-746 746-756
CDMA/WCDMA**/ TDMA/GSM/LTE*	ESMR800/CELL850	817-824/824-849	862-869/869-894
WCDMA**/LTE*	AWS1/3 1700	1710-1780	2110-2180
CDMA/WCDMA**/TDMA/GSM/LTE*	PCS + G 1900	1850-1915	1930-1995
LTE	WCS	2305-2315	2350-2360
LTE	2500 MHz TDD	2496 – 2690 (UL/DL combined)	

*WCDMA service is based on 3GPP standards, LTE service may be deployed in the future due to frequencies re-farming planned by the carriers as well

**WCDMA service is based on 3GPP2 CDMA2000 standards.

RF Parameters

Service/Band	LTE 700 MHz		ESMR800/ CELL850 MHz		PCS 1900 MHz		AWS 1700 MHz		AWS+AWS3*** 1700 MHz		WCS 2300 MHz		LTE 2500 MHz TDD	
	DL	UL	DL	UL	DL	UL	DL	UL	DL	UL	DL	UL	DL	UL
Frequency Range (MHz)	728 - 746 746 - 756	698 - 716 777 - 787	862-869/ 869-894	817-824/ 824-849	1930 - 1995	1850 - 1915	2110 - 2155	1710 - 1755	2110 - 2180	1710 - 1780	2350 - 2360	2305 - 2315	2496 - 2690	
Maximum Output Power Per Antenna Port (dBm)	15		15		20		18		20		18 (min)****		18 (min)****	
Maximum Input Power (dBm)	0 to 37		-10 to 37/ 0 to 37		0 to 37		0 to 37		0 to 37		0 to 37		0 to 37	
Typical Antenna Gain (dBi)	0		0.5		3		2.5		2.5		2.5		2.5	
Horizontal Polarization Omni @ 34-45 Degree	-2 to 0		-2 to 0		-1 to 1		-1 to 1		-1 to 1		-1 to 1		-1 to 1	
UL Gain (dB)		-19 to 15		-19 to 15		-19 to 15		-19 to 15		-19 to 15		-19 to 15		-19 to 15
Input IP3 (dBm) AGC OFF Typical		-5		-5		-5		-5		-5		-6		-6
Input IP3 (dBm) AGC ON Typical		5		5		5		5		5		5		5
SFDR* (dB)		60		64		64		60		60		60		60
Maximum Intermod	-13		-13		-13		-13		-13		-13			

Distortion [dBm]														
UL NF** (dB)		12		12		12		12		12		12		12
Gain Flatness/Ripple (dB)	±2.0		±2.0		±2.0		±2.0		±2.0		±2.0		±2.0	

* SFDR calculated with bandwidth of 1.23 MHz for the CELL and PCS and with 5 MHz for the LTE and AWS

**Typical for single remote access unit

***AWS3 supported by RAU5x models only.

****20 dBm if only one of the services is operating.

Optical

Optical Output Power < 9 dBm

Max. Optical Budget 5 dB

Back Reflectance - 60 dB

Optical Connector LC APC SM

Fiber Type Corning® SMF-28® fiber or compatible

Wavelength 1310 ± 10nm (@ 25° C)

Environmental Specifications

Operating Temperature 0°C to +50°C (32°F to 122°F)

Storage Temperature -20°C to 85°C (-4°F to 185°F)

Standards and Approvals

Laser Safety FDA/CE 21 CFR 1040.10 and 1040.11 except for deviations pursuant to laser notice no. 50 and IEC 60825-1
Class 1M (applicable to FMM/FRM)

EMC CE EN 301 489, EN55022, EN 61000
FCC 47 CFR Part 15, 22, 24, 27

Safety UL 60950
IEC 60825-1:2007
IEC 60825-2:2010
CAN/CSA-C22.2 No.60950-1-03
Fire Safety UL 2043

Component Specifications

5 Band Remote Access Unit (RAU5/RAU5x)

RAU5/RAU5x hosts the following modules:

1. RXU; Remote expansion module, for additional LTE and AWS MIMO service. One module per RAU5/RAU5x.
2. GEM; Giga bit Ethernet module – upgrade module for the RAU5/RAU5x. One module per RAU5/RAU5xGEM;



Interface Connections

Two LC APC SM fiber connectors; UL and DL
Two DC power inputs ports; main and secondary in case of PoE clients
Two QMA RF ports; for External cavity filter (In/Out) use -LTE and CELL filters
One broadband external antenna QMA connector (connected antenna must have a return loss of 12 dB)
One RJ-45 MGMT (local) connection
RXU module interface – power, digital and RF
GEM module Interface – power and digital

Antenna

Omni-Directional (15° down from horizon)

Power Consumption

For Main Power Input:

Input Range: 37-57 VDC

RAU5/RAU5x only: 44.5 V; 50 W

RAU5/RAU5x + RXU: 44.5 V; 76 W

RAU5/RAU5x + GEM: 44.5 V; 52 W

RAU5/RAU5x + RxU + GEM: 44.5 V; 78 W

For Secondary Power Input:

For 2 PoE ports of 802.3af: 46 V; 31.5 W (Input range: 43 - 57 V DC)

For 2 PoE ports of 802.3at: 52.5 V; 62 W (Input range: 52 - 57 V DC)

Management

Managed via the headend control module (HCM):

- RAU5: software v1.3 and higher
- RAU5x: software v1.9 and higher

Physical Characteristics (Enclosure and Modules)

Mounting:

Wall/ceiling (Horizontal mount)

Mounting bracket included in the installation kit

Mid-mount (acoustic ceiling) – separately ordered kit

Dimensions (H x W x D):

Without external antenna: 3.6* x 12.9 x 10.4 in (90 x 327 x 264 mm)

**3.6 in (90 mm) without standard mounting bracket; 4.4 in (111 mm) with standard mounting bracket*

With external antenna and skirt: 6.1 x 13.1 x 13.1 in (154 x 338 x 338 mm)

Weight (applies to both RAU5/RAU5x) :

RAU5x only (no external antenna or plug-in modules): 10 lbs (4.5 kg)

RAU5x and RXU and GEM only: 14.39 lbs (6.5 kg)

External Antenna: 3.7 lbs (1.7 kg)

Environment

Ambient Temperature:

Wall-mount installations: 45°C (113°F)

Ceiling-mount installations: 50°C (122°F)

Remote Expansion Unit (RxU)

Supported Services	Upgrade module supporting two services AWS MIMO and LTE 700 MIMO
Interfaces	Three pins for integration with RAU5/RAU5x(power, control and RF)



Management	Management via host RAU5/RAU5x
-------------------	-----------------------------------

Physical Characteristics	Mounting:	Plugs into RAU5/RAU5x
	Dimensions (H x W x D):	1.09 x 12.8 x 9.8 in (27.7 x 327.5 x 250 mm)
	Weight:	3.08 lbs (1.4 kg)

2300 MHz/2500 MHz Remote Expansion Unit (RxU2325)

Services	Upgrade module supporting two services 2.3 GHz WCS and 2.5 GHz (LTE) TDD bands
Interfaces	Two QMA RF ports for external LTE and CELL cavity filter connections One broadband external antenna QMA connector (connected antenna must have a return loss of 12 dB)



Management	Management via host RAU5x
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Physical Characteristics	Mounting:	Plugs into RAU5/RAU5x
	Dimensions (H x W x D):	1.09 x 12.8 x 9.8 in (27.7 x 327.5 x 250 mm)
	Weight:	3.08 lbs (1.4 kg)

Cavity Duplexer for LTE 700 MHz

LTE 700 MHz external cavity duplexer for RAU/RxU modules supporting the LTE band and which are deployed alongside units supporting the public safety service.

Frequency Range	777 MHz ~ 787 MHz
Bandwidth	10 MHz
Insertion Loss (Maximum)	1.5 dB
Passband Ripple (Maximum)	0.8 dB
Return Loss (Minimum)	18.0 dB, all ports
Rejection	55 dB Min @ DC ~ 620 MHz 40 dB Min @ 698 MHz ~ 716 MHz 35 dB Min @ 728 MHz ~ 757 MHz 30 dB Min @ 765 MHz ~ 775 MHz 30dB Min @ 793 MHz ~ 1000 MHz



25 dB Min @ 1396 MHz ~ 1432 MHz
 40 dB Min @ 1800 MHz ~ 2700 MHz

Average Power Rating	0.5W CW maximum	
In/Out Impedance	50 Ohms nominal	
Operating Temperature	-20° C to +85° C	
Environmental	RoHS compliant	
Interfaces	Two RF SMA connectors	
Physical Characteristics	Mounting:	Wall, ceiling, acoustic ceiling
	Dimensions	5.6 x 3.8 x 1.8 in
	(H x W X D):	(144 x 98 x 46 mm)

Cavity Duplexer for 800 MHz

CELL 800 MHz external cavity duplexer for RAU/RxU modules supporting the CELL band and which are deployed alongside units supporting the public safety service.



Frequency Range	817 MHz ~ 849 MHz	
Insertion Loss	1.4 dB Typical	
	1.6 dB Maximum	
Ripple	0.9 dB Typical	
	1.1 dB Maximum	
Return Loss (Minimum)	15 dB	
Rejection	55 dB Min @ DC ~ 620 MHz	
	40 dB Min @ 728 MHz ~ 757 MHz	
	30 dB Min @ 777 MHz ~ 787 MHz	
	23 dB Min @ 815 MHz	
	23 dB Min @ 851 ~ 866 MHz	
	45 dB Min @ 1000 MHz ~ 1300 MHz	
	50 dB Min @ 1800 MHz ~ 2700 MHz	

Average Power Rating	0.5W CW Max.	
In/Out Impedance	50 Ohms Nominal	
Operating Temperature	-20° C to +85° C	
Environmental	RoHS Compliant	
Interfaces	Two RF SMA connectors	
Physical Characteristics	Mounting:	Wall, ceiling, acoustic ceiling
	Dimensions	6.0 x 2.9 x 1.6 in
	(H x W X D):	(159 x 75 x 42 mm)

Gigabit Ethernet Module (GEM)

GEM –Ethernet over fiber-to-copper.

10/100/1000BASE-T Ethernet 1000BASE-X fiber.

Two 802.3 at compliant Power over Ethernet (PoE) PSE ports



Interfaces	GEM – L2 switch contains: One 1000BASE-X fiber SFP Two 10/100/1000BASE-T with 802.3at compliant Power over Ethernet (PoE+) PSE ports	
Throughput	Six Gbps forwarding rate	
Power	Installations with RAU5/RAU5x - powered via RAU secondary power input (see RAU5 power consumption specifications)	
Switching	IPv4 and IPv6 transparent MAC table 512 entries VLAN - unfiltered forwarding between ports IGMP forward to all ports, no snooping	
Physical Characteristics	Mounting:	Plug-in: RAU5/RAU5x upgrade module
	Dimensions (H x W x D):	1.28 x 3.79 x 5.95 in (32.7 x 96.3 x 151.3 mm)
	Weight:	1.1 lbs (0.5 kg)

8 Appendix D: Ordering Information

RAU5x Remotes

Part Number	Description
RAU5XUS	Remote access unit, five band remote supporting: ESMR 800/CELL 850, LTE 700, AWS+AWS3 1700 and PCS 1900
RAU5XUS-A	Remote access unit, supporting five bands and broad-band antenna. ESMR 800/CELL 850, LTE 700, AWS+AWS3 1700, and PCS 1900; With antenna assembled (P/N: RAU5US-ANT)
RAU5XUS-E	Remote access unit, supporting five bands and 2x PoE+ ports. ESMR 800/CELL 850, LTE 700, AWS+AWS3 1700, and PCS 1900
RAU5xUS-AE	Remote access unit, supporting five bands, broad-band antenna and 2x PoE+ ports. ESMR 800/CELL 850, LTE 700, AWS+AWS3 1700, and PCS 1900 Antenna assembled (P/N: RAU5US-ANT)
RAU5XUS-2325	Remote access unit supporting seven bands: LTE 700, ESMR 800/CELL 850, PCS 1900, AWS and AWS3 1700, WCS 2300 and 2500 TDD
RAU5XUS-A2325	Remote access unit supporting seven bands: LTE 700, ESMR 800/CELL 850, PCS 1900, AWS and AWS3 1700, WCS 2300, and 2500 TDD; includes assembled antenna (P/N: RAU5US-ANT)
RAU5XUS-E2325	Remote access unit with two PoE+ ports supporting seven bands: LTE 700, ESMR 800/CELL 850, PCS 1900, AWS and AWS3 1700, WCS 2300, and 2500 TDD.
RAU5XUS-AE2325	Remote access unit, with two PoE+ Ports supporting seven bands: LTE 700, ESMR 800/CELL 850, PCS 1900, AWS+AWS3 1700, WCS 2300 and 2500 TDD; includes assembled antenna (P/N: RAU5US-ANT)

RAU5 Remotes

Part Number	Description
RAU5US	Remote Access Unit, five band Remote supporting: ESMR 800/CELL 850, LTE 700, AWS 1700 and PCS 1900
RAU5US-E	Remote Access Unit, 2 PoE+ ports and five band Remote supporting: ESMR 800/CELL 850, LTE 700, AWS 1700 and PCS 1900
RAU5US-ME	Remote Access Unit, 2 PoE+ ports, five band Remote and MIMO bands supporting: ESMR 800/CELL 850, MIMO-LTE 700, MIMO-AWS 1700 and PCS 1900
RAU5US-M	Remote Access Unit, 5 band Remote and MIMO bands supporting: ESMR 800/CELL 850, MIMO-LTE 700, MIMO-AWS 1700 and PCS 1900
RAU5US-A	Remote Access Unit, five band Remote supporting: ESMR 800/CELL 850, LTE 700, AWS 1700, and PCS 1900 + Ant assembled with the RAU5 - PN:RAU5US-ANT
RAU5US-AE	Remote Access Unit, 2 PoE+ ports and five band Remote supporting: ESMR 800/CELL 850, LTE 700, AWS 1700, and PCS 1900 + Ant assembled to the RAU5 - PN:RAU5US-ANT
RAU5US-AM	Remote Access Unit, five band Remote and MIMO bands supporting: ESMR 800/CELL 850, MIMO-LTE 700, MIMO-AWS 1700, and PCS 1900 + Ant assembled to the RAU5 - PN:RAU5US-ANT
RAU5US-AME	Remote Access Unit, 2 PoE+ ports, five band Remote and MIMO bands supporting: ESMR 800/CELL 850, MIMO-LTE 700, MIMO-AWS 1700 and PCS 1900 + Ant assembled with the RAU5 - PN:RAU5US-ANT

Accessories

Part Number	Description
RAU5US-ANT	Broad-band antenna module for RAU5/RAU5x
BR-RAU5US-Wall	Remote bracket for wall mount installation; supports up to two RAU5x units back-to-back
BR-RAU5US-TOP	RAU5/RAU5x bracket for floating ceilings tile, mid-mount installation
BR-RAU5US-CAP	Cover plate for "Top ceiling" RAU5x bracket (BR-RAU5US-TOP) – for installations including RAU5/RAU5x without Corning external antenna