Corning

ONE™ Wireless Platform
User Manual

Preface Material

About This Manual

This user guide provides all the information necessary to understand the architecture and general installation procedures and requirements of Corning® ONE™ Wireless Platform.

Note: The commissioning procedure, monitoring and management capabilities and configuration options of the ONE™ Wireless Platform elements are described in a dedicated User Manual (ONE™ HCM User Manual).

Hardware

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 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 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.

N ote: 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

⚠️ WARNINGS!

- 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 4.7 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 ONE™ system 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 ONE™ devices and the associated cables.
· 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.
· 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.

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1   Introduction

1.1   About Corning ONE™

The Corning Optical Network Evolution Platform (ONE) by Corning provides a flexible in-building RF and network digital coverage solution based on a fiber optic transport backbone.

The fiber-optics infrastructure is easily deployable via a wide range of pre-terminated composite cables and advanced end-to-end equipment. Easy to design, Plug and Play™ connectors, significantly reduce installation cost and deployment time.

The Corning ONE solution is an ideal fit for large, high-rise or campus-style deployments. It generates significant CAPEX savings and OPEX savings through the use of user configurable service distribution groups and an infrastructure that is simple to deploy and efficient in usage.

Dynamic service distribution group management allows precise service distribution control to meet changing density needs, and provides further savings by enabling sharing of equipment at various levels for service providers.

Radio source agnostic, remote units can be used as network extenders. Ethernet capability with dedicated fiber link for Wi-Fi offload brings a higher level of granularity and support for devices and applications with very high speed requirements.

Corning ONE fiber-optics infrastructure allows various combinations of SISO and MIMO services to be routed from the headend to specified remote locations on each floor, according to user defined configurations (via the Web Management GUI). This allows optimizing service coverage and provides equipment savings. While the fiber-optics infrastructure is common, the services can be routed via service provider shared or dedicated equipment. By default, the system is configured to support a single service group: all services are transferred to all remote locations. This default configuration can be easily modified according to site requirements.

The following figure illustrates service distribution from the head-end to various locations on each remote floor. Each color represents a specific service, where different combinations of services are distributed at various locations on the same floor according to coverage requirements.

Figure 1-1. Illustration of Precise Service Distribution over Selected Remote Areas

1.2　Key Features and Capabilities

- Comprehensive service support - SISO/MIMO services.
- Supported services - CELL, PCS, LTE700 and AWS
- Flexible, configurable service distribution - advanced capacity and coverage management for better macro offload and enhanced user experience.
- Broadband enabled:
  - A range of ready-made fiber-optic (and power) composite cables simplify installation at all levels
  - Fiber backbone unleashes unlimited RF Spectrum
  - Easy scales to higher speeds requirements
- Ethernet Support - dedicated fiber link for Ethernet backhaul, enables optimal use and offload of Wi-Fi® resources.
- Scalable and customizable - infrastructure can be quickly expanded to support more services or increase coverage without downtime
- Carrier-grade network management:
  - Single-source, remote end-to-end field upgradable platform
  - Ready for SON, HetNet and future network requirements.

1.3　General System Specifications and Requirements

1.3.1　Supported Browsers

Corning ONE™ system Web GUI Management has been optimized to operate on the following browsers:

- Microsoft Internet Explorer v7.0 and　higher
- Mozilla Firefox v3.2 and higher
- Sun Solaris Mozilla
- Google Chrome 8.0 and higher

1.3.2　Environmental and Regulatory Specifications

1.3.2.1　Temperature and Humidity

The environmental specifications listed below are relevant to all ONE™ solution devices.

	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

1.3.2.2 Safety and Regulatory Approvals

The safety and regulatory specifications listed below are relevant to all Corning ONE™ devices.

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 (applicable for Access Unit only)

Table 1-2. Safety and Regulatory Approvals

1.3.3 Power Specifications

1.3.3.1 Power Input and Consumption

RF Head End Units	Power Input		Power Consumption for Full Chassis
HEU	AC power source:	100 to 220 V AC	Chassis with 12 RIMs and two RIX: 200 W
	DC power source:	48 V DC	
OIU	AC power source:	100 to 220 V AC	Chassis with 12 OIMs and two OIX: 300 W
	DC power source:	48 V DC	
IHU	AC power source:	100 to 220 V AC	Fully Loaded chassis: 300 W
	DC power source:	48 V DC	

Table 1-3. RF Headend Units Power Consumption

RAU + Add-On Modules	Max. Power Consumption	Power Input Range
RAU (alone)	37 V; 35 W	35 – 57 V DC
RAU + RxU	37 V; 60 W	
RAU + GEM	37 V; 39 W	
RAU + RxU + GEM	37 V; 64 W	
RAU5 + Add-On Modules	Max. Power Consumption	Power Input Range
RAU5 (alone)	44.5 V; 48 W	37 – 57 V DC
RAU5 + RxU	44.5 V; 73 W	
RAU5 + GEM	44.5 V; 52 W	
RAU5 + RxU + GEM	44.5 V; 77 W	

Table 1-4. RAU and RAU5 Power and Current Consumption for Main Power Input

Unit	Device	Input Range	Power Consumption
RAU	For two PoE ports of 802.3af	43- 57 V DC	43 V; 30 W
	For two PoE ports of 802.3at	52- 57 V DC	52 V; 62 W
RAU5	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 1-5. RAU and RAU5 Power and Current Consumption for Main Secondary Input

Digital Remote End Units	Power Input Range	Power Consumption
CEU	110 to 240 V AC	(Fully occupied) 50 W
GEM installed in RAU	See Table 1-4	See Table 1-4
GEU-S	42-57 V DC	4.5 W

Table 1-6. Digital Path Remote End Power Specifications

1.3.3.2 Cable Gauge Requirements

Table 1-7 provides the information required to calculate the required power supply for the remote units.

	RAU SISO (ft)	RAU SISO + GEM (ft)	RAU SISO + GEM Supporting PoE	RAU SISO + GEM Supporting PoE+ (ft)	RAU MIMO (ft)	RAU MIMO + GEM (no PoE) (ft)	RAU MIMO + GEM Supporting PoE (ft)	RAU MIMO + GEM Supporting PoE+ (ft)	GEU-S (ft)	GEU-S Supporting PoE (ft)	GEU-S Supporting PoE+ (ft)
22AWG	540	490	410	100	310	290	290	100	2000	310	80
20AWG	870	780	650	160	500	460	460	160	3200	500	130
16AWG	2200	1900	1600	400	1200	1100	1100	400	8200	1200	350
14AWG	3500	3100	2650	650	2010	1800	1800	650	1350	2000	550

Table 1-7. Required Cable Gauge

1.3.3.3 Power, Heat and Rack Specifications

Table 1-8 and Table 1-9 provide the power, heat and rack specifications for the headend and remote end ceiling equipment.

Headend/Telco Rms							
P/N	Description	Min-Max Voltage (VAC)	Max Power Draw (Watts)	No. of Units	Heat (BTU/hr)	Rack Space 19-in (RU)	Dimensions (in) HxWxD
HEU	Headend Unit	100 -220	200	1	680	4	7 x 17.3 x 18.9
OIU	Optical Interface Unit	100 - 220	300	1	1020	4	7 x 17.3 x 18.9
IHU	Integrated Headend Unit	100 – 220	300	1	1020	4	7 x 17.3 x 15.5
CEU	Centralized Ethernet Unit (3 x CEMs – Centralized Ethernet Modules)	110 - 240	50	1	170	1	1.75 x 17 x 8.5
ICU	Interconnect Unit (4 x 200 W PSMs)	110 - 240	930	1	442	1	1.75 x 17 x 19.2

Table 1-8. Power, Heat and Rack Specifications for Headend Equipment

Ceilings					
Unit	Description	Min-Max Voltage (VDC)	Max Power Draw (Watts)	Heat (BTU/hr)	Dimensions (in)
RAU	Remote Access Unit	37 - 57	35	119	13.1 x 13.1 x 4
RAU5	5 Band Remote Access Unit	37 - 57	48	-	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
RAU + RxU	Remote Access Unit + Remote Expansion Unit	37 - 57	60	204	13.1 x 13.1 x 4
GEM	Gigabit Ethernet Module	37 - 57	4	14	1.3 x 3.8 x 5.9
GEU-S	Gigabit Ethernet Unit - Standalone	37 - 57	4	14	5 x 10.5 x 3.3
GEM Supporting PoE	For two PoE ports of 802.3af: 43V; 30W				
	For two PoE ports of 802.3at: 52V; 62W				

Table 1-9. Power, Heat and Rack Specifications for Ceiling Equipment (Remote End)

1.3.3.4 Remote End Distance and Power Draw Matrix

Table 1-10, Table 1-11, Table 1-12 and Table 1-13 provide the distance and power draw specifications for the remote end units.

RAU 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 1-10. Remote End Distance and Power Draw for (Standalone) RAU SISO

RAU + 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 1-11. Remote End Distance and Power Draw for RAU + 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 1-12. 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 1-13. Remote End Distance and Power Draw for GEM w/PoE.3at

1.3.4   Dimensions and Weight of Units

Table 1-14, Table 1-15 and Table 1-16 describe the physical specifications of the Corning ONE™ headend and remote end units.

Unit	Dimensions (H x W x D)	Weight: lbs [kg]
HEU	7 x 17.3 x 18.95 in (177.8 x 440 x 481.7 mm)	Chassis: 37 lbs (16.8 kg) Per RIM: 1.9 lbs (0.9 kg) Per RIX: 1.54 lbs (0.7 kg) HCM: 2.2 lbs (1.0 kg) PSM: 1.98 lbs (0.9 kg)
OIU	7 x 17.3 x 18.95 in [177.8 x 440 x 481.7 mm]	Chassis: : 37 lbs (16.8 kg) Per OIM: 1.5 lb (0.7 kg) Per OIX: 1.54 lb (0.7 kg) ACM: 2.2 lb (1.0 kg) PSM: 1.98 lb (0.9 kg)
IHU	7 x 17.3 x 15.5 in [177.8 x 440 x 394 mm]	Chassis: 30 lbs (14 kg) Per RIM: 1.9 lbs (0.9 kg) Per RIX: 1.54 lbs (0.7 kg) Per OIM: 1.5 lb (0.7 kg) Per OIX: 1.54 lb (0.7 kg) ACM: 2.2 lb (1.0 kg) PSM: 1.98 lb (0.9 kg)

Table 1-14. RF Path Headend Units

Unit	Dimensions (H x W x D)	Weight: lbs [kg]
ICU	1.74 x 17 x 19.2 in (44.4 x 431.8 x 11.96 mm)	5.5 lb (2.5 kg) – without PSM
RAU (including mounting bracket)	13.1 x 13.1 x 4 in (332.7 x 332.7 x 101.6 mm)	RAU only = 7.93 lb (3.6 kg); RAU + RxU + GEM = 12.2 lb (5.5 kg)
RAU5 (including mounting bracket)	5.25 x 13.1 x 13.1 in (133.35 x 332.74 x 332.74 mm)	RAU5 only: 10 lbs (4.5 kg) RAU5 + RXU + GEM: 14.39 lbs (6.5 kg)

Table 1-15. RF Path Remote Units

Unit		Dimensions (H x W x D)	Weight: lbs [kg]
CEU:	CEU	1.71 x 17 x 8.5 in (43.65 x 431.8 x 216 mm) (with mounting ears: W = 19 in/482.8 mm)	7.55 lb (3.4 kg)
	CEM	1.41 x 3.94 x 7.68 in (36 x 100.14 x 195.14 mm)	1.44 lb (0.65 kg)
GEM		1.28 x 3.79 x 5.95 in (32.7 x 96.3 x 151.3 mm)	1.1 lb (0.5 kg)
GEU-S		5.01 x 10.51 x 3.26 in (including mounting bracket) (127.5 x 267 x 83 mm)	2.64 lb (1.2 kg)

Table 1-16. Digital Path Units

1.3.5   Optical Specifications

Parameter	Specification
Optical Output Power	< 9 dBo
Max. Optical Budget	5 dB
Optical Connector	OIM: MTP® connector RAU: LC APC SM
Fiber Type	Corning® SMF-28® or Compatible
Wavelength	1310±10 nm (Standard)

Table 1-17. Optical Specifications

1.3.6   System Architecture and Topologies

The Corning ONE™ solution fiber-optic infrastructure is used to transmit both RF and digital services:

- RF services – Broadband RF distribution over fiber-optics infrastructure transfers converged wireless services from the headend towards Remote Access Units (RAU) deployed at the remote end locations according to user defined configuration.
- Digital services – fiber-optics infrastructure transfers digital services from the corporate LAN to Gigabyte Ethernet Modules (GEM) and then 3rd party equipment deployed on each floor.
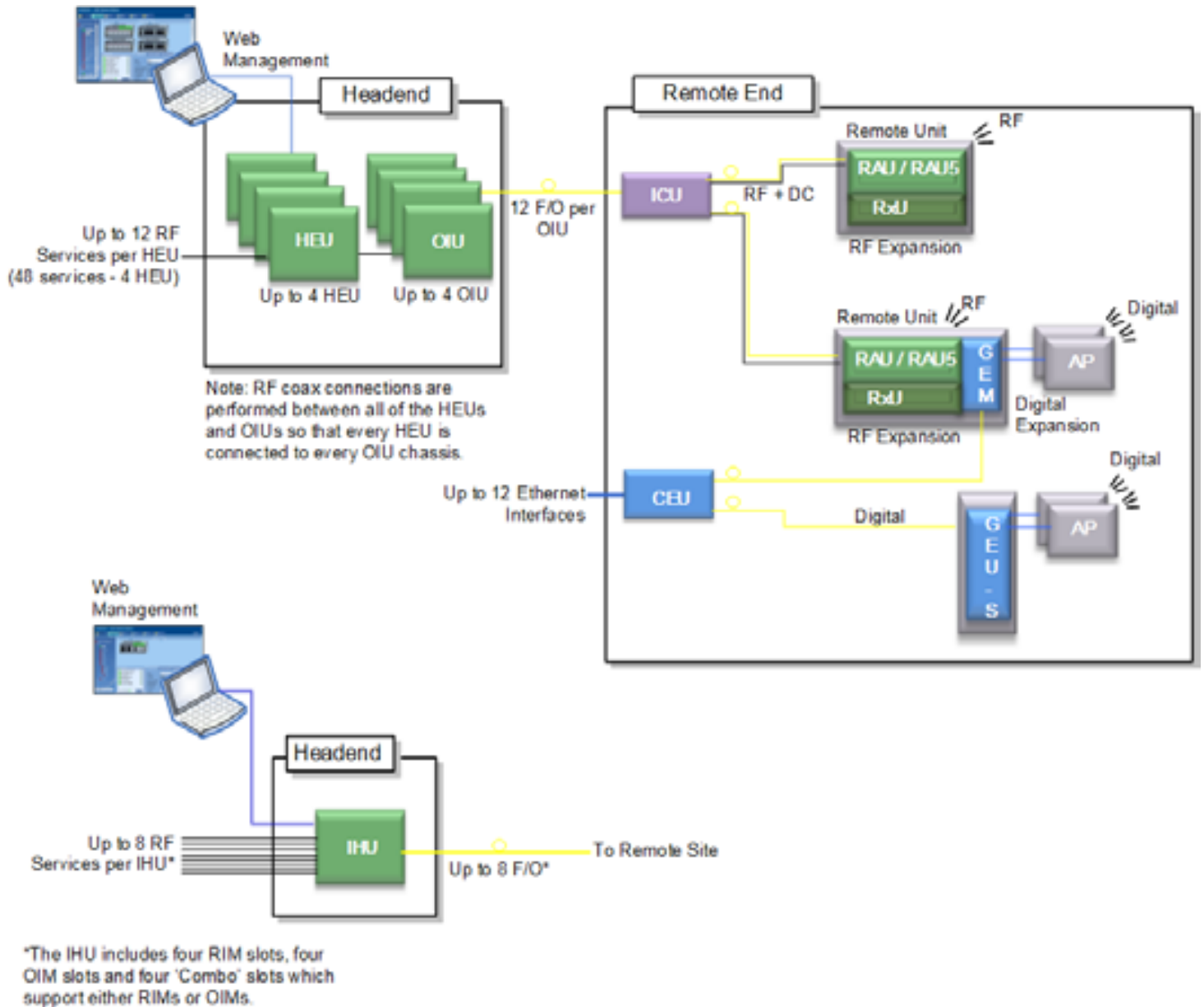
Figure 1-2. Corning ONE™ Solution Basic Architecture

Acronyms	
HEU = Headend Unit	GEU-S = Gigabit Ethernet Unit-Standalone
RIM = Radio Interface Module	ICU = Interconnect Unit Unit
RAU = Remote Access Unit	IHU = Integrated Headend Unit
RxU = Remote Expansion Unit	CEU = Centralized Ethernet Unit
GEM = Gigabit Ethernet Module	OIU = Optical Interface Unit
RIM = Radio Interface Module	OIM = Optical Interface Module

Table 1-18. Acronyms in System Architecture

1.3.6.1   RF Path

At the headend, RF signals from the RF signal sources (e.g. BTS/BDA) are conditioned by service specific (conditioner) modules in the HEU (Headend Unit) and organized into (up to three) user configurable sectors. The conditioned RF signals are converted to optic signals by the (wideband) OIU (Optic Interface Unit) and specific sectors are routed towards selected remote locations according to user defined configurations.

The optic fibers at the OIU are routed to the ICU (Integrated Centralized Unit) at the remote end. From the ICU the optic fibers are distributed along with DC to the Remote Access Units (RAU).

For small/medium size deployments an IHU (Integrated Headend Unit) can be installed at the headend. The IHU is a compact headend unit that interfaces up to eight RF sources, conditions the signals and performs the RF to optic conversion of the signals which are then routed towards the remote site.

Note: A fully occupied OIU (12 OIMs) supports up to 36 RAUs; Each IHU can support up to eight OIMs (with four RIMs) supporting up to 24 RAUs.

Figure 1-3. ONE™ Solution RF Path Architecture

1.3.6.2   Digital Path

The Digital 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 (Gigabit Ethernet Modules) modules and distributed to two third party equipment such as Access Points, Ethernet switch, etc.

Note: GEMs can be connected to the CEU either directly, or via an ICU (described in section 1.3.6.1). In that case, the ICU can also provide DC to the GEMs.

Figure 1-4. Corning ONE™ Solution Digital Path Architecture

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1.4 Corning ONE™ WEB Management Application

The Corning ONE™ solution consisting of the HEU and its hosted elements is managed via a WEB session to the HEU. The GUI based WEB management application provides all the required configuration, management and monitoring options for the Corning ONE system. The ONE Web management application consists of the Main Menu bar, where the displayed side-bar and work area options vary according to the selected menu option.

Note: Refer to the ONE HCM User Manual for a complete description of the Web Management application.

Figure 1-5. Main Window (Config Tab - Default Display)

The Main Menu Bar includes the following tabs:

Tab	Description
Monitor	N/A
Management	Displayed upon login by default. Displays general module information and device alarms and provides the configuration options for the available selected site devices. A general overview is given in section 1.4.1.
Events	Displays the events that occurred on the monitored devices and enables generating reports. Configuration changes that are initiated by the network manager are not considered events display. See Events Display section.
Config	Set-up tool used for initial system set-up, commissioning of system devices and adjustment procedure.
Admin	Provides administration options such as firmware upgrade, user management options and IP settings required for receiving traps.
Help	Provides access to Online Help

Table 1-19. Main Menu Tabs

1.4.1   Overall Device Display - Management Tab

The Management window is displayed by default upon login and includes the following for each selected element:

· Network Topology Tree - hierarchically displays the connected and available site devices and their status.
· Device Management Tabs - device specific which include the configurable parameters (e.g. service control, RF parameters) and general information (e.g. device name, Firmware version)
· Device View - visualization of device, with LEDs corresponding to the device status. Device view can be used for fault sourcing at a glance.
· Alarms - displays the device alarms for fault sourcing and provides alarm masking options

Note the following:

· The device selected in the Network Topology Tree appears green in the Device View Mode area
· Point to module in Device View to display property info

Figure 1-6. Management Tab

1.5 User Controlled Service Group Distribution

ONE™ fiber-optics infrastructure allows various combinations of SISO and MIMO services to be routed from the headend to specified remote locations on each floor, according to user defined configurations. This allows optimizing service coverage and provides equipment savings. While the fiber-optics infrastructure is common, the services can be routed via service provider shared or dedicated equipment. By default, the system is configured to support a single service group: all services are transferred to all remote locations. This default configuration can be easily modified according to site requirements.

The following figure illustrates service distribution from the head-end to various locations on each remote floor. Each color represents a specific service, where different combinations of services are distributed at various locations on the same floor according to coverage requirements.

Figure 1-7. Illustration of Service Group Distribution

1.5.1   MIMO Configurations

MIMO topologies provide more density by using two independent RF paths for the same service, where the independent paths are implemented by dedicated modules along the path.

MIMO configuration is implemented by routing the two RF bands over dedicated RF paths at both the entry point (in the Headend Unit) and at the exit point (at the Remote Unit). Note that the Optical Interface Unit is wideband and the services are combined in a single OIM for routing to the same Remote End Unit. At the Remote End Unit, the services are distributed by two dedicated modules.

Note: MIMO configuration can also be implemented by two separate Remote End Units.
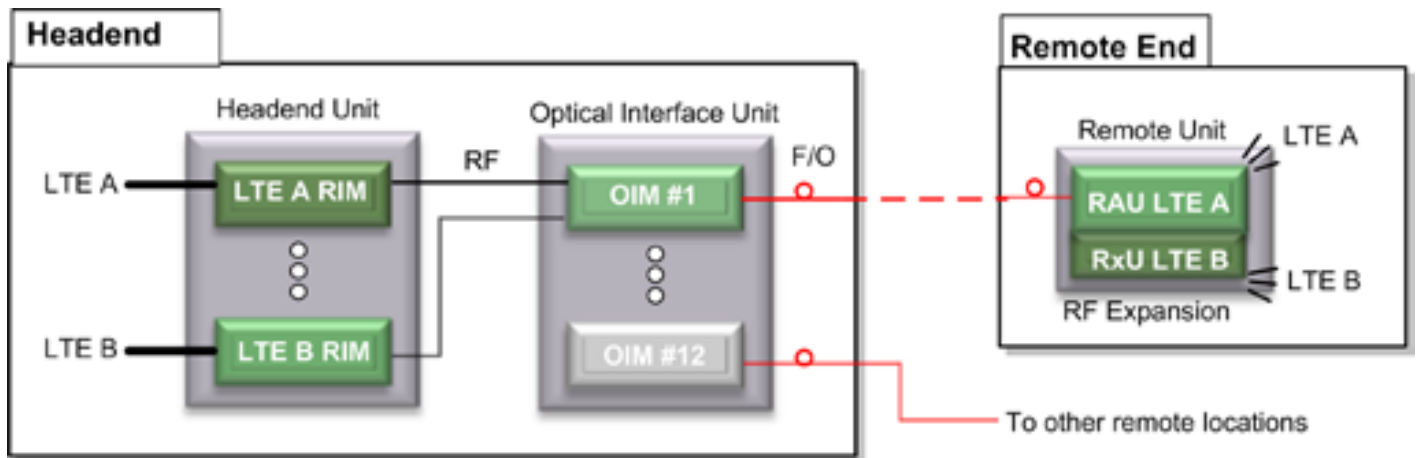
Figure 1-8. Example of MIMO Configuration

1.5.2   Single Service Group Example

In this example, all four services (A,B,C,D) are routed to all (up to 72) remote locations. In the illustrated topology, a single HEU conditions the services and feeds them to two OIU systems for conversion to optic signals. Each OIU supports up to 36 RAU (Remote Access Units).
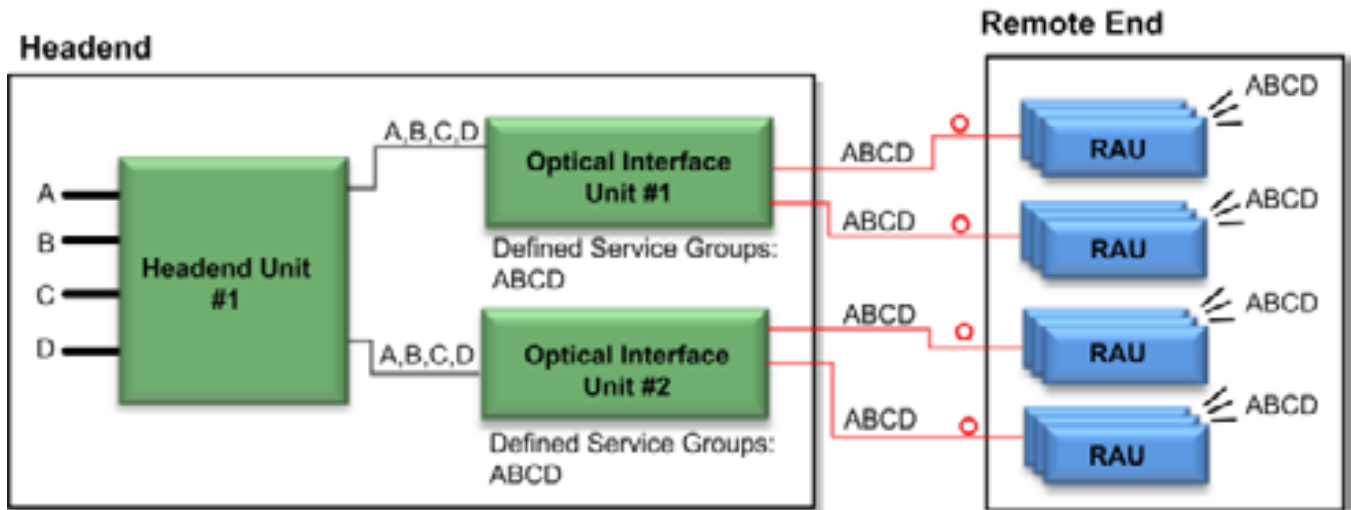
Figure 1-9. Single Service Group Configuration

1.5.3   Dual Service Group Example

In this example, two service groups are defined: A,B,C and C,D. Note that a service can be allocated to any of the service groups at the same time. For example, service C is allocated to both service groups. Both service groups are routed to the OIU for optic conversion. Each OIU module (OIM) can be configured to support either one or (if they do not have a common band) to both service groups and the corresponding services are routed from the OIM to its hosted RAU units.

NOTE: In the example below, band C is common to both Service groups #1 and #2; therefore, an OIM cannot be assigned both service groups (i.e. ABC + CD).
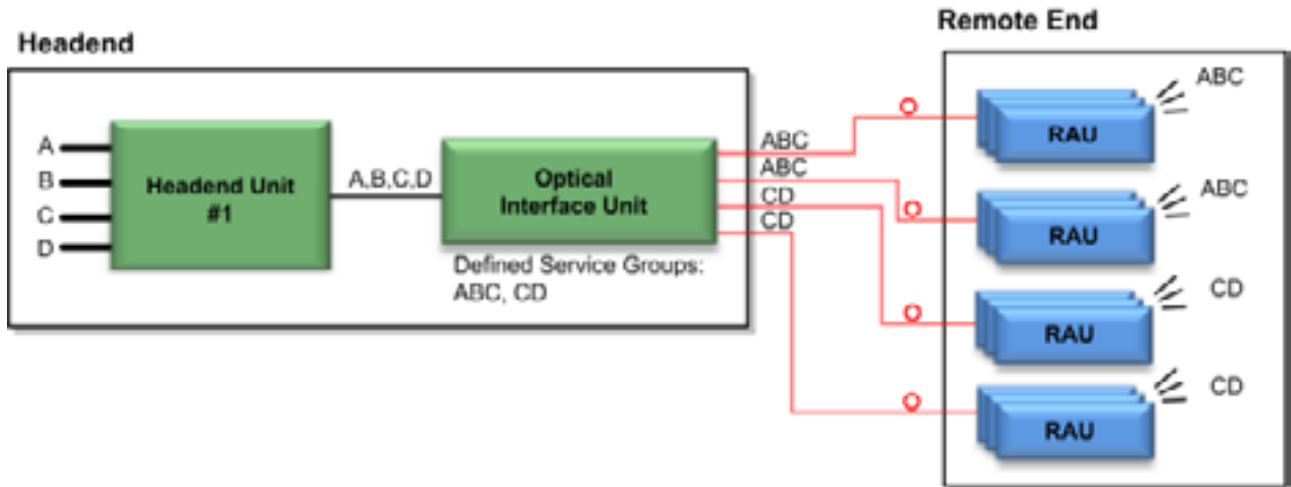
Figure 1-10. Example of Dual Service Group Configuration

1.5.4   Tri Service Group Example

In this example, three service groups are defined: ABC, AB, CD. Note that a service can be allocated to any of the service groups at the same time. For example, services C and B are allocated to two of the service groups. The services are routed to the OIU for optic conversion. Each Optical Interface Module (OIM) can be configured to be included in either one, two or three service groups in any combination and the corresponding services are routed from the OIM to its hosted RAU units.

Note: An OIM cannot support two service groups that have a common band (e.g. ABC and BC, or ABC and CD).
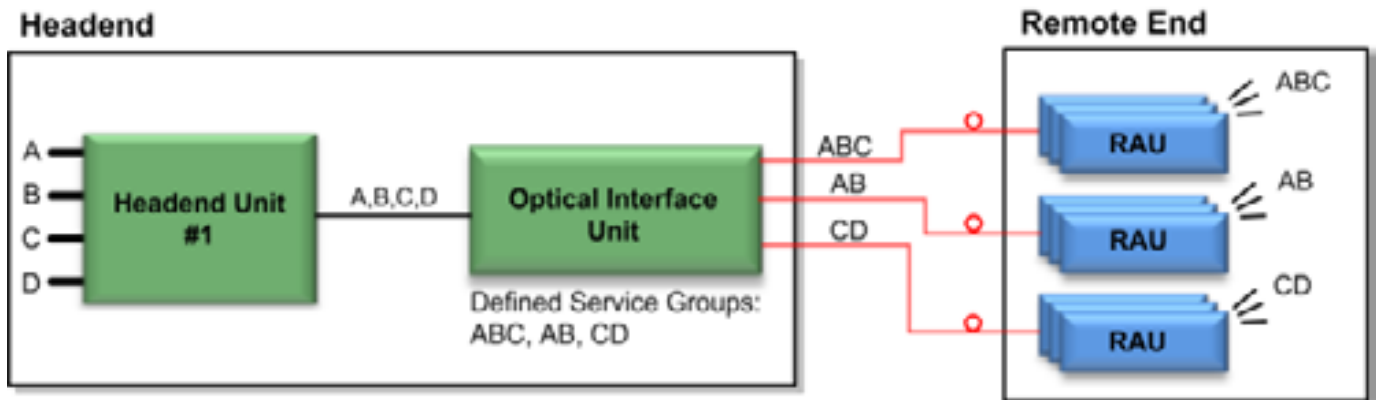
Figure 1-11. Example of Three Service Group Configuration

1.5.5   Tri Service Group Example with Two HEUs

This tri-service group example supports two HEUs. In this topology, the services routed via the two HEUs can be grouped in any combination between the two, providing up to three service groups. These groups of services are all routed towards a common OIU. Each OIU module (OIM) can be configured to support any (legal) combination of service groups and the corresponding services are routed from the OIM to its hosted RAU units.

Note: Multiple service groups allocated to the same OIM cannot share any identical frequency bands.
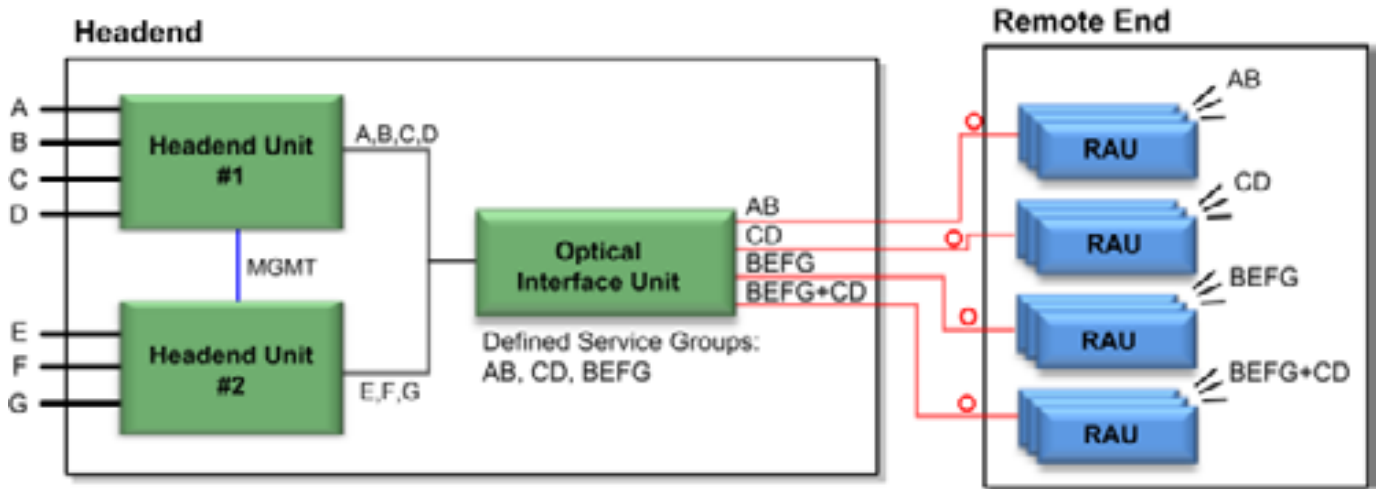
Figure 1-12. Example of Tri-Service Group Configuration with Two HEUs

2   Unit Descriptions - RF Path

This chapter provides detailed descriptions of the Corning ONE™ solution components. The descriptions are organized according to RF and Digital path headend and remote end components. This includes port and LED interface descriptions.

2.1   RF Path - Headend Components

Corning ONE RF Path coverage solution includes the following headend elements:

· HEU – Headend Unit
· OIU – Optical Interface Unit
· IHU – Integrated Headend Unit (IHU performs both HEU and OIU functions)
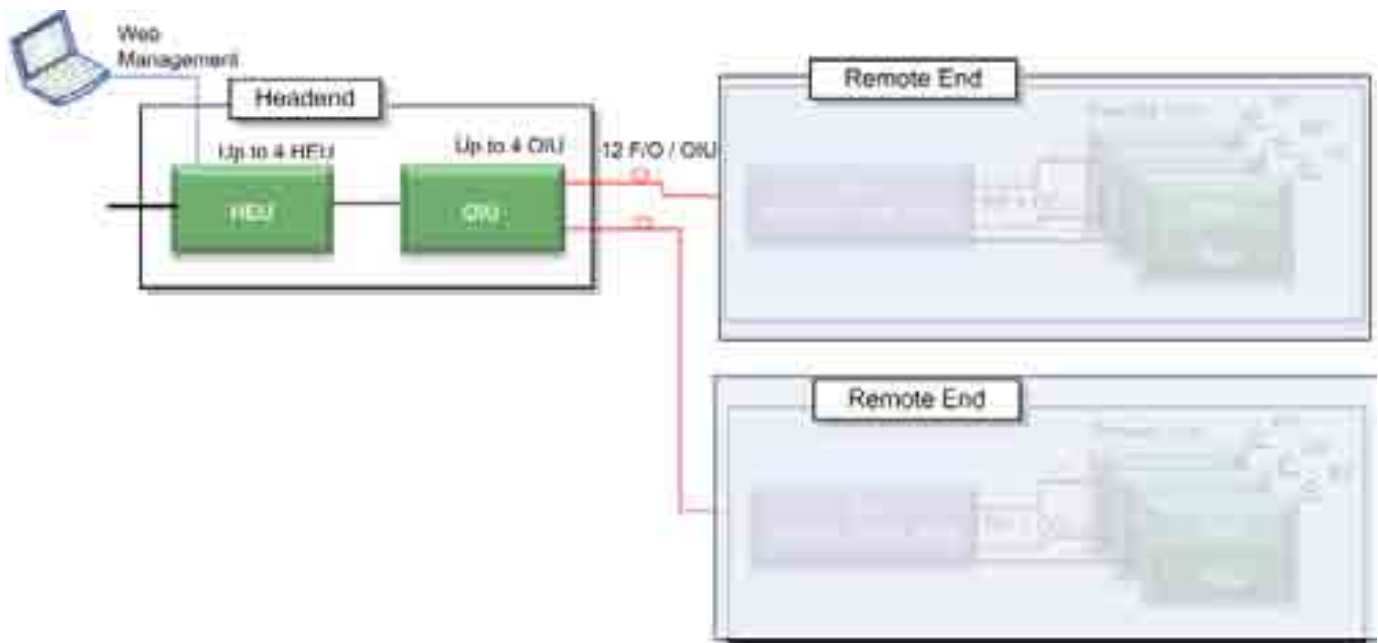
Figure 2-1. RF Path with HEU and OIU Headend Components
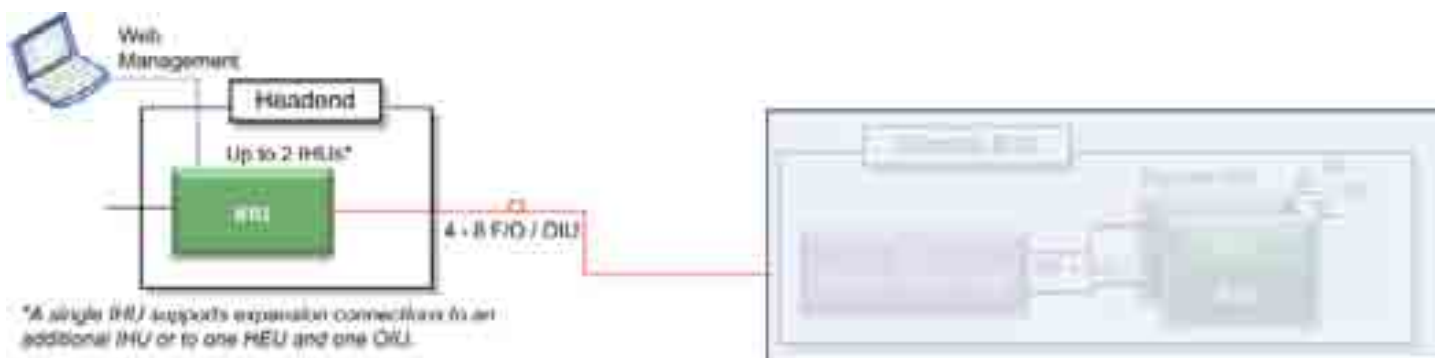
Figure 2-2. RF Path with IHU Headend Component

2.1.1   HEU (Headend Unit)

The HEU performs the following main functions:

· Conditions (up to 12) RF sources to a level required for feeding to the Optical Interface Unit (OIM).
· Enables the configuration of up to three sectors consisting of groups of RF services.
· Main HEU – includes HCM module enabling single source control and management of the ONE™ solution RF path
· Auxiliary HEU – includes ACM modules and is managed via the HCM in the Main HEU

Note: Only one HEU per system can be installed with an HCM module and serves as the "Main HEU". Any additional HEU chassis are installed with ACM modules and are considered "Auxiliary HEUs".

Each HEU supports up to 12 services. For additional services or density, two or more HEU units can be cascaded so that the Auxiliary HEUs are managed from the Main HEU (via the HCM). For HEU installation procedure, see section 5.1.1.
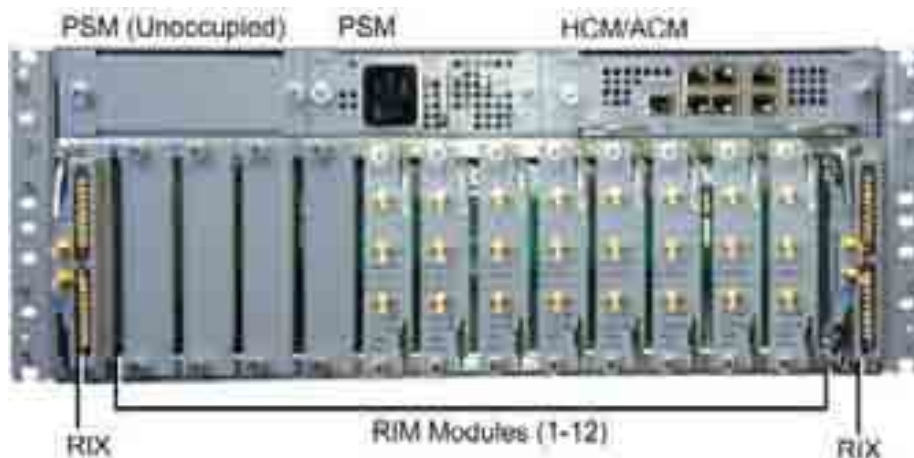
Figure 2-3. HEU Front Panel with Installed Modules

HEU hosts the following modules:

Module	Description
HCM (Headend Control Module)	Provides overall system management and control functions. The HEU in which the HCM is installed serves as the Main HEU. See section 2.1.1.1.
ACM (Auxiliary Control Module)	Provides interfaces for management of domestic modules via HCM; Installed in HEUs' in configurations with more than one HEU; HEU chassis with ACM modules are considered Auxiliary HEUs. See section 2.1.1.2.
RIM (RF Interface Module)	RF source conditioner; Provides the service specific RF interface to the RF source; Up to 12 RIMs can be hosted by the HEU; See section 2.1.1.3.
RIX (RF Expander Module)	HEU to OIU interface module; See section 2.1.1.4.
ETM (Expander Termination Module)	For configurations with one RIX an ETM is required for terminating the unused Expander slot. See section 2.1.1.5.
PSM (Power Supply Modules)	PSM-AC:100 - 240 V AC

Module	Description
	PSM-DC: 48 V DC Note: If two are installed, both must be powered on. See sections 2.1.1.7. (PSM-AC) and 2.1.1.8 (PSM-DC).

Table 2-1. HEU Modules

2.1.1.1   HCM (Headend Control Module)

Overall system management and control capabilities are performed via the HCM, which is installed in an HEU or IHU chassis (one HCM per system installation). The headend unit hosting the HCM module serves as the Main headend unit (any additional HEU/IHU chassis is installed with an ACM).

The HCM directly interfaces to the corporate LAN and to up to four ACM modules installed in additional HEU/IHU/OIU chassis (see section 2.1.2). The HCM includes Local and LAN management ports and LED status indicators.

Figure 2-4. HCM Module

Table 2-2 and Table 2-3 provide a description of the HCM ports and LED status indicators.

Port	Description
INTERNAL (TO ACM)	Four RJ45, 100Mb Ethernet ports - used for management of connected OIU systems (and/or HEU Slaves).
LAN	RJ-45, 1Gb Ethernet port - connects to the corporate LAN for remote management
LOCAL	RJ-45, 1Gb Ethernet port - local configuration and management
CONSOLE	RJ-45, serial port - local configuration for service personnel
SD Card Slot	Supports uSD cards up to 32 GB (used for saving and importing configuration files between different HEU chassis)

Table 2-2. HCM Ports

LED	Description
PWR	Steady Green - Power input detected by HCM Off – No power is supplied to the unit
RUN	Blinking Green – HCM Boot up sequence complete and module SW up and running Off – No power supplied to the unit
SYS	Steady Green – Overall status of the managed system is ok
FAN	Steady Green – Normal operation status for all fans Red – Fault indicated in at least one fan

Table 2-3. HCM LED Description

2.1.1.2   ACM (Auxiliary Control Module)

The ACM is installed in any additional HEU/IHU* chassis in installations with more than one HEU/IHU (one HEU is installed with the HCM).

The ACM provides the interfaces for remote management and control capabilities of the host chassis and connected modules via a local connection to the HCM (see section 2.1.1.1).

*Note: The ACM is also installed in each OIU chassis.

Figure 2-5. ACM Module

Table 2-4 and Table 2-5 provide a description of the ACM ports and LED status indicators.

Port	Description
INTERNAL (TO HCM)	Four RJ45, 100Mb Ethernet ports used for OIU and/or HEU slave management connections
Console	One RJ45, serial port used for basic IP configuration and local connection for service personnel

Table 2-4. ACM Ports Description

LED	Description
PWR	Steady Green - Power input detected by ACM Off – No power is supplied to the unit
RUN	Blinking Green – ACM Boot up sequence complete and module SW up and running Off – No power supplied to the unit
SYS	Steady Green – Overall status of the managed system is ok
FAN	Steady Green – Normal operation status for all fans Red – Fault indicated in at least one fan

Table 2-5. ACM LED Indicators Description

2.1.1.3 RIM/RIM-M (RF Interface Module)

The RIM/RIM-M module is a service specific RF conditioning module (up to 12 are installed in an HEU chassis) which interfaces to the RF signal source. Each RIM supports both Simplex and Duplex RF connectors. LEDs provide status indications on signal level and module operation.

Note: RIM-M modules support MIMO services (e.g.700 MHz LTE, AWS).

Figure 2-6. RIM Module

Table 2-6 and Table 2-7 provide a description of the RIM ports and LED status indicators.

Port	Description
DL/UL	UL and DL simplex connections to the RF signal source
DUP	Duplexed UL and DL connection to the RF signal source

Table 2-6. RIM Ports Description

LED	Description
Protect	N/A
DL High	Provides indication on DL RF level in conditioner module: Off - DL RF input level in threshold range Steady Red – Signal is 3 dB above max. expected power
DL Low	Provides indication on DL RF level in conditioner module: Off - DL RF input level in threshold range Steady Red – No signal or 15 dB below max. expected power
RUN	Blinking Green - Power on and module SW has initialized and is up and running Off - No power
PWR	On - Input power is within required range

Table 2-7. RIM LED Descriptions

RIX (RF Expander Module)

The RIX Expander module provides the RF interface to the OIU unit. Up to two RIX Expander modules are installed in each HEU chassis, providing support for up to four OIU (via OIU Expander modules - OIX).

IMPORTANT! An unoccupied Expander slot must be terminated with an (Expander Termination Module)

Note: The RIX and OIX Expander modules are similar in appearance but are NOT INTERCHANGEABLE. Each Expander module is indicated as RIX or OIX on the bottom of the module.
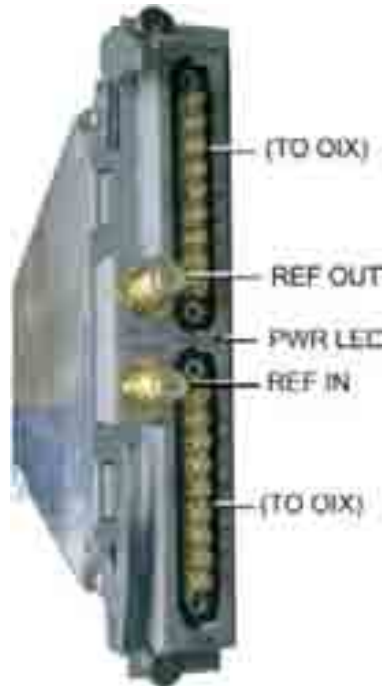
Figure 2-7. RIX Expander Module Interfaces

Port	Description
(TO OIX)	Two 9 – pin connectors which serve as the RF interfaces to the OIX (in the OIU). RIX supports connections to two OIXs via an Expander cable (ERFC).
REF OUT/REF IN	Two QMA connectors used for reference clock signal connections between RIX modules. Note: The reference clock passes from the Main HEU to all Auxiliary chassis.

Table 2-8. RIX Ports Description

2.1.1.4 ETM (Expander Termination Module)

The ETM is required for HEU/OIU units in which only one corresponding RIX/OIX module is installed. The unoccupied RIX/OIX slot must be terminated with an ETM.

Figure 2-8. Expander Termination Module

2.1.1.5 PSM (Power Supply Module)

Two types of Power Supply Modules are available:

· PSM-AC: 100 – 240 VAC;
· PSM-DC: 48 V DC; 9 A Max.

Note: The power rating for both PSM types is 300 W.

· Each headend unit chassis (i.e. HEU/OIU/IHU) can support two PSM modules, where the second PSM provides redundancy in case one of the supplies fails.
· Both types of PSM modules (AC and DC) can be installed in the same chassis.
· If two modules are installed, both must be connected to their respective power source (AC or DC) and turned on at all times.

2.1.1.6 PSM-AC (Power Supply Module-AC Power Source)

The PSM-AC includes an AC power connector, on/off switch and Power Status LED. See Figure 2-9.

Figure 2-9. PSM-AC Power Supply Module

2.1.1.7 PSM-DC (Power Supply Module-DC Power Source)

The PSM-DC power source rating is 48 V DC; 9 A Max.; 300 W. The PSM-DC includes a six pin terminal block connector, supporting up to three DC wire pairs.

Figure 2-10. DC Power Supply Module

2.1.2   OIU (Optical Interface Unit)

The OIU interfaces to the HEU/IHU, performs the RF to optic conversion of the received signal and distributes the wireless RF services to the RAU units over the fiber optic infrastructure to the remote site. Each OIU supports up to 12 SM optic fibers (one fiber per OIM), which are routed to up to 36 RAU (three Remote Access Units per OIM).

OIU hosts the following modules:

·   ACM - Auxiliary Control Unit; provides interfaces for management of OIU modules via HCM (see section 2.1.2.1)
·   OIM- Optical Interface Modules; converts the RF to three Optical links (see section 2.1.2.2)
·   OIX- Optical Interface Expander; OIU to HEU interface Module (see section 2.1.2.3)

Note: For configurations with one OIX an ETM (Expander termination module) is required for terminating the unoccupied OIX slot. See section 2.1.1.5.

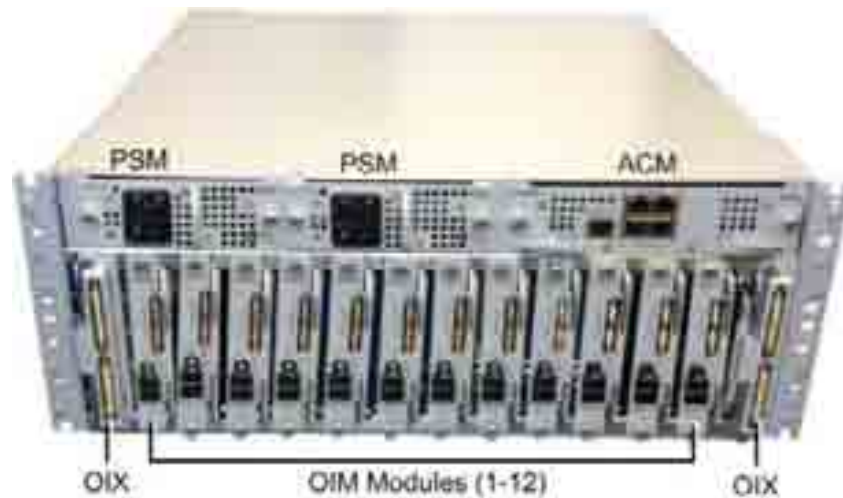·   PSM (AC/DC) - Power Supply Module; powers the unit (see section 2.1.1.6)

Figure 2-11. OIU Front Panel with Installed Modules

Draft

2.1.2.1   ACM (Auxiliary Control Module)

See section 2.1.1.2.

2.1.2.2   OIM (Optical Interface Module)

The OIM is a wideband RF to F/O (and vice-versa) media conversion module. Up to 12 OIM units can be installed in each OIU, where each OIM can support up to three Remote Access Unit (RAU) connections.

Figure 2-12. Optical Interface Module

Port	Description
OPTICAL LINK	Female MTP® Connector for optical interface connection; SMF
1:1 INTERFACE	Six Kenpole connector for 1:1 direct signal transportation, three UL and three for DL Enables (DL and UL) broad band connection to each optical link

Table 2-9. OIM Ports Description

LED	Description
Link 1-3	Steady Green - optical link power to/from the connected remote is normal Blinking Green - optical power from remote is lower than required
RUN	Blinking Green – OIM module SW has initialized and is up and running Off – Power off
PWR	Steady Green – Input power detected in OIM

Table 2-10. OIM LED Descriptions

2.1.2.3 OIX (Optical Expander Module)

Each OIX Expander module provides the RF interface to up to two HEU units via two 9-pin connectors. Two OIX Expander modules are installed in each OIU chassis. Up to four OIU units can be hosted by an HEU.

Note: The OIU Expander Modules are similar in appearance to the HEU Expander modules but are NOT INTERCHANGEABLE. Each Expander module is indicated as RIX or OIX on the bottom of the module.
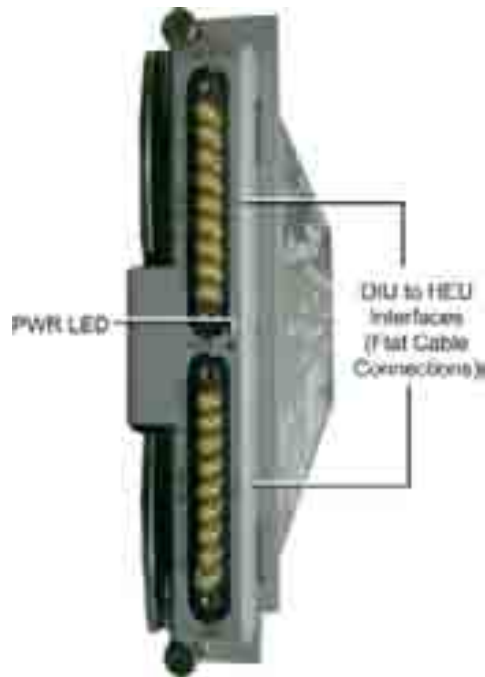

Figure 2-13. OIX Expander Module Interfaces

2.1.3 IHU (Integrated Headend Unit)

The IHU combines both HEU and OIU functionality in a single compact chassis. The IHU interfaces to the RF sources (via RIM modules), conditions the signals, performs the RF to optic conversion of the received signal and distributes the wireless RF services to the RAU units over the fiber optic infrastructure to the remote site.
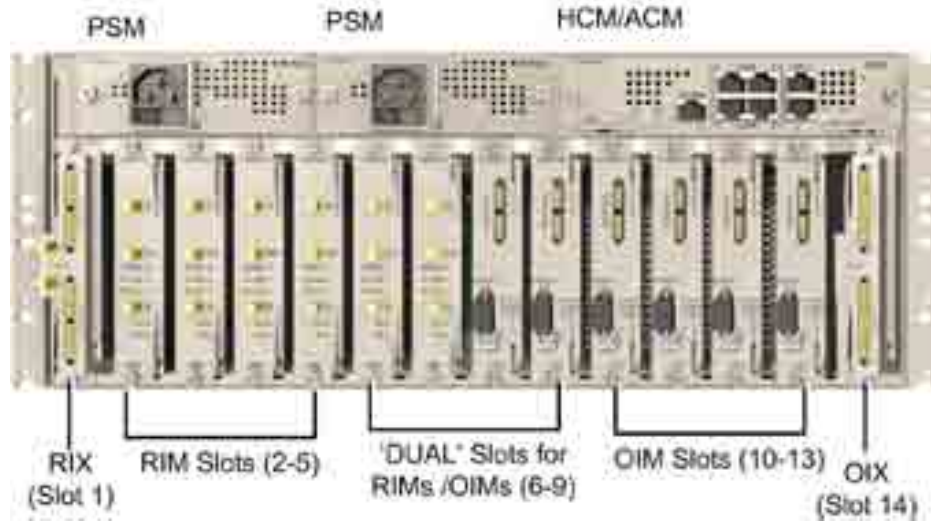

Figure 2-14. IHU Front Panel with Installed Modules

Note: The IHU also includes a pre-assembled Cable management Tray with routed ERFC cable (not shown in Figure 2-14) used for connecting the RIX and OIX modules.

IHU hosts the following modules:

1. HCM- Headend Control Module; overall system management module (see section 2.1.1.1)
2. ACM – Auxiliary Control Module; provides interfaces for management of domestic modules via HCM (see section 2.1.1.2); installed in IHUs in configurations with more than one IHU
3. RIM - Radio Interface Module; RF source conditioner (see section 2.1.1.3); Up to four RIMs in Slots 2-5 (marked in RED); Up to four additional RIMs in 'Combo' Slots 6 – 9 (marked in WHITE)
4. RIX - Radio Interface Expander; RF to optic interface module (see section2.1.1.4); One RIX is installed in the IHU - Slot 1' RIX installed in IHU supports expansion connections to one additional IHU or HEU.
5. OIM – Optical Interface Modules; converts the RF to three Optical links (see section 2.1.2.2); Up to four OIMs in Slots 10 – 13 (marked in BLUE); Up to four additional OIMs in 'DUAL' Slots 6 – 9 (marked in WHITE)

   Note: Each IHU supports up to 8 SM optic fibers (one fiber per OIM), which are routed to up to 24 RAU (three Remote Access Units per OIM).

6. OIX - Optical Interface Expander; RF to optic interface Module (see section 2.1.2.3); One OIX is installed in the IHU - Slot 14; OIX installed in IHU supports expansion connections to one additional IHU or OIUU.
7. PSM- Power Supply Module; AC or DC power supply (see section 2.1.1.6).

2.2   RF Path Remote End Site Components

The RF coverage solution remote end components comprise the following elements:

· ICU (Interconnect Unit) - forwards optics along with DC to the RAU and its sub-modules.

· RAU (Remote Access Unit) - provides RF distribution and includes internal antennas. It can also encase data distribution module (GEM).

· RxU (Remote Expansion Unit) - installed in the RAU. Provides support for two additional RF services for a total of 6 services per RAU.
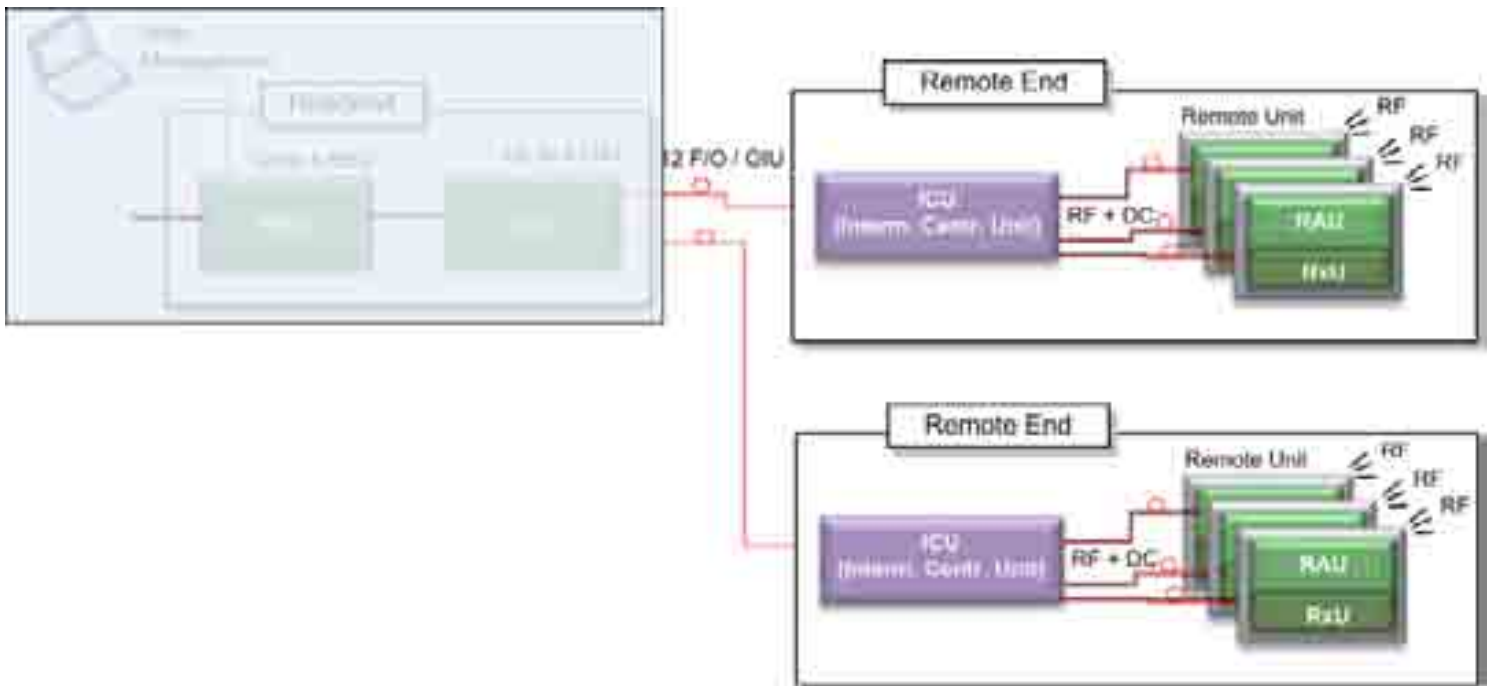

Figure 2-15. RF Path Remote End Components

A detailed description of the remote end components is provided in the following sections

2.2.1   ICU (Interconnect Unit)

Note: The ICU unit is common for the RF and Digital path components.

The ICU is installed at the floor level. It provides the LC APC optical interface along with DC power to the RAU RF (and data) sub-modules. The optical and DC signals are routed via a composite cable connected between the ICU and hosted RAU modules. The optics signal is provided via one or two dedicated Edge® modules that convert MTP optic interfaces to LC/APC interface; the DC power is provided by up to four dedicated power supplies. A single power connection feeds all ICU power supply modules.

Note: Pretium EDGE® Module – MTP® to LC APC splice module/cassette/field-term cassette
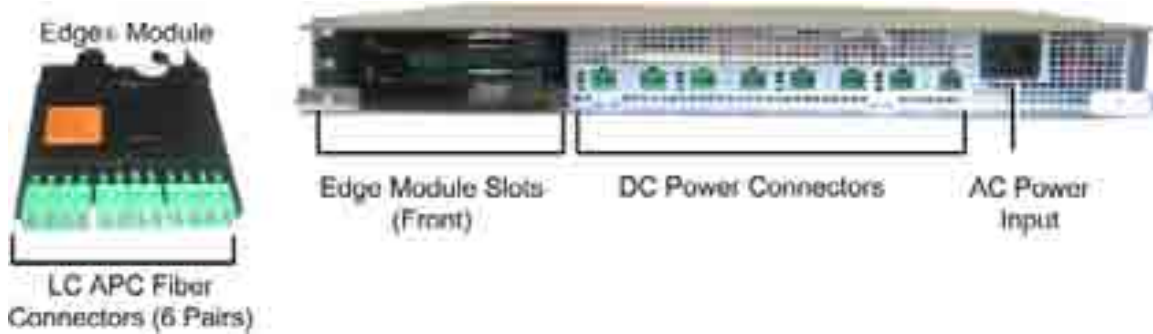
Figure 2-16. ICU Front Panel Interfaces and Modules

Chassis/Module	Interface	Description
ICU Chassis	Power Connectors	Up to eight DC power connectors, depending on number of power supply modules installed.
PSM	AC Power Input	110-240 V AC power input to unit
Edge® Module	LC APC SM MTP® SM fiber port	Optic connectors implemented by up to two Edge® modules inserted from the rear: six connectors per Edge® module.
Edge® Splice Cassette	LC APC to a (twelve x 250µm single fiber) pigtail	
Edge® Field-Term Cassette	LC APC to LC APC	

Table 2-11. ICU Front Panel Interface Descriptions

Edge® modules and power supplies are extracted and inserted from the rear of the unit.
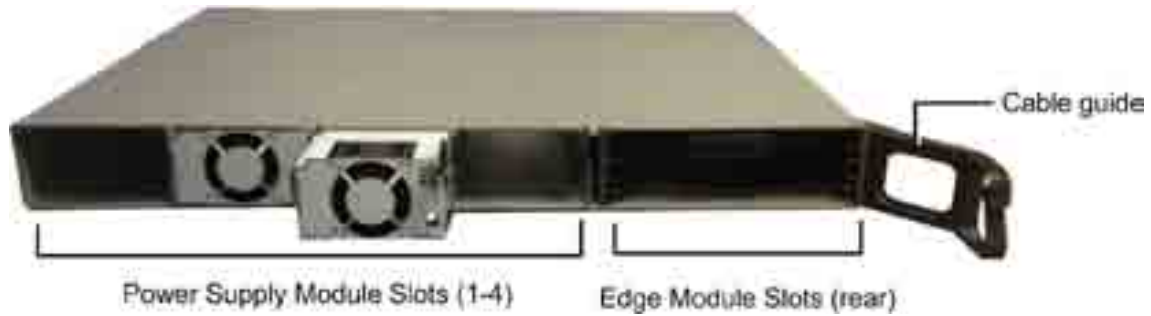
Figure 2-17. ICU Rear Panel Interfaces and PSM Modules

2.2.2   RAU (Remote Access Unit)

The RAU distributes up to four RF services via internal antennas (external antennas are optional). The RF services are received over optic cables and converted for distribution over internal (or optionally, external) antennas.
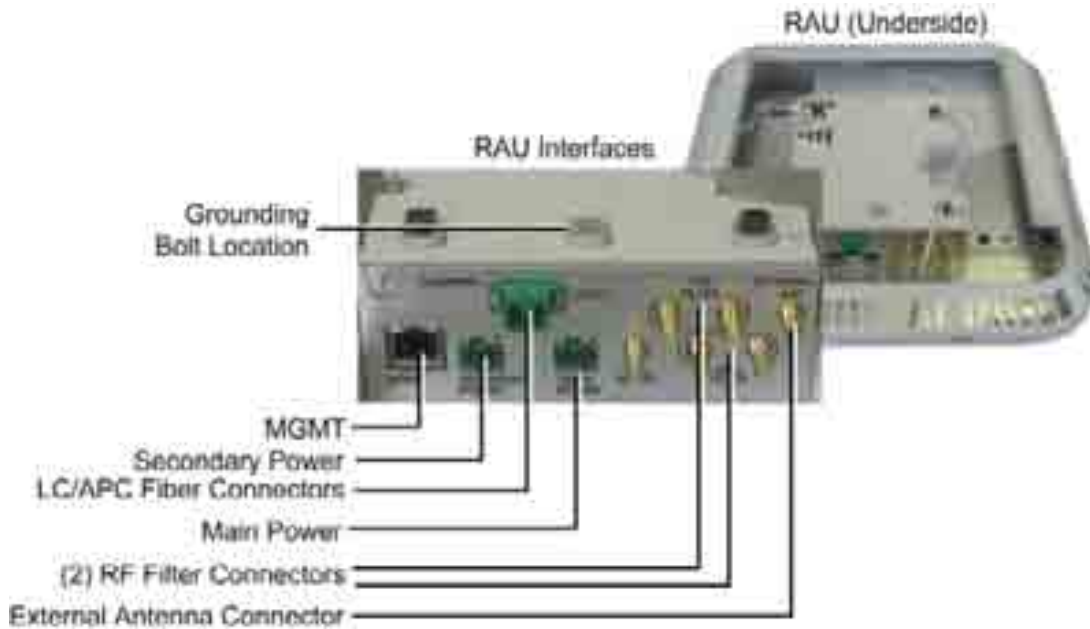
Figure 2-18. RAU Module Interfaces

Note: The RAU enclosure 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.

Interface	Description
MGMT	RJ-45 local management connection
PWR	DC power inputs Main - connect to DC (from composite cable) Secondary – in case of PoE clients. Used when GEM modules are installed (in addition to Main)
F/O	LC APC SM connectors for UL and DL optic connections

Interface	Description
Listening Mode	N/A
RF Filter (e.g. LTE, CELL)	QMA RF ports for external cavity filter use (In/Out). For CELL and LTE filters.
External Antenna	Optional connection to broadband external antennas. Antenna must have a return loss of 12dB. Requires GUI configuration (internal antenna is enabled by default).
Grounding Bolt Location	Use the 8-32X3/8 bolt (supplied with RAU) to connect RAU to earth ground

Table 2-12. RAU Interfaces

The RAU status LEDs are located on the top left (see Figure 2-19).
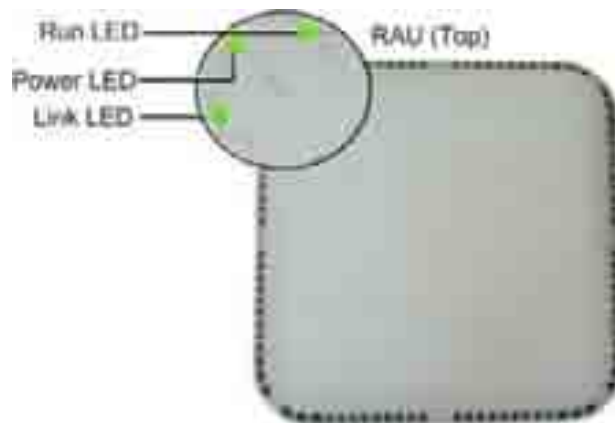
Figure 2-19. RAU LEDs

LED	Description
RUN	Blinking Green Blinking – RAU Initializing
	Steady Green – RAU boot up sequence complete and module SW up and running
	Off – No power supplied to unit
POWER	Steady Green - Power input detected by RAU
	Off - No power supplied to RAU
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 is detected

Table 2-13. RAU Status LEDs Description

2.2.3　RAU5 (5 Band Remote Access Unit)

RAU5 is a multi-service remote that distributes up to five RF services. The RF services are received over optic cables and converted for distribution over external vertical, directional or omni-directional antennas via external QMA antenna ports.

Note: Specific RAU5 models are available with provided external antenna enclosure.

Figure 2-20. RAU5 Interfaces
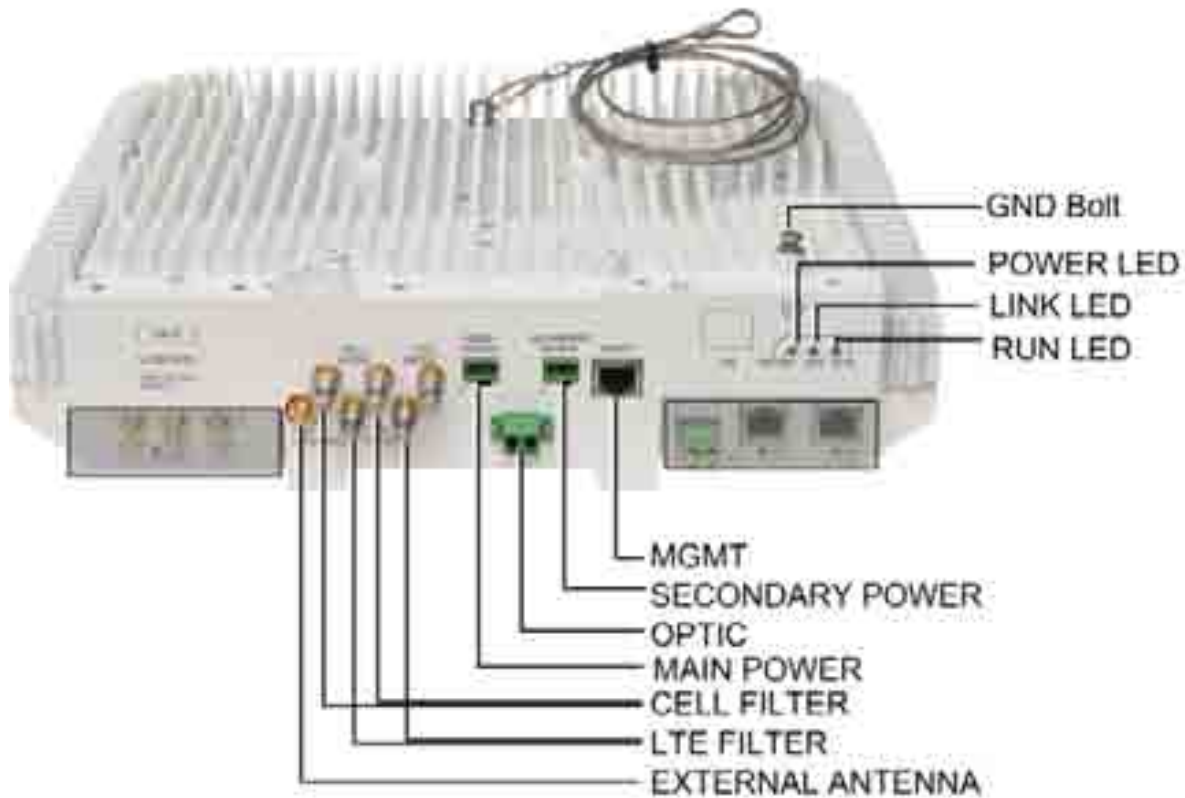
Note: The RAU enclosure can host two additional modules: RxU for MIMO support (e.g. LTE700 and AWS) and GEM for digital coverage. See relevant sections for details on these modules.

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 1.3.3.1 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 1.3.3.1 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 RAU5 to earth ground

Table 2-14. RAU5 Connection Interface Descriptions

LED	Description
POWER	Steady Green - Power input detected by RAU5 Off - No power supplied to RAU
LINK	Steady Green – Optical link power to/from the RAU 5is normal Blinking green – Optical power from remote is lower than required Off – No optical link is detected
RUN	Blinking Green Blinking – RAU5 Initializing Steady Green – RAU5 boot up sequence complete and module SW up and running Off – No power supplied to unit

Table 2-15. RAU5 LED Descriptions

2.2.4   RxU (Remote Expansion Unit)

The RxU is an Add-on to the RAU/RAU5 which provides support for MIMO services (i.e. 700 MHz LTE, AWS).
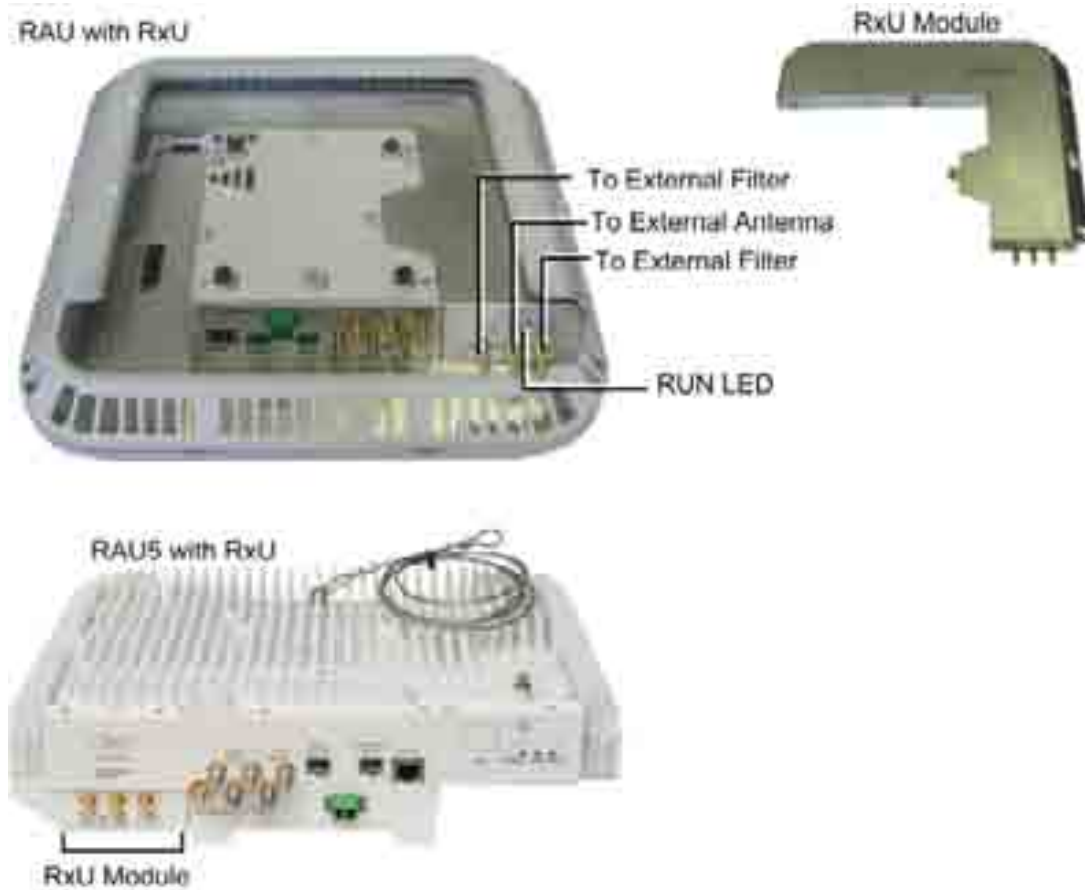
Figure 2-21. RxU (Installed in RAU) Interfaces

Module	Description
External Antenna	RF Connection to external antenna, used for above-ceiling installation. Antenna must have a return loss of 12 dB. (Both the RxU and the RAU 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 SW is up and running.

Table 2-16. RxU Front Panel Interface Connections

3   Unit Descriptions - Digital Path

This chapter provides detailed descriptions of the Digital Path components.

3.1   Digital Path Components

The digital path comprises the following elements - located at the remote end

- CEU – Centralized Ethernet Unit
- GEU-S – Standalone Gigabit Ethernet Unit

Note: The GEM module can also be installed in the RAU enclosure so that the RAU provides both RF and digital services.
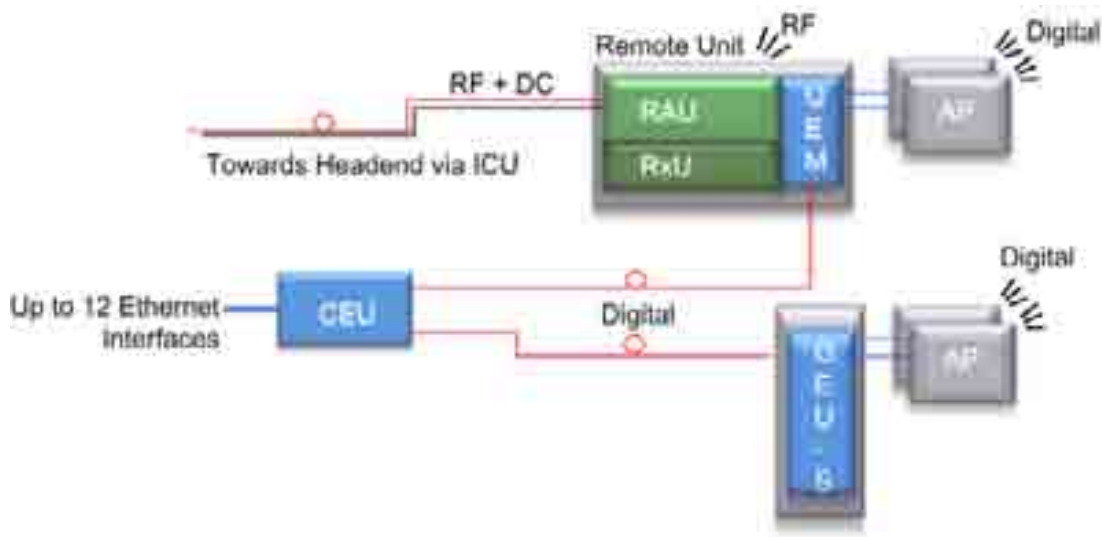

Figure 3-1. Corning ONE™ Digital Path Architecture

3.2 CEU (Centralized Ethernet Unit)

The CEU is a Centralized Ethernet-over-Fiber media and rate converter unit. Located at the remote end, it converts Ethernet media (from a LAN switch) to fiber media for routing towards GEM modules. The CEU hosts three Centralized Media Converter Modules (CEMs).

Figure 3-2. CEU Front Panel with Installed CEM Module

Figure 3-3. CEU Rear Panel

3.2.1 CEM (Centralized Ethernet Module)

The CEU supports up to three CEM modules, where each CEM supports four Ethernet ports (LAN switch connections) and four F/O connectors (towards GEM modules). All interfaces (except for power) are located on the front panel.

Figure 3-4. CEM Interfaces (Installed in CEU)

The CEM module interfaces include Ethernet connections to the Ethernet switch, F/O connections and LED status indicators.

Table 3-1 provides a description of the CEM ports.

Port	Description
ETH	Four 10/100/1000BASE-T RJ-45 connectors (LAN switch connections)
F/O	Four 10/100/1000BASE-T Copper ports to four LC UPC fiber connectors (using SFP –small-form pluggable module) towards GEM modules
USB port	USB serial port - service port
PWR	Steady Green – Power input detected for corresponding module

Table 3-1. Ports Description
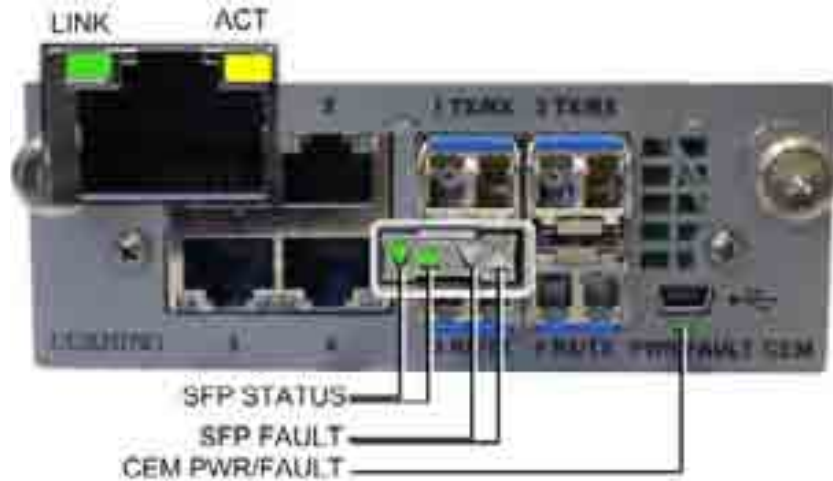
Figure 3-5. CEM LEDs

Table 3-3   provides a description of the CEM LEDs.

LED	Description	
CEM PWR/FAULT	Steady Green - short blink every ~10 sec. (heartbeat):	CEM On/Normal
	Steady Yellow:	Faulty CEM
LINK	Steady Green:	Link
	Off:	No link
ACTIVITY	Blinking Yellow:	Activity
	Off:	No activity
SFP STATUS	Blinking Green:	Activity
	Steady Green:	Link
	Off:	No link
SFP FAULT	Off:	No fault detected
	Steady Yellow:	Fault detected

Table 3-2. CEM LED Description

3.3   GEM (Gigabit Ethernet Module)

The GEM converts the received optical signal to two Ethernet digital connections, which are then routed along with PoE to two remote access points. The GEM module can be installed in the following configurations:

·   Installed in RAU - as an optional plug-in module (see section 5.2.2)

·   As a standalone module (GEU-S) - (see section 6.2)

Figure 3-6. GEM Interfaces

Table 3-3 and Table 3-4 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 3-3. GEM Port Interfaces

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Figure 3-7. GEM LED Description

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

Table 3-4. GEM LED Indicator Descriptions

3.4 GEU-S (Standalone Gigabit Ethernet Unit)

The GEU-S is a GEM Standalone unit and includes the mounting option and DC power supply for the GEM module. See 6.2 for details on the installation procedure. Allows for the GEM to perform media conversion services from Fiber to Copper and to supply PoE and PSE services

Figure 3-8. GEU Enclosure: Top (Left) and Open Underside (Right)

Table 3-5 and Table 3-6 provide descriptions of the ports and LED indicators for the GEU module of GEU-S unit. Refer to section 3.3 for the GEM module ports and LED descriptions.

Port	Description
DC Power Connector	Connector for DC wire pairs (42-57 V DC)
Ethernet	RJ-45 port used for Ethernet connection

Table 3-5. GEM Port Interfaces

LED	Description
GEU PWR	Steady Green – Power input detected in GEU module

Table 3-6. GEU LED Indicator Descriptions

4 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.

4.1 Infrastructure Preparation

The following installation rules are based on the assumption that the site survey and installation planning (including power requirements) have been completed.

4.2 Installation Requirements

The infrastructure preparation consists of two main phases:

A. **Floor Planning:** Planning the distribution of the Remote Access Units (RAUs) on each floor to provide the required coverage.

B. **Telecom Closet Planning:** Planning the layout of the devices and cables in the telecom closet or shaft. This includes all cabling and other voice service and digital coverage distribution systems that are relevant to the specific installation.

4.3 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 Repeater.
- 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

4.4 Rack Installation Guidelines

These guidelines are relevant to the system components which are installed in 19-inch communication racks: RF Path components: HEU, OIU and ICU; Digital Coverage components: CEU

- Verify that the rack height can support all the units to be installed, where you may also want to consider future installations. Figure 4-1 shows an example of a rack configuration for the RF path components at the headend which facilitates and simplifies the cabling connections.
- The configuration is for a single operator. If the site is serviced by more than one operator, each operator often installs their equipment in a separate rack. Refer to section 5.1.1.2 for 4x4 HEU-OIU rack installation configurations (maximum configuration including four HEU and four OIU units).

Figure 4-1. Example of Communication Rack Installation

4.4.1 Rack Safety Instructions

The following guidelines are relevant to the rack installed units. Review the following guidelines to help ensure your safety and protect the equipment from damage during the installation.

- Only trained and qualified personnel should be allowed to install or replace this equipment.
- Verify that ambient temperature of the environment does not exceed 50°C (122° F)
- To maintain a low center of gravity, ensure that heavier equipment is installed near the bottom of the rack and load the rack from the bottom to the top.
- Ensure that adequate airflow and ventilation within the rack and around the installed components so that the safety of the equipment is not compromised. It is recommended to allow for at least about 2 cm of airspace between devices in the rack.
- Verify that the equipment is grounded as required – especially the supply connections.

4.5   Power Requirements

This section summarizes the power requirements of all Corning ONE™ RF and digital coverage devices.

4.5.1   Power Safety Instructions

SAFETY WARNINGS! When installing or selecting the power supplies:

· Use only the power cables (AC and DC) and any other relevant accessories provided with the unit to connect the power supply to the ONE™ units.
· 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
· Install external over-current protective devices for the system according to the requirements described in section 1.3.3 - Power .
· For GEU-S units – 3rd party equipment (PoE clients) intended for connection to the PoE outputs must meet the "Resistance to Fire" requirement (clause 4.7) of the IEC/EN/UL60950-1 standard.

4.5.2   Types of Power Supplies

Corning supplies various power supplies that can be installed in a rack or mounted on a wall, depending on your configuration.

4.5.3   Circuit Breakers

Calculate the required fuse protection while referring to section 1.3.3 - Power . Also, when Install fuse protections for the system taking into account that there may be other Corning system elements that require external fuse protection.

4.6   RF Coaxial Cable Guidelines

4.6.1   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.

4.6.2   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 RAUs.
·   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 RAUs at the remote locations

4.6.3　Coax Cable Lengths and Losses

Use coax ½", 50ohm, male-to-male QMA type, for connecting to RAU 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

4.7   Antenna Specifications and Guidelines

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

4.7.1   Authorized Antennas and Required Specifications

- Corning ONE™ RAU (Remote Access Unit) is equipped   with an Omni Directional integrated antenna; 0 dBi (15 deg. down from horizon)
- Corning ONE™ RAU5 (5 Band Remote Access Unit) requires external broadband antenna. RAU5 can be ordered with Corning ONE 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)

4.7.2   General Installation Guidelines

- The RAU should be installed at a convenient location, free of metallic obstruction (can also be installed in plenum spaces).
- Install the RAU 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.

4.8   Fiber Optic Requirements

4.8.1   Authorized Optic Cables

The following specified optic cables are authorized for use with ONE™ products:

Vertical	Horizontal
Plug & Play™ Plenum Optical cables MTP Fiber Connectors 12 – 144 fibers 2-sided or 1-sided Armored, non-armored	Composite Plenum Tether Assemblies Fiber: LC APC, 2 – 24 fibers Cu: 16AWG, 14AWG, 12AWG; 2 – 12 Conductors Armored, non-armored

4.8.2   Fiber Optic Rules

- Use only MTP® or 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.
- Pay special attention while connecting the MTP® and/or 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.

4.9 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 1.3.3.

Types of Power Supplies

Corning supplies various power supplies that can be installed in a rack or mounted on a wall, depending on your configuration.

5   Installation – RF Path Elements

This chapter describes the installation of the RF path components. For specific guidelines on infrastructure planning, design and installation, please consult with a Corning Product Line Manager or Corning approved Installer.

5.1   Headend Elements

The (RF coverage) headend site installation consists of installing the HEU and OIU units.

Note the following information:

- The chassis and modules are supplied separately and must be inserted by the user. Only the fan module is factory installed in the chassis rear.
- The headend elements are installed at the IDF (Intermediate Distribution Frame), adjacent (or as close as possible) to each other to facilitate the connections. See section 5.1.1.2 for an optimal 4x4 HEU-OIU rack configuration – in terms of location in rack where each OIU is connected to each HEU.
- The ERFC cable (Expander Cable interconnecting the (OIU/IHU) OIX and (HEU/IHU) RIX modules) are provided in lengths ranging from 16 to 59 in so as to accommodate a range of HEU-OIU rack installation configurations.
- Hot-swappable modules: RIM (RF Interface Modules) and Power Supply(ies), Fan Modules and RIX/OIX   (Expander Modules). HCM, ACM modules are not hot-swappable.
- If a redundant power supply is provided, both supplies must be installed, connected to respective AC or DC power and switched on.
- The 4x4 configuration includes four HEU units connected to four OIU units. This is the maximum number of headend units that can be managed by a single HCM.
- The components of each system installation are control and managed via a single HCM which is installed in an HEU/IHU chassis.

Note: The management connections for the Corning ONE™ system elements are detailed in the HCM UM.

5.1.1   HEU Installation

Note the following information:

- The HEU chassis is supplied empty and only includes the factory assembled FAN Module (FAM). All other modules are ordered separately and must be installed.
- The RF service interfaces are implemented by service specific RIM/RIM-M modules that are provided separately according to your order.
- In installations with more than one HEU, the HEU in which the HCM module is installed is determined as the "Main HEU". Any additional HEU unit is installed with an ACM module and is managed via the HCM in the Main HEU through an RJ45/RJ45 connection.
- One HEU supports connections to up to four OIU units (the IHU supports connections to one HEU)
- The Cable management Tray can be assembled either before or after the unit is installed (see section 5.1.3 - HEU/OIU Cable Management Tray).

5.1.1.1   Unpacking and Inspection

This section describes the installation procedure for the Corning ONE™ Headend Unit (HEU) and relevant modules.

Unpack and inspect the cartons as follows:

8. Open the shipping cartons and carefully unpack each unit from the protective packing material.
9. Verify that all the items required for installing the Corning ONE HEU according to the items listed in Table 5-1. If any of the listed items are missing, contact your Corning representative.
10. Check for signs of external damage. If there is any damage, call your Corning representative.

Items required for installing the HEU:

HEU Kit	Quantity	Item
Headend Unit Chassis (with blank panels on RIM slots and one PSM slot) – includes factory installed Fan Module (FAM) in chassis rear	1	
Fan Module (FAM) – single unit hosting 4 fans (factory installed in chassis rear)	1	
RJ45/RJ45 communication cable L=2m-2.15m (P/N 705900003) – HCM management cable	1	
RIM Kit (1-12 according to order)	**Quantity**	**Item**
Radio Interface Module (service specific)	1	

RIX Module Kit (1 or 2 according to order)	Quantity	Item
Radio Expander Module – expands the RF sources to the OIU	1	
Pilot Transport Cable (P/N: PCKC47*) – Single QMA to QMA cable; L = 47 in; used for passing reference clock signal connections between RIX modules. *Additional lengths can be ordered: · PCKC20: L=20 in · PCKC63: L=63 in · PCKC79: L=79 in	1	
ERFC Cable Kit (according to order)	**Quantity**	**Item**
ERFC (Expander Cable) - RF interface cable used to connect between RIX and OIX modules; 9 pin SMP to SMP connector Available in five different lengths: · ERFC16: L= 16 in · ERFC24: L= 24 in · ERFC34: L= 34 in · ERFC40: L= 40 in · ERFC59: L= 59 in	1	
ETM Kit (according to order)	**Quantity**	**Item**
ETM Expander Termination Module (for unoccupied Expander slot)	1	
PSM Kit (AC or DC modules - 1 or 2 kits according to order)	**Quantity**	**Item**
PSM-AC: 100-240 VAC Power Supply Module including standard IEC 60320-1 C13 cable	1	
PSM-DC: 48 V DC Power Supply Module; 9 A Max.; six pin DC input terminal block connector; includes six terminal rings used for crimping onto the DC wires	1	
Controller Module Kit (HCM or ACM - according to order)	**Quantity**	**Item**
HCM Kit (Headend Control Module) – installed in Main headend unit (i.e HEU or IHU) unit; enables remote/local management of all hosted units	1	
ACM Kit (Auxiliary Control Module) – installed in Auxiliary headend units; provides management connections for the Auxiliary headend unit (i.e additional HEU/IHU or OIU).	1	

Table 5-1. Items Required for HEU Installation

5.1.1.2   Mounting the HEU Chassis

Note the following:

· HEU chassis requires 4U rack height availability
· Rack nuts and screws not provided (depend on rack type)

To mount the HEU chassis (in 19-in rack)

1. Determine the location of the HEU in the rack while considering additional headend units and the lengths of the available ERFC cables. Figure 5-1 and Figure 5-2   illustrate the optimal rack installations for a maximum 4x4 HEU-OIU configuration in shared and dedicated equipment scenarios.
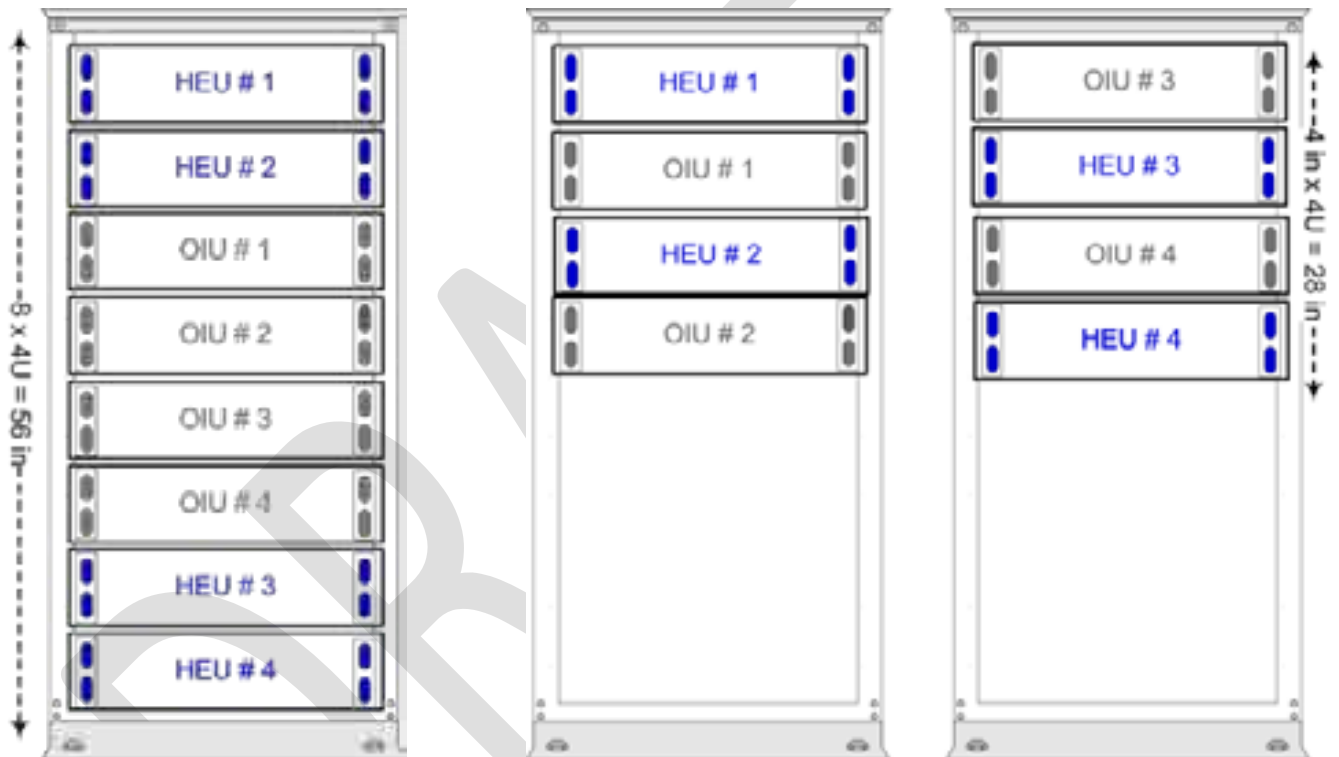
Figure 5-1. 4x4 Installation Diagram – Dedicated   Figure 5-2. 4x4 Installation Diagram – Shared

2. Referring to Figure 5-3 secure the units' rack ears to the rack frame as follows:

· Insert two screws half-way into the rack frame.

· Position the chassis on to the screws using the handles and the bottom half slots of the rack ears.

· Secure the unit in the rack via all applicable bracket holes using the appropriate rack nuts and screws.

Figure 5-3. Installing Chassis in Rack

5.1.1.3 Installing all Modules

To install the HEU modules:

1. Refer to Figure 5-4 for module locations. Remove blank panel and slide in the relevant module (chassis slots are 100% mistake proof) as shown in Table 5-2 :
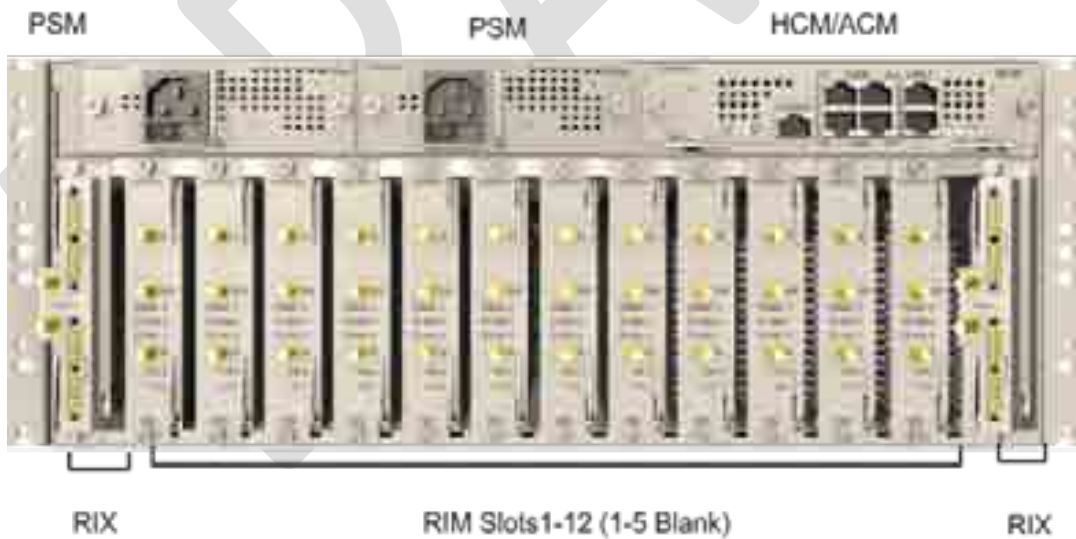
Figure 5-4. Example of occupied HEU

Module	Quantity	Comment
HCM (for Main HEU units)	1	In installations with more than one HEU, the HCM is installed in one of the chassis which will be referred to as the "Main" HEU; One HCM per system installation.
ACM (for Auxiliary HEU units)	1	Installed in the HEU in configurations consisting of more than one HEU chassis
PSM	1 - 2	· For installations with one PSM module – install module in left most slot · For installations with two PSM modules – remove blank panel from middle slot and insert additional PSM module
RIX	1 - 2	In installations with only one RIX, the unoccupied RIX slot must be terminated with an ETM.
RIM	1 - 12	No need to terminate unoccupied RIM slot – leave blank panel

Table 5-2. Modules Required for HEU Installation

2. Referring to examples of modules shown in Figure 5-5 and Figure 5-6 secure the modules to the backplane by:

· Closing the ejectors (for relevant modules)

· Tightening the captive screws

Note: Modules with ejectors (i.e. RIM, RIX and HCM/ACM) the ejectors should be completely open when inserting in dedicated slot and then push in until the module clicks in to the backplane. Figure 5-5 and Figure 5-6 show examples of module type captive screws and ejectors.

Figure 5-5. HCM Ejectors and captive Screws
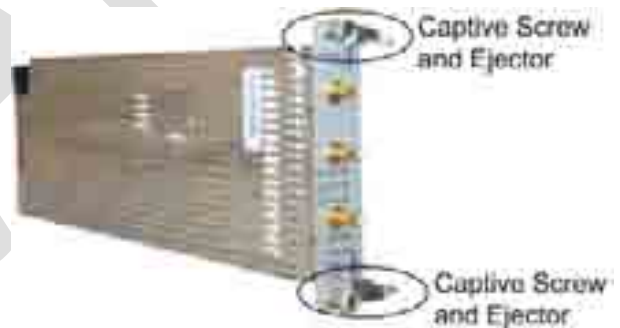
Figure 5-6. RIM Ejectors and captive Screws

5.1.1.4   Grounding HEU Chassis

The grounding connection is performed via a two-hole, standard barrel grounding lug located on the HEU rear panel (see Figure 5-7):

· For use with stranded copper wire conductors
· 10-14 AWG
· Holes - 1/4 inch

Figure 5-7. Grounding lug (HEU Chassis Rear)

5.1.1.5   RIM Connections to RF Source

For each service specific RIM - connect (Simplex or Duplex) RF QMA connectors to the service providers' external RF source. See Figure 5-8.
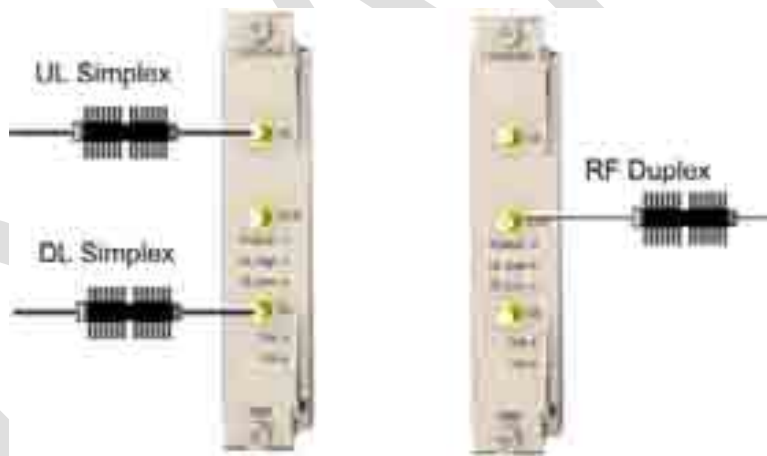
Figure 5-8. RIM RF Source Interfaces

5.1.1.6   RIX to OIX Connections

Note: Each RIX module supports connections to up to two OIX modules (in OIU/IHU).

Using the appropriate length ERFC cable (according to distance of available OIX port) connect the HEU RIX module 9-Pin connector to the corresponding connector on the OIX module. See Figure 5-9.

Refer to Section 5.1.1.7 for schematic diagram of coax connections in a maximum HEU-OIU configuration of 4x4 where all HEU units are connected to all OIU units.
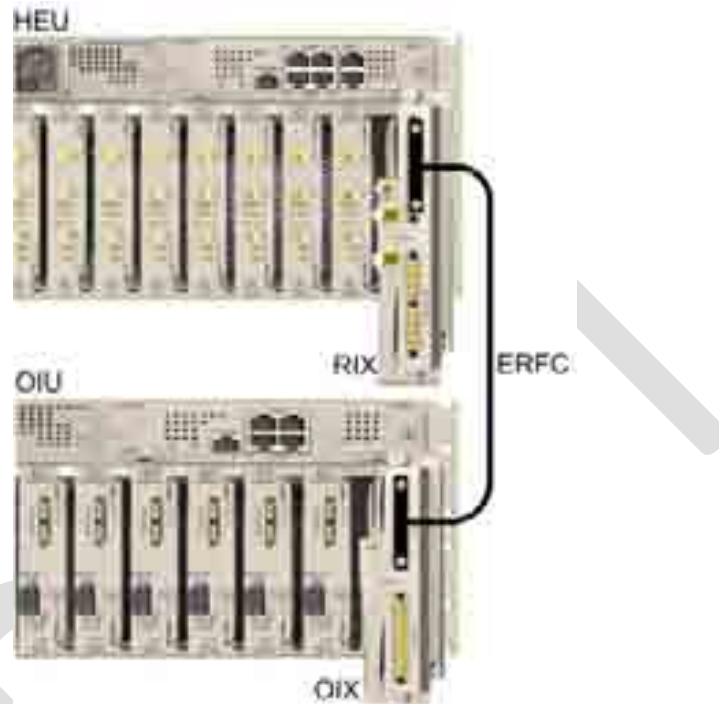
Figure 5-9. HEU to OIU Coax Connections

5.1.1.7   Coax Connections for HEU-OIU 4X4 Installation Configurations

Figure 5-10 and Figure 5-11 illustrate the optimal installation configurations when installing four HEU and four OIU chassis in a rack so that all HEU units can be connected to all OIU units. The optimal configuration takes into consideration the minimum and maximum ERFC cable lengths (provided with OIX modules) in either a single 19-inch rack (shared rack equipment scenario) or two separate racks (dedicated rack per operator).
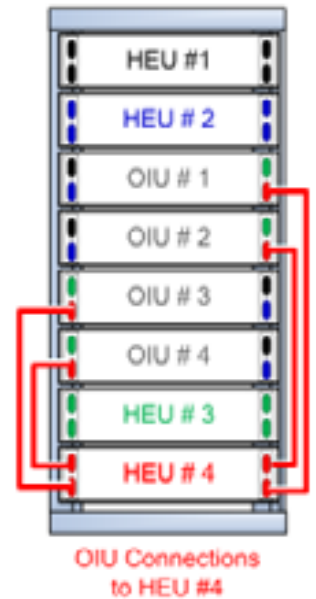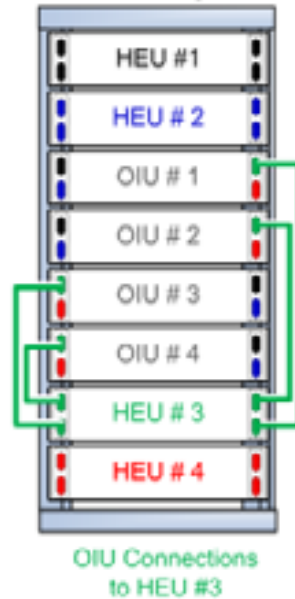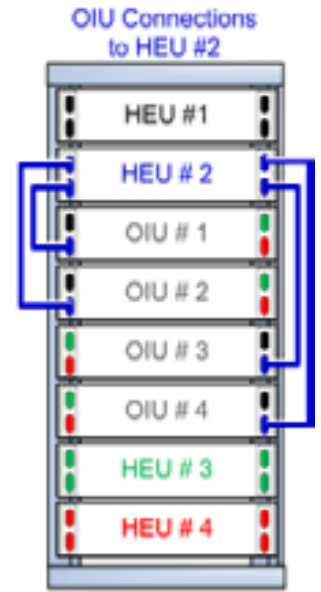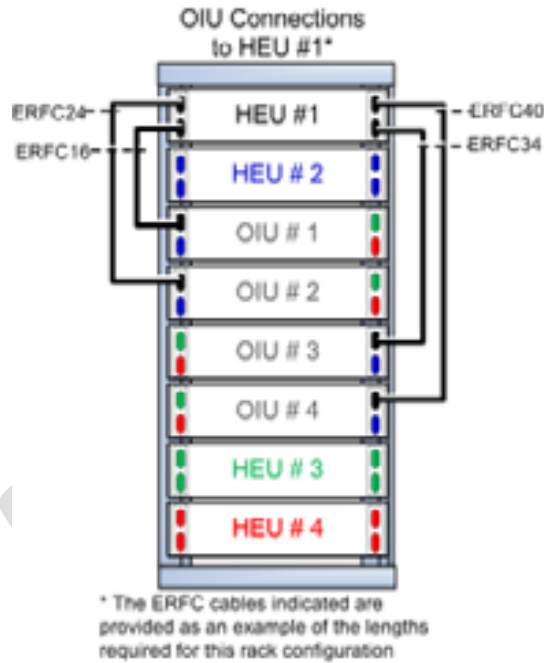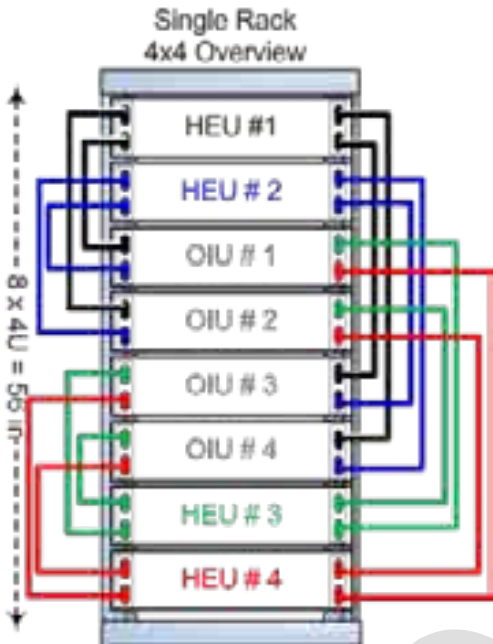
Figure 5-10. HEU-OIU 4x4 Installation Configuration for Shared Provider Equipment

Figure 5-11. HEU-OIU 4x4 Installation Configuration for Dedicated Provider Equipment

Figure 5-10 illustrates how each HEU is connected to each OIU in a dedicated equipment (single rack) scenario. In Figure 5-11 the port numbers (1-4) indicated on each HEU correspond to the OIUs in the rack and vice versa for the OIU port numbers. For example, Port 3 in HEU #1 indicates the connection to OIU #3, whereas Port 1 in OIU #3 indicates the connection to HEU #1.
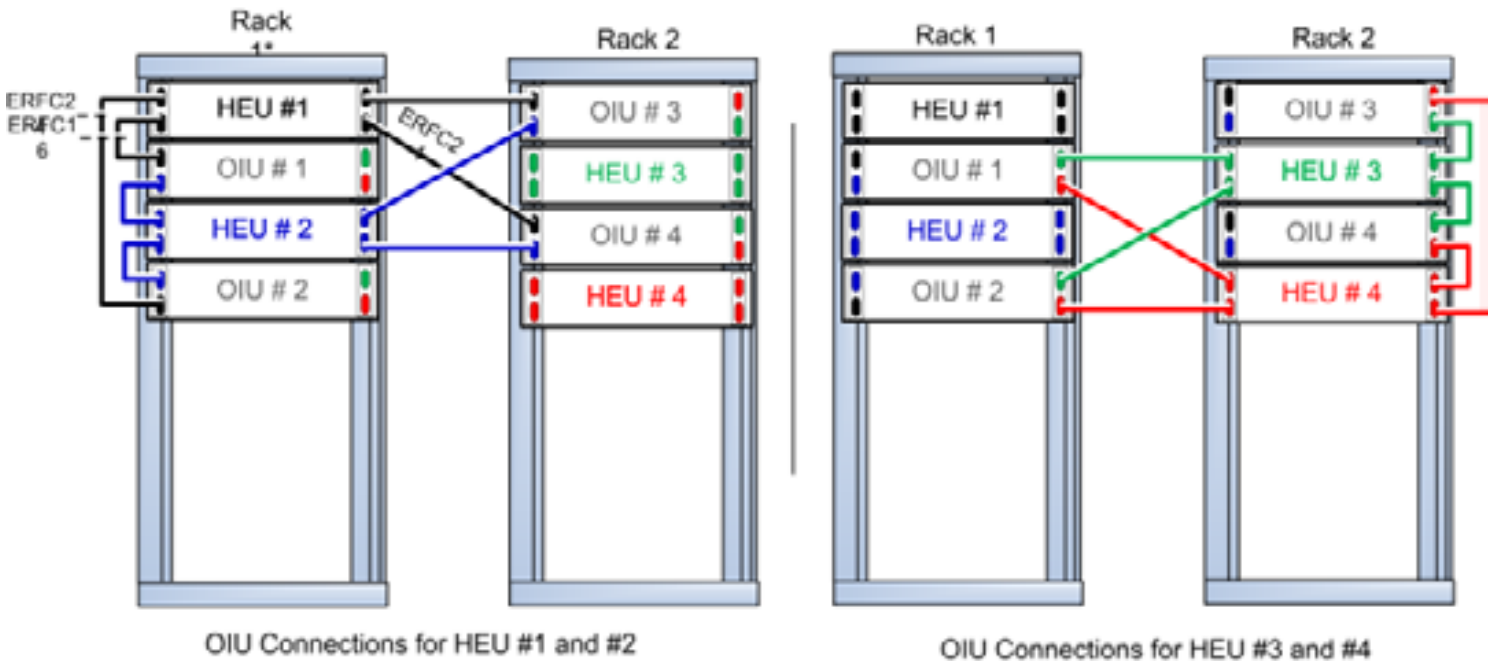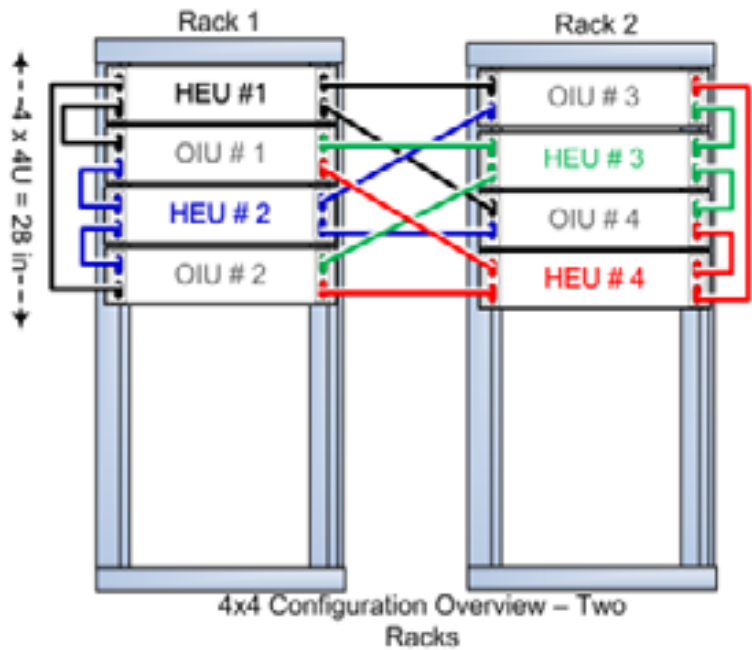
Figure 5-12. 4x4 HEU-OIU Two Rack Configurations

Figure 5-12 illustrates how each HEU is connected to each OIU in a shared equipment (dual rack) scenario. In Figure 5-12. the port numbers (1-4) indicated on each HEU correspond to the OIUs in the racks and vice versa for the OIU port numbers. For example, Port 3 in HEU #1 indicates the connection to OIU #3, whereas Port 1 in OIU #3 indicates the connection to HEU #1.

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5.1.1.8 RIX Pilot Clock Connections

Referring to Figure 5-13 (Shared Rack), use the QMA/QMA jumper cable to connect the **REF OUT** and **REF IN** ports of each of the RIX modules in the HEU (or IHU) chassis.

Note that The REF IN and REF OUT pilot clock ports must be connected in a closed loop as shown in Figure 5-13 and Figure 5-14 and that both RIX modules of each chassis must be connected.

From	To
Main HEU RIX **REF OUT**	1st Auxiliary HEU RIX **REF IN**
(For additional Auxiliary HEUs) 1st Auxiliary HEU RIX **REF OUT**	2nd Auxiliary HEU RIX **REF IN**
2nd Auxiliary HEU RIX **REF OUT**	3rd Auxiliary HEU RIX **REF IN**

Table 5-3.RIX Pilot Clock Connections

Figure 5-13 and Figure 5-14 show an example of the required pilot clock connections in 4x4 configurations.
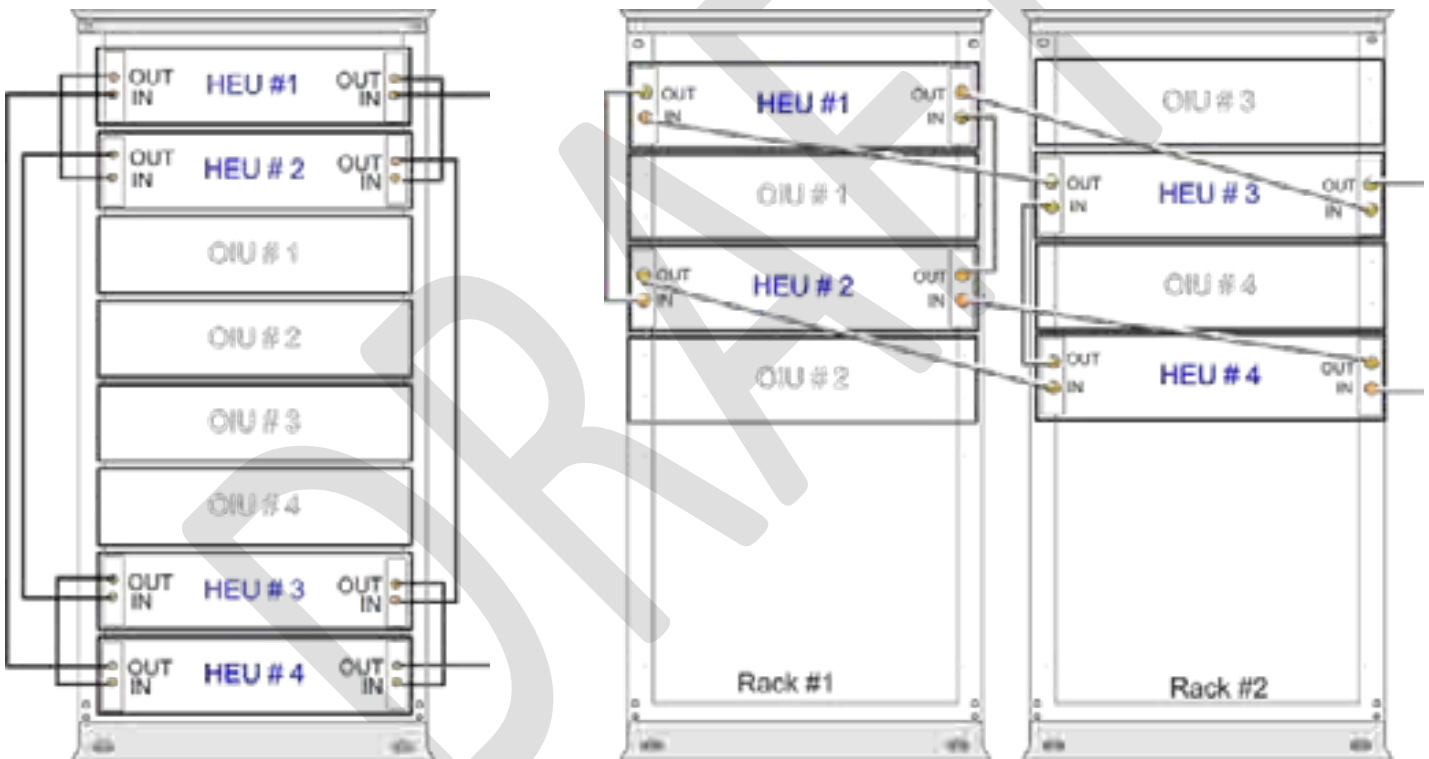
Figure 5-13. Pilot Clock Connections Diagram – (4x4) Shared Rack

Figure 5-14 Pilot Clock Connections Diagram – (4x4) Dedicated Rack

5.1.1.9   Management Connections

Note the following:

·   One RJ45/RJ45 management cable is provided with each IHU unit.
·   **IMPORTANT!** Refer to HCM User Manual for instructions on how to correctly perform the management connections.

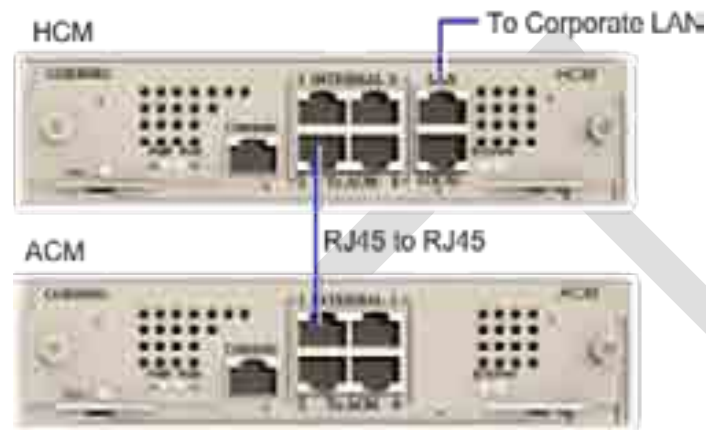| |
|---|
| **ATTENTION!** Make sure there are no loopback connections to the HCM or ACM modules! An HCM connected to an ACM cannot have another cable connecting it back to the HCM – doing so may cause alarm flooding resulting in a system freeze! |

Figure 5-15. Example of HCM LAN Connection and a Connection to a Single ACM Module

5.1.1.10 Power Up

Note the following:

· The PSM modules are installed in the headend unit chassis in one or both of the dedicated PSM slots (top left and middle)

· Two power supplies can be installed in the same chassis in order to provide redundancy.

· PSM-DC can be installed in the same chassis along with a PSM-AC module.

· For installations with two PSM modules, both modules must be:

  · Connected to their respective power source (AC or DC)

  · Switched ON to begin system operation

  · Turned on at all times after installation

For PSM-AC modules

1. Connect power cable (100-240 VAC) supplied with module to the PSM-AC input connector and to the AC outlet and switch on. See Figure 5-16

2. Verify that the Power Status LED on each PSM shows green. See Figure 5-16 for PSM-AC LED.

Figure 5-16. AC Power Supply Module LEDs

For PSM-DC

General information:

- The PSM-DC is provided with six terminal rings (PN: 708A043001)
- Type of terminal ring provided: PMNF2-3R-C or PMV2-3RB-3K (depending on availability)
- PSM-DC power source rating: 48 V DC; 9A max.

To power up the PSM-DC module:

3. Crimp the provided terminal rings onto the DC wire pairs.

IMPORTANT! Make sure to use an appropriate crimper – do not use a plier!

Figure 5-17. Crimping the Terminal Rings onto the DC Wire

Required information:

- Type of terminal ring crimped onto DC wires – PANDUIT ring terminal:
  - Compatible wire size: 1.5 – 2.5mm² wire range/14AWG to 16AWG
  - M3 stud size
- No. of required wire pairs:
  - Remote feed - three pairs; 100 W max. per pair
  - Local Plant feed - two pairs; 100 W max. per pair

4. Connect crimped terminal rings to DC connectors.

IMPORTANT! Verify that the DC power source is OFF before connecting the wire pairs!

Figure 5-18. Connecting PSM-DC Wire Pairs

- Max. current consumption per pair:
  - Remote feed = 1.55 A
  - Plant feed = 4.65 A
- For optimal cable management, route all wire pairs to the left side of the rack

5. Turn on DC source and verify that power status LED is green.
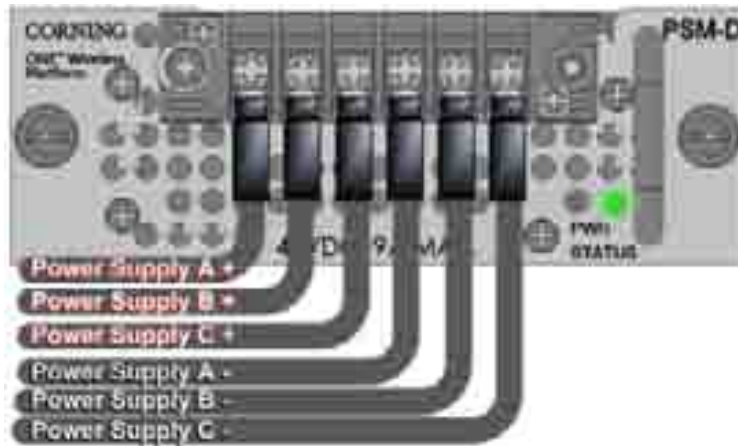
Figure 5-19. Connected DC Wire Pairs and Green Power LED

5.1.1.11 Verify Normal operation

1. Verify that the Power Status LED on each PSM shows green. See Figure 5-16 (PSM-AC) and Figure 5-19 (PSM-DC).
2. If RF source is operational, verify that the RIM (see Figure 5-20) and HCM/ACM (see Figure 5-21) LEDs indicate normal operation according to Table 5-4:

Module	LED	Description
RIM	Protect	N/A
	DL High	Off - DL RF input level in threshold range Steady Red – DL RF input level is 3dB above max expected power
	DL Low	Off - DL RF input level in threshold range Steady Red - DL RF input level is 15dB below max expected power
	RUN	Blinking Green - RIM module SW has initialized and is up and running Off – Power off
	PWR	Steady green - Input power is within required range
HCM/ACM	PWR	Steady Green - Power input detected by HCM/ACM
	RUN	Blinking Green – HCM module SW up and running
	SYS	Steady Green - Overall status of the managed system is ok
	FAN	Steady Green – Normal operation status for all fans

Table 5-4. RIM and HCM/ACM LED Descriptions
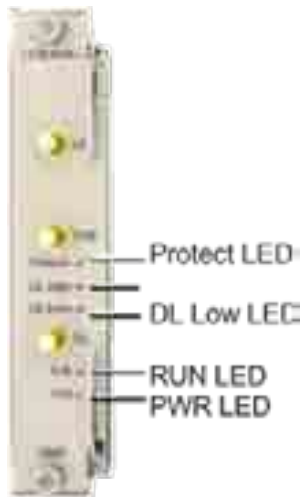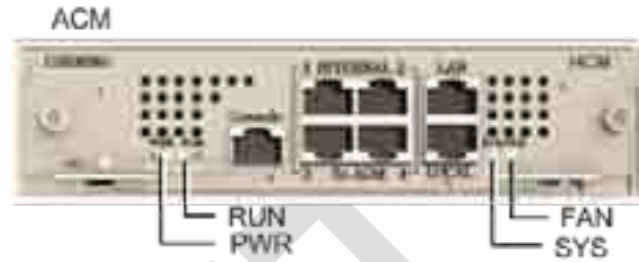
Figure 5-20. RIM LEDs   Figure 5-21. HCM/ACM LEDs

5.1.2   OIU Installation

Note the following:

- OIU chassis is supplied empty and only includes the factory assembled FAN Module (FAM). All other modules are ordered separately and must be installed.
- The Cable management Tray can be assembled either before or after the unit is installed (see section 5.1.3 - HEU/OIU Cable Management Tray).

5.1.2.1   Items Required for OIU Installation

The following items are required for installing the ONE™ OIU. If any of the listed items are missing, contact your Corning representative.

OIU Kit	Quantity	Item
OIU Chassis (with blank panels) - with FAM Unit on the rear side of the chassis	1	
Fan Module (FAM) – one unit hosting four fans (factory installed in chassis rear)	1	
RJ45/RJ45 communication cable L=2m-2.15m (P/N 705900003) – ACM management cable	1	
OIM Kit (1-12 according to order)	**Quantity**	**Item**
Optical Interface Module (OIM)	1	

	Quantity	Item
MTP-LC APC Harness Cable (P/N 37HP900162-06F) - connector for splitting fibers (6) leading from OIM to (FMU) Edge module	1	
PSM Kit (AC or DC modules - 1 or 2 kits according to order)	**Quantity**	**Item**
PSM-AC: 100-240 VAC Power Supply Module including standard IEC 60320-1 C13 cable	1	
PSM-DC: 48 V DC Power Supply Module; 9 A Max.; Includes six pin terminal block connector	1	
OIU Expander Module Kit (1 or 2 according to order)	**Quantity**	**Item**
OIX (Optical Interface Expander Module) – connects to the HEU/IHU RIX Expander module; provides RF interface to HEU/IHU	1	
ETM Kit (according to order)	**Quantity**	**Item**
ETM (Expander Termination Module) - used for terminating unused Expander slot	1	
ACM Kit	**Quantity**	**Item**
ACM (Auxiliary Control Module) – enables remote (via HCM)/local management of all hosted units	1	

5.1.2.2   Mounting Chassis in 19-in Rack

Note the following:

· Up to four OIU chassis can be connected to a single HEU (IHU supports connections to one OIU)
· OIU chassis requires 4U rack height availability
· Rack nuts and screws not provided (depend on rack type)

To mount OIU chassis

1. Determine the location of the OIU in the rack while considering additional headend units and the lengths of the ERFC cables (described in HEU Quick Start Guide).
2. Figure 5-22 and Figure 5-23 describe the optimal rack installations for 4x4 HEU-OIU configurations in dedicated or shared equipment scenarios.
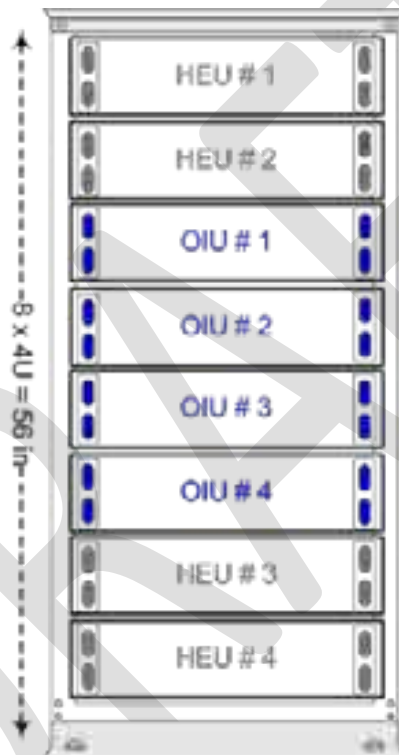
Figure 5-22. 4x4 Rack Installation Diagram – Dedicated.
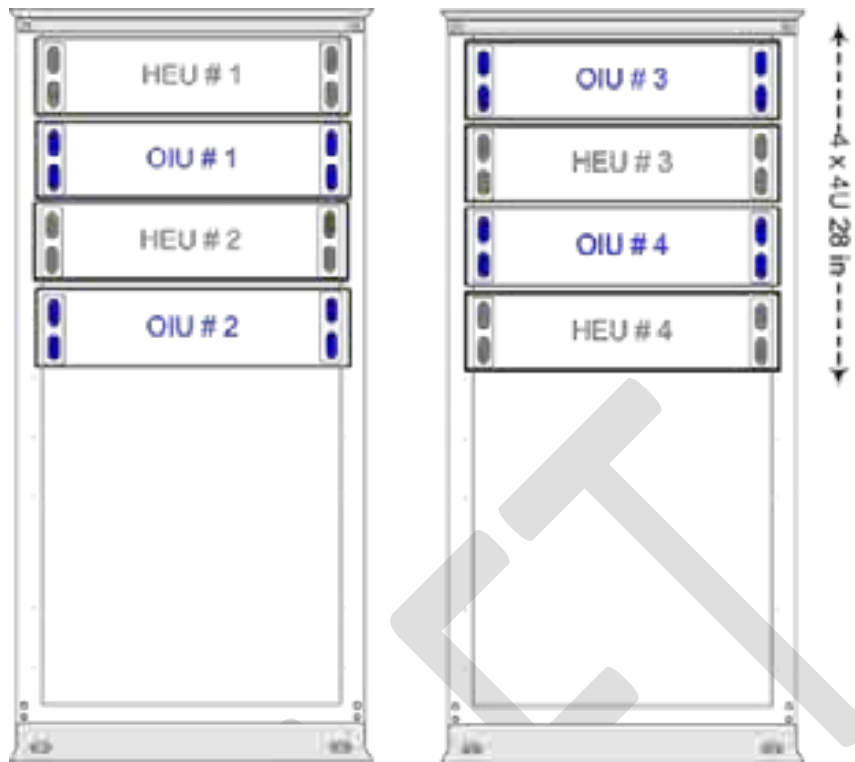
Figure 5-23. 4x4 Rack Installation Diagram – Shared

3. Referring to Figure 5-24 secure the units' rack ears to the rack frame as follows:
    ·   Insert two screws half-way into the rack frame.
    ·   Position the chassis on to the screws using the handles and the bottom half slots of the rack ears.

4. Secure the unit in the rack via all applicable bracket holes using the appropriate rack nuts and screws.
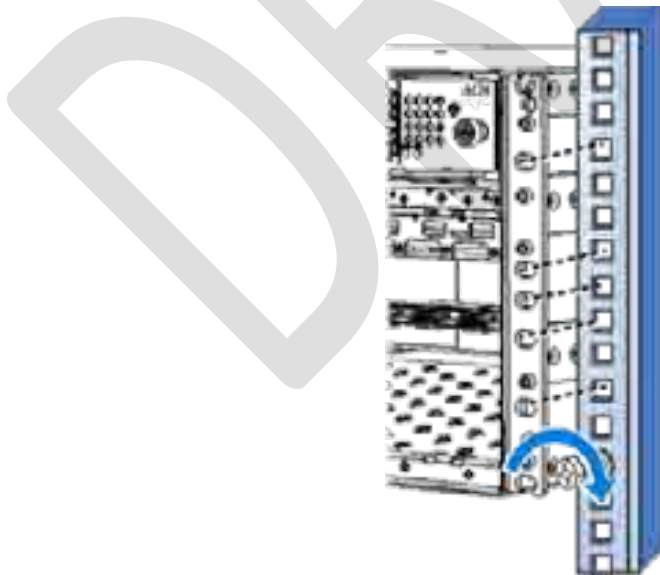

Figure 5-24. Installing Chassis in Rack

5.1.2.3 Installing All Modules

1. Remove blank panel (where relevant) and slide in the relevant module (chassis slots are 100% mistake proof). Refer to Figure 5-25 for module locations.

Module	Quantity	Comment
ACM	1	-
PSM	1 - 2	· For installations with one PSM module – install module in left most slot · For installations with two PSM modules – remove blank panel from middle slot and insert additional PSM module
OIX	1 - 2	For single OIX installations, the second OIX slot must be occupied with an Expander Termination Module (ETM).
OIM	1 - 12	No need to terminate unoccupied OIM slot – leave blank panel
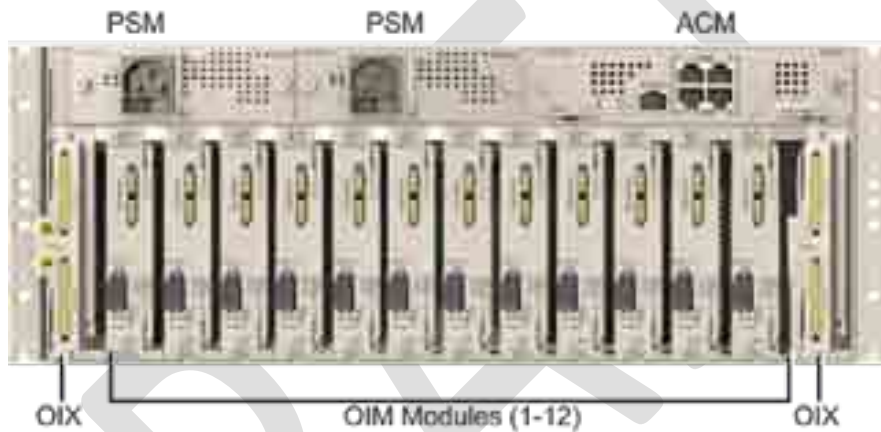
Figure 5-25. Location of OIU Front Panel Modules in Chassis

> Note: For modules with ejectors (i.e. OIM, OIX and ACM) – verify that the ejectors are completely open when inserting in dedicated slot and then push in until the module clicks in to the backplane. Figure 5-26 shows example of module type captive screws and ejectors.

2. Secure modules into the OIU backplane by:
   · Closing ejectors firmly (for relevant modules)
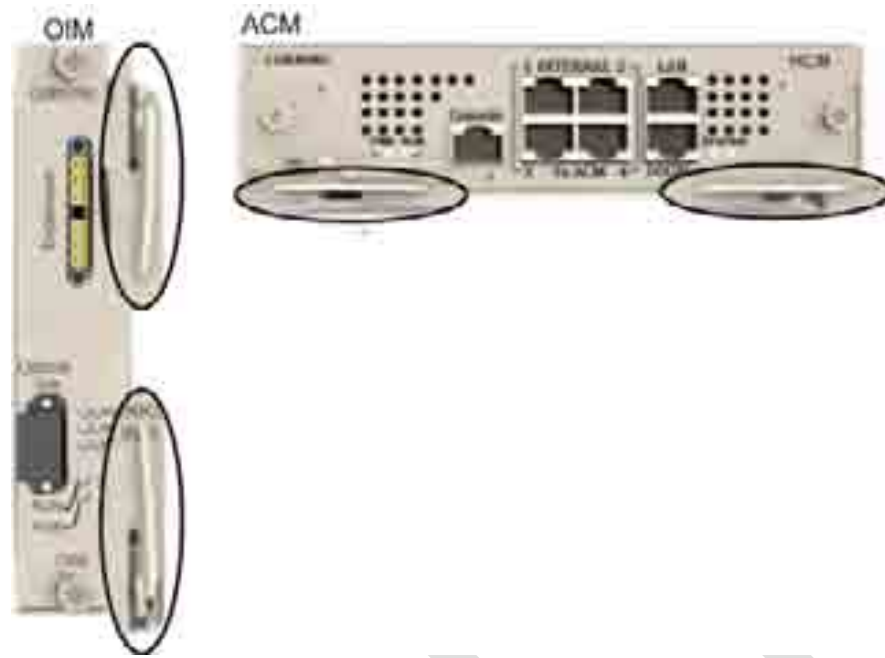   · Tightening the captive screws
   See Figure 5-26.

Figure 5-26. Example of Module Type Captive Screws and Ejectors

5.1.2.4 Grounding Chassis

The grounding connection is performed via a two-hole, standard barrel grounding lug located on the HEU rear panel (see Figure 5-27).

- · For use with stranded copper wire conductors
- · 10-14 AWG
- · Holes - 1/4 inch.

Figure 5-27. OIU Grounding Lug (Chassis Rear)

5.1.2.5   Fiber Connections

1. Using the provided Corning MTP-LC APC Harness Cable:

    · Connect the cable MTP® connector to the OIM MTP connector

    · Remove the protective plastic covers and connect the three LC APC connection fibers to the FMU Edge module LC APC connections. See Figure 5-28.

2. Take note of the fiber numbering (1/2/3). See Figure 5-28.

Figure 5-28. OIM Fiber Connections

5.1.2.6   RF Connections to HEU

RF connections between the OIU and HEU/IHU are performed using the ERFC cable (included in HEU/IHU order) and are described in section 5.1.1.6. See Figure 5-29 for general view of connections.
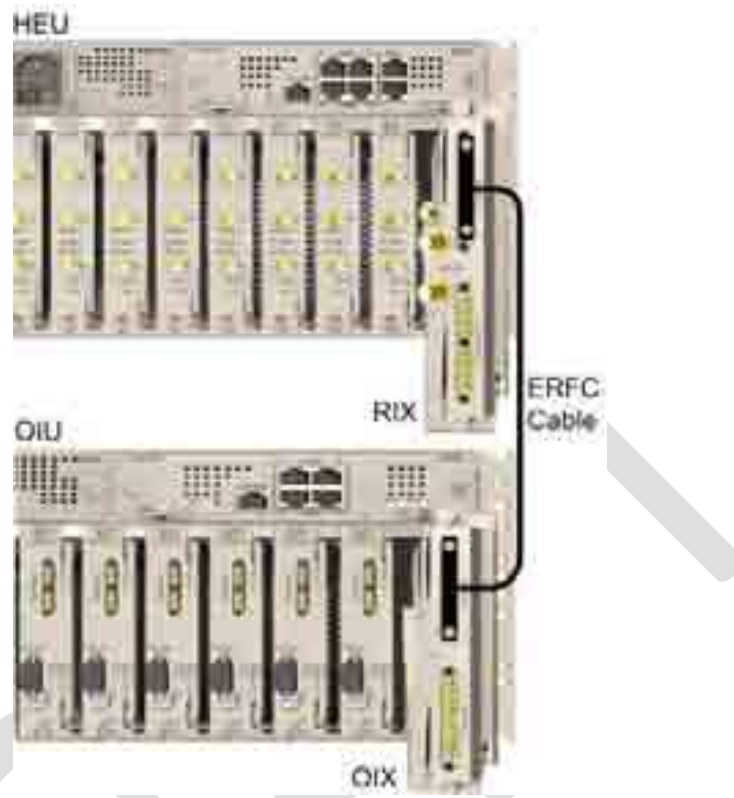
Figure 5-29. Example of OIX to RIX RF Connection

5.1.2.7 Management connections

Refer to HCM User Manual or Quick Installation Sheet (CMA-348-AEN) for instructions on how to correctly perform the management connections between HCM and ACM modules.

5.1.2.8 Power Up

Refer to HEU section 5.1.1.10 for details on connecting the AC/DC PSM modules.

Note: The PSM modules are common for both HEU and OIU chassis.

5.1.2.9 Verifying Normal Operation

If OIU chassis is powered on, verify that the OIM and ACM (see Figure 5-30) module LEDs indicate normal operation:

| Module	LED	Description
OIM	LINK 1/2/3	Steady Green - Optical link power to/from the connected remote is normal
		Blinking Green - Optical power from remote is lower than required
	RUN	Blinking Green - OIM module SW has initialized and is up and running
		Off – Power off
	PWR	Steady Green - Power input detected in OIM
ACM	PWR	Steady Green - Power input detected by ACM
	RUN	Blinking Green – ACM module SW up and running
	SYS	Steady Green - Overall status of the managed system is ok
	FAN	Steady Green – Normal operation status for all fans

Table 5-5. OIM and ACM LED Descriptions
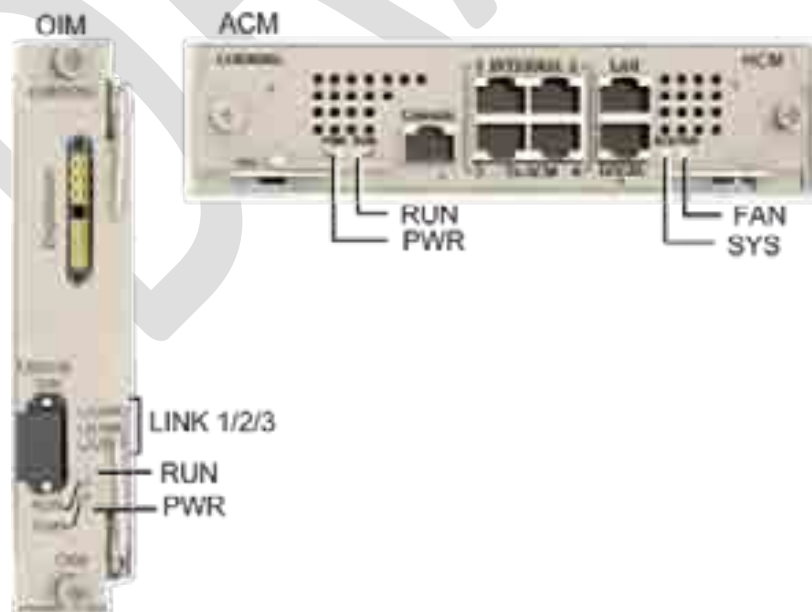
Figure 5-30. OIM and ACM Module Status LEDs

5.1.3   HEU/OIU Cable Management Tray

The HEU/OIU Cable Management tray is an optional accessory that can be assembled onto the HEU and OIU chassis, facilitating cable management and providing an aesthetic solution for organizing cable slack.

Note the following:

· The accessory can be assembled either before or after the HEU/OIU module cables are connected.
· The Cable Management Tray consists of two items:
    · Cable Management Tray – Item A in Step 1
    · Door Sleeve – Item B in Step 4
· A Phillips screwdriver is required.

Assemble the Cable Management Tray as follows:

1. Assemble Cable Tray Onto Chassis
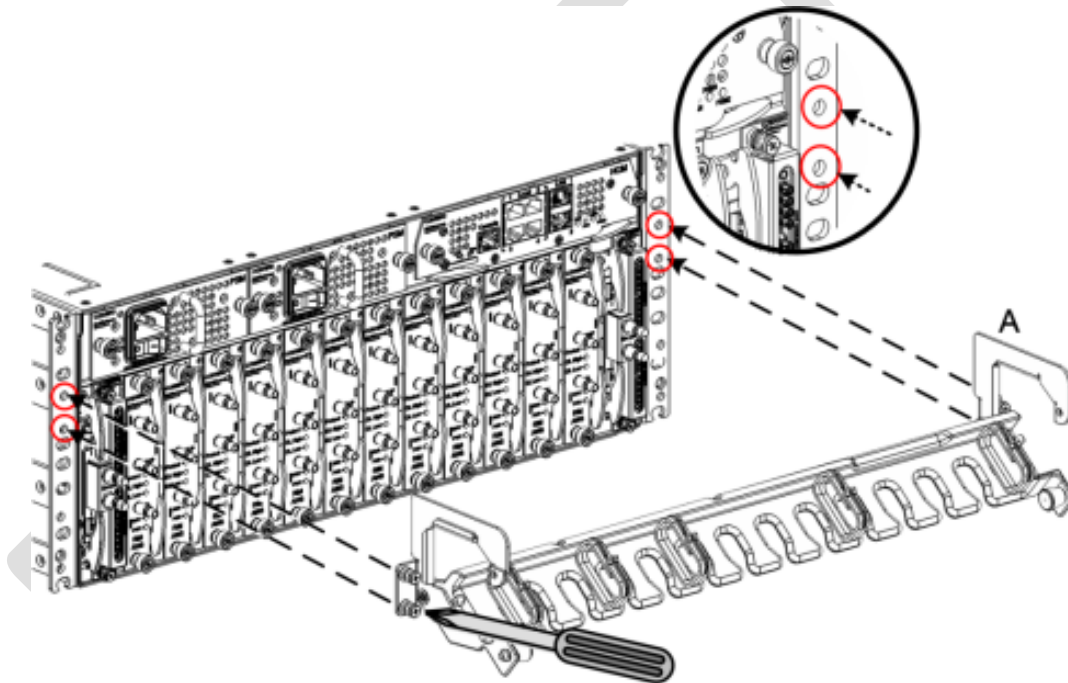
Figure 5-31. Assembling Cable Tray onto Chassis

2. Route Connection Cables Through Cable Tray (From the Middle Leftwards/Rightwards) and Pull Up Tray
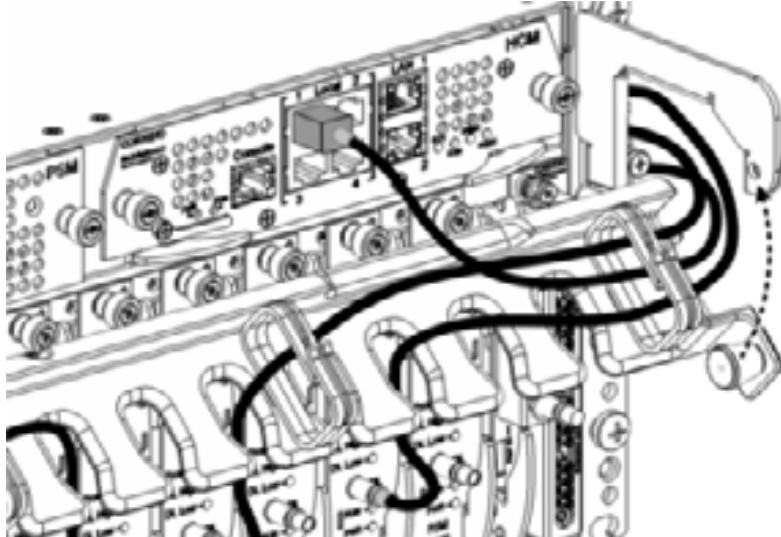
Figure 5-32. Routed Connection Cables

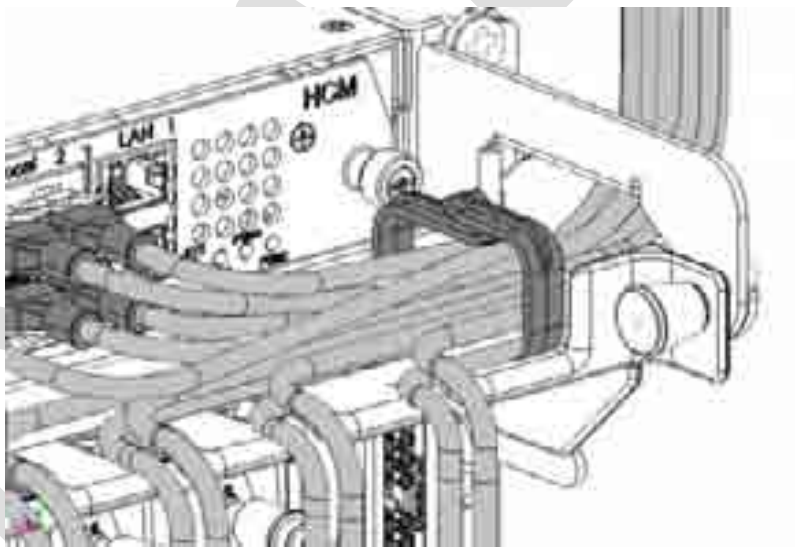   3. Close Management Tray (as shown in Figure 5-33)

Figure 5-33. Closed Management Tray

Note: The tray pin must first be pulled towards the left and then released into the hole (shown in figure above).
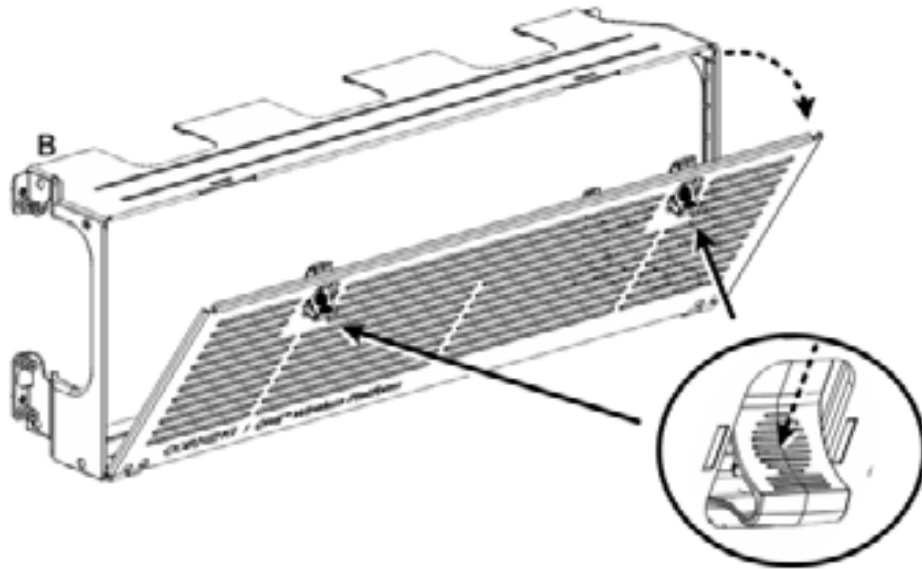
4. Pull Down the Cover Door.

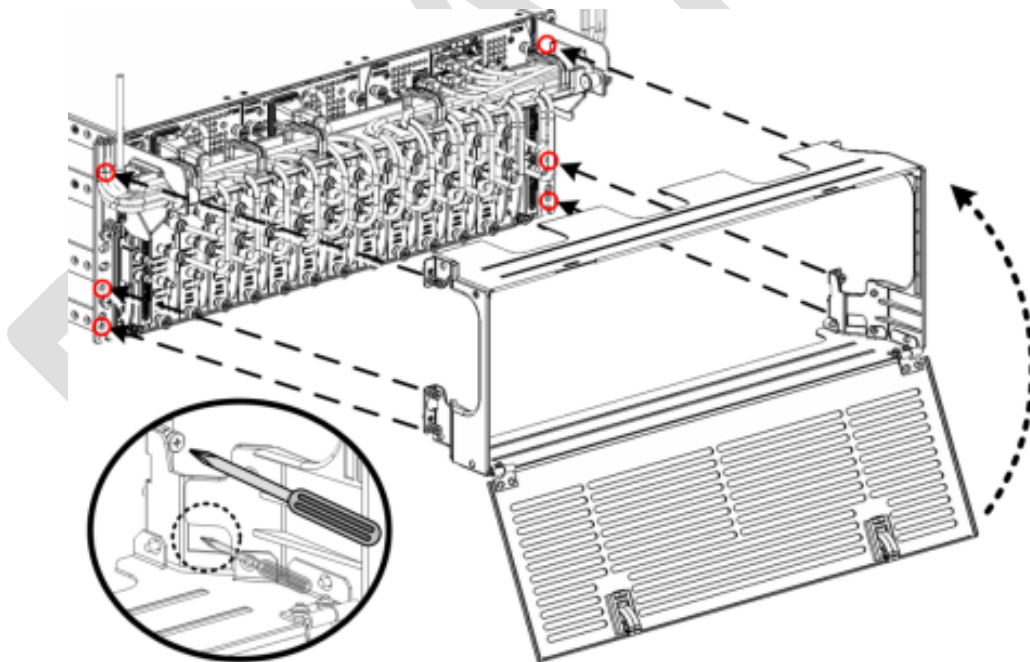Figure 5-34. Opening Cover Door

5. Assemble Cover onto Chassis
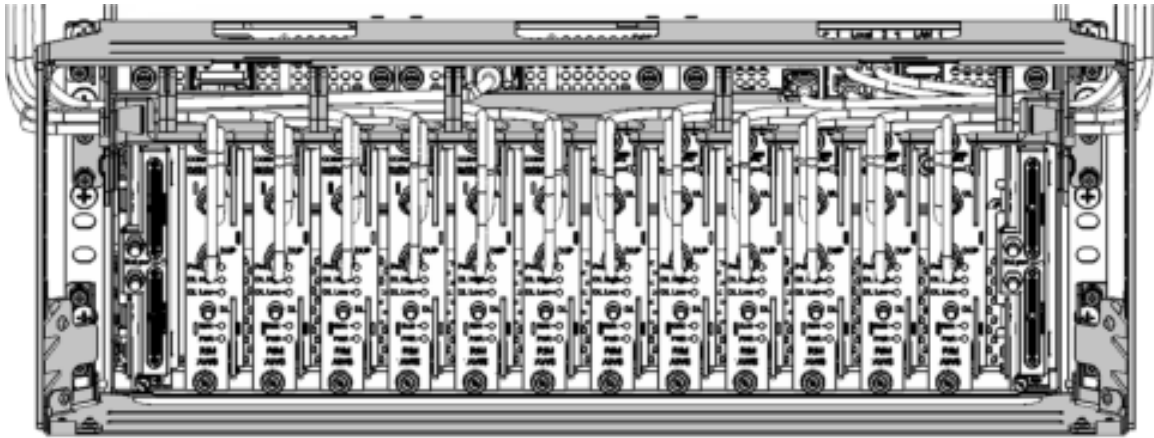

Figure 5-35. Assembling Cover Door

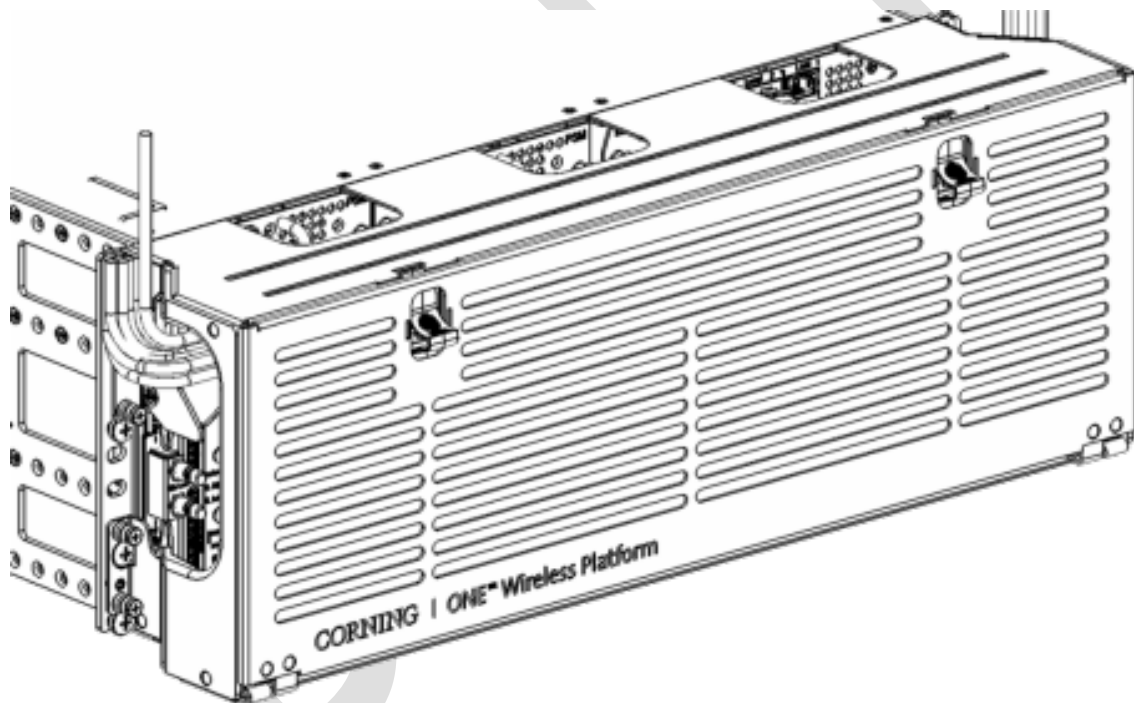Figure 5-36. View of Assembled Chassis and Cover – Open

Figure 5-37. View of Assembled Chassis and Cover – Closed

5.1.4 IHU Installation

Note the following information:

- The IHU chassis includes the S-FAM (Fan Module) and preassembled cable management tray routed with a 34 in 9 pin cable ready for the Expanders (i.e. RIX and OIX) connectivity.
- Each IHU includes 14 slots supporting the following modules:
  - RIX slot (Slot 1)
  - RIM slots (Slots 2-5; marked in RED)
  - Combo slots (Slots 6-9; marked in WHITE) – each slot supports RIMs or OIMs
  - OIM slots (Slots 10-13; marked in BLUE)
  - One OIX slot (Slot 14)
- IHU supports the following expansion connection options:
  - To a single IHU or,
  - To one HEU and one OIU

5.1.4.1 Unpacking and Inspection

This section describes the installation procedure for the Corning ONE™ Integrated Headend Unit (IHU) and relevant modules.

Unpack and inspect the cartons according as follows:

1. Open the shipping cartons and carefully unpack each unit from the protective packing material.
2. Verify that all the items required for installing the Corning ONE HEU according to the items listed in Table 5-6. If any of the listed items are missing, contact your Corning representative.
3. Check for signs of external damage. If there is any damage, call your Corning representative.

Items required for installing the IHU:

IHU Kit	Quantity	Item
Integrated Headend Unit Chassis	1	
Fan Module (S-FAM) – single unit hosting 4 fans (installed in the chassis rear)	1	
RJ45/RJ45 communication cable L=2m-2.15m (P/N 705900003) – HCM management cable	1	
Cable Management Tray - includes management tray with routed ERFC cable and door sleeve ERFC (Expander Cable) - RF interface cable between RIX and OIX modules; 9 pin SMP to SMP connector; L=34 in	1	

RIM Kit (up to 8 according to order)	Quantity	Item
Radio Interface Module (service specific)	1	

OIM Kit (up to 8 according to order)	Quantity	Item
Optical Interface Module (OIM)	1	
MTP-LC APC Harness Cable (P/N 37HP900162-006F) - connector for splitting fibers (6) leading from OIM to (FMU) Edge module	1	

RIX Module Kit	Quantity	Item
Radio Expander Module – expands the RF sources to the OIM modules via the OIX	1	
Pilot Transport Cable (P/N: PCKC47*) – Single QMA to QMA cable; L = 47 in; used for passing reference clock signal connections between RIX modules. *Additional various lengths are available: · PCKC20: L=20 in · PCKC63: L=63 in · PCKC79: L=79 in	1	

OIX Kit	Quantity	Item
OIU Expander Module - connects to the RIX Expander module; provides RF interface between RIM and OIMs	1	

PSM Kit (AC or DC modules - 1 or 2 kits according to order)	Quantity	Item
PSM-AC: 100-240 VAC Power Supply Module including standard IEC 60320-1 C13 cable	1	
PSM-DC: 48 V DC Power Supply Module; 9 A Max.; Includes six pin terminal block connector	1	

Controller Module Kit (HCM or ACM - according to order)	Quantity	Item
HCM Kit (Headend Control Module) – installed in Main IHU unit; enables remote/local management of all hosted units	1	
ACM Kit (Auxiliary Control Module) – installed in Auxiliary IHU units; provides management connections for the Auxiliary IHU.	1	

Table 5-6. Items Required for IHU Installation

5.1.4.2   Assembling Cable Management Tray onto IHU and Connecting ERFC Cable

Note the following:

·   The IHU Cable Management Tray is used for managing the unit connection cables.

·   The IHU Cable Management Tray includes a routed ERFC34 cable; Expander Cable - RF interface cable between RIX and OIX modules; 9 pin SMP to SMP connector; L=34 in

·   The Cable Management Tray consists of two items:

·   Cable Management Tray with routed ERFC cable

·   Door Sleeve

·   A Phillips screwdriver is required.

Assemble the provided Cable Management Tray and connect ERFC Cable (routed through tray) as follows:

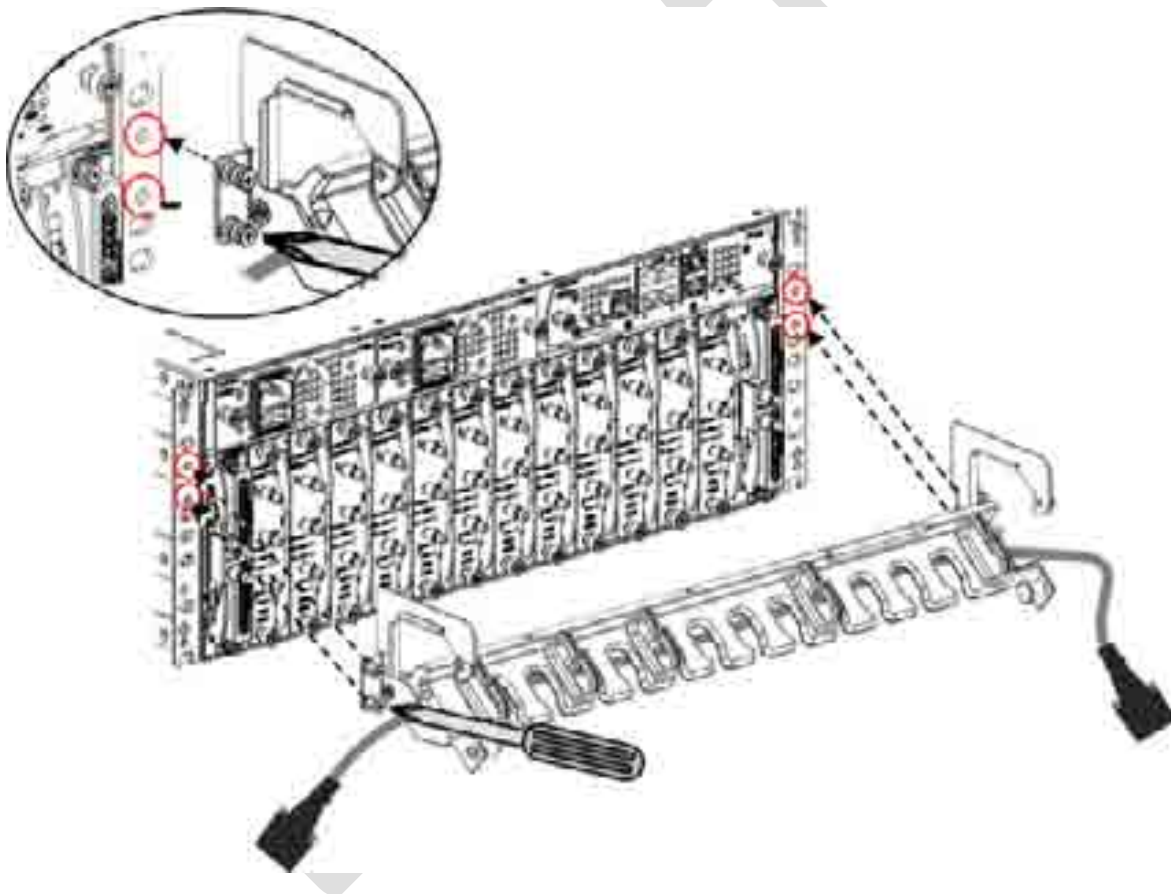1. Attach Cable Management Tray to IHU chassis:

Figure 5-38. Assembling Cable Tray

2. Connect ERFC Cable to RIX (Slot 1) 9-Pin connector and OIX (Slot 14) connector
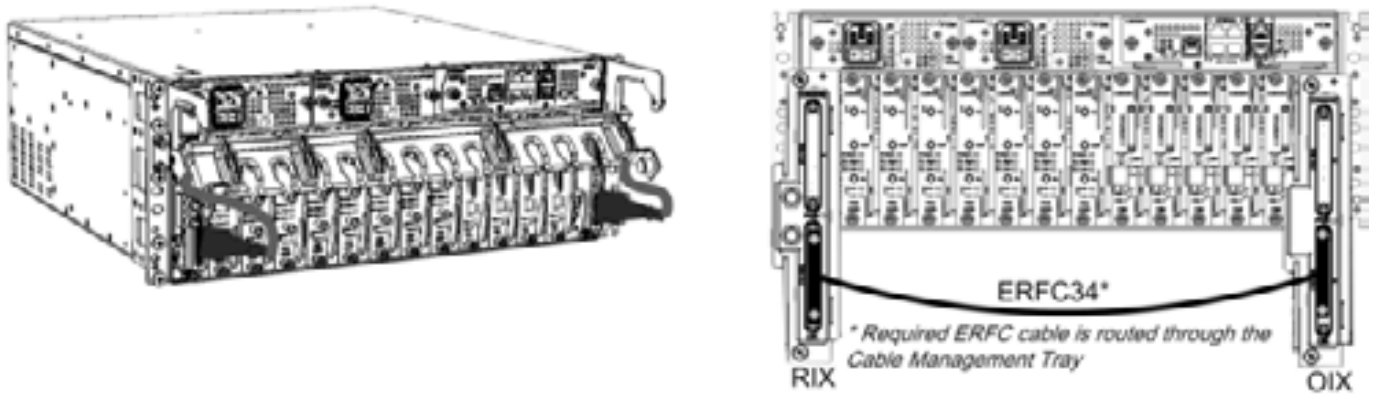

Figure 5-39. Connecting the ERFC Cable
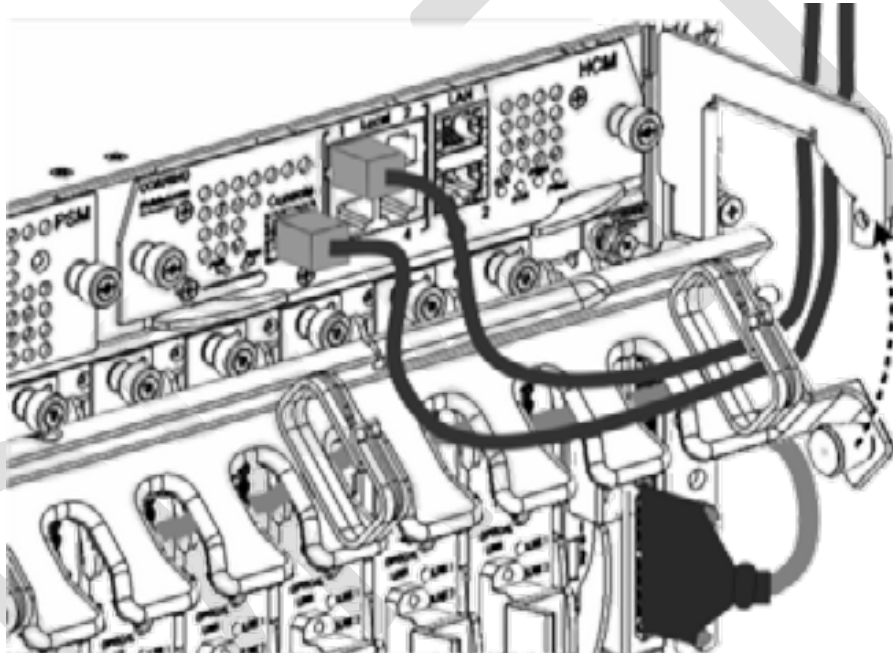
3. Route connected cables and lock tray

Figure 5-40. Routing Connection Cables

Note: The tray pin must first be pulled towards the left and then released into the hole (shown in figure above).

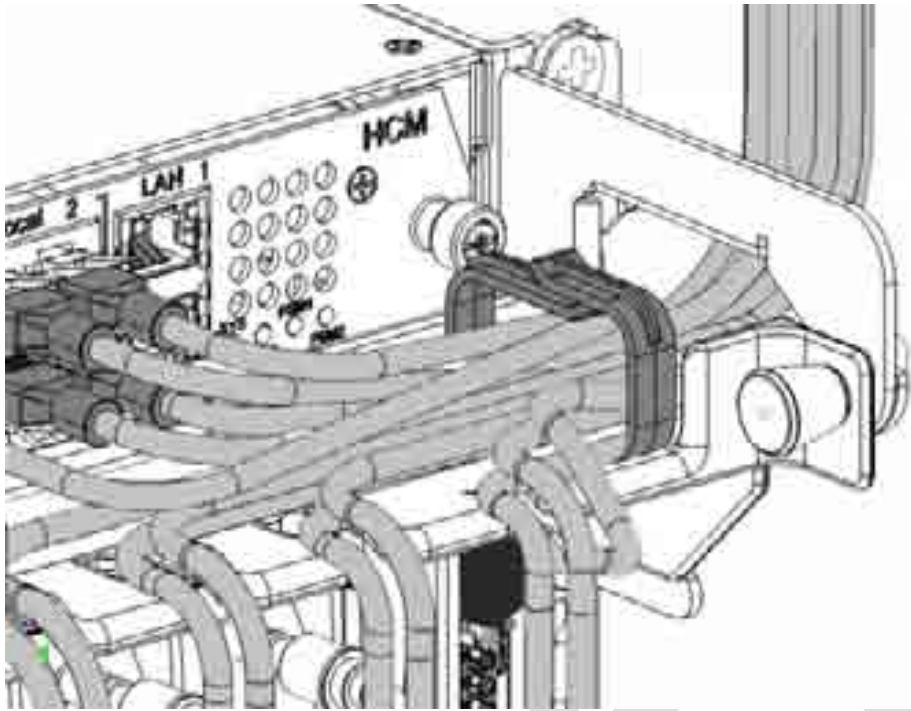CORNING │ ONE™ Wireless Platform

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Figure 5-41. Example of Routed Connection Cables and Locked Tray

Assemble the Door Cover as follows:
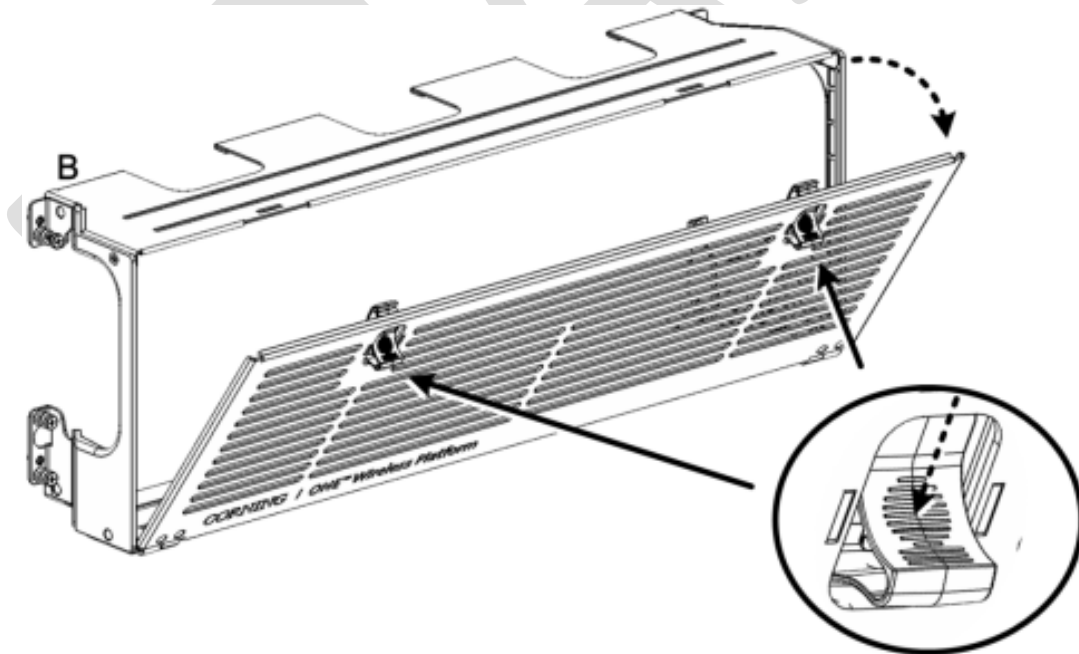
4. Pull Down the Cover Door

Figure 5-42. Opening Cover Door

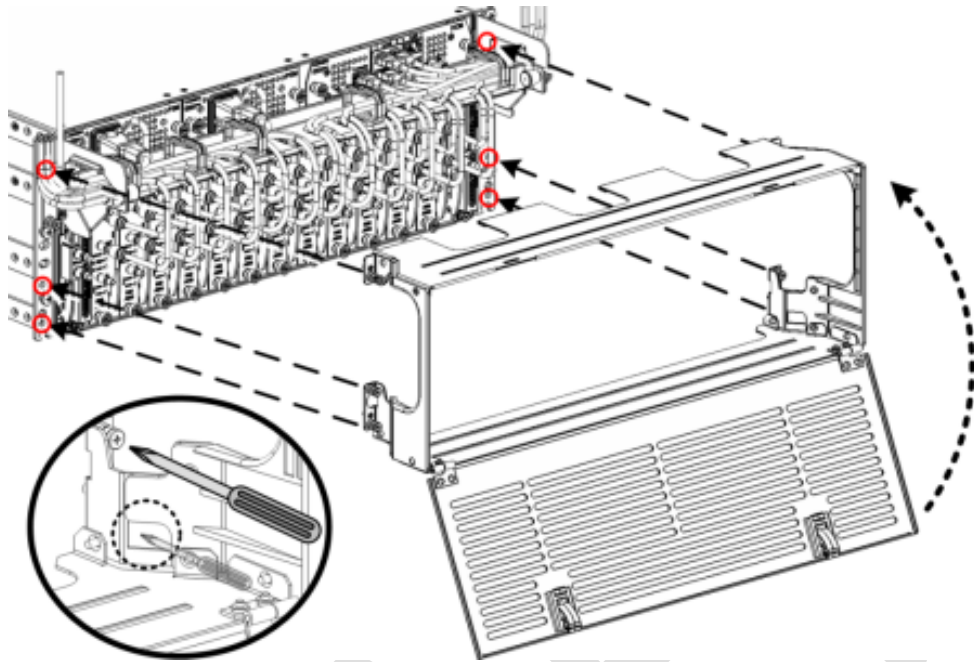5. Attach door to IHU Chassis and tighten integrated screws
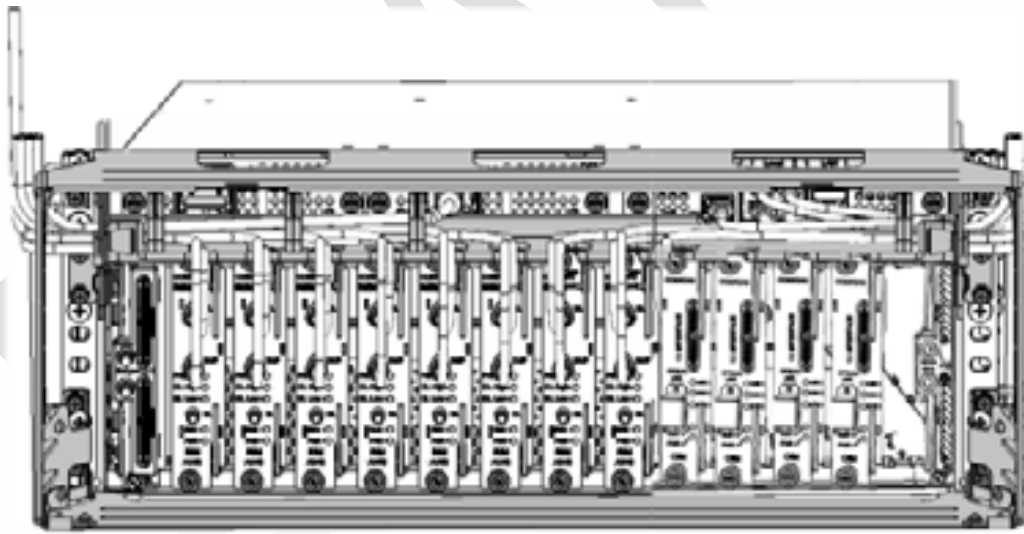

Figure 5-43. Attaching Cover Door

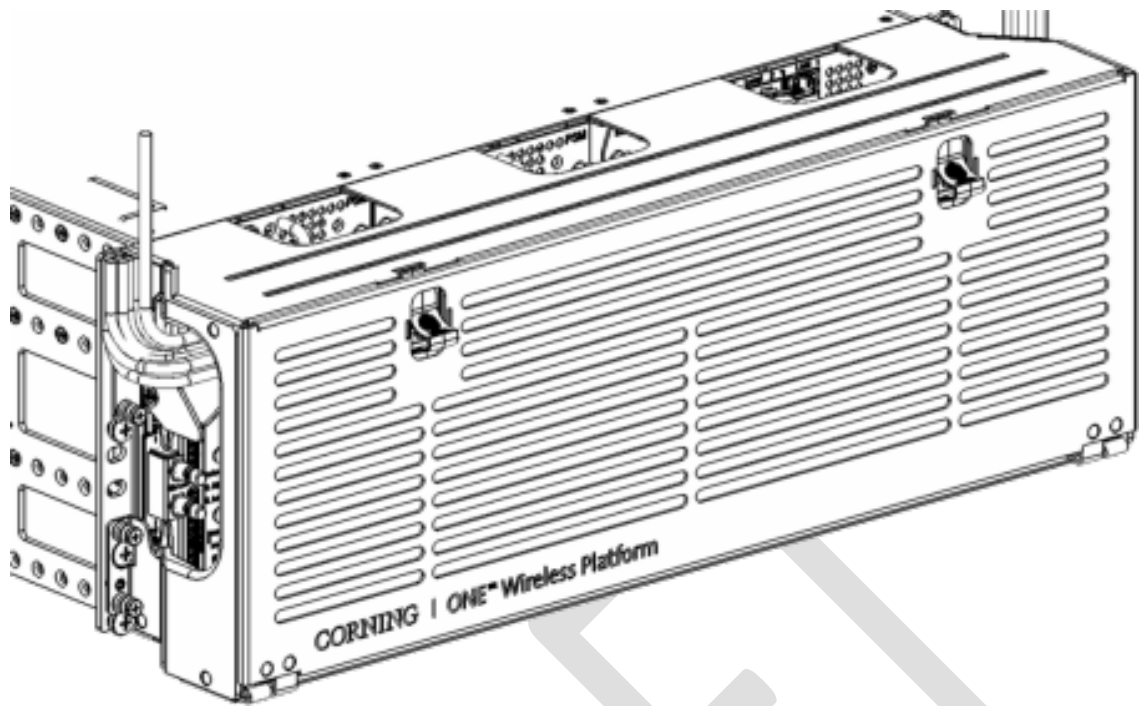Figure 5-44. Assembled Cable Management Tray and Door – Open View

Figure 5-45. Assembled Cable Management Tray and Door – Closed View

5.1.4.3   Mounting the IHU Chassis

Note the following:

- IHU chassis requires 4U rack height availability
- Rack nuts and screws not provided

To mount the IHU chassis (in 19-in rack)

1. Determine the location of the IHU in the rack while considering additional units (i.e. IHU, HEU, OIU) and the lengths of the available ERFC cable(s).
2. Referring to Figure 5-46 secure the units' rack ears to the rack frame as follows:

    - Insert two screws half-way into the rack frame.

    - Position the chassis on to the screws using the handles and the bottom half slots of the rack ears.

    - Secure the unit in the rack via all applicable bracket holes using the appropriate rack nuts and screws.
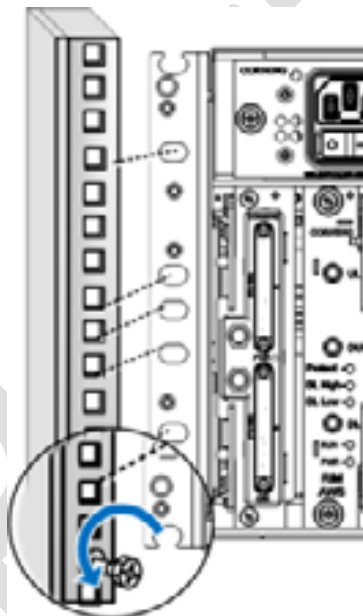

Figure 5-46.Installing Chassis in Rack

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5.1.4.4 Installing all Modules

For modules with ejectors (i.e. RIM, RIX, OIM, OIX and HCM/ACM) – verify that the ejectors are completely open when inserting in dedicated slot and then push in until the module clicks in to the backplane. Figure 5-47 shows example of module type captive screws and ejectors.

Figure 5-47.Module Captive Screws and Ejectors

To install the IHU modules:

1. Refer to Figure 5-48 for module locations. Remove blank panel and slide in the relevant module (chassis slots are 100% mistake proof) according to Table 5-7:

    · (One or two) PSM – for single power supply installations, install the PSM in either (PSM) slot

    · (Two) RIX modules

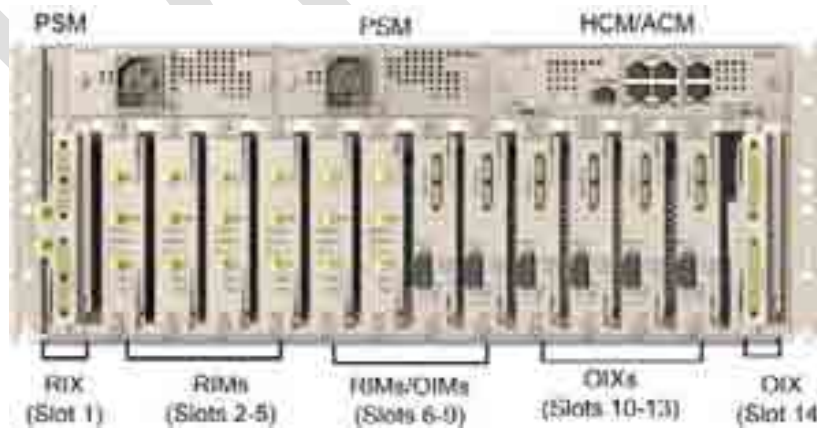   · (One to 12) RIM – no need to terminate unoccupied RIM slot.

Figure 5-48.IHU (Shown Without Cable Management Tray)

Module	Quantity	Comment
HCM (for Standalone/Main IHU units)	1	In installations with more than one IHU, the HCM is installed in one of the chassis which will be referred to as the "Main" HEU; One HCM per system installation.
ACM (for Auxiliary IHU unit)	1	Installed in the IHU in configurations consisting of more than one IHU chassis
PSM	1 - 2	For single power supply installations, install the PSM in either (PSM) slot
RIX	1	
OIX	1	
RIM	1 – 8	· Up to four in dedicated slots and up to four* in combo slots · No need to terminate unoccupied RIM slots – leave blank panel
OIM	1 – 8	· Up to four in dedicated slots and up to four* in combo slots · No need to terminate unoccupied OIM slots – leave blank panel
· *the combo slots may contain any combination of OIMs and RIMs up to four modules in total		

Table 5-7. Modules Required for IHU Installation

2. Referring to examples of modules shown in Figure 5-47 secure the modules to the backplane by:

- Closing the ejectors (for relevant modules)
- Tightening the captive screws

5.1.4.5   Grounding IHU Chassis

The grounding connection is performed via a two-hole, standard barrel grounding lug located on the IHU rear panel (see Figure 5-7):

- For use with stranded copper wire conductors
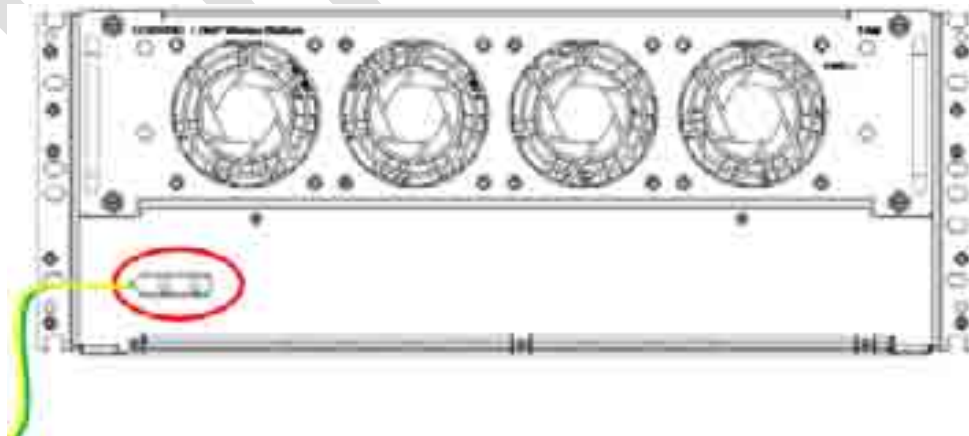- 10-14 AWG
- Holes - 1/4 inch

Figure 5-49. IHU Grounding Lug (IHU Chassis Rear)

5.1.4.6 IHU Expansion Connections to IHU, HEU and OIU Units

Note the following:

A single IHU supports expansion connections as follows:

· To one additional IHU unit
· To one HEU and one OIU (see Figure 5-50)

For connections to additional IHU or HEU and OIU units:

Using the appropriate length ERFC cable (according to distance of available OIX/RIX port) connect remaining IHU RIX and OIX module connectors as follows:

· Connections to additional IHU unit (see Figure 5-50):
  · IHU #1 RIX 9-Pin connector to the corresponding IHU #2 OIX module
  · IHU #1 OIX 9-Pin connector to the corresponding IHU #2 RIX module

Figure 5-50. RIX to OIX Connections between two IHUs
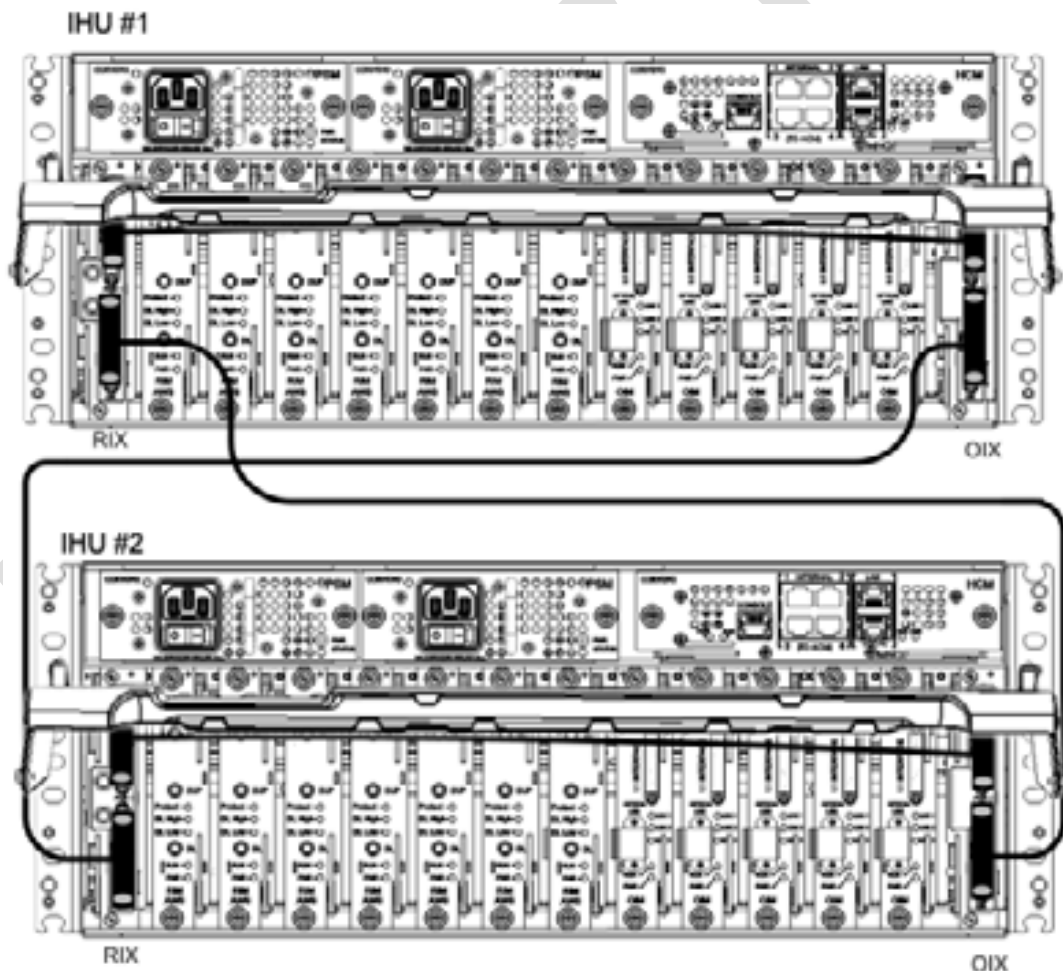
· Connections to additional HEU and OIU units (see Figure 5-51):
  · IHU RIX 9-Pin connector to the corresponding connector on the OIX module of the additional OIU.
  · IHU OIX 9-Pin connector to the corresponding connector on the RIX module of the additional HEU.
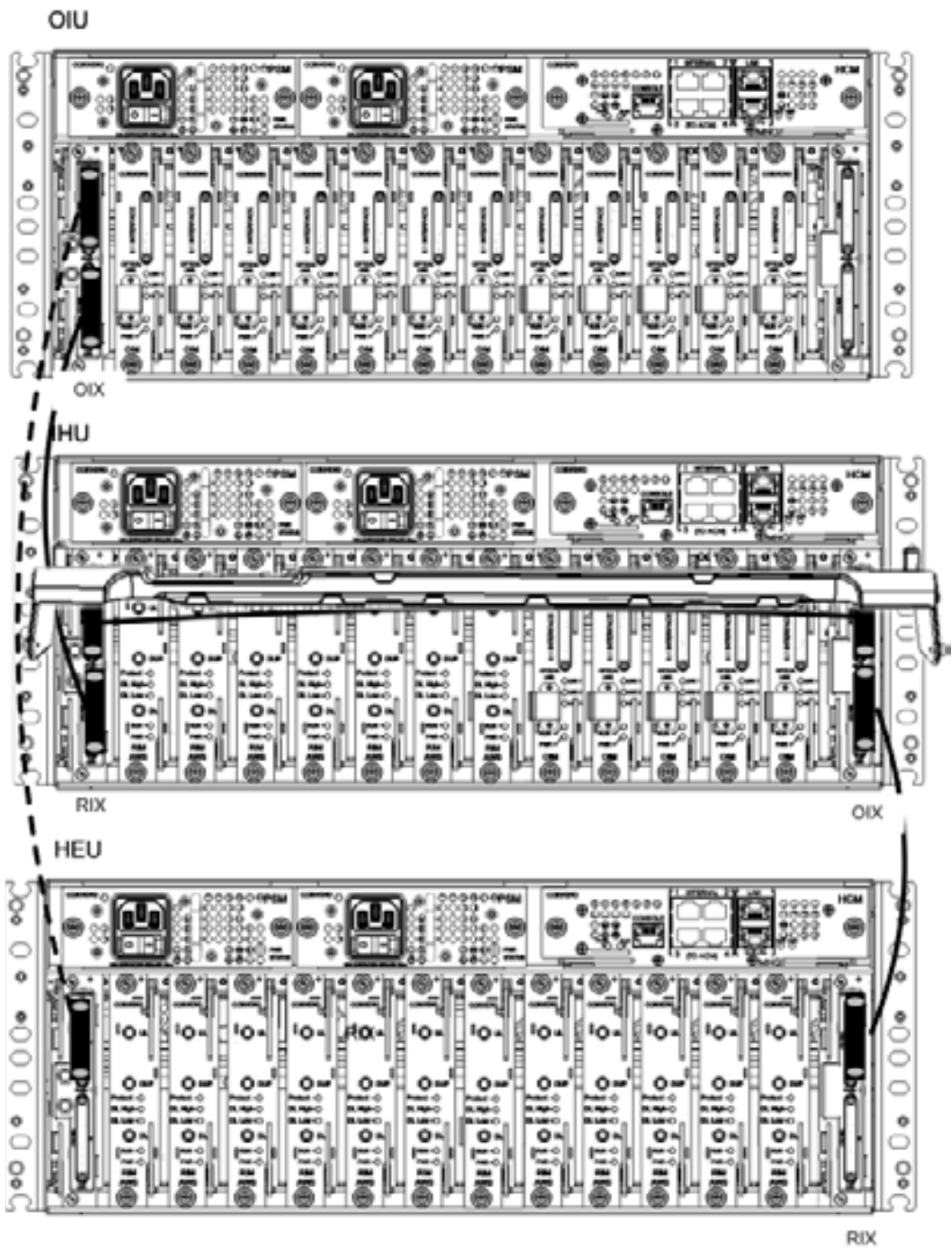
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Figure 5-51. RIX to OIX Connections between IHU, HEU and OIU

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5.1.4.7   RIM Connections to RF Source

To connect RIMs to RF source:

1. For each RIM - connect the RF coax cable to the RIM's Simplex or Duplex QMA connectors. See HEU section 5.1.1.5
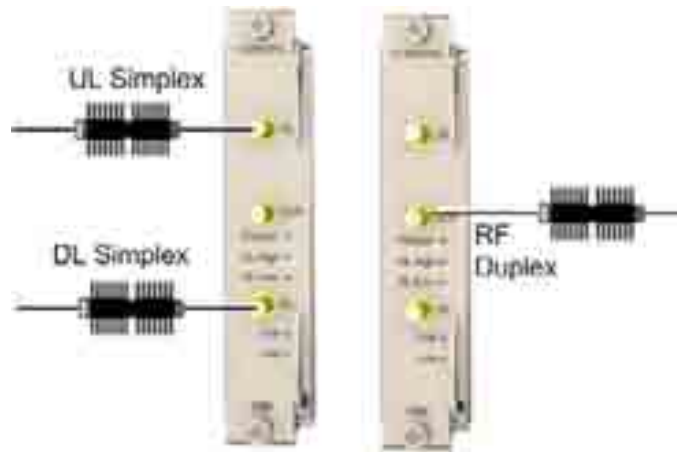

Figure 5-52. Example of RIM RF Source Simplex/Duplex Connections

2. Route the connected cables through the Cable Management Tray towards the right or left of the tray (depending on the module location in the chassis).
    3. Connect the RF coax cable from the RIM to the corresponding external RF source.

5.1.4.8   RIX 10 MHz Pilot Clock Connections

Note the following:

·   This section is only relevant for configurations with additional IHU or HEU and OIU units.
·   The REF IN and REF OUT pilot clock ports must be connected in a closed loop as shown in Figure 5-53.
·   Both RIX modules of each chassis must be connected.
·   The jumper cables are routed through the sides of the cable management tray and door.

To perform an RIX pilot clock connection

Referring to Figure 5-53 use the QMA/QMA jumper cable (PCKC47 provided with each RIX) to connect the **REF OUT** and **REF IN** ports of each of the RIX modules in the HEU chassis.
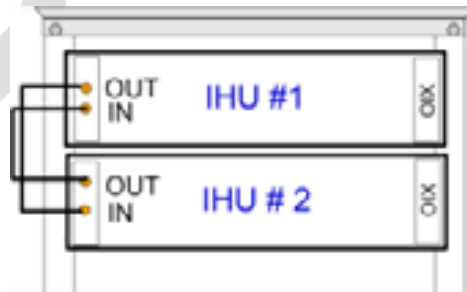
Figure 5-53. Example of Pilot Clock Connections between Two IHU Units

Fiber Connections

Using the provided Corning MTP-LC APC Harness Cable:

· Connect the   cable MTP® connector to the OIM MTP connector
· Remove the protective plastic covers and connect the three LC APC connection fibers to the FMU (Fiber Management Unit) Edge module LC APC connections. See Figure 5-54.

Figure 5-54. OIM Fiber Connections

5.1.4.9   Management Connections

Refer to HCM User Manual or Quick Installation Sheet (CMA-348-AEN) for instructions on how to correctly perform the management connections between HCM and ACM modules.

5.1.4.10 Power Up

Note: Max power consumption for fully loaded chassis is 300 W.

The same PSM modules are installed in all of the headend units. Refer to section 0 for instructions on how to connect PSM-AC and PSM-DC modules.

5.1.4.11 Verify Normal operation

1. Verify that the Power Status LED on each PSM shows green. See Figure 5-16 (PSM-AC) and Figure 5-19 (PSM-DC).
2. Referring to Table 5-8 and Figure 5-55 - verify that the RIM (if RF source is operational), OIM and HCM/ACM LEDs indicate normal operation.

Module	LED	Description
RIM	Protect	N/A
	DL High	Off - DL RF input level in threshold range Steady Red – DL RF input level is 3 dB above max expected power
	DL Low	Off - DL RF input level in threshold range Steady Red - DL RF input level is 15 dB below max expected power
	RUN	Blinking Green - RIM module SW has initialized and is up and running Off – Power off
	PWR	Steady green - Input power is within required range
OIM	Link 1/2/3	Steady Green - Optical link power to/from the connected remote is normal Blinking Green - Optical power from remote is lower than required
	Run	Blinking Green - OIM module SW has initialized and is up and running Off – Power off
	PWR	Steady Green - Power input detected in OIM
HCM/ACM	PWR	Steady Green - Power input detected by HCM/ACM
	RUN	Blinking Green - HCM module SW up and running
	SYS	Steady Green - Overall status of the managed system is ok
	FAN	Steady Green - Normal operation status for all fans

Table 5-8. RIM/OIM and HCM/ACM LED Descriptions

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Figure 5-55. RIM, OIM and HCM/ACM LEDs

5.2 RF Remote-End Installation

The remote end site (RF coverage) installation consists of installing the ICU and RAU module(s).

5.2.1 ICU Installation

Note the following:

- The ICU is a passive unit installed at the floor level and provides the power and fiber interfaces to the RAU units (and to the GEU for the digital path).
- Connections between the ICU and the RAU units are performed via Corning composite cables (ordered separately) consisting of:
  - 2 DC wires
  - 3 LC APC pairs
- Chassis and modules are supplied separately and must be inserted by the user
- All ICU modules (i.e. PS and Edge) are hot-swappable
- Each ICU chassis hosts up to four Power Supply modules and up to two Edge modules

5.2.1.1 Items Required for ICU Installation

The following kits and included items are required for installing the ICU. If any of the listed items are missing, contact your Corning representative.

ICU Chassis Kit	Quantity	Item
ICU Chassis	1	
IEC 60320-1 C13 right angled, AC power cable 110-240V AC, 50-60	1	
Wall mount bracket	2	
Power Supply Kit (1 to 4 according to order)	**Quantity**	**Item**
Power supply module	1	
Edge Module Kit (1 to 2 according to order)	**Quantity**	**Item**
Edge Module	1	

5.2.1.2   Installing Power Supply Module

Note: The power supply modules are hot-swappable and can be installed/extracted either before or after power-up.

1. With the lever up, slide the power supply module into any of 1-4 PS slots on the ICU chassis rear (Figure Figure 5-56).

Figure 5-56. Inserting Power Supply Module

2. Push in the module until the lever meets the chassis (Figure 5-57).

Figure 5-57. Securing PS Module in ICU Chassis

3. Secure by pulling the lever downward until it "clicks" and module is flush with chassis rear.

5.2.1.3 Installing Edge Module

Note: The Edge module can be installed from either the front or the rear of the ICU chassis. This procedure illustrates a front side installation.

1. Pull one of the Edge module trays all the way out – until it "clicks".
2. Slide in the Edge module between the guides and fit the module guide into the tray "Push" button slot, as shown in Figure 5-58.

Figure 5-58. Inserting Edge Module (Chassis Front)

3. Push the module gently in until it "clicks" and is "flush" with the ICU panel - leaving the tray in place. See Figure 5-59.

Figure 5-59. Edge Module Flush with Panel (Chassis Front)

4. Push the tray back in place.
5. Repeat Steps 1-4 for additional Edge module.

5.2.1.4   Mounting ICU in 19-IN Rack

Note the following:

- Continue to next section if ICU is to be mounted on wall.
- If the ICU is rack mounted, the modules can be inserted either before or after the unit is mounted.
- Mount the ICU in the 19-in communication rack and secure using pre-assembled bracket.

Figure 5-60. ICU Rack Brackets

5.2.1.5   Mounting ICU on Wall

1. Remove the rack mounting brackets and set the screws aside.

2. Using the screws (previously set aside), assemble the wall mount brackets onto the sides of the ICU.
3. Using the wall mount bracket holes as a guide, mark the holes to be drilled on the wall.

5.2.1.6 Connect MTP Fiber

Note: The fiber connection is performed between the Edge module MTP connector and the FMU (Fiber Management Unit) using a trunk cable.

1. From the rear panel, pull the tray with the Edge module all the way out.

2. Gently extract the edge module by pressing on the safety latch and pulling slowly outwards. Refer to Figure 5-61.
3. Remove the MTP connector cover and connect the MTP fiber cable.
4. Push in the module tray.

Figure 5-61. Extracting Edge Module

5.2.1.7 Composite Cable Connections

Note: The composite cable connections are connected towards the RAU and/or GEU units.

1. Connect one side of the composite cable DC wiring to any of the ICU DC power connectors (1-8) on the front panel. See Figure 5-62.
2. Extract the Edge module (see Steps 1-4 of 5.2.1.6), remove the tip covers from the composite cable fiber pairs and connect to the Edge module LC/APC fiber connectors. See Figure 5-62.
3. Note the cable coding on the fibers.
4. Push Edge module and tray back in place.
5. Connect the DC wiring and fibers from the opposite end of the composite cable to the RAU/GEU units - described in corresponding Quick Installation Sheet documents.
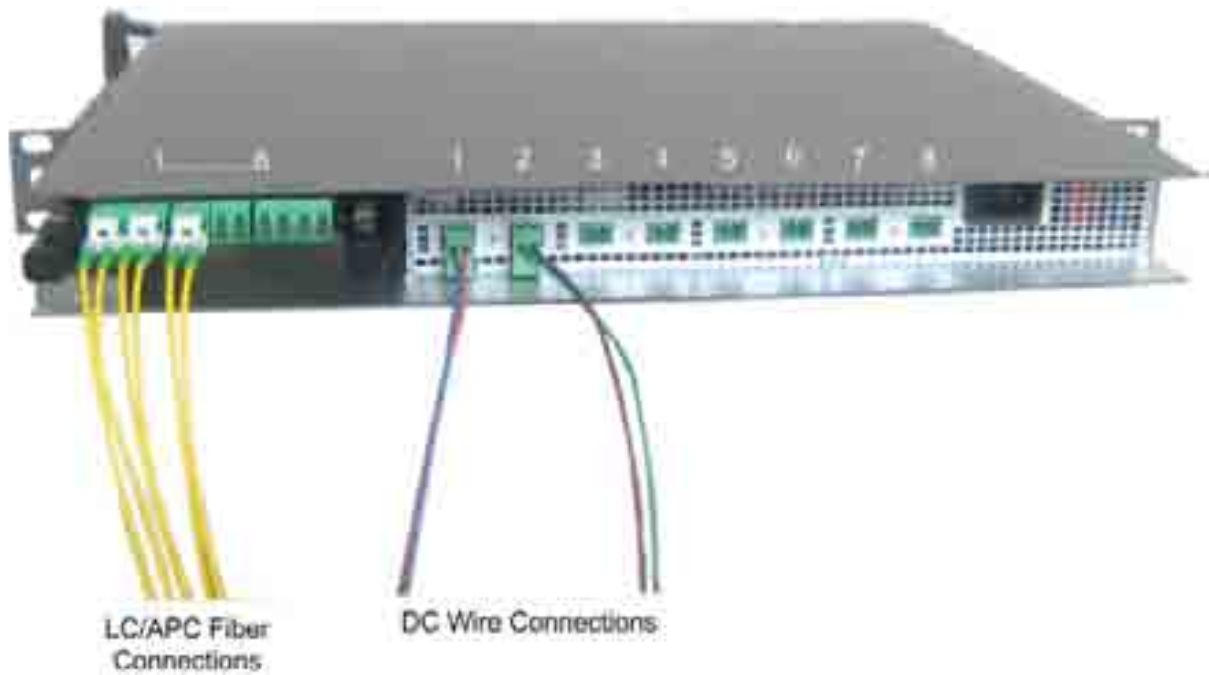
Figure 5-62. ICU Fiber and DC Connectors

5.2.1.8 Power Up

1. Connect the ICU power connector (front panel) to the AC power outlet using the provided power cable.
2. Verify that the PS LED indicators (located between the corresponding DC connectors on the front panel) show green. Refer to Figure 5-63.
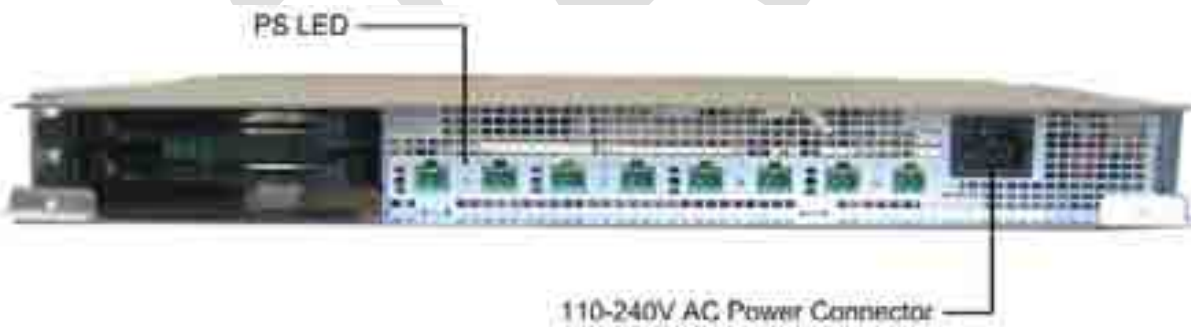

Figure 5-63. AC Power Connection and LEDs

5.2.2   RAU Installation

5.2.2.1   General Information

1. The RAU modules are deployed on the floor level and interface to the RF antennas.
2. The RAU can be provided in a number of configurations:

    · RAU alone (without RxU and GEM); weight = 7.93 lbs (3.6 kg)

    · RAU + RxU

    · RAU + GEM

    · RAU + RxU + GEM; weight = 12.12 lbs (5.5 kg)

    Note: Existing RAU units can be upgraded with RxU (for MIMO support) and/or GEM modules (for Ethernet services) – see Appendix A for instructions on how to upgrade the RAU with these modules.

3. The RAU supports various mounting installation options:

    · Wall-mount installations (vertical); required ambient temperature of 45°C [113°F]

    · Ceiling-mount installations (horizontal): required ambient temperature of 45°C 50°C [122°F]

    Note: If the RAU is installed below or mid-mount an acoustic ceiling, a support bar (T-Bar) is required (not included). Acoustical ceiling grid work is not designed to support the weight of the enclosure.

4. The RAU unit is provided with a mounting bracket used for mounting on the wall or concrete ceilings (including above acoustic ceiling mounts). Additional below/mid-mount acoustic ceiling mounting options are possible using a T-Bar mounting bracket (not provided).
5. RAU optic fiber connections and DC power are provided via a Corning Composite cable (ordered separately).
6. External cavity filters (AK-CVT700; AK-CVT800) are required for installations in which RAU/RXU modules supporting the corresponding CELL and LTE bands are deployed alongside units supporting the public safety service. See section 5.2.3 for installation instructions.

5.2.2.2   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	Quantity	Image
Remote Access Unit (RAU): RAU-R-G-C85P19L70A17-ME RAU-R-C85P19L70A17-M RAU-G-C85P19L70A17-E RAU-C85P19L70A17	1	
Mounting Bracket (factory assembled on RAU underside) *Note: Mounting Bracket includes holes in various sizes and locations for flexible installation options. Mounting screws not provided.*	1	
Screw, SEM 8-32X3/8 , Pan Head, Philips - used for grounding and to secure bracket to RAU	2	
"Skirt" Frame Cover – used for acoustic ceiling cut-out template and for aesthetic installation	1	
Safety Cable – used to secure RAU to permanent structure in acoustic ceiling installations; connected to RAU	1	

5.2.2.3   Routing Connection Cables

1. Locate the following connection cables:
   - DC wiring:
     - o   One pair for MAIN POWER connection
     - o   One pair for SECONDARY POWER connection (for RAU models including GEM module)
   - Fiber pairs:
     - o   One fiber pair for RAU module
     - o   One fiber pair for GEM module (for RAU models including GEM)
   - Grounding wire

2. Route the connection cables through center of the Mounting Bracket. See Figure 5-64.
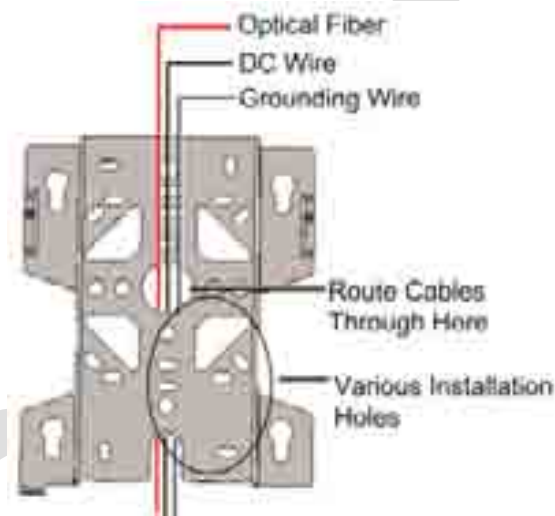

Figure 5-64. Routing Connection Cables through Bracket

5.2.2.4   Mounting RAU Installation Bracket (Wall/Concrete Ceiling)

Note: If using the RAU mid-mount bracket accessory kit – refer to section 5.2.2.6.

Note the following:

· When mounting the bracket, the Safety tab (circled in Figure 5-65 and Figure 5-66) should always be positioned to face the same direction as the RAU connectors (up or down).
· When installing above acoustic ceiling, allow for at least 1 inch above the acoustic ceiling for air flow cooling. See Figure 5-66.
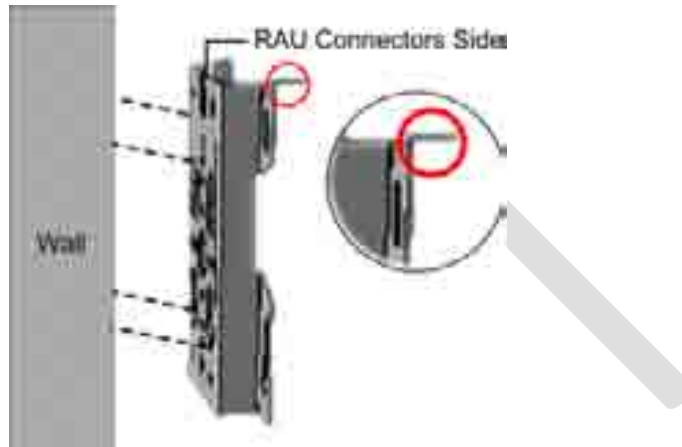
Figure 5-65. Wall Mount Bracket Installation

1. Using the Mounting Bracket Installation Template (see Appendix B), mark and drill appropriate holes for mounting the bracket. Any of the applicable screw holes can be used.
2. Remove mounting bracket from RAU underside and mount the bracket on the wall (Figure 5-65) or concrete ceiling (Figure 5-66) using any of the applicable screw holes (screws not provided).
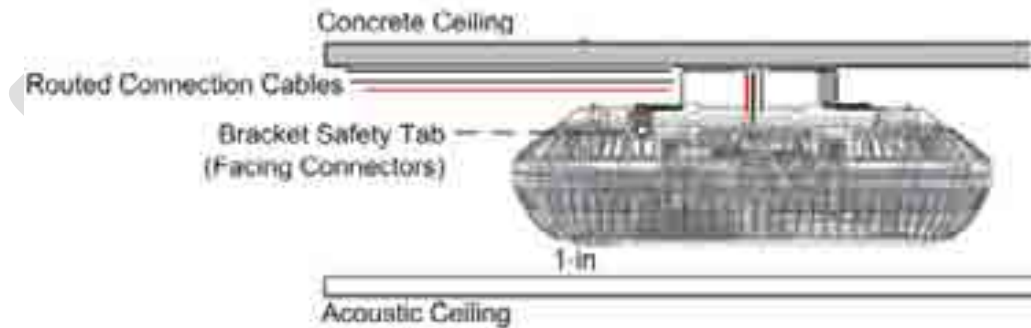

Figure 5-66. Above Acoustic Ceiling Installation

5.2.2.5   Additional Bracket Installation Options

Note 1: A T-Bar Mounting Bracket can be used (not provided) to mount the RAU below or mid-mount an acoustic ceiling.

Note 2: A mid-mount installation option including a panel for replacing acoustic tile is available using the separately ordered RAU mid-mount accessory kit (P/N: AK-RAU-BRCK-MM) – refer to section 5.2.2.6.

1. For mid-mount only - using the inner circumference of the RAU Skirt (provided) as a template, cut out an opening in the acoustic ceiling tile for the RAU. See Figure 5-67.
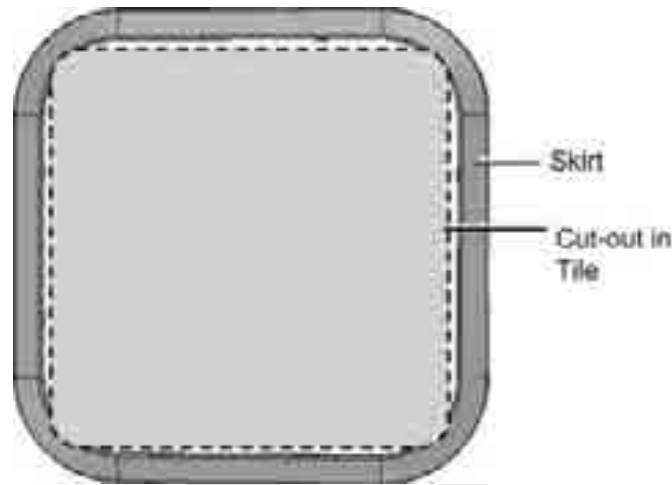

Figure 5-67. Skirt for Mid-Mount Cut-Out

2. Install the T-Bar on the ceiling above the acoustic tiles (according to manufacturers' instructions) and route the previously located connections cables through the center of the RAU Mounting Bracket. See Figure 5-68.
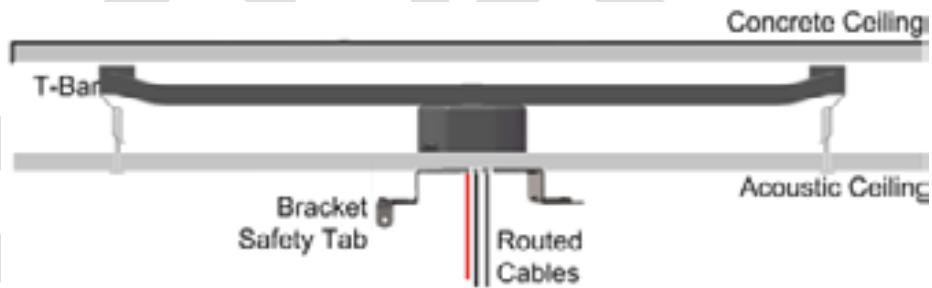
Figure 5-68. Routed Cables and Mounting Bracket Installed on T-Bar (Below Ceiling)

3. Install RAU bracket on the T-Bar, using any of the applicable bracket installation holes. See Figure 5-69.
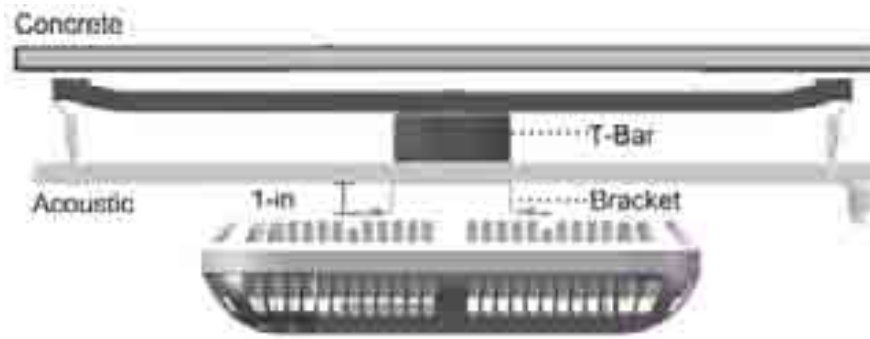
Figure 5-69. Below Acoustic Ceiling Installation

Note the following:

·   Safety tab should face the direction of the RAU connectors

·   Below Ceiling – 1-in minimum between ceiling tile and RAU (shown in Figure 5-69)

·   Mid-Mount – 2.5 in (63.5 mm) between ceiling and lowest part of RAU (shown in Figure 5-70)
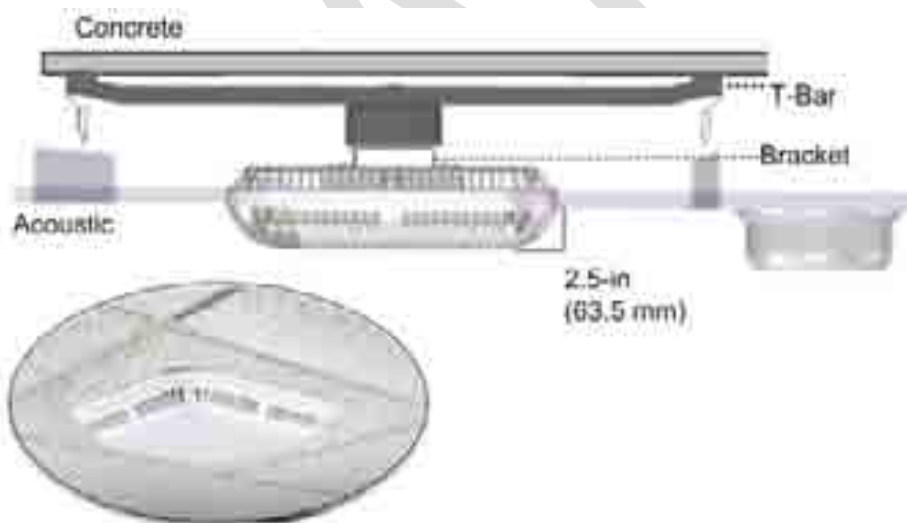
Figure 5-70. Mid-Mount Acoustic Ceiling Installation

5.2.2.6 RAU Mid-Mount Installation Option

The RAU mid-mount bracket accessory kit (AK-RAU-BRCK-MM; ordered separately) provide an aesthetic solution for a installing the RAU in mid-mount of an acoustic ceiling. The kit includes a tile like panel onto which the RAU is mounted and which replaces a standard acoustic ceiling tile.
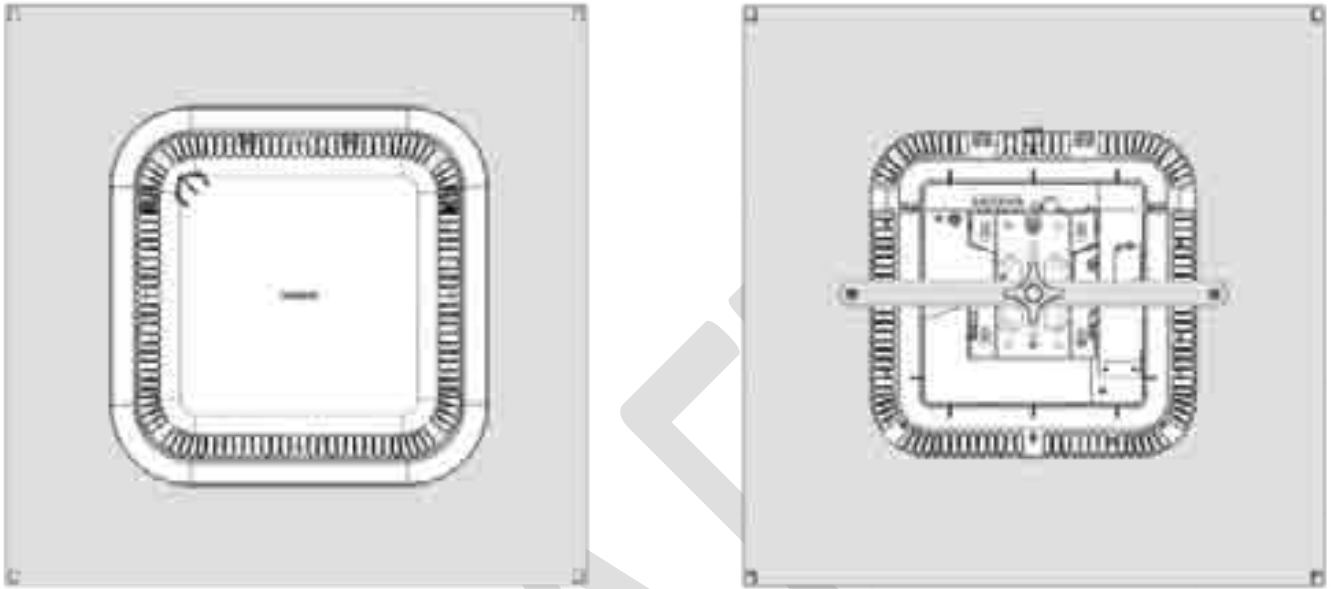

Figure 5-71. RAU Mid-Mount Complete Assembly – Top (Right) and Bottom (Left) View

RAU Mid-Mount Bracket Accessory kit Items

Item No.	Description	Quantity	
1	Plate	1	
2	Spacer	1	
3	Assembled flat bar	1	
4	Nylon four arm knob with threaded stud	1	

To install the mid-mount option:

1. Referring to Figure 5-72, assemble the RAU Frame Cover (provided with the RAU) onto the RAU.
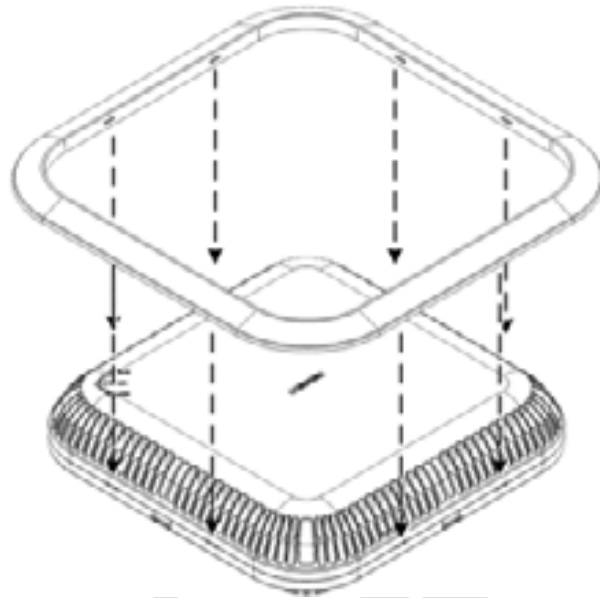
Figure 5-72. Assembling RAU Frame Cover

2. Position the RAU on a flat surface with the mounting bracket facing upwards and lower the plate (Item 1) onto the RAU, as shown in Figure 5-73.
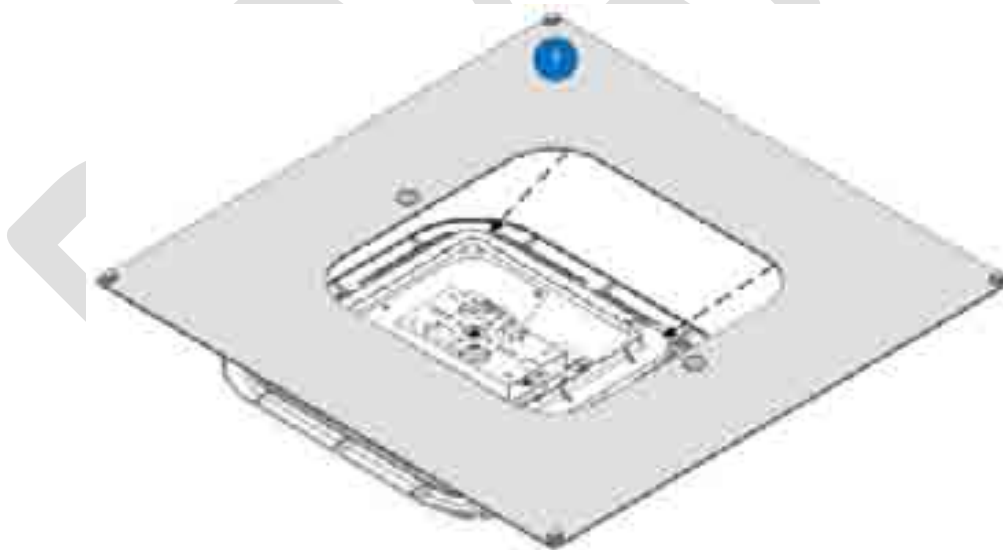
Figure 5-73. Lowering Plate onto RAU

3. Slide the Spacer (Item 2) in through the RAU mounting bracket and insert into bracket middle hole. Refer to Figure 5-74.

Figure 5-74. Inserting Spacer into RAU Mounting Bracket

4. Assemble Flat Bar (Item 3) and Knob (Item 4) as shown in Figure 5-75.
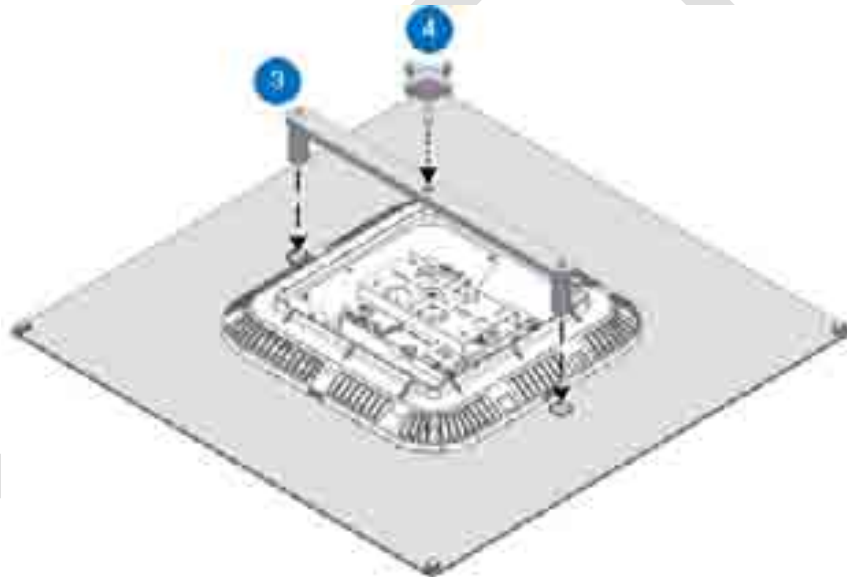
Figure 5-75. Assembling Flat Bar and Knob onto Plate

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5. Tighten knob to secure Flat bar in place. Refer to Figure 5-76.
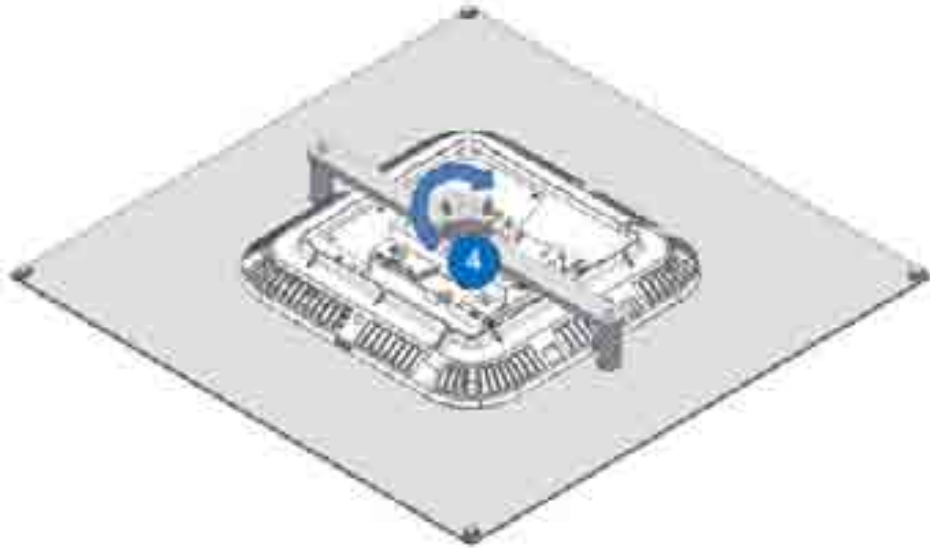
Figure 5-76. Securing Plate to Flat Bar

6. Replace relevant acoustic tile with Mid-Mount assembly.

5.2.2.7 Connections

1. Hold the RAU near the mounting bracket and routed cables.

2. Connect the earth ground to the RAU using one of the provided 8-32X3/8 screws. See grounding bolt location circled in Figure 5-77.
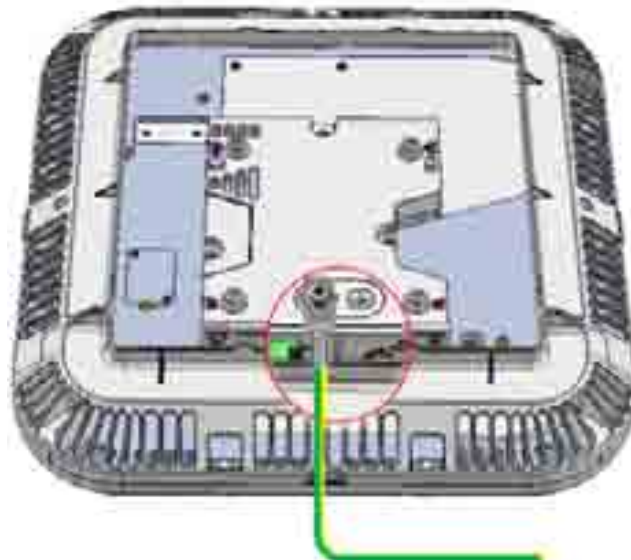
Figure 5-77. Grounding Bolt Location

3. Pull the front panel and remove to access connectors. See Figure 5-78.
4. Route the cables over the top of the RAU and towards the front panel connectors, where the bracket will be located. (The cables will be routed between the RAU and the bracket). See Figure 5-78.
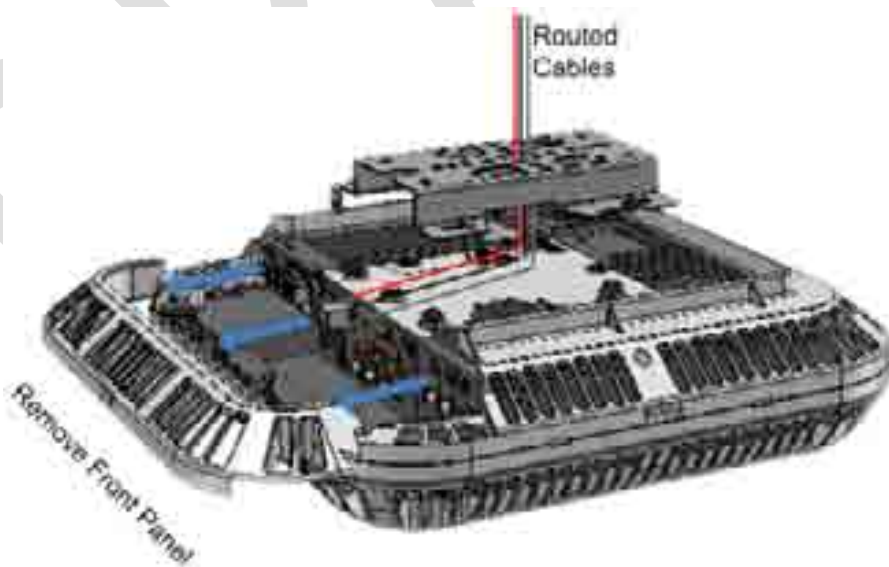
Figure 5-78. Route Cables towards RAU Connectors

5. Pull the front panel and remove to access connectors. See Figure 5-78.
6. Connect optic fiber pair to RAU module LC APC connector. See Figure 5-79.
7. RAU optional RF connections:

- EXTERNAL ANT. – for RAU installations above acoustic ceiling requiring external antennas; QMA connector
- RF FILTER – (QMA) External Filter connections (if required by site planner; refer to section 5.2.3).
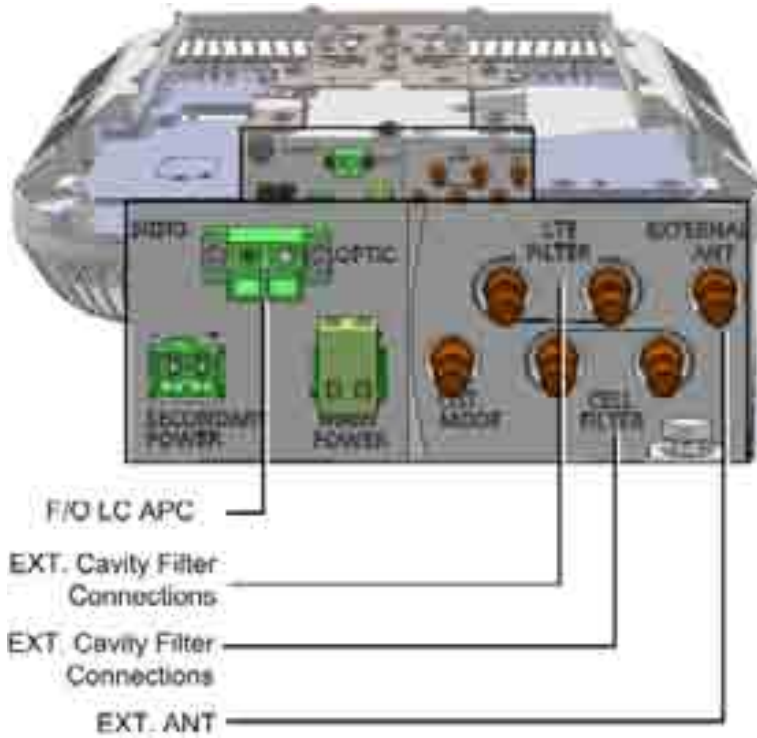
Figure 5-79. RAU Front Panel Connections

8. For RAU configurations with RxU module (see Figure 5-80) :
   · EXTERNAL ANT. – for installations above acoustic ceiling requiring external antennas; QMA connector
   · RF FILTER – (QMA) External Filter connections (if required by site planner; refer to section 5.2.3)

Figure 5-80. RxU module Interfaces

9. RAU **MAIN POWER** (for RAU/RAU+RxU) DC input power connections (see Figure 5-81) – connect DC wire pair to the terminal block connector:
   · Power input range: 37 to 57 VDC
   · Wire size: 12-30 AWG
   · Max. consumption:
     o RAU: 35 W
     o RAU + RxU: 60 W
     o RAU + GEM: 39 W
     o RAU + RxU + GEM: 64 W
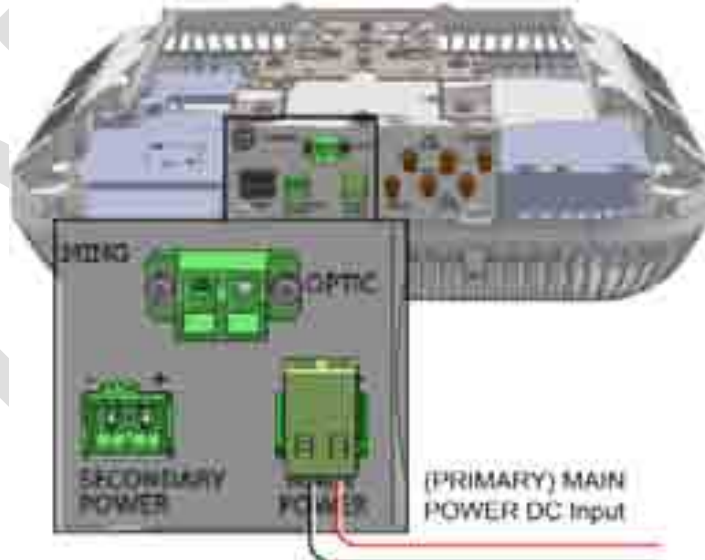
Figure 5-81. RAU MAIN POWER DC Input Connection

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10. For configurations with the GEM module only:

   A. Connect DC wire pair to the RAU **SECONDARY POWER** DC input connector:

   o Wire size: 12-30 AWG

   o For 2 PoE ports of 802.3af: 43V; 30 W (Input range: 43 - 57 V DC)

   o For 2 PoE ports of 802.3at: 52V; 62 W (Input range: 52 - 57 V DC)
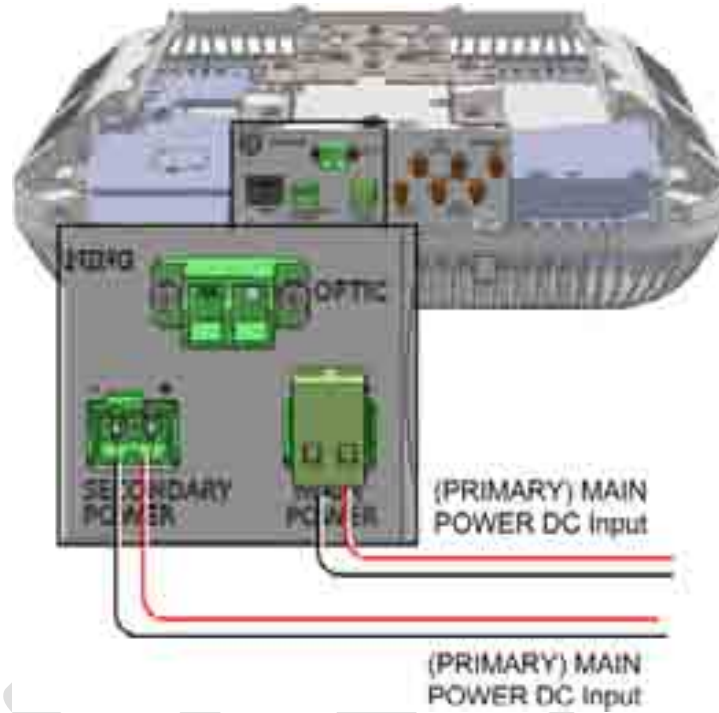
Figure 5-82. RAU MAIN and SECONDARY POWER DC Input Connections

B. Connect fiber to SFP module ports as follows (see Figure 5-83):

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

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

Note: A and B Ethernet ports - 10/100/1000BASE-T with 802.3at compliant Power over Ethernet (PoE+) PSE port
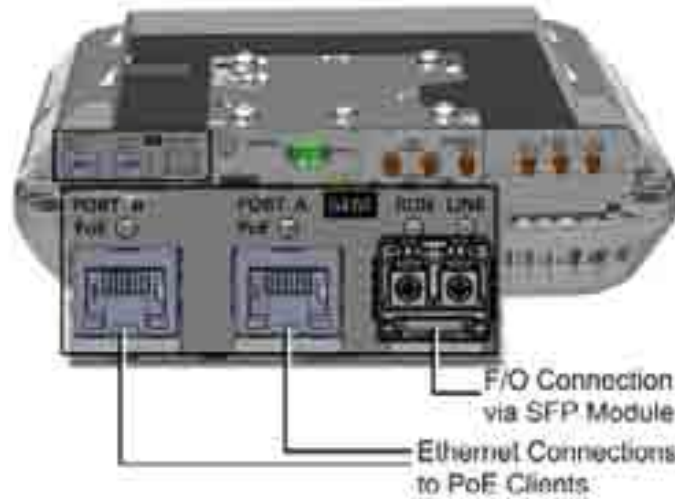
Figure 5-83. GEM Module Interfaces (SFP Module Shown without Adapters)

D. Verify normal operation according to Figure 5-84 and Table 5-9.
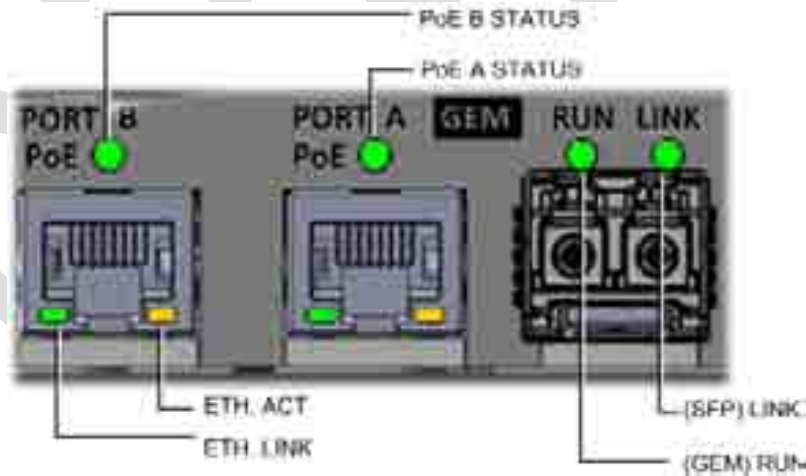
Figure 5-84. GEM Status LEDs

LED	State	Description
(GEM) RUN/STATUS	Steady Green (with short blink every ~ 10 sec): Steady Yellow:	GEM On/Normal GEM Fault
Ethernet LINK	Steady Green: Off:	Link No link
Ethernet ACT	Blinking Yellow: Off:	Activity No activity
(SFP) LINK	Steady Green: Blinking Green: Steady Yellow: Off:	Link Activity Fault No link
PoE	Steady Green: Steady Yellow: Off:	PoE Enabled PoE Fault PoE Off

Table 5-9. GEM LED Status Descriptions

5.2.2.8 Mounting RAU onto Mounting Bracket

1. For Mid-Mount acoustic ceiling installations (not including installations using the Corning dedicated RAU Mid-Mount installation option) – attach the RAU Skirt (provided) to the enclosure to cover the rigid edges of the cut-out panel.
2. Referring to Figure 5-85 and Figure 5-86, insert the RAU pins (four) into the bracket key-holes and lock in.

Note: The safety screw tab (circled in Figure 5-86) should be in the same direction of the RAU connectors.
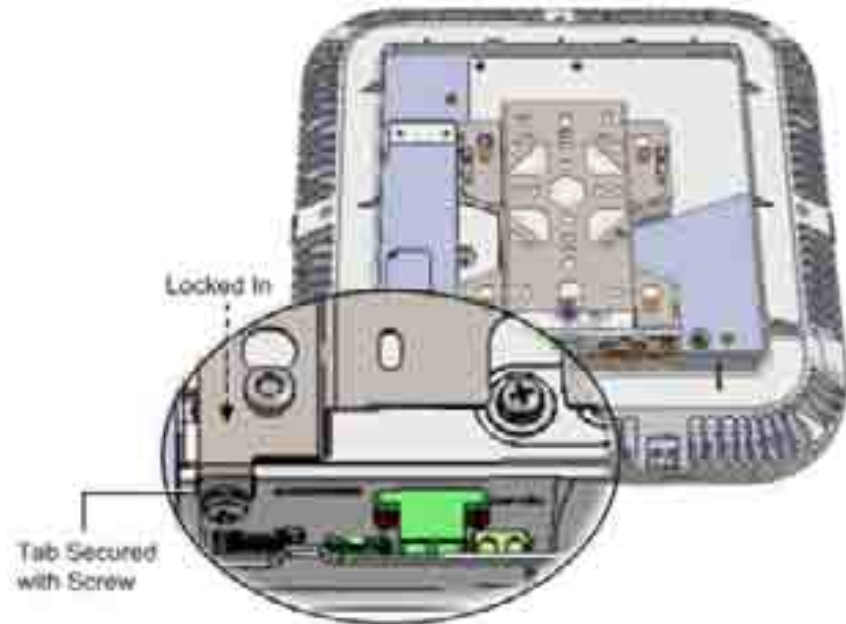
Figure 5-85. RAU and Bracket Assembly
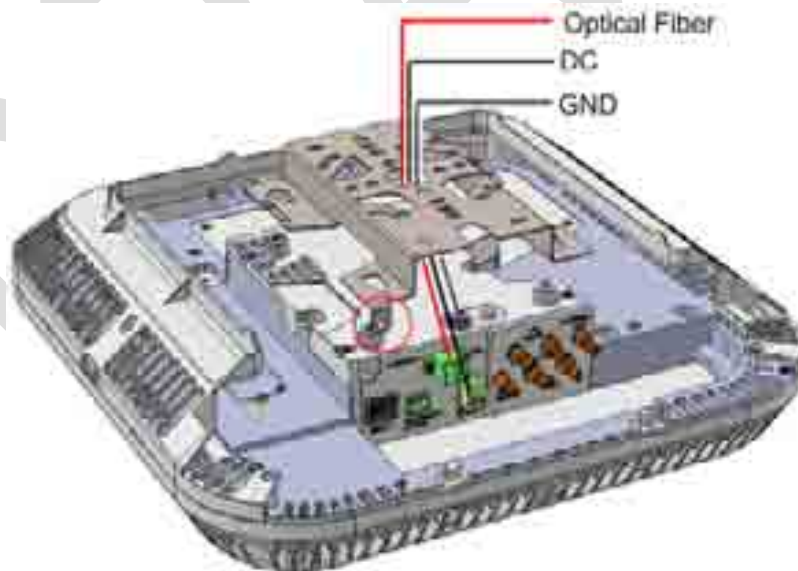
Figure 5-86. Mounting RAU onto Mounting Bracket

3. Secure the bracket safety screw tab to the RAU using an 8-32X3/8, Pan Head, Philips screw (provided). See Figure 5-85.
4. Fit the front panel cover back on.
5. For Acoustic Ceiling Mounts - using the supplied security cable, attach the RAU to a permanent structure within the ceiling (e.g. acoustic ceiling grid or concrete ceiling above).

5.2.2.9   Verify RAU Modules Normal Operation

Referring to Table 5-10 and Figure 5-87, verify RAU normal operation via RAU LEDs (located on enclosure cover).

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 detected by RAU
	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 the unit

Table 5-10. RAU LED Description
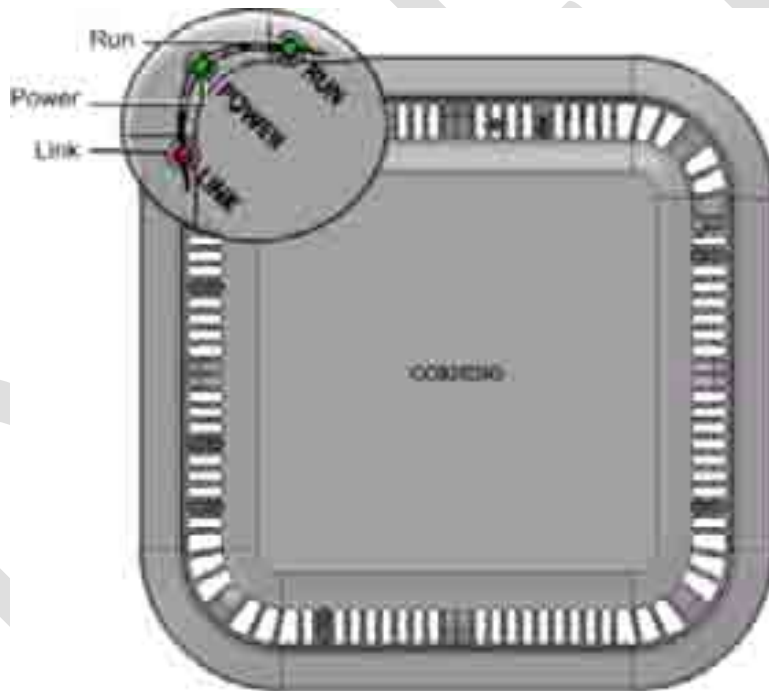
Figure 5-87. RAU LEDs

5.2.3 RAU5 Installation

5.2.3.1 General Information

1. The RAU5 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 mounting bracket 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: RAU5 bracket for floating ceilings tile, Mid-Mount installation
    · BR-RAU5US-Wall: RAU5 remote bracket for wall mount installation; Supports up to two RAU5 units back-to-back
4. RAU5 weight:
    · RAU5 Alone: 10 lbs (4.54 kg)
   · RAU5 + RxU + GEM: 14.39 lbs (6.5 kg)
5. A broadband antenna is required for RAU5 models ordered without a preassembled connected antenna (see Table 5-11 for RAU5 models).
6. External cavity filters are required for installations in which RAU5/RXU modules supporting the corresponding CELL and LTE bands are deployed alongside units supporting the public safety service. Installation instructions (Quick Start Guide) are provided with each separately ordered filter (AK-CVT700; AK-CVT800).

5.2.3.2 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	
Remote Access Unit (RAU5): · RAU5US · RAU5US-A* · RAU5US-E · RAU5US-AE* · RAU5US-ME · RAU5US-AM* · RAU5US-M · RAU5US-AME* *RAU5 model including assembled external broadband antenna*	1	
Mounting Bracket (preassembled on RAU5 underside) *Note: Mounting Bracket includes holes in various sizes and locations for flexible installation options. Screws for mounting on surfacMounting screws not provided.*	1	
Safety Cable – preconnected to the RAU5	1	

Table 5-11 RAU5 Package Contents

5.2.3.3   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 RAU models including GEM module)
· Fiber pairs (Corning® SMF-28® fiber or compatible):
  · One fiber pair for RAU module
  · One fiber pair for GEM module (for RAU models including GEM)
· Grounding wire

For RAU5 models not including external antenna – RF jumper cables from installed external antenna

5.2.3.4   Bracket Installation and Mounting RAU5

Note the following:

· The installation procedure for the bracket provided with the RAU5 refers to wall and concrete ceiling installations. For additional mounting options refer to Appendix D: RAU5 Mid-Mount Bracket Assembly.
· When mounting the bracket on a wall the captive screw (indicated in Figure 5-88) should always be positioned in the same direction as the RAU5 connectors.
· In wallmount installations the connectors should face downwards.
· If installing above acoustic ceiling, allow for at least 1 inch above the acoustic ceiling for air flow cooling.
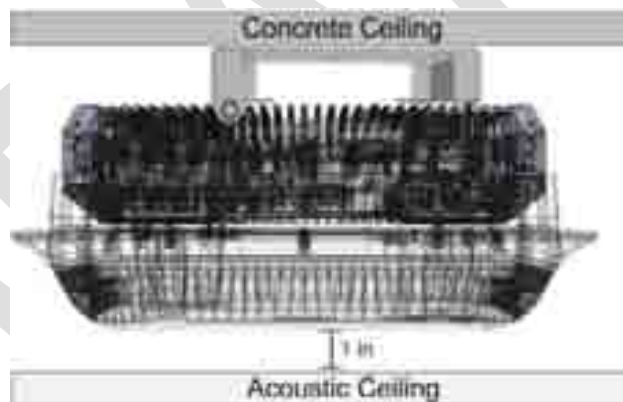
Figure 5-88.Example of (Concrete) Ceiling Installation of Mounting Bracket (RAU5 with External Antenna)

To install the RAU5 Bracket

1. Refer to Appendix C: RAU5 Bracket Dimensions for mounting bracket dimensions.
2. Remove the mounting bracket from the RAU5 underside and use to mark and drill appropriate holes for mounting the bracket on the wall or concrete ceiling. Refer to Appendix for bracket dimensions.
3. Any of the applicable screw holes can be used.
4. Drill the appropriate screws (not provided) through the bracket installation holes and secure to surface.

Note: The RAU5 connectors should face the bracket captive screw.
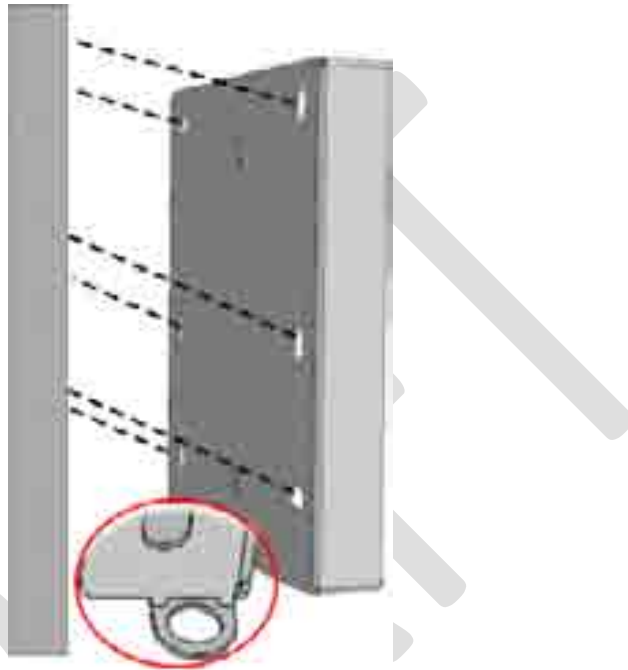
Figure 5-89. Example of Mounting Bracket Installation and Captive Screw Location (Bottom Right)

Referring to Figure 5-91, perform the following steps:

5. Insert the four RAU5 pins into the wide ends of the bracket key-holes.
6. Make sure that the bracket captive screw fits into the designated half-slot on the RAU5.
7. Lock RAU5 pins into the narrow ends of the bracket keyholes.
8. Close captive screw to secure RAU5 and bracket assembly. See Figure 5-91.
9. Using the supplied security cable, attach the RAU5 to a permanent structure within the ceiling (e.g. acoustic ceiling grid or concrete ceiling above).
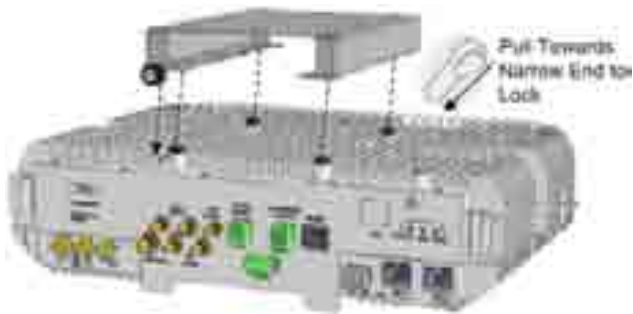
Figure 5-90. RAU5 pins and Bracket Key-holes

Figure 5-91.   Closing Bracket Captive Screw

5.2.3.5   Cables Ground, F/O and RF connections

1. Route the cables located in Section 2.
2. Connect the earth ground to the RAU5 8-32 x 3/8 grounding screw. See Figure 5 for example of RAU5 ground connection.
3. Connect optic fiber pair to RAU5 module LC APC optic connector. See Figure 5-92.
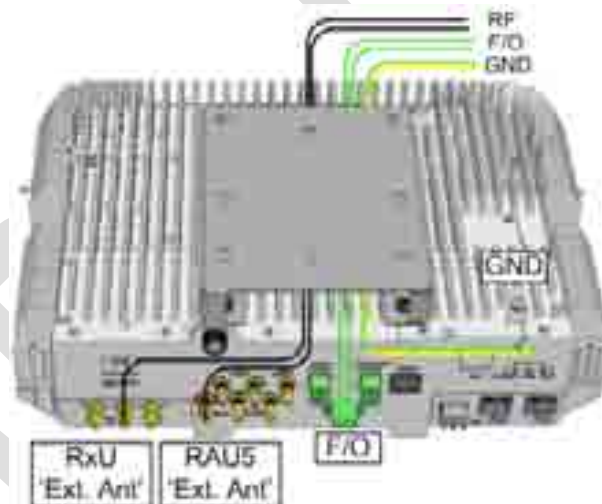
Figure 5-92.   GND, F/O and RF Cable Connections

4. If required by site planner – perform (QMA) connections to CELL and/or LTE external filters.

   Note: *Refer to Quick Installation Sheet (CMA-366-AEN) provided with 700/800 Cavity Filter or download from Corning Resource Center (Product resources) site.*

5. For RAU5 models not including external antennas – connect the RAU5 QMA 'Ext. Ant.' connector to the external antenna.

Note: Supported external antenna types: vertical, directional or omni-directional antennas. RAU models with RxU module also require connecting the RxU to external antenna.

5.2.3.6 Main Power Connections

RAU5 **MAIN POWER** (for RAU5/RAU5+RxU) DC input power connections (see Figure 5-93) – connect DC wire pair to the terminal block connector:

· Power input range: 37 to 57 VDC

· Wire size: 12-30 AWG

· Max. consumption:

   · RAU5: 44.5 V; 48 W

   · RAU5 + RxU: 44.5 V; 73 W
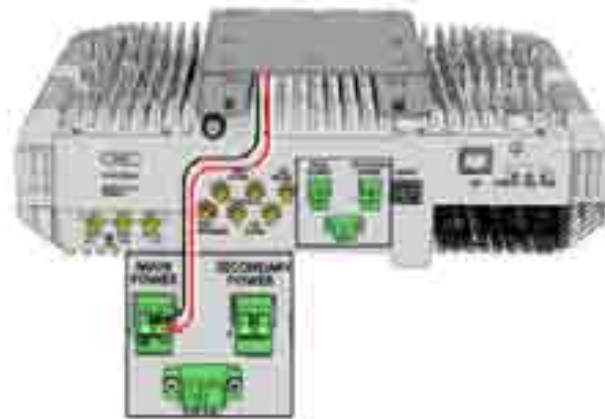
Figure 5-93 RAU5 Main Power DC Connections

5.2.3.7 GEM Connections (for Configurations including GEM Modules)

1. Connect DC wire pair to the RAU5 **Secondary Power** DC input connector (see Figure 5-94):

· Wire size: 12-30 AWG

· Max. Consumption:

   · RAU5 + GEM: 44.5 V ; 52W

   · RAU5 + RxU + GEM: 44.5 V ; 77W

   · For 2 PoE ports of 802.3af: 43V ; 30 W (Input range: 43 – 57 V DC)

   · For 2 PoE ports of 802.3af: 52V ; 62 W (Input range: 52 – 57 V DC)

Figure 5-94. RAU5 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.
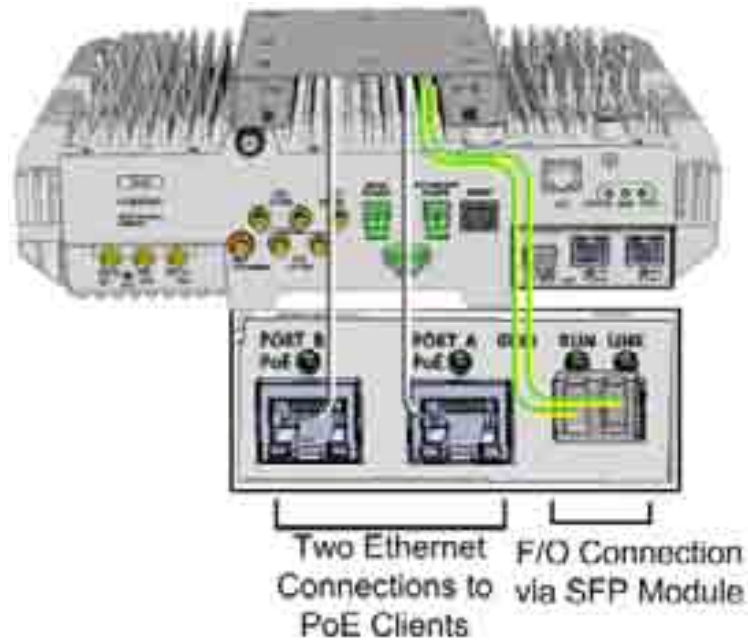
Figure 5-95. GEM Module Interfaces Connections

5.2.3.8 Verify Normal Operation

Referring to Figure 5-96 and Table 5-12 verify normal operation of RAU5, RxU and GEM (if installed) modules.
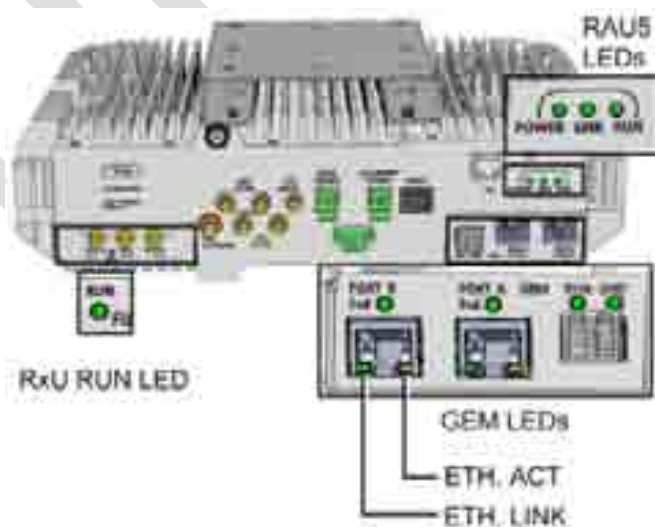
Figure 5-96. RAU5, RxU and GEM LEDs

Module	LED	Description	
RAU5	LINK	Steady Green:	Optical link power to/from the RAU5 is normal
		Blinking Green:	Optical power from remote is lower than required
		Off:	No optical link detected
	POWER	Steady Green:	Input power detected by RAU5
		Off:	No power supplied to RAU5
	RUN	Blinking Green:	RAU5 boot up sequence complete and module SW up and running
		Off:	No power supplied to the unit
RxU	RUN	Blinking Green:	RxU boot up sequence complete and module SW 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 5-12. Normal Operation LED Status Descriptions

5.2.4   RAU/RAU5/RxU Cavity Filter Installation

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 RAU/RAU5 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 RAU/RAU5 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 5-97.

A = Four keyholes for wall mount installation

B = Two holes for hanging from concrete ceiling

C = Two slots for securing to acoustic ceiling grid with tie wraps
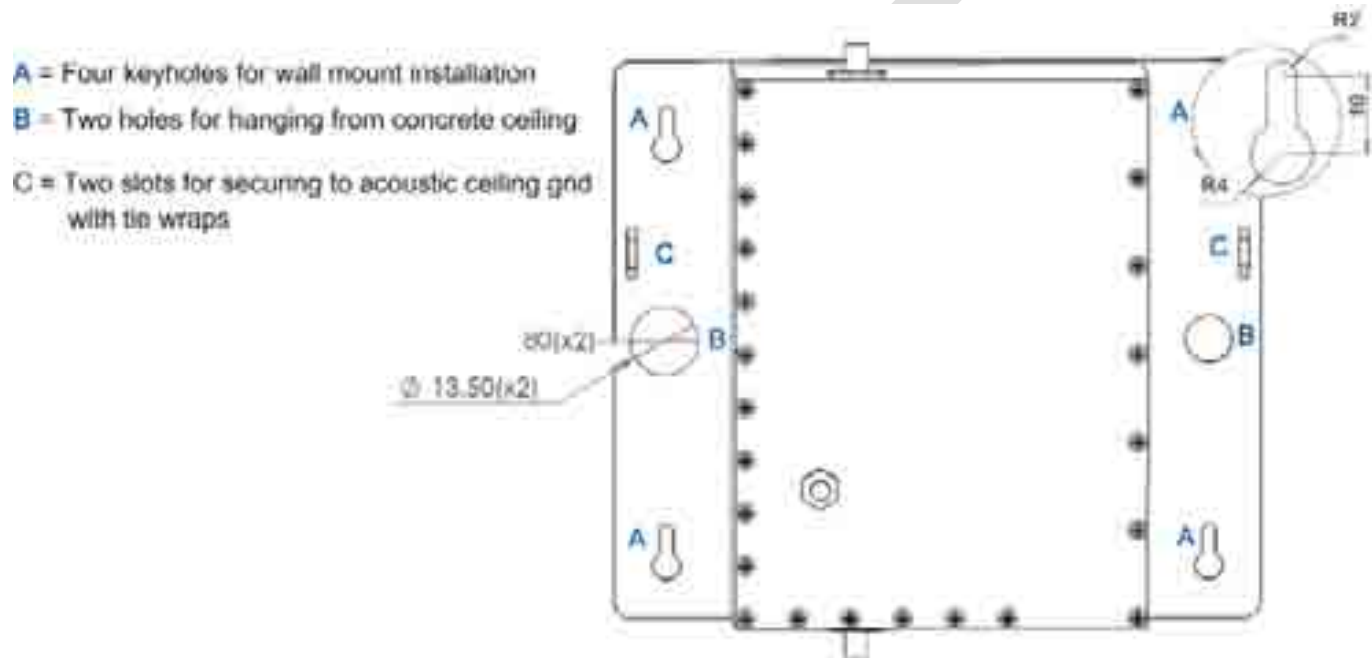
Figure 5-97.Cavity Filter Dimensions and Mounting Holes

- Consider the length of the RF jumpers (3m) and the distance from the RAU 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).

5.2.4.1 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 CVT700 – LTE; 0.5W; 698-716MHz; 777-787MHz; IL=1.5 dB; SMA	1	
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 RAU/RxU filter connections	2	

5.2.4.2   (Concrete) Ceiling Mounting Option

To mount Cavity Filter on Concrete Ceiling

1. Using the two holes (Item B in Figure 5-97) 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 5-98.
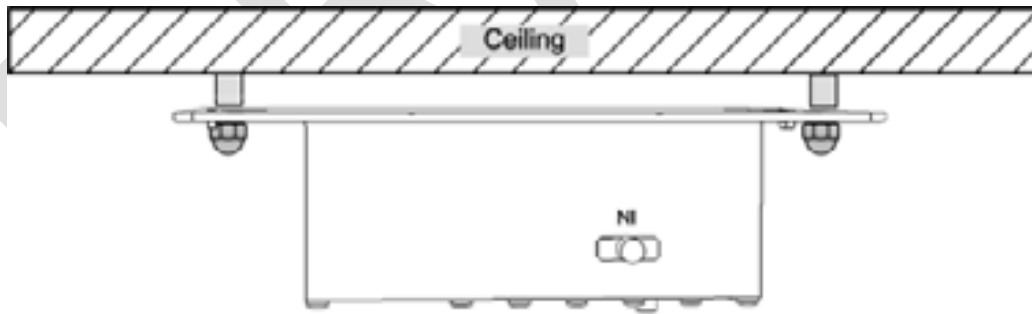
Figure 5-98. Illustration of Cavity Filter Mounted on Ceiling

5.2.4.3 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 5-97) and securing the assembly to the grid with the provided safety cable. Refer to Figure 5-99.
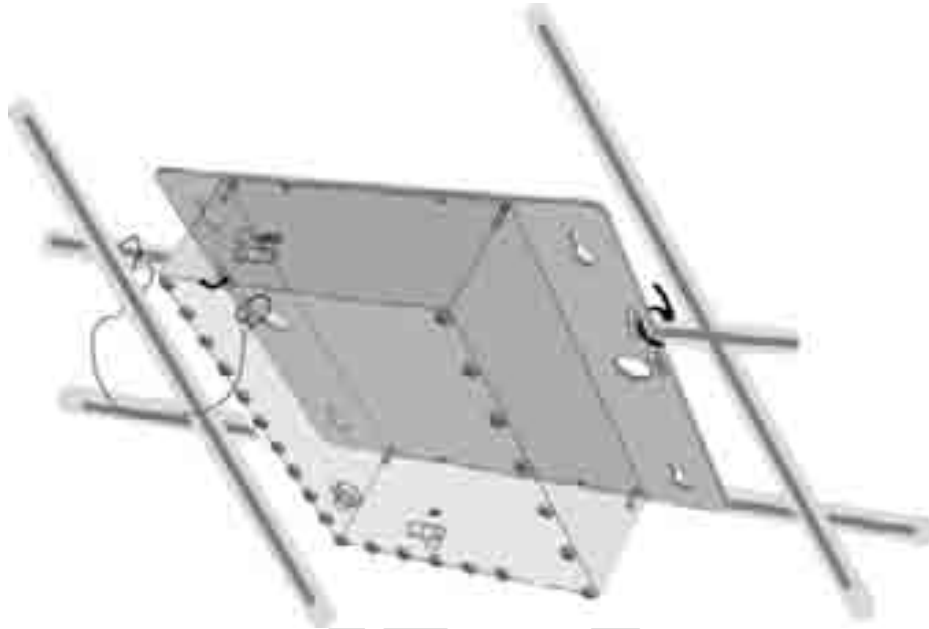
Figure 5-99. Illustration of Cavity Filter Mounted on Acoustic Ceiling Grid

5.2.4.4 Wall Mount Installation

To mount Cavity Filter on Wall

1. Using the four key holes (Item A in Figure 5-97) 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).
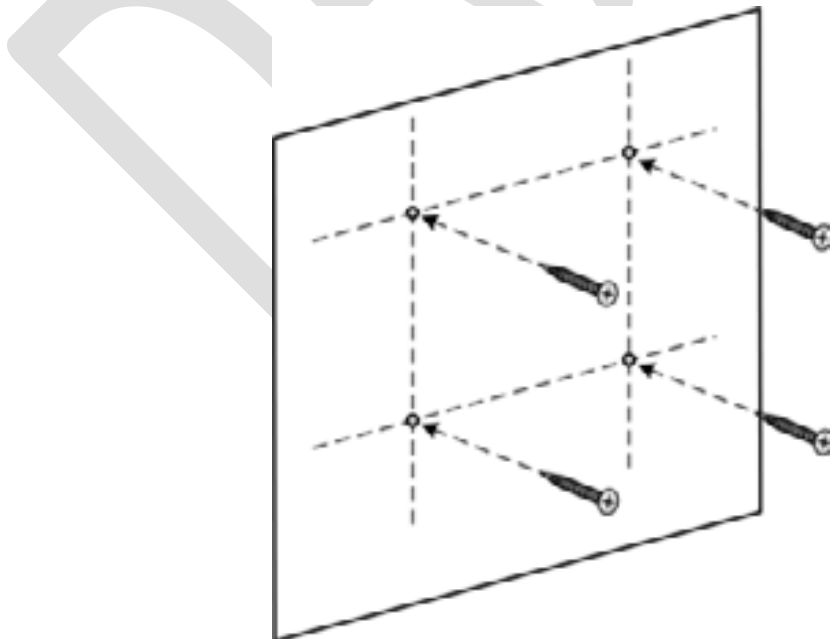
Figure 5-100. Marking and Inserting Anchors in Wall

3. Hang the Cavity Filter on the anchors/screws and pull down to lock in narrow end of key hole. Refer to Figure 5-101.
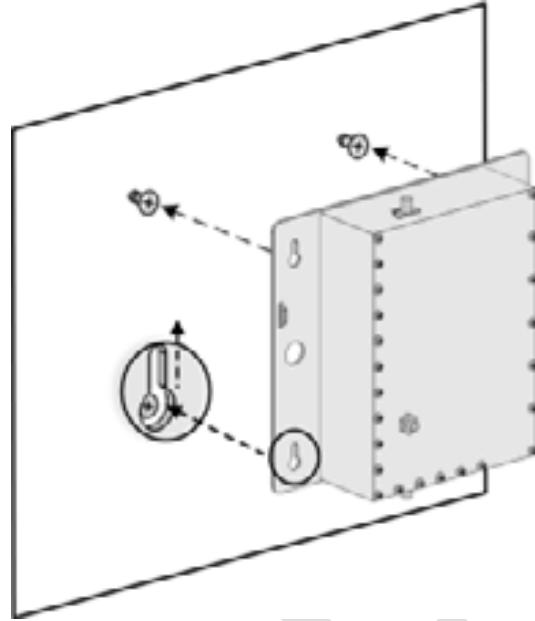
Figure 5-101. Mounting Cavity Filter on Wall

5.2.4.5   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 700MHz band and the RAU/RAU5 is installed with an RxU – both RAU/RAU5 and RxU modules must be connected to an external LTE filter. See Figure 5-102 and Figure 5-103.

Figure 5-102. Example of RAU and External CELL Filter Connections
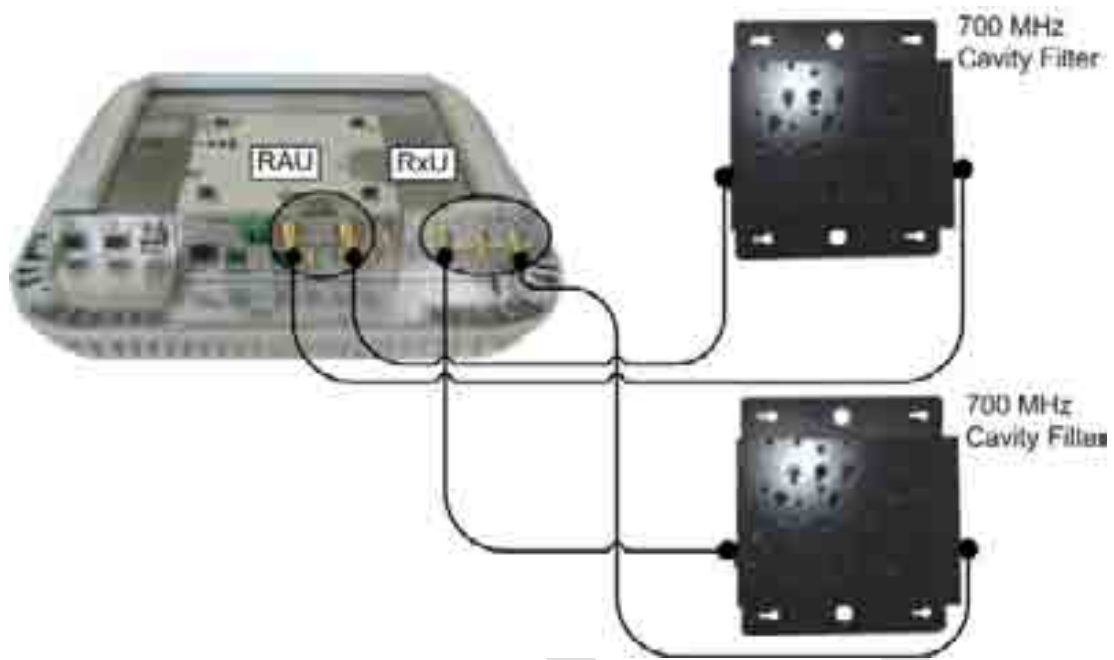
Figure 5-103. Example of External LTE Filter Connections to RAU and RxU

6 Installation – Digital Coverage Elements

This chapter describes the installation procedures for each of the Digital Coverage components. It contains only brief descriptions of the approach of each installation procedure. For specific guidelines on infrastructure planning, design and installation, please consult with a Corning Product Line Manager or Corning approved Installer. All these elements are installed at the remote end.

6.1 CEU Installation

General Information

· The CEU interfaces to the main Ethernet switch and to the remote Gigabit Ethernet Modules (GEM).
· The CEU is rack mounted or wall mounted at the IDF (Intermediate Distribution Frame).
· The CEU can host up to three Centralized Ethernet Modules (CEMs), which are not included in the CEU package (ordered separately).
· The CEM Tx/Rx Ethernet fiber ports, used for interfacing to the GEM modules, require SFP modules (included) and LC-UPC to LC APC adapter if using LC/APC fiber.

6.1.1 Items Required for CEU Installation

The following items are required for installing the ONE™ CEU. If any of the listed items are missing, contact your Corning representative.

CEU KIT	Quantity	
Central Ethernet Unit (CEU) with power supply	1	
Standard IEC right angle 110-240VAC, 50-60 Hz cable	1	
Wall mount brackets	2	
CEM KIT	**Quantity**	
Central Ethernet Module (CEM)	1	
SFP modules (pre-inserted in Tx/Rx ports)	4	
ATT. LC/HAP 0dB – used for APC cable	8	

Table 6-1. Items Required for CEU Installation

6.1.2   Installing CEM Module(s)

4. Remove the blank panel.
5. Slide in the CEM and hand tighten the captive screws. Refer to Figure 7-1.

Figure 6-1. Inserting CEM Module(s)

6.1.3   Mounting CEU in 19-IN Rack

Note: Continue to next section if CEU is to be mounted on wall.

Mount the CEU (1U) in the 19-in communication rack and secure using pre-assembled brackets.

6.1.4   Mounting CEU on Wall

6. Remove the rack mounting brackets and set aside screws.
7. Assemble wall mount brackets on to the sides of the CEU using the screws.
8. Using the bracket holes as a guide, mark the holes to be drilled on the wall and mount with appropriate screws.

6.1.5   Connecting CEM to Main LAN

Connect any of the CEM RJ45 (1-4) Ethernet ports to the Main LAN Ethernet switch. See Figure 7-2.

Figure 6-2. CEM LAN and Fiber Connection Ports

6.1.6   Connecting Fiber

1. Verify the fiber type:
    - ·   If   LC/APC (Green), use an LC-APC to UPC adapter
    - ·   If LC/UPC (Blue), no adapter is needed
2. Connect the corresponding SFP module connectors (i.e. Tx/Rx port 1 corresponds to fiber port 1) to the GEM LC/APC fiber connector. See Figure 7-3.
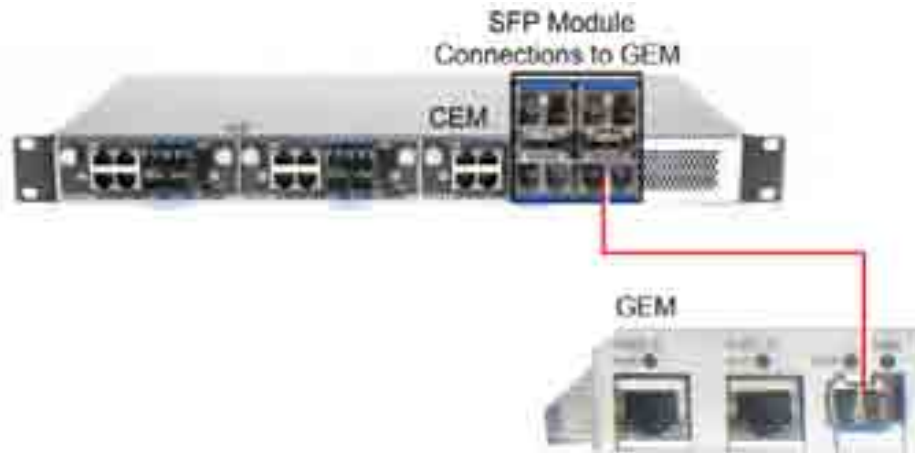
Figure 6-3. CEM to GEM Fiber Connections

6.1.7   Power Up

1. Make sure the power switch is off.
2. Connect supplied 110-240 VAC power cable to the power connector located at the rear of the unit. See Figure 7-4.
3. Switch power on.

Figure 6-4. CEM Power Connector

6.1.8   Verifying Normal Operation Status

Referring to the CEM LED description in section 3.2.1, verify F/O, ETH and PWR LED status on CEM module.

6.2   GEU-S Installation

This section describes the installation procedure for the GEU-S installed at the remote site.

Note the following:

- The GEU-S unit must always be mounted parallel to the ceiling or wall with a 1-in (minimum) clearance from the surface on the back and front to allow for proper airflow cooling and heat dissipation.
- The GEU- is provided with a mounting bracket used for mounting on the wall or concrete ceilings (including above acoustic ceiling mounts). Additional below/mid-mount acoustic ceiling mounting options are possible using a T-Bar mounting bracket (not provided).
- GEU-S weight: 2.64 lbs (1.2 kg)

6.2.1   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.

Description	Quantity	
Standalone Gigabit Ethernet Unit (GEU-S)	1	
Mounting Bracket with CADDY® "Twist On" Fixture Support	1	
SFP – Fiber UPC Module (pre-inserted)	1	
UPC to APC Adapter	2	
Screw, SEM 8-32X3/8 , Pan Head, Philips - used to secure bracket to GEU-S	1	

Table 6-2.GEU-S Package Contents

6.2.2   Routing Connection Cables

1. Locate DC, fiber, Ethernet and grounding wiring connections.
2. Route the connection cables through the center of the Mounting Bracket. See Figure 7-5.
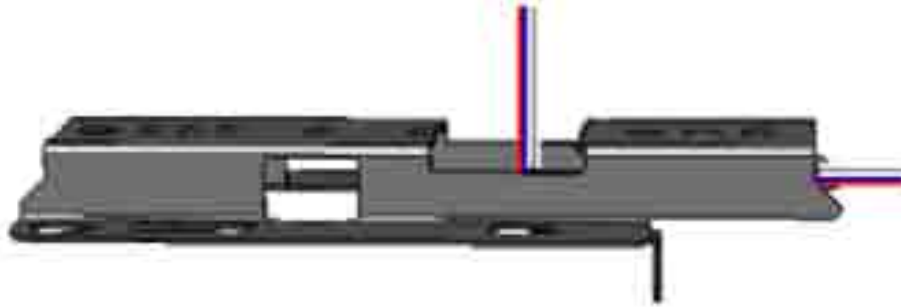
Figure 6-5: Mounting Bracket on Wall

6.2.3   Installing the Mounting Bracket

Note the following:

·   For wall mount installations - GEU-S must be installed parallel to the wall with the connectors facing downwards. See Figure 7-7
·   For above acoustic ceiling installations:
·   Allow for at least 1 inch above the acoustic ceiling for air flow cooling.
·   Safety screw tab (shown in Figure 7-8) should be positioned to face the same direction as the GEU-S connectors.
·   Refer to Figure 7-6 for bracket dimensions.
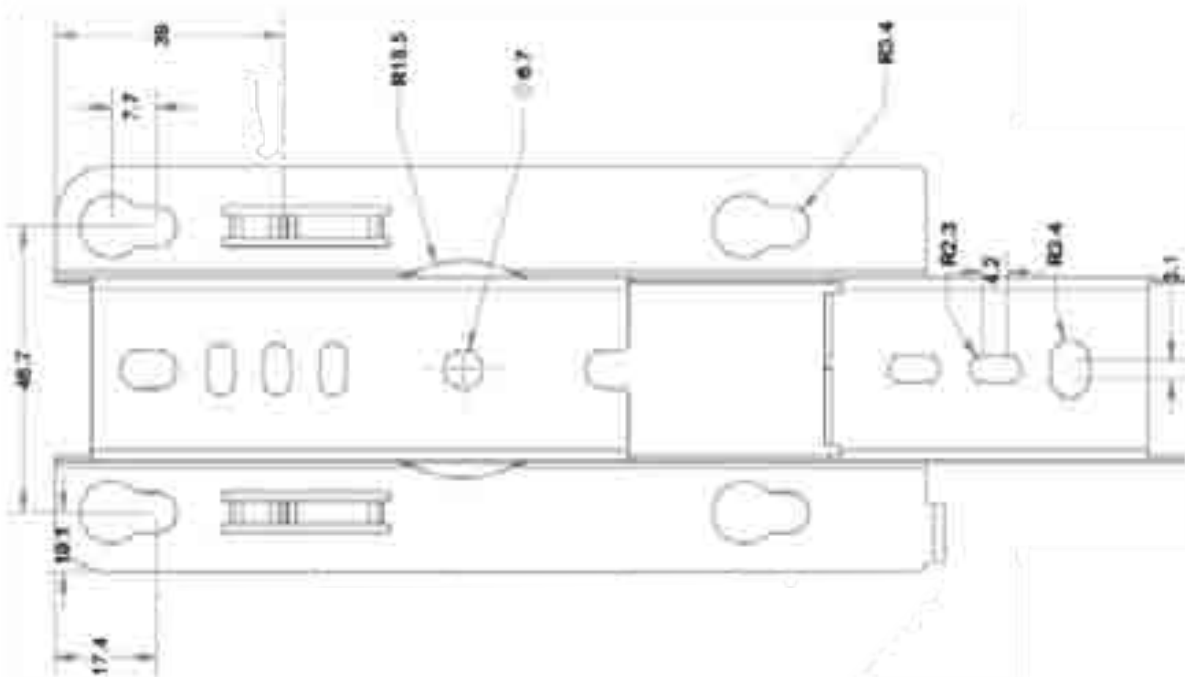
Figure 6-6: Mounting Bracket Dimensions

To install the mounting bracket

Mount the bracket on the wall (Figure 7-7) or concrete ceiling (Figure 7-8) using any of the screw hole sets and the appropriate screws (not provided).
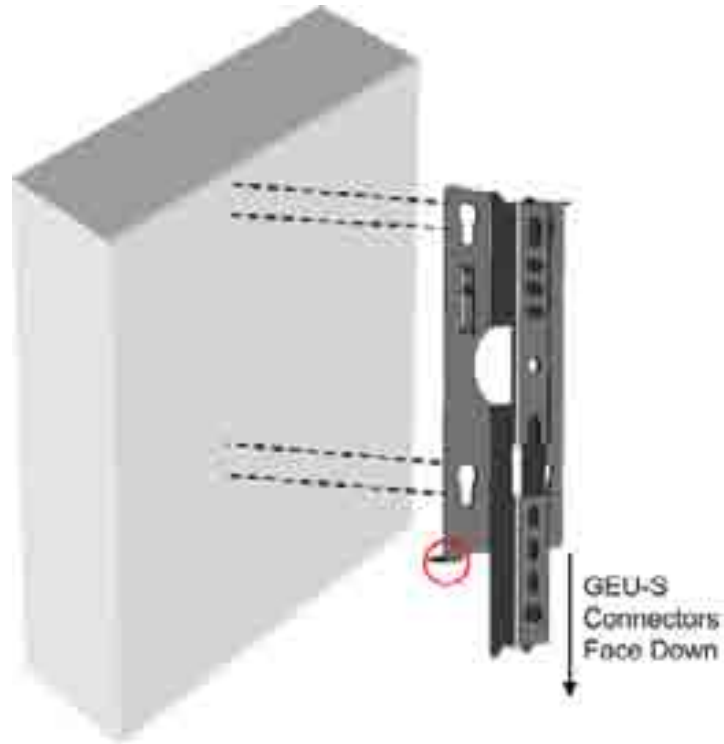
Figure 6-7: Mounting Bracket on Wall (Routed Cables Not Shown)
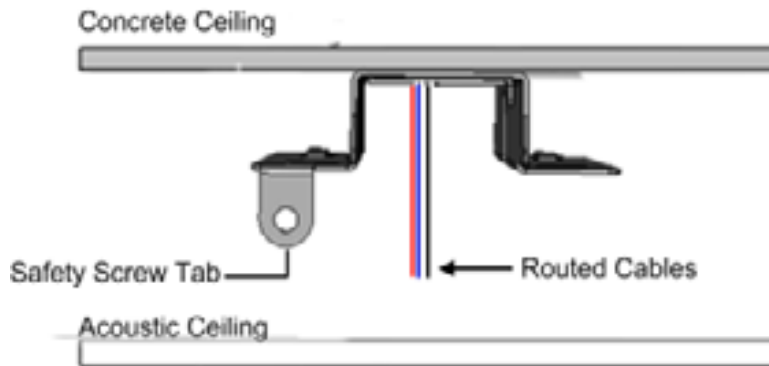
Figure 6-8: Bracket Installation and Routed Cables

6.2.4   Additional Bracket Installation Options

Note: A T-Bar Mounting Bracket can be used (not provided) to mount the GEU-S below an acoustic ceiling.

1. Referring to Figure 7-9, install the T-Bar on the ceiling above the acoustic tiles (according to manufacturers' instructions).
2. Make sure to allow for a minimum of 1-in between ceiling tile and GEU-S.

Figure 6-9: Below Ceiling Installation

3. Route the connections cables through the center of the GEU-S Mounting Bracket.

Note: The safety screw tab (circled in Figure 7-10) should face the same direction as the GEU-S connectors.
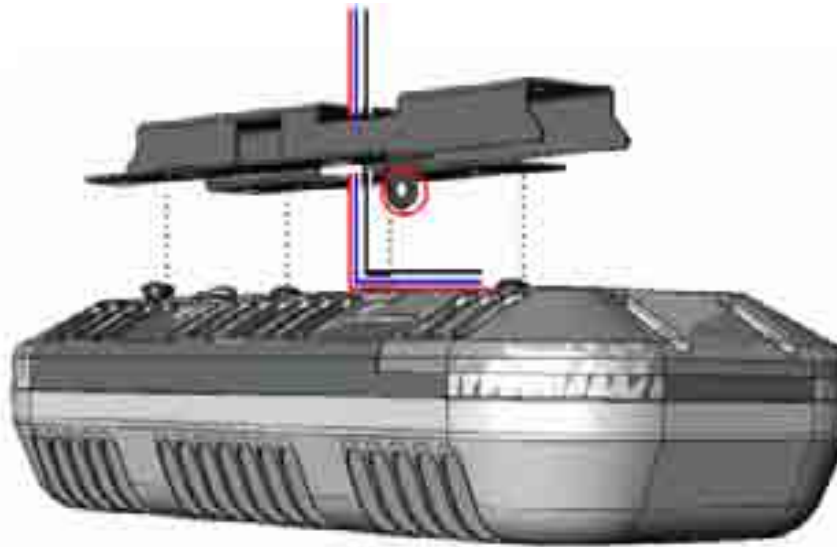
Figure 6-10: Routing Cables and Mounting GEU-S on Bracket

4. Install GEU-S bracket on the T-Bar, using any of the appropriate bracket installation holes.

6.2.5   Assembling the GEU-S onto the Bracket

Note: The safety screw tab (circled in Figure 7-11) should be in the same direction of the connectors.

1. Hold the GEU-S near the mounting bracket and routed cables.
2. Route the cables towards the front panel connectors, where the bracket will be located as shown in Figure 7-11.
3. Insert the four GEU-S pins into the wide end of the bracket holes and then pull towards the narrow end to lock in.
4. Using the provided screw (SEM 8-32X3/8), secure the bracket to the GEU-S via the safety screw tab.
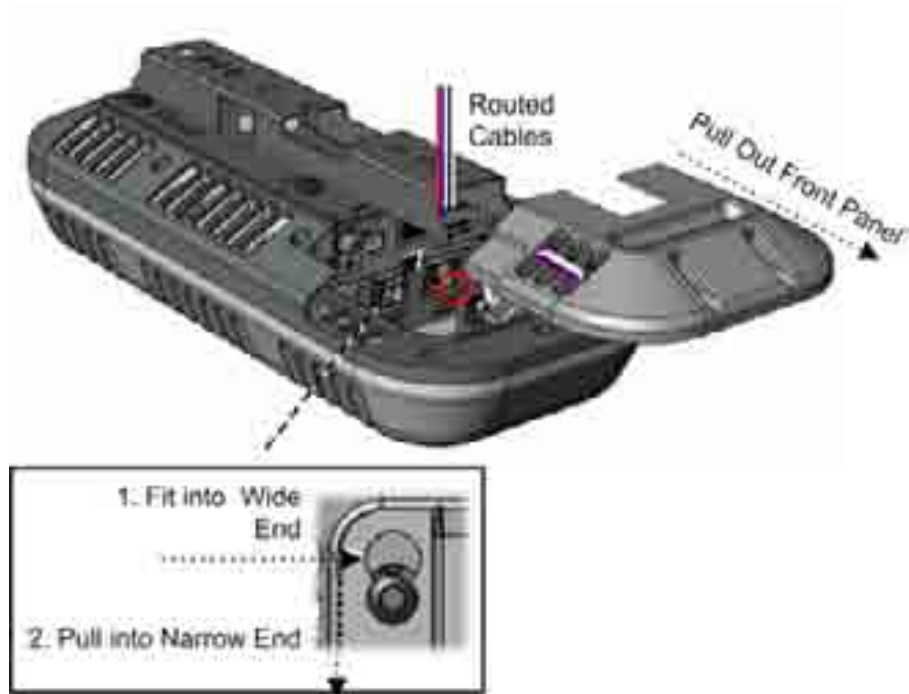
Figure 6-11: Locking GEU-S

6.2.6   Connecting Cables

Referring to Figure 7-12, connect as follows:

1. Pull out front panel cover to access connectors. See Figure 7-11.
2. Connect the optic fiber to the SFP module:

    ·   Fiber terminated with LC UPC connector (blue) – connect directly to SFP module

    ·   Fiber terminated with LC APC (green) – connect using the provided APC to UPC adapters

3. Connect the RJ45 PoE output ports to (2) PoE clients using Ethernet cables.
4. Reach under bracket, and connect the earth ground to the GEU-S grounding bolt (32 x 3/8 screw).
5. Connect DC wire pairs (46 – 57 VDC).
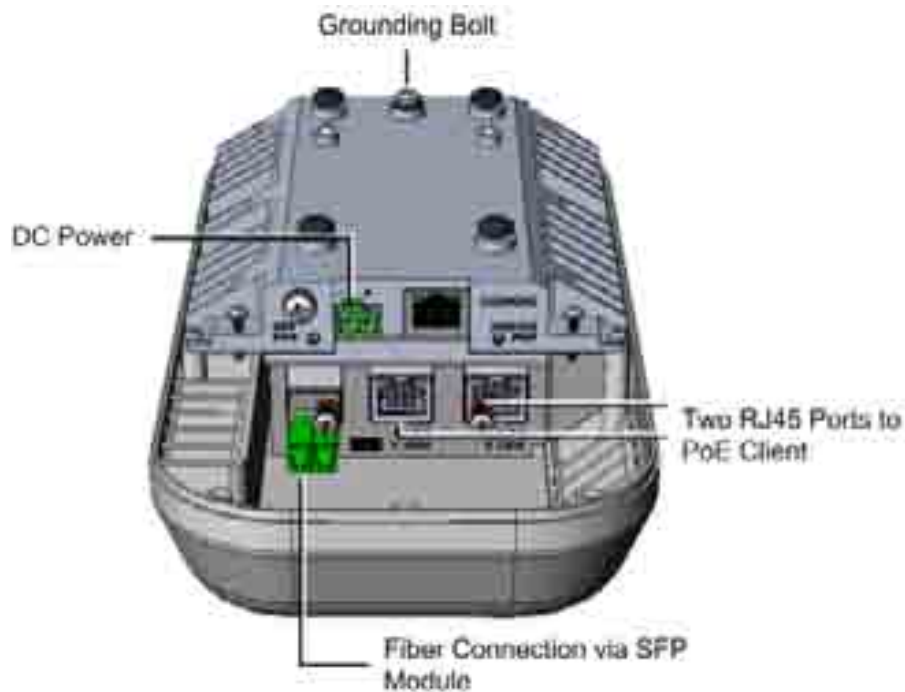
Figure 6-12: GEU-S Connection Ports (Bracket Not Shown)

6.2.7　Verify Normal Operation

Verify GEU-S normal operation via the GEM and GEU module LEDs. Figure 7-13 and **Error! Reference source not found.** provide a description of the GEU LEDs. For complete description of GEM and GEU-S LEDs, refer to section 3.3 (GEM) and 3.4 (GEU-S).
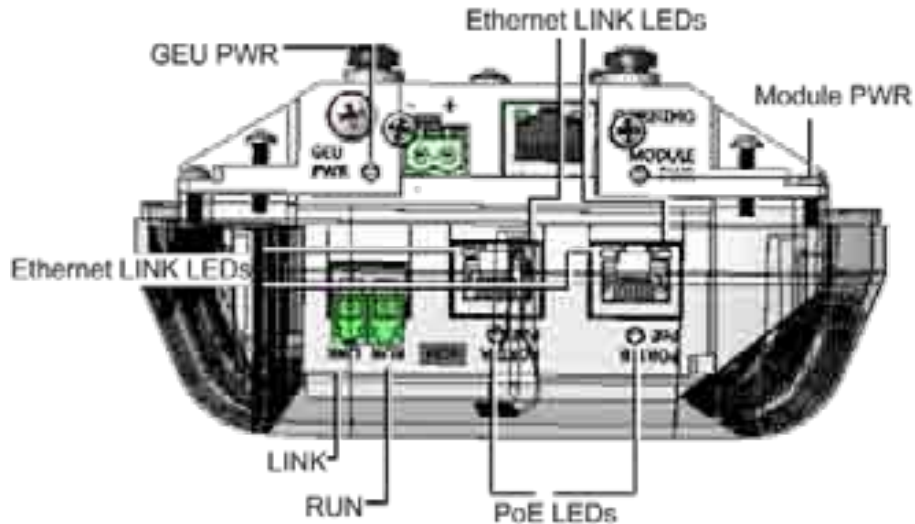
Figure 6-13: GEU-S LEDs

6.2.8　Replace Front Panel Cover

Refer to Figure 7-14.
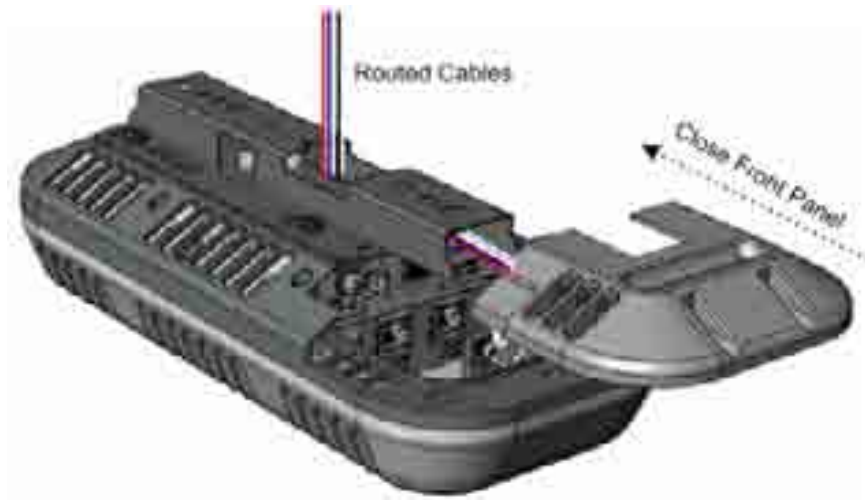
Figure 6-14: Replacing Front Panel

7 Appendix A: RAU Upgrades

7.1 Upgrading RAU with an RxU

This section describes how to upgrade an RAU with an RxU, providing MIMO support for the LTE700 and AWS bands..

7.1.1 General Information

·   The RxU expands the RAU band support to additional two MIMO bands.
·   The RxU can either be pre-installed in the RAU module (according to order) or easily added at a later stage when required.
·   The installation of the RxU module is hot-swappable and does not require disconnecting cables or power.

7.1.2 Package Contents

The package content includes one RxU module. Check the item for external damage.

Item	Quantity	Image
Remote Expansion Unit (RxU)	1	

7.1.3   Installing the RxU Module in the RAU

Note: There is no need to disconnect the cables leading from the ceiling.

To install RxU module in RAU enclosure:

1. Referring to Figure 8-1, remove RAU enclosure cover:
    A. Remove the Safety Tab Screw, securing the bracket to the RAU (located above MGMT port).

    B. Slide the RAU back into wide end of bracket screw holes, so that it "clicks" and remove unit.

    C. Unscrew the five screws securing the RAU enclosure cover and remove cover.

    D. Remove front flap in direction of arrows.
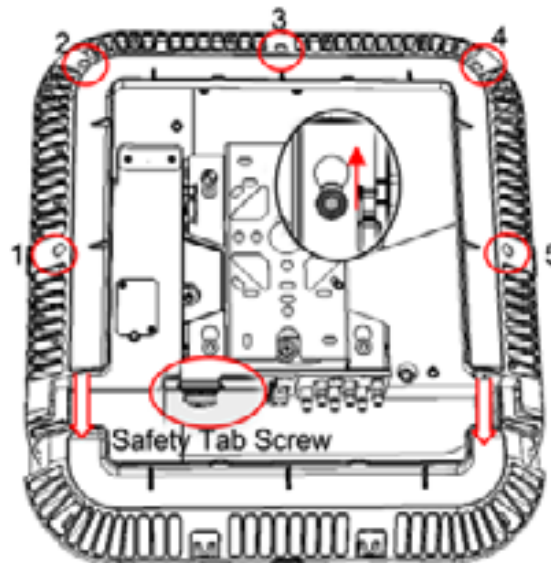
Figure 7-1. Removing RAU Enclosure Cover

2. Assemble the RxU in the RAU enclosure:
    A. Plug the RxU in to the right side of the RAU as indicated in Figure 8-2.

    B. RxU and RAU interface ports should face the same direction.

    C. Replace the cover except for the front access panel.
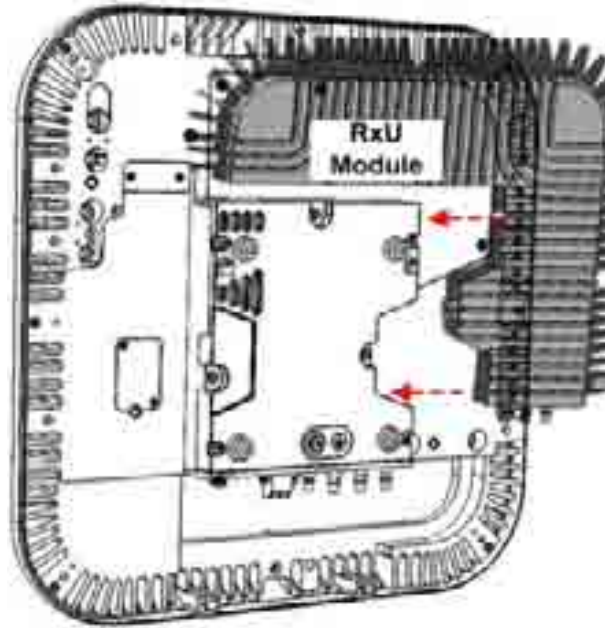
Figure 7-2. RxU Module Assembly

3. If required by site planner - connect the filter to the RF filter connectors on the RxU. Refer to Figure 8-3 for location of RxU filter connections.

> Note: Refer to section 5.2.3 for Cavity Filter installation and connections.

Figure 7-3. Assembled RxU Interfaces

4. Verify that RAU LEDs on, on front cover (see Figure 8-4) 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
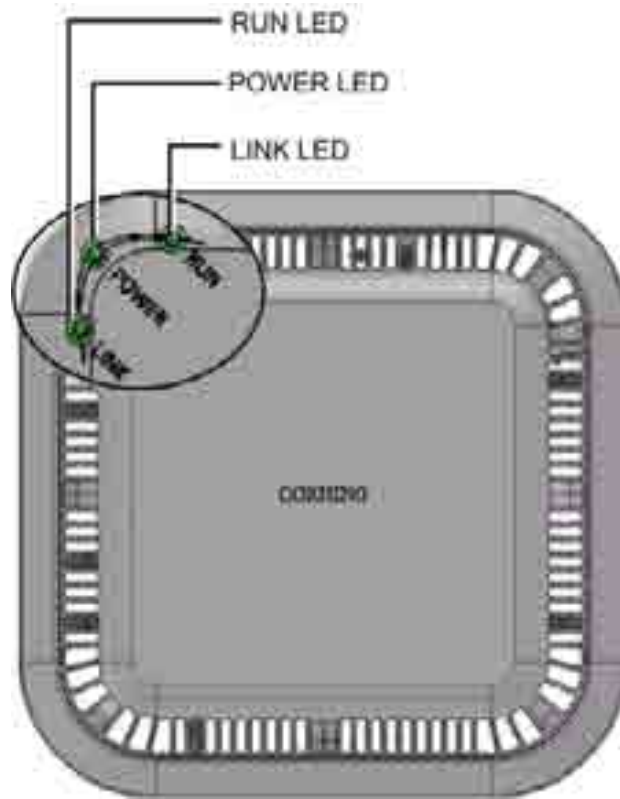
Figure 7-4. RAU Enclosure LEDS

5.   Assemble RAU front access panel and remount.

7.2   Upgrading RAU GEM Installation (Upgrade)

The GEM module provides Ethernet Data coverage distributed through 3rd party equipment - supports PoE connection for up to two Access Points (APs).

This section describes how to upgrade an RAU with a GEM module enabling the distribution of RF and Ethernet data coverage from a single unit.

Note: If digital coverage is required during Greenfield deployment then the GEM is pre-installed in the RAU.

7.2.1   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.

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

Table 7-1.GEM Package Contents

7.2.2   Installing the GEM module in the RAU

1. Remove RAU front panel and then cover by removing the five screws indicated in Figure 7-5
2. Plug GEM into the left side of the RAU, as shown in Figure 7-6 and secure the four GEM screws.
3. Replace the cover except for the front panel so that the interface ports are accessible, as shown in Figure 7-7.
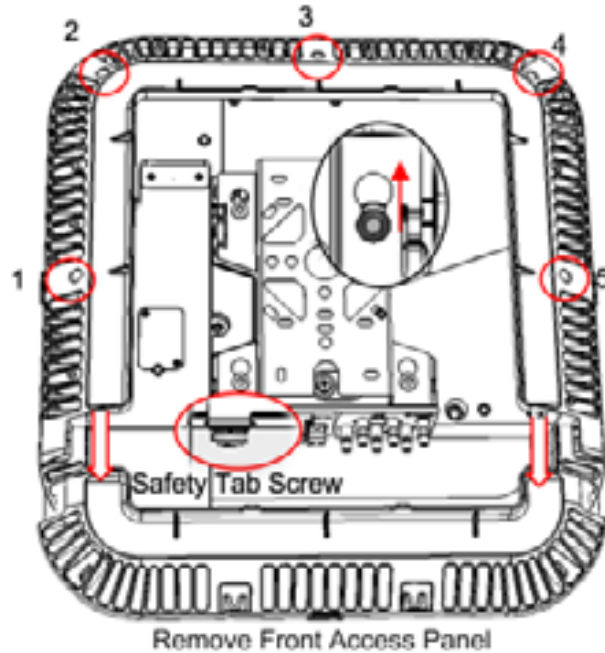
Figure 7-5. Removing RAU Enclosure Cover
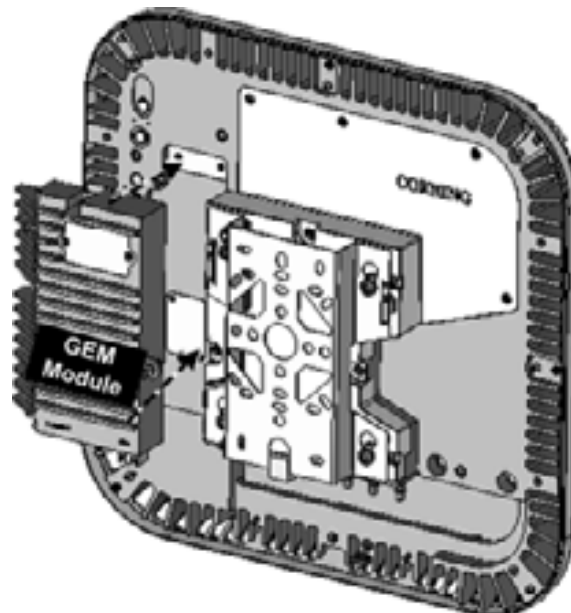
Figure 7-6. GEM Module Assembly
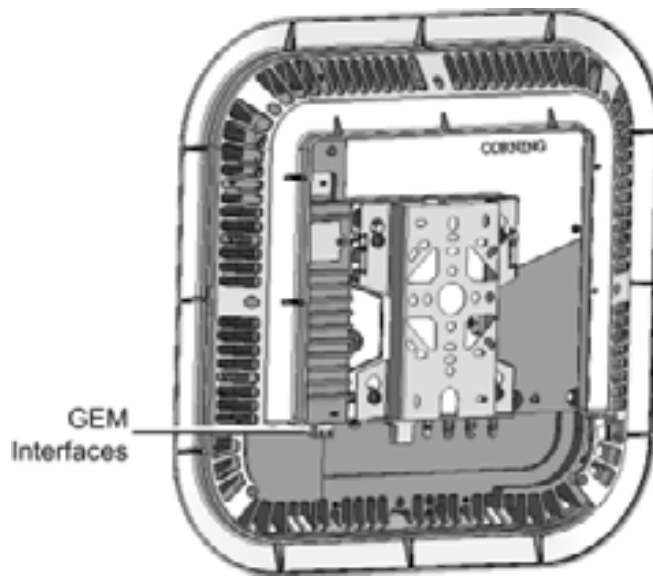
Figure 7-7. RAU and GEM with Assembled Cover

Refer to section 5.2.2.7 (Step 10) for GEM connections.

8   Appendix B: RAU Mounting Bracket Installation Template Sheet (Scale 1:1)
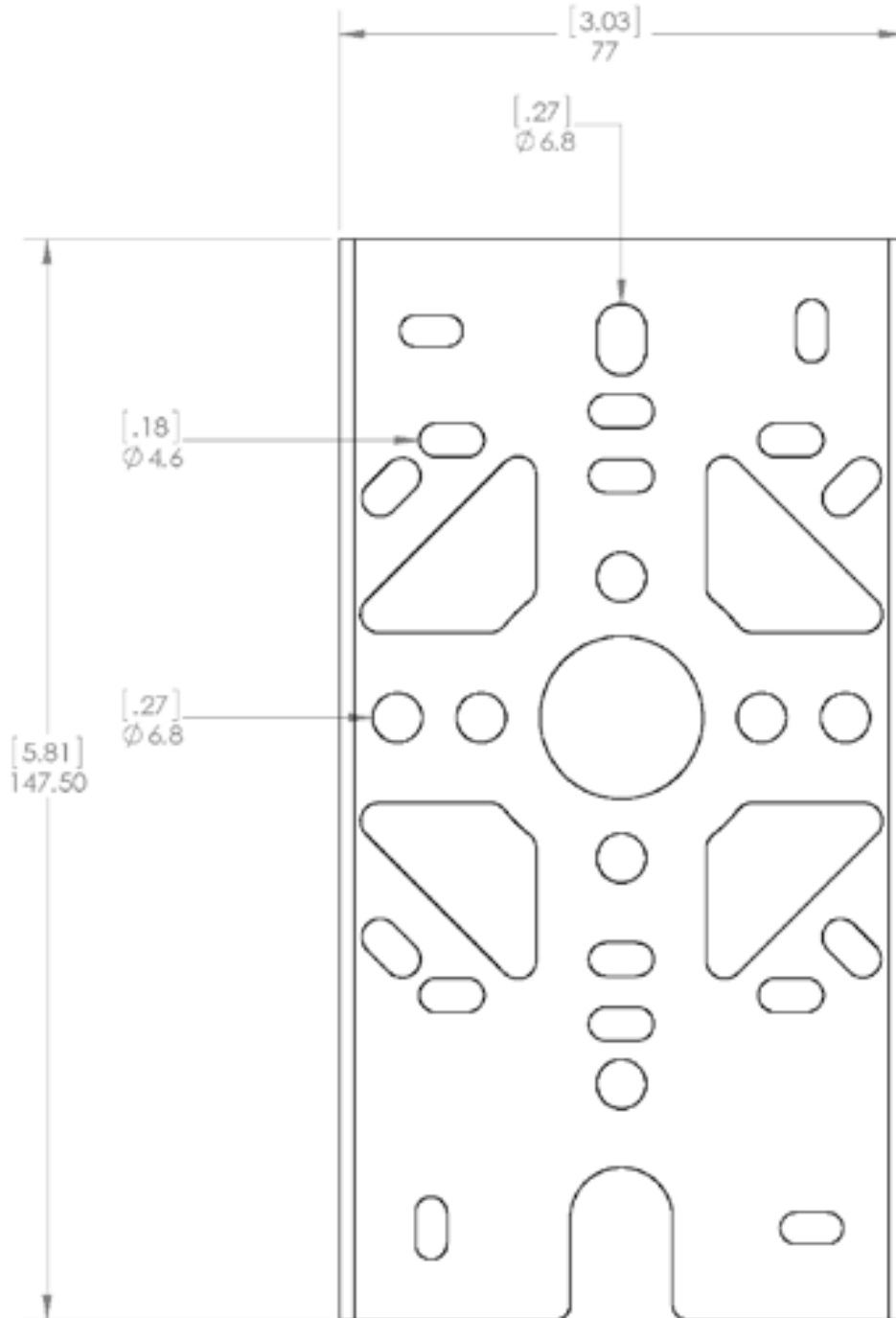
Figure 8-1. RAU Mounting Bracket Template
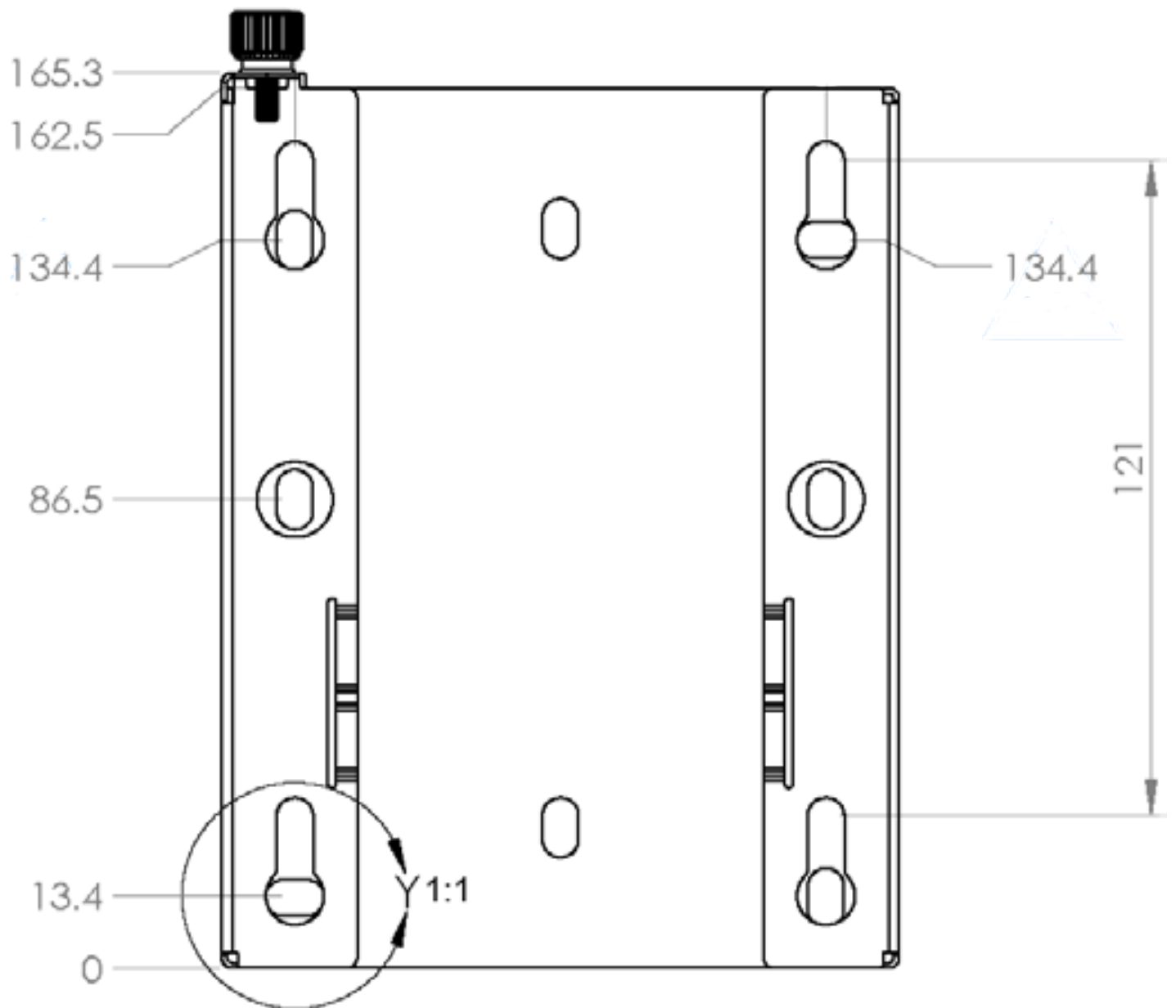
Figure 8-2 RAU5 Mounting Bracket Dimensions

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9   Appendix C: RAU5 Bracket Dimensions
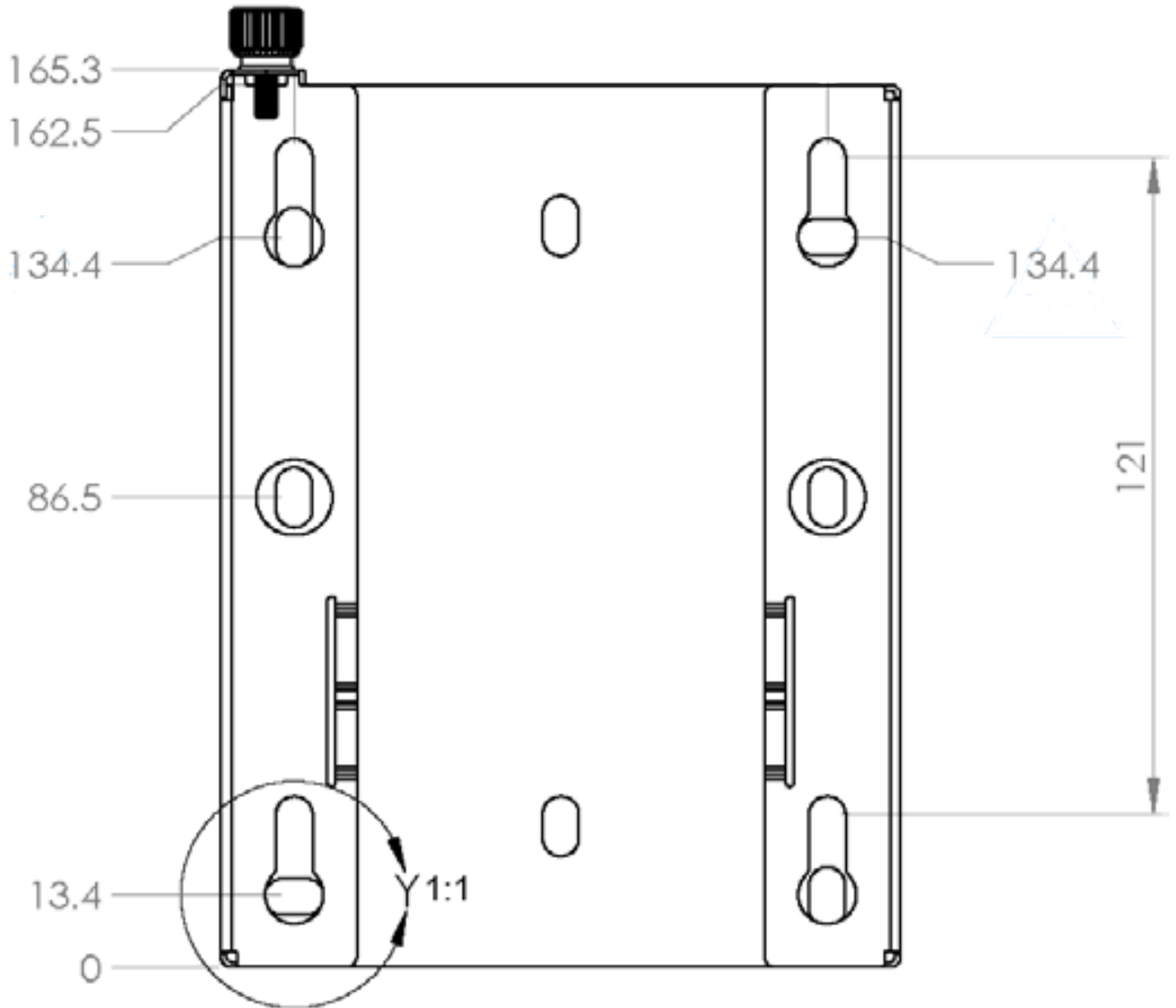
10 Appendix D: RAU5 Mid-Mount Bracket Assembly

10.1 General Information

1. This Quick Installation Sheet provides instructions on how to assemble the RAU5 (ordered separately) onto the mid-mount bracket and install the assembly in an acoustic ceiling.
   2. The RAU5 mid-mount bracket assembly is designed to replace a standard acoustic ceiling tile.
   3. The mid-mount bracket assembly accessory kit is only used with the following RAU5 models including the plug-in external antenna:

· RAU5US-A

· RAU5US-AE

· RAU5US-AM

· RAU5US-AME

   4. It is recommended to perform the RAU5 connections after the unit is secured to the 'Dumper' (section 5).

10.2 Package Contents

The RAU5-BRCK-MM accessory kit consists of an assembled plate (corresponding to a standard acoustic ceiling tile) and Dumper.
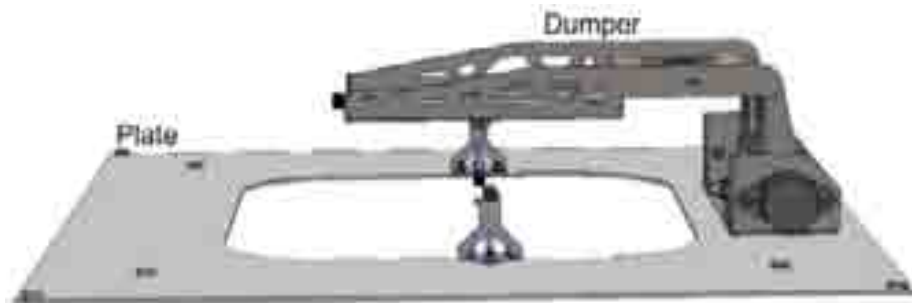
Figure 10-1 Acoustic Ceiling Tile and Dumper Arm

10.3 Installing Mid-Mount Bracket and Mounting RAU5

10.3.1 Preparing RAU5 for Mounting

5. Open the captive screw of the preassembled bracket securing the RAU5 to the mounting bracket.
6. Hold the RAU5 firmly with one hand and the bracket with the other and push the four RAU5 unit pins into the wide ends of the bracket keyholes.
7. Remove bracket.

Figure 10-2 Removing Bracket and Antenna Skirt

10.3.2 Installing Bracket Plate

1. Place the Bracket Plate in the acoustic ceiling.
   2. Secure the plate to the grid via the eight slots (see Figure 11-3)
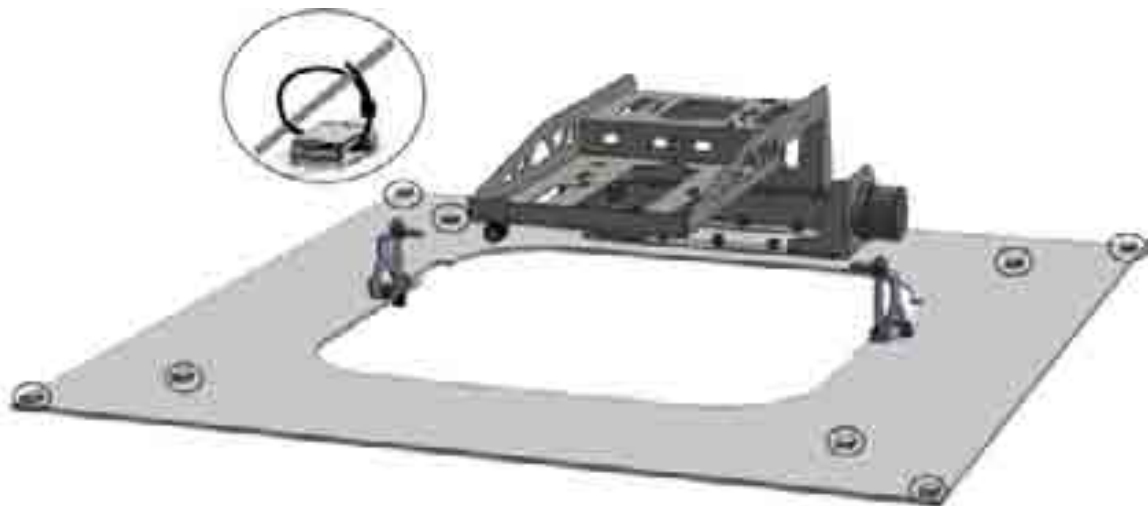
Figure 10-3 Securing Bracket Plate

3. Pull down the Dumper to a vertical position.

Figure 10-4. Lowered Dumper Arm

10.3.3 Mounting RAU5

1. Fit the four Pins on the RAU5 Underside into Wide End of Corresponding Dumper Keyholes and Pull down into Narrow Ends to Secure.

Note: Dumper captive screw must face the RAU5 connectors
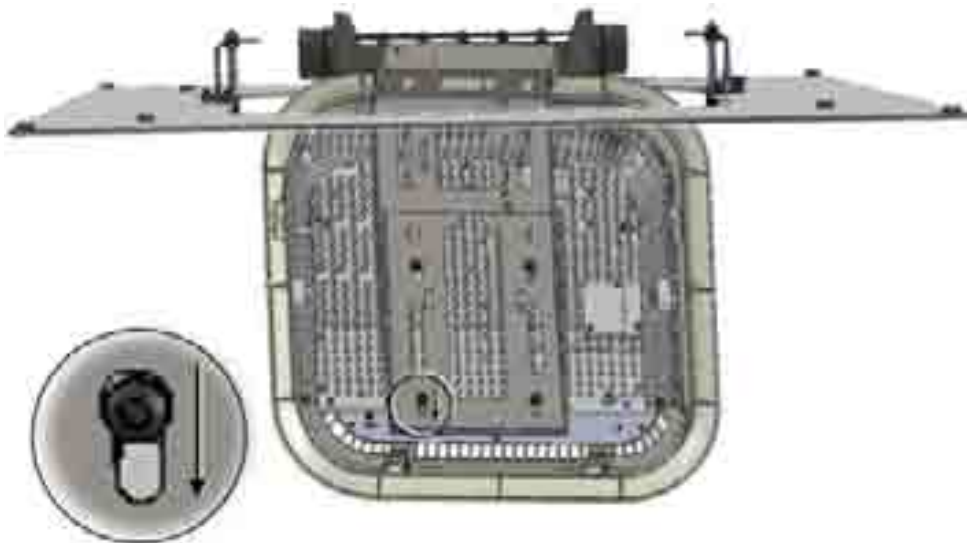
Figure 10-5.Fitting RAU5 onto Dumper Bracket

2. Close Dumper Captive Screw to Secure RAU5 in Place.

Note: it is recommended to perform the RAU5 connections after the unit is secured to the Dumper.

11 Appendix E: Specifications

Supported Services

| Technology | Service/Band | Frequency Range (MHz) | |
		Uplink (UL)	Downlink (DL)
LTE	700 MHz	698-716	728-746
		777-787	746-756
CDMA/WCDMA**/ TDMA/GSM/LTE*	ESMR800	817-824	862-869/
CDMA/WCDMA**/ TDMA/GSM/LTE*	CELL 850	824-849	869-894
CDMA/WCDMA**/TDMA/GSM/LTE*	PCS 1900	1850-1915	1930-1995
WCDMA**/LTE*	AWS 2100	1710-1755	2110-2155

*WCDMA service is based on 3GPP standards, LTE service may 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 per Service (RAU)

Service/Band	LTE 700 MHz		CELL850 MHz		PCS 1900 MHz		AWS 2100 MHz	
RF Parameter	DL	UL	DL	UL	DL	UL	DL	UL
Frequency Range (MHz)	728-746 746-756	698-716 777-787	869-894	824-849	1930-1995	1850-1915	2110-2155	1710-1755
Max Output Power Per Antenna Port (dBm)	15		15		17		18	
Max Input Power (dBm)	0 to 37		0 to 37		0 to 37		0 to 37	
Mean Gain (dB)		-19 to 15		-19 to 15		-19 to 15		-19 to 15
Input IP3 (dBm) AGC OFF Min		-7		-7		-7		-7
Input IP3 (dBm) AGC ON Min		5		5		5		5
SFDR** (dB)		59		63		63		59
Max Intermod Distortion (dBm)	-13		-13		-13		-13	
UL NF*(dB)		12		12		12		12
Gain Flatness/Ripple (dB)	±2.0		±2.0		±2.0		±2.0	

*Typical for single remote antenna
** SFDR calculated with BW of 1.23MHz for the CELL and PCS and with 5MHz for the LTE and AWS

RF Parameters per Service (RAU5)

Service/Band	LTE 700 MHz		ESMR800/ CELL850 MHz		PCS 1900 MHz		AWS 2100 MHz	
RF Parameter	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
Max Output Power Per Antenna Port (dBm)	15		15		20		18	
Max Input Power (dBm)	0 to 37		0 to 37		0 to 37		0 to 37	
Typical Antenna Gain (dBi)	3		3		3		3	
Horizontal Polarization Omni @ 34-45 Degree	-2 to 0		-2 to 0		-1 to 1		-1 to 1	
Mean Gain (dB)		-19 to 15		-19 to 15		-19 to 15		-19 to 15
Input IP3 (dBm) AGC OFF Min		-5		-5		-5		-5
Input IP3 (dBm) AGC ON Min		5		5		5		5
SFDR** (dB)		60		64		64		60
Max Intermod Distortion (dBm)	-13		-13		-13		-13	
UL NF*(dB)		12		12		12		12
Gain Flatness/Ripple (dB)	±2.0		±2.0		±2.0		±2.0	

*Typical for single remote antenna
** SFDR calculated with BW of 1.23MHz for the CELL and PCS and with 5MHz for the LTE and AWS

Environmental, Standards and Optical

Environmental

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
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 (applicable for Access Unit only)

Optical

Optical Output Power	< 9 dBo
Max. Optical Budget	5 dB
Back Reflectance	- 60 dB
Optical Connector	OIM: Female MTP® connector;
	RAU: Single Mode; LC APC Duplex
Fiber Type	Corning® SMF-28® fiber or compatible
Wavelength	1310 ± 10 nm (@ 25° C)

RF Path: Coverage Component Specifications

Headend Unit (HEU)

HEU will host the following modules:

3. RIM - Radio Interface Module; RF source conditioner.
4. Up to 12 RIMs can be hosted by the HEU.
5. RIX - Radio Interface Expander; HEU to OIU interface module

Note: For configurations with one RIX an ETM is required for terminating the unused Expander slot.

6. HCM - Headend Control Module; overall system management module
7. ACM – Auxiliary Control Module; provides interfaces for management of domestic modules via HCM; installed in HEUs' in configurations with more than one HEU
8. PSM - Power Supply Module; AC or DC Power Supply
9. ERFC - RF interface cable, 9-PIN (various cable lengths available)

ERFC

RIM	Interfaces:	Three QMA RF ports; UL, DL and Duplex
	No. of supported bands:	Single band

RIX	Interfaces:	Two 9-pin connectors (one per OIX)
		Two QMA ports for reference clock connections between RIX modules
	No. of supported OIU interfaces:	Two OIUs

ETM	ETM (Expander Termination Module) - used for terminating unused Expander slot	

HCM	Interfaces:	To four ACM RJ-45 INTERNAL ports
	Remote Management:	One RJ-45 LAN port
	Local Management:	One RJ-45 LOCAL port
	Local Configuration:	One CONSOLE port
	System LEDs:	PWR, RUN, SYS, FAN

ACM	Interfaces:	Four RJ-45 INTERNAL ports One RJ-45 CONSOLE port System LEDs – PWR, RUN, SYS, FAN

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PSM-AC	Power Input:	100-220 V AC
	Power Rating:	300 W
	HEU Power Consumption (Full Chassis): ON/Off Switch	200 W
	Optional:	Additional PSM-AC for redundancy
PSM-DC	Power Input:	48 V DC; 9 A Max.
	Power Rating:	300 W
	HEU Power Consumption (Full Chassis):	200 W
	Connector:	Six pin terminal block connector
	Optional:	Additional PSM for redundancy
Physical Characteristics (Chassis + Modules)	Mounting:	Rack-mount – 19 in and 4U
	Dimensions (H x W x D):	7 x 17.3 x 18.95 in (177.8 x 440 x 481.7 mm)
	Weight:	Chassis: 37 lbs (16.8 kg) Per RIM: 1.9 lbs (0.9 kg) Per RIX: 1.54 lbs (0.7 kg) HCM: 2.2 lbs (1.0 kg) PSM: 1.98 lbs (0.9 kg)

Optical Interface Unit (OIU)

OIU will host the following modules:

10. OIM - Optical Interface Modules; converts the RF to three optical links
11. OIX -   Optical Interface Expander; OIU to HEU interface module

Note: For configurations with one OIX an ETM is required for terminating the unused Expander slot.

12. ACM - Auxiliary Control Module; manages unit domestic modules, "Slave" controller to the HCM
13. PSM - Power Supply Module; AC or DC power supply

OIM	Interfaces:	Optical Interface: One Female MTP® Connector Six Kenpole connector for 1:1 direct signal transportation, three UL and three for DL
OIX	RF interfaces:	Two 9-pin connectors

Optical Interface Unit (OIU) (continued)

ETM	(See ETM in HEU section for description)
ACM	(See ACM in HEU section for interfaces)
PSM-AC	(See PSM-AC in HEU section for interfaces) Power Consumption (Full Chassis): 300 W
PSM-DC	(See PSM-DC in HEU section for interfaces) Power Consumption (Full Chassis): 300 W
Physical Characteristics (Chassis + Modules)	Mounting: Rack-mount – 19 in and 4U Dimensions (H x W x D): Chassis: 7 x 17.3 x 18.95 in (177.8 x 440 x 481.7 mm) Cable Management Tray: 6.96 x 20.02 x 4.35 in (176.9 x 508.6 x 110.6 mm) Weight: Chassis : 37 lbs (16.8 kg) Per OIM: 1.5 lbs (0.7 kg) Per OIX: 1.54 lbs (0.7 kg) ACM: 2.2 lbs (1.0 kg) PSM: 1.98 lbs (0.9 kg)

Integrated Headend Unit (IHU)

IHU will host the following modules:

1. RIX - Radio Interface Expander; RF interface to OIX module
2. RIM - Radio Interface Module; RF source conditioner.
   Up to eight (four in RIM slots [2-5] and four in combo slots [6-9]) RIMs can be hosted by the IHU
3. OIM- Optical Interface Modules; converts the RF to three optical link
   Up to eight (four in OIM slots [10-13] and four in combo slots [6-9])
4. OIX- Optical Interface Expander; OIU to IHU interface Module.
5. HCM- Headend Control Module; overall system management module
6. ACM – Auxiliary Control Module; provides interfaces for management of IHU modules via HCM; installed in IHUs' in configurations with more than one headend unit (i.e. HEU/IHU)
7. PSM- Power Supply Module; AC or DC power supply

Cable Management tray with Routed ERFC Cable*

14. ERFC – RF interface cable, 9-PIN; L= 34 in (*routed in provided Cable Management Tray)
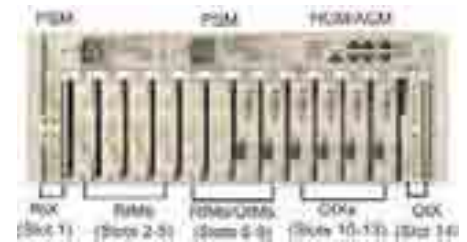
RIM	(See RIM in HEU section for description and interfaces)
RIX	(See RIX in HEU section for description and interfaces)
OIM	(See OIM in HEU section for description and interfaces)
OIX	(See OIX in HEU section for description and interfaces)
HCM	(See HCM in HEU section for description and interfaces)
ACM	(See ACM in HEU section for description and interfaces)

PSM-AC	(See PSM-AC in HEU section for description and interfaces)
	IHU Max Power Consumption (Full Chassis): 300 W
PSM-DC	(See PSM-DC in HEU section for description and interfaces)
	IHU Max Power Consumption (Full Chassis): 300 W

Physical Characteristics (Chassis and Modules)	Mounting:	Rack-mount – 19 in , 4U	
	Dimensions (H x W X D):	Chassis:	7 x 17.3 x 15.5 in
			(177.8 x 440 x 394 mm)
	Weight:	Chassis:	30 lbs (14 kg)
		Per RIM:	1.9 lbs (0.9 kg)
		Per OIM:	1.5 lbs (0.7kg)
		RIX:	1.54 lbs (0.7 kg
		OIX:	1.54 lbs (0.7 kg)
		ACM:	2.2 lbs (1.0 kg)
		PSM:	1.98 lbs (0.9 kg)

Interconnect Unit (ICU)

ICU will host the following modules:

15. PSM-I; Power Supply Module, up to four PSM-I modules can be installed.
16. Pretium EDGE® Module – MTP® to LC APC splice module/cassette/field-term cassette. Up to two EDGE® Modules can be installed.

Chassis Interfaces	Power Input: 110-240 V AC, 50-60 Hz power
	Output: Eight DC ports- 57 V DC, Max. 60V (UL limit)
Pretium Edge® Module Interfaces	Pretium EDGE® Module, 12 F, LC APC to MTP® APC Connector, Single-mode (OS2)
Pretium Edge® Splice Cassette Interfaces	12 F, LC duplex, Single-mode APC, single-fiber
Pretium Edge® Field-Term Cassette Interfaces	12 F, LC duplex, Single-mode APC, No Pigtail
Power Consumption	ICU with four PSM-I: 942 W

Physical Characteristics (Chassis)	Mounting:	Rack-mount – 19 in 1U
	Dimensions (H x W x D):	1.74 x 17 x 19.2 in
		(44.4 x 431.8 x 11.96 mm)
	Weight:	5.5 lbs (2.5 kg) – without PSM

Remote Access Unit (RAU)

RAU will host the following modules:

17. RxU; Remote Expansion Module, for additional LTE and AWS MIMO service. One module per RAU.
18. GEM; Giga bit Ethernet Module – upgrade module for the RAU. One module per RAU

Supported Services	SISO: CELL, PCS, AWS, 700LTE MIMO: AWS/ 700LTE (with Expansion Module - RxU)
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; 0 dBi (15° down from horizon)

Power Consumption	For Main Power Input: Input Range: 37-57 V DC
	                                     RAU: 37 V; 35 W
	                                     RAU + RxU: 37 V; 60 W
	                                     RAU + GEM: 37 V; 39 W
	                                     RAU + RxU + GEM: 37 V; 64 W
	
	For Secondary Power Input: For 2 PoE ports of 802.3af: 43 V; 30 W (Input range: 43 - 57 V DC)
	                                     For 2 PoE ports of 802.3at: 52 V; 62 W (Input range: 52 - 57 V DC)

Management	Managed via the HCM

Physical Characteristics (Enclosure and Modules)	Mounting: Wall/ceiling (Horizontal mount)
	                 Mounting bracket included in installation kit
	
	Dimensions (H x W X D): 4 x 13.1 x 13.1 in (including mounting bracket)
	                             (101.6 x 332.7 x 332.7 mm)
	
	Weight: RAU only: 7.93 lbs (3.6 kg)
	              RAU + RXU + GEM: 12.12 lbs (5.5 kg)

Environment	Ambient Temperature: Wall-mount installations: 45°C (113°F) Ceiling-mount installations: 50°C (122°F)

Remote Access Unit (RAU)

RAU will host the following modules:

1. RxU; Remote Expansion Module, for additional LTE and AWS MIMO service. One module per RAU5.
2. GEM; Giga bit Ethernet Module – upgrade module for the RAU5. One module per RAU5

Supported Services	SISO: CELL/ESMR, PCS, AWS, 700LTE MIMO: AWS/ 700LTE (with Expansion Module - RxU)
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; 0 dBi (15° down from horizon)

Power Consumption	For Main Power Input:	Input Range: 37-57 V DC RAU: 44.5 V; 48 W RAU + RxU: 44.5 V; 73 W RAU + GEM: 44.5 V; 52 W RAU + RxU + GEM: 44.5 V; 77 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 HCM	
Physical Characteristics (Enclosure and Modules)	Mounting:	Wall/ceiling (Horizontal mount) Mounting bracket included in installation kit Mid-mount (acoustic ceiling) – separately ordered kit
	Dimensions (H x W X D):	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)
	Weight:	R RAU5 only: 10 lbs (4.5 kg) RAU5 and RXU and GEM: 14.39 lbs (6.5 kg)
Environment	Ambient Temperature:	Wall-mount installations: 45°C (113°F) Ceiling-mount installations: 50°C (122°F)

Remote Expansion Unit (RxU)

Services	Upgrade module supporting two services AWS MIMO and LTE 700 MIMO
Interfaces	Three pins for integration with RAU (power, control and RF)
Management	Management via host RAU
Physical Characteristics	Mounting: Installed in the RAU enclosure
	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 (Max.)	1.5 dB
Passband Ripple (Max.)	0.8 dB
Return Loss (Min.)	8.0 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 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 (H x W X D): 5.6 x 3.8 x 1.8 in (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 (Max.)	1.4 dB Typical 1.6 dB Max.
Ripple	0.9 dB Typical 1.1 dB Max.
Return Loss (Min.)	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 (H x W X D): 6.0 x 2.9 x 1.68 in (159 x 75 x 42 mm)

Digital Coverage Component Specifications

Centralized Ethernet Unit (CEU)

CEU will host the following module:

Three CEMs; Centralized Ethernet Module; media and rate converter, Ethernet (copper) to fiber.

Interfaces	CEM supports four 10/100/1000BASE-T RJ-45 connectors to four LC UPC fiber connectors Four 10/100/1000BASE-T Copper ports Four 1000BASE-X fiber SFP
Throughput	Eight Gbps forwarding per CEM
Power	Input: 110-240 V AC, 50-60 Hz power Power Consumption (fully occupied): 50 W

Physical Characteristics

Mounting:		Rack-mount 19 in; 1U
Dimensions (H x W x D):	CEU:	1.71 x 17/19 (with mounting ears x 8.5 in (43.66 x 431.8 / 482.8 with mounting ears x 216 mm)
	CEM Module:	1.41 x 3.94 x 7.68 in (36 x 100.14 x 195.14 mm)
Weight:	CEU:	7.55 lb (3.4 kg)
	CEM Module:	1.44 lb (0.65 kg)

Gigabit Ethernet Module (GEM)

GEM – Ethernet over fiber to copper

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

Two 802.3at 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 RAU - powered via RAU Secondary power input (see RAU power consumption spec) Installations with GEU-S – powered via GEU power input (see GEU-S power consumption spec)
Switching	IPv4 and IPv6 transparent MAC table 512 entries VLAN - unfiltered forwarding between ports IGMP forward to all ports, no snooping
Physical Characteristics	Mounting: Standalone: GEU-S / Add-on: RAU 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)

Standalone Gigabit Ethernet Unit (GEU-S)

GEU-S will host the following module:

GEM; Gigabit Ethernet Module; Media converter, Ethernet over fiber to Copper.

Services	Supplies power and management port for hosted modules. When it hosts a GEM it allows it to perform media conversion services from Fiber to Copper and to supply PoE + PSE services
Interfaces	DC PWR connector Service Port – RJ-45 (to GEM)
Power Input	42-57 V DC
Physical Characteristics	Mounting: Wall/ceiling mount Dimensions (H x W x D): 5.01 x 10.51 x 3.26 in (including mounting bracket) (127.5 x 267 x 83 mm) Weight: 2.64 lbs (1.2 kg)

Optical: Cabling, Unit/Modules Specifications

Cabling

Vertical	Plug & Play™ Plenum Optical cables MTP® Fiber Connectors 12 – 144 fibers Two-sided or one-sided Armored, non-armored	
Horizontal	Composite Plenum tether assemblies Fiber: LC APC, 2 – 24 fibers Cu: 16AWG, 14AWG, 12AWG; 2 – 12 Conductors Armored, non-armored	

Fiber Management

FMU	1U: 144 Fibers 2U: 288 Fibers 4U: 576 Fibers Plug & Play™ Modules or Splice Cassettes	

12 Appendix F: Ordering Information

HEU and OIU Assemblies and Modules

Part Number	Description
HEU:	Headend Unit assembly (without RIMs); support for 1-12 RIMs:
HEU-2-00-1-A-H	Hosts two RIX modules; one PSM-AC module and one HCM module
HEU-2-00-1-D-H	Hosts two RIX modules; one PSM-DC module and one HCM module
HEU-2-00-1-A-A*	Hosts two RIX modules; one PSM-AC module and one ACM module
HEU-2-00-1-D-A*	Hosts two RIX modules; one PSM-DC module and one ACM module
HEU-1-00-1-A-H	Hosts one RIX module; one ETM module; one PSM-AC and one HCM module
HEU-1-00-1-D-H	Hosts one RIX module; one ETM module; one PSM-DC and one HCM module
HEU-1-00-1-A-A	Hosts one RIX module; one ETM module; one PSM-AC and one ACM module
HEU-1-00-1-D-A	Hosts one RIX module; one ETM module; one PSM-DC and one ACM module
HEU Modules:	
HCM	Head End Control Module; Includes two RJ-45 cables (2 m)
RIX	Radio Interface Expander – HEU expansion module; two must be ordered
RIM:	Radio Interface Module for HEU chassis
RIM-L70	LTE 700 MHz service
RIM-C85	CELL 850 service MHz service
RIM-P19	PCS 1900 MHz service
RIM-A17	AWS 1700 MHz service
RIM-L70-M	LTE 700 MHz MIMO service
RIM-A17-M	AWS 1700 MHz MIMO service
OIU	Optical Interface Unit assembly (without OIMs); support for 1-12 Optical Interface Modules
OIU-2-00-1-A-A	Hosts two OIX modules, one PSM-AC module and one ACM module
OIU-2-00-1-D-A	Hosts two OIX modules, one PSM-DC module and one ACM module
OIU-1-00-1-A-A	Hosts one OIX module; one ETM module; one PSM-AC and one ACM module
OIU-1-00-1-D-A	Hosts one OIX module; one ETM module; one PSM-DC and one ACM module
OIU Modules:	
OIM	Optical Interface Module for OIU Chassis; three Optical links
OIX	Optical Interface Expander – OIU expansion module
IHU	Integrated Headend Unit assembly (without RIMs and OIMs); support for four RIMs, four OIMs and four additional RIMs/OIMs in dual slots
IHU-2-11-1-A-H	Hosts one RIX; one OIX; one ERFC cable; one PSM-AC module and one HCM module
IHU-2-11-2-A-H	Hosts one RIX; one OIX; one ERFC cable; two PSM-AC modules and one HCM module
IHU-2-11-1-A-A	Hosts one RIX; one OIX; one ERFC cable; one PSM-AC module and one ACM module
IHU-2-11-2-A-A	Hosts one RIX; one OIX; one ERFC cable; two PSM-AC module and one ACM module
IHU-2-111-D-H	Hosts one RIX; one OIX; one ERFC cable; one PSM-DC module and one HCM module
IHU-2-11-2-D-H	Hosts one RIX; one OIX; one ERFC cable; two PSM-DC modules and one HCM module
IHU-2-11-1-D-A	Hosts one RIX; one OIX; one ERFC cable; one PSM-DC module and one ACM module
IHU-2-11-2-D-A	Hosts one RIX; one OIX; one ERFC cable; two PSM-DC modules and one ACM module

Additional HEU, OIU and IHU Modules	
ACM	Auxiliary Control Module; Includes two RJ-45 cables (2 m)
PSM-AC	AC Power Supply – installed in HEU and OIU chassis; includes US plug power cords
PSM-DC	DC Power Supply - installed in HEU and OIU chassis; includes 48 V DC six pin terminal block connector
ETM**	Expander Termination Module; 50 Ohm; used for terminating unoccupied RIX/OIX slot; only relevant for HEU and OIU chassis

*Use this PN with ACM when it is a second HEU connected to the Prime HEU;
**Supported from SW Rel. 1.2 only

Remote Units

Part Number	Description
RAU:	Remote Access Unit
RAU-C85P19L70A17	RAU supporting SISO CELL850, PCS1900, LTE700 MHz and AWS1700; SMF
RAU-R-C85P19L70A17-M	RAU supporting SISO CELL850 and PCS1900; MIMO for LTE700 and AWS bands; SMF
RAU-G-C85P19L70A17-E	RAU supporting SISO CELL850, PCS1900, LTE700 MHz and AWS1700; two PoE and Ethernet ports; support for Ethernet services; SMF
RAU-R-G-C85P19L70A17-ME	RAU supporting SISO CELL850 and PCS1900; MIMO for LTE700 and AWS bands; two PoE and Ethernet ports; support for Ethernet services; SMF
RAU5:	5 Band Remote Access Unit
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
ICU:	Interconnect Unit; US power cord included
ICU-24-P-12-AF-H-4	24 fibers; hosts two splice cassette modules and four PSM-I modules
ICU-24-P-12-AF-H-3	24 fibers; hosts two splice cassette modules and three PSM-I modules
ICU-12-P-12-AF-H-2	12 fibers; hosts one splice cassette module and two PSM-I modules
ICU-12-P-12-AF-H-1	12 fibers; hosts one splice cassette module and one PSM-I module
ICU-24-M-12-AF-0-4	24 fibers; hosts two EDGE® modules and four PSM-I modules
ICU-24-M-12-AF-0-3	24 fibers; hosts two EDGE® modules and three PSM-I modules
ICU-12-M-12-AF-0-2	12 fibers; hosts one EDGE® module and two PSM-I modules
ICU-12-M-12-AF-0-1	12 fibers; hosts one EDGE® module and one PSM-I module
PSM-I	ICU Power Supply Module

Digital Path Units

Part Number	Description
GEU-S	Standalone Gigabit Ethernet Unit
CEU	Centralized Ethernet Unit; hosts up to three CEM modules
CEM	Centralized Ethernet Module; includes SFP and UPC to APC adapter

Accessories

Part Number	Description
CblTray	HEU/OIU Cable management tray and door sleeve; chassis sleeve for managing cables and door for covering front panel
AK-RAU-BRCK-MM	Accessory kit used for mid-mount acoustic ceiling installations of the RAU; includes flat bar and plate for assembling the RAU; assembly replaces standard acoustic tile (RAU ordered separately)
RAU5US-ANT	Broad Band Antenna Module for RAU5-Remote Access Unit
M-RAU5US-AME	RAU5US Mockup, includes Ant, GEM & RxU - Not functional, mechanical only
BR-RAU5US-Wall	RAU5 remote bracket for wall mount installation; Supports up to two RAU5 units back-to-back
BR-RAU5US-TOP	RAU5 bracket for floating ceilings tile, Mid-Mount installation
37HP900162-006F	MTP-LC APC Harness Cable; Connector for splitting fibers (six) leading from OIM to (FMU) Edge module
ERFC:	Expander RF Cable; SMP to SMP connector
ERFC16	L= 16 in; 9 pin
ERFC24	L= 24 in; 9 pin
ERFC34	L= 34 in; 9 pin
ERFC40	L= 40 in; 9 pin
ERFC59	L= 59 in; 9 pin
PCKC:	Pilot Transport Cable; Single QMA to QMA
PCKC20	L=20 in
PCKC47	L=47 in
PCKC63	L=63 in
PCKC79	L=79 in

Hardware

Part Number	Description
EDGE-01U-SP	1U Rack-Mount Fiber Housing, holds 12 Pretium EDGE® modules or splice cassettes
ECM-UM12-18-89	12-Fiber LC APC EDGE PnP Module
EDGE-CS12-AF-P00RE	Pretium EDGE® Splice Cassette
EDGE-CS12AF	Pretium EDGE® Field-Term Cassette
CDF-RJ12-BKT	12-in Rack Bracket for managing cables
FMU:	Fiber Management Unit; EDGE® -01U-SP housing; hosts EDGE® module
ED1-12M12AF-0R0000	12 Fibers
ED1-24M12AF-0R0000	24 Fibers
ED1-48M12AF-0R0000	48 Fibers
ED1-72M12AF-0R0000	72 fibers
ED1-96M12AF-0R0000	96 Fibers
ED1-E4M12AF-0R0000	144 Fibers

Cable Ordering Information

Cable Configurations

Composite Cable Ordering Configuration

H	R	1	8	1	8		4	C	0	6	U	8	2	0				F	-	P	K
		1		2			3	4	5	6		7	8	9		10					11	12

Trunk Cable Ordering Configuration

H	R	1	3	1	3	0	0	N	0		G	8	2	0				F	-	P	K
		1		2			3	4	5	6		7	8	9		10					11	12

1

Connector.
13 = MTP® Connector, SM Elite
18 = LC/APC Duplex

4

Cu conductor count.
0 = 0 conductors
4 = 4 conductors

7

Fiber type.
U = ZBL Fiber
G = XB fiber

10

Select cable length.
004 – 999 ft.

2

Connector.
13 = MTP® Connector, SM Elite
18 = LC/APC Duplex

5

Cu connectors.
Cu = With connectors
N = No connectors

8

Jacket type.
8 = Plenum Indoor

11

Pulling grip type.
P = One-sided pulling grip

3

Select cu wire gauge
0 = No Cu Wire
F = 12AWG
G = 14AWG
H = 16AWG
K = 20AWG

6

Fiber count.
06 = 6 fibers
24 = 24 fibers
48 = 48 fibers
72 = 72 fibers
96 = 96 fibers
E4 = 144 fibers

9

Armored/non-armored
20 = Non-armored

12

Kit type
K = 2 Strain relief trunk holders

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