

Corning

ONE™ Wireless Platform
User Manual

PART 1

CORNING

PART 1

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.

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

Warnings and Admonishments

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

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

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

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

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

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

Regulatory Compliance Information



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

Care of Fiber Optic Connectors

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

Company Certification

ISO 9001: 2000 and ISO 13485: 2003

Licensee Contact Information

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

Additional Relevant Documents

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

Document Name	CMA Lit Code
Headend Control Module (HCM) and Web Management GUI User Manual	
Campus Connectivity Fiber Connectivity Modules (FCM) Datasheet	CMA-421-AEN
Mid-Power Remote Unit (MRU) Datasheet	CMA-422-AEN
Mid-Power Remote Unit (MRU) User Manual	CMA-438-AEN
5 band remote access unit (RAU5) datasheet	CMA-377-AEN

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1 Introduction

1.1 About Corning® ONE™ Wireless Platform

The Corning® ONE™ wireless platform is an all optical converged solution, unifying cellular, Wi-Fi and Ethernet backhaul. The platform provides a flexible in-building cellular and network data coverage solution based on a fiber optic transport backbone. Fiber-to-the edge technology allows for virtually unlimited bandwidth to support today and tomorrow's growing demands of wireless users.

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

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. Various combinations of services are allowed for routing 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.

Built-in Gigabit Ethernet support enables offload, expansion and best-use of Wi-Fi resources while the integrated antenna provides flexibility for ease and cost.

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.

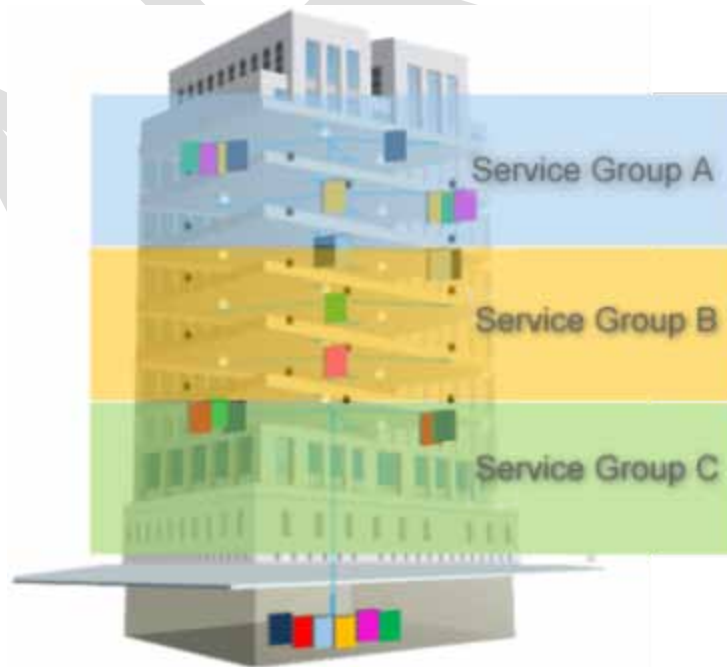


Figure 1-1. Illustration of Precise Service Distribution over Selected Remote Areas

In addition, the Corning ONE wireless platform campus connectivity solution (FCM) comprising two modules enables point-to-point extension of cellular services along with 10 Gb Ethernet to a distance of up to 12.4 miles. The solution utilizes single mode (SM) fiber to extend up to three user configured service groups from the main headend to a remote site.

Note: Refer to FCM datasheet for solution specifications (can be downloaded from Corning partner portal).

1.2 Key Features and Capabilities

- Comprehensive service support
- Supported services - LTE700, ESMR, CELL, PCS, AWS, WCS, and TDD 2500 MHz
- Flexible, configurable service distribution - advanced capacity and coverage management for better macro offload and enhanced user experience.; Point-to-point connectivity and BTS hoteling in star topologies (via FCM modules)
- Fiber conservation – via FCM solution, enables single fiber transport of all RF services and 10 Gb Ethernet over a distance of 12.4 mi
- 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 Environmental and Regulatory Specifications

1.3.1.1 Temperature and Humidity

The environmental specifications listed below are relevant to all Corning 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

1.3.1.2 Safety and Regulatory Approvals

The safety and regulatory specifications listed below are relevant to all Corning® ONE™ wireless platform 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 RAU5 only)

Table 1-2. Safety and Regulatory Approvals

1.3.2 Power Specifications

Note: This section provides the power specifications for the headend units and the RAU/RAU5 (including GEM). For MRU specifications refer to MRU datasheet (CMA-422-AEN) and user manual (CMA-438-AEN). These can be downloaded from Corning partner portal.

1.3.2.1 Power Input and Consumption

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

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 + GEM	37 V; 39 W	

Table 1-4. RAU 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

Table 1-5. RAU Power and Current Consumption for Secondary Input

RAU5 + Add-On Modules	Max. Power Consumption	Power Input Range
RAU5 (alone)	44.5 V; 50 W	37 – 57 V DC
RAU5 + GEM	44.5 V; 52 W	

Table 1-6. RAU5 Power and Current Consumption for Main Power Input

Unit	Device	Input Range	Power Consumption
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 1-7. RAU5 Power and Current Consumption for 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 1-6	See Table 1-6
GEU-S	42-57 V DC	4.5 W

Table 1-8. Digital Path Remote End Power Specifications

1.3.2.2 Cable Gauge Requirements

Table 1-9 provides the information required to calculate the required power supply for the remote units.

Note: Table also applies to RAU5.

	RAU SISO (ft)	RAU SISO + GEM (ft)	RAU SISO + GEM Supporting PoE	RAU SISO + GEM Supporting PoE+ (ft)	GEU-S (ft)	GEU-S Supporting PoE (ft)	GEU-S Supporting PoE+ (ft)
22AWG	540	490	410	100	2000	310	80
20AWG	870	780	650	160	3200	500	130
16AWG	2200	1900	1600	400	8200	1200	350
14AWG	3500	3100	2650	650	1350	2000	550

Table 1-9. Required Cable Gauge

1.3.2.3 Power, Heat and Rack Specifications

Table 1-10 and Table 1-11 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 1-10. 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	50	171	Without mounting bracket: 3.2 x 12.9 x 9.8 in (82.1 x 337.3 x 249.4 mm) With mounting bracket: 5.25 x 13.1 x 13.1 in (133.35 x 332.74 x 332.74 mm)
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 1-11. Power, Heat and Rack Specifications for Ceiling Equipment (Remote End)

1.3.2.4 Remote End Distance and Power Draw Matrix

Note: RAU values apply to RAU5 as well unless RAU5 specifically indicated.

Table 1-12, **Error! Reference source not found.**, Table 1-13 and Table 1-14 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 1-12. Remote End Distance and Power Draw for (Standalone) RAU SISO

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 1-13. 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 1-14. Remote End Distance and Power Draw for GEM w/PoE.3at

1.3.3 Dimensions and Weight of Units

Table 1-15, Table 1-16 and Table 1-17 describe the physical specifications of the Corning® ONE™ headend and remote end units.

Note: Refer to MRU datasheet for MRU physical dimensions and weight.

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) Per FRM: 2.42 lbs (1.1 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) Per FMM: 2.42 lbs (1.1 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 1-15. 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);
RAU5 (including mounting bracket)	Without external antenna: 3.6* x 12.9 x 10.4 in (90 x 327 x 264 mm) *3.6 in (90 mm) without standard mounting bracket; 4.4 in (111 mm) with standard mounting bracket With external antenna and skirt: 6.1 x 5.3 x 5.3 in (154 x 334 x 334 mm)	RAU5 only: 10 lbs (4.5 kg)

Table 1-16. 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)
CEU: 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 1-17. Ethernet Path Units

1.3.4 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 1-18. Optical Specifications

1.4 System Architecture and Topologies

The Corning® ONE™ wireless platform solution fiber-optic infrastructure is used to transmit both RF and Ethernet services:

- RF services – Broadband RF distribution over fiber-optics infrastructure transfers converged wireless services from the headend towards remote-end units (e.g. RAU5) deployed at the remote end locations according to user defined configuration.
- Ethernet 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.

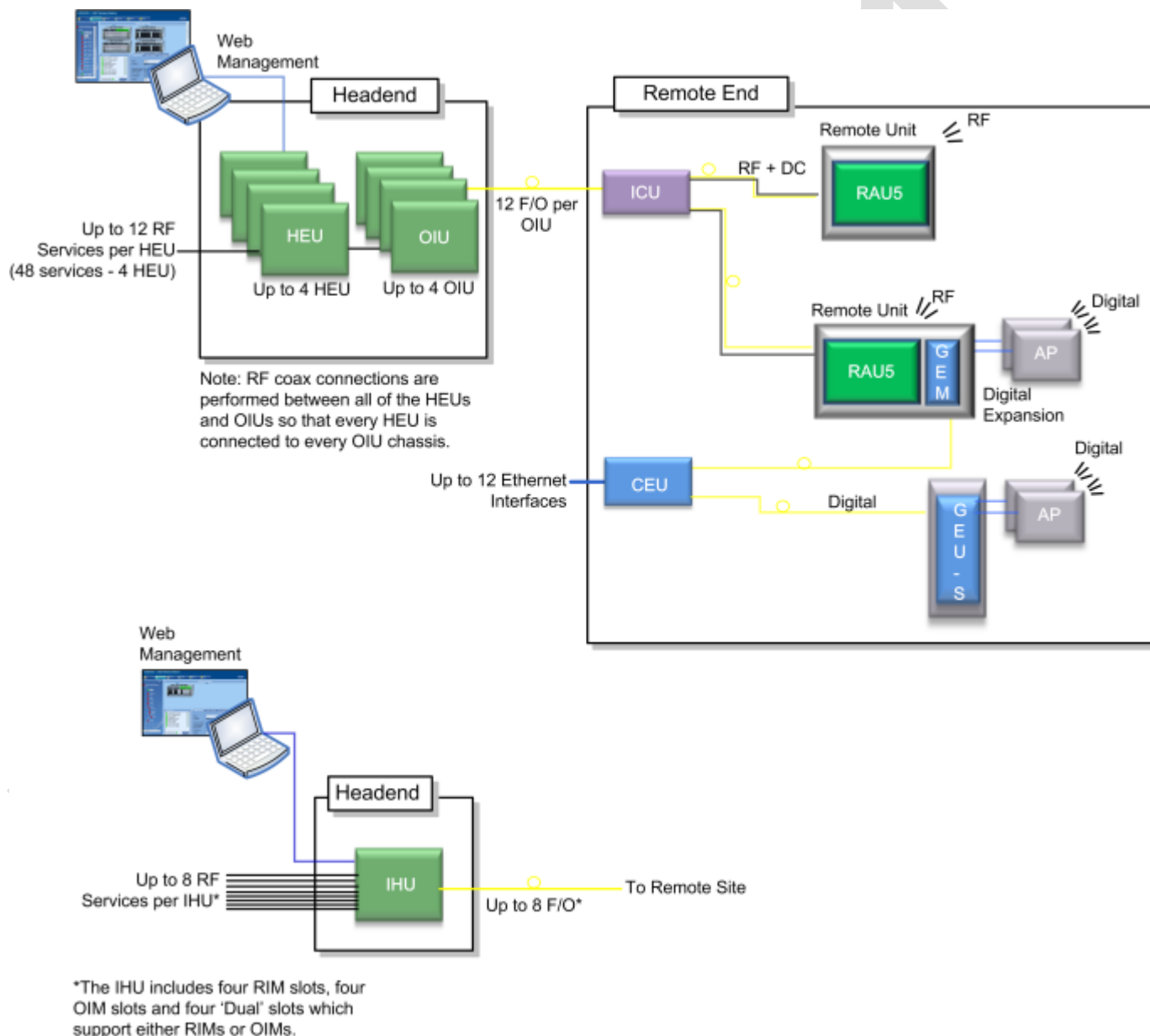


Figure 1-2. Corning ONE Wireless Platform Basic Architecture

Acronyms
HEU = Headend unit
RIM = Radio interface module
RAU5 = 5 Band remote access unit
GEM = Gigabit Ethernet module
RIM = Radio interface module
GEU-S = Gigabit Ethernet Unit-Standalone
ICU = Interconnect unit
IHU = Integrated headend unit
CEU = Centralized Ethernet unit
OIU = Optical Interface unit
OIM = Optical Interface module

Table 1-19. Acronyms in System Architecture

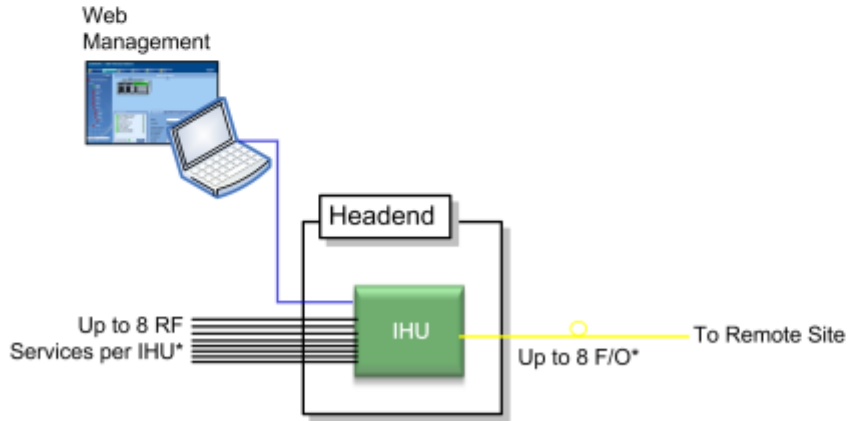
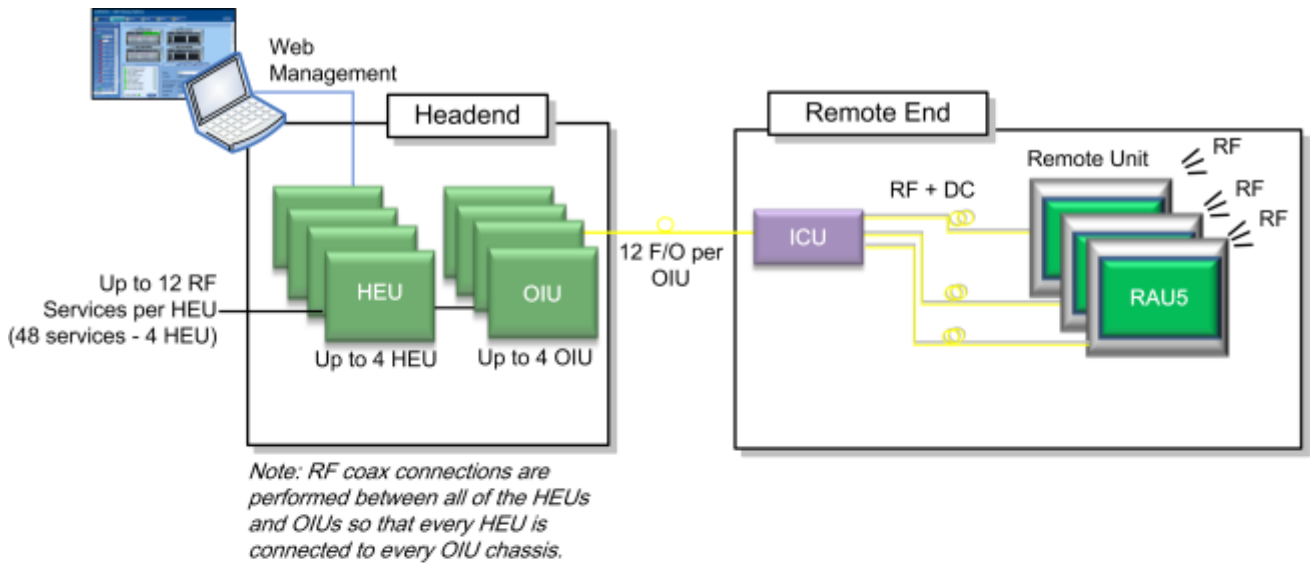
1.4.1 RF Path

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

The optic fibers at the OIU are routed to the integrated centralized unit (ICU) at the remote end. From the ICU the optic fibers are distributed along with DC to the remote access units (RAU5).

For small/medium size deployments an integrated headend unit (IHU) 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.



**The IHU includes four RIM slots, four OIM slots and four 'Dual' slots which support either RIMs or OIMs.*

Figure 1-3. Corning® ONE™ Solution RF Path Architecture

1.4.2 Ethernet Path

The digital services from the corporate LAN (received via Ethernet Switch) are converted to optic signals by the centralized Ethernet unit (CEU) and routed over optic fibers towards the GEM units. The optical traffic is then converted to 1 GbE by the Gigabit Ethernet modules (GEM) 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 1.4.1). In that case, the ICU can also provide DC to the GEMs.

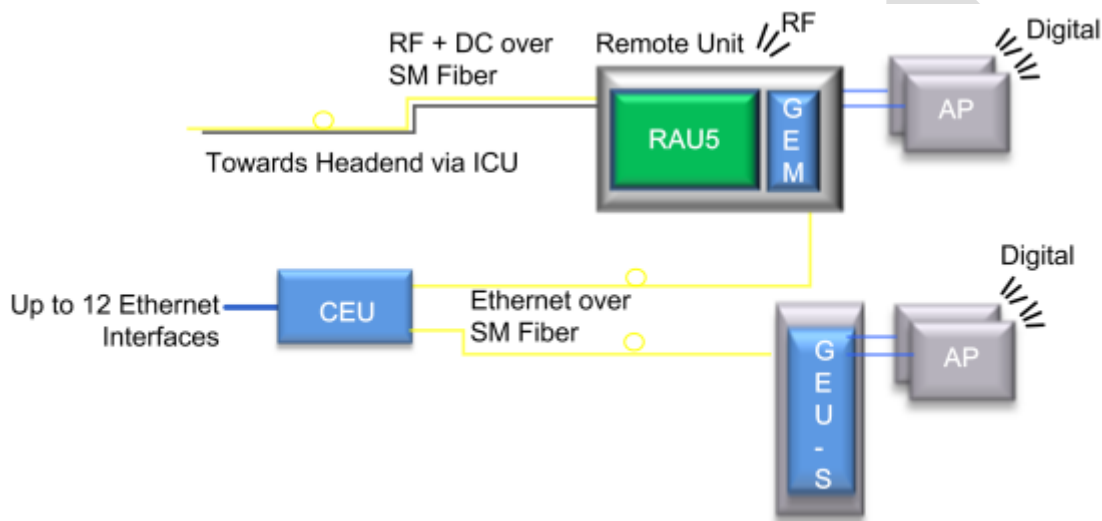


Figure 1-4. Corning ONE™ Solution Ethernet Path Architecture

1.5 WEB Management Application

The Corning® ONE™ wireless platform headend control module (HCM) enables centralized, system-level element management and provides comprehensive end-to-end, single source setup and management of the Corning ONE wireless platform active RF system components after their physical installation.

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

Figure 1-5 shows the Management window, displayed by default upon login (shows installation with multiple sites via FMM-to-FRM connections).

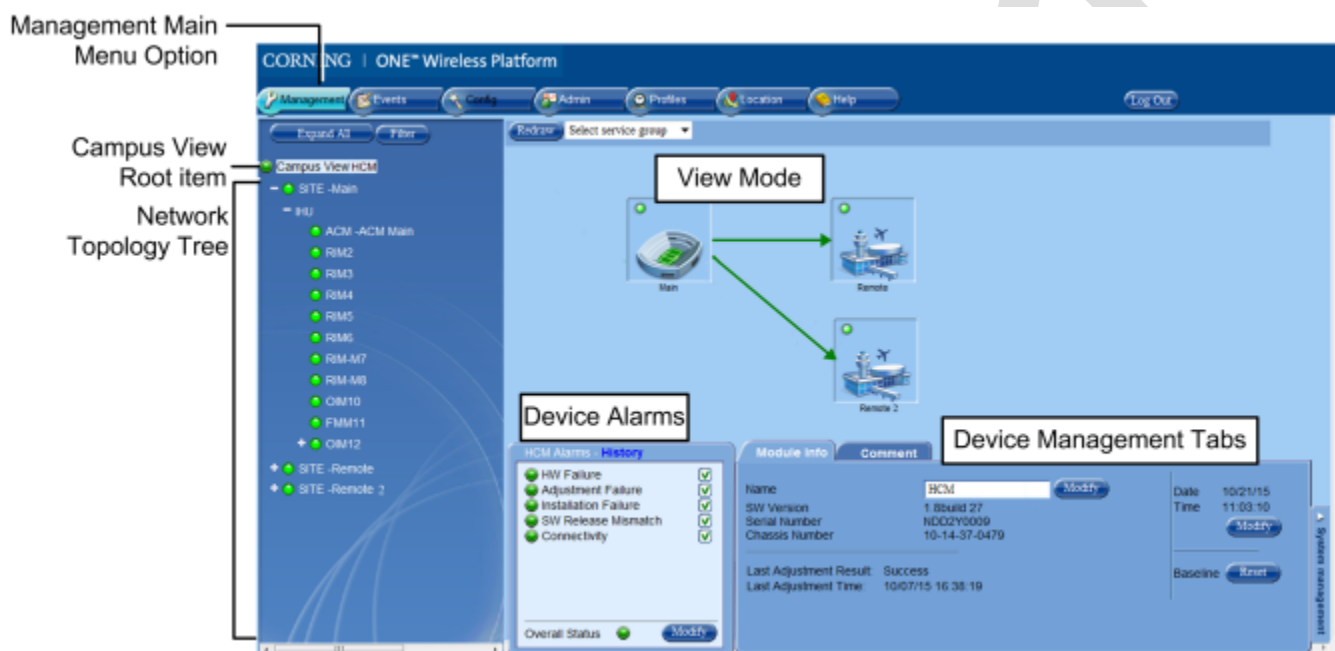


Figure 1-5. Main Window (Management Tab - Default Display)

The main menu bar includes the following tabs:

Tab	Description
Management	Displayed upon login by default. Displays general module information and device alarms and provides the configuration options for the available selected site devices.
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.
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.
Profiles	Enables creating complete system configuration and setup profile offline and activating at a later time.
Location	Enables importing maps and icons to graphically display the geographical location and types of sites as well as the floor plans and map power settings for the system elements.
Help	Provides access to Online Help

Table 1-20. Main Menu Tabs

1.6 User Controlled Service Group Distribution

Corning® ONE™ fiber-optics infrastructure allows various combinations of SISO 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.

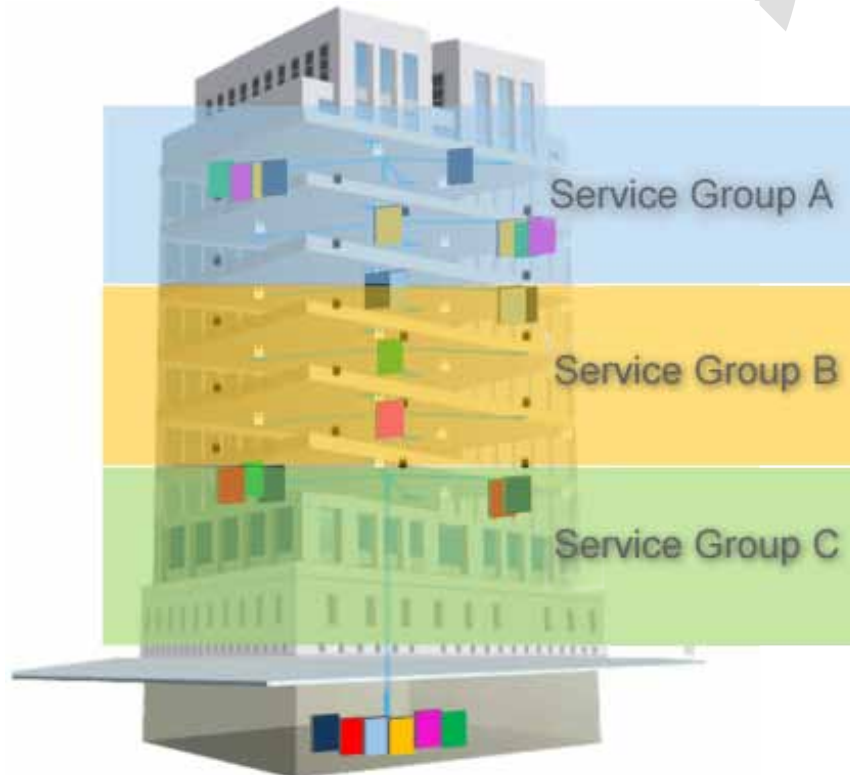


Figure 1-6. Illustration of Service Group Distribution

1.6.1 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 optical signals. Each OIU supports up to 36 RAU (Remote Access Units).

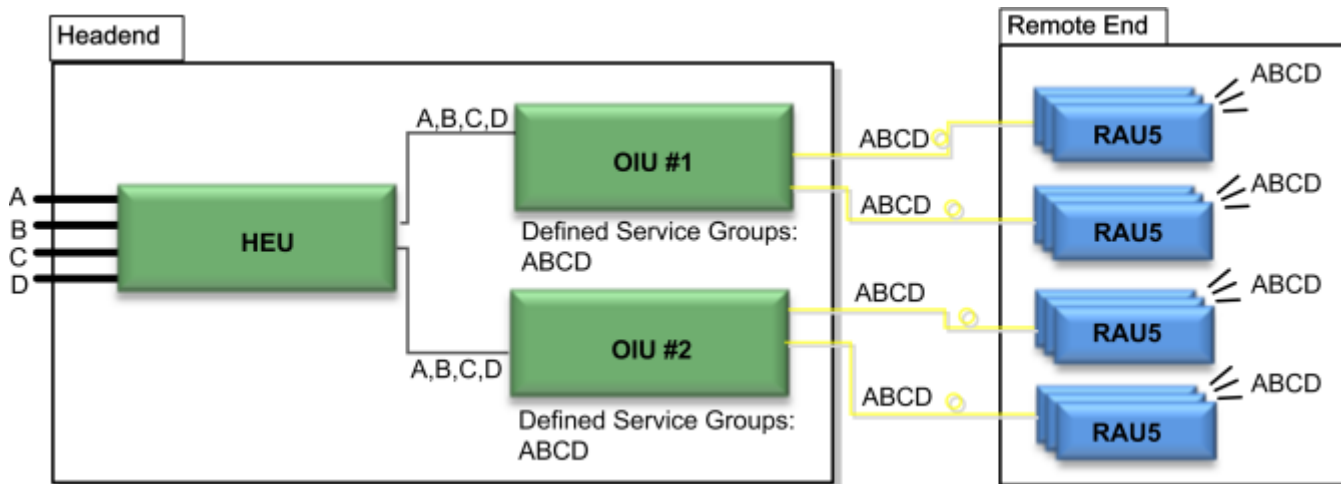


Figure 1-7. Single Service Group Configuration

1.6.2 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).

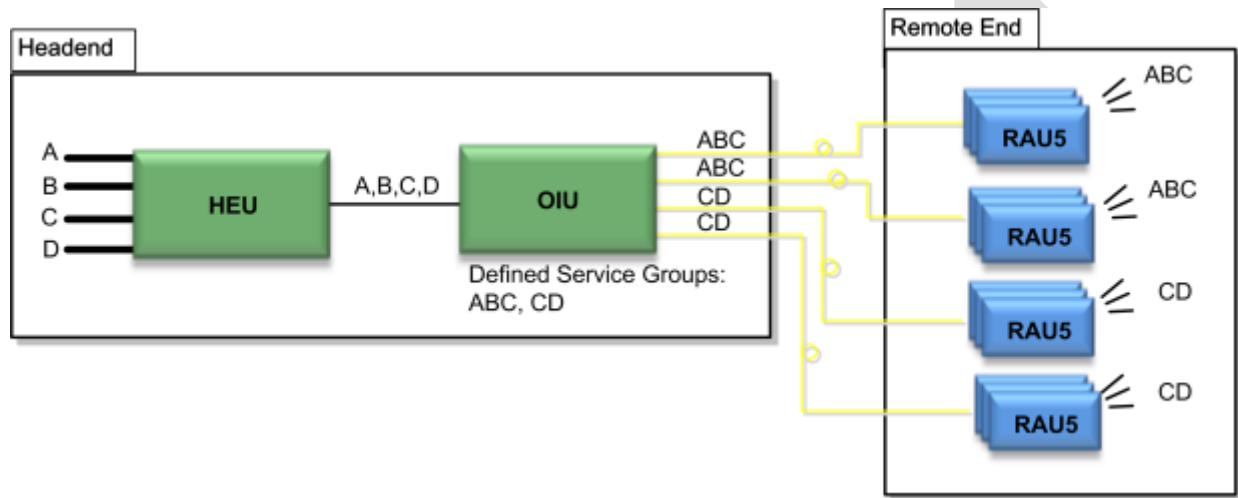


Figure 1-8. Example of Dual Service Group Configuration

1.6.3 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).

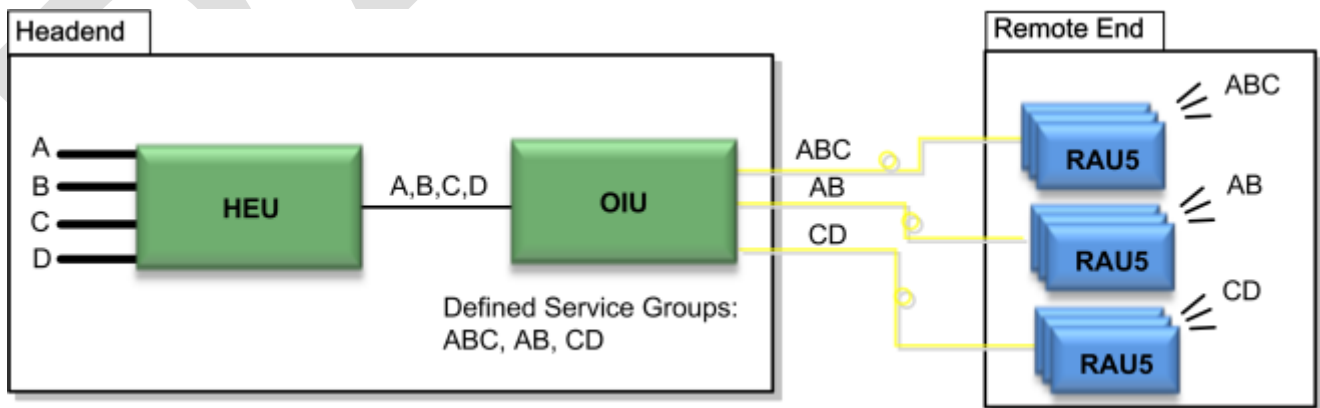


Figure 1-9. Example of Three Service Group Configuration

1.6.4 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.

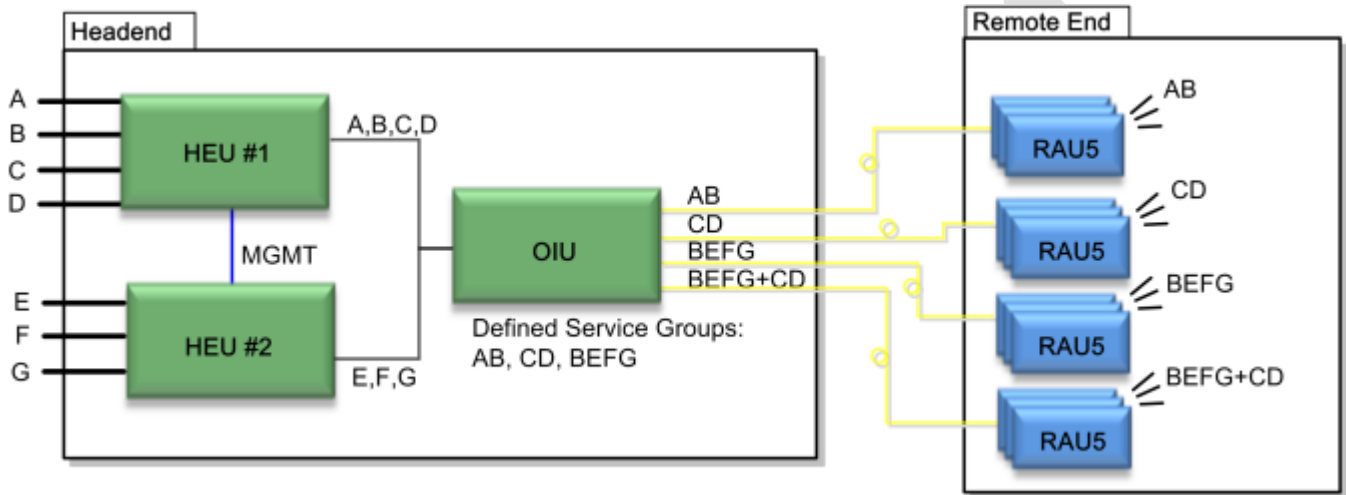


Figure 1-10. Example of Tri-Service Group Configuration with Two HEUs

1.6.5 Example of FMM-to-FRM Service Distribution

The example in Figure 1-11 illustrates the basic FMM-to-FRM connectivity for extending conditioned services from a main site where the RF sources are deployed to remote sites at a distance of up to 12.4 miles (20 km). Three service groups can be configured to transfer services over one FCM link.

On the downlink, RF signals are conditioned by the RIMs then converted by the FMM to an optical signal transporting it to the remote FRM along with the 10 GbE transport.

At the remote site, the FRM converts the received optical signal to RF signals to feed different remote units with user-defined service groups. The 10 GbE transport pipe will be forwarded to the Ethernet switches.

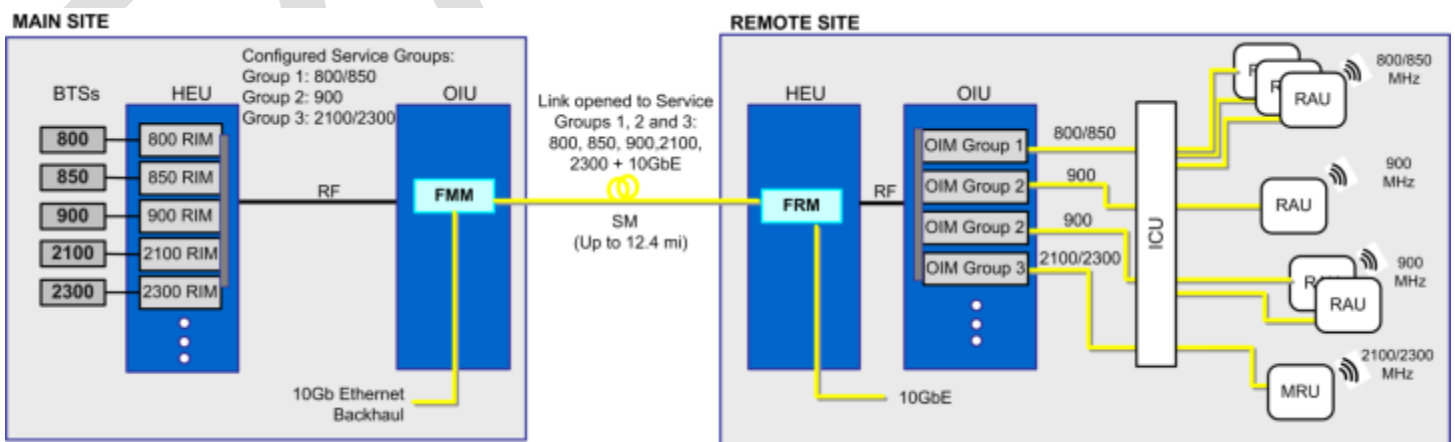


Figure 1-11. Example 1 of FMM-to-FRM Service Distribution

The example in Figure 1-12 illustrates a differentiation of service groups. In addition to all of the configured service groups being transmitted to all of the remote units at the main site, two of the service groups (2 and 3) are transported to the remote site and then to different remote units.

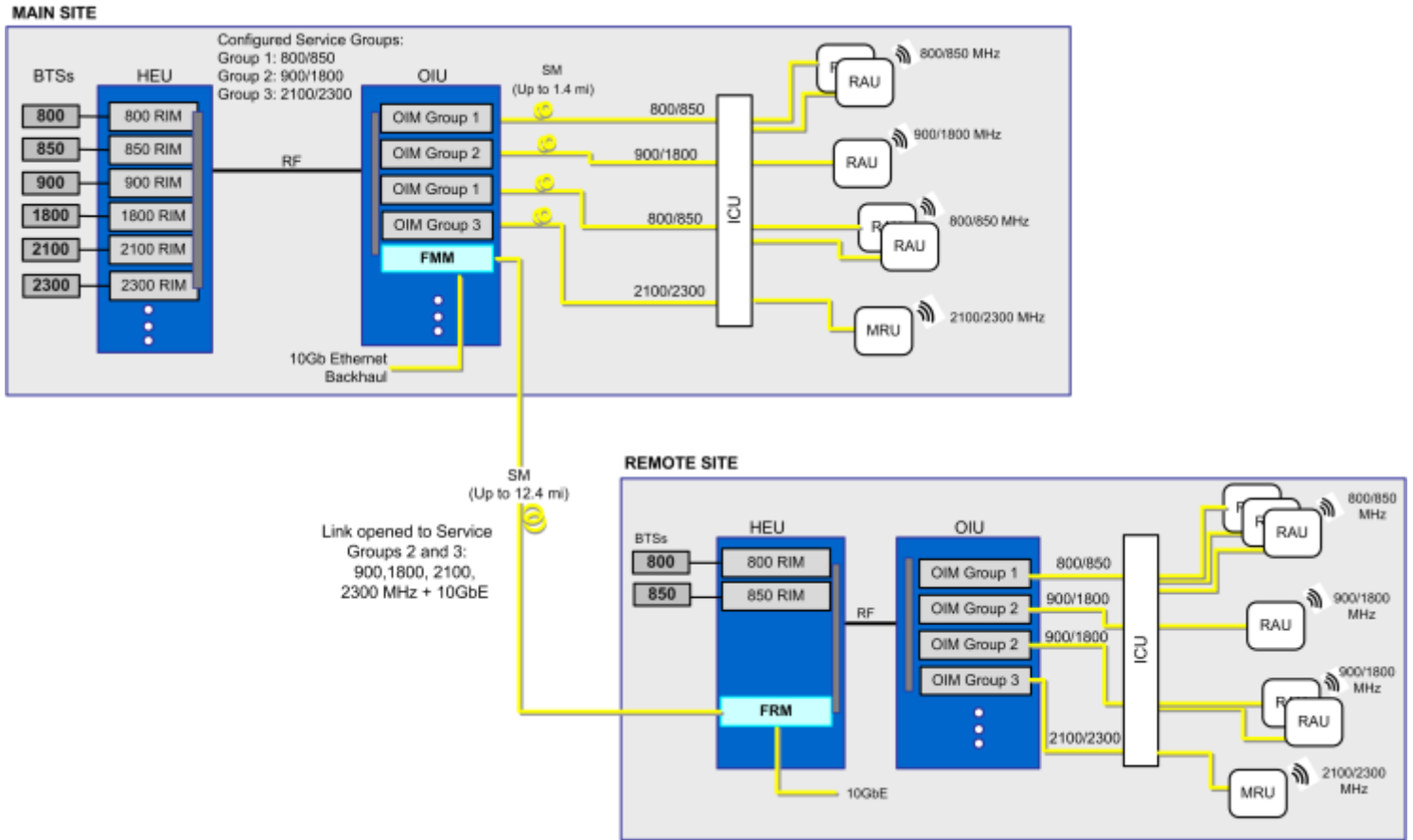


Figure 1-12. Example 2 of FMM-to-FRM Service Distribution

2 Unit Descriptions - RF Path

This chapter provides detailed descriptions of the Corning® ONE™ wireless platform 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 wireless platform 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)

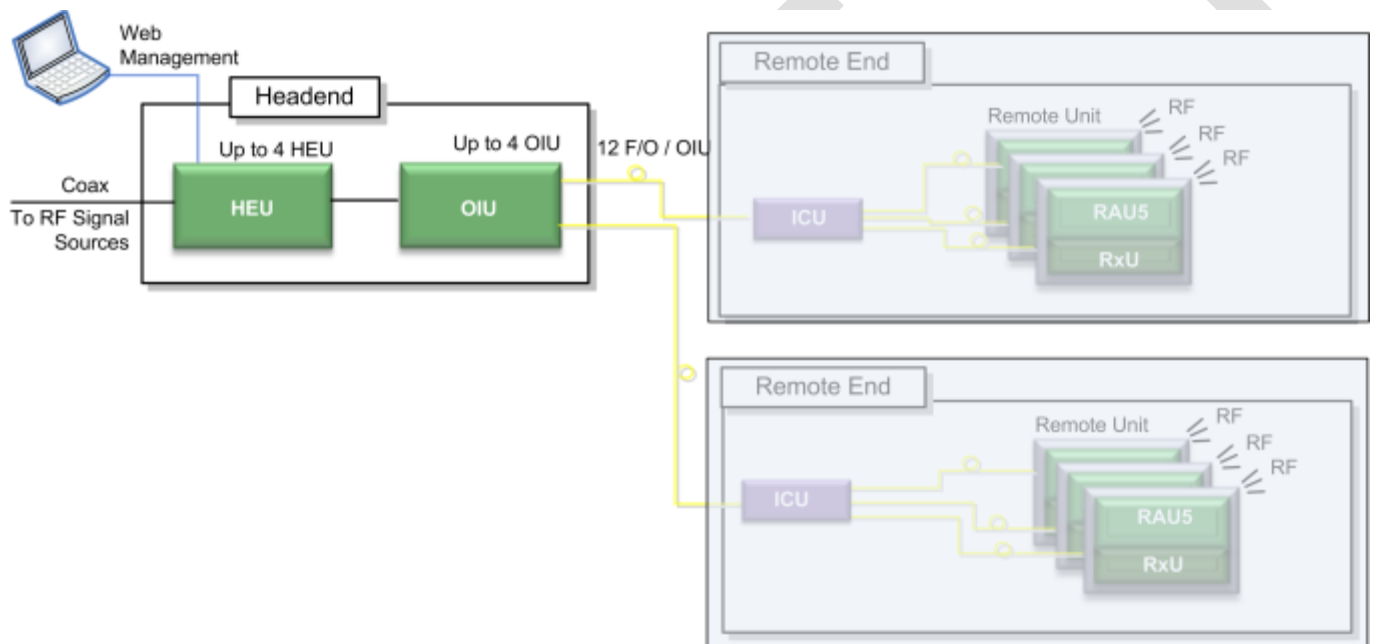


Figure 2-1. RF Path with HEU and OIU Headend Components

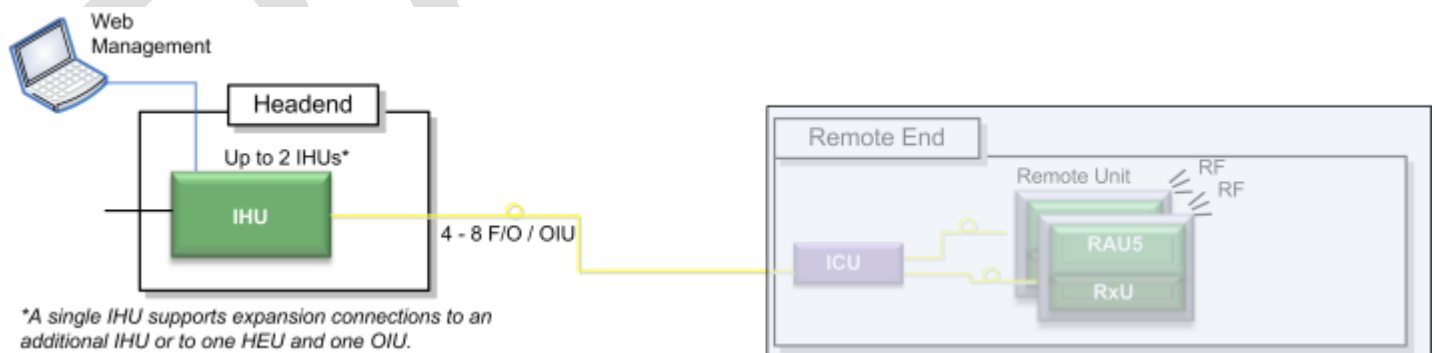


Figure 2-2. RF Path with IHU Headend Component

2.1.1 HEU

The headend unit (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 Corning® ONE™ wireless platform 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 **Error! Reference source not found.**

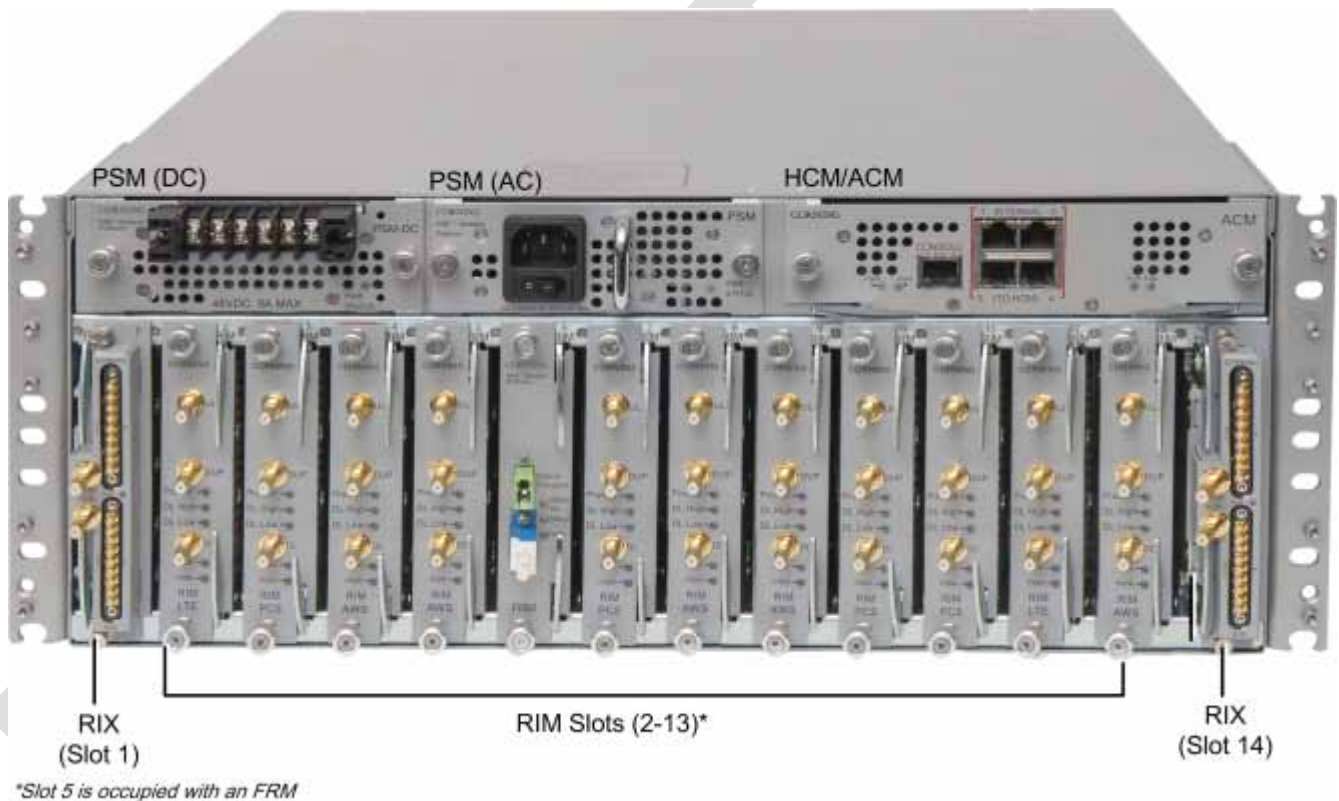


Figure 2-3. Example of HEU with Installed Modules

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. See section 2.1.1.2.
RIM	Radio interface module – RF source conditioner; provides the service specific RF interface to

Module	Description
	the RF source; Up to 12 RIMs can be hosted by the HEU; See section 2.1.1.3.
FRM	Fiber remote module - performs the optic-to-RF conversion of the cellular services at the remote end of the FMM-to-FRM link (FCM solution); interfaces to FMM via SM fiber and Ethernet fiber (for 10 GbE transport)
RIX	RF expander module; RIM to OIX interface module; See section 2.1.1.5.
ETM	Expander termination module; For configurations with one RIX an ETM is required for terminating the unused Expander slot. See section 2.1.1.6.
PSM	Power supply modules: PSM-AC: 100 - 240 V AC PSM-DC: 48 V DC <i>Note: If two are installed, both must be powered on. See section 2.1.1.7.</i>

Table 2-1. HEU Modules

2.1.1.1 HCM

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.

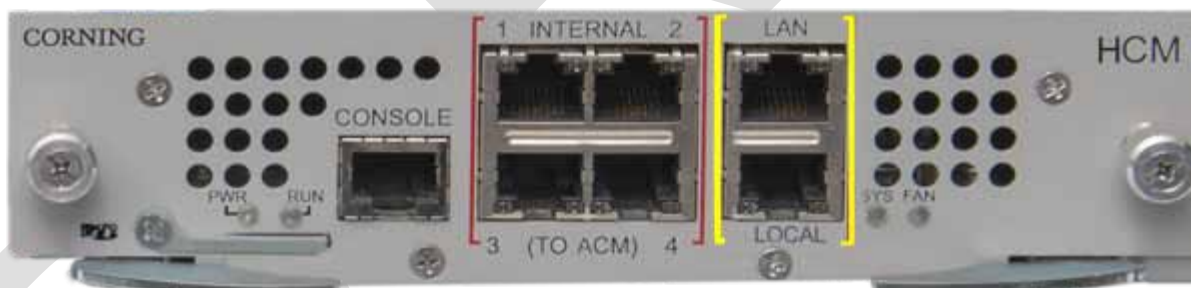


Figure 2-4. HCM Module

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

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

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

2.1.1.4 FRM

The fiber remote module installed in a RIM slot of an HEU/IHU at the remote site and performs the optic-to-RF conversion of the cellular services extended from the fiber main module (FMM) at the main site.



Figure 2-7.FRM

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

Port	Description
Optical Transport	LC APC SM fiber connector for optical transport
10 GbE	LC UPC fiber connector for 10 GbE connection

Table 2-8. FRM Ports Description

LED	Description
Optical Link	Steady green - optical link power to/from the connected remote is normal Off – no optical power from remote detected
SW Run	Blinking green –FRM software has initialized and is up and running Off – power off
PWR	On - power input detected in FRM

Table 2-9. FRM LED Descriptions

2.1.1.5 RIX

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.

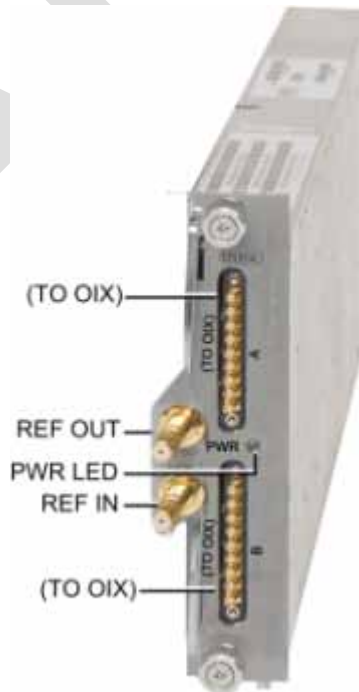


Figure 2-8. RIX Expander Module Interfaces

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 2-10. RIX Ports Description

2.1.1.6 ETM

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 2-9. Expander Termination Module

2.1.1.7 PSM

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.

PSM-AC

The PSM-AC includes an AC power connector, on/off switch and Power Status LED. See Figure 2-10.



Figure 2-10. PSM-AC Power Supply Module

PSM-DC

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.

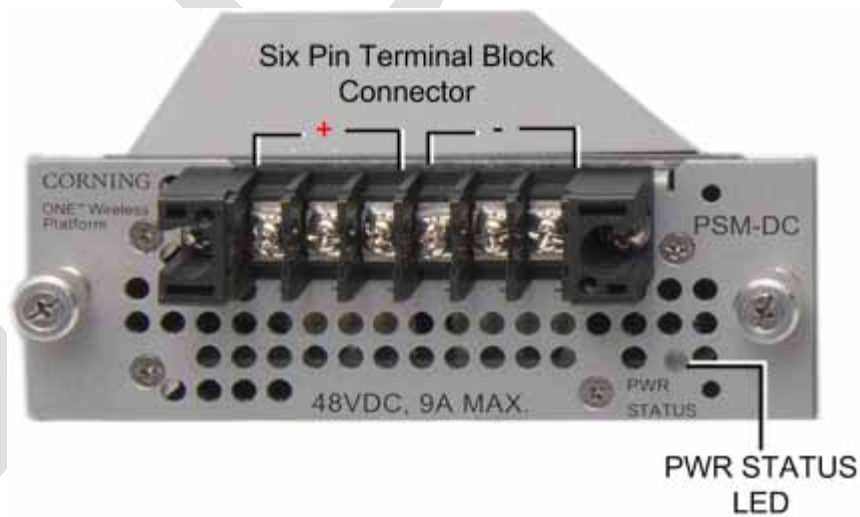
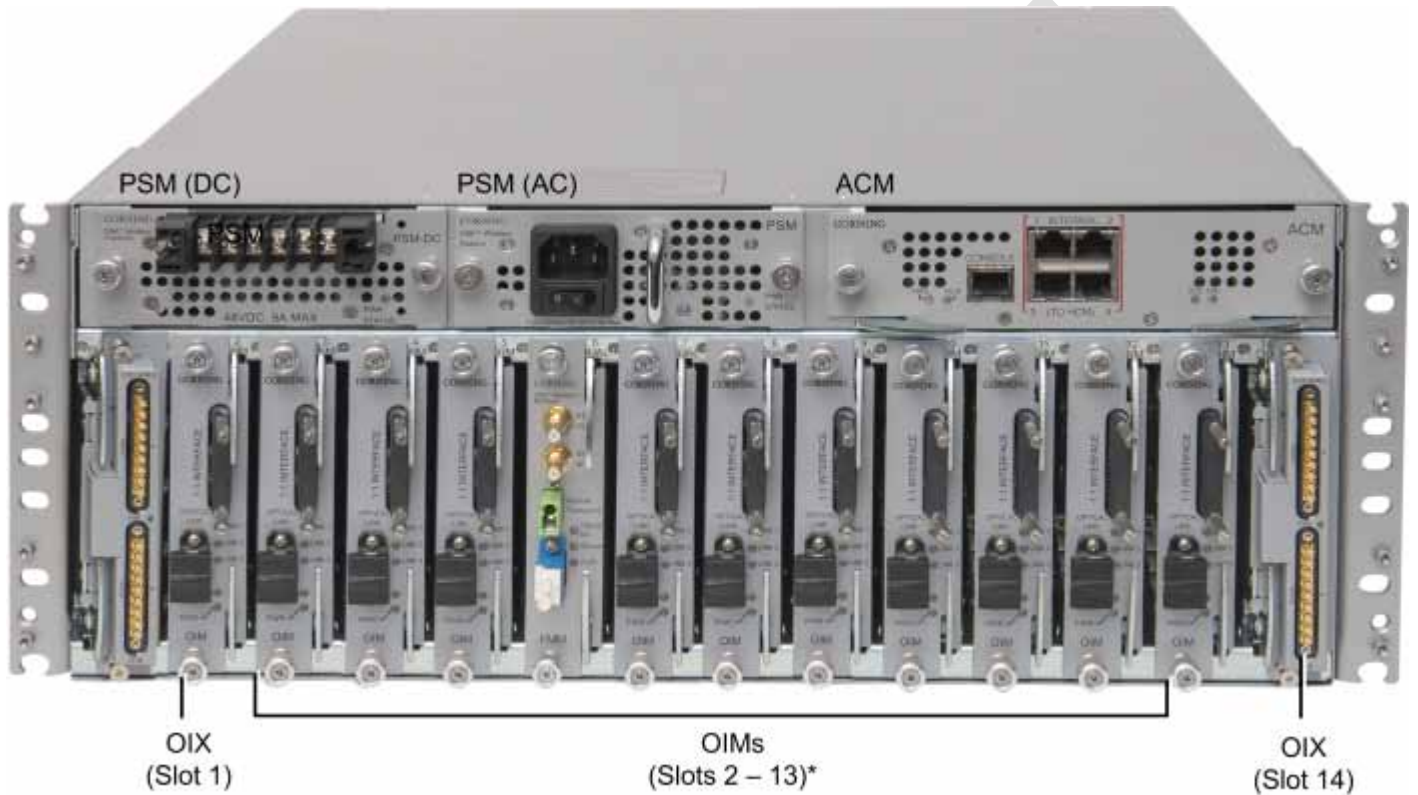


Figure 2-11. DC Power Supply Module

2.1.2 OIU

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



*Slot 5 is occupied with an FMM

Figure 2-12. OIU Front Panel with Installed Modules

OIU hosts the following modules:

Module	Description
ACM	Auxiliary control module - provides interfaces for management of domestic modules via HCM; Installed in HEUs' in configurations with more than one HEU. See section 2.1.1.2.
OIM	Optical interface module; converts the RF to three Optical links (see section 2.1.2.2)
FMM	Fiber main module; installed in an OIM slot at the main site; performs the RF-to-optic conversion of the allocated service groups and transmits the cellular services along with 10 Gb Ethernet to the remote side where the FRM is installed.
OIX	Optical interface expander; OIU to HEU interface module (see section 2.1.2.4). <i>Note: For configurations with one OIX an ETM (Expander termination module) is required for terminating the unoccupied OIX slot. See section 2.1.1.6.</i>
ETM	Expander termination module; For configurations with one RIX an ETM is required for terminating the unused Expander slot. See section 2.1.1.6.

Module	Description
PSM	Power supply module: PSM-AC:100 - 240 V AC PSM-DC: 48 V DC <i>Note: If two are installed, both must be powered on. See section 2.1.1.7.</i>

Table 2-11. HEU Modules

2.1.2.1 ACM

See section 2.1.1.2.

2.1.2.2 OIM

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.

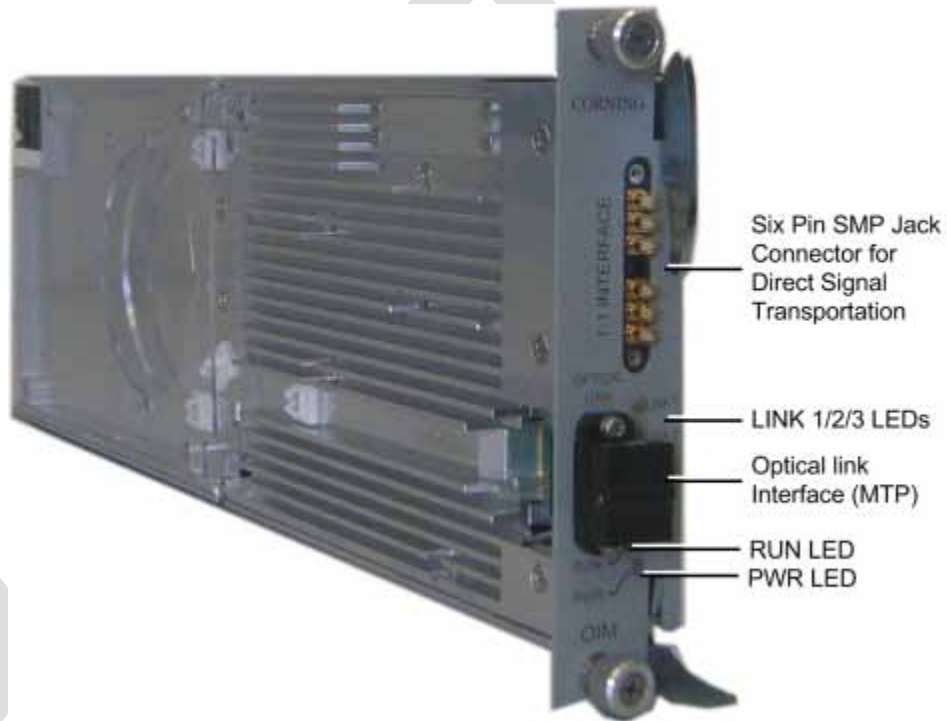


Figure 2-13. Optical Interface Module

Port	Description
OPTICAL LINK	Female MTP® Connector for optical interface connection; SMF
1:1 INTERFACE	Six pin SMP jack 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 2-12. OIM Ports Description

LED	Description
-----	-------------

LED	Description
Link 1-3	Steady Green - optical link power to/from the connected remote is normal Off - no optical power from remote detected
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 2-13. OIM LED Descriptions

2.1.2.3 FMM

The fiber main module installed in a OIM slot of an OIU/IHU at the remote site and performs the RF-to-optic conversion of the cellular services received from the BTS signal sources, extending them along with 10 Gb Ethernet to the FRM module at the remote site.

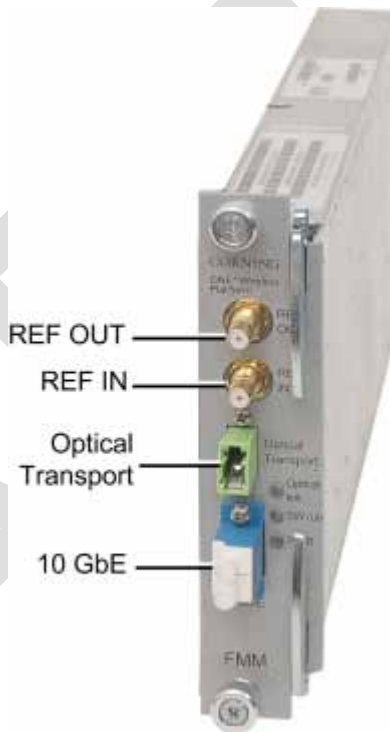


Figure 2-14.FMM

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

Port	Description
Optical Transport	LC APC SM fiber connector for optical transport
10 GbE	LC UPC fiber connector for 10 GbE connection
REF IN/OUT	QMA ports for reference clock connections between FMMs

Table 2-14. FRM Ports Description

LED	Description
Optical Link	Steady green - optical link power to/from the connected remote is normal Off – no optical power from remote detected
SW Run	Blinking green – FMM software has initialized and is up and running Off – power off
PWR	On - power input detected in FRM

Table 2-15. FRM LED Descriptions

2.1.2.4 OIX

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.

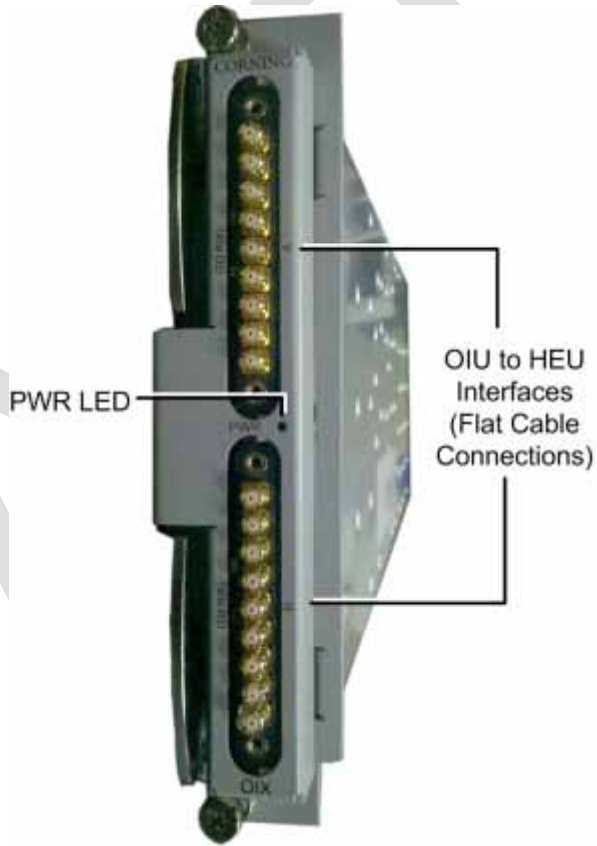


Figure 2-15. OIX Expander Module Interfaces

2.1.3 IHU

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.

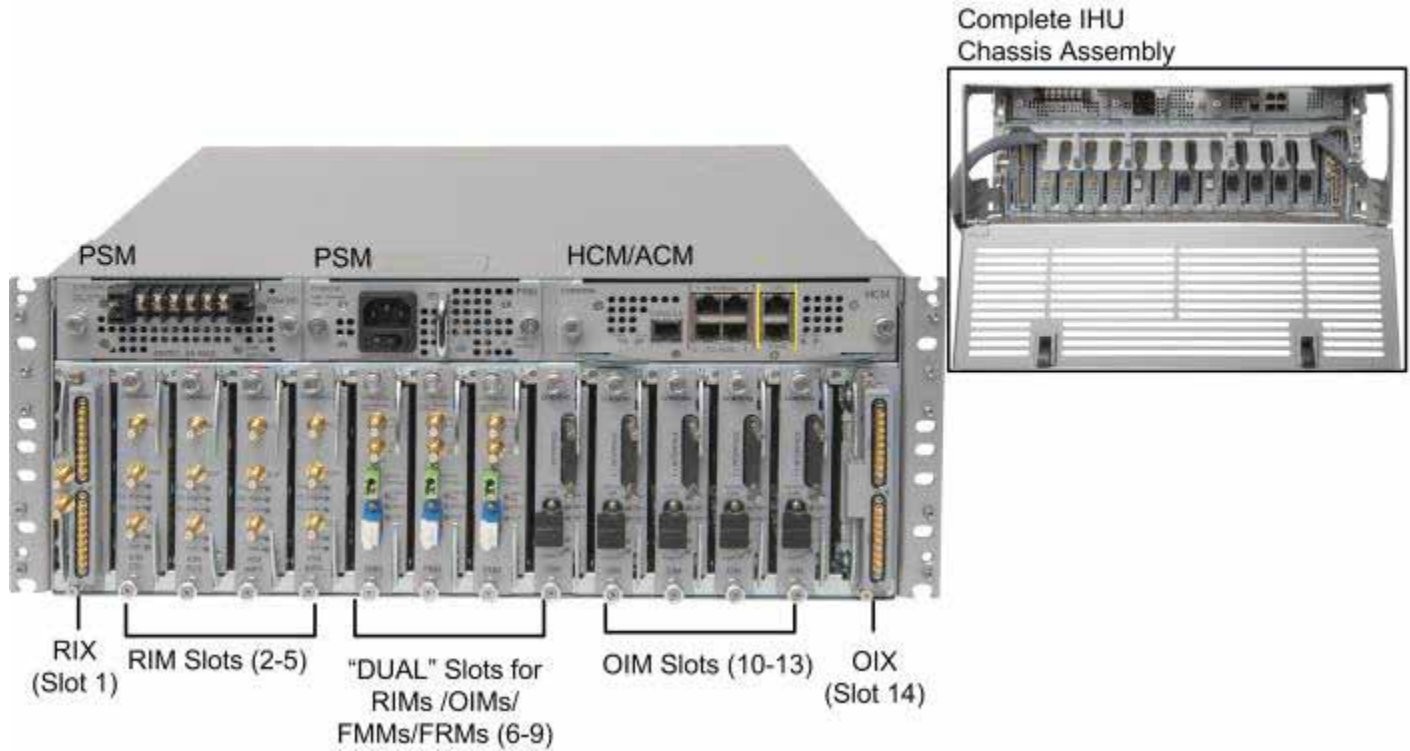


Figure 2-16. IHU Front Panel with Installed Modules

Note: The IHU also includes a pre-assembled Cable management Tray with routed ERFC cable (shown in inset) used for connecting the RIX and OIX modules.

IHU hosts the following modules:

Module	Description
HCM	Headend Control Module; overall system management module (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. See section 2.1.1.2.
RIM	Radio interface module - RF source conditioner; provides the service specific RF interface to the RF source (see Section 2.1.1.3); Up to four RIMs are supported in slots 2-5 (marked in red); Up to four additional RIMs are supported in "Dual" slots 6 – 9 (marked in white);
OIM	Optical interface module - converts the RF to three Optical links (see section 2.1.2.2). Up to four OIMs are supported in slots 10 – 13 (marked in blue); Up to four additional OIMs are supported in "DUAL" slots 6 – 9 (marked in white)
FMM	Fiber main module - installed in an OIM slot at the main site; performs the RF-to-optic conversion of the allocated service groups and transmits the cellular services along with 10 Gb Ethernet to the remote side where the FRM is installed. See Section 2.1.2.3. Up to four FMMs are supported in slots 10 – 13 (marked in blue); Up to four additional FMMs are

Module	Description
	supported in "DUAL" slots 6 – 9 (marked in white)
FRM	Fiber remote module - performs the optic-to-RF conversion of the cellular services at the remote end of the FMM-to-FRM link (FCM solution); interfaces to FMM via SM fiber and Ethernet fiber (for 10 GbE transport). See Section 2.1.1.4. Up to four FRMs are supported in slots 2-5 (marked in red); Up to four additional FRMs are supported in "Dual" slots 6 – 9 (marked in white);
RIX	Radio interface expander; RF to optic interface module (see section 2.1.1.5); One RIX is installed in the IHU - slot 1 RIX installed in IHU supports expansion connections to one additional IHU or HEU.
OIX	Optical interface expander - OIU to HEU interface module (see section 2.1.2.4). One OIX is installed in the IHU - Slot 14; OIX installed in IHU supports expansion connections to one additional IHU or OIU.
PSM	Power supply module: PSM-AC: 100 - 240 V AC PSM-DC: 48 V DC <i>Note: If two are installed, both must be powered on. See Section 2.1.1.7.</i>

Table 2-16. IHU Modules

2.2 RF Path Remote End Site Components

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

- Interconnect unit (ICU) - forwards optics along with DC to the RAU and its sub-modules.
- 5 band remote access unit (RAU5) - provides RF distribution and includes internal antennas. It can also encase data distribution module (GEM).

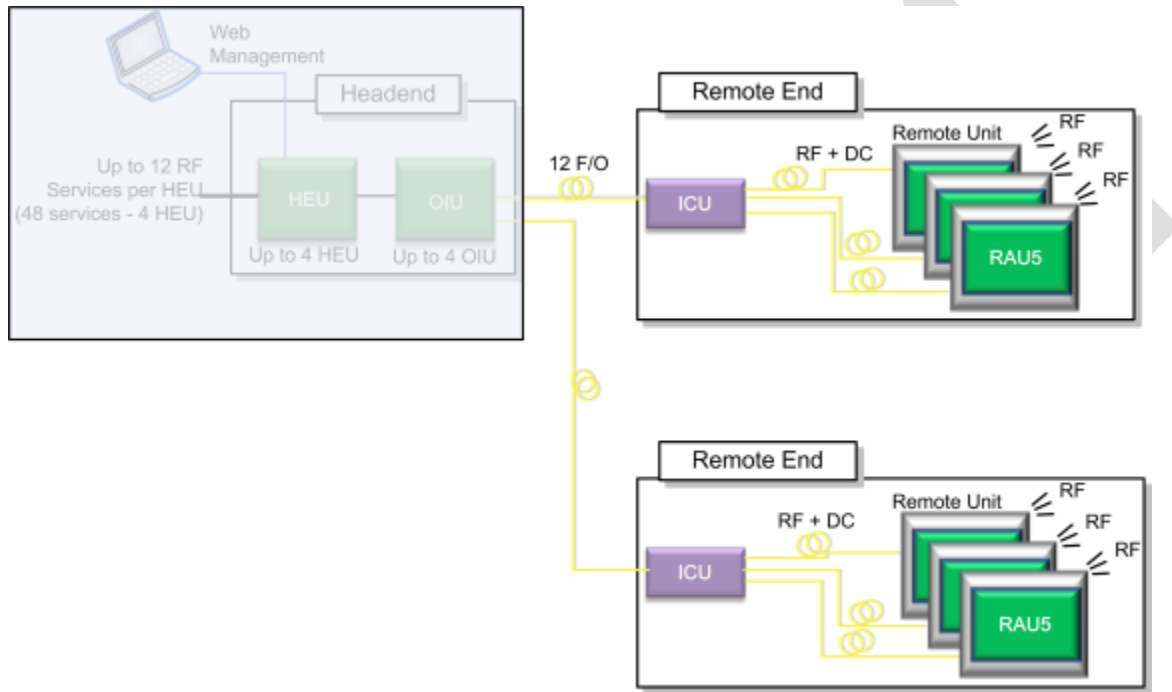


Figure 2-17. RF Path Remote-end Components

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

2.2.1 ICU

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

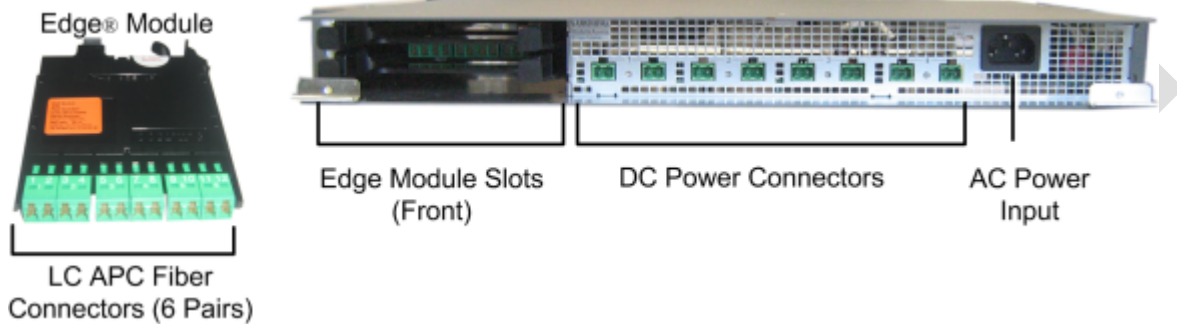


Figure 2-18. ICU Front Panel Interfaces and Modules

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 2-17. ICU Front Panel Interface Descriptions

Pretium Edge® modules and power supplies are extracted and inserted from the rear of the unit.

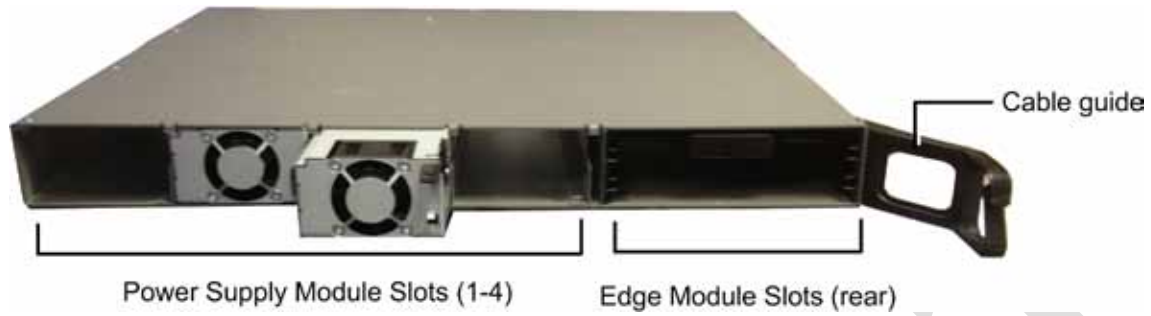


Figure 2-19. ICU Rear Panel Interfaces and PSM Modules

2.2.2 RAU

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.

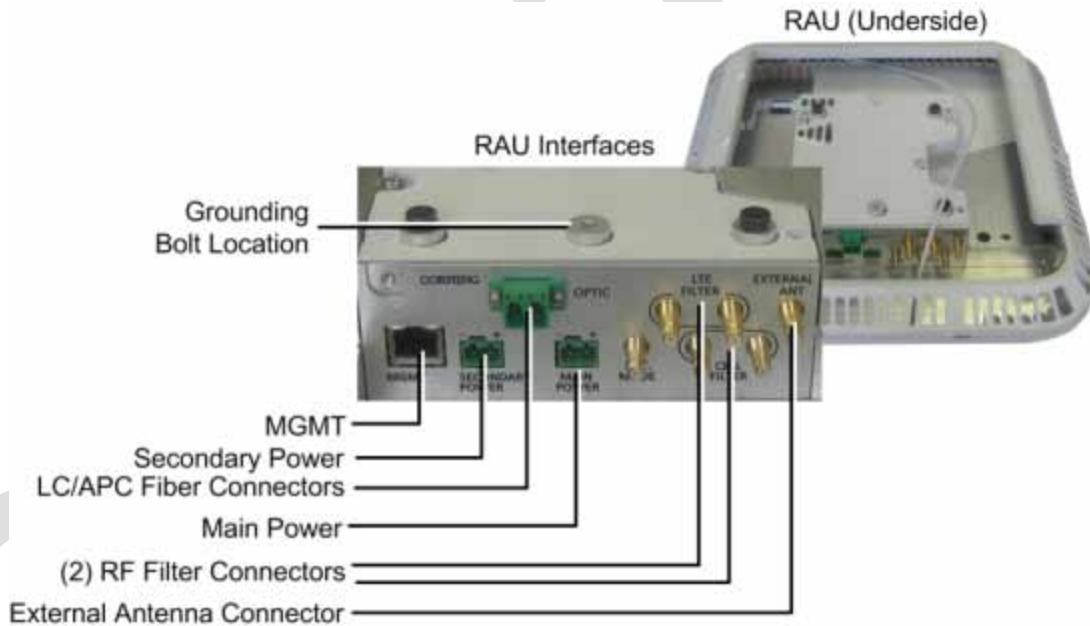


Figure 2-20. RAU Module Interfaces

Note: The RAU enclosure can host a GEM for digital coverage. See Section 3.3 for details on the GEM.

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 2-18. RAU Interfaces

The RAU status LEDs are located on the top left (see Figure 2-21).

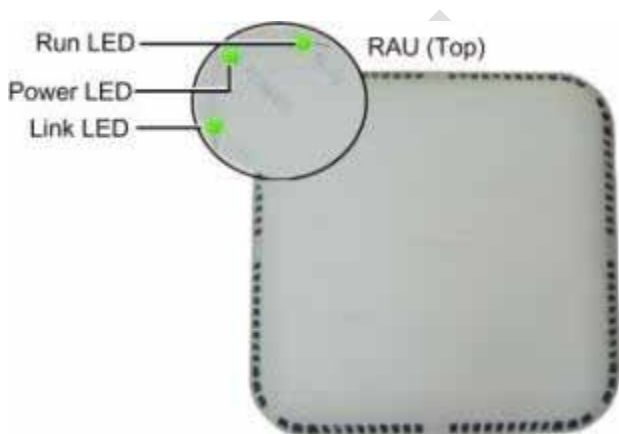


Figure 2-21. RAU LEDs

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 2-19. RAU Status LEDs Description

2.2.3 RAU5

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.

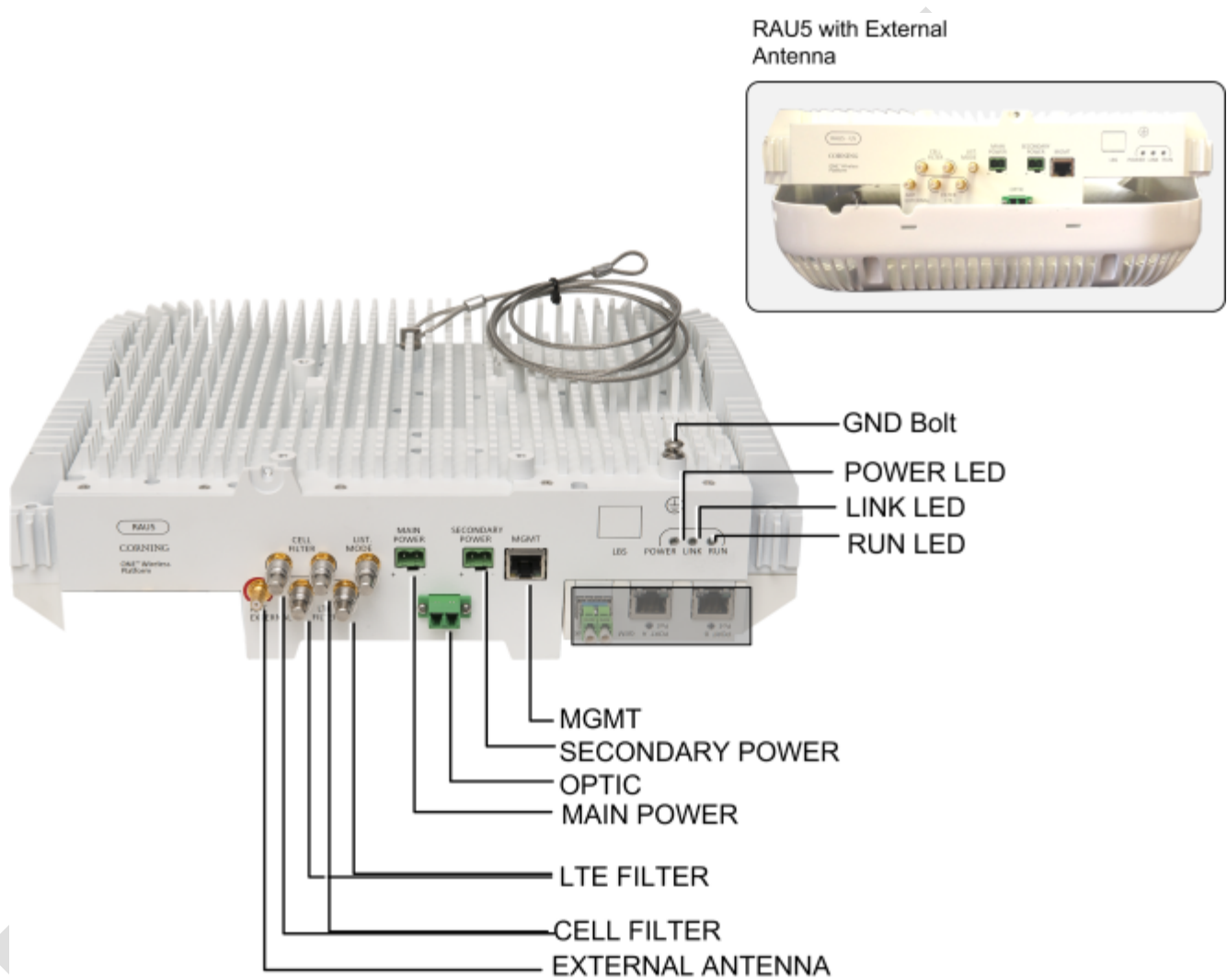


Figure 2-22. RAU5 Interfaces

Note: The RAU5 enclosure can host a GEM for digital coverage. See Section 3.3 for details on GEM.

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 1.3.2.1 for power consumption
SECONDARY POWER	Secondary DC input required for use in addition to “MAIN POWER” with PoE clients (installations including GEM module); Refer to section 1.3.2.1 for power input per PoE port and consumption
LIST. MODE	N/A
EXTERNAL ANTENNA	QMA connector for external broadband antenna connection
CELL/LTE FILTER	Two QMA RF connectors (In/Out) per external cavity filter type (i.e. LTE and CELL)
OPTIC	LC APC SM connectors for UL and DL fiber optic connections
GROUNDING BOLT	8-32 x 3/8 grounding screw used for connecting RAU5 to earth ground

Table 2-20. 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 5 is 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 software up and running Off – no power supplied to unit

Table 2-21. RAU5 LED Descriptions

3 Unit Descriptions - Ethernet Path

This chapter provides detailed descriptions of the Ethernet path components.

3.1 Ethernet Path Components

The Ethernet 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.

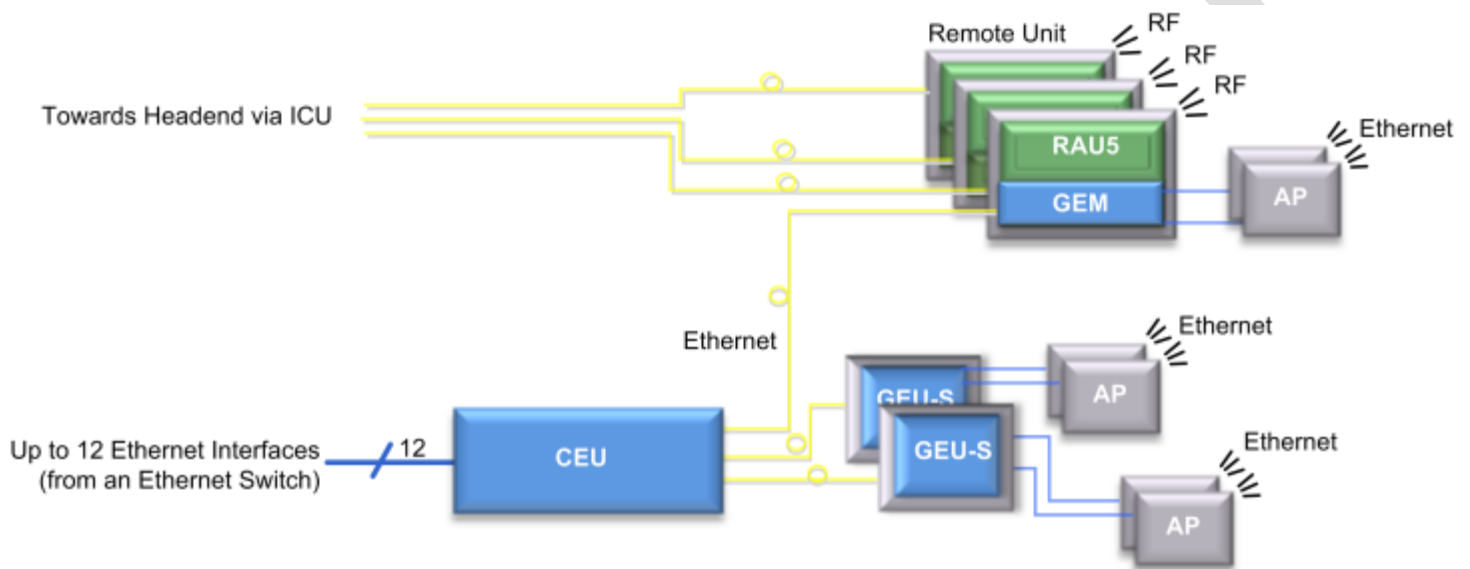


Figure 3-1. Corning® ONE™ Wireless Platform Ethernet Path Architecture

3.2 CEU

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

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.

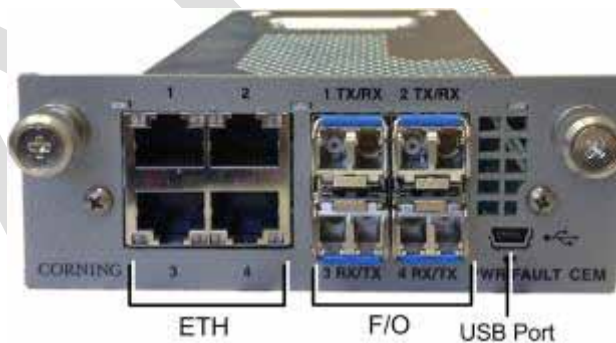


Figure 3-4. CEM Interfaces (Installed in CEU)

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

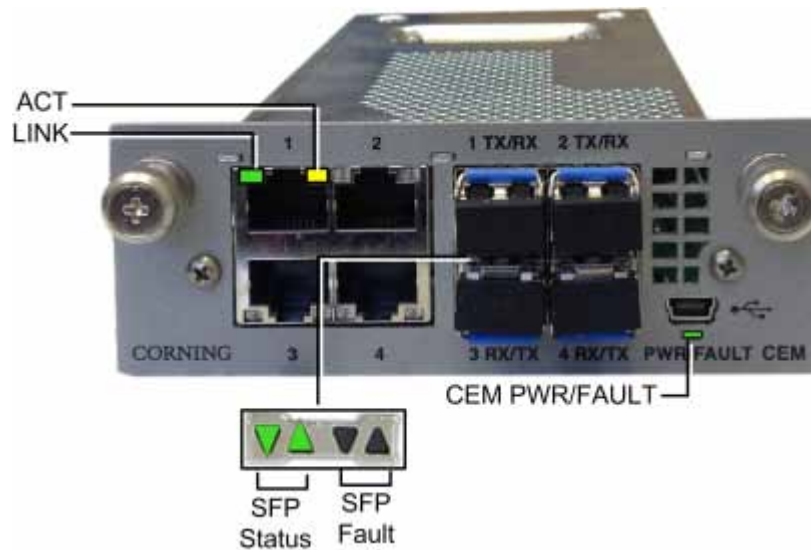


Figure 3-5. CEM LEDs

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
ACT(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

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 **Error! Reference source not found.**)
- As a standalone module (GEU-S) - (see section **Error! Reference source not found.**)



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



Figure 3-7. GEM LED Description

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

Table 3-4. GEM LED Indicator Descriptions

3.4 GEU-S

The GEU-S is a GEM Standalone unit and includes the mounting option and DC power supply for the GEM module. See **Error! Reference source not found.** 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.

4.2.1 Installation Location Requirements

- Mounting surface shall be capable of supporting the weight of the equipment.
- In order to avoid electromagnetic interference, a proper mounting location must be selected to minimize interference from electromagnetic sources such as large electrical equipment.
- Working space available for installation and maintenance for each mounting arrangement.
- Ensure unrestricted airflow.
- Ensure grounding connector is within reach of the ground wire.
- Ensure a power source is within reach of the power cord and the power source has sufficient capacity.
- Where appropriate, ensure unused RF connectors are terminated.
- Do not locate the equipment near large transformers or motors that may cause electromagnetic interference.
- Reduce signal loss in feeder cable by minimizing the length and number of RF connections.
- Ensure the equipment will be operated within the stated environment (refer to “User manual - Part 1” or unit datasheet).
- Where appropriate, confirm available of suitably terminated grade of RF and optical fiber.
- Observe handling of all cables to prevent damage.

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; Ethernet 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 **Error! Reference source not found.** 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 system components.
- Be sure to disconnect all power sources before servicing.
- Calculate the required power according to the requirements of the specific installation and then determine the configuration of the power supplies. The required DC cables will then be determined by the selected PS configuration.
- Use only UL approved power supplies
- Install external over-current protective devices for the system according to the requirements described in Section 1.3.2 in “Part 1”.
- 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 1.3.2 in “Part 1”. Also, take into account when installing fuse protections for the system 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 Corning® 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
- **IMPORTANT!** All RF link patches along the FMM-to-FRM link must be LC APC. Do not use UPC!
- 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 1.5.

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 Appendix E: Specifications

Supported Services

Technology	Frequency Range (MHz)		
	Service/Band	Uplink (UL)	Downlink (DL)
LTE	700 MHz Lower ABC	698-716	728-746
	700 MHz Upper C	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 + G 1900	1850-1915	1930-1995
WCDMA**/LTE*	AWS 2100	1710-1755	2110-2155

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

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

Notes: Supported frequency range for FMM/FRM modules: 300-2700 MHz; WCS and BRS/EBS bands are supported for the Corning® ONE™ wireless platform mid-power remote unit (MRU). For complete MRU specifications, refer to the MRU datasheet (CMA-422-AEN), which can be downloaded from the Corning partner portal.

RF Parameters per Service (RAU)

Service/Band	LTE 700 MHz		CELL850 MHz		PCS 1900 MHz		AWS 2100 MHz	
	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	
	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		-10 to 37/ 0 to 37		0 to 37		0 to 37	
Typical Antenna Gain (dBi)	0		0.5		3		2.5	
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

RF Parameters for FCM Solution

RF Parameter	
Maximum Input Power (DL) to FMM	-40 dBm (+ / - 5 dB before adjustment)
Maximum Input Power (UL) to FRM	+/- 37 dBm (+/- 7 dB before adjustment)

FCM System Typical Performance (@25 degrees system gain 0 dB)

Remote Type	Optical Link Loss (dB)	System NF (dB)
RAU4/RAU5US	10	19
RAU4/RAU5US/MRU	5	17

Optical Specifications

OIM to Remotes

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 RAU5: LC APC SM
Fiber Type	Corning® SMF-28® fiber or compatible
Wavelength	1310 ± 10 nm (@ 25° C)

FMM to FRM

Optical Output Power	< 14 dBm (over multiple wavelengths)
Optical Budget	Single hop: Low power remote: 10 dB (maximum)/12.4 mi Low/mid-power remote: 5 dB <i>Note: See ordering information for selection of appropriate 10 GbE SFP+ corresponding to actual optical budget. Optical attenuator is included for 10 GbE for short distance links. Second hop (future option): 5 dB/ 1.2 2 miles (for low-power solutions)</i>
Maximum Optical Back Reflection per Mated-pair Connectors	- 60 dB
Optical Connector	LC/APC SMF (Green) Simplex (for FMM-to-FRM link) LC/UPC SMF (Blue) Duplex (for connection to customer's 10 GbE SFP+)
Fiber Type	Corning® SMF-28® or equivalent
Optical Return Loss (ORL)	ORL should be greater than 60 dB for all connections between the FMM and FRM. This requires use of angled polished connectors (APC) exclusively
Dispersion Compensation	Links in excess of 7 km require the insertion of a dispersion compensating fiber (DCF). See ordering information for selection of appropriate DCF module

Environmental Specifications

Operating Temperature	0°C to +50°C (32°F to 122°F)
Storage Temperature	-20°C to 85°C (-4°F to 185°F)

Standards and Approvals

Laser Safety	FDA/CE 21 CFR 1040.10 and 1040.11 except for deviations pursuant to laser notice no. 50 and IEC 60825-1 Class 1M (applicable to FMM/FRM)
EMC	CE EN 301 489, EN55022, EN 61000 FCC 47 CFR Part 15, 22, 24, 27
Safety	UL 60950 IEC 60825-1:2007 IEC 60825-2:2010 CAN/CSA-C22.2 No.60950-1-03 Fire Safety UL 2043 (applicable for access unit only)

RF Path: Coverage Component Specifications

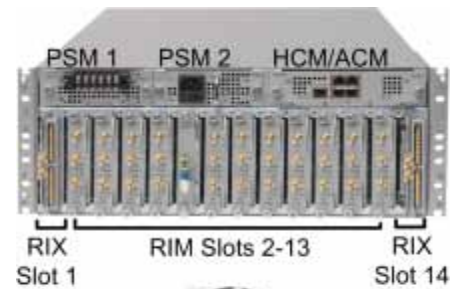
Headend Unit (HEU)

HEU hosts the following modules:

1. RIM - Radio Interface Module; RF source conditioner. Up to 12 RIMs can be hosted by the HEU.
2. 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.

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



RIM	Interfaces: No. of supported bands:	Three QMA RF ports; UL, DL and Duplex Single band
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RIX	Interfaces: No. of supported OIU interfaces:	Two 9-pin connectors (one per OIX) Two QMA ports for reference clock connections between RIX modules Two OIUs
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ETM	ETM (Expander Termination Module) - used for terminating unused Expander slot
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HCM	Interfaces: Remote Management: Local Management: Local Configuration: System LEDs:	To four ACM RJ-45 INTERNAL ports One RJ-45 LAN port One RJ-45 LOCAL port One CONSOLE port PWR, RUN, SYS, FAN
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ACM	Interfaces:	Four RJ-45 INTERNAL ports One RJ-45 CONSOLE port System LEDs – PWR, RUN, SYS, FAN
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RF Path: Coverage Component Specifications (continued)

Headend Unit (HEU) (continued)

PSM-AC	Power Input:	100-220 V AC	
	Power Rating:	300 W	
	HEU Power Consumption (Full Chassis):	200 W	
	ON/Off Switch		
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)		

RF Path: Coverage Component Specifications (continued)

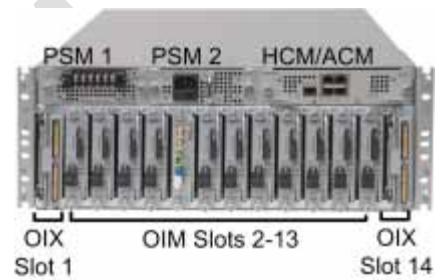
Optical Interface Unit (OIU)


OIU hosts the following modules:

1. OIM - Optical Interface Modules; converts the RF to three optical links
2. 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.

3. Fiber main module (FMM); See FCM specifications for description
4. ACM - Auxiliary Control Module; manages unit domestic modules, "Slave" controller to the HCM
5. PSM - Power Supply Module; AC or DC power supply




OIM	Interfaces:	Optical Interface: One Female MTP® Connector Six pin SMP jack RF connector for 1:1 direct signal transportation, three UL and three for DL	
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OIX	RF interfaces:	Two 9-pin connectors	
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ETM	(See ETM in HEU section for description)		
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ACM	(See ACM in HEU section for interfaces)		
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PSM-AC	(See PSM-AC in HEU section for interfaces) Power Consumption (Full Chassis): 300 W		
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PSM-DC	(See PSM-DC in HEU section for interfaces) Power Consumption (Full Chassis): 300 W		
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RF Path: Coverage Component Specifications (continued)

Optical Interface Unit (OIU) (continued)

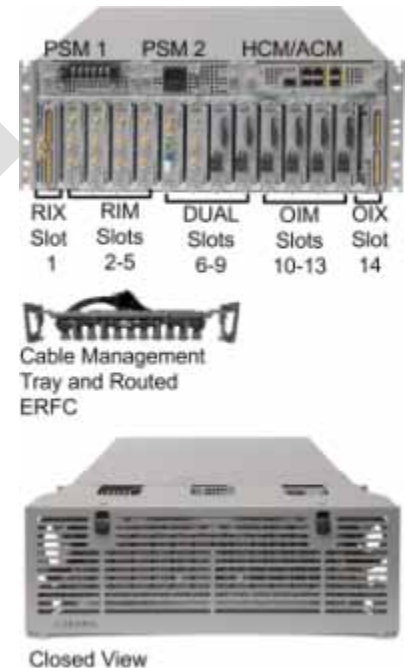
Physical Characteristics (Chassis + Modules)	Mounting:	Rack-mount – 19 in and 4U	
	Dimensions (H x W x D):	Chassis:	7 x 17.3 x 18.95 in (177.8 x 440 x 481.7 mm)
		Cable Management Tray:	6.96 x 20.02 x 4.35 in (176.9 x 508.6 x 110.6 mm)
	Weight:	Chassis :	37 lbs (16.8 kg)
		Per OIM:	1.5 lbs (0.7 kg)
Per 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; IHU Max Power Consumption (Full Chassis): 300 W
6. ERFC – RF interface cable, 9-PIN; L= 34 in (routed in provided Cable Management Tray)

Note: Refer to HEU specifications for descriptions of RIX, RIM, HCM /ACM and PSM modules and refer to OIU specifications for descriptions of OIM and OIX modules







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:
		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)	

RF Path: Coverage Component Specifications (continued)

Interconnect Unit (ICU)

ICU hosts the following modules:


1. PSM-I; Power Supply Module, up to four PSM-I modules can be installed.
2. 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: 1.74 x 17 x 19.2 in (H x W x D): (44.4 x 431.8 x 11.96 mm) Weight: 5.5 lbs (2.5 kg) – without PSM	

Remote Access Unit (RAU)

RAU hosts the following additional module:

GEM; Giga bit Ethernet Module – upgrade module for the RAU. One module per RAU

Supported Services	SISO: CELL, PCS, AWS, 700 LTE	
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)	

RF Path: Coverage Component Specifications (continued)

Remote Access Unit (RAU) (continued)

Interface Connections (continued)	One RJ-45 MGMT (local) connection 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 + GEM: 37 V; 39 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)
Environment	Ambient Temperature:	Wall-mount installations: 45° C (113° F) Ceiling-mount installations: 50° C (122° F)

5 Band Remote Access Unit (RAU5)

RAU5 hosts the following additional module:

GEM; Giga bit Ethernet Module – upgrade module for the RAU5. One module per RAU5

Supported Services SISO: CELL/ESMR, PCS, AWS, 700LTE

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



RF Path: Coverage Component Specifications (continued)

5 Band Remote Access Unit (RAU5) (continued)

Interface Connections (continued)	One Broadband External antenna QMA connector (connected antenna must have a return loss of 12 dB) One RJ-45 MGMT (local) connection GEM module Interface – power and digital
Antenna	Omni Directional (15° down from horizon)
Power Consumption	For Main Power Input: Input Range: 37-57 V DC RAU: 44.5 V; 50 W RAU + GEM: 44.5 V; 52 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 external antenna: 3.6* x 12.9 x 10.4 in (90 x 327 x 264 mm) <i>*3.6 in (90 mm) without standard mounting bracket; 4.4 in (111 mm) with standard mounting bracket</i> With external antenna and skirt: 6.1 x 5.3 x 5.3 in (154 x 334 x 334 mm) Weight: RAU5 only (no external antenna or plug-in modules): 10 lbs (4.5 kg) External Antenna: 3.7 lbs (1.7 kg)
Environment	Ambient Temperature: Wall-mount installations: 45° C (113° F) Ceiling-mount installations: 50° C (122° F)

RF Path: Coverage Component Specifications (continued)

Cavity Duplexer for LTE 700 MHz

LTE 700 MHz external cavity duplexer for RAU 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	0.5 W CW Max.
In/Out Impedance	50 Ohms Nominal
Operating Temperature	-20° C to +85° C
Environmental	RoHS compliant

RF Path: Coverage Component Specifications (continued)

Cavity Duplexer for LTE 700 MHz (continued)

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 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	0.5 W 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)

Fiber Connectivity Module (FCM) Specifications

Fiber Main Module (FMM)

Interfaces	Two QMA ports for reference clock connections between FMMs One LC APC SM fiber connector for optical transport One LC UPC fiber connector for 10 GbE connection
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Weight	2.42 lbs (1.1 kg)
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Fiber Remote Module (FRM)

Interfaces	One LC APC SM fiber connector for optical transport One LC UPC fiber connector for 10 GbE connection
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Weight	2.42 lbs (1.1 kg)
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Ethernet Coverage Component Specifications

Central Ethernet Unit (CEU)

CEU hosts the following module:

Three central Ethernet module s (CEMs); 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
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Throughput	Eight Gbps forwarding per CEM
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Power	Input: 110-240 V AC, 50-60 Hz power Power Consumption (fully occupied): 50 W
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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)

Ethernet Coverage Component Specifications (continued)

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	 1U
		 2U
		 3U

6 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-2-11-1-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-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
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

FCM Solution Modules

Part Number	Description
FCM	One FMM and one FRM supporting distances up to 4.3 miles; 47-in single QMA-to-QMA pilot transport cable (P/N: PCKC47*)
FCM0408	One FMM and one FRM; dispersion compensation fiber cassette supporting distances of 4.3-8 miles and rack-mounting bracket; 47-in single QMA-to-QMA pilot transport cable (P/N: PCKC47*)
FCM0811	One FMM and one FRM; dispersion compensation fiber cassette supporting distances of 8-11 miles and rack-mounting bracket; 47-in single QMA-to-QMA pilot transport cable (P/N: PCKC47*)
FCM1112	One FMM and one FRM; dispersion compensation fiber cassette supporting distances of 11-12.4 miles and rack-mounting bracket; 47-in single QMA-to-QMA pilot transport cable (P/N: PCKC47*)

*Additional lengths can be ordered – see ordering information for PCKC.

SFP+ Modules

Note: SFP+ modules are required for transporting the 10 GbE through the FMM-to-FRM link. One SFP+ module for the main switch (FMM side) and another for the remote switch (FRM side).

FMM-to-FRM Loss Budget	Comments	Vendor	PN	Product description
Up to 10 dB	For FRM Side	Cisco	DWDM-SFP10G-30.33	10GBase-DWDM 1530.33 nm SFP10G
Up to 10 dB	For FMM Side	Cisco	DWDM-SFP10G-50.12	10GBase-DWDM 1550.12 nm SFP10G
Up to 4 dB	For FRM Side	Eoptolink	EOLP-1696-10N	10GBase-LR SFP+ CWDM 1530 nm
Up to 4 dB	For FMM Side	Eoptolink	EOLP-1696-10O	10GBase-LR SFP+ CWDM 1550 nm
Up to 8 dB	For FRM Side	Eoptolink	EOLP-1696-14NN	10GBase-ER SFP+ CWDM 1530 nm
Up to 8 dB	For FMM Side	Eoptolink	EOLP-1696-14ON	10GBase-ER SFP+ CWDM 1550 nm
Up to 10 dB	For FRM Side	Eoptolink	EOLP-1696-23NN	10GBase-ZR SFP+ CWDM 1530 nm
Up to 10 dB	For FMM Side	Eoptolink	EOLP-1696-23ON	10GBase-ZR SFP+ CWDM 1550 nm

Ethernet 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
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
FCM Accessories:	
AK-BR-DCF	19 in/1U rack-mount enclosure; Supports two AK-DCFxxxx cassettes
AK-DCF0408	Dispersion compensating fiber; DSCM for compensation of 6.2 miles (10 km) SM fiber, LC/APC connectors, standard box
AK-DCF0811	Dispersion compensating fiber; DSCM for compensation of 9.3 miles (15 km) SM fiber, LC/APC connectors, standard box
AK-DCF1112	Dispersion compensating fiber; DSCM for compensation of 12.4 miles (20 km) SM fiber, LC/APC connectors, standard box
ERFC:	
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:	
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

- | | | | |
|---|--|--|--|
| <p> 1
Connector.
13 = MTP® Connector, SM Elite
18 = LC/APC Duplex</p> | <p> 4
Cu conductor count.
0 = 0 conductors
4 = 4 conductors</p> | <p> 7
Fiber type.
U = ZBL Fiber
G = XB fiber</p> | <p> 10
Select cable length.
004 – 999 ft.</p> |
| <p> 2
Connector.
13 = MTP® Connector, SM Elite
18 = LC/APC Duplex</p> | <p> 5
Cu connectors.
Cu = With connectors
N = No connectors</p> | <p> 8
Jacket type.
8 = Plenum Indoor</p> | <p> 11
Pulling grip type.
P = One-sided pulling grip</p> |
| <p> 3
Select cu wire gauge
0 = No Cu Wire
F = 12AWG
G = 14AWG
H = 16AWG
K = 20AWG</p> | <p> 6
Fiber count.
06 = 6 fibers
24 = 24 fibers
48 = 48 fibers
72 = 72 fibers
96 = 96 fibers
E4 = 144 fibers</p> | <p> 9
Armored/non-armored
20 = Non-armored</p> | <p>12
Kit type
K = 2 Strain relief trunk holders</p> |

Corning Optical Communications Wireless. • 13221 Woodland Park Rd, Suite 400 • Herndon, VA 20171 USA

866-436-9266 • FAX: 703-848-0280 • Tech Support Hotline: 410-553-2086 or 800-787-1266 • www.corning.com/opcomm

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