FibeAir® 1500HP

Product Description

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Version 10.0

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1 Introduction

Widespread popular demand for wireless connectivity has greatly increased in recent years as public and private sectors strive to meet the diverse and growing demand for capacity-rich applications.

In the wireless communication industry, radios capable of longer distances, excellent performance, growth-on-demand, and lower cost of ownership constitute the optimal network infrastructure building blocks.

The advantages of wireless networks, including minimal operational costs, faster and easier installation, efficient capacity upgrade, and high-quality data delivery, have made them the medium of choice for both operators and businesses alike.

With those demands in mind Ceragon introduces FibeAir 1500HP, the latest in the FibeAir family of products.

FibeAir 1500HP is a high transmit power RFU (Radio Frequency Unit). It is designed to enable high quality wireless communication in the most cost-effective way, including an ultra-high power transmitter that reaches longer distances and uses smaller antennas.

Designed for maximum flexibility and transmission efficiency, FibeAir 1500HP includes two receivers and one transmitter in a single transceiver unit. This design gives it a built-in Diversity capability using an innovative digital multi-mode IF combiner and increases the reliability of the link. If a hardware failure occurs in a 1+1 Hot StandBy or N+1 configuration with Space Diversity, the Diversity functionality is not affected.

FibeAir 1500HP can be installed in a Split Mount or All-Indoor configuration. In the Split Mount installation, the RFU is installed near the antenna, with a single cable connecting between the RFU and IDU. In the All-Indoor configuration, the RFU is installed in the rack with the IDU and a flexible waveguide connects the RFU and antenna.

Thus, FibeAir 1500HP, with its built-in Diversity functionality and installation type flexibility, presents a comprehensive, efficient, and budget-saving wireless network building block that equips operators with a true competitive edge.

1.1 Document Highlights

- Split Mount Configuration – Section 5, Split Mount
- Main Features – Section 3.2 Main Features of the 1500HP RFU
- All-Indoor Configuration – Section 6, All-Indoor
- All-Indoor Compact (Horizontal) Configuration – Section 6.7, All-Indoor Compact (Horizontal)

2 References and Standards

EN 300 234: “Transmission and Multiplexing (TM); Digital Radio Relay Systems (DRRS); High capacity DRRS carrying 1xSTM-1 / OC-3 signals and operating in frequency bands with about 30 MHz channel spacing and alternated arrangements”.

EN 300 385: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Electro Magnetic Compatibility (EMC) standard for fixed radio links and ancillary equipment".

ETS 300 019: "Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment".

ETS 300 132-2: "Equipment Engineering (EE); Power supply interface at the input to telecommunications equipment; Part 2: Operated by direct current (dc)".

ITU-R Recommendation F.1191: "Bandwidths and unwanted emissions of digital radio-relay systems".

ITU-R Rec. F.383-6: "Radio-frequency channel arrangements for high capacity radio-relay systems operating in the lower 6 GHz band.

ITU-R Rec. F.384-7: “Radio-frequency channel arrangements for medium and high capacity analogue or digital radio-relay systems operating in the upper 6HGHz band

FCC 101.147 [7] “Radio-frequency channel arrangements for radio-relay systems operating in upper 6HGHz band

ITU-R Rec. F.385-6: “Radio-frequency channel arrangements for radio-relay systems operating in the 7 GHz band

ITU-R Rec. F.386-6: “Radio-frequency channel arrangements for medium and high capacity analogue or digital radio-relay systems operating in the 8 GHz band

ITU-R Rec. F.387-8: “Radio-frequency channel arrangements for radio-relay systems operating in the 11 GHz band

ITU-T Recommendation G.703 (1991): "Physical/electrical characteristics of hierarchical digital interfaces".

ITU-T Recommendation G.707 (1996): "Network node interface for the synchronous digital hierarchy (SDH / SONET)".

CEPT/ERC 14-01E “Radio-frequency channel arrangements for radio-relay systems operating in the 6LGHz band”.

FCC 101.147 [6] “Radio-frequency channel arrangements for radio-relay systems operating in the 11GHz band”.

3 Product Overview

Ceragon's FibeAir 1500HP supports multiple capacities, frequencies, modulation schemes, and configurations for various network requirements. The RF transceiver units operate in the frequency range of 6-11 GHz.

FibeAir 1500HP capacities can be upgraded from 10 Mbps up to more than 2 Gbps and from one carrier up to 10 carriers connected to one antenna.

For long distance links and backbone requirements, FibeAir 1500HP offers Space Diversity functionality. Each transceiver can contain two receivers and one transmitter, which enable built-in Diversity capability. Built in Diversity in each transceiver increases the reliability of the link. In a 1+1/2+2 Hot StandBy or N+0/ N+1 configuration with Space Diversity, if a hardware failure occurs, the Diversity is not affected.

FibeAir 1500HP can be installed in a Split Mount configuration or in several All-Indoor options as described in section. For more information see, section 5, *Split Mount* and section 6, *All-Indoor*.

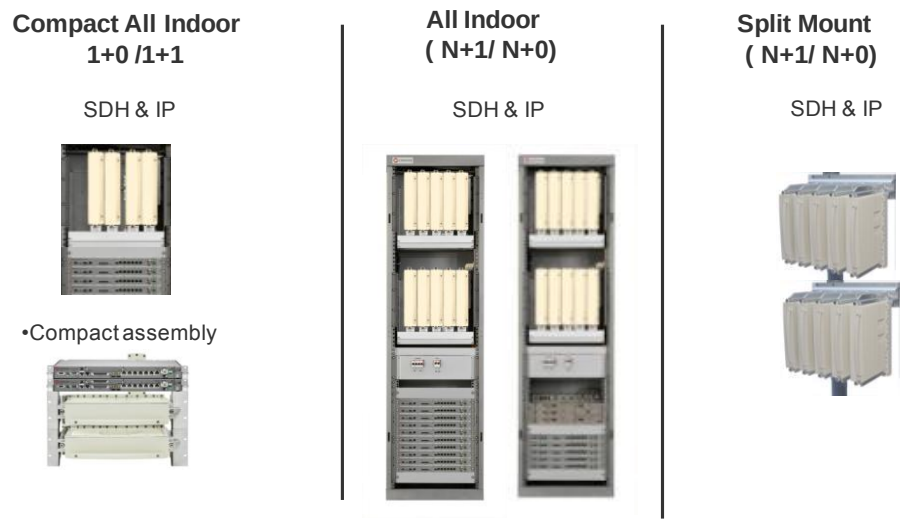


Figure 1 - FibeAir 1500HP Configurations

3.1 The Complete Solution

The FibeAir 1500HP RFU works together with FibeAir 1500R, IP-10, 3200T, 1500P, and IP-MAX ². These IDUs are Ceragon's modular network connectivity and are designed to meet growing market demands for increased spectral-efficient systems.

FibeAir 1500HP RFUs work together with the different FibeAir IDUs to provide a powerful, reliable, and comprehensive solution for a variety of wireless network scenarios and requirements. The system was designed to support network expansion of from one to ten radio carriers.

The following IDUs are compatible with 1500HP RFUs:

- FibeAir IP-10 and IP-MAX² are Ceragon's comprehensive Ethernet solutions that offer Fast/Gigabit Ethernet and TDM services for wireless transmission with fiber-like quality.
- FibeAir 3200T is a high capacity N+1/ N+0 trunk radio system that was designed to support multiple STM-1 / OC-3 carriers, for various network requirements.
- FibeAir 1500R is a high capacity N+N/ N+0 trunk radio system that was designed to support multiple STM-1 / OC-3 carriers, for various network requirements

3.1.1 RFU Part Numbers

The following table presents the different RFU options and in which configurations they are used.

Table 1 RFU Part Numbers

Diversity/Non-Diversity	Split Mount	All Indoor
Space Diversity IFC (2Rx) (6, 7,8 ,11GHz)	15HP-RFU-f	15HP-RFU-f
None Space Diversity (1Rx) (6, 7,8GHz)	15HPS-1R-RFU-f	15HPA-1R-RFU-f
None Space Diversity (1Rx) (11GHz)	15HPS-1R-RFU-11w	15HPA-1R-RFU-11w

3.1.2 OCB Part Numbers

The following table presents the different RFU options and in which configurations they are used.

Table 2 OCB Part Numbers

Diversity/Non-Diversity	Split Mount
Space Diversity IFC (2Rx) (6, 7,8 ,11GHz)	15OCBf-SD-xxxY-ZZ-H/L
None Space Diversity (1Rx) (6, 7,8GHz)	15OCBf-xxxY-ZZ-H/L
*11GHz None Space Diversity (1Rx)	15OCB11w-xxxY-ZZ-H/L

Note: * 11GHz OCB – is a wide BW OCB which supports up to 40MHz, when the other OCBs (6L, 6H, 7, 8GHz) support up to 30MHz

Table 3 OCB Part Numbers for All Indoor Compact

Diversity/Non-Diversity	All Indoor Compact
Space Diversity IFC (2Rx) (6, 7,8 GHz)	15OCBf-SD-xxxY-ZZ-H/L
Space Diversity IFC (2Rx) (11GHz)	15OCB11w-SD-xxxY-ZZ-H/L
None Space Diversity (1Rx) (6, 7,8GHz)	15OCBf-xxxY-ZZ-H/L
*11GHz None Space Diversity (1Rx)	15OCB11w-xxxY-ZZ-H/L

Note: * 11GHz OCB – is a wide BW OCB which supports up to 40MHz, when the other OCBs (6L, 6H, 7, 8GHz) support up to 30MHz

FibeAir IP-10G IDU

FibeAir 1500R IDU

FibeAir 3200T IDU

Figure 2 - FibeAir IDUs

3.2 Main Features of the 1500HP RFU

- Operates in the frequency range of 6-11 GHz
- Installation type: Split Mount or All-Indoor
- High transmit
- Split Mount: 29/30 dBm
- All-Indoor: 32 dBm
- Configurable Ethernet Capacity: from 10 Mbps to 10+0 x 260/ 370Mbps or Nx DS3
- Configurable TDM Capacity: from STM-1/OC-3 up to 9+1/10+0 x STM-1/OC-3
- Configurable Modulation: QPSK, 16, 32, 64, 128, 256 QAM
- Configurable Channel bandwidth: 10/14/20/28/29.65/40 MHz
- Space Diversity using innovative digital IF combiner
- Two receivers and one transmitter in a single transceiver unit provides built-in Diversity capability
- Variety of interfaces for TDM and IP
- Built-in XPIC (Cross Polarization Interference Canceller) Co-Channel Dual Polarized (CCDP) feature for double transmission capacity, and more bandwidth efficiency
- ATPC (Automatic Tx Power Control)
- Compliant with ETSI, FCC, ITU-T, ITU-R standards and frequency plans, for worldwide operation
- Compatible with FibeAir IP-10, 1500R ,3200T IDU and , IP-MAX², 1500P
- Level 3 NEBS compliance for the New OCB and horizontal All-Indoor

3.3 Frequency Bands

The frequency band of each radio is described in the following table.

Table 4 Frequency Bands

Frequency Band	Frequency Range (GHz)	Channel Bandwidth	ITU-R Standard
L6 GHz	5.925 to 6.425	29.65 MHz	▪ ITU-R F.383
	5.925 to 6.425	10 MHz to 30 MHz	▪ FCC Part 101.147 (i)
U6 GHz	6.425 to 7.100	20 MHz to 40 MHz	▪ ITU-R F.384
	6.525 to 6.875	10 MHz , 40MHz	▪ FCC Part 101.147 (k7)
7 GHz	7.425 to 7.900	14 MHz to 28 MHz	▪ ITU-R F.385 Annex 4
	7.425 to 7.725	28 MHz	▪ ITU-R F.385 Annex 1
	7.110 to 7.750	28 MHz	▪ ITU-R F.385 Annex 3
8 GHz	7.725 to 8.275	29.65 MHz	▪ ITU-R F.386 Annex 1
	8.275 to 8.500	14 MHz to 28 MHz	▪ ITU-R F.386 Annex 3
	7.900 to 8.400	14 MHz to 28 MHz	▪ ITU-R F.386 Annex 4
11 GHz	10.700 to 11.700	10 MHz to 30 MHz or 40 MHz	▪ ITU-R 387-8 ▪ FCC 101.147 [6]

3.4 Typical Configuration Overview

FibeAir 1500HP supports the following configurations:

- **Unprotected N+0 -** 1+0 to 10+0 - Data is transmitted through N channels, without redundancy (protection)

- **Hot StandBy - 1+1 HSB, 2+2 HSB** - Two RFUs use the same RF channel connected via a coupler, whereby one channel transmits and the other acts as a backup (StandBy). The 2+2 HSB configurations uses two RFUs are chained using two frequencies and connected via a coupler to the other pair of RFUs.

- **N+1 Frequency Diversity -** N+1 (1+1 to 9+1) - Data is transmitted through N channels and an additional (+1) frequency channel, which protects the N channels. If failure or signal degradation occurs in one of the N channels, the +1 channel carries the data of the affected N carrier. Additional configurations can be achieved using two racks, such as 14+2.

  Note: Space Diversity can be used in each of the configurations

3.5 RFU Overview

The RFU handles the main radio processing. It includes the following radio components: signal receiving, signal transmission, IF processing, and power supply.

There are two types of RFUs: one with a dual receiver, and one with a single receiver. The RFU with a dual receiver supports Space Diversity using IF combining, which combines two signals, main and diversity, and uses the combined signal to overcome multipath phenomenon (for Space Diversity configurations).

The RFU with a single receiver does not support Space Diversity using IF combining. This RFU will be used when Space Diversity with IF combining is not required.

Both RFUs support Space Diversity BBS (Base Band Switching) where the IF signal switching is performed in the IDU.

The two RFU types (with and without Space Diversity) have two different part numbers.

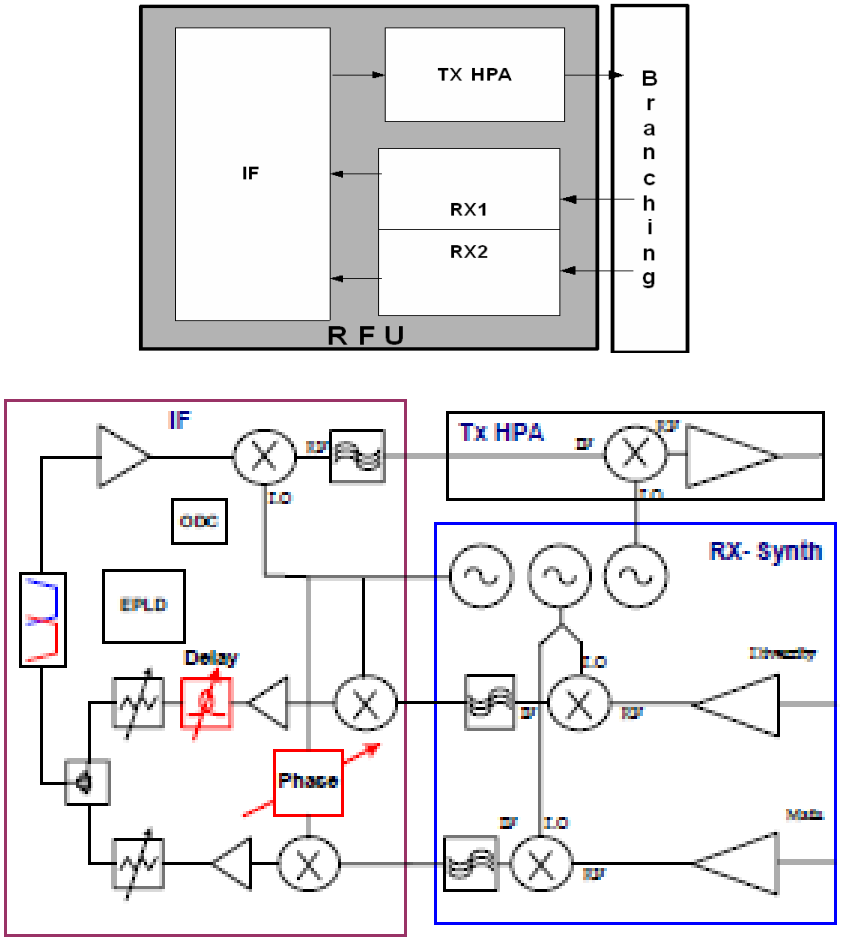


Figure 3 - RFU HP Block Diagram and OCB Block Diagrams

3.6 1500HP Assembly Options

The 1500HP contains two assembly options:

- Split Mount
- All-Indoor

3.6.1 Split Mount Assembly

All the RFUs are mounted outdoor on pole mount near the antenna and are assembled with an outdoor branching network (OCB). A four foot flexible waveguide connects the OCB to the antenna port.

Figure 4 - 9+1/10+0 Split Mount Configuration

3.6.2 All-Indoor Assembly

All the RFUs are mounted indoors in a rack and are connected to a branching network (ICB and ICC). The elliptical waveguide connects the branching network that is in the rack to the antenna port that is located outside.

There are three types of racks:

- ETSI rack 2.2m or 2m (special PN)
- 19" rack
- Compact vertical assembly (19" and ETSI rack)

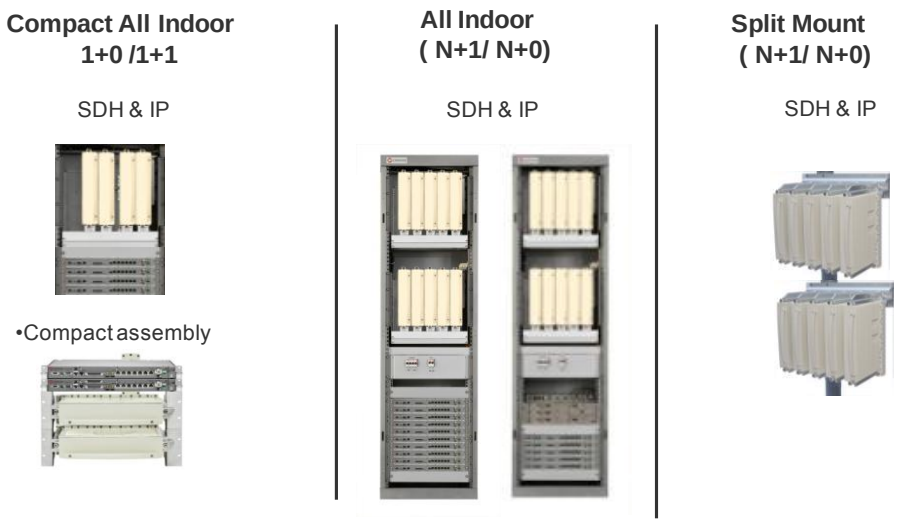


Figure 5 - 1500HP Assembly Options

3.7 Applications

FibeAir 1500HP can be used for a variety of applications, at a flexible and cost-effective long haul solution.

The following are examples of applications for which FibeAir 1500HP is optimally suited.

Long Distance Connectivity

For both fixed line and mobile operators, FibeAir 1500HP provide long distance connectivity.

Use of lower frequencies, which require high transmit power, Space Diversity, and multiple carriers, enables FibeAir 1500HP to facilitate backbone long haul network building.

Fixed Infrastructure

FibeAir 1500HP is an optimal solution for expansion mobile cellular networks that require high capacity due to an increase in subscribers, cell sites, and data rich applications. It offers smooth migration from existing PDH to SONET/SDH network functionality and to next generation ATM/IP, using different capacities: DS3, FE/GBE, and up to N+1 x STM-1/OC-3.

With its reliable fiber-like transmission/receiving quality and protection capabilities, FibeAir 1500HP is a dependable telecommunications solution for different network topologies, such as ring, mesh, chained, and star, which require both accuracy and stability.

FibeAir 1500HP can be deployed in an ATM-based or SDH/SONET backbone, providing high capacity to carry Digital Video Broadcast services and data. Since FibeAir 1500HP deployment is fast and easy, it can provide ATM-based services quickly and efficiently to public and private end users.

1500HP, with its unique flexibility structure and branching connections, enables easy upgrade for mobile networks with single or dual carrier capacity to N+0 / N+ 1 carrier.

Broadcast Networks

The scalability and modularity of FibeAir 1500HP wireless solutions are ideal for effectively building and expanding contribution and distribution digital broadcast networks.

Deployed in an ATM-based SDH backbone or IP network, FibeAir 1500HP offers reliable high quality transmission of Digital Video Broadcast signals and data. Applications include TV, radio, telemedicine, and others.

Private Networks

FibeAir 1500HP solutions provide transparent high capacity connection of enterprise LAN and PBX systems, which reduces communication costs, operating expenses, and maintenance requirements. Wireless high capacity connectivity is ideal for a variety of private networks and enterprises, such as utility operators, corporate facilities, education campuses, hospitals, banks, and others.

Applications include LAN Ethernet connectivity, VoIP, client-server applications, remote storage, video conferencing, TDM T1/E1 services, network infrastructure redundancy, and others.

Government and Emergency Services

Ceragon's FibeAir 1500HP quality product meets the high-level demands of governmental customers by providing rapidly deployed secure and long distance data transmission, in a single compact, light weight, and scalable solution.

Applications include disaster recovery, temporary installations, broadband voice, data and video services, and surveillance and monitoring.

4 Space Diversity Feature

4.1 Space Diversity Concept

In long distance wireless links, multipath phenomenon commonly exist, whereby fading occurs over time, space, and frequency.

The 1500HP RFU provides two types of Space Diversity optimizations, which are ideal solutions for the multipath phenomenon:

- IF Combining
- BBS (Base Band Switching)

All RFUs support Space Diversity BBS (Base Band Switching).

Figure 6 - SD with Multiple RFUs

Figure 7 - SD with Single RFU

4.1.1 IF Combining Mechanism

The RFU includes an IF combining mechanism, which combines the signals received from both antennas, to improve signal quality.

FibeAir 1500HP IF combining is performed by an innovative digital optimization algorithm. When distortion occurs, it is measured in both receiver paths; a new combined signal is produced, which improves the system gain by up to 3 dB. A single or multiple RFUs support space Diversity and can be connected to two antennas.

A delay calibration for the diversity waveguide is required and is done automatically via the NMS (see Installation Guide for more information).

Each RFU has built-in space diversity functionality, with one transmitter and two receivers. The receivers receive two different signals from two antennas, which are installed 10-20 meters apart.

There are two options for connecting the RFUs to the diversity antennas:

- Waveguide to coaxial cable – uses waveguide adaptor (CPR type) to N-type coaxial cable. This is the default option.
- Elliptical waveguide – uses waveguide connector (CPR type) with elliptical waveguide.

4.1.2 Base Band Switching

FibeAir 1500HP can operate with base band Space Diversity. In this option, each RFU is connected to a separate antenna. One RFU is mounted near the main antenna (connected via four foot flexible waveguide), the second RFU is mounted near the diversity antenna (connected via four foot flexible waveguide).

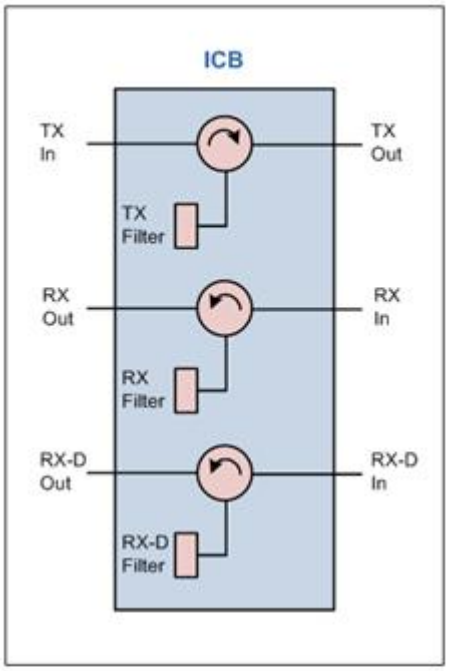
With Diversity performed in the indoor (base band), the modem switches to the other RF signal when interference occurs, and returns to the main signal when the interference is gone. In this way, the system performs optimum signal receiving by switching to the best signal performance.

4.2 Branching Network - Overview

Branching networks routes the signals from the RFUs to the antenna. The branching network can contain multiple OCBs or ICBs. When using Split Mount or All-Indoor compact (horizontal) configuration, the OCB branching network can be used. When using an All-Indoor configuration (vertical), the ICB branching network is used.

The main differences in branching concept between the OCB and the ICB is the how the signals are circulated.

- **OCB** – the Tx and the Rx path circulate together to the main OCB port. When chaining multiple OCBs, each Tx signal is chained to the following OCB Rx signal and so on (uses S-bend section). See section 5.3, *New OCB Components*.
- **ICB** – all the Tx signals are chained together to one Tx port (at the ICC) and all the Rx signals are chained together to one Rx port (at the ICC). The ICC circulates all the Tx and the Rx signals to one antenna port (see the components description below). See section 6.3.2, *ICB - Indoor Circulator Block.*



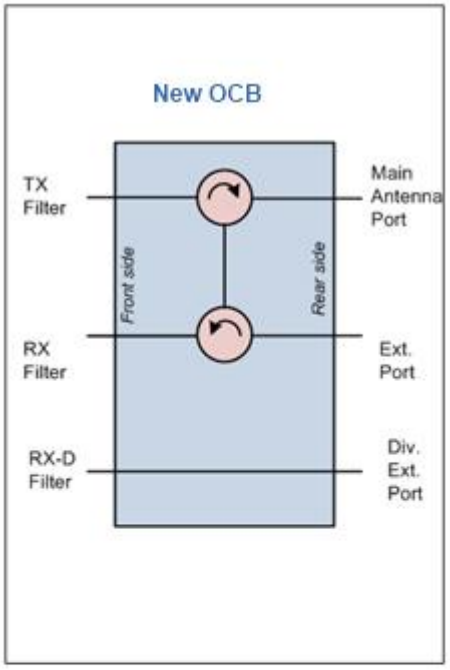


Figure 8 - All-Indoor Vertical Branching

Figure 9 - Split Mount Branching and All-Indoor Compact

5 Split Mount

5.1 Split Mount Overview

This section discusses the Split Mount assembly. The Split Mount configuration uses the Outdoor Circulator Block (OCB) to circulate and combine the multiple channels. There are detailed desciptions of the different configurations that are available and a general upgrade procedure.

Figure 10 - 5 x 1500HP Chain Units

5.2 New OCB - Outdoor Circulator Block

The OCB has the following main purposes:

1. Hosts the circulators and the attached filters.
2. Chain and accumulate radio signal (multiple carriers)
3. Routes the RF through the filters and circulators.
4. Allows RFU connection to the Main and Diversity antennas.

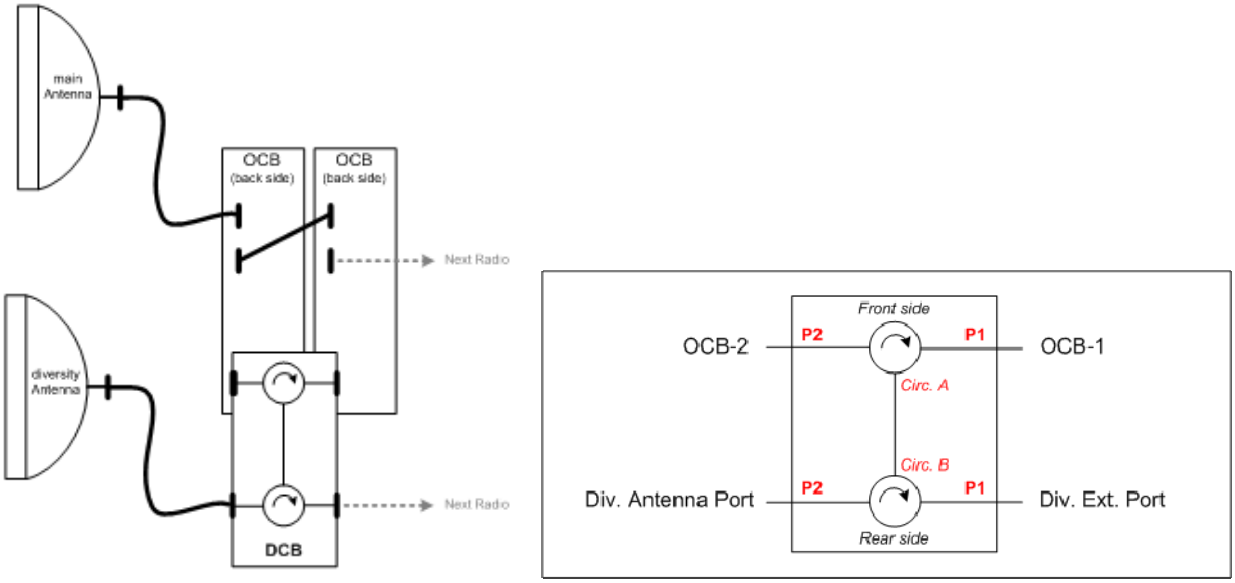


Figure 11 - New OCB

For SD (IFC) configuration, a diversity block is added.

The new OCB has the following purposes:

- The new OCB has a single type and is connected to the OBN via flexible waveguide. The connection is at the rear side.
- The new OCB has proprietary accessories
- Each OCB has 3 waveguide access points: in/out ports are at the OCB rear. The ports include:
- Tx port
- Rx port
- Diversity port

If the system is not configured for diversity, all the relevant access points on the OCB must be terminated using waveguide shorts. Unused Rx ports will be terminated with a 50 ohm termination.

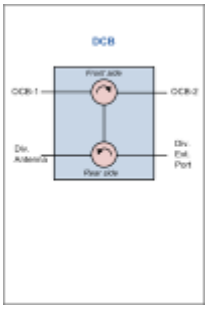
5.3 New OCB Components

The following components can be used with the new OCB depending on the specific configuration:

RF Filters

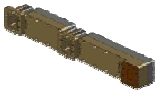
RF filters are used for specific frequency channels and Tx/Rx separation. The filters are attached to the OCB, and each RFU contains one Rx and one Tx filter. In a Space Diversity using IF combining configuration, each RFU contains two Rx filters (which combine the IF signals) and one Tx filter. The filters can be replaced without removing the OCB. The RF filter is installed with every configuration.

DCB - Diversity Circulator Block 



An external block which is added in Space Diversity configurations.

DCB is connected to the diversity port and chains two OCBs.

Coupler Kit 

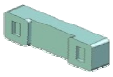
The coupler kit is used for 1+1 Hot StandBy configurations. (loss 1.6 /6dB)

Symmetrical Coupler Kit 

The Symmetrical coupler kit is used for: (loss of 3/3 dB)

- When chaining adjacent channels (only 28/30 MHz)
- 1+1 Hot StandBy configurations with a symmetrical loss of 3dB in each direction

Note: CPLRs loss tolerance is ±0.7 dB

U Bend 

The U Bend connects the chained DCB (Diversity Circulator Block) in N+1/N+0 configurations.

S Bend 

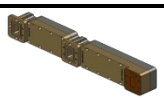
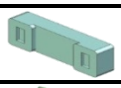
The S Bend connects the chained OCB (Outdoor Circulator Block) in N+1/N+0 configurations.

Pole Mount Kit 

The Pole Mount Kit is used to fasten up to five OCBs and the RFUs to the pole. The kit enables fast and easy installation.

5.3.1 New OCB Component Summary

Table 5 New OCB Components

Component Name	Marketing Model	Marketing Description	Picture
DCB	DCBf	DCB Diversity Block f GHz kit	
CPLR	OCB-CPLR-f	OCB Coupler f GHz	
CPLR_Sym	OCB-CPLR_SYM-f	OCB symmetrical Coupler fGHz	
UBend	DCB-UBend	DCB Ubend connection f GHz	
SBend	OCB-SBend	OCB SBend connection f GHz	
Pole Mount	OCB-Pole Mount	OCB-Pole Mount	

Note: f= 6L, 6H, 7, 8, 11 GHz

Waveguide Flange

The radio output port (C - Carrier) is frequency dependent, and is terminated with the following waveguide flanges:

Table 6 Waveguide Flange

Frequency Band (GHz)	Waveguide Flange
6L	CPR137
6H	CPR137
7	CPR112
8	CPR112
11	CPR90

5.4 Split Trunk Configurations

Split trunk is when multiple carriers are chained together and are connected to one antenna. This section describes common configurations for multiple channels.

5.4.1 1+1/2+2 HSB Configurations

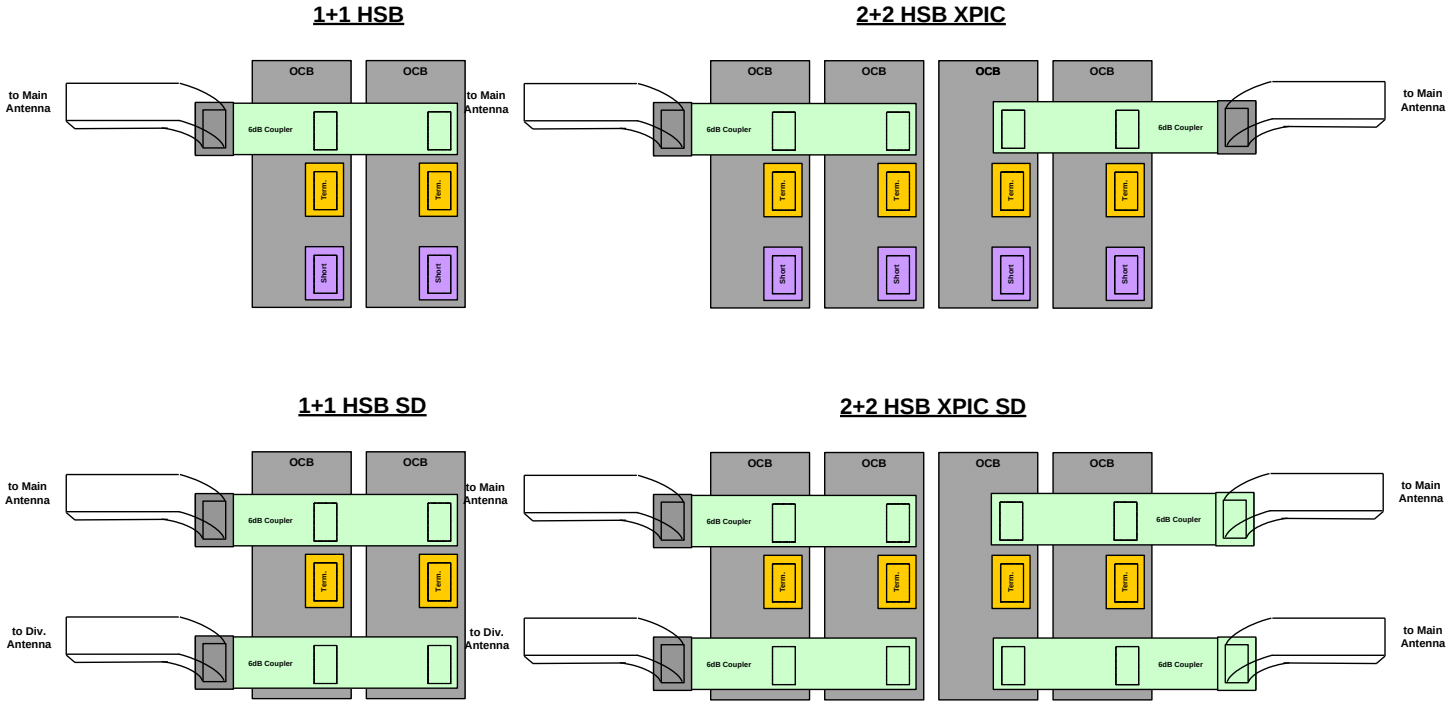
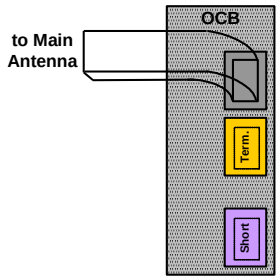


Table 7 HSB Configurations (1+1/2+2)

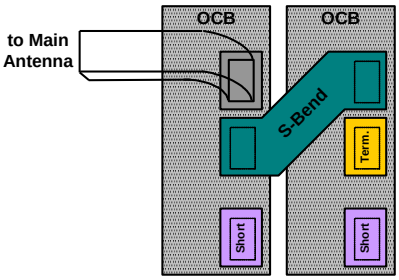
Configuration	OCB	DCB	U-bend	S-bend	Coupler	3dB Coupler	Term.	Cover / Short	Pole Mount
1+1 HSB	2	0	0	0	1	0	2	2	1
1+1 HSB SD	2	0	0	0	2	0	2	0	1
2+2 XPIC HSB	4	0	0	0	2	0	4	4	1
2+2 XPIC HSB SD	4	0	0	0	4	0	4	0	4

5.4.2 N+0/N+1 Single Pole Configurations (N = 1 to 5)

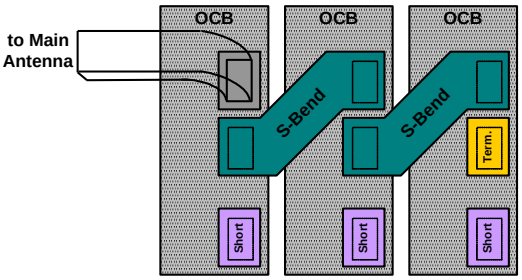
1+0



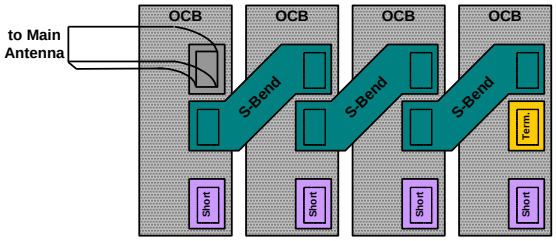
1+1 / 2+0



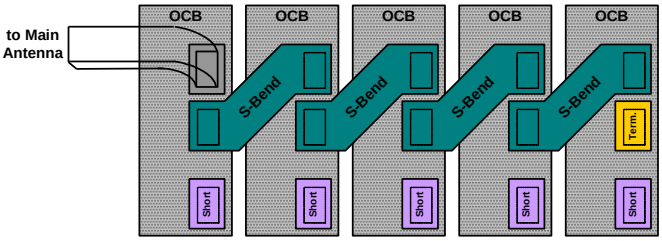
2+1 / 3+0



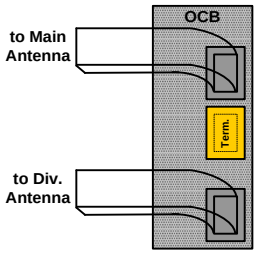
3+1 / 4+0



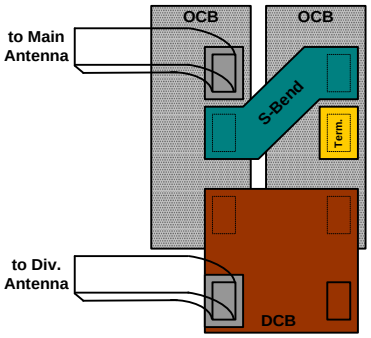
4+1 / 5+0



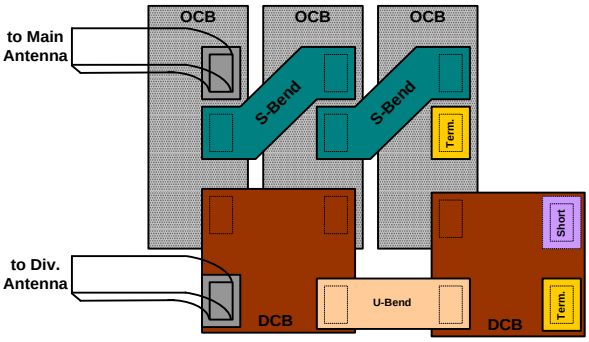
1+0 SD



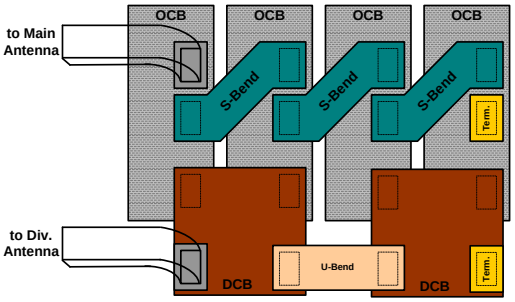
1+1 / 2+0 SD



2+1 / 3+0 SD



3+1 / 4+0 SD



4+1 / 5+0 SD

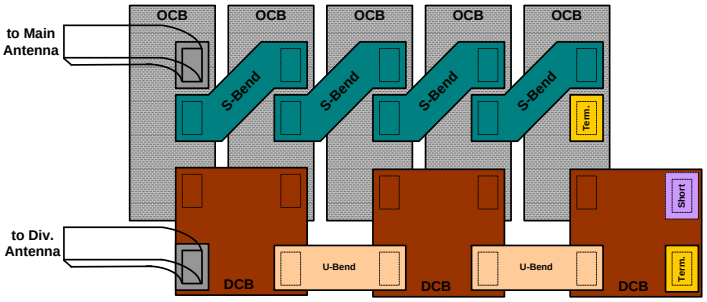
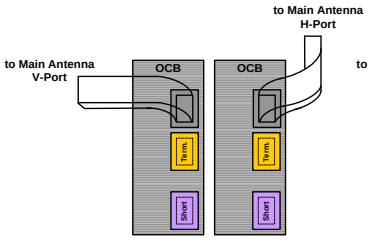


Table 8 Single Pole Configurations N+0/N+1 (N = 1 to 5)

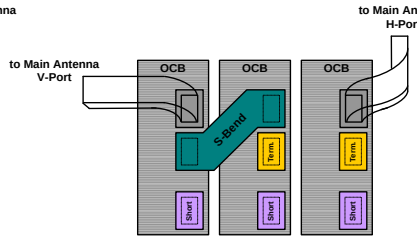
Configuration	OCB	DCB	U-bend	S-bend	Term.	Cover / Short	Pole Mount
1+0	1	0	0	0	1	1	1
1+0 SD	1	0	0	0	1	0	1
1+1 / 2+0	2	0	0	1	1	2	1
1+1 / 2+0 SD	2	1	0	1	1	0	1
2+1 / 3+0	3	0	0	2	1	3	1
2+1 / 3+0 SD	3	2	1	2	2	1	1
3+1 / 4+0	4	0	0	3	1	4	1
3+1 / 4+0 SD	4	2	1	3	2	0	1
4+1 / 5+0	5	0	0	4	1	5	1
4+1 / 5+0 SD	5	3	2	4	2	1	1

5.4.3 N+0/N+1 CCDP Configurations (N = 1 to 5)

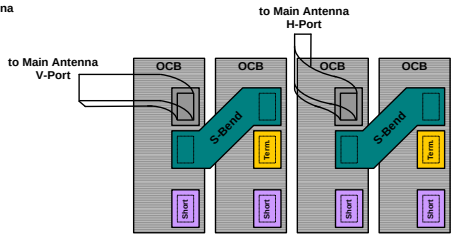
2+0 XPIC



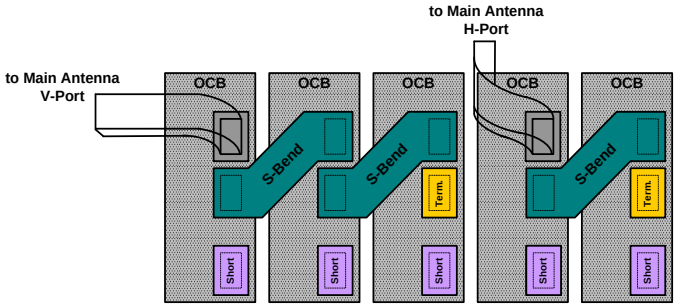
2+1 XPIC



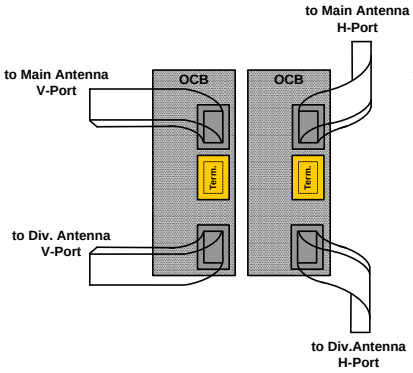
3+1 XPIC



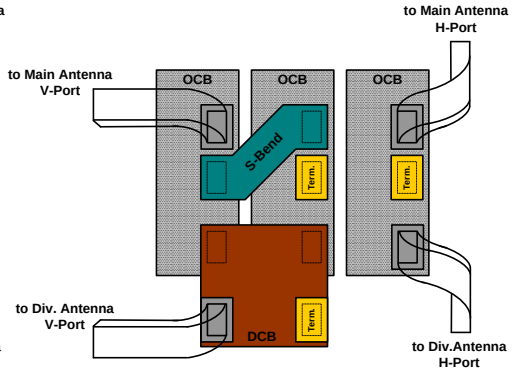
4+1 XPIC



2+0 XPIC SD



2+1 XPIC SD



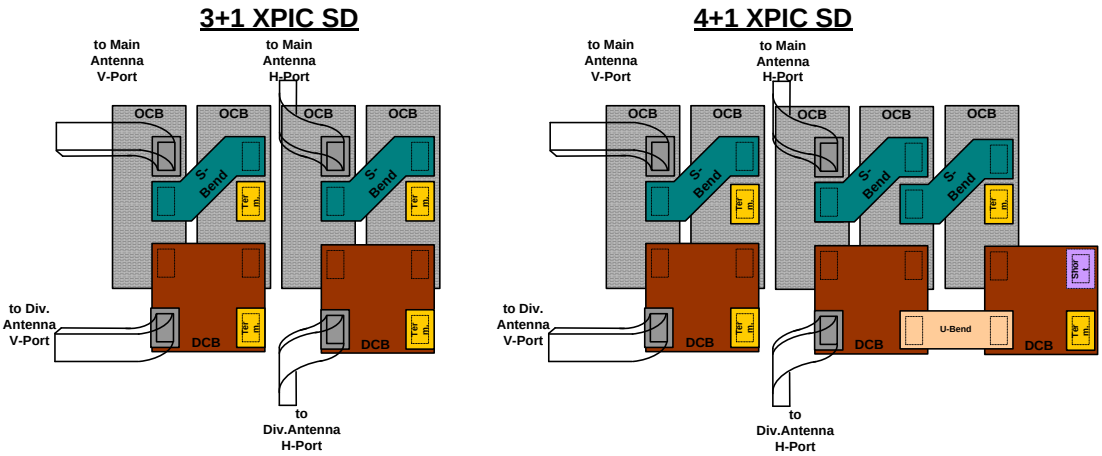
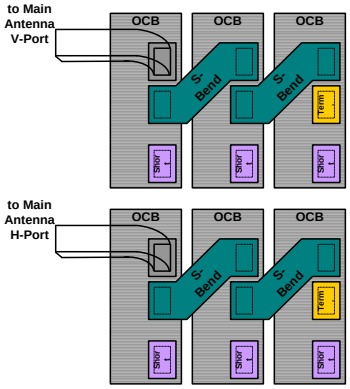


Table 9 CCDP Configurations N+0/N+1 (N = 1 to 5)

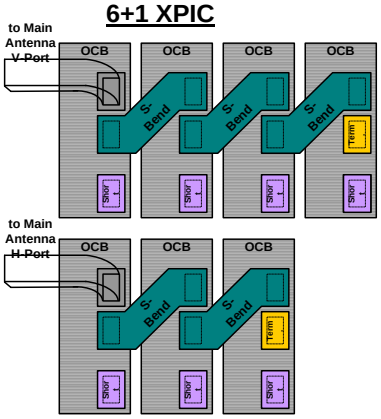
Configuration	OCB	DCB	U-bend	S-bend	Term.	Cover / Short	Pole Mount
2+0 XPIC	2	0	0	0	2	2	1
2+0 XPIC SD	2	0	0	0	2	0	1
2+1 XPIC	3	0	0	1	2	3	1
2+1 XPIC SD	3	1	0	1	3	0	1
3+1 XPIC	4	0	0	2	3	4	1
3+1 XPIC SD	4	2	0	2	4	0	1
4+1 XPIC	5	0	0	3	2	5	1
4+1 XPIC SD	5	3	1	3	4	1	1

5.4.4 N+0/N+1 CCDP Configurations (N = 5 to 10)

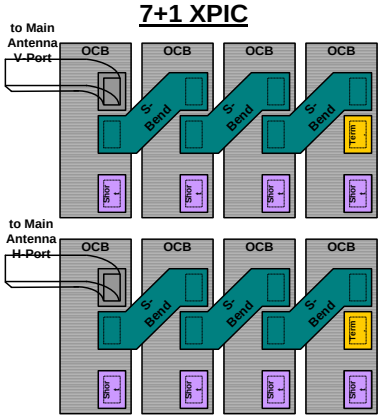
5+1 XPIC



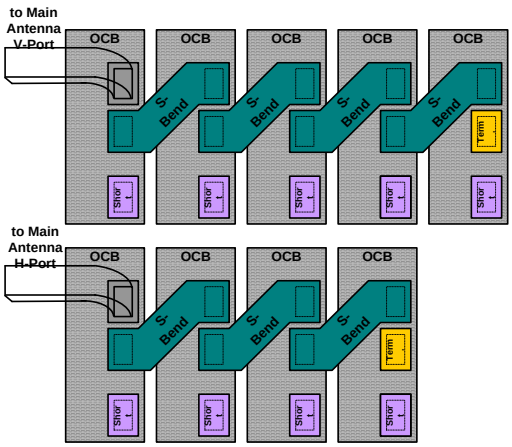
6+1 XPIC



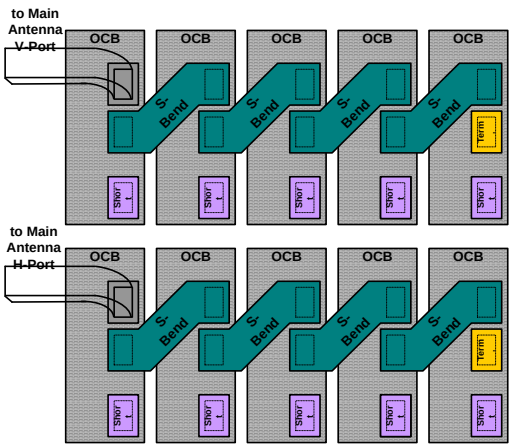
7+1 XPIC



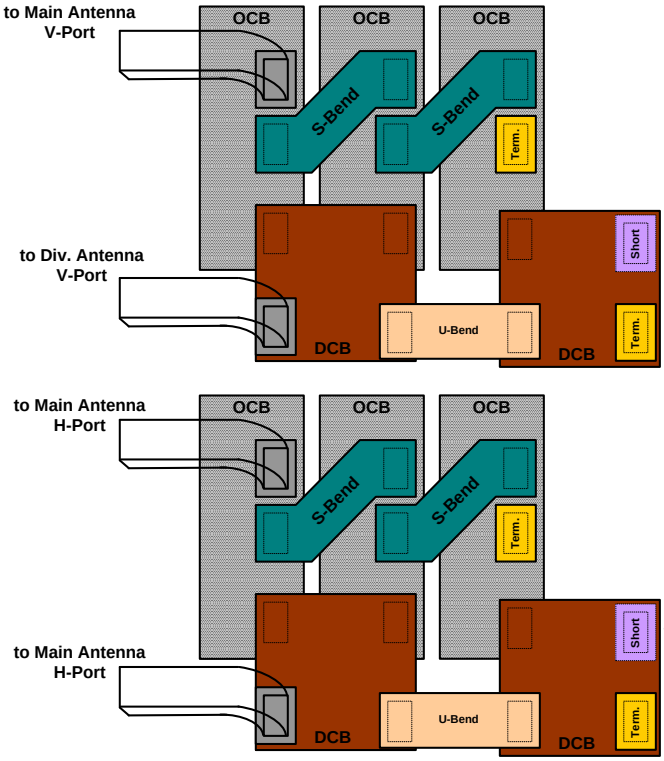
8+1 XPIC



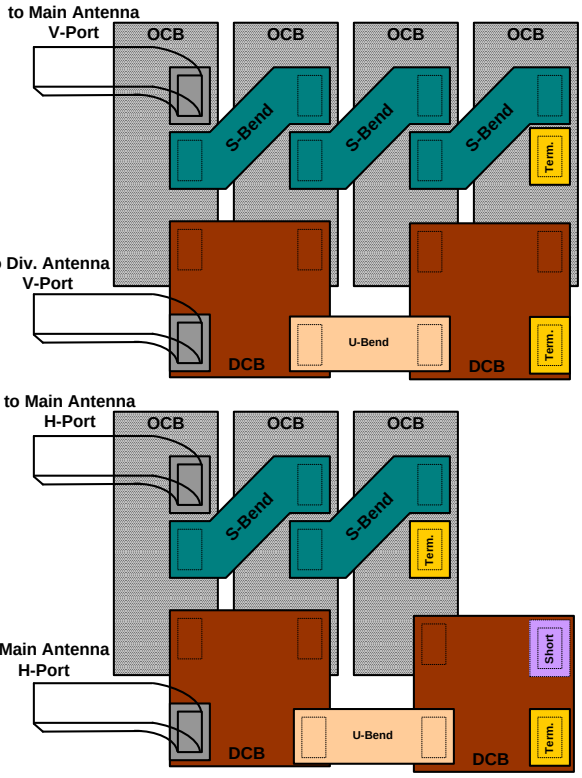
9+1 XPIC



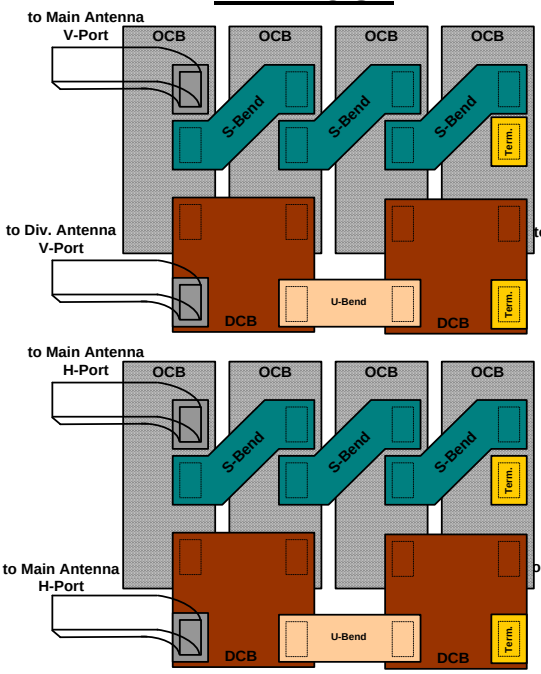
5+1 XPIC SD



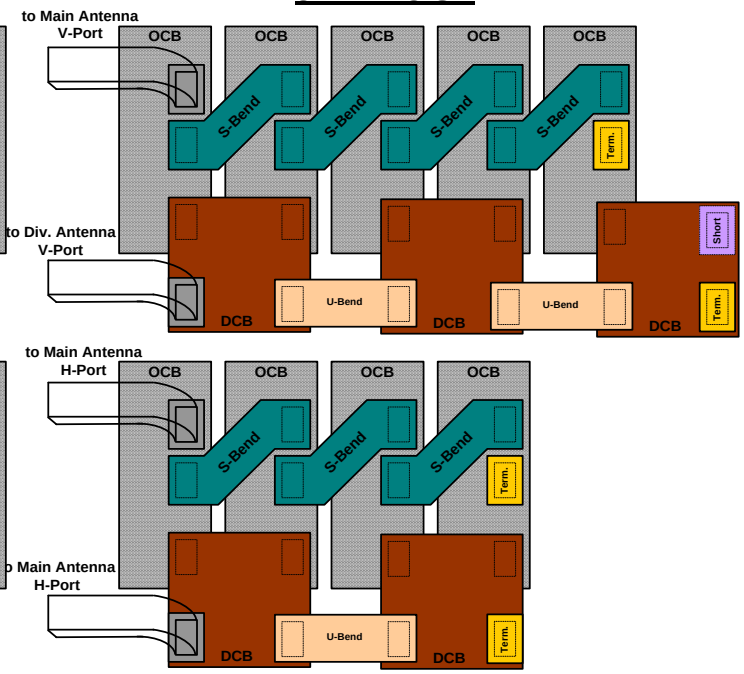
6+1 XPIC SD



7+1 XPIC SD



8+1 XPIC SD



9+1 XPIC SD

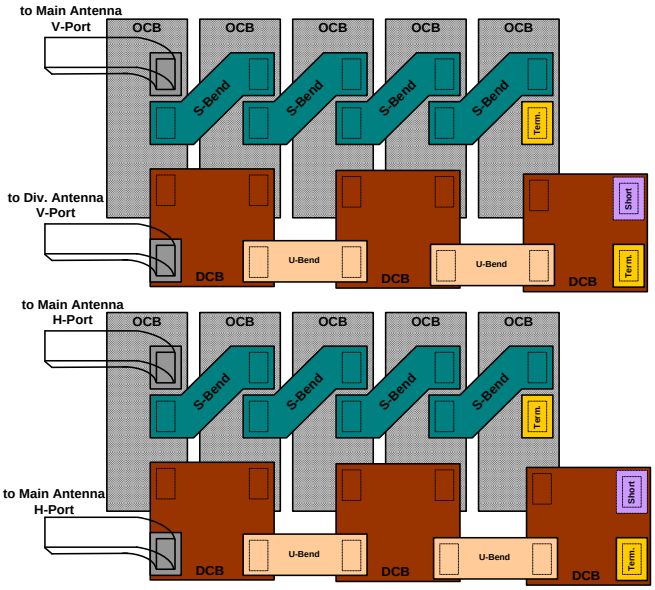


Table 10 CCDP Configurations N+0/N+1 (N = 5 to 10)

Configuration	OCB	DCB	U-bend	S-bend	Term.	Cover / Short	Pole Mount
5+1 XPIC	6	0	0	4	2	6	2
5+1 XPIC SD	6	4	2	4	4	2	2
6+1 XPIC	7	0	0	5	2	7	2
6+1 XPIC SD	7	4	2	5	4	1	2
7+1 XPIC	8	0	0	6	2	8	2
7+1 XPIC SD	8	4	2	6	4	0	2
8+1 XPIC	9	0	0	7	2	9	2
8+1 XPIC SD	9	5	3	7	4	1	2
9+1 XPIC	10	0	0	8	2	10	2
9+1 XPIC SD	10	6	4	8	4	2	2

5.5 Split Mount Branching Loss

When designing a link budget calculation, the branching loss (dB) should be considered as per specific configuration. This section contains tables that list the branching loss for the following Split Mount configurations.

Table 11 Split Mount Braching Loss

Interfaces	1+0	1+1 FD 2+0	2+1 3+0	3+1 4+0	4+1 5+0	5+1 6+0	6+1 7+0	7+1 8+0	8+1 9+0	9+1 10+0
CCDP with DP Antenna	0 (1c)	0 (1c)	0.5 (2c)	0.5 (2c)	1.0 (3c)	1.0 (3c)	1.5 (4c)	1.5 (4c)	2 (5c)	2 (6c)
SP Non-adjacent Channels	0 (1c)	0.5 (2c)	1.0 (3c)	1.5 (5c)	2.0 (4c)	NA	NA	NA	NA	NA

Notes:

- **(c)** – Radio Carrier
- **CCDP -** Co-channel dual polarization
- **SP –**Single pole antenna
- **DP –** Dual pole antenna

In addition the following losses are added when using these items:

Table 12 Split Mount - Additional Losses

Item	Where to Use	Loss
Flex WG	All configurations	0.5
15m Coax cable	Diversity path 6-8/11 GHz	5/6.5
Symmetrical Coupler	Adjacent channel configuration.	3

5.6 Upgrade Procedure

The following components need to be added when upgrading from a 1+0 Split Mount configuration to N+1:

- OCBs
- RFUs
- IDU/IDMs
- Flexible waveguides

When adding RF channels or carriers, RFUs and OCBs with specific filters need to be added as well.

The OCBs are chained together using couplers (for the same frequency) or U-bends/S-bends (for different frequencies), in accordance with the specific configuration.

Open ports on the OCBs will be terminated with 50 ohm terminations.

Detailed upgrade procedure documents are available for specific configurations.

Please note legacy OCBs can be upgraded and cascaded with NEW OCB. Please contact Ceragon for details.

5.7 Split Mount Part Numbers

The following table presents the different options and in which configurations they are used.

5.7.1 RFU Part Numbers

Table 13 Split Mount RFU Part Numbers

Space Diversity/Non-Diversity	Split Mount
Space Diversity IFC (2Rx) (6, 7,8 ,11GHz)	15HP-RFU-f
None Space Diversity (1Rx) (6, 7,8GHz)	15HPS-1R-RFU-f
None Space Diversity (1Rx) (11GHz)	15HPS-1R-RFU-11w

5.7.2 OCB Part Numbers

Table 14 Split Mount OCB Part Numbers

Space Diversity/Non-Diversity	Split Mount
Space Diversity IFC (2Rx) (6, 7,8 ,11GHz)	15OCBf-SD-xxxY-ZZ-H/L
None Space Diversity (1Rx) (6, 7,8GHz)	15OCBf-xxxY-ZZ-H/L
*11GHz None Space Diversity (1Rx)	15OCB11w-xxxY-ZZ-H/L

* 11GHz OCB – is a wide BW OCB which supports up to 40MHz, when the other OCBs (6L, 6H, 7, 8GHz) support up to 30MHz

6 All-Indoor

6.1 All-Indoor Overview

All-Indoor configurations are when all the equipment is installed indoors (room, shelter) and an elliptical waveguide connects the radio output port from the room to the antenna

A basic block diagram for trunk system, including the main blocks, is shown in the following figure. The block diagram includes marked interface points which shall serve as reference points for several technical parameters used in this document.

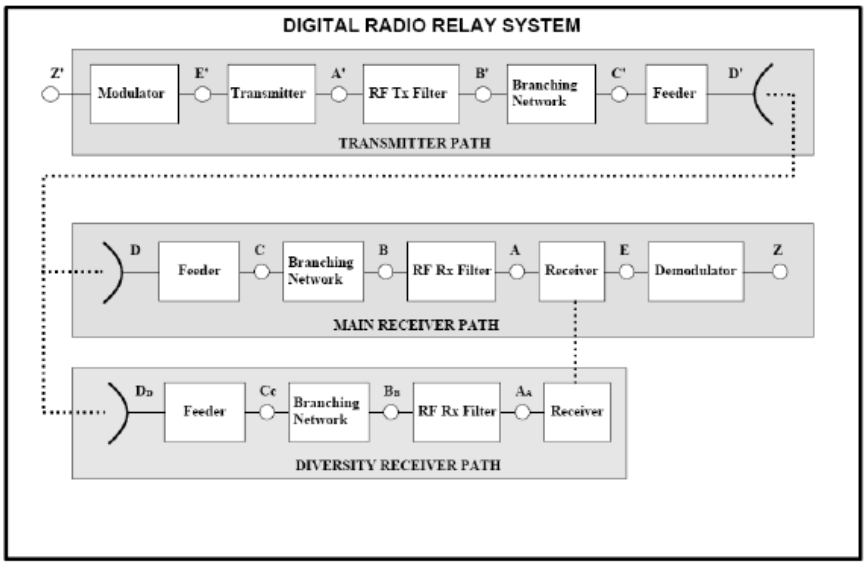


Figure 12 - Block Diagram of Trunk System

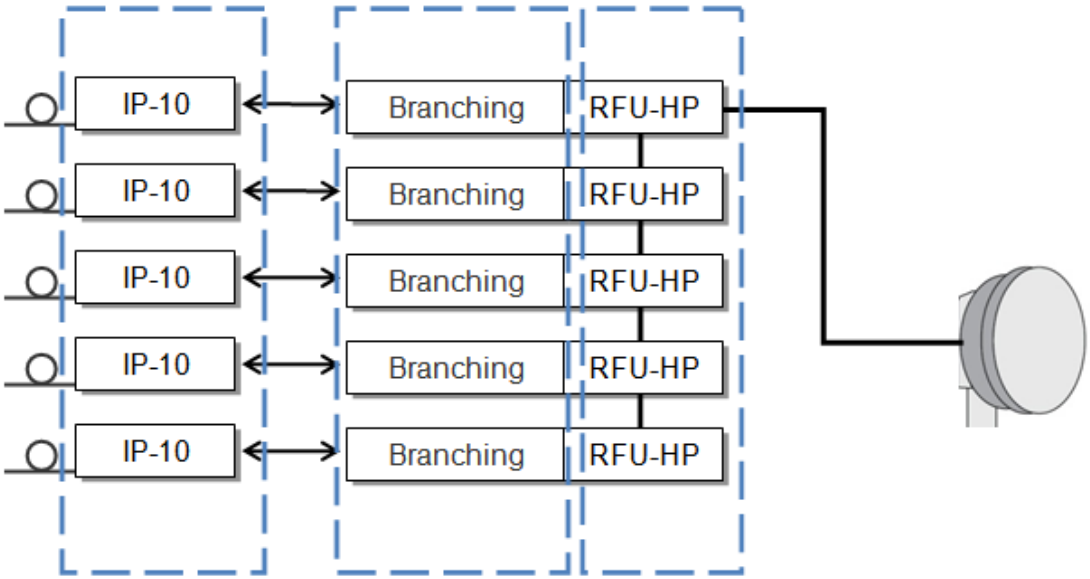


Figure 13 - All-Indoor System with 5 IP-10 Carries

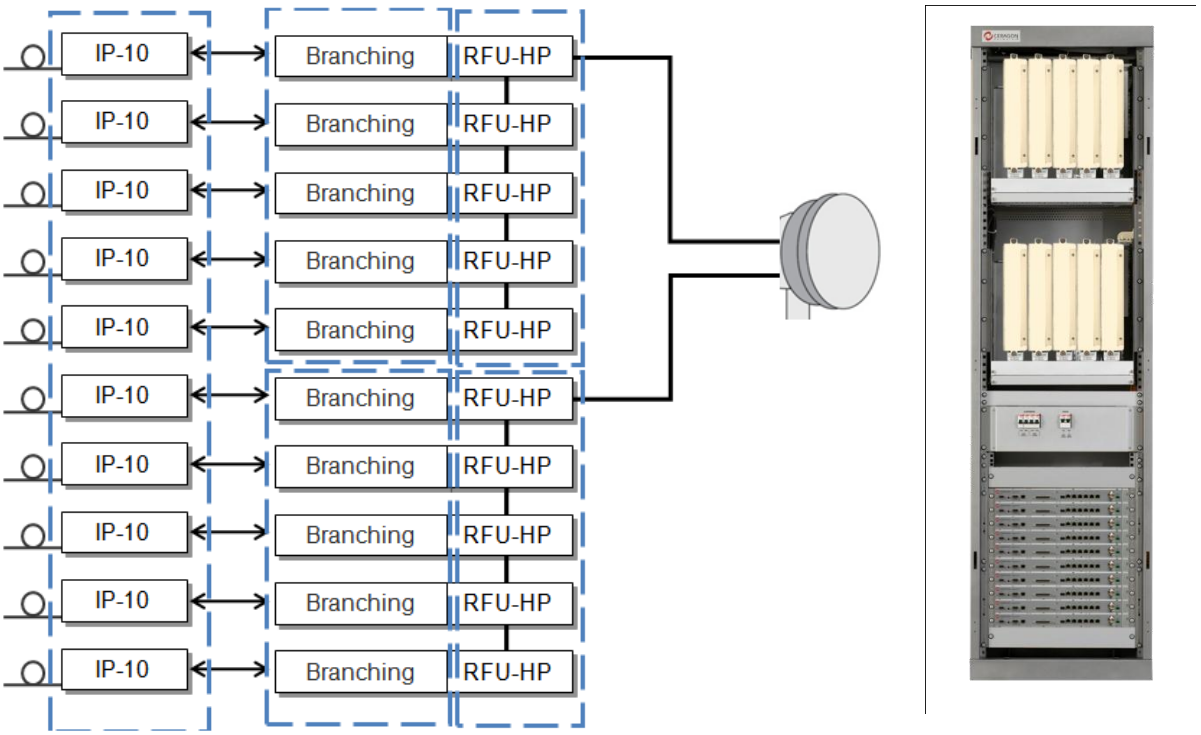


Figure 14 - All-Indoor System with 10 IP-10 Carries

6.2 All-Indoor Components

The branching concept (as described in section 4.2, Branching Network - Overview) is similar to All-Indoor application.

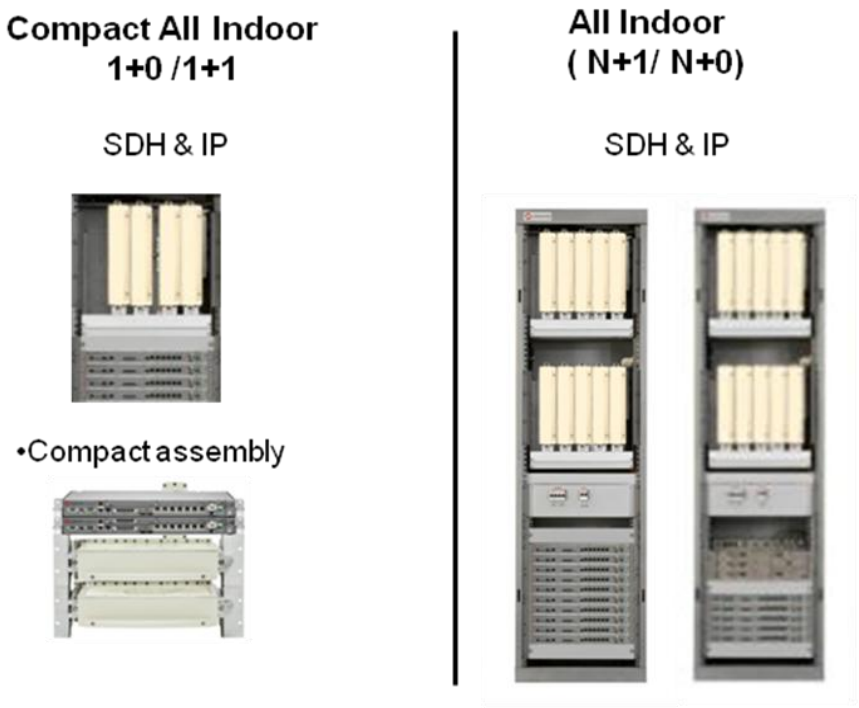
When using All-Indoor configurations, there are two types of branching implementations:

Using ICBs

Vertical assembly, up to 10 carriers per rack (5 carries per subrack)

Using NEW OCBs

Compact horizontal assembly, up to 2 carriers per subrack



6.3 RFU Subrack Components

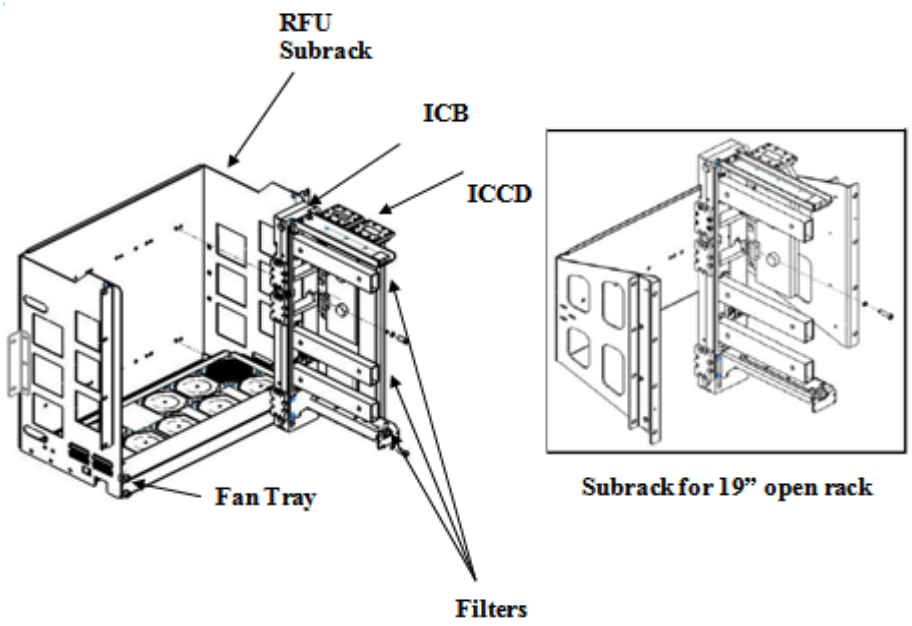


Figure 15 - Subrack for ETSI Rack

6.3.1 Subrack

The subrack hosts all the RFU components and connections, as shown in the previous illustration.

The subrack includes:

RFUs - up to five RFUs per subrack (each RFU connects to an ICB)

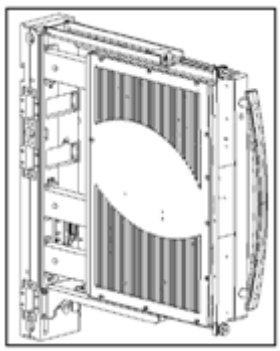


Figure 16 - RFU with Branching

6.3.2 ICB - Indoor Circulator Block

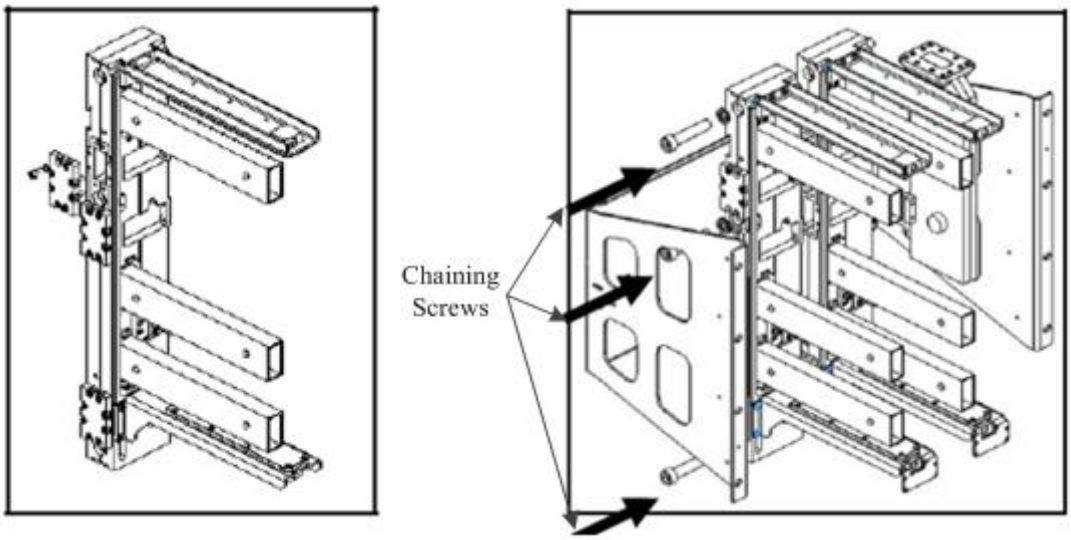
Each RFU is connected to one ICB, and several ICBs are chained to each other. The chained ICBs carry different RF channels and are connected to a single ICC, which sums the RF signals.

The main ICB functions include:

- Hosts the circulators and filters.
- Routes the RF signals in the correct direction, via the filters and circulators.

The ICB is a modular stand-alone unit. When system expansion is necessary, additional ICBs will be added and chained with the existing ICBs.

The branching chain to neighbor ICB ICC is done through the holes at the side, a long screw connects the ICBs to each other and the last ICB at the chain is terminated with 50ohm termination (SD port does not need to terminated if the SD filter is not attach to the ICB) , as shown below:



6.3.3 RF Filters

The RF Filters are used for specific frequency channels and Tx/Rx separation. The filters are attached to the ICB, and each RFU contains one Rx and one Tx filter.

In a Space Diversity configuration, each RFU contains two Rx filters (to combine the IF signals) and one Tx filter.

6.3.4 ICC - Indoor Combiner Circulator

The ICC does not perform space diversity ICB summing (single output port).

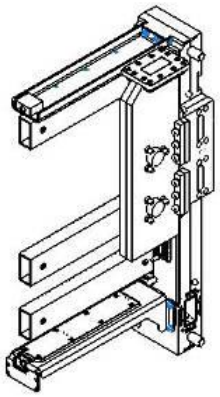


Figure 17 Indoor Combiner Circulator

The ICC sums the Rx and Tx signals and combines the N channels to the output ports (one or two, in accordance with the configuration).

6.3.5 ICCD - Indoor Combiner Circulator Diversity

The ICCD performs space diversity ICB summing (two output ports).

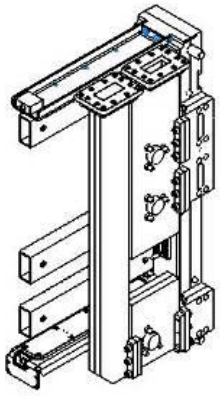


Figure 18 Indoor Combiner Circulator Diversity

- Patch Panel –ICBs IF and XPIC cables are connected to the patch panel ; the indoors IF cables (IP-10 / IP-max / 1500R / 3200T) will be connected to the specific RFU location, XPIC cable will use between two RFUs which are using the same Tx and Rx filters with different polarizations (V and H).
- Fan Tray - contains eight controlled and monitored fans, which cool the RFU heat dissipations. The fan tray is a tray which is part of ETSI rack (as shown above), while when using a 19" frame rack a fan tray is a separate unit which must be assembled separately (shown below).

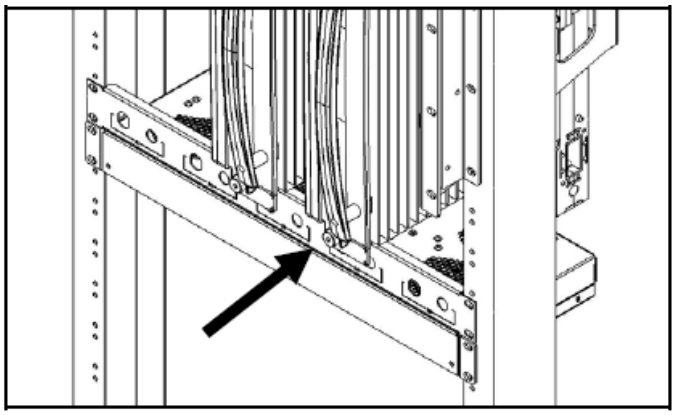


Figure 19 - Fan Tray in 19" Frame Rack

6.3.6 Rigid Waveguides - T12, T13 and T14

Rigid waveguide sections which assemble in the rack, to connect the ICC / ICCD from the bottom rack to the top of the rack (C'), the specific Rigid WG sections are used dependant on the configuration.

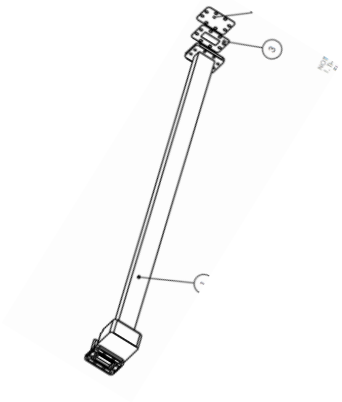


Figure 20 - T12 Rigid Waveguide

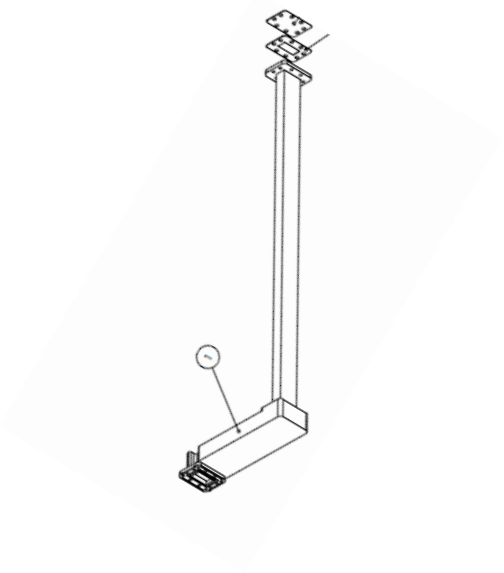


Figure 21 - T13 Rigid Waveguide

6.4 Configuration Example

In this configuration, three ICBs are chained together and connected to a vertical ICC, and two ICBs are chained together and connected to a horizontal ICC polarization

The RF components include:

- Five RFUs
- Five ICBs
- Two ICCs

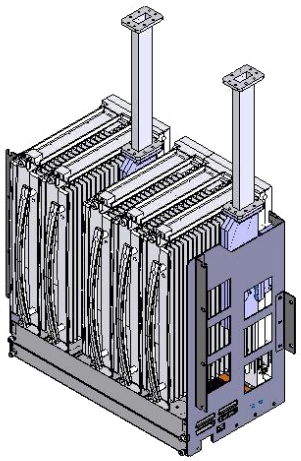


Figure 22 - 4+1 XPIC Assembly Configuration

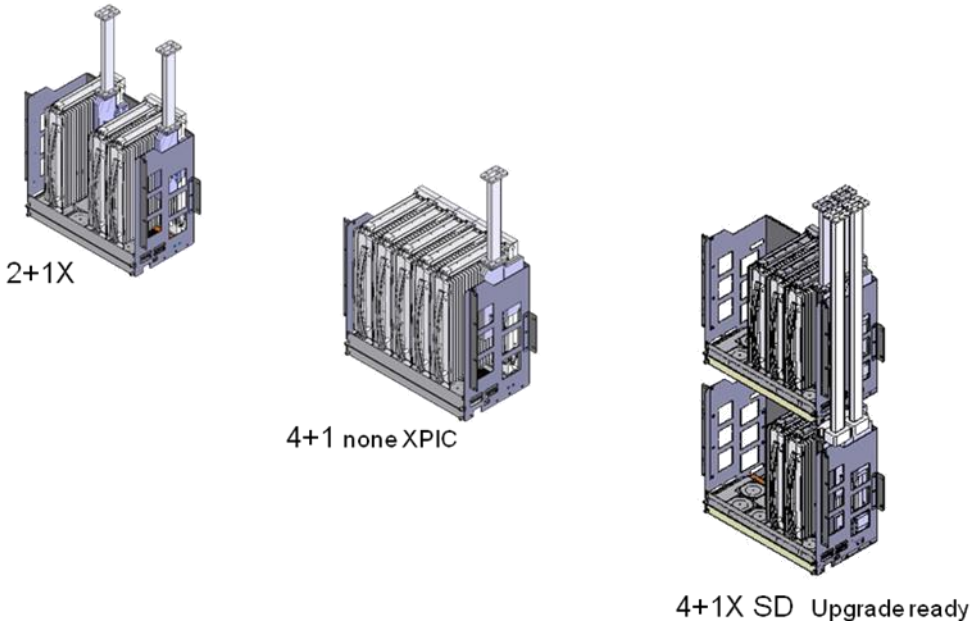


Figure 23 - Additional Example Assembly Configurations

In case a configuration with more than ten carries, two racks are assembled and connected.

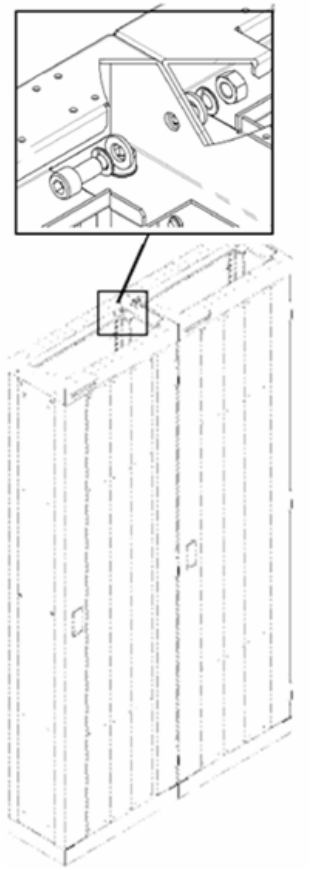


Figure 24 - Configuration with More than Ten Carries and Two Racks

6.4.1 Typical All-Indoor Configurations

The following tables contain a list of typical All-Indoor configurations.

Table 15 All-Indoor Configurations (1+0 /1+1 HSB)

1+0 / 1+1 HSB	
32T-f_1+0	3200T-f_1+0
32T-f_1+0_EW	3200T-f_1+0_East West
32T-f_1+0_SD	3200T-f_1+0_Space Diversity
32T-f_1+0_SD_EW	3200T-f_1+0_Space Diversity East West
32T-f_1+1_HSB	3200T-f_1+1_HSB
32T-f_1+1_HSB_EW	3200T-f_1+1_HSB_East West
32T-f_1+1_HSB_SD	3200T-f_1+1_HSB_Space Diversity
32T-f_1+1_HSB_SD_EW	3200T-f_1+1_HSB_Space Diversity East West

Table 16 All-Indoor Configurations (N+0/N+1 XPIC)

N+0 / N+1 XPIC	
32T-f_1+1/2+0_X	3200T-f_1+1/2+0 XPIC
32T-f_2+1/3+0_X	3200T-f_2+1/3+0 XPIC
32T-f_3+1/4+0_X	3200T-f_3+1/4+0 XPIC
32T-f_4+1/5+0_X	3200T-f_4+1/5+0 XPIC
32T-f_5+1/6+0_X	3200T-f_5+1/6+0 XPIC
32T-f_6+1/7+0_X	3200T-f_6+1/7+0 XPIC
32T-f_7+1/8+0_X	3200T-f_7+1/8+0 XPIC
32T-f_8+1/9+0_X	3200T-f_8+1/9+0 XPIC
32T-f_9+1/10+0_X	3200T-f_9+1/10+0 XPIC

Table 17 All-Indoor Configurations (N+0 / N+1 XPIC Space Diversity)

N+0 / N+1 XPIC Space Diversity	
32T-f_1+1/2+0_X _SD	3200T-f_1+1/2+0 XPIC Space Diversity
32T-f_2+1/3+0_X _SD	3200T-f_2+1/3+0 XPIC Space Diversity
32T-f_3+1/4+0_X_SD	3200T-f_3+1/4+0 XPIC Space Diversity
32T-f_4+1/5+0_X_SD	3200T-f_4+1/5+0 XPIC Space Diversity
32T-f_5+1/6+0_X_SD	3200T-f_5+1/6+0 XPIC Space Diversity
32T-f_6+1/7+0_X_SD	3200T-f_6+1/7+0 XPIC Space Diversity
32T-f_7+1/8+0_X_SD	3200T-f_7+1/8+0 XPIC Space Diversity
32T-f_8+1/9+0_X_SD	3200T-f_8+1/9+0 XPIC Space Diversity

N+0 / N+1 XPIC Space Diversity	
32T-f_9+1/10+0_X_SD	3200T-f_9+1/10+0 XPIC Space Diversity
32T-f_1+1/2+0_X_EW	3200T-f_1+1/2+0 XPIC East West
32T-f_2+1/3+0_X_EW	3200T-f_2+1/3+0 XPIC East West
32T-f_3+1/4+0_X_EW	3200T-f_3+1/4+0 XPIC East West
32T-f_4+1/5+0_X_EW	3200T-f_4+1/5+0 XPIC East West
32T-f_1+1/2+0_X_SD_EW	3200T-f_1+1/2+0 XPIC East West Space Diversity
32T-f_2+1/3+0_X_SD_EW	3200T-f_2+1/3+0 XPIC East West Space Diversity
32T-f_3+1/4+0_X_SD_EW	3200T-f_3+1/4+0 XPIC East West Space Diversity
32T-f_4+1/5+0_X_SD_EW	3200T-f_4+1/5+0 XPIC East West Space Diversity

Table 18 All-Indoor Configurations (N+0/N+1 Single Pol)

N+0/N+1 Single Pol	
32T-f_1+1/2+0_SP	3200T-f_1+1/2+0_SP
32T-f_2+1/3+0_SP	3200T-f_2+1/3+0_SP
32T-f_3+1/4+0_SP	3200T-f_3+1/4+0_SP
32T-f_4+1/5+0_SP	3200T-f_4+1/5+0_SP

Table 19 All-Indoor Configurations (N+0/N+1 Single Pol Space Diversity)

N+0/N+1 Single Pol Space Diversity	
32T-f_1+1/2+0_SP_SD	3200T-f_1+1/2+0_Single Pole Space Diversity
32T-f_2+1/3+0_SP_SD	3200T-f_2+1/3+0_Single Pole Space Diversity
32T-f_3+1/4+0_SP_SD	3200T-f_3+1/4+0_Single Pole Space Diversity
32T-f_4+1/5+0_SP_SD	3200T-f_4+1/5+0_Single Pole Space Diversity
32T-f_1+1/2+0_SP_EW	3200T-f_1+1/2+0_Single Pole East West
32T-f_2+1/3+0_SP_EW	3200T-f_2+1/3+0_Single Pole East West
32T-f_3+1/4+0_SP_EW	3200T-f_3+1/4+0_Single Pole East West
32T-f_4+1/5+0_SP_EW	3200T-f_4+1/5+0_Single Pole East West
32T-f_1+1/2+0_SP_SD_EW	3200T-f_1+1/2+0_Single Pole Space Diversity East West
32T-f_2+1/3+0_SP_SD_EW	3200T-f_2+1/3+0_Single Pole Space Diversity East West
32T-f_3+1/4+0_SP_SD_EW	3200T-f_3+1/4+0_Single Pole Space Diversity East West
32T-f_4+1/5+0_SP_EW	3200T-f_4+1/5+0_Single Pole East West

Table 20 All-Indoor Configurations (N+0/N+1 XPIC Upgrade ready)

N+0/N+1 XPIC Upgrade Ready	
32T-f_1+1/2+0_X_UR	3200T-f_1+1/2+0_XPIC_Upgrade Ready
32T-f_2+1/3+0_X_UR	3200T-f_2+1/3+0_XPIC_Upgrade Ready
32T-f_3+1/4+0_X_UR	3200T-f_3+1/4+0_XPIC_Upgrade Ready
32T-f_4+1/5+0_X_UR	3200T-f_4+1/5+0_XPIC_Upgrade Ready

Table 21 All-Indoor Configurations (N+0/N+1 XPIC Space Diversity Upgrade ready)

N+0/N+1 XPIC Space Diversity Upgrade Ready	
32T-f_1+1/2+0_X_SD_UR	3200T-f_1+1/2+0_XPIC_Space Diversity Upgrade Ready
32T-f_2+1/3+0_X_SD_UR	3200T-f_2+1/3+0_XPIC_Space Diversity Upgrade Ready
32T-f_3+1/4+0_X_SD_UR	3200T-f_3+1/4+0_XPIC_Space Diversity Upgrade Ready
32T-f_4+1/5+0_X_SD_UR	3200T-f_4+1/5+0_XPIC_Space Diversity Upgrade Ready

Table 22 All-Indoor Configurations (19" Without Rack)

19" Without Rack	
32T19-f_1+0_WO_rack	3200T19_inch-f_1+0_Without_rack
32T19-f_1+0_EW_WO_rack	3200T19_inch-f_1+0_East West Without rack
32T19-f_1+0_SD_WO_rack	3200T19_inch-f_1+0_Space Diversity Without rack
32T19-f_1+0_SD_EW_WO_rack	3200T19_inch-f_1+0_Space Diversity East West Without rack
32T19-f_1+1_HSB_WO_rack	3200T19_inch-f_1+1_HSB_Without_rack
32T19-f_1+1_HSB_SD_WO_rack	3200T19_inch-f_1+1_HSB_Space Diversity Without rack
32T19-f_1+1_HSB_EW_WO_rack	3200T19_inch-f_1+1_HSB_East West Without rack
32T19-f_1+1_HSB_SD_EW_WO_rack	3200T19_inch-f_1+1_HSB_Space Diversity East West Without rack

For additional configurations and details please contact the Ceragon office.

6.5 All-Indoor Branching Loss

ICC has a 0 dB loss, since the RFU is calibrated to Pmax, together with the filter and 1+0 branching loss.

The following table presents the branching loss per configuration and the Elliptical wave guide (WG) losses per meter which will be add for each installation (dependant on the WG length)

Table 23 All-Indoor Branching Loss

Configuration	Interfaces		1+0	1+1 FD 2+0	2+1 3+0	3+1 4+0	4+1 5+0
All-Indoor	WG looses per 100m	6L	4				
		6H	4.5				
		7/8GHz	6				
		11GHz	10				
	Symmetrical Coupler	Added to adjacent channel configuration	3				
	CCDP with DP antenna		0.3 (1c)	0.3 (1c)	0.7 (2c)	0.7 (2c)	1.1 (3c)
	SP Non adjacent channels		0.3 (1c)	0.7 (2c)	1.1 (3c)	1.5 (4c)	1.9 (5c)
	CCDP with DP antenna Upgrade Ready		0.3 (1c)	0.7 (1c)	1.1 (2c)	1.1 (2c)	1.5 (3c)

Configuration	Interfaces		5+1 6+0	6+1 7+0	7+1 8+0	8+1 9+0	9+1 10+0
All-Indoor	WG looses per 100m	6L	4				
		6H	4.5				
		7/8GHz	6				
		11GHz	10				
	Symmetrical Coupler	Added to adjacent channel configuration	3				
	CCDP with DP antenna		1.5 (3c)	1.9 (4c)	1.9 (4c)	2.3 (5c)	2.3 (6c)
	SP Non adjacent channels		NA	NA	NA	NA	NA
	CCDP with DP antenna Upgrade Ready		1.5 (3c)	1.9 (4c)	1.9 (4c)	2.3 (5c)	2.3 (6c)

6.6 All-Indoor Rack Types

Three types of racks can be used:

- 19” lab rack (open frame)
- 19” rack
- ETSI rack

The 19” rack is not commonly used in Ceragon configurations.

The 19” lab rack (open frame) – contains a subrack that is preassembled at the factory and then shipped. The customer can also use an existing rack and the subrack is installed separately at the site.

6.6.1 Examples of Rack Types

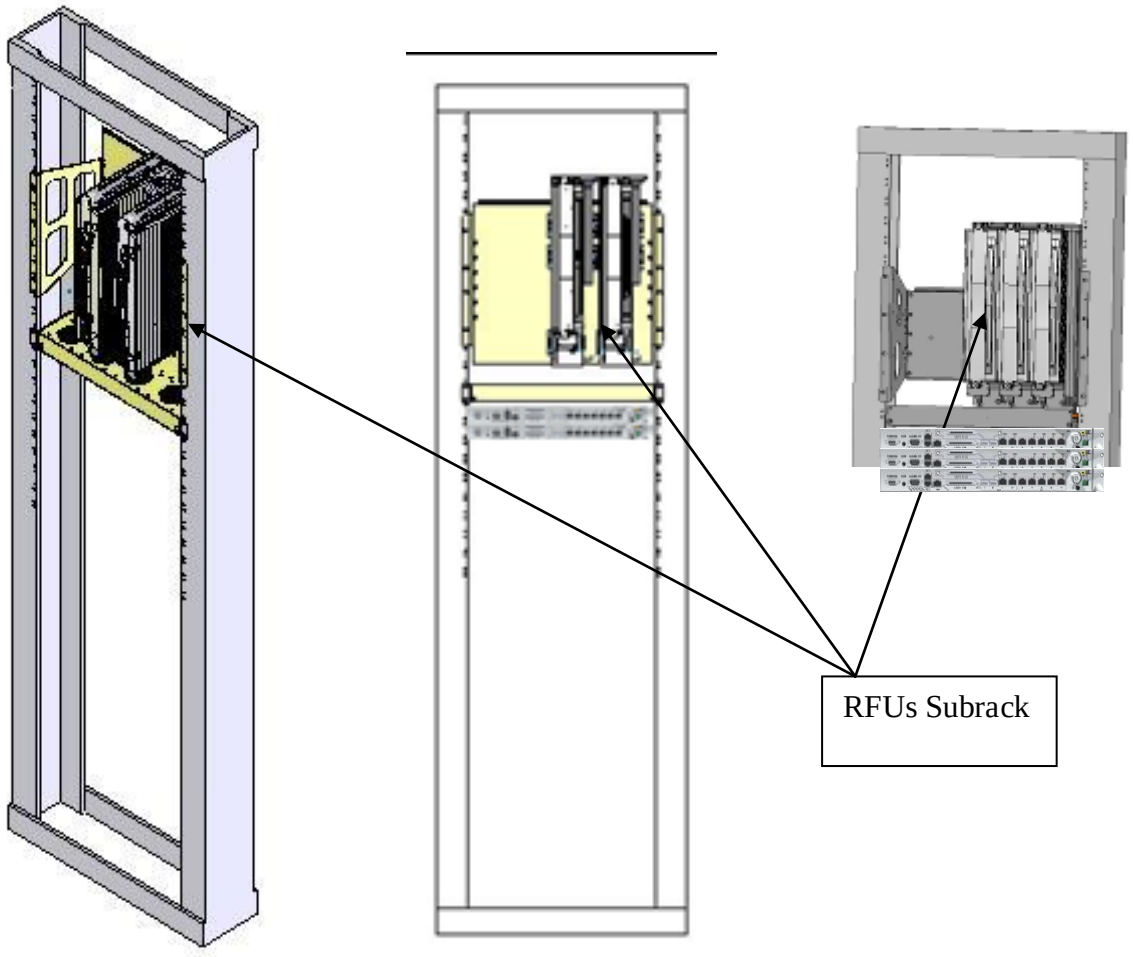


Figure 25 - 19” Lab Rack (Open Frame) Examples

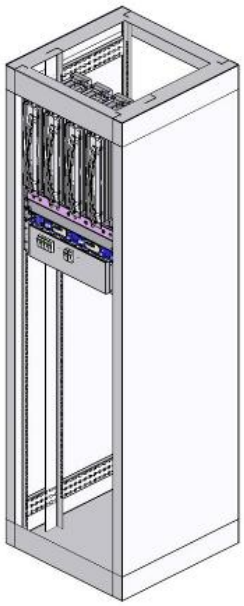


Figure 26 - 19" Rack Example

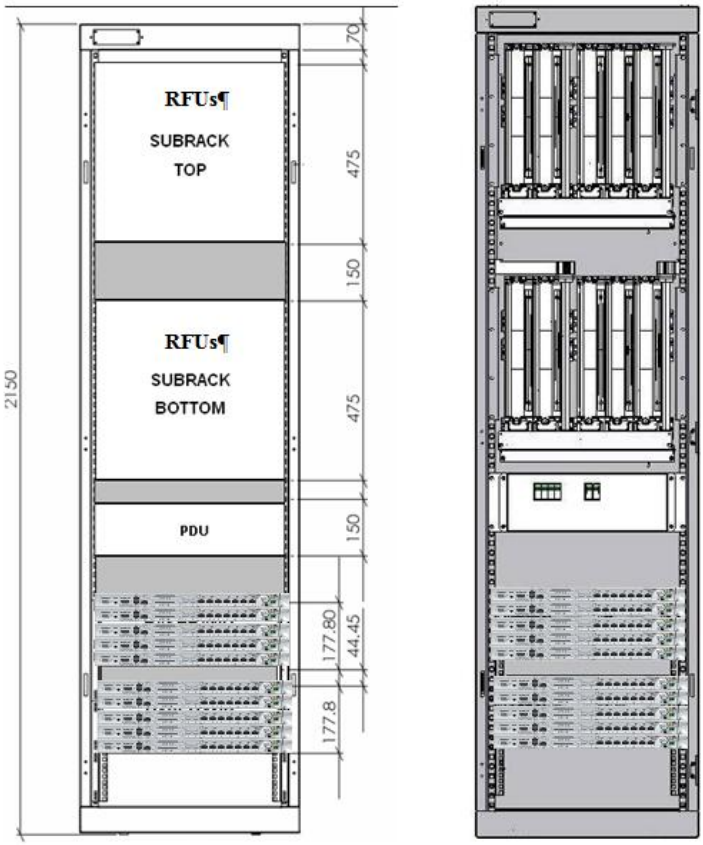


Figure 27 - ETSI Rack Example

6.7 All-Indoor Compact (Horizontal)

For minimal rack space usage, an All-Indoor configuration can be installed in horizontal position using the new OCB in a 19" rack or ETSI open rack/ frame rack. The New OCB is compliant with NEBS GR-1089-CORE, GR-63-CORE standards.

Note that this installation type and configuration does not require a fan tray.

This installation type is compatible with the following RFUs PN:

Non Space Diversity All-Indoor

1. **15HPA-1R-RFU-f**
2. **15HPA-2R-RFU-f**
3. **15HPA-1R-RFU-11w**

Figure 28 - 1500HP RFU All-Indoor 1Rx RF Unit

Figure 29 - 1500HP RFU All-Indoor Space Diversity

Figure 30 - 1500HP RFU All-Indoor 1Rx RF Unit, 11G 40MHz

Main configurations

- 1+0
- 1+0 East West
- 1+1
- 1+1 East West

The indoor units generally installed for these configurations are:

- IP-10
- 1500R / 1500P
- IP-MAX²

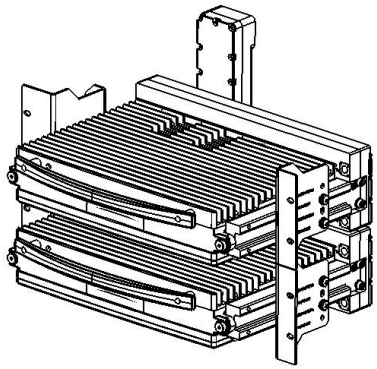


Figure 31 - 1+1 HSB Compact Front View

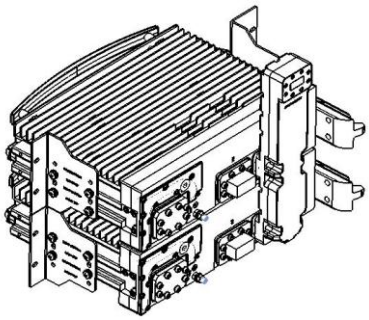
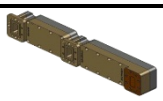
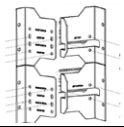
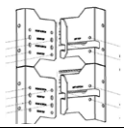


Figure 32 - 1+1 HSB Compact Rear View

6.7.1 All-Indoor Compact (Horizontal) Placements Components

The following table lists the components for All-Indoor compact placements:

Table 24 All-Indoor Compact Placement Components

Component Name	Marketing Model	Marketing Description	Picture
DCB	DCBf	DCB Diversity Block f GHz kit	
CPLR	OCB-CPLR-f	OCB Coupler f GHz	
SBend	OCB-SBend	OCB SBend Connection f GHz	
Rack Adapt	OCB 19” Rack Adapt	OCB-Pole Mount	
Rack Adapt	OCB ETSI Rack Adapt	OCB-Pole Mount	

Note: f= 6L, 6H, 7, 8, 11 GHz

6.7.2 All-Indoor Horizontal Placements Configurations

This section contains examples of horizontal placement configurations.

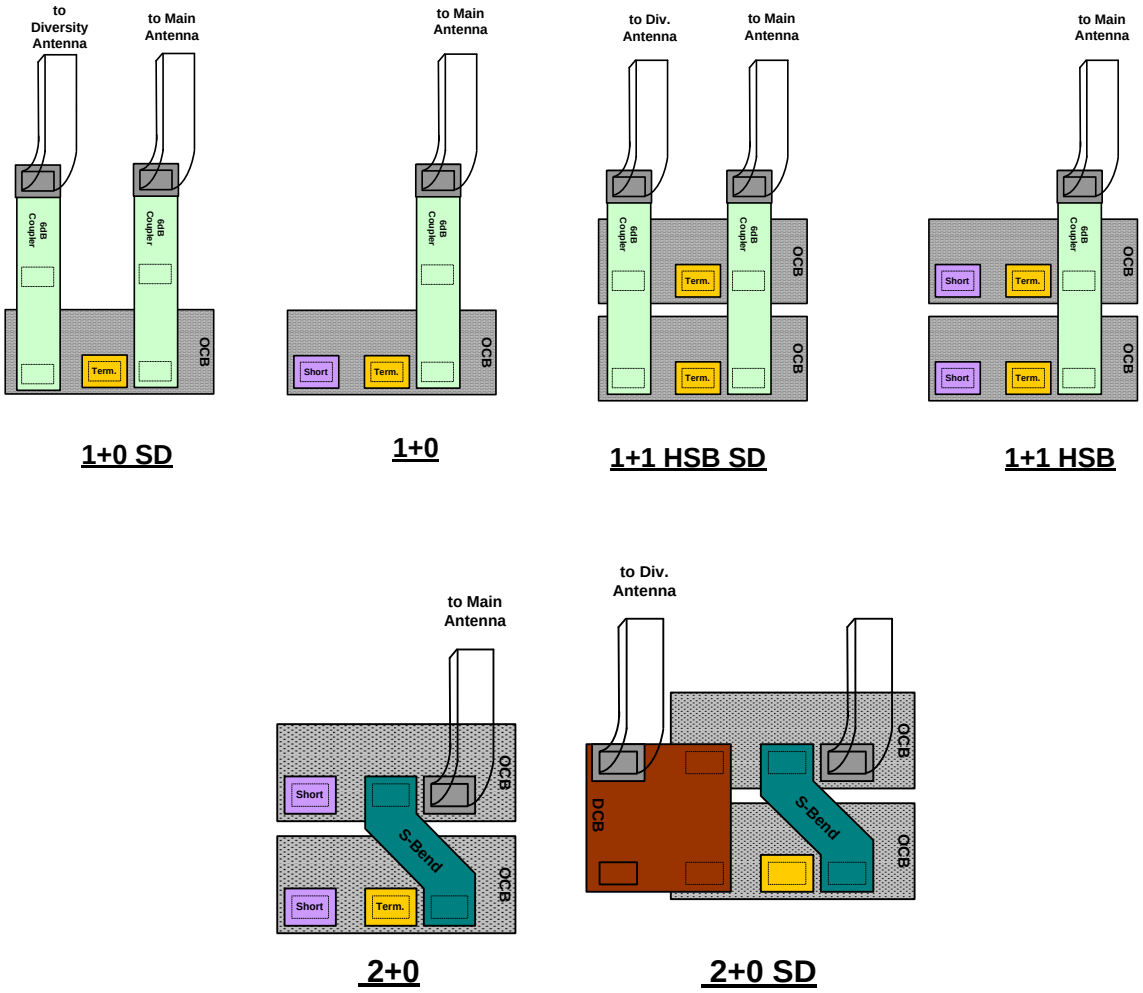


Table 25 All-Indoor Horizontal Placements Configurations

Configuration	OCB	DCB	S-bend	6dB CPLR	Term.	Short	Rack Adapt
1+0	1	0	0	0	1	1	1
1+0 SD	1	0	0	0	1	0	1
1+1 HSB	2	0	0	1	2	2	1
1+1 HSB SD	2	0	0	2	2	0	1
2+0	2	0	1	0	1	2	1
2+0 SD	2	1	1	0	1	0	1

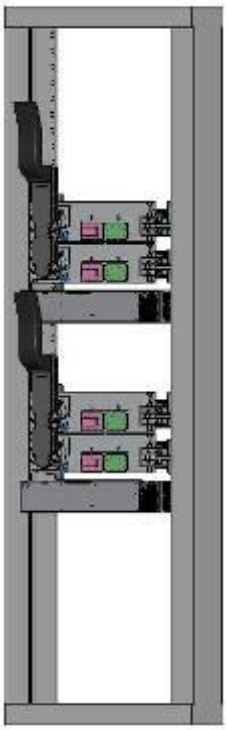


Figure 33 - 1+1 East West Compact Front View

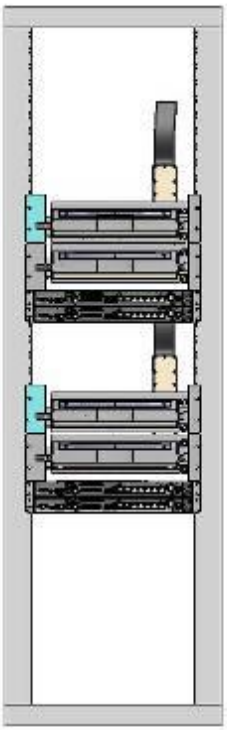


Figure 34 - 1+1 East West Compact Rear View

6.8 All-Indoor Compact Cascading With Other Radio Systems

6.8.1 Radio Cascading with New OCB

When there is a legacy foreign vendor and there is a requirement to add more capacity and cascade the existing radio system with Ceragon radio, there are multiple options:

The main configuration which is bee cascading is 1+1, the cascading options are:

1+1 SD: Option #1:

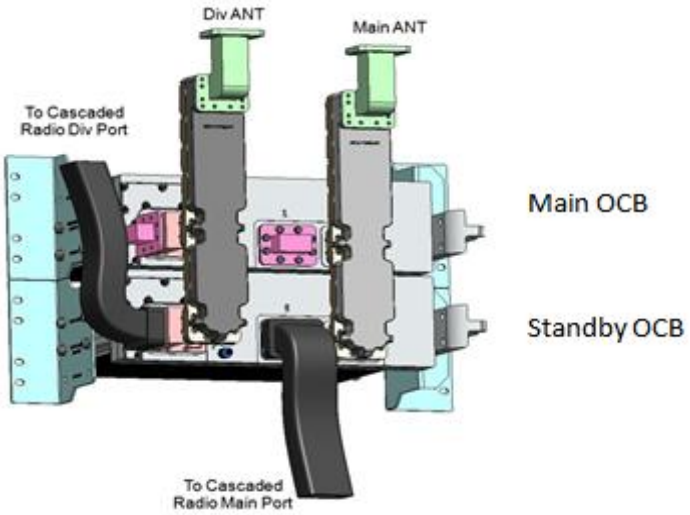


Figure 35 - 1+1 SD with New OCB Cascading with Other Vendor Radio --Rear View (Option 1)

The expected loss is:

Table 26 Radio Cascading Expected Loss (Option 1)

Port	Item Name	Expected Losses (dB)
Main OCB main Port	CPLR	1.6
SD Main OCB	CPLR + Circ	1.9
StandBy OCB secondary Port	CPLR	6
StandBy OCB secondary SD Port	Ext Circulator	6.5

1+1 SD: Option #2:

In this configuration the cascading is done via the Rx port and DCB module.

The DCB module is a dual circulators block.

This option has an advantage of lower loss in the diversity port, only 0.5dB on both diversity ports.

The OCB is mounted opposite, where the SD StandBy port has been rejected by the filters and DC.

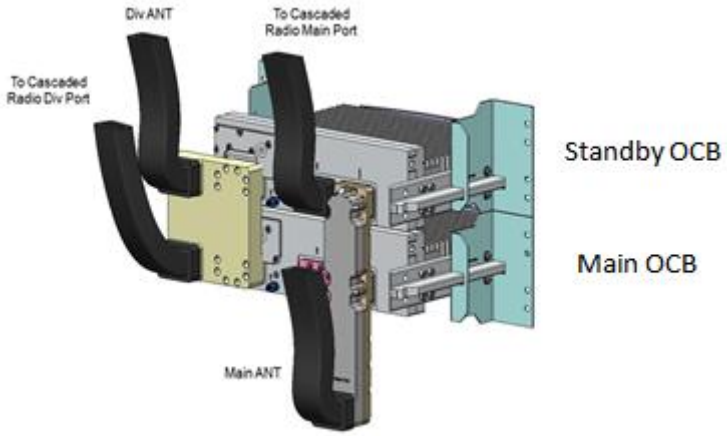


Figure 36 - 1+1 SD with New OCB Cascading with Other Vendor Radio -- Rear View (option #2)

The expected loss is:

Table 27 Cascading Expected Loss (Option 2)

Port	Item name	Expected losses (dB)
Main OCB Main Port	CPLR	1.6
SD Main OCB	DCB	0.5
StandBy OCB Secondary Port	CPLR	6
StandBy OCB Secondary SD Port	DCB and filters	10-15

For additional cascading configurations and info please contact Ceragon office.

6.9 PDU – Power Distribution Unit

The PDU distributes the power supply (-48V) from the main power input to the relevant indoor unit (3200T / IP-10 /1500R / IP-max² / 1500P).

The PDU is preassembled and wired in an ETSI rack and is provided separately, when required, for 19" lab rack. When ordering a 19" configuration, there are two rack assembly options:

19" lab rack provided separately

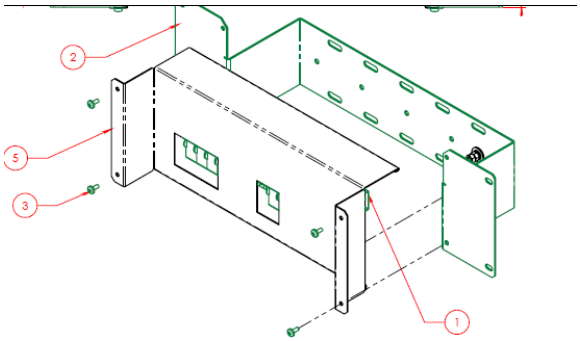
19" lab rack provided by the customer

For both options, a PDU for 19" can be provided when requested.

There are two types of PDUs

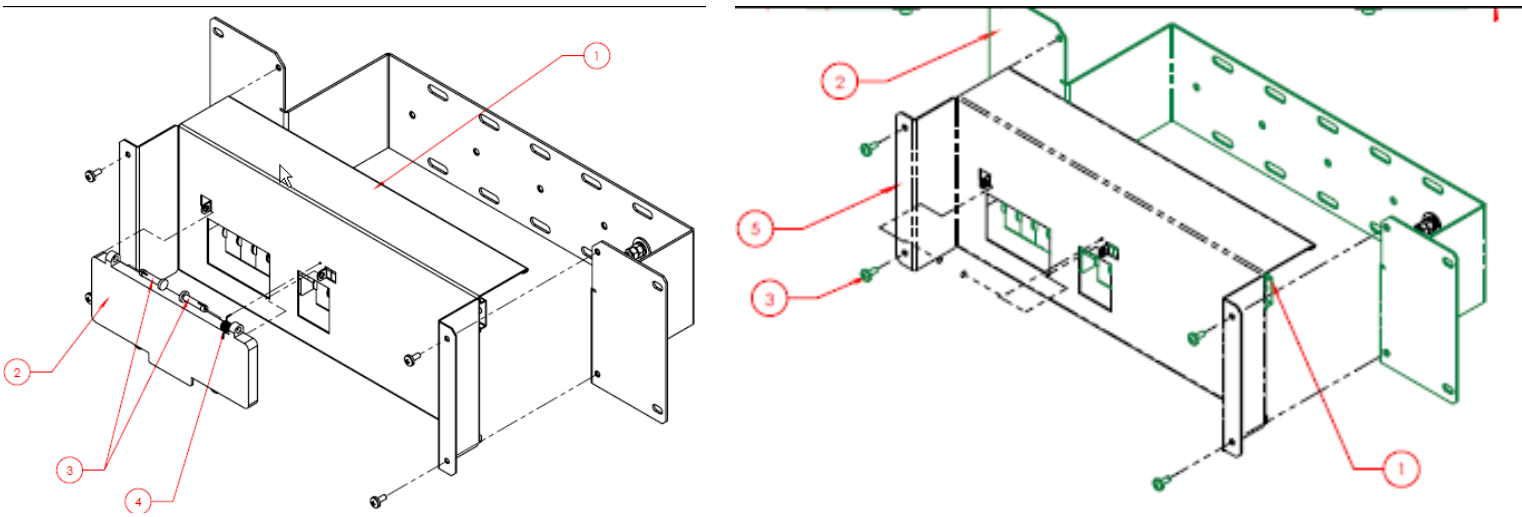
The default PDU which been assembling with each ETSI rack contain:

- Two main switches – one for each five IDU carriers
- Two FAN tray switches



1A. The default PDU which is assembled with ETSI rack has a special addition of a plastic cover.

For special cases, when PDU protection is required, a PDU with plastic protection cover can be provided. The PN for this PDU with protection cover is: 32T-PDU_CVR.



A PDU which distributes 10 x DC signals, the PDU type can be preassembled with an ETSI Rack and needs to be specially ordered because it is not the default PDU.

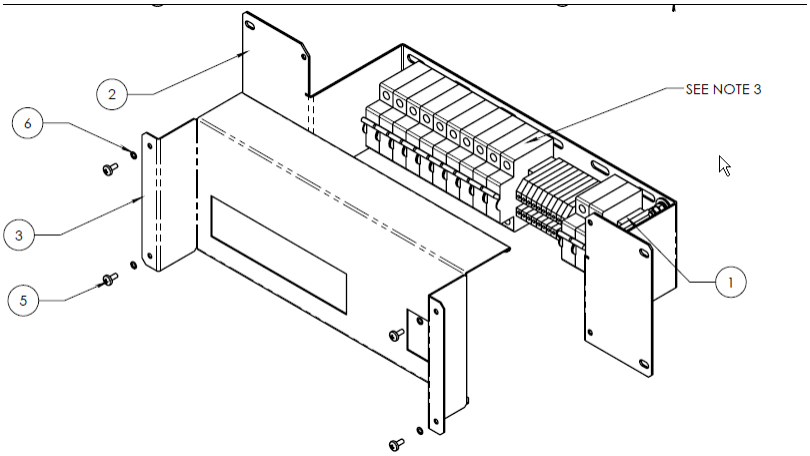


Figure 37 - PDU with 10 Switches PN: 32T-PDU10

7 Environmental Conditions Standard Compliance

The system is fully compliant with the following standards:

Operational

RFU: ETS 300 019-1-4 class 4.1, with an operating temperature range of: -50°C to 55°C

Storage and Transportation

Storage: ETS 300 019-2-2 class 1.2, with a high temperature limit of: +85°C

Transportation: ETS 300 019-2-2 class 2.2

EMC

The system's EMC and ESD requirements comply with the conditions specified in EN 300 385 [9] for class B.

Level 3 NEBS Compliance

The New OCB is compliant with NEBS GR-1089-CORE, GR-63-CORE standards.

The NEBS compliance is applicable just to configurations which use the New OCB, for split mount and All-Indoor horizontally mounted as shown below:

7.1 Safety Conditions Standard Compliance

The system complies with the UL 1950 and EN 60950 safety standards.

8 PolyView™ Network Management System for Wireless Backhaul Networks

PolyView™ is Ceragon's innovative, user-friendly Network Management System (NMS) designed for managing large scale wireless backhaul networks. Built on a powerful platform that offers users a comprehensive set of management functions at the network level PolyView provides enhanced system functionality and comprehensive network management.

Optimized for centralized operation and maintenance of a complete network, PolyView provides network operators and service providers with straightforward remote access to all NMS functions. PolyView's powerful and intuitive graphical interface enables users to easily manage and maintain the network, including functionality for managing faults, performance, end-to-end configuration, and system security.

8.1 Overview

It automatically searches for and selects optimal end-to-end primary and protection trails across complex topologies, enabling optimal utilization of available resources based on comprehensive trail definitions. Trails can be built either automatically based on user-defined trail endpoints, or manually, according to varying degrees of manual input, with full resource control.

The user-friendly TDM end-to-end trail GUI includes trail properties, current trail status information (alarms, active/StandBy, and PMs) and operational actions, and allows users to fully view TDM service status.

PolyView includes inherent redundancy support for main NOC sites and redundant sites with no single point of failure, including robust integration ability for northbound NMS platforms (disaster immunity and recovery).

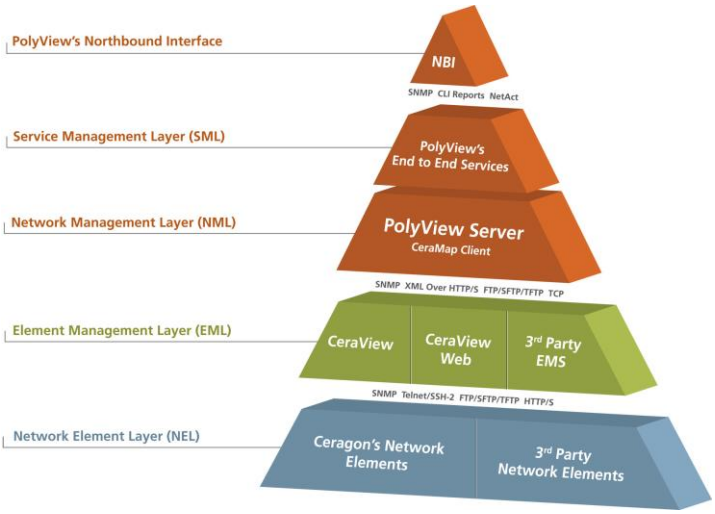
8.2 Flexible Multi-platform

PolyView server and CeraMap client can be easily and seamlessly installed on servers running Windows or UNIX supporting current and future network requirements. PolyView works homogenously with its internal standard centralized MySQL database with backup and restore features.

PolyView provides an easy to comprehend and easy-to-use network view with unique, up-to-date NMS features presented in a user-friendly GUI. PolyView provides a range of system functionalities, including an easy auto-discovery feature, intuitive configuration procedure, daily maintenance with advanced report interface, software download capabilities, and simple methods to investigate system faults.

PolyView supports the Ceragon FibeAir products such as FibeAir IP-10 family and FibeAir 1500R. It complements Ceragon's Element Management System (EMS) by providing management support at the network level. PolyView's unique user interface, CeraMap™, enables fast and easy design of multi-layered network element maps, and helps manage the network from the initial deployment stage through ongoing maintenance and configuration procedures.

8.3 End-to-End Provisioning



Quick and easy, end-to-end provisioning services are essential for any successful network management system. PolyView's point-and-click, comprehensive system engine is designed to help users define network services using a fast, easy and accurate interface. PolyView's Enhanced Trail Management functions enable users to create, delete, modify and manage TDM trails.

8.4 Full FCAPS Support

8.4.1 Fault Management

- Real-time alarm monitoring
- Graphic representation of alarms and severity levels including corrective action and probable cause
- Configurable alarm filtering
- Alarm history log - up to 365 days can be stored
- Alarm synchronization mechanism - including network elements and northbound interface

8.4.2 Configuration Management

- Point and click, end-to-end provisioning
- Configuration Broadcast to multiple network elements
- Scheduled network elements software download configuration upload and download
- Network Auto Discovery
- Automated management processes - offline reports, configuration backup, and application execution

8.4.3 Performance Management

- Personalized PM reports easily viewed on any available PM point on the network
- All performance history is maintained on 15-min and 24-hr resolution for up to 365 days
- TDM trails PM data
- PM collection – user-defined, centralized scheduled
- Network element polling – PMs, inventory, logs, and alarm synchronization

8.4.4 Security

- User-controlled levels and privileges
- User access control
- Secured channels and protocols
- Authentication and encryption
- NMS/NEs operation audits
- Remote authentication via an embedded RADIUS client

9 FibeAir 1500HP Specifications

9.1 RF Parameters

Table 28 RF Parameters

Frequency	6L GHz	6H GHz	7 GHz	8 GHz	11 GHz
Standards	ETSI/FCC	ETSI/FCC	ETSI	ETSI	ETSI/FCC
Operating Frequency Range (GHz)	5.925-6.425	6.425-7.1	7.1-7.9	7.725-8.5	10.7-11.7
RF Channel Spacing (MHz)	10/28/29.65/30	10/28/29.65/40	28/29.65	28/29.65/40	10/28/30/40
ATPC (dB)	20 dB dynamic range				
Capacity	10 Mbps up to 260/370 Mbps per carrier , or STM-1/OC3, DS3				
Modulation Type	QPSK, 16, 32, 64, 128, 256 QAM				
System Configurations	Unprotected: 1+0 to 9+0 Protected: 1+1; 2+2 Hot StandBy, N+1 Frequency Diversity up to 9+1 Co-channel operation with XPIC (CCDP) All configurations are available with Space Diversity				

9.2 Mechanical/Electrical

Table 29 Mechanical/Electrical Specifications

Transceiver (RFU) Dimensions	Height: 490 mm (19”) Width: 144 mm (6”) Depth: 280 mm (11”) Weight: 7 kg (15 lbs) (excluding Branching)
OCB Branching **(Split Mount and Compact All-Indoor)**	Height: 420 mm (19”) Width: 110 mm (6”) Depth: 380 mm (11”) Weight: 7 kg (15 lbs) (excluding Branching)
IDU-RFU Connection	Coaxial cable RG-223 (100 m/300 ft), Belden 9914/RG-8 (300 m/1000 ft) or equivalent, N-type connectors (male)
RFU Power Consumption	Split Mount (29dBm): 80W All indoor (32dBm) : 100W
Indoor Temperature Range	-5 C to +45 C
Outdoor Temperature Range	-35 C to +55 C
Power Supply	-40.5 to -72 VDC

9.3 Network Management

Table 30 Network Management Specifications

Type	SNMP, in compliance with RFC 1213, RFC 1595 (SONET MIB)
Local or Remote NMS Station	CeraView and PolyView with advanced GUI for Windows 98/2000/XP/NT or UNIX, integrated with HP OpenView
NMS Interface	Ethernet bridge 10Base-T, RS-232 (PPP, SLIP), built-in Ethernet hub
Local Configuration and Monitoring	Standard ASCII terminal, serial RS-232
In-Band Management	DCCr, DCCm, media-specific, proprietary
TMN	Ceragon NMS functions are in accordance with ITU-T recommendations for TMN
Performance Monitoring	Integral with onboard memory per ITU-T G.828

9.4 Transmit Power

Table 31 Transmit Power Specifications

Transmit Power (dBm)	Split Mount		All-Indoor	
Modulation	**6 to 8GHz**	**11GHz**	**6 to 8GHz**	**11GHz**
QPSK	30	27	33	30
8 PSK	30	27	33	30
16 QAM	30	27	33	30
32 QAM	30	26	33	29
64 QAM	29	26	32	29
128 QAM	29	26	32	29
256 QAM	27	24	30	27

10 Appendix A - Channel Frequencies (6-11 GHz)

Note: For additional frequency plans not included in this appendix, contact your Ceragon representative.

Table 34 Channel Frequencies (6GHz)

		Low Band		High Band	
T/R Sep.	**Block**	**Ch.**	**Center Freq. F0**	**Ch.**	**Center Freq. F0**
240	A	L01	5955.00	H01	6195.00
		L02	5995.00	H02	6235.00
		L03	6035.00	H03	6275.00
		L04	6075.00	H04	6315.00
		L05	6115.00	H05	6355.00
		L06	6155.00	H06	6395.00
252.04	A	L01	5945.20	H01	6197.24
		L02	5974.85	H02	6226.89
		L03	6004.50	H03	6256.54
		L04	6034.15	H04	6286.19
		L05	6063.80	H05	6315.84
		L06	6093.45	H06	6345.49
		L07	6123.10	H07	6375.14
		L08	6152.75	H08	6404.79
252.04 ISBN 0-478-24297-2 (N. Zealand)	B	L01	5930.375	H01	6182.415
		L02	5960.025	H02	6212.065
		L03	5989.675	H03	6241.715
		L04	6019.325	H04	6271.365
		L05	6048.975	H05	6301.015
		L06	6078.625	H06	6330.665
		L07	6108.275	H07	6360.315
		L08	6137.925	H08	6389.965
252.04 ISBN 0-478-24297-2 (N. Zealand)	C	L01	5939	H01	6191
		L02	5967	H02	6219
		L03	5995	H03	6247
		L04	6023	H04	6275
		L05	6051	H05	6303
		L06	6079	H06	6331
		L07	6107	H07	6359
		L08	6135	H08	6387
260	A	L01	5955.00	H01	6215.00
		L02	6015.00	H02	6275.00
		L03	6075.00	H03	6335.00
		L04	6135.00	H04	6395.00

		Low Band		High Band	
T/R Sep.	**Block**	**Ch.**	**Center Freq. F0**	**Ch.**	**Center Freq. F0**
266	A	L01	5941.00	H01	6207.00
		L02	5969.00	H02	6235.00
		L03	5997.00	H03	6263.00
		L04	6025.00	H04	6291.00
		L05	6053.00	H05	6319.00
		L06	6081.00	H06	6347.00
		L07	6109.00	H07	6375.00
		L08	6137.00	H08	6403.00
300	A	L02	5987.50	H02	6287.50
		L03	6077.50	H03	6377.50

10.1 6 GHz Filters

Table 35 Channel Frequencies (6 GHz Filters)

			Low Band		High Band	
	T/R Sep.	**Block**	**Ch.**	**Center Freq. F0**	**Ch.**	**Center Freq. F0**
FCC 101.147 (k7)	170.00	A	L1-3	6555.00	H1-3	6725.00
	160.00	A	L4-6	6595.00	H4-6	6755.00
			L5-7	6605.00	H5-7	6765.00
			L6-8	6615.00	H6-8	6775.00
			L7-9	6625.00	H7-9	6785.00
			L8-10	6635.00	H8-10	6795.00
			L9-11	6645.00	H9-11	6805.00
			L10-12	6655.00	H10-12	6815.00
			L11-13	6665.00	H11-13	6825.00
			L12-14	6675.00	H12-14	6835.00
			L13-15	6685.00	H13-15	6845.00
			L14-16	6695.00	H14-16	6855.00
	340	A	L01	6460.00	H01	6800.00
			L02	6500.00	H02	6840.00
			L03	6540.00	H03	6880.00
			L04	6580.00	H04	6920.00
			L05	6620.00	H05	6960.00
			L06	6660.00	H06	7000.00
			L07	6700.00	H07	7040.00
			L08	6740.00	H08	7080.00
ISBN 0-478-24297-2 (N .Zealand)	340	B	L01	6440.00	H01	6780.00
			L02	6480.00	H02	6820.00
			L03	6520.00	H03	6860.00
			L04	6560.00	H04	6900.00
			L05	6600.00	H05	6940.00
			L06	6640.00	H06	6980.00
			L07	6680.00	H07	7020.00
			L08	6720.00	H08	7060.00
	340	C	L01	6708.00	H01	7048.00
			L02	6736.00	H02	7076.00

			Low Band		High Band	
	T/R Sep.	**Block**	**Ch.**	**Center Freq. F0**	**Ch.**	**Center Freq. F0**
SRSP 306-4	340	D	L01	6445.00	H01	6785
			L02	6475.00	H02	6815
			L03	6505.00	H03	6845
			L04	6535.00	H04	6875
			L05	6565.00	H05	6905
	500	A	L01	6440	H01	6940
			L02	6480	H02	6980
			L03	6520	H03	7020
			L04	6560	H04	7060

10.2 7 GHz Filters

Table 36 Channel Frequencies (7 GHz Filters)

		Low Band		High Band	
T/R Sep.	**Block**	**Ch.**	**Center Freq. F0**	**Ch.**	**Center Freq. F0**
150	A	L01	7440.00	H01	7590.00
		L02	7470.00	H02	7620.00
		L03	7500.00	H03	7650.00
		L04	7530.00	H04	7680.00
		L05	7560.00	H05	7710.00
154	A	L01	7442	H01	7596
		L02	7470	H02	7624
		L03	7498	H03	7652
		L04	7526	H04	7680
		L05	7554	H05	7708
154	B	L01	7456	H01	7610
		L02	7484	H02	7638
		L03	7512	H03	7666
		L04	7540	H04	7694
		L05	7568	H05	7722
154	C	L01	7142	H01	7296
		L02	7170	H02	7324
		L03	7198	H03	7352
		L04	7226	H04	7380
		L05	7254	H05	7408
161	A	L01	7138.5	H01	7299.5
		L02	7166.5	H02	7327.5
		L03	7194.5	H03	7355.5
		L04	7222.5	H04	7383.5
		L05	7250.5	H05	7411.5
		L11	7145.5	H11	7306.5
		L12	7173.5	H12	7334.5
		L13	7201.5	H13	7362.5
		L14	7229.5	H14	7390.5
		L21	7152.5	H21	7313.5
		L22	7180.5	H22	7341.5
		L23	7208.5	H23	7369.5
		L24	7236.5	H24	7397.5
		L31	7159.5	H31	7320.5
		L32	7187.5	H32	7348.5

		Low Band		High Band	
T/R Sep.	**Block**	**Ch.**	**Center Freq. F0**	**Ch.**	**Center Freq. F0**
		L33	7215.5	H33	7376.5
		L34	7243.5	H34	7404.5
161	B	L01	7263.5	H01	7424.5
		L02	7291.5	H02	7452.5
		L03	7319.5	H03	7480.5
		L04	7347.5	H04	7508.5
		L05	7375.5	H05	7536.5
		L11	7270.5	H11	7431.5
		L12	7298.5	H12	7459.5
		L13	7326.5	H13	7487.5
		L14	7354.5	H14	7515.5
		L21	7277.5	H21	7438.5
		L22	7305.5	H22	7466.5
		L23	7333.5	H23	7494.5
		L24	7361.5	H24	7522.5
		L31	7284.5	H31	7445.5
		L32	7312.5	H32	7473.5
		L33	7340.5	H33	7501.5
		L34	7368.5	H34	7529.5
161	C	L01	7438.5	H01	7599.5
		L02	7466.5	H02	7627.5
		L03	7494.5	H03	7655.5
		L04	7522.5	H04	7683.5
		L05	7550.5	H05	7711.5
		L11	7445.5	H11	7606.5
		L12	7473.5	H12	7634.5
		L13	7501.5	H13	7662.5
		L14	7529.5	H14	7690.5
		L21	7452.5	H21	7613.5
		L22	7480.5	H22	7641.5
		L23	7508.5	H23	7669.5
		L24	7536.5	H24	7697.5
		L31	7459.5	H31	7620.5
		L32	7487.5	H32	7648.5
		L33	7515.5	H33	7676.5
		L34	7543.5	H34	7704.5

		Low Band		High Band	
T/R Sep.	**Block**	**Ch.**	**Center Freq. F0**	**Ch.**	**Center Freq. F0**
161	D	L01	7563.5	H01	7724.5
		L02	7591.5	H02	7752.5
		L03	7619.5	H03	7780.5
		L04	7647.5	H04	7808.5
		L05	7675.5	H05	7836.5
		L11	7570.5	H11	7731.5
		L12	7598.5	H12	7759.5
		L13	7626.5	H13	7787.5
		L14	7654.5	H14	7815.5
		L21	7577.5	H21	7738.5
		L22	7605.5	H22	7766.5
		L23	7633.5	H23	7794.5
		L24	7661.5	H24	7822.5
		L31	7584.5	H31	7745.5
		L32	7612.5	H32	7773.5
		L33	7640.5	H33	7801.5
		L34	7668.5	H34	7829.5
161	E	L01	7300	H01	7461
		L02	7416	H02	7577
161	F	L01	7128	H01	7289
		L02	7177	H02	7338
		L03	7226	H03	7387
		L04	7428	H04	7589
		L05	7477	H05	7638
		L06	7526	H06	7687
161	G	L01	7267	H01	7428
		L02	7302	H02	7463
		L03	7323	H03	7484
		L04	7337	H04	7498
		L05	7365	H05	7526
		L06	7372	H06	7533
161	H	L01	7295	H01	7456
ISBN 0-478-24297-2 (N. Zealand)		L02	7463	H02	7624
		L03	7491	H03	7652
		L04	7519	H04	7680
		L05	7547	H05	7708
161	J	L01	7428	H01	7589
		L02	7456	H02	7617
		L03	7484	H03	7645
		L04	7512	H04	7673

		Low Band		High Band	
T/R Sep.	**Block**	**Ch.**	**Center Freq. F0**	**Ch.**	**Center Freq. F0**
		L05	7540	H05	7701
161	K	L01	7498	H01	7659
		L02	7526	H02	7687
		L03	7554	H03	7715
				H01	7603
				H02	7631
				H03	7659
161	N	L01	7379	H01	7540
		L02	7386	H02	7547
161	O	L01	7449	H01	7610
		L02	7533	H02	7694
161	P	L01	7135	H01	7296
		L02	7163	H02	7324
		L03	7191	H03	7352
		L04	7219	H04	7380
		L05	7247	H05	7408
161	R	L01	7316	H01	7477
		L02	7379	H02	7540
161	S	L01	7124.5	H01	7285.5
		L02	7126	H02	7287
		L03	7149	H03	7310
		L04	7182	H04	7343
161	T	L01	7281	H01	7442
		L02	7344	H02	7505
		L03	7351	H03	7512
161 Australia	U	L01	7432	H01	7593
		L02	7446	H02	7607
		L03	7460	H03	7621
		L04	7474	H04	7635
		L05	7488	H05	7649
		L06	7502	H06	7663
		L07	7516	H07	7677
		L08	7530	H08	7691
		L09	7544	H09	7705
		L10	7558	H10	7719
		L01-02	7439	H01-02	7600
		L03-04	7467	H03-04	7628
		L05-06	7495	H05-06	7656
		L07-08	7523	H07-08	7684
		L09-10	7551	H09-10	7712

		Low Band		High Band	
T/R Sep.	**Block**	**Ch.**	**Center Freq. F0**	**Ch.**	**Center Freq. F0**
168	A	L01	7121	H01	7289
		L02	7149	H02	7317
		L03	7177	H03	7345
		L04	7205	H04	7373
		L05	7233	H05	7401
168	B	L01	7457	H01	7625
		L02	7485	H02	7653
		L03	7513	H03	7681
		L04	7541	H04	7709
		L05	7569	H05	7737
168	C	L01	7428	H01	7596
		L02	7456	H02	7624
		L03	7484	H03	7652
		L04	7512	H04	7680
		L05	7540	H05	7708
175	A	L01	7140	H01	7315
182	A	L01	7428	H01	7610
		L02	7456	H02	7638
		L03	7484	H03	7666
		L04	7512	H04	7694
		L05	7540	H05	7722
185	A	L01	7173.5	H01	7358.5
196	A	L01	7121	H01	7317
		L02	7149	H02	7345
		L03	7177	H03	7373
		L04	7205	H04	7401
		L05	7233	H05	7429
245	A	L01	7442	H01	7687
		L02	7470	H02	7715
		L03	7498	H03	7743
		L04	7526	H04	7771
		L05	7554	H05	7799
		L06	7582	H06	7827
		L07	7610	H07	7855
		L08	7638	H08	7883
270	A	L01	7155	H01	7425

		Low Band		High Band	
T/R Sep.	**Block**	**Ch.**	**Center Freq. F0**	**Ch.**	**Center Freq. F0**
300	A	L01	7150	H01	7450
		L02	7180	H02	7480
		L03	7210	H03	7510
		L04	7240	H04	7540
		L05	7270	H05	7570
		L06	7300	H06	7600
		L07	7330	H07	7630
		L08	7360	H08	7660
		L09	7390	H09	7690

10.3 8 GHz Filters

Table 37 Channel Frequencies (8 GHz Filters)

		Low Band		High Band	
T/R Sep.	**Block**	**Ch.**	**Center Freq. F0**	**Ch.**	**Center Freq. F0**
119	A	L01	8293	H01	8412
		L02	8307	H02	8426
		L03	8321	H03	8440
		L04	8335	H04	8454
		L05	8349	H05	8468
		L06	8363	H06	8482
119	B	L01	8286	H01	8405
		L02	8293	H02	8412
		L03	8300	H03	8419
For F0=7597				F Reject	
154	A	L01	8217	H01	8371
		L02	8245	H02	8399
		L03	8273	H03	8427
		L04	8301	H04	8455
		L05	8329	H05	8483
200	A	L01	7917.5	H01	8117.5
208	A	L01	8064	H01	8272
		L02	8092	H02	8300
		L03	8120	H03	8328
		L04	8148	H04	8356
		L05	8176	H05	8384
		L06	8204	H06	8412
		L07	8232	H07	8440
252.02	A	L01	7990	L01	8242.02
		L02	8020	L02	8272.02
266	A	L01	7926	H01	8192
		L02	7954	H02	8220
		L03	7982	H03	8248
		L04	8010	H04	8276
		L05	8038	H05	8304
		L06	8066	H06	8332
		L07	8094	H07	8360
		L08	8122	H08	8388
266	B	L01	7940	H01	8206
		L02	7996	H02	8262

		Low Band		High Band	
T/R Sep.	**Block**	**Ch.**	**Center Freq. F0**	**Ch.**	**Center Freq. F0**
266	C	L01	8052	H01	8318
		L02	8080	H02	8346
		L03	8108	H03	8374
266	D	L01	8024.0	H01	8290.0
	E	L01	8029.0	H01	8295.0
For F0 = 7710				F Reject	
300 Canada SRSP-307.7	A	L01	7740	H01	8040
		L02	7770	H02	8070
		L03	7800	H03	8100
		L04	7830	H04	8130
		L05	7860	H05	8160
		L06	7890	H06	8190
		L07	7920	H07	8220
		L08	7950	H08	8250
310	A	L01	7745	H01	8055
		L02	7785	H02	8095
		L03	7825	H03	8135
		L04	7865	H04	8175
		L05	7905	H05	8215
		L06	7945	H06	8255
310	B	L01	8059	H01	8369
		L02	8087	H02	8397
		L03	8115	H03	8425
		L04	8143	H04	8453
		L05	8171	H05	8481
F0 = 8200 MHz					
310 ECC (02)06 (CEPT)	C	L01	7919	H01	8229
		L02	7947	H02	8257
		L03	7975	H03	8285
		L04	8003	H04	8313
		L05	8031	H05	8341
		L06	8059	H06	8369
		L07	8087	H07	8397
		L08	8115	H08	8425
		L09	8143	H09	8453
		L10	8171	H10	8481

		Low Band		High Band	
T/R Sep.	**Block**	**Ch.**	**Center Freq. F0**	**Ch.**	**Center Freq. F0**
	A	L01	7747.70	H01	8059.02
311.32	B	L02	7777.35	H02	8088.67
		L03	7807.00	H03	8118.32
		L04	7836.65	H04	8147.97
		L05	7866.30	H05	8177.62
		L06	7895.95	H06	8207.27
		L07	7925.60	H07	8236.92
		L08	7955.25	H08	8266.57
311.32		L01	7732.875	H01	8044.195
		L02	7762.525	H02	8073.845
		L03	7792.175	H03	8103.495
		L04	7821.825	H04	8133.145
		L05	7851.475	H05	8162.795
		L06	7881.125	H06	8192.445
		L07	7910.775	H07	8222.095
		L08	7940.425	H08	8251.745
311.32	C	L01	7728.680	H01	8040.000
	D	L01	7784.680	H01	8096.000
	E	L01	7795.680	H01	8107.000
	F	L01	7815.680	H01	8127.000
	G	L01	7818.680	H01	8130.000
	H	L01	7823.680	H01	8135.000
	I	L01	7844.180	H01	8155.500
	J	L01	7858.000	H01	8169.320
311.32 ITU-R 386-6 [1]	K	L01	7740.5	H01	8051.8
		L02	7768.5	H02	8079.8
		L03	7796.5	H03	8107.8
		L04	7824.5	H04	8135.8
		L05	7852.5	H05	8163.8
		L06	7880.5	H06	8191.8
		L07	7908.5	H07	8219.8
		L08	7936.5	H08	8247.8
530	A	L01	7760	H01	8290

10.4 11 GHz Filters

Table 38 Channel Frequencies (11 GHz Filters)

		Low Band		High Band	
T/R Sep.	**Block**	**Ch.**	**Center Freq. F0**	**Ch.**	**Center Freq. F0**
168	A	L01	10322	H01	10490
		L02	10350	H02	10518
		L03	10378	H03	10546
		L04	10406	H04	10574
		L05	10434	H05	10602
		L06	10462	H06	10630
530	A	L01	10715	H01	11245
		L02	10755	H02	11285
		L03	10795	H03	11325
		L04	10835	H04	11365
		L05	10875	H05	11405
		L06	10915	H06	11445
		L07	10955	H07	11485
		L10	11075	H10	11605
		L11	11115	H11	11645
		L12	11155	H12	11685
530	CS	L01	10775	H01	11305
		L02	10725	H02	11255
		L03	11125	H03	11655
490	A	L01	10735	H01	11225
		L02	10775	H02	11265
		L03	10815	H03	11305
		L04	10855	H04	11345
		L07	10975	H07	11465
		L08	11015	H08	11505
		L09	11055	H09	11545
		L10	11095	H10	11585
		L11	11135	H11	11625
		L12	11175	H12	11665

		Low Band		High Band	
T/R Sep.	**Block**	**Ch.**	**Center Freq. F0**	**Ch.**	**Center Freq. F0**
490	B	L01	10715	H01	11205
		L02	10755	H02	11245
		L03	10795	H03	11285
		L04	10835	H04	11325
		L05	10875	H05	11365
		L06	10915	H06	11405
		L07	10955	H07	11445
		L08	10995	H08	11485
		L11	11115	H11	11605
500	CS	L02	11125	H02	11625
520	A	L01	10730	H01	11250
		L02	10790	H02	11310
		L03	10850	H03	11370
		L04	10910	H04	11430
		L05	10970	H05	11490
		L06	11030	H06	11550
500	A	L01	10715	H01	11215
490	C	L02	10755	H02	11245
		L03	10795	H03	11285
		L04	10835	H04	11325
		L05	10875	H05	11365
		L06	10915	H06	11405
		L07	10955	H07	11445
		L08	10995	H08	11485
		L11	11115	H11	11605
		L12	11155	H12	11645

		Low Band		High Band	
T/R Sep.	**Block**	**Ch.**	**Center Freq. F0**	**Ch.**	**Center Freq. F0**
490 SRSP 310-7	D	L01	10725	L01	11215
		L02	10755	L02	11245
		L03	10785	L03	11275
		L04	10815	L04	11305
		L05	10845	L05	11335
		L06	10875	L06	11365
		L07	10905	L07	11395
		L08	10935	L08	11425
		L09	10965	L09	11455
		L10	10995	L10	11485
		L11	11025	L11	11515
		L12	11055	L12	11545
		L13	11085	L13	11575
		L14	11115	L14	11605
		L15	11145	L15	11635
		L16	11175	L16	11665
500	A	L13	11185	H13	11685
530	A	L01	10715	H01	11245
		L02	10755	H02	11285
		L03	10795	H03	11325
		L04	10835	H04	11365
		L05	10875	H05	11405
		L06	10915	H06	11445
		L07	10955	H07	11485
		L08	10995	H08	11525
		L09	11035	H09	11565
		L10	11075	H10	11605
		L11	11115	H11	11645
		L12	11155	H12	11685
530	CS	L01	10775	H01	11305
		L02	10725	H02	11255
		L03	11125	H03	11655

		Low Band		High Band	
T/R Sep.	**Block**	**Ch.**	**Center Freq. F0**	**Ch.**	**Center Freq. F0**
490	A	L01	10735	H01	11225
		L02	10775	H02	11265
		L03	10815	H03	11305
		L04	10855	H04	11345
		L05	10895	H05	11385
		L06	10935	H06	11425
		L07	10975	H07	11465
		L08	11015	H08	11505
		L09	11055	H09	11545
		L10	11095	H10	11585
		L11	11135	H11	11625
		L12	11175	H12	11665
F0= 11200 MHz				Australia-Interleaved CEPT/ 12-6 E	
490	B	L01	10715	H01	11205
		L02	10755	H02	11245
		L03	10795	H03	11285
		L04	10835	H04	11325
		L05	10875	H05	11365
		L06	10915	H06	11405
		L07	10955	H07	11445
		L08	10995	H08	11485
		L09	11035	H09	11525
		L10	11075	H10	11565
		L11	11115	H11	11605
500	CS	L02	11125	H02	11625
520	A	L01	10730	H01	11250
		L02	10790	H02	11310
		L03	10850	H03	11370
		L04	10910	H04	11430
		L05	10970	H05	11490
		L06	11030	H06	11550
		L07	11090	H07	11610
		L08	11150	H08	11670

		Low Band		High Band	
T/R Sep.	**Block**	**Ch.**	**Center Freq. F0**	**Ch.**	**Center Freq. F0**
F0= 10715 MHz				FCC 101.147 [6]	
500	A	L01	10715	H01	11215
490	C	L02	10755	H02	11245
		L03	10795	H03	11285
		L04	10835	H04	11325
		L05	10875	H05	11365
		L06	10915	H06	11405
		L07	10955	H07	11445
		L08	10995	H08	11485
		L09	11035	H09	11525
		L10	11075	H10	11565
		L11	11115	H11	11605
		L12	11155	H12	11645
SRSP 310-7					
490	D	L01	10725	L01	11215
		L02	10755	L02	11245
		L03	10785	L03	11275
		L04	10815	L04	11305
		L05	10845	L05	11335
		L06	10875	L06	11365
		L07	10905	L07	11395
		L08	10935	L08	11425
		L09	10965	L09	11455
		L10	10995	L10	11485
		L11	11025	L11	11515
		L12	11055	L12	11545
		L13	11085	L13	11575
		L14	11115	L14	11605
		L15	11145	L15	11635
		L16	11175	L16	11665
FCC 101.147 [6]					
500	A	L13	11185	H13	11685