



PRELIMINARY

Alcatel-Lucent 9500

MICROWAVE PACKET RADIO for ANSI | RELEASE 4.1.0

Indoor: MSS-8 / MSS-4 / MSS-1 / MPT-HL

Outdoor: ODU300 / MPT-HC / MPT-XP / 9558HC

Product Information

3EM23952AL Edition 0.1

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THIS PRODUCT COMPLIES WITH D.H.H.S. RADIATION PERFORMANCE STANDARDS 21 CFR, 1040.10, FOR A CLASS 1 LASER PRODUCT.

DANGER

Invisible laser radiation is present when the optic connector is open. AVOID DIRECT EXPOSURE TO BEAM.

WARNING

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case users will be required to correct the interference at their own expense.

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FCC part 15 subpart B

1. 9500 MPR-A unlicensed radio

1.1 The JF6-9558H/6933B-9500MPT (MPT-HL) unlicensed radio provides fast deployment of service with microwave radio. No license and small antennas (no FCC and Industry Canada requirements) allow immediate turn-up. After the license is received, the unlicensed MPT-HL radio can be easily converted to the lower 6 GHz licensed band.

1.2 The JF6-9558HC/6933B-9558HC (9558HC) unlicensed radio provides fast deployment of service with microwave radio. No license and small antennas (no FCC and Industry Canada requirements) allow immediate turn-up. The 9558HC unlicensed radio can not be upgraded to licensed operation.

1.3 The JF6-9558H/6933B-9500MPT and JF6-9558HC/6933B-9558HC unlicensed radio operates in the 5725-5850 Information, Scientific, and Medical (ISM) band in accordance with FCC Part 15.247 and IC RSS-210. This unlicensed radio, although operating in the same band as a spread spectrum radio, operates using narrower bandwidths than spread spectrum.

1.4 The 9558HC 5.8 Unlicensed band (JF6-9558HC/6933B-9558HC) is currently being certified and is not available for quote, sale, or deployment.

FCC Class B compliance statement

1.5 The JF6-9558H/6933B-9500MPT and JF6-9558HC/6933B-9558HC unlicensed radio have been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules and IC RSS-210. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Class B requirements

1.6 This device complies with part 15 of the FCC Rules and IC RSS-210. Operation is subject to the following three conditions: (1) this device may not cause harmful interference. (2) This device must accept any interference received, including interference that may cause undesired operation. (3) This device must be professionally installed.

1.7 Cet appareil radio est conforme à IC RSS-210. Son fonctionnement respecte les trois conditions suivantes : 1) cette radio ne cause pas d'interférences néfastes, 2) cette radio peut recevoir des interférences, ainsi que des interférences qui peuvent causer des opérations non désirées, et 3) cette radio doit être installée par des Professionnels.

CAUTION Possibility of service interruption. Changes or modifications not expressly approved by Alcatel-Lucent could void the authority to operate the JF6-9558H/6933B-9500MPT and JF6-9558HC/6933B-9558HC (unlicensed) radio.

CAUTION Possibility of service interruption. Installation, Turn-Up, Maintenance, and Operation Instruction supplied with the JF6-9558H/6933B-9500MPT and JF6-9558HC/6933B-9558HC (unlicensed) radio require strict adherence for continued part 15 of the FCC Rules and IC RSS-210 compliance.

Regulatory compliance warning: *Physical changes or modifications to the JF6-9558H/6933B-9500MPT and JF6-9558HC/6933B-9558HC (unlicensed) radio are strictly prohibited.*

9500 MPR-A general system description

1. Introduction

1.1 This General System Description applies to 9500 MPR-A software R4.1.0 (hereafter called R4.1.0) and any subsequent or maintenance release to this release. It describes system applications, floor space, and power requirements. Signal input and output characteristics are also defined. This manual can be used by system and operations staff who plan to operate, install, commission, or maintain a 9500 MPR-A, and by any others who must be familiar with the equipment.

1.2 Alcatel-Lucent 9500 MPR-A Microwave Packet radio (9500 MPR-A) is a solution for smooth transformation of backhaul networks from TDM to IP.

1.3 The Alcatel-Lucent 9500 MPR-A efficiently transports multimedia traffic since it handles packets natively, while still supporting legacy TDM DS1/DS3/OC-3 traffic. It also provides the quality of service needed to satisfy end-users. This solution improves packet aggregation, increases bandwidth and optimizes Ethernet connectivity. With the Alcatel-Lucent 9500 MPR-A the network can easily and efficiently absorb rapid growth in multimedia traffic, because it handles packets natively by adapting the transmission of the packets to the air conditions and the quality required by the different types of services.

Purpose and function

1.4 The 9500 MPR-A is a microwave digital radio family that supports both PDH and packet data (Ethernet) for migrating from TDM to IP. The 9500 MPR-A provides a generic, modular IP platform for multiple network applications (including 2G/3G/HSDPA/WiMAX back hauling to Metro Ethernet areas) to accommodate broadband services. The 9500 MPR-A radio family supports low, medium, and high capacity applications using ANSI data rates, frequencies, channel plans, and tributary interfaces.

- TDM/PDH Data Rates: DS1, DS3 and OC-3
- Ethernet Data Speeds: 10, 100, 1000 Mb/s
- RF Frequency Range: 6 to 38 GHz

Innovative solutions

1.5 The 9500 MPR-A innovative solutions:

- **Multiservice aggregation layer:** the capacity to use Ethernet as a common transmission layer to transport any kind of traffic, independently by the type of interface. Ethernet becomes the convergence layer.
- **Service awareness:** traffic handling and quality management, queuing traffic according to the type of service assigned, independently by the type of interface
- **Packet node:** no service aggregation limits with all traffic aggregated in packets, in term of: capacity, type of service requirements and type of interface
- **Service-driven adaptive modulation:** fully exploit the air bandwidth in its entirety by changing modulation scheme according to the propagation availability and allocate transport capacity, discriminating traffic by different services, only possible in a packet-based environment.

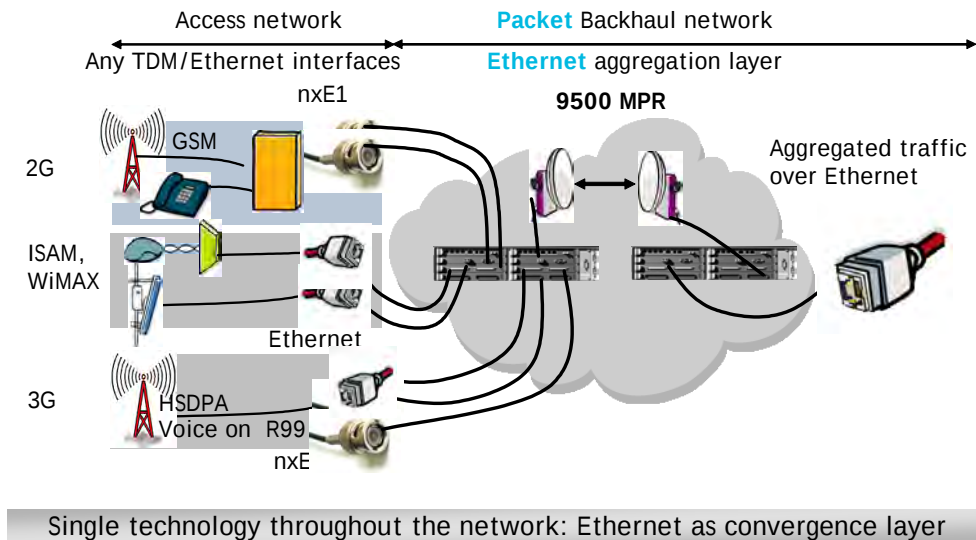
Multiservice aggregation layer

1.6 9500 MPR-A aggregates and carries over a **COMMON PACKET LAYER:** TDM 2G, 3G, LTE, and IP/Ethernet. This allows sharing of common packet transmission infrastructures, regardless of the nature of carried traffic.

1.7 Due to the nature of Ethernet, each service can be discriminated based on several parameters like quality of service.

1.8 Mapping different access technologies over Ethernet is achieved by standardized protocols like circuit emulation and pseudo-wire.

Figure 1-1. Multiservice aggregation layer



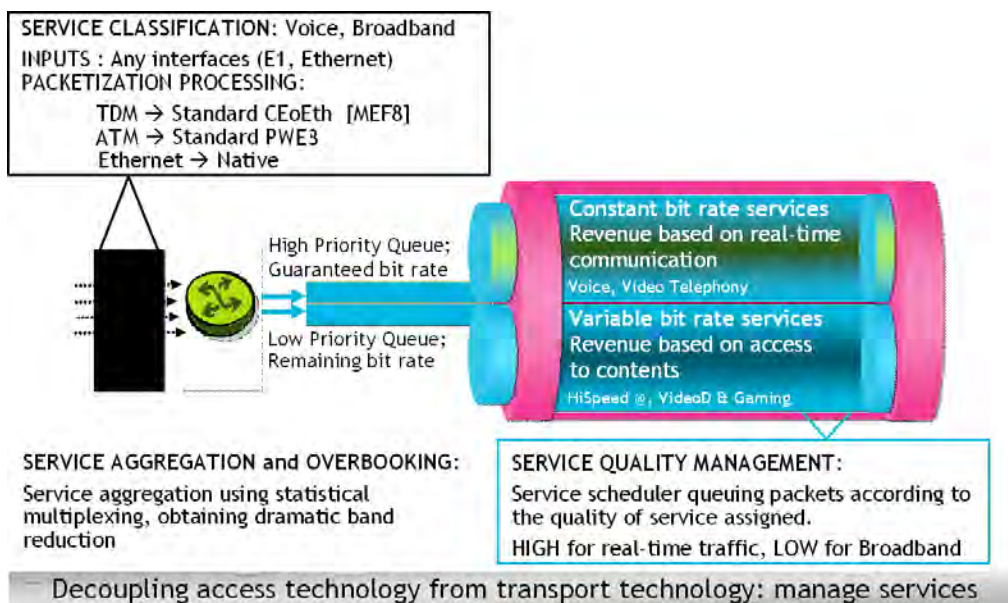
Service awareness

1.9 Service awareness means the ability to discriminate the different traffic types carried over the converged Ethernet stream. The traffic flow can be composed by DS1, DS3, OC-3, and/or IP/Eth, coming from different sources, and therefore having different requirements.

1.10 For instance DS1 traffic from a 3G base stations can carry voice (high priority, real time service) and data (lower priority and possibly non real time with high variability load, such as internet browsing, music download or video streaming).

1.11 Service awareness is what allows identifying the traffic types, and in case of the non real time variable bit rate one, optimize the band with overbooking of the radio scarce resource.

Figure 1-2. Service awareness



Packet node

1.12 9500 MPR-A offers a **SINGLE PACKET MATRIX** able to switch, aggregate and handle any of the possible incoming traffic types with virtually no capacity limits (up to 10 Gbps).

Figure 1-3. Packet node



Address new data services in the best way: packet natively

Service-driven adaptive modulation

1.13 Traffic with high priority will always have bandwidth available, like voice (deterministic approach).

1.14 Broadband traffic is discriminated by QoS dynamically, with modulation scheme changes driven by propagation conditions.

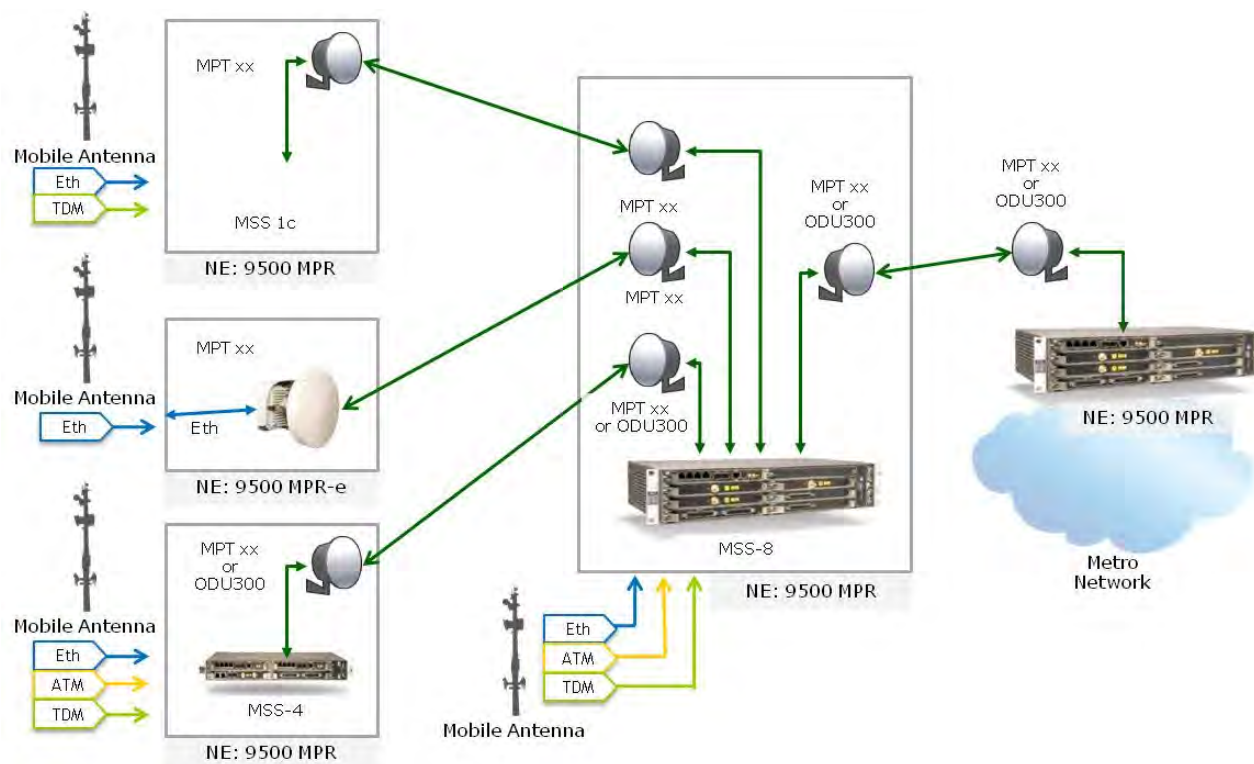
Figure 1-4. Service-driven packet adaptive modulation



9500 MPR-A family overview

1.15 9500 MPR-A introduces new elements to the microwave packet family. The most compact IDU solutions (MSS-1c) for DS1 and Ethernet hybrid connectivity and a zero footprint solution (no IDU) addressing full out-door applications. The new set of multipurpose Outdoor Units (ODU), the MPT-HC and MPT-XP addresses any application in the microwave domain. Stand alone and split mount applications depending on the network requirement and layout. The MPT-HC/XP supports a variety of configurations to address the different parts of the network in the most cost effective solution and also includes millimeter wavelength.

Figure 1-5. 9500 MPR-A family



1.16 The Microwave Service Switch shelf (MSS-1c/4/8) provides baseband processing and tributary interfaces as well as supervision.

1.17 The MOD300 radio card and ODU300 provides radio function from 6 GHz to 38 GHz.

1.18 The P8ETH Ethernet Access Switch card and Microwave Packet Transport-Long Haul (MPT-HL) transceiver provides radio function from 6 GHz to 11 GHz.

1.19 The MPTACC MPT Access card and Microwave Packet Transport-High Capacity (MPT-HC/XP) transceiver provides radio function from 6 GHz to 38 GHz.

1.20 The MPT-HC/XP transceiver supports direct connection to the Core-E electrical and optical Ethernet ports.

1.21 The MPT-HC/XP transceiver supports direct connection to the P8ETH optical Ethernet ports.

1.22 9500 MPR-A replaces the traditional terminal or single-link based approach to networking with a nodal solution.

1.23 The MOD300 and ODU300 support up to six RF links for operation on the same or different frequency bands. An ODU300 for each link is connected to plug-in MOD300 card Radio Interface inside the MSS-4/8 shelf.

1.24 The MPTACC and MPT-HC/XP support up to twelve RF links for operation on the same or different frequency bands. An MPT-HC/XP for each link is connected to plug-in MPTACC card inside the MSS-4/8 shelf. Each MPTACC supports up to two MPT-HC/XP Transceivers.

1.25 Four MPT-HL shelves support up to eight RF links for operation on the same or different frequency bands. A Transceiver card in the MPT-HL shelf for each link is connected to P8ETH Ethernet Access Switch card inside the MSS-4/8 shelf.

1.26 A mixture of radio transceiver technologies supports up to a maximum of eighteen radio interfaces.

1.27 Other plug-in cards provide line interface access and management. Supports a mix of non-protected and protected or diversity operation for single link, repeater, nodal or hub radio configurations.

1.28 System control and synchronization is provided by the Enhanced Control and Switching Module (Core-E) card.

Documentation

1.29 For additional information, refer to the following related documentation:

- 9500 MPR-A Installation Practices manual (PN 3EM23953AL)
- 9500 MPR-A Operation and Administration manual (PN 3EM23954AL)
- 9500 MPR-A Turn-Up manual (PN 3EM23955AL)
- 9500 MPR-A Maintenance and Trouble Clearing manual (PN 3EM23956AL)
- 9500 MPR-A Engineering Support Documentation manual (PN 3EM23957AL)
- 9500 MPR MPT-GC User Manual (PN 3DB19025AA)

- 9500 MPR MPR-e User Manual (PN 3DB19901EB)
- 9500 MPR MSS-1c User Manual (PN 3DB19901DB)

Standards

1.30 The following is a partial list of the standards that have influenced certain behavioral aspects of the 9500 MPR-A:

- 21 CFR PART 1040.10 and 1040.11
- ANSI Z136.2
- ATIS 0600315
- Banned substances list
- CENELEC EN 61000-3-2
- CENELEC EN 61000-3-3
- CENELEC EN 61000-4-8
- CISPR/I/105/CDV-CISPR/I/29/CD-CISPR/I/106/CDV
- CISPR 16-1-1
- CISPR 16-1-2
- CISPR 16-1-4
- CISPR 16-2-1
- CISPR 16-2-3
- CISPR 16-2-4
- CISPR 16-4-2
- CISPR 22
- CSA-C22.2 No 60950
- EC RoHS Directive 2002/95/EU, compliance with
- EC WEEE Directive 2002/96/EU, compliance with
- EN 301 751

- EN 302 217-2-2
- EN 50 385
- EN 50 383
- ETSI and RTTE directive: health and safety
- ETSI and RTTE directive: electromagnetic compatibility
- ETSI and RTTE directive: ETSI standard
- ETSI and RTTE directive: EN 302 217
- ETSI standards: Transmitter requirements
- ETSI standards: Receiving requirements
- ETSI standards: Note
- ETSI EN 302 217-1 to 4
- ETSI EN 301 489
- ETSI EN 300 019
- ETSI EN 300 753
- ETSI EN 300 119
- ETSI EN 300 132-2
- ETSI EN 300 132-3
- ETSI EN 300253
- ETSI EN 300 386
- ETSI EN 55022
- EU Directive EuP Directive 92/42/EEC, Compliance with proposal
- FCC OET 65
- FCC Title 247, Part 15
- GR-63
- GR-78
- GR-487-CORE

- GR-1089-CORE
- GR-3108
- Human exposure
- IC RSS-210
- IEC 61000-4
- ICES 003
- ICNIRP
- IEC EN 60950-1
- IEC EN 50385
- IEC EN 60825-1/-2:2000
- IEC UL 60950-1
- IEC 60529
- IEEE Std 802.3
- IEEE Std 802.1D
- IEEE Std 802.1Q
- IEEE 1613
- IETF RFC 2474
- IETF RFC 2475
- IETF RFC 3550
- IETF RFC 0793
- IETF RFC 0791
- IETF RFC 1157
- IETF RFC 768
- IETF RFC 2616
- ITU-T G.664
- ITU-T G.703

- ITU-T G.704
- ITU-T G.706
- ITU-T G.775
- ITU-T G.823
- ITU-T G.8261
- ITU-T G.826
- ITU-T G.921
- ITU-T Recommendation K20
- ITU-T Recommendation K21
- ITU-T Recommendation K45
- ITU-T Recommendation K44
- MEF 8
- NAR EIA-310
- Safety (Canada)
- SR-332
- TR NWT 000499
- TR TSY 000191

JF6-9558H and JF6-9558HC (unlicensed) radio

1.31 The JF6-9558H/6933B-9500MPT (MPT-HL) and JF6-9558HC/6933B-9558HC (MPT-HC) unlicensed radio provides fast deployment of service with microwave radio. No license and small antennas (no FCC and Industry Canada requirements) allow immediate turn-up. After the license is received, the unlicensed radio can be easily converted to the lower 6 GHz licensed band.

1.32 The JF6-9558H/6933B-9500MPT and JF6-9558HC/6933B-9558HC unlicensed radio operates in the 5725-5850 Information, Scientific, and Medical (ISM) band in accordance with FCC Part 15.247 and IC RSS-210. This unlicensed radio, although operating in the same band as a spread spectrum radio, operates using narrower bandwidths than spread spectrum.

1.33 The MPT-HC 5.8 Unlicensed band (JF6-9558HC/6933B-9558HC) is currently being certified and is not available for quote, sale, or deployment.

FCC class B compliance statement

1.34 The JF6-9558H/6933B-9500MPT and JF6-9558HC/6933B-9558HC unlicensed radio have been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules and IC RSS-210. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC class B requirements

1.35 This device complies with part 15 of the FCC Rules and IC RSS-210. Operation is subject to the following three conditions: (1) this device may not cause harmful interference. (2) This device must accept any interference received, including interference that may cause undesired operation. (3) This device must be professionally installed.

CAUTION Possibility of service interruption. Changes or modifications not expressly approved by Alcatel-Lucent could void the authority to operate the JF6-9558H/6933B-9500MPT and JF6-9558HC/6933B-9558HC unlicensed radio.

CAUTION Possibility of service interruption. Installation, Turn-Up, Maintenance, and Operation Instruction supplied with the JF6-9558H/6933B-9500MPT and JF6-9558HC/6933B-9558HC unlicensed radio require strict adherence for continued part 15 of the FCC Rules and IC RSS-210 compliance.

2. System administration

2.1 Three applications are available for 9500 MPR-A system administration:

1. Craft Terminal (CT)
2. WebEML
3. MIB

2.2 The Craft Terminal and WebEML provide a Graphical User Interface (GUI) to enable a user to view and perform system administration for all Network Elements (NEs) in a network, including remote 9500 MPR-A systems. The Craft Terminal and WebEML as an interface for performing provisioning, monitoring, and alarm management for the 9500 MPR-A.

2.3 For more information on the The Craft Terminal and WebEML refer to the 9500 MPR-A R4.1.0 Operation and Administration manual (PN 3EM23954AL).

2.4 Network Management support using Alcatel-Lucent 1350 OMS, 1352 Compact, and 5620 SAM.

3. Features

3.1 The following lists the features of R4.1.0 of 9500 MPR-A. To administer these features by the Craft Terminal and WebEML refer to the 9500 MPR-A Operation and Administration manual (PN 3EM23954AL).

Microwave service switch (MSS)

- [MSS-8 shelf](#)
- [MSS-4 shelf](#)
- [MSS-1c shelf](#)

Radio

- [Radio configuration](#)
 - 1+0 and 1+1 Terminal
 - 1+0 and 1+1 Drop and Insert Repeater
 - 1+0 and 1+1 3-Way Junction
 - 1+0 and 1+1 Nodal x-Way Junction
- [Protection schemes](#)
 - 1+0 unprotected
 - 1+1 Hot StandBy (HSB)
 - 1+1 Space Diversity (SD)
 - 1+1 Frequency Diversity (FD)
 - 2x(1+0) XPIC
 - 4x(1+0) XPIC
 - 2x(1+1) XPIC
- [Channel spacing](#)
- Static Modulation
- [Adaptive modulation](#)

- Admission control
- Adaptive equalization
- Fiber-microwave protection
- Frequency agility
- Link identifier
- Loopback
 - Core facing radio digital loopback
 - Radio facing circuit loopback
 - Core facing IF cable loopback
 - Core facing RF loopback
- Performance monitoring
 - Adaptive modulation PM
 - Radio analog PM
 - Radio ethernet PM
 - Radio hop PM
 - Radio link PM
 - Radio QoS PM
 - Radio RSL PM
- Power monitoring
- Radio direction label
- Radio L1 LAG
- Radio L2 LAG
- Transmit power control
 - ATPC
 - RTPC
- Tx mute

- XPIC

Radio transceivers

- MPT-GC
- MPT-HC/XP/9558HC
 - MPR-e (standalone MPT-HC/XP)
 - Unlicensed radio for MPT-HL and 9558HC
- MPT-HL
 - Lower 6 GHz frequency plan
 - Unlicensed radio for MPT-HL and 9558HC
- ODU300

Ethernet

- Ethernet traffic management
 - 802.1D
 - 802.1Q
- Frame type
 - Ethernet v2
 - 802.3
 - 802.1Q
- Quality of service (QoS)
 - QoS classification
 - QoS priority value to internal forwarding class
 - Internal forwarding class to queue mapping
 - Queue scheduler algorithm
 - Queue size
 - QoS with jumbo frame

- QoS in the Core-E card
- QoS in the modem MOD300 card
- QoS in the MPT-HC/XP
- QoS in the MPT-HL
- Ethernet features provisioned by craft terminal
 - C-VLAN translation
 - Port based rate limiting
 - Storm control (broadcast, multicast, and unknown unicast)
 - VLAN based rate limiter
 - Per-VLAN per-COS rate limiter
- Ethernet features configured by enhanced configuration file
 - Access control list
 - Out of range VLAN swap
 - Per-flow policer
 - Stacked VLAN (Q-in-Q) tagging
 - VLAN remarking
 - VLAN swap
 - 2xE1DS1 SFP Support
- Input/output flow control
- Reserved multicast addresses
- Traffic mode
- Ethernet synchronization messaging channel
- Ethernet connectivity fault management
- TACACS+
- Ethernet ring protection
- Jumbo frame

- Ethernet L2 LAG
- Performance monitoring
- Port segregation
- Synchronous ethernet
- VLAN IDs

Managed services and profiles

- TDM2TDM
- TDM2ETH
- SDH2SDH
- ETH2ETH

Traffic interfaces

- Core-E
 - 10/100/1000 Base-T ethernet interfaces
 - GigE SFP ethernet interfaces
 - MPT-HC/XP radio interface
 - 2xDS1 SFP
- DS1 PDH interface
- DS3 PDH interface
- OC-3 SDH interface
- Ethernet access switch
 - 10/100/1000Base-T ethernet interfaces
 - GigE SFP ethernet interfaces
 - MPT-HL radio interface
- MODEM 300 radio interface
- MPT access

Power

- Power injector box
- MPT power unit
- MPT Extended Power Unit

Configurations

- MSS-8 shelf configurations
- MSS-4 shelf configurations
- Stand alone MSS-4/MSS-8 shelf
- Stacking MSS-4/MSS-8 shelf configuration

Alarm management

- System Alarms
- Equipment Alarms
- Facility Alarms
- Alarm Monitor Tool

Cross-connections

- DS1/DS3 Cross-connections
- OC-3 Cross-connections
- Radio-radio cross-connections
- Ethernet cross-connections

Database backup and restore

External Communications

In-service upgrade

LAG (link aggregation group)

- L1/L2 link aggregation on radio ports (radio L1/L2 LAG)

- L2 Link aggregation on user ethernet ports (ethernet L2 LAG)

License key management

Loopback

- Core facing radio digital loopback
- Radio facing circuit loopback
- Core facing IF cable loopback
- Core facing RF loopback
- Line facing PDH (DS1/DS3) loopback
- Radio facing PDH (DS1/DS3) loopback
- Loopback time-out

Network Management

- Alcatel-Lucent 1350 OMS
- Alcatel-Lucent 1352 CM
- Alcatel-Lucent 1353 NM
- Alcatel-Lucent 5620 SAM

Performance monitoring

- Adaptive modulation PM
- Ethernet user port PM
- PDH PM (DS1)
- Radio analog PM
- Radio ethernet PM
- Radio hop PM
- Radio link PM
- Radio QoS PM
- Radio RSL PM

Port segregation

- TDM ports
- MPT access ports
- MPT-HC/XPs number for each MPT plug in
- ODU300
- ODU300 and MPTACC
- MPT-HC/XPs protected on different plug-ins

Remote inventory

Security

- User authentication
- User profile management
- SNMP operating mode (SNMPv3 support)

Stacking for EAS/MPT access cards

Synchronization

- Differential clock recovery
- Adaptive clock recovery
- Synchronization protection
- Quality level priority
- Hold-off and wait-to-restore

4. Equipment layout

4.1 The 9500 MPR-A contains cards that plug into shelf assemblies and mechanical equipment housed in equipment racks. Power and signaling connections are made through backplane connectors.

Rack assemblies

4.2 MSS-4/8/1c and MPT-HL shelf assemblies are mounted in either an equal flange aluminum equipment rack or an unequal flange seismic rack. See Figure [4-1](#) equal flange aluminum equipment rack. See Figure [4-2](#) for unequal flange seismic rack. Each rack uses 1.75-inch Electronic Industries Association (EIA) rack mounting increments. A 7 feet equal flange aluminum rack provides 46 EIA rack increments. A 7 feet unequal flange seismic rack provides 43 EIA rack increments.

4.3 Seismic racks meet EIA specifications regarding earthquake resistance.

4.4 Refer to table [4-A](#) for standard equipment rack specifications. Refer to table [4-B](#) for seismic equipment rack specifications.

Figure 4-1. Standard equal flange aluminum rack assembly (PN 694-9000-006)

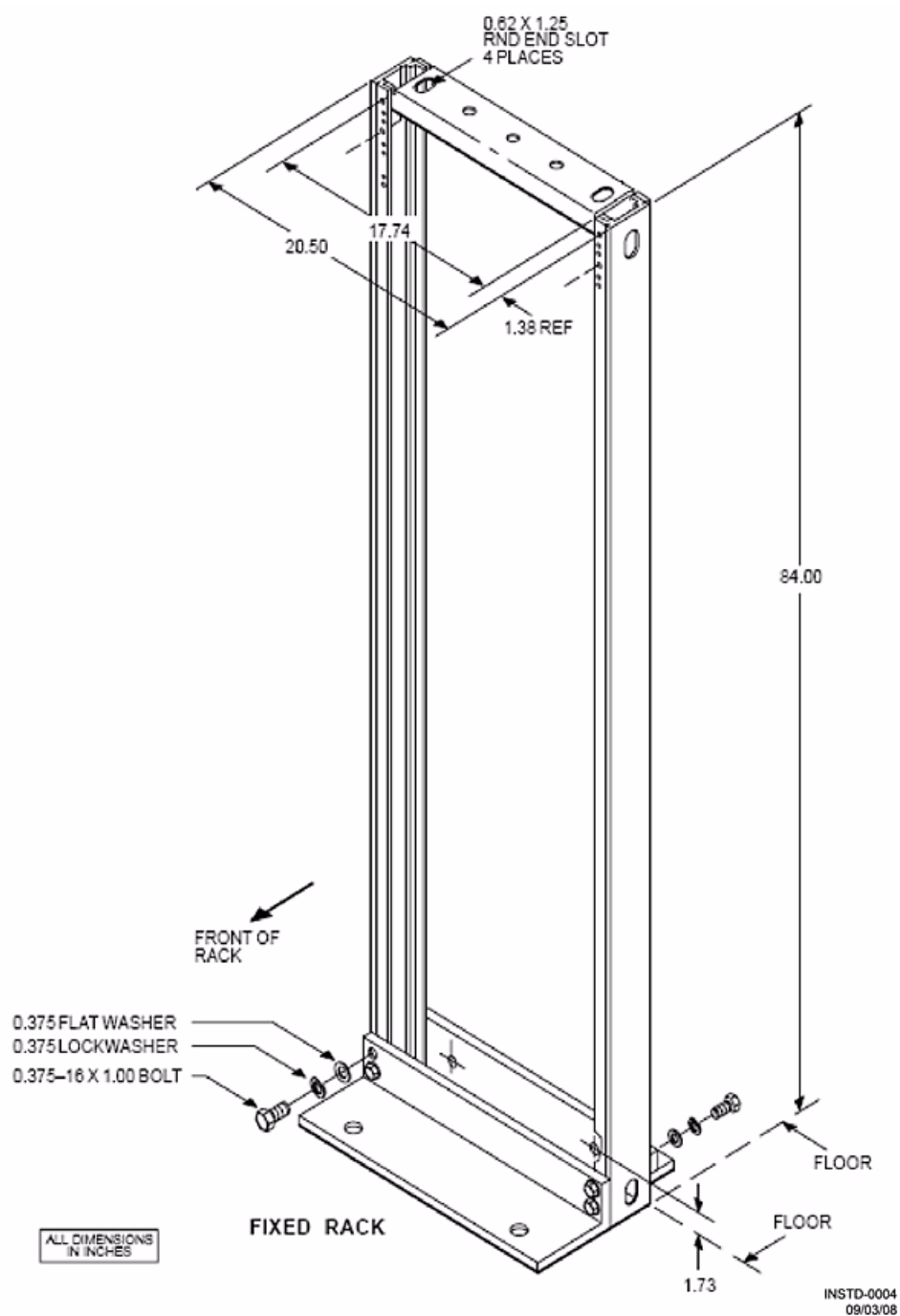
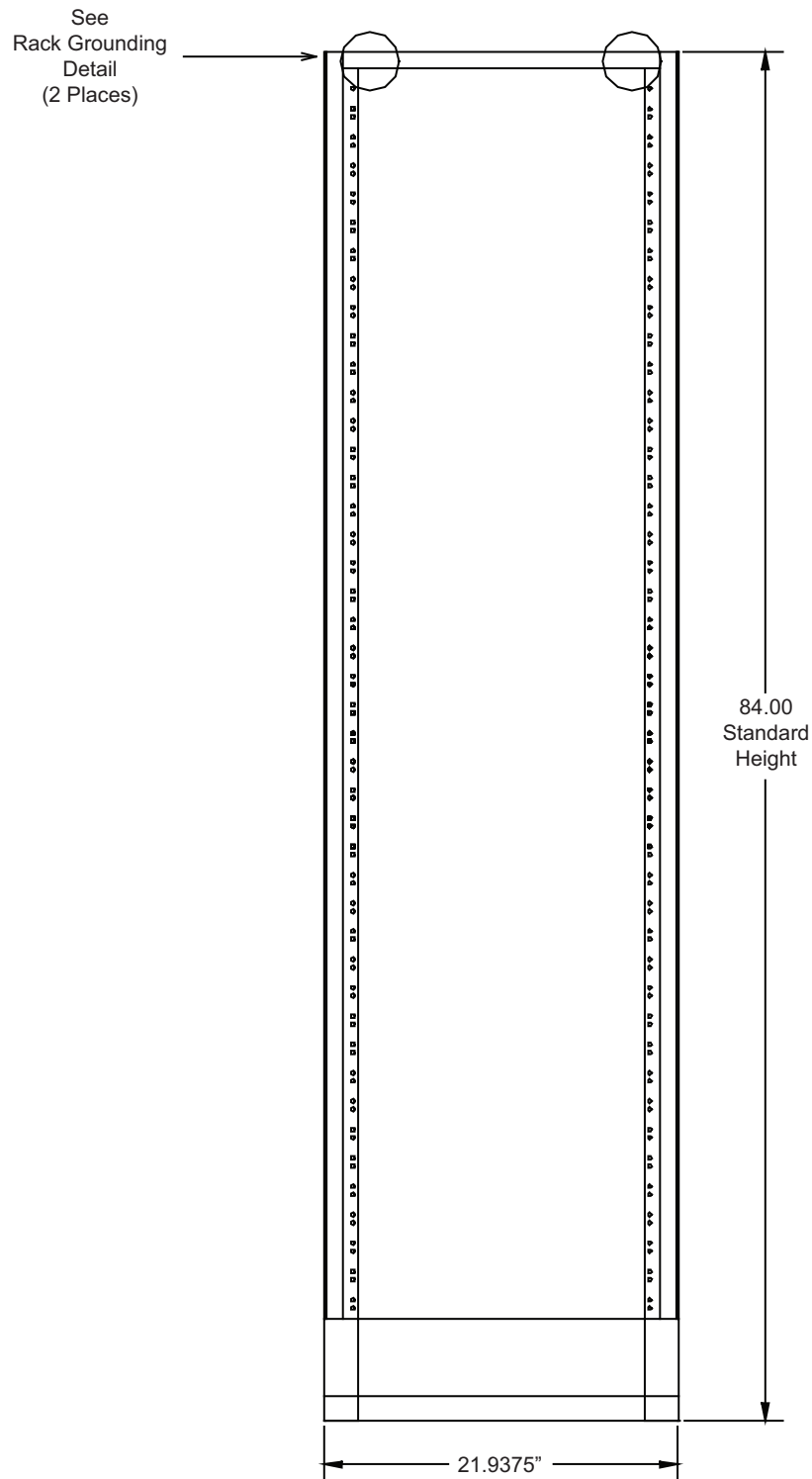


Figure 4-2. Unequal flange seismic rack assembly (PN 1AD014120046)



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Table 4-A. Standard equipment rack specifications

ITEM	CHARACTERISTICS
1. Description	Equal-flange aluminum rack provides mounting space for shelves in areas where zone 4 earthquake compliance is NOT required
2. Physical dimensions (bays)	
Height	7 ft 0 in.
Width	20.5 in.
Depth	
MSS-8 Stand-Alone Shelf	12 in.
MSS-4 Stand-Alone Shelf	12 in.
MSS-1c Stand-Alone Shelf	12 in.
MPT-HL Shelf W/diplexer	13.5 in.
MPT-HL Shelf W/One Waveguide Bracket	17 in.
MPT-HL Shelf W/Two Waveguide Bracket	22.0 in.

Table 4-B. Seismic equipment rack specifications

ITEM	CHARACTERISTICS
1. Description	Unequal-flange seismic rack provides mounting space for shelves in areas where zone 4 earthquake compliance is required
2. Physical dimensions (bays)	
Height	7 ft 0 in.
Width	22 in.
Depth	
MSS-8 Stand-Alone Shelf	12 in.
MSS-4 Stand-Alone Shelf	12 in.
MSS-1c Stand-Alone Shelf	12 in.
MPT-HL Shelf W/diplexer	13.5 in.
MPT-HL Shelf W/One Waveguide Bracket	17 in.
MPT-HL Shelf W/Two Waveguide Bracket	22.0 in.

Constraints

4.5 Certain constraints must be considered when integrating the system into a physical network environment. Each installation presents its own set of considerations.

Environment

4.6 The MSS-8 shelf is designed for placement in a ‘partially controlled’ environment. Refer to table 4-C for environmental condition specifications.

Table 4-C. Environmental condition specifications

ITEM	ASSEMBLY	OPERATING	NONOPERATING
1. Ambient temperature ¹	MSS-4/8/1c	-5 °C to +55 °C ² (41 °F to 131 °F)	-40 °C to 70 °C (-40 °F to 158 °F)
	MPT-HL	-5 °C to +55 °C ² (41 °F to 131 °F)	-40 °C to 70 °C (-40 °F to 158 °F)
	MPT-HC, MPT-XP, ODU300, Power Injector	-40 °C to +65 °C (-40 °F to 149 °F)	-40 °C to 70 °C (-40 °F to 158 °F)
2. Relative humidity	MSS-4/8/1c, Power Injector	5 to 85% ³ (without condensation)	0 to 95% (without condensation)
	MPT-HL	5 to 85% ³ (without condensation)	0 to 95% (without condensation)
	ODU300, r	0 to 100%	
3. Altitude ⁴	MSS-8, MSS-4, MPT-HC, MPT-HL, MPT-XP, ODU300, Power Injector	-60 to 1800 m (-197 to 5,905 ft)	-60 to 4000 m (-197 to 13,123 ft)
4. Cooling	MSS-4/8/1c, MPT-HL	Forced air	

Table 4-C. Environmental condition specifications (cont.)

5. Vibration and shock	MSS-8, MSS-4, MPT-HC, MPT-HL, MPT-XP, ODU300, Power Injector	Earthquake requirements	
6. Duty cycle	MSS-8, MSS-4, MPT-HC, MPT-HL, MPT-XP, ODU300, Power Injector	Continuous, unattended	

[1] Room temperature is measured at a location 1.5 m (59 in.) above the floor and 400 mm (15.8 in.) in front of the equipment.

[2] Short term operating ambient temperature is -5 °C to +55 °C (23 °F to 149 °F) for a period not to exceed 96 consecutive hours and a total of not more than 15 days in 1 year.

[3] Short term operating Relative humidity is 5 to 90% for a period not to exceed 96 consecutive hours and a total of not more than 15 days in 1 year.

[4] At installation between 1800 m to 4000 m (5905 ft to 13,123 ft) above sea level, with an ambient aisle temperature not to exceed of 30 °C (113 °F).

Shelf assemblies

4.7 System shelf assemblies follow:

- MSS-8 shelf
- MSS-4 shelf
- MSS-1c shelf
- MPT-HL shelf

4.8 System OutDoor Unit (ODU) assemblies follow:

- ODU300
- MPT-HC
- MPT-XP
- MPT-GC

4.9 The following assemblies are also installed in rack assemblies:

- Power Distribution Unit (PDU)
- DS1 37 Pin D-Sub Patch Panel Assembly
- DS1 RJ45 Patch Panel Assembly
- DS3 BNC Patch Panel
- Type N Adapter Plate Assembly

MSS-8 shelf

4.10 The MSS-8 shelf mounts in a standard 19-inch rack. See figures [4-3](#).

4.11 Adapter brackets are available to mount MSS-8 shelf in standard 23-inch rack.

4.12 The MSS-8 shelf houses the following cards:

- Core-E—Enhanced Control and Switching Module - Core-E
- P32E1DS1 (DS1)—DS1 PDH card
- P2E3DS3 (DS3)—DS3 PDH card
- SDHACC (OC-3)—OC-3 SDH card
- P8ETH (EAS)—Ethernet Access Switch card
- MPTACC (RADIO)—MPT Access card
- MOD300 (RADIO)—Modem card
- AUX—Auxiliary card
- Power Injector
- Power Converter
- FAN—MSS Fan

Figure 4-3. MSS-8 shelf, front view

1	CSM-E (Main)	2	CSM-E (Spare)	9
3	Transport Card	4	Transport Card	Fan
5	Transport Card	6	Transport Card	
7	Transport Card	8	Transport Card or Auxiliary Card	

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092010

MSS-4 shelf

4.13 The MSS-4 shelf mounts in a standard 19-inch rack. See figures [4-4](#).

4.14 Adapter brackets are available to mount MSS-4 shelf in standard 23-inch rack.

4.15 The MSS-4 shelf houses the following cards:

- Core-E—Enhanced Control and Switching Module
- P32E1DS1 (DS1)—DS1 PDH card
- P2E3DS3 (DS3)—DS3 PDH card
- SDHACC (OC-3)—OC-3 SDH card
- P8ETH (EAS)—Ethernet Access Switch card
- MOD300 (RADIO)—Modem card
- MPTACC (RADIO)—MPT Access card

- AUX—Auxiliary card
- Power Injector
- FAN—MSS Fan

Figure 4-4. MSS-4 shelf, front view

1	CSM-E (Main)	2	CSM-E (Spare)	5
3	Any Transport	4	Any Transport or Auxiliary Card	Fan

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MPT-HL shelf

4.16 The MPT-HL shelf mounts in a standard 19-inch rack. See figures [4-5](#).

4.17 Adapter brackets are available to mount MPT-HL shelf in standard 23-inch rack.

4.18 The MPT-HL shelf houses the MPT-HL Transceiver card.

Figure 4-5. MPT-HL shelf, front view



Miscellaneous assemblies

4.19 Other system assemblies include the following:

- Power Distribution Unit
- DS1 37 Pin D-Sub Patch Panel Assembly
- DS1 RJ45 Patch Panel Assembly
- DS3 BNC Patch Panel
- Type N Adapter Plate Assembly
- Power Injector Box
- MPT Power Unit

5. Unit descriptions

- 5.1** Refer to table 5-A for brief descriptions of MSS-4/8 shelf assemblies, plug-in cards, and miscellaneous components.
- 5.2** Refer to table 5-B for brief descriptions of ODU300, antennas, couplers and miscellaneous components.
- 5.3** Refer to table 5-C for brief descriptions of MPT-HL shelf assembly, plug-in transceivers, and miscellaneous components.
- 5.4** Refer to table 5-D for brief descriptions of MPT-HC/XP, antennas, couplers, and miscellaneous components.
- 5.5** Refer to table 5-E for brief descriptions of rack assemblies, Power units, Patch Panels, cable assemblies, and miscellaneous components.
- 5.6** Refer to table 5-F for brief descriptions of software, RTU capacity License, and documentation.

Table 5-A. MSS-4/8 shelf unit descriptions

UNIT	DESCRIPTION
Microwave Switching Services Shelf (MSS-8) PN: 3DB18485AB Qty: 1 per 9500 MPR-A node	The MSS-8 houses equipment that supports 10 Gb/s packet switching, synchronization, protection switching, provisioning, and alarm management. Up to 192 DS1 TDM circuits, up to 12 DS3 TDM circuits, up to 12 OC-3 SDH circuits, up to 16 10/100/1000BaseT Ethernet circuits, or 12 GigE SFP optical Ethernet circuits for customer data flows. It is composed of a power panel, and a card cage. Two Control and Switching Module (Core-E) slots support either one Core-E card in unprotected configuration or two Core-E cards in protected configuration. Six transport slots support any mixture of unprotected and/or 1+1 EPS protected transport cards. Supported transport types include: up to two P8ETH (Ethernet) cards, up to six P32E1DS1 (DS1) cards, up to six P2E3DS3 (DS3), up to six SDHACC (OC-3), up to six MPTACC (2xradio), up to six MOD300 (radio) cards, and/or up to one AUX (Auxiliary) cards. One fan card is required for system cooling.

Table 5-A. MSS-4/8 shelf unit descriptions (cont.)

UNIT	DESCRIPTION
MSS-8 shelf Kits PN: 3EM22715AB, 3EM22715AC Qty: 1 per 9500 MPR-A node	MSS-8 shelf kits provide one MSS-8 shelf, power cables, FAN card, and miscellaneous rack hardware. PN: 3EM22715AB is MSS-8 shelf kit W/FAN Card PN: 3EM22715AC is MSS-8 shelf kit W/Alarm FAN Card
Microwave Switching Services Shelf (MSS-4) PN: 3DB18219AB Qty: 1 per 9500 MPR-A node	The MSS-4 houses equipment that supports 10 Gb/s packet switching, synchronization, protection switching, provisioning, and alarm management. Up to 64 DS1 TDM circuits, up to 4 DS3 TDM circuits, up to 4 SDHACC (OC-3) circuits, up to 16 10/100/1000BaseT Ethernet circuits, or 12 GigE SFP optical Ethernet circuits for customer data flows. It is composed of a power panel, and a card cage. Two Control and Switching Module (Core-E) slots support either one Core-E card in unprotected configuration or two Core-E cards in protected configuration. Two transport slots support any mixture of unprotected or 1+1 EPS protected transport cards. Supported transport types include: up to two P8ETH (Ethernet) cards, up to two P32E1DS1 (DS1) cards, up to two P2E3DS3 (DS3), up to two SDHACC (OC-3), up to two MPTACC (2xradio), up to two MOD300 (radio) cards, and/or up to one AUX (Auxiliary) cards. One fan card is required for system cooling.
MSS-4 shelf Kit PN: 3EM24463AA Qty: 1 per 9500 MPR-A node	MSS-4 shelf kit provide one MSS-4 shelf, power cable, FAN card, and miscellaneous rack hardware.
Enhanced Control and Switching Module (Core-E) PN: 3DB18326AC Qty: 1 or 2 per MSS-8 Shelf	Enhanced Control and Switching Module (Core-E) performs all supervisory functions for the 9500 MPR-A MSS-8 shelf and switches Ethernet packets from peripheral ports to radio ports. One Core-E card is required in unprotected configuration. Two Core-E cards are required in protected configuration.
Radio Interface Card (MOD300) PN: 3DB18136AE Qty: Up to 6 per MSS-8 Shelf, up to 2 per MSS-4 Shelf	The MOD300 card converts Ethernet packet data and modulates them into an IF signal which is then sent to the ODU300. IF signal from the ODU300 is demodulated by the MOD300 card and then converts them into Ethernet packet data. The MSS-8 shelf supports up to six MOD300 cards, or up to six unprotected radio channels, and/or up to three protected radio channels. The MOD300 card supports only static modulation schemes.

Table 5-A. MSS-4/8 shelf unit descriptions (cont.)

UNIT	DESCRIPTION
Enhanced Radio Interface Card (MOD300EN) PN: 3DB18538AC Qty: Up to 6 per MSS-8 Shelf, up to 2 per MSS-4 Shelf	The MOD300EN card converts Ethernet packet data and modulates them into an IF signal which is then sent to the ODU300. IF signal from the ODU300 is demodulated by the MOD300EN card and then converts them into Ethernet packet data. The MSS-8 shelf supports up to six MOD300EN cards, or up to six unprotected radio channels, and/or up to three protected radio channels. The MOD300EN card supports both static and adaptive modulation schemes.
8-Port Ethernet Access Switch (EAS) (P8ETH) PN: 3DB18206AC Qty: Up to 2 per MSS-8 Shelf, up to 2 per MSS-4 Shelf	The P8ETH card provides four 10/100/1000 10BaseT Ethernet interfaces and four GigE optical Ethernet SFP interfaces. The MSS-4/8 shelves support one protected pair of P8ETH cards or two unprotected P8ETH cards. The P8ETH GigE optical Ethernet SFP interfaces can be configured to support MPT-HL transceivers. Each P8ETH supports up to four MPT-HL transceiver based radio channels or a mixture of eight unprotected or up to four protected radio channels per MSS-4/8 shelves.
MPT Access card W/PFoE (MPTACC) PN: 3DB18634AB Qty: Up to 6 per MSS-8 Shelf, up to 2 per MSS-4 Shelf	The MPTACC card with PFoE provides 2 MPT-HC/XP interfaces. The MSS-8 shelf supports up to six MPTACC cards, or a mixture of up to twelve unprotected MPT-HC/XP radio channels, or up to six protected MPT-HC/XP radio channels. The MSS-4 shelf supports up to two MPTACC cards, or a mixture of up to four unprotected MPT-HC/XP radio channels, or up to two protected MPT-HC/XP radio channels. The MPTACC card with PFoE supports Power Feed over Ethernet solution to simplify inter connectivity between the MSS-4/8 shelf and MPT-HC/XP.
32-Port DS1 PDH Transport card (P32E1DS1) PN: 3DB18126AE Qty: Up to 6 per MSS-8 Shelf, up to 2 per MSS-4 Shelf	The P32E1DS1 card provides 32 DS1 interfaces. The MSS-8 shelf supports up to six P32E1DS1 cards, or a mixture of up to one-hundred ninety-two unprotected DS1 interfaces, or up to ninety-six protected DS1 interfaces. The MSS-4 shelf supports up to two P32E1DS1 cards, or a mixture of up to sixty-four unprotected DS1 interfaces, or up to thirty-two protected DS1 interfaces.
2-Port DS3 PDH Transport card (P2E3DS3) PN: 3DB18194AC Qty: Up to 6 per MSS-8 Shelf, up to 2 per MSS-4 Shelf	The P2E3DS3 card provides 2 DS3 interfaces. The MSS-8 shelf supports up to six P2E3DS3 cards, or a mixture of up to twelve unprotected DS3 interfaces, or up to six protected DS3 interfaces.
2-Port OC-3 SDH Transport card (SDHACC) PN: 3DB18735AA Qty: Up to 6 per MSS-8 Shelf, up to 2 per MSS-4 Shelf	The SDHACC card provides 2 OC-3 interfaces. The MSS-8 shelf supports up to six SDHACC cards, or a mixture of up to twelve unprotected OC-3 interfaces, or up to six protected OC-3 interfaces.

Table 5-A. MSS-4/8 shelf unit descriptions (cont.)

UNIT	DESCRIPTION
Auxiliary Card (AUX) PN: 3DB18236AB Qty: Up to 1 per MSS-4/8 shelf	The AUX card provides thirteen housekeeping alarms, six alarm inputs and seven alarm outputs. The MSS-4/8 shelves support up to one AUX card per shelf.
+24/-48 Volt Converter ¹ PN: 3DB18764AA, 3DB18862AA, 3DB18863AA QTY: 1 per MSS-8 Shelf	The +24/-48 Volt Converter converts +24 Vdc office battery voltage to -48 Vdc for MSS-8 shelf +24 Vdc office applications. PN: 3DB18764AA is +24/-48 Volt converter (Spare) PN: 3DB18862AA is 2 converters W/Chassis PN: 3DB18863AA is 1 converter W/Chassis
Fan 2U Card, MSS-8 Shelf (FAN) PN: 3DB18134BB Qty: 1 per MSS-8 Shelf	Provides forced air flow for MSS-8 shelf cooling. One is required per MSS-8 shelf.
Fan 2U Card W/Alarms, MSS-8 Shelf (FAN) PN: 3EM23911AA Qty: 1 per MSS-8 Shelf	Provides forced air flow for MSS-8 shelf cooling. One is required per MSS-8 shelf. Fan Card w/Alarms provides summary, major, and minor alarm front panel LEDs and alarm relay outputs.
Fan 1U Card, MSS-4 Shelf (FAN) PN: 3DB18218AD Qty: 1 per MSS-4 Shelf	Provides forced air flow for MSS-4 shelf cooling. One is required per MSS-4 shelf.
MSS-4/8 Shelf Slot Cover PN: 3DB18163AB QTY: 1 per unequipped MSS-4/8 card slot	MSS-4/8 shelf slot cover is required for all unequipped slots for EMI compliance and proper system cooling.

[1] For shelves equipped with the +24/-48 Volt Converter card, the FAN 2U Card W/Alarms is required.

Table 5-B. ODU300 unit descriptions

UNIT	DESCRIPTION
OutDoor Unit (ODU300) ODU300 W/Lightning Surge Suppressor, lower 6 GHz, 252.04 MHz Separation PN: 3DB23215HA/3DB23215HF Qty: 1 per Lower 6 GHz, 252.04 MHz Separation Radio Channel	The ODU300 is a microprocessor controlled transceiver that interfaces the MSS-8 shelf MOD300 card with the antenna. Supports static and adaptive modulation schemes. Channel frequency is software selectable within tuning range of the ODU300. The ODU300 is frequency dependent. ODU300 includes built-in lightning surge suppressor. PN: 3DB23215HA is ODU300, 5930 - 6020 MHz, HP, TX Low PN: 3DB23215HD is ODU300, 6182 - 6272 MHz, HP, TX High PN: 3DB23215HB is ODU300, 5989 - 6079 MHz, HP, TX Low PN: 3DB23215HE is ODU300, 6241 - 6331 MHz, HP, TX High PN: 3DB23215HC is ODU300, 6078 - 6168 MHz, HP, TX Low PN: 3DB23215HF is ODU300, 6330 - 6420 MHz, HP, TX High
OutDoor Unit (ODU300) ODU300 W/Lightning Surge Suppressor, Upper 6 GHz, 160 MHz Separation PN: 3DB23214HA/3DB23214HF Qty: 1 per Upper 6 GHz, 160 MHz Separation Radio Channel	The ODU300 is a microprocessor controlled transceiver that interfaces the MSS-8 shelf MOD300 card with the antenna. Supports static and adaptive modulation schemes. Channel frequency is software selectable within tuning range of the ODU300. The ODU300 is frequency dependent. ODU300 includes built-in lightning surge suppressor. PN: 3DB23214HA is ODU300, 6540 - 6610 MHz, HP, TX Low PN: 3DB23214HB is ODU300, 6710 - 6780 MHz, HP, TX High PN: 3DB23214HC is ODU300, 6590 - 6660 MHz, HP, TX Low PN: 3DB23214HD is ODU300, 6760 - 6830 MHz, HP, TX High PN: 3DB23214HE is ODU300, 6640 - 6710 MHz, HP, TX Low PN: 3DB23214HF is ODU300, 6800 - 6870 MHz, HP, TX High

Table 5-B. ODU300 unit descriptions (cont.)

UNIT	DESCRIPTION
OutDoor Unit (ODU300) ODU300 W/Lightning Surge Suppressor, Upper 6 GHz, 340 MHz Separation PN: 3DB23216HA/3DB23216HF Qty: 1 per Upper 6 GHz, 340 MHz Separation Radio Channel	The ODU300 is a microprocessor controlled transceiver that interfaces the MSS-8 shelf MOD300 card with the antenna. Supports static and adaptive modulation schemes. Channel frequency is software selectable within tuning range of the ODU300. The ODU300 is frequency dependent. ODU300 includes built-in lightning surge suppressor. PN: 3DB23216HA is ODU300, 6430 - 6590 MHz, HP, TX Low PN: 3DB23216HB is ODU300, 6770 - 6930 MHz, HP, TX High PN: 3DB23216HC is ODU300, 6515 - 6675 MHz, HP, TX Low PN: 3DB23216HD is ODU300, 6855 - 7015 MHz, HP, TX High PN: 3DB23216HE is ODU300, 6600 - 6760 MHz, HP, TX Low PN: 3DB23216HF is ODU300, 6940 - 7100 MHz, HP, TX High
OutDoor Unit (ODU300) ODU300 W/Lightning Surge Suppressor, 7 GHz, 175 MHz Separation PN: 3DB23223HA/3DB23228HA, Qty: 1 per 7 GHz, 175 MHz Separation Radio Channel	The ODU300 is a microprocessor controlled transceiver that interfaces the MSS-8 shelf MOD300 card with the antenna. Supports static and adaptive modulation schemes. Channel frequency is software selectable within tuning range of the ODU300. The ODU300 is frequency dependent. ODU300 includes built-in lightning surge suppressor. PN: 3DB23223HA is ODU300, 7124 - 7185 MHz, HP, TX Low PN: 3DB23224HA is ODU300, 7299 - 7360 MHz, HP, TX High PN: 3DB23225HA is ODU300, 7157.5 - 7217.5 MHz, HP, TX Low PN: 3DB23226HA is ODU300, 7332.5 - 7392.5 MHz, HP, TX High PN: 3DB23227HA is ODU300, 7190 - 7250 MHz, HP, TX Low PN: 3DB23228HA is ODU300, 7365 - 7425 MHz, HP, TX High

Table 5-B. ODU300 unit descriptions (cont.)

UNIT	DESCRIPTION
OutDoor Unit (ODU300) ODU300 W/Lightning Surge Suppressor, 7 GHz, 150 MHz Separation PN: 3DB23217HA/3DB23222HA Qty: 1 per 7 GHz, 150 MHz Separation Radio Channel	The ODU300 is a microprocessor controlled transceiver that interfaces the MSS-8 shelf MOD300 card with the antenna. Supports static and adaptive modulation schemes. Channel frequency is software selectable within tuning range of the ODU300. The ODU300 is frequency dependent. ODU300 includes built-in lightning surge suppressor. PN: 3DB23217HA is ODU300, 7424 - 7485 MHz, HP, TX Low PN: 3DB23218HA is ODU300, 7574 - 7635 MHz, HP, TX High PN: 3DB23219HA is ODU300, 7470 - 7530 MHz, HP, TX Low PN: 3DB23220HA is ODU300, 7620 - 7680 MHz, HP, TX High PN: 3DB23221HA is ODU300, 7515 - 7575 MHz, HP, TX Low PN: 3DB23222HA is ODU300, 7665 - 7725 MHz, HP, TX High
OutDoor Unit (ODU300) ODU300 W/Lightning Surge Suppressor, 8 GHz, 300 MHz Separation PN: 3DB23033HA/3DB23033HD Qty: 1 per Upper 8 GHz, 300 MHz Separation Radio Channel	The ODU300 is a microprocessor controlled transceiver that interfaces the MSS-8 shelf MOD300 card with the antenna. Supports static and adaptive modulation schemes. Channel frequency is software selectable within tuning range of the ODU300. The ODU300 is frequency dependent. ODU300 includes built-in lightning surge suppressor. PN: 3DB23033HA is ODU300, 7722.5 - 7859 MHz, HP, TX Low PN: 3DB23033HC is ODU300, 8025 - 8171 MHz, HP, TX High PN: 3DB23033HB is ODU300, 7844 - 7981 MHz, HP, TX Low PN: 3DB23033HD is ODU300, 8145 - 8287 MHz, HP, TX High

Table 5-B. ODU300 unit descriptions (cont.)

UNIT	DESCRIPTION
OutDoor Unit (ODU300) ODU300 W/Lightning Surge Suppressor, 11 GHz, 490-500 MHz Separation PN: 3DB23035HA/3DB23035HH Qty: 1 per 11 GHz, 490-500 MHz Separation Radio Channel	The ODU300 is a microprocessor controlled transceiver that interfaces the MSS-8 shelf MOD300 card with the antenna. Supports static and adaptive modulation schemes. Channel frequency is software selectable within tuning range of the ODU300. The ODU300 is frequency dependent. ODU300 includes built-in lightning surge suppressor. PN: 3DB23035HA is ODU300, 10675 - 10835 MHz, TX Low PN: 3DB23035HE is ODU300, 11200 - 11345 MHz, TX High PN: 3DB23035HB is ODU300, 10795 - 10955 MHz, TX Low PN: 3DB23035HF is ODU300, 11310 - 11465 MHz, TX High PN: 3DB23035HC is ODU300, 10915 - 11075 MHz, TX Low PN: 3DB23035HG is ODU300, 11430 - 11585 MHz, TX High PN: 3DB23035HD is ODU300, 11035 - 11200 MHz, TX Low PN: 3DB23035HH is ODU300, 11550 - 11705 MHz, TX High
OutDoor Unit (ODU300) ODU300 W/Lightning Surge Suppressor, 15 GHz, 475/490 MHz Separation PN: 3DB23039HC, 3DB23039HD Qty: 1 per 15 GHz, 475/490 MHz Separation Radio Channel	The ODU300 is a microprocessor controlled transceiver that interfaces the MSS-8 shelf MOD300 card with the antenna. Supports static and adaptive modulation schemes. Channel frequency is software selectable within tuning range of the ODU300. The ODU300 is frequency dependent. ODU300 includes built-in lightning surge suppressor. PN: 3DB23039HC is ODU300, 14500 - 14660 MHz, TX Low PN: 3DB23039HD is ODU300, 14975 - 15135 MHz, TX Low
OutDoor Unit (ODU300) ODU300 W/Lightning Surge Suppressor, 18 GHz, 1560 MHz Separation PN: 3DB23062HC, 3DB23062HD Qty: 1 per 18 GHz, 1560 MHz Separation Radio Channel	The ODU300 is a microprocessor controlled transceiver that interfaces the MSS-8 shelf MOD300 card with the antenna. Supports static and adaptive modulation schemes. Channel frequency is software selectable within tuning range of the ODU300. The ODU300 is frequency dependent. ODU300 includes built-in lightning surge suppressor. PN: 3DB23062HC is ODU300, 17700 - 18060 MHz, TX Low PN: 3DB23062HD is ODU300, 19260 - 19620 MHz, TX Low

Table 5-B. ODU300 unit descriptions (cont.)

UNIT	DESCRIPTION
OutDoor Unit (ODU300) ODU300 W/Lightning Surge Suppressor, 23 GHz, 1200 MHz Separation PN: 3DB23045HA/3DB23045HH Qty: 1 per 23 GHz, 1200 MHz Separation Radio Channel	The ODU300 is a microprocessor controlled transceiver that interfaces the MSS-8 shelf MOD300 card with the antenna. Supports static and adaptive modulation schemes. Channel frequency is software selectable within tuning range of the ODU300. The ODU300 is frequency dependent. ODU300 includes built-in lightning surge suppressor. PN: 3DB23045HA is ODU300, 21200 - 21570 MHz, TX Low PN: 3DB23045HE is ODU300, 22400 - 22770 MHz, TX High PN: 3DB23045HB is ODU300, 21475 - 21845 MHz, TX Low PN: 3DB23045HF is ODU300, 22675 - 23045 MHz, TX High PN: 3DB23045HC is ODU300, 21750 - 22120 MHz, TX Low PN: 3DB23045HG is ODU300, 22950 - 23320 MHz, TX High PN: 3DB23045HD is ODU300, 22030 - 22400 MHz, TX Low PN: 3DB23045HH is ODU300, 23230 - 23600 MHz, TX High
OutDoor Unit (ODU300) ODU300 W/Lightning Surge Suppressor, 38 GHz, 700 MHz Separation PN: 3DB23258HO/3DB23258HV Qty: 1 per 38 GHz, 700 MHz Separation Radio Channel	The ODU300 is a microprocessor controlled transceiver that interfaces the MSS-8 shelf MOD300 card with the antenna. Supports static and adaptive modulation schemes. Channel frequency is software selectable within tuning range of the ODU300. The ODU300 is frequency dependent. ODU300 includes built-in lightning surge suppressor. PN: 3DB23258HO is ODU300, 38600 - 38800 MHz, TX Low PN: 3DB23258HP is ODU300, 39300 - 39500 MHz, TX High PN: 3DB23258HQ is ODU300, 38750 - 38950 MHz, TX Low PN: 3DB23258HR is ODU300, 39450 - 39650 MHz, TX High PN: 3DB23258HS is ODU300, 38950 - 39150 MHz, TX Low PN: 3DB23258HT is ODU300, 39650 - 39850 MHz, TX High PN: 3DB23258HU is ODU300, 39100 - 39300 MHz, TX Low PN: 3DB23258HV is ODU300, 39800 - 40000 MHz, TX High

Table 5-B. ODU300 unit descriptions (cont.)

UNIT	DESCRIPTION
ODU300 Couplers PN: 3CC58012AAAA/3CC58027AAAA QTY: as required per site configuration	ODU300 Coupler PN: 3CC58020AAAA is 6 GHz Band (1.5 dB/6 dB) Unequal Coupler PN: 3CC58025AAAA is 7/8 GHz Band (3 dB/3 dB) Equal Coupler PN: 3CC58019AAAA is 7/8 GHz Band (1.5 dB/6 dB) Unequal Coupler PN: 3CC58023AAAA is 11 GHz Band (3 dB/3 dB) Equal Coupler PN: 3CC58017AAAA is 11 GHz Band (1.5 dB/6 dB) Unequal Coupler PN: 3CC58027AAAA is 18 GHz Band (1.5 dB/6 dB) Unequal Coupler PN: 3CC58012AAAA is 23 GHz Band (3 dB/3 dB) Equal Coupler PN: 3CC58014AAAA is 23 GHz Band (1.5 dB/6 dB) Unequal Coupler
ODU300 or Coupler Pole Mount (Non-Integrated) PN: 3CC58001AA QTY: as required per site configuration	ODU300 or Coupler Pole Mount (non-Integrated antenna configuration)
ODU300 Rack Mount Bracket PN: 3EM21370AA/3EM21370AB QTY: as required per site configuration	ODU300 Rack Mount Bracket for Non-integrated radio configuration PN: 3EM21370AA is ODU300, 19 inch rack mount bracket PN: 3EM21370AB is ODU300, 23 inch rack mount bracket

Table 5-B. ODU300 unit descriptions (cont.)

UNIT	DESCRIPTION
MSS to ODU300 Cabling QTY: as required per site configuration	MSS to ODU300 Cabling PN: 3EM23311AA is MOD300 Cable Jumper, 14 inches PN: 3EM23311AB is MOD300 Cable Jumper, 9 feet PN: 3EM23272AA is Type N Adapter Bracket, supports up to three MOD300 IF signal type N jumper cables which provides a transition from the MOD300 card connector to Type N connector PN: 1AC014320002 is LMR-400 Coaxial Cable PN: 1AB095530045 is Type N PPC Nm-400 Connector, Straight, Male PN: 1AB095530046 is Type N PPC Nm-400 Connector, straight, female PN: 1AB383930001 is PPC 400NT Tool Kit PN: 1AB350440001 is LMR Grounding Kit PN: 3CC50015AA is Lightning Arrestor INU/ODU (2 Arrestor) Kit PN: 3CC50030AA is Lightning Arrestor INU Only (1 Arrestor) Kit

Table 5-C. MPT-HL shelf unit descriptions

UNIT	DESCRIPTION
Microwave Packet Transport-Long Haul Shelf (MPT-HL) PN: 3EM22618AB Qty: Up to 4 per 9500 MPR-A node	The MPT-HL shelf supports Two MPT-HL transceiver cards, either two unprotected radio channels or one protected radio channel.
MPT-HL Shelf Kits PN: 3EM24238AA, 3EM23238AB Qty: 1 per MPT-HL shelf	The MPT-HL shelf kits contain; one MPT-HL shelf, MPT-HL Transceiver power cable(s), Transceiver blank cover, and miscellaneous rack hardware. MPT-HL shelf kits are unpopulated. PN: 3EM24238AA is single Transceiver shelf kit PN: 3EM24238AB is Dual Transceiver shelf kit
MPT-HL Transceiver (MPT-HL) PN: 3EM22617AA, 3EM22617AC Qty: 1 per Lower 6 GHz Channel	The MPT-HL Transceiver card is a microprocessor controlled RF transceiver that interfaces the MSS-4/8 shelf P8ETH card MPT-HL port with the antenna. Supports static modulation scheme. Channel frequency is software selectable within tuning range of the MPT-HL Transceiver. The MPT-HL Transceiver is frequency dependent. PN: 3EM22617AA is MPT-HL, 5725 - 6425 MHz PN: 3EM22617AC is MPT-HL, 5925 - 6425 MHz, HP

Table 5-C. MPT-HL shelf unit descriptions (cont.)

UNIT	DESCRIPTION
MPT-HL Transceiver (MPT-HL) PN: 3EM22617AB, 3EM22617AD Qty: 1 per Upper 6 GHz Channel	The MPT-HL Transceiver card is a microprocessor controlled RF transceiver that interfaces the MSS-4/8 shelf P8ETH card MPT-HL port with the antenna. Supports static modulation scheme. Channel frequency is software selectable within tuning range of the MPT-HL Transceiver. The MPT-HL Transceiver is frequency dependent. PN: 3EM22617AB is MPT-HL, 6425 - 6930 MHz PN: 3EM22617AD is MPT-HL, 6425 - 6930 MHz, HP
MPT-HL Transceiver (MPT-HL) PN: 3EM24627AA Qty: 1 per 7 GHz Channel	The MPT-HL Transceiver card is a microprocessor controlled RF transceiver that interfaces the MSS-4/8 shelf P8ETH card MPT-HL port with the antenna. Supports static modulation scheme. Channel frequency is software selectable within tuning range of the MPT-HL Transceiver. The MPT-HL Transceiver is frequency dependent. PN: 3EM24627AA is MPT-HL, 7125-7775 MHz
MPT-HL Transceiver (MPT-HL) PN: 3EM24627AB Qty: 1 per 8 GHz Channel	The MPT-HL Transceiver card is a microprocessor controlled RF transceiver that interfaces the MSS-4/8 shelf P8ETH card MPT-HL port with the antenna. Supports static modulation scheme. Channel frequency is software selectable within tuning range of the MPT-HL Transceiver. The MPT-HL Transceiver is frequency dependent. PN: 3EM24627AB is MPT-HL, 7725-8500 MHz
MPT-HL Transceiver (MPT-HL) PN: 3EM23888AA Qty: 1 per 10.5 GHz Channel	The MPT-HL Transceiver card is a microprocessor controlled RF transceiver that interfaces the MSS-4/8 shelf P8ETH card MPT-HL port with the antenna. Supports static modulation scheme. Channel frequency is software selectable within tuning range of the MPT-HL Transceiver. The MPT-HL Transceiver is frequency dependent. PN: 3EM23888AA is MPT-HL, 10400 - 10700 MHz
MPT-HL Transceiver (MPT-HL) PN: 3EM23888AB, 3EM23888AC Qty: 1 per 11 GHz Channel	The MPT-HL Transceiver card is a microprocessor controlled RF transceiver that interfaces the MSS-4/8 shelf P8ETH card MPT-HL port with the antenna. Supports static modulation scheme. Channel frequency is software selectable within tuning range of the MPT-HL Transceiver. The MPT-HL Transceiver is frequency dependent. PN: 3EM23888AB is MPT-HL, 10700 - 11200 MHz PN: 3EM23888AC is MPT-HL, 11200 - 11700 MHz

Table 5-C. MPT-HL shelf unit descriptions (cont.)

UNIT	DESCRIPTION
MPT-HL Transceiver Air Filter PN: 3EM24040AA Qty: 1 per MPT-HL Transceiver (Optional)	Replacement MPT-HL Transceiver air filter.
MPT-HL Transmit Monitor Port Kit PN: 3EM24447AA, 3EM24447AB Qty: (Optional)	Provides transmit monitor port for 6 GHz and 11 GHz PN: 3EM24447AA is 6 GHz Transmit Monitor Port PN: 3EM24447AB is 11 GHz Transmit Monitor Port
Diplexer Bracket Kits PN: 3EM23465AA/3EM23465AD Qty: as required	Diplexer Bracket Kits PN: 3EM23465AA is Hot Standby 1:10 Coupler PN: 3EM23465AB is Hot Standby W/space Diversity PN: 3EM23465AC is 1+0 Non-Standby PN: 3EM23465AD is Single Shelf Repeater
Diplexer Clamp and Isolator Kits PN: 3EM23466AA/3EM23466AM, 3EM24188AA/3EM24188AD Qty: as required	Diplexer Clamp and Isolator Kits: Frequency Band: 5725-5850 GHZ PN: 3EM23466AJ is Hot Standby 1:10 coupler PN: 3EM23466AK is Hot Standby W/space Diversity PN: 3EM23466AL is 1+0 Non-Standby PN: 3EM23466AM is Single Shelf Repeater Frequency Band: 5925-6425 PN: 3EM23466AA is Hot Standby 1:10 coupler PN: 3EM23466AB is Hot Standby W/space Diversity PN: 3EM23466AC is 1+0 Non-Standby PN: 3EM23466AD is Single Shelf Repeater Frequency Band: 6525-6875 GHZ PN: 3EM23466AE is Hot Standby 1:10 coupler PN: 3EM23466AF is Hot Standby W/space Diversity PN: 3EM23466AG is 1+0 Non-Standby PN: 3EM23466AH is Single Shelf Repeater Frequency Band: 7125-8500 GHZ PN: 3EM24728AA is Hot Standby 1:10 coupler PN: 3EM24728AB is Hot Standby W/space Diversity PN: 3EM24728AC is 1+0 Non-Standby PN: 3EM24728AD is Single Shelf Repeater Frequency Band: 10500-11700 GHZ PN: 3EM24188AA is Hot Standby 1:10 coupler PN: 3EM24188AB is Hot Standby W/space Diversity PN: 3EM24188AC is 1+0 Non-Standby PN: 3EM24188AD is Single Shelf Repeater

Table 5-C. MPT-HL shelf unit descriptions (cont.)

UNIT	DESCRIPTION																																																																																																							
Waveguide Transition Kits PN: 3EM23511AA/3EM23511AJ Qty: as required	Waveguide Transition Kits Frequency Band: 5725-5850 GHZ PN: 3EM23511AA is A2 (6 GHz) Position Kit PN: 3EM23511AB is A3 (6 GHz) Position Kit PN: 3EM23511AC is A4 (6 GHz) Position Kit PN: 3EM23511AD is A5 (6 GHz) Position Kit PN: 3EM23511AE is Flat Bracket Kit PN: 3EM23511AF is A2 (11 GHz) Position Kit PN: 3EM23511AG is A3 (11 GHz) Position Kit PN: 3EM23511AH is A4 (11 GHz) Position Kit PN: 3EM23511AJ is A5 (11 GHz) Position Kit																																																																																																							
RF Diplexer Filters PN: Qty: as required	RF Diplexer Filters: <table><tr><td></td><td>Xmt Freq</td><td>Rcv Freq</td><td>Filter BW</td></tr><tr><td>PN: 3EM24458AA is</td><td>5725-5755</td><td>5790-5820</td><td>30 MHz</td></tr><tr><td>PN: 3EM24458AB is</td><td>5755-5785</td><td>5820-5850</td><td>30 MHz</td></tr><tr><td>PN: 3EM24458AC is</td><td>5725-5755</td><td>5820-5850</td><td>30 MHz</td></tr><tr><td>PN: 3EM16710AB is</td><td>5925-6175</td><td>6175-6425</td><td>10 MHz</td></tr><tr><td>PN: 3EM16710AC is</td><td>6175-6425</td><td>5925-6175</td><td>10 MHz</td></tr><tr><td>PN: 3EM24335AA is</td><td>5925-6175</td><td>6175-6425</td><td>30 MHz</td></tr><tr><td></td><td>6175-6425</td><td>5925-6175</td><td>30 MHz</td></tr><tr><td>PN: 3EM09730AA is</td><td>6525-6875</td><td>6525-6875</td><td>10 MHz</td></tr><tr><td>PN: 3EM24333AA is</td><td>6525-6710</td><td>6710-6875</td><td>30 MHz</td></tr><tr><td></td><td>6710-6875</td><td>6525-6710</td><td>30 MHz</td></tr><tr><td>PN: 967-1585-002 is</td><td>6440-6750</td><td>6440-6750</td><td>10 MHz</td></tr><tr><td>PN: 967-1585-003 is</td><td>6440-6750</td><td>6750-7080</td><td>10 MHz</td></tr><tr><td>PN: 967-1585-004 is</td><td>6750-7080</td><td>6440-6750</td><td>10 MHz</td></tr><tr><td>PN: 967-1585-005 is</td><td>6750-7080</td><td>6750-7080</td><td>10 MHz</td></tr><tr><td>PN: 3EM04024AC is</td><td>6440-6580</td><td>6740-6920</td><td>30 MHz</td></tr><tr><td>PN: 3EM04024AD is</td><td>6581-6740</td><td>6921-7080</td><td>30 MHz</td></tr><tr><td>PN: 3EM04024AE is</td><td>6740-6920</td><td>6440-6580</td><td>30 MHz</td></tr><tr><td>PN: 3EM04024AF is</td><td>6921-7080</td><td>6581-6740</td><td>30 MHz</td></tr><tr><td>PN: 3EM24412AA is</td><td>7125-7575</td><td>7300-7755</td><td>40 MHz</td></tr><tr><td>PN: 3EM24412AB is</td><td>7725-8115</td><td>8025-8500</td><td>40 MHz</td></tr><tr><td>PN: 3EM24412AA is</td><td>7125-7750</td><td>7750-8500</td><td>40 MHz</td></tr><tr><td>PN: 3EM24078AA is</td><td>10550-10680</td><td>10550-10680</td><td>10 MHz</td></tr><tr><td>PN: 3EM24081AA is</td><td>10700-11200</td><td>11200-11700</td><td>30 MHz</td></tr><tr><td></td><td>11200-11700</td><td>10700-11200</td><td>30 MHz</td></tr></table>					Xmt Freq	Rcv Freq	Filter BW	PN: 3EM24458AA is	5725-5755	5790-5820	30 MHz	PN: 3EM24458AB is	5755-5785	5820-5850	30 MHz	PN: 3EM24458AC is	5725-5755	5820-5850	30 MHz	PN: 3EM16710AB is	5925-6175	6175-6425	10 MHz	PN: 3EM16710AC is	6175-6425	5925-6175	10 MHz	PN: 3EM24335AA is	5925-6175	6175-6425	30 MHz		6175-6425	5925-6175	30 MHz	PN: 3EM09730AA is	6525-6875	6525-6875	10 MHz	PN: 3EM24333AA is	6525-6710	6710-6875	30 MHz		6710-6875	6525-6710	30 MHz	PN: 967-1585-002 is	6440-6750	6440-6750	10 MHz	PN: 967-1585-003 is	6440-6750	6750-7080	10 MHz	PN: 967-1585-004 is	6750-7080	6440-6750	10 MHz	PN: 967-1585-005 is	6750-7080	6750-7080	10 MHz	PN: 3EM04024AC is	6440-6580	6740-6920	30 MHz	PN: 3EM04024AD is	6581-6740	6921-7080	30 MHz	PN: 3EM04024AE is	6740-6920	6440-6580	30 MHz	PN: 3EM04024AF is	6921-7080	6581-6740	30 MHz	PN: 3EM24412AA is	7125-7575	7300-7755	40 MHz	PN: 3EM24412AB is	7725-8115	8025-8500	40 MHz	PN: 3EM24412AA is	7125-7750	7750-8500	40 MHz	PN: 3EM24078AA is	10550-10680	10550-10680	10 MHz	PN: 3EM24081AA is	10700-11200	11200-11700	30 MHz		11200-11700	10700-11200	30 MHz
	Xmt Freq	Rcv Freq	Filter BW																																																																																																					
PN: 3EM24458AA is	5725-5755	5790-5820	30 MHz																																																																																																					
PN: 3EM24458AB is	5755-5785	5820-5850	30 MHz																																																																																																					
PN: 3EM24458AC is	5725-5755	5820-5850	30 MHz																																																																																																					
PN: 3EM16710AB is	5925-6175	6175-6425	10 MHz																																																																																																					
PN: 3EM16710AC is	6175-6425	5925-6175	10 MHz																																																																																																					
PN: 3EM24335AA is	5925-6175	6175-6425	30 MHz																																																																																																					
	6175-6425	5925-6175	30 MHz																																																																																																					
PN: 3EM09730AA is	6525-6875	6525-6875	10 MHz																																																																																																					
PN: 3EM24333AA is	6525-6710	6710-6875	30 MHz																																																																																																					
	6710-6875	6525-6710	30 MHz																																																																																																					
PN: 967-1585-002 is	6440-6750	6440-6750	10 MHz																																																																																																					
PN: 967-1585-003 is	6440-6750	6750-7080	10 MHz																																																																																																					
PN: 967-1585-004 is	6750-7080	6440-6750	10 MHz																																																																																																					
PN: 967-1585-005 is	6750-7080	6750-7080	10 MHz																																																																																																					
PN: 3EM04024AC is	6440-6580	6740-6920	30 MHz																																																																																																					
PN: 3EM04024AD is	6581-6740	6921-7080	30 MHz																																																																																																					
PN: 3EM04024AE is	6740-6920	6440-6580	30 MHz																																																																																																					
PN: 3EM04024AF is	6921-7080	6581-6740	30 MHz																																																																																																					
PN: 3EM24412AA is	7125-7575	7300-7755	40 MHz																																																																																																					
PN: 3EM24412AB is	7725-8115	8025-8500	40 MHz																																																																																																					
PN: 3EM24412AA is	7125-7750	7750-8500	40 MHz																																																																																																					
PN: 3EM24078AA is	10550-10680	10550-10680	10 MHz																																																																																																					
PN: 3EM24081AA is	10700-11200	11200-11700	30 MHz																																																																																																					
	11200-11700	10700-11200	30 MHz																																																																																																					

Table 5-C. MPT-HL shelf unit descriptions (cont.)

UNIT	DESCRIPTION
Space Diversity Filters PN: Qty: as required	Space Diversity Filters: PN: Freq Band Filter BW 3EM11649AA is Space Div Filter 5725-5755 30 MHz 3EM11649AB is Space Div Filter 5755-5785 30 MHz 3EM11649AC is Space Div Filter 5790-5820 30 MHz 3EM11649AD is Space Div Filter 5820-5850 30 MHz 967-0506-002 is Space Div Filter 5925-6175 10 MHz 967-0506-003 is Space Div Filter 6175-6425 10 MHz 3EM04182AA is Space Div Filter 5925-6050 30 MHz 3EM04182AB is Space Div Filter 6050-6175 30 MHz 3EM04182AC is Space Div Filter 6175-6300 30 MHz 3EM04182AD is Space Div Filter 6300-6425 30 MHz 3EM19463AA is Space Div Filter 6525-6875 10 MHz 3EM04235AA is Space Div Filter 6525-6710 30 MHz 3EM04235AB is Space Div Filter 6710-6875 30 MHz 967-0506-004 is Space Div Filter 6440-6750 10 MHz 967-0506-005 is Space Div Filter 6750-7080 10 MHz 3EM04235AC is Space Div Filter 6440-6580 30 MHz 3EM04235AD is Space Div Filter 6580-6740 30 MHz 3EM04235AE is Space Div Filter 6740-6920 30 MHz 3EM04235AF is Space Div Filter 6920-7080 30 MHz 3EM19619AA is Space Div Filter 7125-7750 30 MHz 3EM19619AB is Space Div Filter 7750-8500 30 MHz 695-8307-001 is Space Div Filter 10550-10680 10 MHz 3EM24310AA is Space Div Filter 10700-11200 30 MHz 3EM24310AB is Space Div Filter 11200-11700 30 MHz

Table 5-C. MPT-HL shelf unit descriptions (cont.)

UNIT	DESCRIPTION
RF Stacking Filters PN: Qty: as required	RF Stacking Filters: PN: Freq Band Filter BW 3EM16948AA is RF Stack Filter, Rcv 5925-6175 30 MHz 3EM16949AB is RF Stack Filter, Xmt 6175-6425 30 MHz 3EM16948AB is RF Stack Filter, Rcv 6175-6425 30 MHz 3EM16949AA is RF Stack Filter, Xmt 5925-6175 30 MHz 3EM16948AD is RF Stack Filter, Rcv 6525-6875 30 MHz 3EM16949AD is RF Stack Filter, Xmt 6525-6875 30 MHz 3EM16948AE is RF Stack Filter, Rcv 6440-6740 30 MHz 3EM16949AF is RF Stack Filter, Xmt 6740-7080 30 MHz 3EM16948AF is RF Stack Filter, Rcv 6740-7080 30 MHz 3EM16949AE is RF Stack Filter, Xmt 6440-6740 30 MHz 3MU00071AA is RF Stack Filter, Rcv 7125-7445 30 MHz 3MU00071AF is RF Stack Filter, Xmt 7445-7750 30 MHz 3MU00071AB is RF Stack Filter, Rcv 7445-7750 30 MHz 3MU00071AE is RF Stack Filter, Xmt 7125-7445 30 MHz 3MU00071AC is RF Stack Filter, Rcv 7750-8125 30 MHz 3MU00071AH is RF Stack Filter, Xmt 8125-8500 30 MHz 3MU00071AD is RF Stack Filter, Rcv 8125-8500 30 MHz 3MU00071AG is RF Stack Filter, Xmt 7750-8125 30 MHz 3EM05115AA is RF Stack Filter, Rcv 10.7-11.2 30 MHz 3EM05114AC is RF Stack Filter, Xmt 11.2-11.7 30 MHz 3EM05115AC is RF Stack Filter, Rcv 11.2-11.7 30 MHz 3EM05114AA is RF Stack Filter, Xmt 10.7-11.2 30 MHz
Isolator Kits PN: 3EM23524AA/3EM23524AF, 3EM24189AA/3EM24189AC Qty: as required	Isolator Kits: Frequency Band: 5725-6425 GHZ PN: 3EM23524AA is Hot Standby 1:10 coupler PN: 3EM23524AB is Hot Standby W/Space Diversity PN: 3EM23524AC is 1+0 Non-Standby Frequency Band: 6400-7080 GHZ PN: 3EM23524AD is Hot Standby 1:10 coupler PN: 3EM23524AE is Hot Standby W/Space Diversity PN: 3EM23524AF is 1+0 Non-Standby Frequency Band: 7125-8500 GHZ PN: 3MU00074AA is Hot Standby 1:10 coupler PN: 3MU00074AB is Hot Standby W/Space Diversity PN: 3MU00074AC is 1+0 Non-Standby Frequency Band: 10700-11700 GHZ PN: 3EM24189AA is Hot Standby 1:10 coupler PN: 3EM24189AB is Hot Standby W/space Diversity PN: 3EM24189AC is 1+0 Non-Standby

Table 5-C. MPT-HL shelf unit descriptions (cont.)

UNIT	DESCRIPTION
Waveguide Extension Kits PN: 3EM24123AR, 3EM24123AS, 3EM24166AQ, 3EM24166AR Qty: as required	Waveguide Extension Kits PN: 3EM24123AR is Xmt/Rcv W/G Ext A8/A11 (6 GHz) PN: 3EM24123AS is Space Div W/G Ext A8/A11 (6 GHz) PN: 3EM24166AQ is Xmt/Rcv W/G Ext A8/A11 (11 GHz) PN: 3EM24166AR is Space Div W/G Ext A8/A11 (11 GHz)
Stacking Filter Waveguide Kits: 6 GHz PN: 3EM24123AA/3EM24123AQ Qty: as required	Stacking Filter Waveguide Kits: 6 GHz PN: 3EM24123AA is Hot Standby 1st MPT, Xmt and Rcv PN: 3EM24123AB is Hot Standby 1st and 2nd MPT, Xmt and Rcv PN: 3EM24123AC is Hot Standby 3rd MPT, Xmt and Rcv PN: 3EM24123AD is Hot Standby 3rd and 4th MPT, Xmt and Rcv PN: 3EM24123AE is Add-On Space Diversity 1st MPT PN: 3EM24123AF is Add-On Space Diversity 1st and 2nd MPT PN: 3EM24123AG is Add-On Space Diversity 3rd MPT PN: 3EM24123AH is Add-On Space Diversity 3rd and 4th MPT PN: 3EM24123AL is Field Add-On Xmt and Rcv Circulator Kit PN: 3EM24123AM is Freq Diversity 1st MPT PN: 3EM24123AN is Freq Diversity 1st and 2nd MPT PN: 3EM24123AP is Freq Diversity 3rd MPT PN: 3EM24123AQ is Freq Diversity 3rd and 4th MPT
Stacking Filter Waveguide Kits: 8 GHz PN: 3MU00075AA/3MU00075AK Qty: as required	Stacking Filter Waveguide Kits: 6 GHz PN: 3MU00075AA is Hot Standby 1st MPT, Xmt and Rcv PN: 3MU00075AB is Hot Standby 1st and 2nd MPT, Xmt and Rcv PN: 3MU00075AC is Hot Standby 3rd MPT, Xmt and Rcv PN: 3MU00075AD is Hot Standby 3rd and 4th MPT, Xmt and Rcv PN: 3MU00075AE is Add-On Space Diversity 1st MPT PN: 3MU00075AF is Add-On Space Diversity 1st and 2nd MPT PN: 3MU00075AG is Add-On Space Diversity 3rd MPT PN: 3MU00075AH is Add-On Space Diversity 3rd and 4th MPT PN: 3MU00075AK is Field Add-On Xmt and Rcv Circulator Kit PN: 3MU00075AL is Freq Diversity 1st MPT PN: 3MU00075AM is Freq Diversity 1st and 2nd MPT PN: 3MU00075AN is Freq Diversity 3rd MPT PN: 3MU00075AP is Freq Diversity 3rd and 4th MPT

Table 5-C. MPT-HL shelf unit descriptions (cont.)

UNIT	DESCRIPTION
Stacking Filter Waveguide Kits: 11 GHz PN: 3EM24166AA/3EM24166AP Qty: as required	Stacking Filter Waveguide Kits: 11 GHz PN: 3EM24166AA is Hot Standby 1st MPT, Xmt and Rcv PN: 3EM24166AB is Hot Standby 1st and 2nd MPT, Xmt and Rcv PN: 3EM24166AC is Hot Standby 3rd MPT, Xmt and Rcv PN: 3EM24166AD is Hot Standby 3rd and 4th MPT, Xmt and Rcv PN: 3EM24166AE is Add-On Space Diversity 1st MPT PN: 3EM24166AF is Add-On Space Diversity 1st and 2nd MPT PN: 3EM24166AG is Add-On Space Diversity 3rd MPT PN: 3EM24166AH is Add-On Space Diversity 3rd and 4th MPT PN: 3EM24166AK is Field Add-On Xmt and Rcv Circulator Kit PN: 3EM24166AL is Freq Diversity 1st MPT PN: 3EM24166AM is Freq Diversity 1st and 2nd MPT PN: 3EM24166AN is Freq Diversity 3rd MPT PN: 3EM24166AP is Freq Diversity 3rd and 4th MPT
Flange Adapter Kits PN: 3DH04122HA/3DH04122HT Qty: as required	Flange Adapter Kits: Frequency Band: 5925-7125 GHZ PN: 3DH04122HA is Flange Type CPR-137, 1 port kit PN: 3DH04122HB is Flange Type CPR-137, 2 port kit PN: 3DH04122HC is Flange Type CPR-137, 3 port kit PN: 3DH04122HD is Flange Type CPR-159, 1 port kit PN: 3DH04122HE is Flange Type CPR-159, 2 port kit PN: 3DH04122HF is Flange Type CPR-159, 3 port kit PN: 3DH04122HG is Flange Type CMR-159, 1 port kit PN: 3DH04122HH is Flange Type CMR-159, 2 port kit PN: 3DH04122HJ is Flange Type CMR-159, 3 port kit Frequency Band: 7125-8500 GHZ PN: 3DH04122HK is Flange Type CPR-112, 1 port kit PN: 3DH04122HL is Flange Type CPR-112, 2 port kit PN: 3DH04122HM is Flange Type CPR-112, 3 port kit Frequency Band: 10700-11700 GHZ PN: 3DH04122HN is Flange Type CPR-90, 1 port kit PN: 3DH04122HP is Flange Type CPR-90, 2 port kit PN: 3DH04122HQ is Flange Type CPR-90, 3 port kit PN: 3DH04122HR is Flange Type CMR-90, 1 port kit PN: 3DH04122HS is Flange Type CMR-90, 2 port kit PN: 3DH04122HT is Flange Type CMR-90, 3 port kit

Table 5-D. MPT-HC/XP/9558HC unit descriptions

UNIT	DESCRIPTION
9558HC OutDoor Unit (9558HC) 9558HC, 5.8 GHz unlicensed, 64 MHz separation with External diplexer¹ PN: 3DB20913BA, 3DB20914BA Qty: 1 or 2 per 5.8 GHz unlicensed, 64 MHz separation radio channel	The 9558HC OutDoor Unit is a microprocessor controlled RF transceiver that interfaces the MSS-4,8,1c shelf MPTACC, Core-E Ethernet port, P8ETH card, or MPR-e (stand-alone) with the antenna. Supports static and adaptive modulation scheme. Channel frequency is software selectable within tuning range of the 9558HC Transceiver. The 9558HC Transceiver is frequency dependent. An 9558HC connected to a Core-E port or P8ETH card requires external power. Power can be provided using one of the following: • power injector card • power injector box • MPT Power Unit • MPT Extended Power Unit PN: 3DB20913BA is 9558HC, 5725.5-5785.5 MHz, Tx Low PN: 3DB20914BA is 9558HC, 5789.5-5849.5 MHz, Tx High
MPT-HC OutDoor Unit (MPT-HC) MPT-HC, L6 GHz, 252 MHz separation PN: 3DB20441BA, 3DB20442BA, 3DB20443BA, 3DB20444BA Qty: 1 or 2 per L6 GHz, 252 MHz separation radio channel	The MPT-HC OutDoor Unit is a microprocessor controlled RF transceiver that interfaces the MSS-4,8,1c shelf MPTACC, Core-E Ethernet port, P8ETH card, or MPR-e (stand-alone) with the antenna. Supports static and adaptive modulation scheme. Channel frequency is software selectable within tuning range of the MPT-HC Transceiver. The MPT-HC Transceiver is frequency dependent. An MPT-HC connected to a Core-E port or P8ETH card requires external power. Power can be provided using one of the following: • power injector card • power injector box • MPT Power Unit • MPT Extended Power Unit PN: 3DB20441BA is MPT-HC, 5929 - 6050 MHz, Tx Low PN: 3DB20443BA is MPT-HC, 6182 - 6302.04 MHz, Tx High PN: 3DB20442BA is MPT-HC, 6047.96 - 6168 MHz, Tx Low PN: 3DB20444BA is MPT-HC, 6300 - 6420.04 MHz, Tx High

Table 5-D. MPT-HC/XP/9558HC unit descriptions (cont.)

UNIT	DESCRIPTION
MPT-HC High Power OutDoor Unit (MPT-HC) MPT-HC, L6 GHz, 252.04 MHz separation with External diplexer¹ PN: 3DB20800BA, 3DB20802BA Qty: 1 or 2 per L6 GHz, 252.04 MHz separation radio channel	The MPT-HC High Power OutDoor Unit is a microprocessor controlled RF transceiver that interfaces the MSS-4,8,1c shelf MPTACC, Core-E Ethernet port, P8ETH card, or MPR-e (stand-alone) with the antenna. Supports static and adaptive modulation scheme. Channel frequency is software selectable within tuning range of the MPT-HC Transceiver. The MPT-HC Transceiver is frequency dependent. An MPT-HC connected to a Core-E port or P8ETH card requires external power. Power can be provided using one of the following: • power injector card • power injector box • MPT Power Unit • MPT Extended Power Unit PN: 3DB20800BA is MPT-HC, 5929.96-6168 MHz, Tx Low PN: 3DB20802BA is MPT-HC, 6182-6420 MHz, Tx High
MPT-HC OutDoor Unit (MPT-HC) MPT-HC, U6 GHz, 160 MHz separation PN: 3DB20367BA, 3DB20434BA, 3DB20435BA, 3DB20436BA, 3DB20462BA, 3DB20463BA Qty: 1 or 2 per U6 GHz, 160 MHz separation radio channel	The MPT-HC OutDoor Unit is a microprocessor controlled RF transceiver that interfaces the MSS-4,8,1c shelf MPTACC, Core-E Ethernet port, P8ETH card, or MPR-e (stand-alone) with the antenna. Supports static and adaptive modulation scheme. Channel frequency is software selectable within tuning range of the MPT-HC Transceiver. The MPT-HC Transceiver is frequency dependent. An MPT-HC connected to a Core-E port or P8ETH card requires external power. Power can be provided using one of the following: • power injector card • power injector box • MPT Power Unit • MPT Extended Power Unit PN: 3DB20367BA is MPT-HC, 6540 - 6610 MHz, Tx Low PN: 3DB20435BA is MPT-HC, 6710 - 6780 MHz, Tx High PN: 3DB20434BA is MPT-HC, 6590 - 6660 MHz, Tx Low PN: 3DB20436BA is MPT-HC, 6750 - 6820 MHz, Tx High PN: 3DB20462BA is MPT-HC, 6640 - 6710 MHz, Tx Low PN: 3DB20463BA is MPT-HC, 6800 - 6870 MHz, Tx High

Table 5-D. MPT-HC/XP/9558HC unit descriptions (cont.)

UNIT	DESCRIPTION
MPT-HC High Power OutDoor Unit (MPT-HC) MPT-HC, U6 GHz, 160/340 MHz separation with External diplexer¹ PN: 3DB20804BA, 3DB20806BA Qty: 1 or 2 per U6 GHz, 160/340 MHz separation radio channel	The MPT-HC High Power OutDoor Unit is a microprocessor controlled RF transceiver that interfaces the MSS-4,8,1c shelf MPTACC, Core-E Ethernet port, P8ETH card, or MPR-e (stand-alone) with the antenna. Supports static and adaptive modulation scheme. Channel frequency is software selectable within tuning range of the MPT-HC Transceiver. The MPT-HC Transceiver is frequency dependent. An MPT-HC connected to a Core-E port or P8ETH card requires external power. Power can be provided using one of the following: • power injector card • power injector box • MPT Power Unit • MPT Extended Power Unit PN: 3DB20804BA is MPT-HC, 6420-6775 MHz, Tx Low PN: 3DB20806BA is MPT-HC, 6710-7115 MHz, Tx High
MPT-HC OutDoor Unit (MPT-HC) MPT-HC, U6 GHz, 340 MHz separation PN: 3DB20437BA, 3DB20438BA, 3DB20439BA, 3DB20440BA, 3DB20464BA, 3DB20465BA Qty: 1 or 2 per U6 GHz, 340 MHz separation radio channel	The MPT-HC OutDoor Unit is a microprocessor controlled RF transceiver that interfaces the MSS-4,8,1c shelf MPTACC, Core-E Ethernet port, P8ETH card, or MPR-e (stand-alone) with the antenna. Supports static and adaptive modulation scheme. Channel frequency is software selectable within tuning range of the MPT-HC Transceiver. The MPT-HC Transceiver is frequency dependent. An MPT-HC connected to a Core-E port or P8ETH card requires external power. Power can be provided using one of the following: • power injector card • power injector box • MPT Power Unit • MPT Extended Power Unit PN: 3DB20437BA is MPT-HC, 6420 - 6600 MHz, Tx Low PN: 3DB20439BA is MPT-HC, 6760 - 6940 MHz, Tx High PN: 3DB20438BA is MPT-HC, 6565 - 6720 MHz, Tx Low PN: 3DB20440BA is MPT-HC, 6905 - 7060 MHz, Tx High PN: 3DB20464BA is MPT-HC, 6595 - 6775 MHz, Tx Low PN: 3DB20465BA is MPT-HC, 6935 - 7115 MHz, Tx High

Table 5-D. MPT-HC/XP/9558HC unit descriptions (cont.)

UNIT	DESCRIPTION
MPT-HC OutDoor Unit (MPT-HC) MPT-HC, 7/8 GHz, 175/300 MHz separation with External Diplexer¹ PN: 3DB20454BC, 3DB20456BB Qty: 1 or 2 per 7/8 GHz, 175/300 MHz separation radio channel	The MPT-HC OutDoor Unit is a microprocessor controlled RF transceiver with External Diplexer that interfaces the MSS-4,8,1c shelf MPTACC, Core-E Ethernet port, P8ETH card, or MPR-e (stand-alone) with the antenna. Supports static and adaptive modulation scheme. Channel frequency is software selectable within tuning range of the MPT-HC Transceiver. The MPT-HC Transceiver is frequency dependent. An MPT-HC connected to a Core-E port or P8ETH card requires external power. Power can be provided using one of the following: • power injector card • power injector box • MPT Power Unit • MPT Extended Power Unit PN: 3DB20454BC is MPT-HC, 7107 - 8377 MHz, Tx Low PN: 3DB20456BC is MPT-HC, 7261 - 8496.114 MHz, Tx High
MPT-HC OutDoor Unit (MPT-HC) MPT-HC, 11 GHz, 490/500 MHz separation PN: 3DB20371BB, 3DB20546BB, 3DB20547BB, 3DB20548BB Qty: 1 or 2 per 11 GHz, 490/500 MHz separation radio channel	The MPT-HC OutDoor Unit is a microprocessor controlled RF transceiver that interfaces the MSS-4,8,1c shelf MPTACC, Core-E Ethernet port, P8ETH card, or MPR-e (stand-alone) with the antenna. Supports static and adaptive modulation scheme. Channel frequency is software selectable within tuning range of the MPT-HC Transceiver. The MPT-HC Transceiver is frequency dependent. An MPT-HC connected to a Core-E port or P8ETH card requires external power. Power can be provided using one of the following: • power injector card • power injector box • MPT Power Unit • MPT Extended Power Unit PN: 3DB20371BB is MPT-HC, 10695 - 10955 MHz, Tx Low PN: 3DB20547BB is MPT-HC, 11205 - 11485 MHz, Tx High PN: 3DB20546BB is MPT-HC, 10935 - 11205 MHz, Tx Low PN: 3DB20548BB is MPT-HC, 11445 - 11705 MHz, Tx High

Table 5-D. MPT-HC/XP/9558HC unit descriptions (cont.)

UNIT	DESCRIPTION
MPT-HC OutDoor Unit (MPT-HC) MPT-HC, 15 GHz, 475 MHz separation PN: 3DB20373BA, 3DB20423BA Qty: 1 or 2 per 15 GHz, 475 MHz separation radio channel	The MPT-HC OutDoor Unit is a microprocessor controlled RF transceiver that interfaces the MSS-4,8,1c shelf MPTACC, Core-E Ethernet port, P8ETH card, or MPR-e (stand-alone) with the antenna. Supports static and adaptive modulation scheme. Channel frequency is software selectable within tuning range of the MPT-HC Transceiver. The MPT-HC Transceiver is frequency dependent. An MPT-HC connected to a Core-E port or P8ETH card requires external power. Power can be provided using one of the following: • power injector card • power injector box • MPT Power Unit • MPT Extended Power Unit PN: 3DB20373BA is MPT-HC, 14500 - 14724 MHz, Tx Low PN: 3DB20423BA is MPT-HC, 14920 - 15144 MHz, Tx High
MPT-HC OutDoor Unit (MPT-HC) MPT-HC, 18 GHz, 1560 MHz separation PN: 3DB20432BA, 3DB20433BA Qty: 1 or 2 per 18 GHz, 1560 MHz separation radio channel	The MPT-HC OutDoor Unit is a microprocessor controlled RF transceiver that interfaces the MSS-4,8,1c shelf MPTACC, Core-E Ethernet port, P8ETH card, or MPR-e (stand-alone) with the antenna. Supports static and adaptive modulation scheme. Channel frequency is software selectable within tuning range of the MPT-HC Transceiver. The MPT-HC Transceiver is frequency dependent. An MPT-HC connected to a Core-E port or P8ETH card requires external power. Power can be provided using one of the following: • power injector card • power injector box • MPT Power Unit • MPT Extended Power Unit PN: 3DB20432BA is MPT-HC, 17700 - 18140 MHz, Tx Low PN: 3DB20433BA is MPT-HC, 19260 - 19700 MHz, Tx High

Table 5-D. MPT-HC/XP/9558HC unit descriptions (cont.)

UNIT	DESCRIPTION
MPT-HC OutDoor Unit (MPT-HC) MPT-HC, 23 GHz Channel, 1200/1232 MHz separation PN: 3DB20473BA, 3DB20474BA, 3DB20475BA, 3DB20476BA Qty: 1 or 2 per 23 GHz, 1200/1232 MHz separation radio channel	The MPT-HC OutDoor Unit is a microprocessor controlled RF transceiver that interfaces the MSS-4,8,1c shelf MPTACC, Core-E Ethernet port, P8ETH card, or MPR-e (stand-alone) with the antenna. Supports static and adaptive modulation scheme. Channel frequency is software selectable within tuning range of the MPT-HC Transceiver. The MPT-HC Transceiver is frequency dependent. An MPT-HC connected to a Core-E port or P8ETH card requires external power. Power can be provided using one of the following: • power injector card • power injector box • MPT Power Unit • MPT Extended Power Unit PN: 3DB20473BA is MPT-HC, 21198 - 21819 MHz, Tx Low PN: 3DB20475BA is MPT-HC, 22400 - 23019 MHz, Tx High PN: 3DB20474BA is MPT-HC, 21781 - 22400 MHz, Tx Low PN: 3DB20476BA is MPT-HC, 22981 - 23600 MHz, Tx High
MPT-HC OutDoor Unit (MPT-HC) MPT-HC, 38 GHz Channel, 700 MHz separation PN: 3DB20379BA, 3DB20562BA, 3DB20563BA, 3DB20564BA Qty: 1 or 2 per 38 GHz, 700 MHz separation radio channel	The MPT-HC OutDoor Unit is a microprocessor controlled RF transceiver that interfaces the MSS-4,8,1c shelf MPTACC, Core-E Ethernet port, P8ETH card, or MPR-e (stand-alone) with the antenna. Supports static and adaptive modulation scheme. Channel frequency is software selectable within tuning range of the MPT-HC Transceiver. The MPT-HC Transceiver is frequency dependent. An MPT-HC connected to a Core-E port or P8ETH card requires external power. Power can be provided using one of the following: • power injector card • power injector box • MPT Power Unit • MPT Extended Power Unit PN: 3DB20379BA is MPT-HC, 38600 - 38950 MHz, Tx Low PN: 3DB20563BA is MPT-HC, 39300 - 39650 MHz, Tx High PN: 3DB20562BA is MPT-HC, 38950 - 39300 MHz, Tx Low PN: 3DB20564BA is MPT-HC, 39650 - 40000 MHz, Tx High

Table 5-D. MPT-HC/XP/9558HC unit descriptions (cont.)

UNIT	DESCRIPTION
MPT-XP High Power OutDoor Unit (MPT-XP) MPT-XP, L6 GHz, 252.04 MHz separation¹ PN: 3DB20760BA, 3DB20761BA Qty: 1 or 2 per L6 GHz, 252.04 MHz separation radio channel	The MPT-XP High Power OutDoor Unit is a microprocessor controlled RF transceiver that interfaces the MSS-4,8,1c shelf MPTACC, Core-E Ethernet port, P8ETH card, or MPR-e (stand-alone) with the antenna. Supports static and adaptive modulation scheme. Channel frequency is software selectable within tuning range of the MPT-HC Transceiver. The MPT-HC Transceiver is frequency dependent. An MPT-XP connected to a Core-E port or P8ETH card requires external power. Power can be provided using one of the following: • MPT Power Unit • MPT Extended Power Unit PN: 3DB20760BA is MPT-XP, 5929.96-6168 MHz, Tx Low PN: 3DB20761BA is MPT-XP, 6182-6420.04 MHz, Tx High
MPT-XP High Power OutDoor Unit (MPT-XP) MPT-XP, U6 GHz, 160/340 MHz separation¹ PN: 3DB20763BA, 3DB20764BA Qty: 1 or 2 per U6 GHz, 160/340 MHz separation radio channel	The MPT-XP High Power OutDoor Unit is a microprocessor controlled RF transceiver that interfaces the MSS-4,8,1c shelf MPTACC, Core-E Ethernet port, P8ETH card, or MPR-e (stand-alone) with the antenna. Supports static and adaptive modulation scheme. Channel frequency is software selectable within tuning range of the MPT-HC Transceiver. The MPT-HC Transceiver is frequency dependent. An MPT-XP connected to a Core-E port or P8ETH card requires external power. Power can be provided using one of the following: • MPT Power Unit • MPT Extended Power Unit PN: 3DB20763BA is MPT-XP, 6420-6775 MHz, Tx Low PN: 3DB20764BA is MPT-XP, 6710-7115 MHz, Tx High

Table 5-D. MPT-HC/XP/9558HC unit descriptions (cont.)

UNIT	DESCRIPTION
MPT-XP High Power OutDoor Unit (MPT-XP) MPT-XP, 7 GHz, 175 MHz separation¹ PN: 3DB20771BA, 3DB20772BA Qty: 1 or 2 per 7 GHz, 175 MHz separation radio channel	The MPT-XP High Power OutDoor Unit is a microprocessor controlled RF transceiver that interfaces the MSS-4,8,1c shelf MPTACC, Core-E Ethernet port, P8ETH card, or MPR-e (stand-alone) with the antenna. Supports static and adaptive modulation scheme. Channel frequency is software selectable within tuning range of the MPT-HC Transceiver. The MPT-HC Transceiver is frequency dependent. An MPT-XP connected to a Core-E port or P8ETH card requires external power. Power can be provided using one of the following: • MPT Power Unit • MPT Extended Power Unit PN: 3DB20771BA is MPT-XP, 7107-7714.5 MHz, Tx Low PN: 3DB20772BA is MPT-XP, 7261-7911 MHz, Tx High
MPT-XP High Power OutDoor Unit (MPT-XP) MPT-XP, 8 GHz, 300 MHz separation¹ PN: 3DB20773BA, 3DB20774BA Qty: 1 or 2 per 8 GHz, 300 MHz separation radio channel	The MPT-XP High Power OutDoor Unit is a microprocessor controlled RF amplifier that provides 7db of amplification for the transmit signal. Interconnects the MPT-HC High Power ODU and high power branching box. The MPT-XP High Power ODU is frequency dependent. An MPT-XP requires external power. Power can be provided using one of the following: • MPT Power Unit • MPT Extended Power Unit PN: 3DB20773BA is MPT-XP, 7725-8377 MHz, Tx Low PN: 3DB20774BA is MPT-XP, 8025-8496.114 MHz, Tx High
9558HC Branching Box, 5.8 GHz unlicensed, 64 MHz separation¹ P/N: 3DB20752BA, 3DB20752BB QTY: 1 per 9558HC 5.8 GHz unlicensed w/External Diplexer	9558HC Branching Box is external diplexer for 5.8 GHz unlicensed, 64 MHz separation. PN: 3DB20752BA is 9558HC Branching Box, Ch1-1P P.SH.64 MHz (f1: 5725.5, f2: 5755.5, f3: 5789.5, f4: 5819.5) PN: 3DB20752BB is 9558HC Branching Box, Ch2-2P P.SH.64 MHz (f1: 5755.5, f2: 5785.5, f3: 5819.5, f4: 5849.5)

Table 5-D. MPT-HC/XP/9558HC unit descriptions (cont.)

UNIT	DESCRIPTION
MPT-HC/XP High Power Branching Box, L6 GHz, 252.04 MHz separation ¹ P/N: 3DB20753BA, 3DB20753BB QTY: 1 per MPT-HC/XP High Power L6 GHz w/External Diplexer	MPT-HC/XP High Power Branching Box is external diplexer for L6 GHz, 252.04 MHz separation. PN: 3DB20753BA is MPT-HC/XP High Power Branching Box, Ch1-1P P.SH.252.04 MHz (f1:5929, f2: 6050, f3: 6182, f4: 6302) PN: 3DB20753BB is MPT-HC/XP High Power Branching Box, Ch2-2P P.SH.252.04 MHz (f1:6032, f2: 6168, f3: 6285, f4: 6420)
MPT-HC/XP High Power Branching Box, U6 GHz, 160 MHz separation ¹ P/N: 3DB20756BA/3DB20756BC QTY: 1 per MPT-HC/XP High Power L6 GHz w/External Diplexer	MPT-HC/XP High Power Branching Box is external diplexer for L6 GHz, 160 MHz separation. PN: 3DB20756BA is MPT-HC/XP High Power Branching Box, Ch1-1P P.SH.160 MHz (f1:6540, f2: 6610, f3: 6710, f4: 6780) PN: 3DB20756BB is MPT-HC/XP High Power Branching Box, Ch2-2P P.SH.160 MHz (f1:6590, f2: 6660, f3: 6750, f4: 6820) PN: 3DB20756BC is MPT-HC/XP High Power Branching Box, Ch3-3P P.SH.160 MHz (f1:6640, f2: 6710, f3: 6800, f4: 6870)
MPT-HC/XP High Power Branching Box, U6 GHz, 340 MHz separation ¹ P/N: 3DB20755BA/3DB20755BC QTY: 1 per MPT-HC/XP High Power L6 GHz w/External Diplexer	MPT-HC/XP High Power Branching Box is external diplexer for L6 GHz, 340 MHz separation. PN: 3DB20755BA is MPT-HC/XP High Power Branching Box, Ch1-1P P.SH.340 MHz (f1:6420, f2: 6600, f3: 6760, f4: 6940) PN: 3DB20755BB is MPT-HC/XP High Power Branching Box, Ch2-2P P.SH.340 MHz (f1:6565, f2: 6720, f3: 6905, f4: 7060) PN: 3DB20755BC is MPT-HC/XP High Power Branching Box, Ch3-3P P.SH.340 MHz (f1:6595, f2: 6775, f3: 6935, f4: 7115)
MPT-HC/XP Branching Box, 7 GHz, 175 MHz separation ¹ P/N: 3CC40072AC, 3CC40072AD QTY: 1 per MPT-HC/XP 7/8 GHz w/External Diplexer	MPT-HC/XP Branching Box is external diplexer for 7 GHz, 175 MHz separation. PN: 3CC40072AC is MPT-HC/XP Branching Box, Ch1-1P P.SH.175 MHz (f1:7125, f2: 7215, f3: 7300, f4: 7390) PN: 3CC40072AD is MPT-HC/XP Branching Box, Ch2-2P P.SH.175 MHz (f1:7155, f2: 7250, f3: 7330, f4: 7425)

Table 5-D. MPT-HC/XP/9558HC unit descriptions (cont.)

UNIT	DESCRIPTION
MPT-HC/XP Branching Box, 8 GHz, 300/310 MHz separation ¹ P/N: 3CC40073AC, 3CC40073AD QTY: 1 per MPT-HC/XP 8 GHz w/External Diplexer	MPT-HC/XP Branching Box is external diplexer for 8 GHz, 300/310 MHz separation. PN: 3CC40073AC is MPT-HC/XP Branching Box, Ch1-1P P.SH.300/310 MHz (f1:7725, f2: 7845, f3: 8025, f4: 8155) PN: 3CC40073AD is MPT-HC/XP Branching Box, Ch2-2P P.SH.300/310 MHz (f1:7845, f2: 7975, f3: 8145, f4: 8275)
RPS Module PN: 3DB20117BA QTY: 1 per MPT-HC/XP configured with RPS 1+1 protection	RPS Module configures MPT-HC/XP ODU for 1+1 Receive Protection Switching configuration. 1 required for each MPT-HC/XP configured for 1+1 RPS protection.
XPIC+RPS Module PN: 3DB20116BB QTY: 1 per MPT-HC/XP configured with Cross Polarization	XPIC+RPS Module configures MPT-HC/XP ODU for XPIC and/or 1+1 RPS. 1 required for each MPT-HC/XP configured for XPIC and/or 1+1 RPS.
MPT-HC/XP/9558HC Coupler QTY: per radio configuration	MPT-HC/XP/9558HC Coupler PN: 3CC58276AB is 5.8 GHz Unlicensed Band Unequal Loss Coupler PN: 3CC58056AA is 6 GHz Band (3:3 dB) Equal Coupler PN: 3CC58056AB is 6 GHz Band (1:10 dB) Unequal Coupler PN: 3CC14536AA is 7/8 GHz Band (3:3 dB) Equal Coupler PN: 3CC14536AB is 7/8 GHz Band (1:10 dB) Unequal Coupler PN: 3CC14140AA is 11 GHz Band (3:3 dB) Equal Coupler PN: 3CC14140AB is 11 GHz Band (1:10 dB) Unequal Coupler PN: 3CC13472AA is 13/15 GHz Band (3:3 dB) Equal Coupler PN: 3CC13472AB is 13/15 GHz Band (1:10 dB) Unequal Coupler PN: 3CC13473AA is 18/25 GHz Band (3:3 dB) Unequal Coupler PN: 3CC13473AB is 18/25 GHz Band (1:10 dB) Equal Coupler PN: 3CC13474AA is 28/38 GHz Band (3:3 dB) Unequal Coupler PN: 3CC13474AB is 28/38 GHz Band (1:10 dB) Equal Coupler

Table 5-D. MPT-HC/XP/9558HC unit descriptions (cont.)

UNIT	DESCRIPTION
MPT-HC/XP OMT (XPIC) Coupler QTY: per radio configuration	MPT-HC/XP OMT 2x(1+0) XPIC Coupler (horizontal and vertical) PN: 3CC58134AA is L6 GHz Band XPIC Coupler PN: 3CC58186AA is U6 GHz Band XPIC Coupler PN: 3CC58124AA is 7 GHz Band XPIC Coupler PN: 3CC58133AA is 8 GHz Band XPIC Coupler PN: 3CC58116AA is 11 GHz Band XPIC Coupler PN: 3CC58163AA is 15 GHz Band XPIC Coupler PN: 3CC58164AA is 18 GHz Band XPIC Coupler PN: 3CC58165AA is 23 GHz Band XPIC Coupler
MPT-HC OMT-C (XPIC) Coupler QTY: per radio configuration	MPT-HC OMT-C 4x(1+0) XPIC Coupler (2 horizontal and 2 vertical) PN: 3CC58244AA is L6 GHz Band 4 ODU OMT-C XPIC Coupler PN: 3CC58200AA is 11 GHz Band 4 ODU OMT-C XPIC Coupler PN: 3CC58200AA is 11 GHz Band 4 ODU OMT-C XPIC Coupler PN: 3CC58201AA is 18 GHz Band 4 ODU OMT-C XPIC Coupler PN: 3CC58202AA is 23 GHz Band 4 ODU OMT-C XPIC Coupler
MPT-HC/XP Loads for unused coupler ports QTY: per radio configuration	OMT/OMT-C Loads for unused coupler ports PN: 3CC58220AA is 27.25-40 GHz Load (WR28 Termination) PN: 3CC58221AA is 18-25 GHz Load (WR42 Termination) PN: 3CC58228AA is 13-15 GHz Load (WR62 Termination) PN: 3CC58223AA is 11 GHz Load (WR75 Termination) PN: 3CC58230AA is 7/8 GHz Load (WR112 Termination) PN: 3CC58225AA is 6 GHz Load (WR137 Termination)
MPT-HC/XP/9558HC Nose Adapter QTY: per radio configuration	Nose Adapter for MPT-HC/XP/9558HC PN: 3EM27405AA is MPT-HC, 5.8 GHz Nose Adapter PN: 3DB01465AA is MPT-HC/XP, 6 GHz Nose Adapter PN: 3DB10136AA is MPT-HC/XP, 7/8 GHz Nose Adapter PN: 3CC50125AA is MPT-HC, 11 GHz Nose Adapter PN: 1AB146090001 is MPT-HC, 15 GHz Nose Adapter PN: 1AB146090002 is MPT-HC, 18/23 GHz Nose Adapter PN: 3DB02082AA is MPT-HC, 38 GHz Nose Adapter

Table 5-D. MPT-HC/XP/9558HC unit descriptions (cont.)

UNIT	DESCRIPTION
MPT-HC/XP or Coupler Pole Mount QTY: as required per site configuration	MPT-HC/XP or Coupler Pole Mount PN: 3CC06071AA is pole mount assembly for integrated antenna configuration PN: 3CC10752AB IS is pole mount assembly for integrated antenna configuration PN: 3CC13034AA is pole mount assembly for not-integrated antenna configuration PN; 3DB10137AA is pole mount assembly for not-integrated antenna configuration
MPT-HC/XP Rack Mount Bracket Kit PN: 3EM16601AA/3EM16601AH QTY: as required per site configuration	MPT-HC/XP Rack Mount Bracket kit provides 19 inch rack bracket, nose adapter, and miscellaneous hardware for use in Non-integrated 1+0 and 1+1 configuration. PN: 3EM16601AC is MPT-HC, 38 GHz Rack Mount Kit PN: 3EM16601AF is MPT-HC/XP, 6 GHz Rack Mount Kit PN: 3EM16601AG is MPT-HC/XP, 7/8 GHz Rack Mount Kit PN: 3EM16601AH is MPT-HC, 11 GHz Rack Mount Kit
Power Injector Card PN: 3CC50128AA QTY: per radio link configuration	Power Injector combines DC battery and Ethernet connections for interconnections with MPT-HC for interconnection between MSS-4/8 Core-E Ethernet ports. Install in MSS-4/8 slot.
Power Injector Box PN: 3CC50129AA QTY: per radio link configuration	Power Injector combines DC battery and Ethernet connections for interconnections with MPT-HC for interconnection between MSS-4/8 Core-E Ethernet ports. Mounts to rack. Power connections A & B directly to battery supply.
Power Injector Bracket PN: 3DB77008AC QTY: per radio link configuration	Bracket used to install Power Injector box in a 19 inch rack.
21 inch Adapter Kit PN: 3CC50065AA QTY: per radio link configuration	Kit used with Power Injector bracket to install Power Injector box in a 21 inch rack.

Table 5-D. MPT-HC/XP/9558HC unit descriptions (cont.)

UNIT	DESCRIPTION
MPT-HC/XP Station Battery Accessories QTY: 1 each for MPT-HC/XP direct connection to station battery.	MPT-HC/XP Station Battery Accessories provide connectivity to station battery. Required for MPT-HC/XP connected to CORE-E card. PN: 3CC50149AA is Lightning Arrestor bracket (up to 4) PN: 3CC50030AAAA is Lightning arrestor W/ground cable PN: 1AB251350001 is Low Pass Filter PN: 3CC52159AA is Type N BNC to 2-Wire Adapter PN: 3CC52188AA is Adapter Cable, N to RJ45 plus R2CT PN: 1AC001100022 is Coax cable 50 ohm (diameter=10.3mm) for Length $\geq$ 200m PN: 1AB095530023 is Grounding Kit for Coax cable (diameter =10.3mm) PN: 1AB095530023 is Type N BNC, Male, Straight, (diameter=10.3mm) N: 1AC041350001 is Coax cable 50 ohm (diameter=6.85mm) for Length <200m PN: 1AD040130004 is Grounding Kit for Coax cable (diameter =6.85mm) PN: 1AB095530036 is Type N BNC, Male, Straight, (diameter=6.85mm)
Cat5E Cable, Outdoor rated PN: 1AC016760006 QTY: as required per site configuration	Cat5E Cable, Outdoor rated used for MPT-HC/XP PFoE and power only applications
RJ-45 Cat5E Connector Kit PN: 1AB074610027 QTY: as required per site configuration	RJ-45 Cat5E connector kit is used with Cat5E outdoor cable.
Cat5E Cable, Indoor rated PN: 1AC016760003 QTY: as required per site configuration	Cat5E Cable, Indoor rated used for indoor Ethernet cable and Core-E MPT-HC/XP port to Power Injector card/box.
RJ-45 Cat5E Connector Kit PN: 1AB074610008 QTY: as required per site configuration	RJ-45 Cat5E connector kit is used with Cat5E indoor cable.
Hirose Crimping Tool (RJ-45) PN: 1AD160490001 QTY: Minimum of 1 available per site installation	Hirose Crimping Tool (RJ-45) used to terminate RJ-45 connectors to Cat5E cable.
R2CT Housing PN: 1AB150990002 QTY: as required per site configuration	R2CT Housing provides watertight cable transition to MPT-HC/XP for Data+Power connection.
Cat5E Grounding Kit PN: 1AD040130004 QTY: as required per site configuration	Cat5E Grounding Kit

Table 5-D. MPT-HC/XP/9558HC unit descriptions (cont.)

UNIT	DESCRIPTION
Hoisting Protection Tube PN: 1AF17000AAAA QTY: Minimum of 1 available per site installation	
SFP Module 1AB187280040, 1AB187280045 QTY: 2 per MPT-HC/XP optical interconnection per NE configuration	SFP Module for data interconnection between MPT-HC/XP and CORE-E card and MPT Access card. PN: 1AB187280040 is SFP Module, 1000BaseT-Lx SM fiber up to 5 km PN: 1AB187280045 is SFP Module, 1000BaseT-Sx MM fiber up to 550 meter
MPT-HC/XP IDU/ODU Fiber PN: 3CC52170AA/3CC52170AL QTY: as required per NE configuration	MPT-HC/XP IDU/ODU Fiber are Multi-Mode Fibers with LC to LC optical Ethernet connectivity and includes Q-XCO housing for outdoor applications. PN: 3CC52170AA is MPT-HC/XP IDU/ODU Fiber, 80 meter PN: 3CC52170AB is MPT-HC/XP IDU/ODU Fiber, 100 meter PN: 3CC52170AC is MPT-HC/XP IDU/ODU Fiber, 120 meter PN: 3CC52170AD is MPT-HC/XP IDU/ODU Fiber, 140 meter PN: 3CC52170AE is MPT-HC/XP IDU/ODU Fiber, 160 meter PN: 3CC52170AF is MPT-HC/XP IDU/ODU Fiber, 180 meter PN: 3CC52170AG is MPT-HC/XP IDU/ODU Fiber, 200 meter PN: 3CC52170AH is MPT-HC/XP IDU/ODU Fiber, 220 meter PN: 3CC52170AI is MPT-HC/XP IDU/ODU Fiber, 250 meter PN: 3CC52170AL is MPT-HC/XP IDU/ODU Fiber, 300 meter
MPT-HC/XP RPS Fiber PN: 3CC52169AA/3CC52169AC QTY: as required per NE configuration	MPT-HC/XP RPS Fibers are LC to LC fibers and includes Q-XCO housing for outdoor applications. PN: 3CC52169AA is MPT-HC/XP RPS Fiber, 1 meter PN: 3CC52169AB is MPT-HC/XP RPS Fiber, 10 meter PN: 3CC52169AC is MPT-HC/XP RPS Fiber, 20 meter

Table 5-D. MPT-HC/XP/9558HC unit descriptions (cont.)

UNIT	DESCRIPTION
MPT-HC/XP XPIC Cable PN: 3CC52186AA/3CC52186AC QTY: as required per NE configuration	MPT-HC/XP RPS Fibers are LC to LC fibers and includes Q-XCO housing for outdoor applications. PN: 3CC52186AA is MPT-HC/XP XPIC Cable, 1 meter PN: 3CC52186AB is MPT-HC/XP XPIC Cable, 2.5 meter PN: 3CC52186AC is MPT-HC/XP XPIC Cable, 8 meter

[1] MPT-HC/9558HC supporting 5.8 GHz unlicensed or 7/8 GHz requires selecting the appropriate Branching Box.

Table 5-E. power, patch panels, and cable assemblies

UNIT	DESCRIPTION
Power	
Power Distribution Unit (PDU) PN: 3EM13317AA Qty: 1 per rack	The PDU provides power distribution and protection fuses for equipment protection.
MPT Power Unit PN 3CC 50173AA Qty: Up to 2 per rack	The MPT Power Unit remotely powers four external MPT ODUs through N-connector cables.
MPT Extended Power Unit PN 3CC 50174AA Qty: Up to 2 per rack	• The MPT Extended Power Unit feeds power to up to two MPT ODUs. Compared to the MPT Power Unit, the MPT Extended Power Unit offers the following additional features: • Galvanic Isolation between Battery Input and ODU Power Output • Output voltage stabilized at -57V • Power Input capability for the following voltages: • +20.4VDC to +28VDC • -57.6VDC to -38.4VDC • Output Power available by means of both N-Connectors and RJ-45 Connectors • Use of the RJ-45 connectors to establish an Ethernet data link connection between IDU and ODU

Table 5-E. power, patch panels, and cable assemblies (cont.)

UNIT	DESCRIPTION
DS1 Accessories	
DS1 D-Connector Patch Panel PN: 3DB16102AA Qty: Up to 6 per 9500 MPR-A node	DS1 D-Connector Patch Panel supports up to 32 protected or unprotected DS1 (Tx and Rx) interfaces. DS1 D-Connector Patch Panel provides 32 customer interconnects using 37-position D-Sub connectors for terminating traditional ABAM cable. Two SCSI to SCSI cables are required per P32E1DS1 card and four SCSI to SCI cables are required for protected pair of P32E1DS1 cards to transition the two card front panel SCSI connectors to the DS1 D-Connector Patch Panel.
DS1 RJ-45 Patch Panel PN: 1AF15245AB Qty: Up to 6 per 9500 MPR-A node	DS1 RJ-45 Patch Panel supports up to 32 protected or unprotected DS1 (Tx and Rx) interfaces. DS1 RJ-45 Patch Panel provides 32 customer interconnects using RJ-45 connectors. Two SCSI to SCSI cables are required per unprotected P32E1DS1 card and four SCSI to SCI cables are required for protected pair of P32E1DS1 cards to transition the two card front panel SCSI connectors to the DS1 RJ-45 Patch Panel. Use RJ-45 Cat5E cable assemblies.
DS1 to X-Connect Cables PN: 3EM23110AA/3EM23110AD QTY: as required per NE configuration	Protected ABAM 8 DS1 pair cable assemblies. Cables are designed to interconnect with the 37 pin DSUB customer interconnect panel. Cables are pigtails with connector on one end only. PN: 3EM23110AA is DS1 to X-Connect cable 15 ft. PN: 3EM23110AB is DS1 to X-Connect cable 30 ft. PN: 3EM23110AC is DS1 to X-Connect cable 50 ft. PN: 3EM23110AD is DS1 to X-Connect cable 100 ft.
P32E1DS1 to Patch Panel Cable PN: 3CC52118AA QTY: 2 per Non-Protected P32E1DS1 QTY: 4 per Protected P32E1DS1 Pair	P32E1DS1 to Patch Panel cable interconnects P32E1DS1 card 68 pin SCSI connector to the DS1 D-Sub or DS1 RJ-45 patch panel.

Table 5-E. power, patch panels, and cable assemblies (cont.)

UNIT	DESCRIPTION
P32E1DS1 68 Pin SCSI to X-Connect Cables PN: 3EM21339AA/3EM21339AD QTY: as required per NE configuration	Non-Protected ABAM 16 DS1 pair cable assemblies. Cables are designed to interconnect with the 68 pin SCSI connectors on the P32E1DS1 card. Cables are pigtailed with connector on one end only. PN: 3EM21339AA is P32E1DS1 to X-Connect cable, Left Side Rack Exit (Slots 3, 5, and 7), 25 ft. PN: 3EM21339AB is P32E1DS1 to X-Connect cable, Right Side Rack Exit (Slots 4, 6, and 8), 25 ft. PN: 3EM21339AC is P32E1DS1 to X-Connect cable, Left Side Rack Exit (Slots 3, 5, and 7), 50 ft. PN: 3EM21339AD is P32E1DS1 to X-Connect cable, Right Side Rack Exit (Slots 4, 6, and 8), 50 ft.
DS3 Accessories	
DS3 Hybrid Splitter Grooming Panel Kit PN: 3EM24462AA QTY: 1 per 6 DS3 Hybrid Splitters	Hybrid Splitter Grooming Panel provides mounting location for up to 6 input/output pairs to manage handle multiple hybrid splitters.
DS3 Hybrid Splitter PN: 3EM22900AA QTY: 2 per protected DS3 interface	DS3 Hybrid splitter is an external 3 dB splitter used to interconnect a protected DS3 signal.
DS3 BNC to Mini-BNC Cable Assembly PN: 3EM22687AA/3EM22687AB QTY: 4 per P2E3DS3 Card	DS3 BNC to Mini-BNC Cable Assembly interconnects P2E3DS3 Mini-BNC to X-Connect. PN: 3EM22687AA is DS3 BNC to Mini-BNC Cable, 2 meters PN: 3EM22687AB is DS3 BNC to Mini-BNC Cable, 5 meters
OC-3 Accessories	
SFP STM-1/OC-3 (SFP) PN: 1AB194670005/3CC50166AAAA, 1AB194670007/3CC50165AAAA QTY: Up to 2 per SDHACC	Provides an STM-1/OC-3 SFP interface for SDH Access card (SDHACC). PN: 1AB194670005/3CC50166AAAA is STM-1/OC-3 SFP, 850 nm PN: 1AB194670007/3CC50165AAAA is STM-1/OC-3 SFP, 1310 nm
Multi-Mode Fiber, LC to SC PN: 3EM07646AA/3EM07646AE QTY: as required per NE configuration	Multi-Mode Fiber, LC to SC for optical Ethernet connectivity. PN: 3EM07646AA is Multi-Mode Fiber, LC to SC, 1 meter PN: 3EM07646AB is Multi-Mode Fiber, LC to SC, 2 meter PN: 3EM07646AC is Multi-Mode Fiber, LC to SC, 3 meter PN: 3EM07646AD is Multi-Mode Fiber, LC to SC, 5 meter PN: 3EM07646AE is Multi-Mode Fiber, LC to SC, 10 meter

Table 5-E. power, patch panels, and cable assemblies (cont.)

UNIT	DESCRIPTION
Single-Mode Fiber, LC to SC PN: 3EM07646AF/3EM07646AK QTY: as required per NE configuration	Single-Mode Fiber, LC to SC for optical Ethernet connectivity. PN: 3EM07646AF is Single-Mode Fiber, LC to SC, 1 meter PN: 3EM07646AG is Single-Mode Fiber, LC to SC, 2 meter PN: 3EM07646AH is Single-Mode Fiber, LC to SC, 3 meter PN: 3EM07646AJ is Single-Mode Fiber, LC to SC, 5 meter PN: 3EM07646AK is Single-Mode Fiber, LC to SC, 10 meter
Optical Splitter/Combiner PN: 1AB123320022/1AB123320023	Optical Splitter/Combiner for Core-E card GigE SFP port protection. PN: 1AB123320022 is Multi-Mode, SC, optical 50/50 fiber coupler unit PN: 1AB123320023 is Single-Mode, SC, optical 50/50 fiber coupler unit
Fiber Management Panel PN: 3EM09257AA	Fiber Management Panel for OC-3, Ethernet fiber storage. PN: 3EM09257AA is Fiber Management Panel
Ethernet SFPs, Electrical, Optical Cable Assemblies	
RJ-45 Cat5E Cable Assemblies ¹ PN: 3EM15052AA/3EM15052BD QTY: as required per NE configuration	RJ-45 Cat5E Cable assemblies. Cables are designed to interconnect with electrical Ethernet ports and the DS1 RJ-45 Patch Panel. One cable is required for each electrical Ethernet/DS1 port. Cable assemblies are not TIA/EIA T568A color pin out compliant. PN: 3EM15052AA is RJ-45 to RJ-45 cable 3 ft. PN: 3EM15052AD is RJ-45 to RJ-45 cable 6 ft. PN: 3EM15052AH is RJ-45 to RJ-45 cable 10 ft. PN: 3EM15052AN is RJ-45 to RJ-45 cable 20 ft. PN: 3EM15052AQ is RJ-45 to RJ-45 cable 30 ft. PN: 3EM15052AU is RJ-45 to RJ-45 cable 50 ft. PN: 3EM15052AY is RJ-45 to RJ-45 cable 70 ft. PN: 3EM15052BB is RJ-45 to RJ-45 cable 100 ft. PN: 3EM15052BC is RJ-45 to RJ-45 cable 200 ft. PN: 3EM15052BD is RJ-45 to RJ-45 cable 300 ft.

Table 5-E. power, patch panels, and cable assemblies (cont.)

UNIT	DESCRIPTION
RJ-45 Cat5E Cable Assemblies PN: 3MU00085AA/3MU00085AM QTY: as required per NE configuration	RJ-45 Cat5E Cable assemblies. Cables are designed to interconnect with electrical Ethernet ports and the DS1 RJ-45 Patch Panel. One cable is required for each electrical Ethernet/DS1 port. Cable assemblies are TIA/EIA T568B color pin out compliant. PN: 3MU00085AA is RJ-45 to RJ-45 cable 1 ft. PN: 3MU00085AB is RJ-45 to RJ-45 cable 2 ft. PN: 3MU00085AC is RJ-45 to RJ-45 cable 3 ft. PN: 3MU00085AD is RJ-45 to RJ-45 cable 6 ft. PN: 3MU00085AE is RJ-45 to RJ-45 cable 10 ft. PN: 3MU00085AF is RJ-45 to RJ-45 cable 20 ft. PN: 3MU00085AG is RJ-45 to RJ-45 cable 30 ft. PN: 3MU00085AH is RJ-45 to RJ-45 cable 50 ft. PN: 3MU00085AJ is RJ-45 to RJ-45 cable 70 ft. PN: 3MU00085AK is RJ-45 to RJ-45 cable 100 ft. PN: 3MU00085AL is RJ-45 to RJ-45 cable 200 ft. PN: 3MU00085AM is RJ-45 to RJ-45 cable 300 ft.
SFP GigE Interface (SFP) PN: 3EM20277AA/3EM20277AD QTY: Up to 2 per Core-E, up to 4 per P8ETH	Provides a 1.25 Gb/s Gigabit Ethernet (GigE) SFP interface for Control and Switching Module (Core-E) and Ethernet Access Switch Card (P8ETH). PN: 3EM20277AA is GigE SFP, 1000Base-SX, 850 nm, 550 m PN: 3EM20277AB is GigE SFP, 1000Base-LX, 1310 nm, 10 km PN: 3EM20277AC is GigE SFP, 1000Base-EX, 1310 nm, 40 km PN: 3EM20277AD is GigE SFP, 1000Base-ZX, 1550 nm, 80 km
SFP 2xE1/DS1 Interface (SFP) PN: 3DB78012AA Qty: as required per NE configuration	Provides two MEF-8 compliant DS1 interfaces from a electrical SFP (RJ45) installed in the CSM-E card.
Splitter cable for 2xE1DS1 SFP PN: 3CC52172AA Qty: as required per NE configuration	
Multi-Mode Fiber, LC to LC PN: 3EM07641AA/3EM07641AE QTY: as required per NE configuration	Multi-Mode Fiber, LC to LC for optical Ethernet connectivity. PN: 3EM07641AA is Multi-Mode Fiber, LC to LC, 1 meter PN: 3EM07641AB is Multi-Mode Fiber, LC to LC, 2 meter PN: 3EM07641AC is Multi-Mode Fiber, LC to LC, 3 meter PN: 3EM07641AD is Multi-Mode Fiber, LC to LC, 5 meter PN: 3EM07641AE is Multi-Mode Fiber, LC to LC, 10 meter

Table 5-E. power, patch panels, and cable assemblies (cont.)

UNIT	DESCRIPTION
Single-Mode Fiber, LC to LC PN: 3EM07641AF/3EM07641AK QTY: as required per NE configuration	Single-Mode Fiber, LC to LC for optical Ethernet connectivity. PN: 3EM07641AF is Single-Mode Fiber, LC to LC, 1 meter PN: 3EM07641AG is Single-Mode Fiber, LC to LC, 2 meter PN: 3EM07641AH is Single-Mode Fiber, LC to LC, 3 meter PN: 3EM07641AJ is Single-Mode Fiber, LC to LC, 5 meter PN: 3EM07641AK is Single-Mode Fiber, LC to LC, 10 meter
Multi-Mode Fiber, LC to SC PN: 3EM07646AA/3EM07646AE QTY: as required per NE configuration	Multi-Mode Fiber, LC to SC for optical Ethernet connectivity. PN: 3EM07646AA is Multi-Mode Fiber, LC to SC, 1 meter PN: 3EM07646AB is Multi-Mode Fiber, LC to SC, 2 meter PN: 3EM07646AC is Multi-Mode Fiber, LC to SC, 3 meter PN: 3EM07646AD is Multi-Mode Fiber, LC to SC, 5 meter PN: 3EM07646AE is Multi-Mode Fiber, LC to SC, 10 meter
Single-Mode Fiber, LC to SC PN: 3EM07646AF/3EM07646AK QTY: as required per NE configuration	Single-Mode Fiber, LC to SC for optical Ethernet connectivity. PN: 3EM07646AF is Single-Mode Fiber, LC to SC, 1 meter PN: 3EM07646AG is Single-Mode Fiber, LC to SC, 2 meter PN: 3EM07646AH is Single-Mode Fiber, LC to SC, 3 meter PN: 3EM07646AJ is Single-Mode Fiber, LC to SC, 5 meter PN: 3EM07646AK is Single-Mode Fiber, LC to SC, 10 meter
SFP Cable (electrical) PN: 3EM23141AA/3EM23141AG QTY: as required per NE configuration	SFP Cable (electrical) for SFP Ethernet connectivity. PN: 3EM23141AA is SFP Cable (electrical), 0.5 meter PN: 3EM23141AB is SFP Cable (electrical), 1.0 meter PN: 3EM23141AC is SFP Cable (electrical), 1.5 meter PN: 3EM23141AG is SFP Cable (electrical), 2.0 meter PN: 3EM23141AD is SFP Cable (electrical), 3.0 meter
Optical Splitter/Combiner PN: 1AB123320022/1AB123320023	Optical Splitter/Combiner for Core-E card GigE SFP port protection. PN: 1AB123320022 is Multi-Mode, SC, optical 50/50 fiber coupler unit PN: 1AB123320023 is Single-Mode, SC, optical 50/50 fiber coupler unit

Table 5-E. power, patch panels, and cable assemblies (cont.)

UNIT	DESCRIPTION
Sync Cable	
Sync Coaxial Cables PN: 3DB05850AA, 3DB18204AA, 3DB04295AA, 3DB02901AA QTY: as required per NE configuration	CORE-E Sync connections require a slip fit coax 1.0/2.3 connector. Available sync cables are as follows: PN: 3DB05850AA is slip fit coax 1.0/2.3 to panel mount female BNC connector, 1 meter (used for sync input and output interconnection) PN: 3DB18204AA is clock to clock w/T slip fit coax 1.0/2.3 cable, 8 inches (used for protected CORE-E Sync interconnection) PN: 3DB04295AA is slip fit coax cable, 1.1 meter (used to interconnect two MSS-4/8 shelf sync ports) PN: 3DB02901AA is slip fit coax cable, 6.0 meters (used to interconnect two MSS-4/8 shelf sync ports)
Fan Alarm Cables	
Fan Alarm Cable PN: 3EM24105AA, 3EM24105AB Qty: 1 per FAN 2U W/Alarms	Provides fan alarm cable stub. PN: 3EM24105AA is Fan Alarm Cable 25 Ft. PN: 3EM24105AB is Fan Alarm Cable 50 Ft.

[1] RJ-45 Cat5E Cable assemblies 3EM15052AA/BD are being phased out and replaced with TIA/EIA 568B compliant RJ-45 cable assemblies 3MU00085AA/AM.

Table 5-F. Software, RTU capacity license, and documentation unit descriptions

UNIT	DESCRIPTION
9500 MPR-A CT License PN: 3EM23067AAAA Qty: 1 per PC Installed	Craft Terminal license for PC used to interface with 9500 MPR-A.
9500 MPR-A R4.0.0 SWP License/CD PN: 3EM23085AMAA Qty: 1 per 9500 MPR-A NE	Software and software license CD-ROM. Includes NE, WebEML, MCT, and MIB software.
9500 MPR-A R4.0.0 Flash Card PN: 3EM23086AMAA Qty: 1 per Core-E	Flash Card for main and spare Core-E unit in MSS-4/MSS-8 shelf.

Table 5-F. Software, RTU capacity license, and documentation unit descriptions (cont.)

UNIT	DESCRIPTION
RTU Capacity License PN: 3EM23068AAAA/3EM23068AEAA Qty: 1 per radio channel	Right To Use (RTU) Capacity Licenses conditions the 9500 MPR-A NE to the maximum capacity of a radio channel. A RTU license is required for each radio channel configured on the 9500 MPR-A NE. PN: 3EM23068AAAA is RTU up to 40Mbps TRx Capacity PN: 3EM23068ABAA is RTU up to 80Mbps TRx Capacity PN: 3EM23068ACAA is RTU up to 120Mbps TRx Capacity PN: 3EM23068ADAA is RTU up to 160Mbps TRx Capacity PN: 3EM23068AEAA is RTU up to 320Mbps TRx Capacity
RTU Adaptive Modulation (License) PN: 3EM23073AAAA Qty: 1 per adaptive modulation radio channel	Right To Use (RTU) Adaptive Modulation License conditions the 9500 MPR-A NE to the number of radio channels which can be configured with adaptive modulation. An RTU Adaptive Modulation license is required for each radio channel configured with adaptive modulation.
RTU 5.8 GHz Unlicensed Band (License) PN: 3EM23261AAAA Qty: 1 per unlicensed band radio channel	Right To Use (RTU) 5.8 GHz Unlicensed Band License conditions the 9500 MPR-A NE to the number of radio channels which can be configured in the 5.8 GHz Unlicensed Band. A 5.8 GHz Unlicensed Band license is required for each radio channel configured in the 5.8 GHz Unlicensed Band.
RTU 9500 MSP Ring (License) PN: 3MU00086AAAA Qty: 1 per Ring configured with MPT-HC/XP	Right To Use (RTU) 9500 MSP Ring RTU License conditions the 9500 MPR-A NE to the number of Ethernet Ring Protection which can be configured in the NE which include MPT-HC/XP radio. A 9500 MSP Ring license is required for each ERPS Ring configured with MPT-HC/XP on the NE.

Table 5-F. Software, RTU capacity license, and documentation unit descriptions (cont.)

UNIT	DESCRIPTION
RTU Capacity License Upgrades PN: 3EM23577AAAA/3EM23577AGAA Qty: 1 per each additional radio channel/capability	Right To Use (RTU) Capacity License Upgrade conditions the 9500 MPR-A NE to increase the number of radio channels supported on the NE and the maximum capacity of the additional radio channel. A RTU license is required for each radio channel configured on the 9500 MPR-A NE. PN: 3EM23577AAAA is RTU up to 40Mbps TRx Capacity Upgrade PN: 3EM23577ABAA is RTU up to 80Mbps TRx Capacity Upgrade PN: 3EM23577ACAA is RTU up to 120Mbps TRx Capacity Upgrade PN: 3EM23577ADAA is RTU up to 160Mbps TRx Capacity Upgrade PN: 3EM23577AEAA is RTU up to 320Mbps TRx Capacity Upgrade PN: 3EM23577AFAA is RTU Adaptive Modulation Upgrade PN: 3EM23577AGAA is RTU 5.8 GHz Unlicensed Band Upgrade PN: 3EM23577AUAA is 9500 MSP Ring RTU Upgrade
Capacity Upgrades PN: 3EM23577AHAA/3EM23577ASAA Qty: 1 per radio channel capacity increase	Capacity Upgrades increases the maximum capacity of radio channels supported on an 9500 MPR-A NE. PN: 3EM23577AHAA is MPT-TR-40T80 (40 Mbps to 80 Mbps) PN: 3EM23577AJAA is MPT-TR-40T120 (40 Mbps to 120 Mbps) PN: 3EM23577AKAA is MPT-TR-40T160 (40 Mbps to 160 Mbps) PN: 3EM23577ALAA is MPT-TR-40T320 (40 Mbps to 320 Mbps) PN: 3EM23577AMAA is MPT-TR-80T120 (80 Mbps to 120 Mbps) PN: 3EM23577ANAA is MPT-TR-80T160 (80 Mbps to 160 Mbps) PN: 3EM23577APAA is MPT-TR-80T320 (80 Mbps to 320 Mbps) PN: 3EM23577AQAA is MPT-TR-120T160 (120 Mbps to 160 Mbps) PN: 3EM23577ARAA is MPT-TR-120T320 (120 Mbps to 320 Mbps) PN: 3EM23577ASAA is MPT-TR-160T320 (160 Mbps to 320 Mbps)

Table 5-F. Software, RTU capacity license, and documentation unit descriptions (cont.)

UNIT	DESCRIPTION
9500 MPR-A R4.1.0 Customer Documentation Library (CD-ROM PN: 3EM23951ALAA Qty: 1 per documentation library CD-ROM	9500 MPR-A R4.1.0 Customer Documentation Library CD-ROM contains the user documentation covering 9500 MPR-A product release.

6. Functional operation

Microwave service switch (MSS)

6.1 Microwave Service Switch (MSS) shelves provides up to 16 Gb/s packet switch node.

6.2 The MSS provides the base-band processing, cross-connection, port aggregation, switching, equipment management, tributaries interfaces, and modem functionality when ODU300 is connected.

6.3 The MSS self consists of card cage and backplane in which mounts access and radio peripheral and Core-E control cards.

6.4 The MSS is frequency-independent.

6.5 Three MSS shelves are available:

- MSS-8 shelf
- MSS-4 shelf
- MSS-1c shelf

MSS-8 shelf

6.6 A fully equipped Microwave Service Switch (MSS-8) shelf provides up to 314 Mb/s full-duplex Ethernet transport capacity per radio carrier channel.

6.7 MSS-8 shelf provides up to 16 Gb/s packet switching which creates flexible aggregate capacity sharing across DS1, DS3, OC-3, and Ethernet traffic.

6.8 The MSS-8 shelf supports the following:

- 1 or 2 Core-E Cards (Working & Spare)
- up to 6 Transport cards
- 1 AUX peripheral unit (optional: supported in transport slot #8)
- 1 DC Converter (optional: supported in transport slots 4, 6, or 8)
- 1 Fans unit

6.9 In the right part of the MSS shelf there are two sub-D 2-pole power supply connectors.

MSS-4 shelf

6.10 A fully equipped Microwave Service Switch (MSS-4) shelf provides up to 314 Mb/s full-duplex Ethernet transport capacity per radio carrier channel.

6.11 MSS-4 shelf provides up to 16 Gb/s packet switching which creates flexible aggregate capacity sharing across DS1, DS3, OC-3, and Ethernet traffic.

6.12 The MSS-4 shelf supports the following:

- 1 or 2 Core-E Cards (Working & Spare)
- up to 2 Transport cards
- 1 AUX peripheral unit (optional: supported in Transport slot #4)
- 1 Fans unit

6.13 In the right part of the MSS shelf there is one sub-D 2-pole power supply connector.

MSS-1c shelf

6.14 Microwave Service Switch (MSS-1c) shelf provides up to 314 Mb/s full-duplex Ethernet transport capacity per radio carrier channel.

6.15 MSS-1c. Compact IDU that complements the existing portfolio addressing the last mile, the far end application in nodal solution and cost optimized point-to-point applications. Its small size of 1 rack unit height and half rack width drastically reduces the space consumption in busy sites. Supports MPT-HC/XP ODU.

6.16 For a detailed description of the MSS-1c shelf, refer to MSS-1c User Manual, PN 3DB19901DB.

Radio

6.17 The system supports up to eighteen radio channels per node.

6.18 The system supports a mixture of radio technologies (MPT-GC, MPT-HC, MPT-HL, MPT-XP, and/or ODU300) on the same NE.

6.19 The radio channels can be either, all the same frequency, different frequencies, or a combination of both.

Radio configuration

6.20 Support for the following radio configurations:

- 1+0 and 1+1 Terminal
- 1+0 and 1+1 Drop and Insert Repeater
- 1+0 and 1+1 3-Way Junction
- 1+0 and 1+1 Nodal x-Way Junction

Protection schemes

6.21 Support for the following radio protection schemes:

- 1+0 unprotected
- 1+1 Hot StandBy (HSB)
- 1+1 Space Diversity (SD)
- 1+1 Frequency Diversity (FD)
- 2x(1+0) XPIC
- 4x(1+0) XPIC
- 2x(1+1) HSB XPIC

Channel spacing

6.22 Support for the following frequency T/R Spacing:

- 64/65 MHz for 5.8 GHz unlicensed
- 252.04 MHz for Lower 6 GHz
- 160/170 MHz for Upper 6 GHz
- 340 MHz for Upper 6 GHz

- 150 MHz for 7 GHz
- 175 MHz for 7 GHz
- 300 MHz for 8 GHz
- 65 MHz for 10.5 GHz
- 490/500 MHz for 11 GHz
- 475/490 MHz for 15 GHz
- 1560 MHz for 18 GHz
- 1200 MHz for 23 GHz
- 700 MHz for 38 GHz

Adaptive modulation

6.23 Adaptive modulation is a mixed mode technology which uses different modulation techniques to maximize capacity during degraded propagation conditions (fading).

6.24 Modulation switching is errorless for all frequencies.

6.25 When a terminal operates in adaptive modulation, it is possible to commission the total capacity of both Ethernet and TDM traffic, up to a bandwidth corresponding to the maximum modulation scheme chosen by the operator. This capacity depends on the channel spacing and the modulation scheme.

Admission control

6.26 Admission control ensures that TDM flows are maintained when the modulation scheme is downgraded automatically by the system due to degraded propagation conditions. The number of TDM links supported is limited to the capacity of the lowest modulation technique selected (typically 4 or 64 QAM).

6.27 The Admission Control feature protects the TDM traffic when TDM traffic is provisioned.

6.28 The maximum number of DS1 links that can be provisioned (or cross-connected in a given radio direction) equals the number of DS1s supported by the lowest modulation provisioned, typically 4 QAM or 64 QAM capacity. The remaining capacity is devoted to other types of traffic such as Ethernet best effort.

6.29 From the system point of view, it is not possible to provision more DS1s than are supported by the lowest modulation scheme. When the modulation scheme is downgraded to the lowest value (16QAM to 4QAM), it is not possible for the system to know which DS1s should be maintained and which should be dropped because all DS1 links have the same priority.

6.30 Admission control checks have been added at CT level, preventing the user from provision more DS1s than are supported by the lowest modulation scheme bandwidth.

6.31 When RSL (received signal level) value decreases, modulation scheme is downgraded first from 64QAM to 16QAM: the traffic with lower priority exceeding 16QAM bandwidth is dropped and all the DS1s are kept.

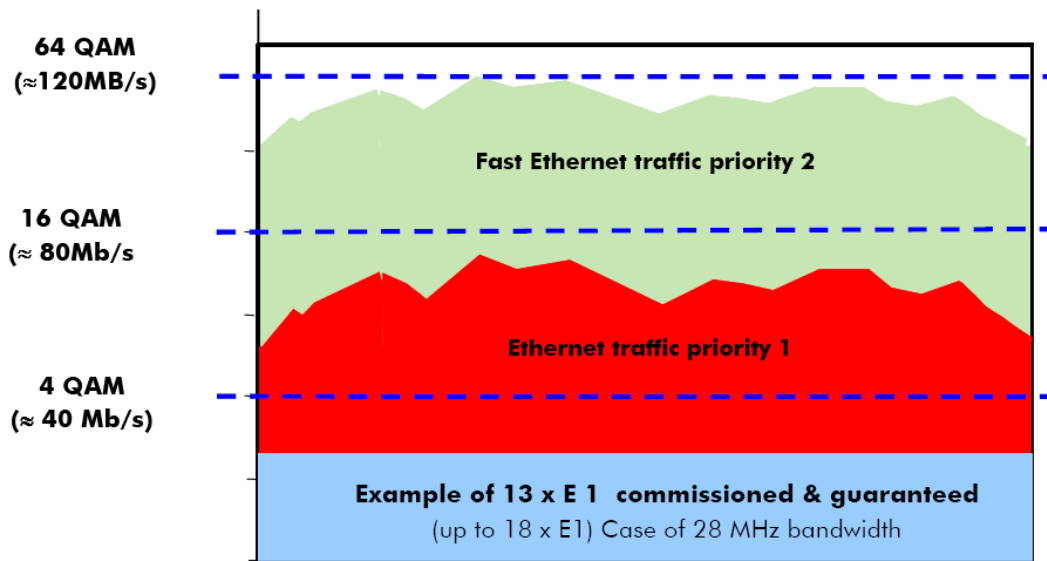
6.32 If the RSL value further decreases, modulation scheme is downgraded to 4QAM and any traffic exceeding 4QAM bandwidth is dropped while the DS1s are maintained.

6.33 Figures 6-1, 6-2, and 6-3 below show how the system operates, in case of modulation changes with admission control (case of 28 MHz bandwidth).

6.34 In this case, the operator has commissioned 13xE1's. Additionally two other kinds of traffic are provisioned, Ethernet traffic #1 and Fast Ethernet traffic #2. Ethernet traffic #1 has a higher QoS priority than Fast Ethernet traffic #2. See Figure 6-1 for an example of this configuration in normal operating mode,

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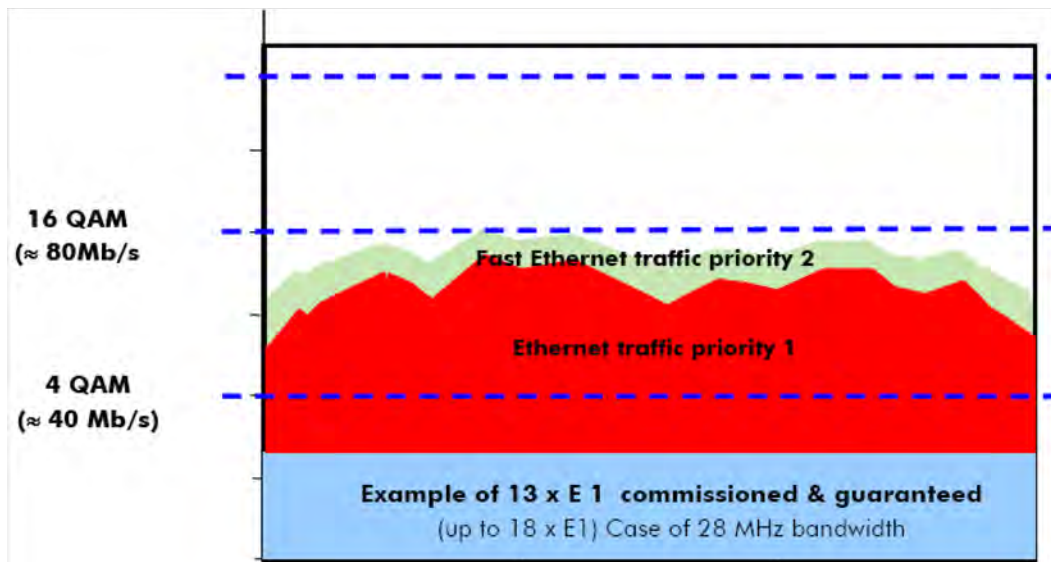
Figure 6-1. Example of traffic 28MHz bandwidth and admission control



6.35 The 13xE1's are saved even in the case of a degradation of the modulation down to 4QAM. Remaining available capacity is used to transmit other types of traffic.

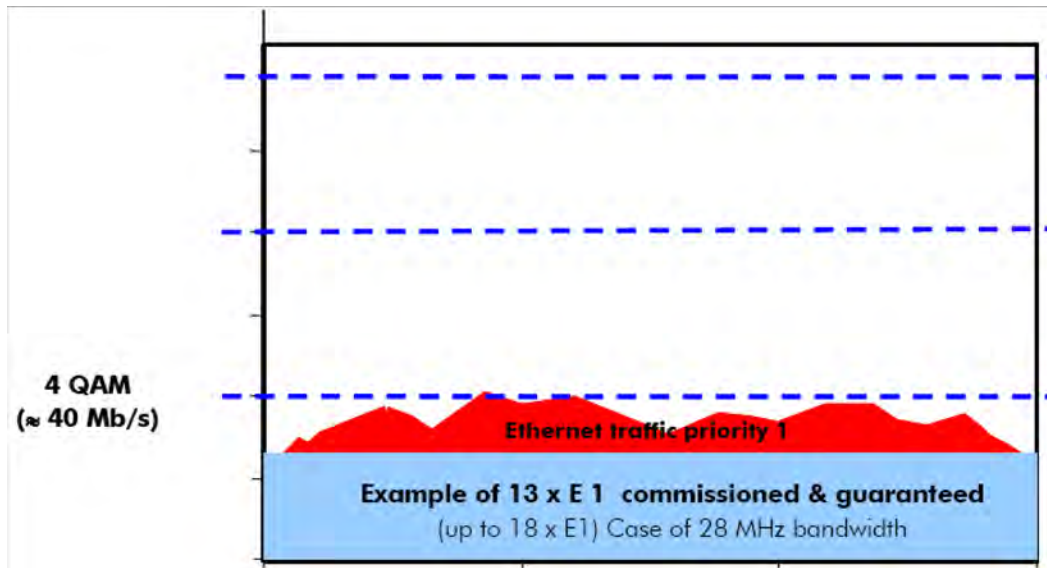
6.36 When the modulation is degraded from 64QAM to 16QAM (Figure 6-2), the E1 flows are maintained while the Ethernet traffic with lowest priority (Fast Ethernet traffic #2) is reduced.

Figure 6-2. Example of traffic 28MHz bandwidth and modulation downgraded to 16QAM



6.37 When the modulation is further degraded to 4QAM (Figure 6-3), the E1 flows are still maintained while the Ethernet traffic with the lowest priority is dropped (Fast Ethernet traffic #2) and the Ethernet traffic with the highest priority is reduced (Ethernet traffic #1) to fit the remaining available bandwidth.

Figure 6-3. Example of traffic 28MHz bandwidth and modulation downgraded to 4QAM



Adaptive equalization

6.38 Adaptive equalization (AE) is employed to improve reliability of operation under dispersive fade conditions, typically encountered over long and difficult paths.

6.39 This is achieved through a multi-tap equalizer consisting of two registers, one with feed-forward taps, the other with feed-back taps. Each of these registers multiply successive delayed samples of the received signal by weighting-coefficients to remove propagation induced inter-symbol interference.

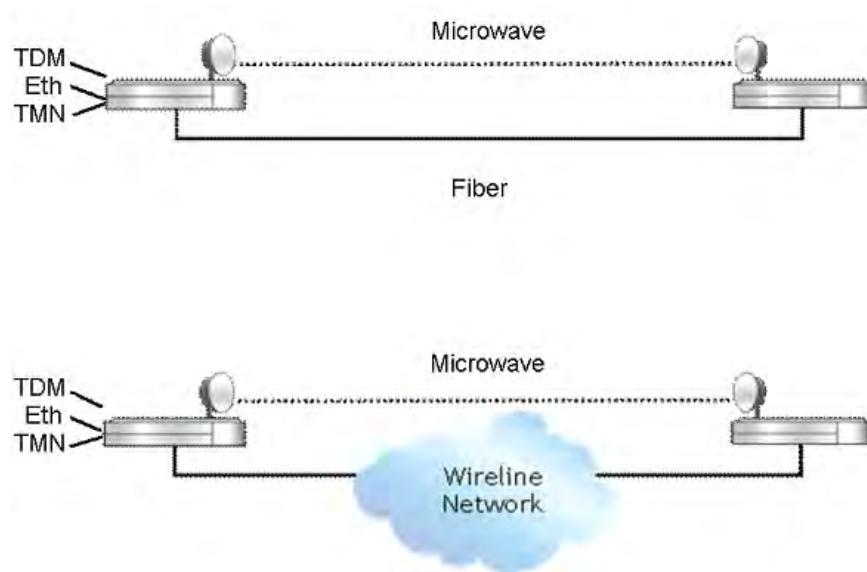
Fiber-microwave protection

6.40 The Fiber-Microwave Protection feature allows to protect an Optical Fiber link with a Microwave link.

6.41 The Main protection resource is the Optical Fiber, while the Spare protection resource is the Microwave link.

6.42 The Optical Fiber link can be either a physical connection between two MPR NEs or a connection between two MPR NEs by a Wireline network, where the access to that Wireline network by MPR NEs is made by Optical Fiber connections. See Figure 6-4.

Figure 6-4. Fiber-microwave protection



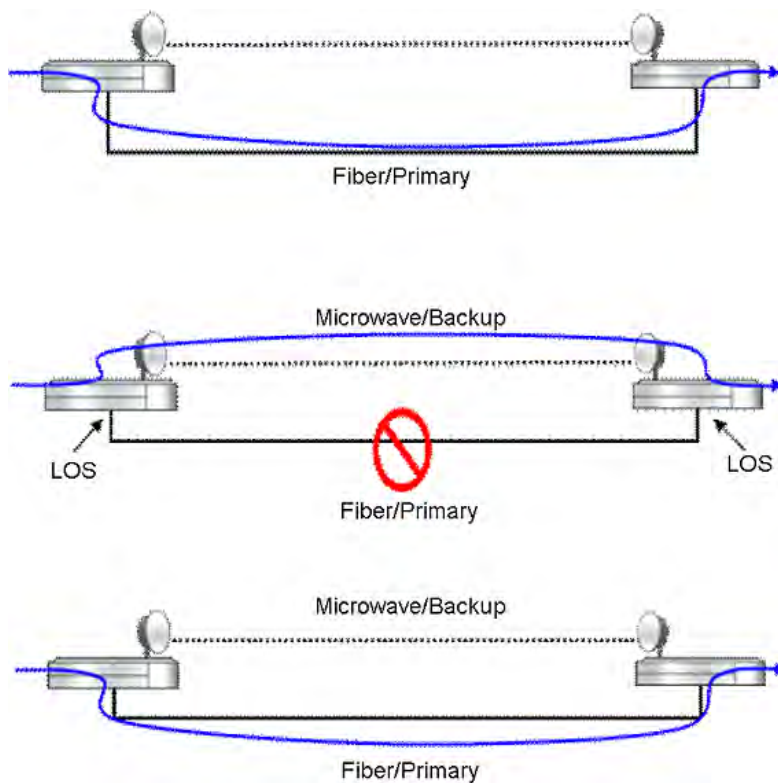
6.43 Normally the traffic (Ethernet and TDM) is transmitted on the Optical Fiber link.

6.44 In case of failure of the Optical Fiber link, the traffic is rerouted automatically to the Microwave link. When the Optical Fiber connection is restored, the traffic is rerouted again on the Optical Fiber link following a Revertive behavior. See Figure 6-5.

6.45 The switching criteria for the Optical fiber link are:

- Ethernet LOS (Core unit)
- SFP Card Missing
- SFP Card Fail

Figure 6-5. Fiber-microwave protection - operation



6.46 The Fiber-Microwave Protection feature is supported by MPR NE using ERPS performing the following configuration:

- Create a Topology having a radio interface and an optical User Ethernet interface as Ring Ports;
- Create a single Instance in the Topology created before. Since it is requested to manage the overall traffic either over Fiber connection or over radio link, the usage of two Instances to load balance traffic in the Ring is not supported;
- Define one of the two NEs as RPL Owner and configure the radio interface as RPL. In no-fault condition, this will set the Ring Port related to the radio interface in blocking, allowing the traffic to be forwarded over Ethernet optical connection.

6.47 In case of Core protection the following configuration has to be performed by the operator in order to guarantee a consistent behavior of the Fiber-Microwave Protection:

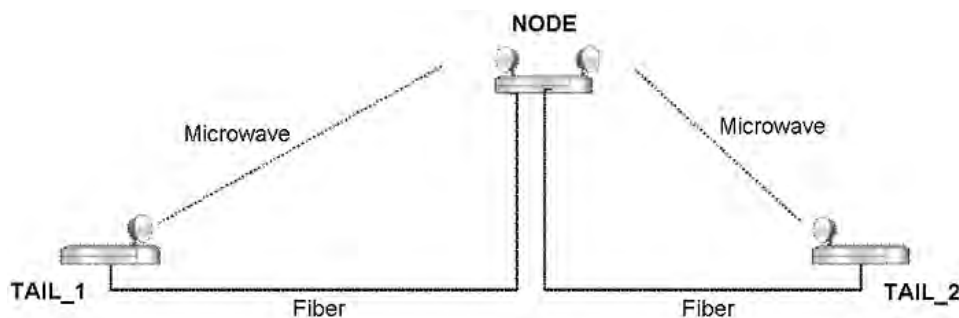
- Usage of optical splitter;

- Disable auto-negotiation on optical User Ethernet interface;
- Disable Ethernet LOS as switching criteria for Core protection;
- Disable Static-LAG.

6.48 The Fiber-Microwave Protection feature is applicable to Tail links at the leaf of the backhauling tree.

6.49 The Fiber-Microwave Protection can be implemented also on Tail links having one MPR NE working as Node, according to the following scenario. See Figure 6-6.

Figure 6-6. Fiber-microwave protection on tail links



6.50 The scenario is supported by the MPR NE using ERPS performing the following configuration:

- Create two Topologies in the NE acting as Node, each Topology having a radio interface and an optical User Ethernet interface as Ring Ports;
- Create a single Instance in both the Topologies created before;
- For each Instance, define the NE acting as Node or the other NE at Tail end as RPL Owner and configure the radio interface as RPL. In no-fault condition, this will left Ring Port related to radio interface in blocking, allowing the traffic to be forwarded over Ethernet optical connection.

Note: The TDM traffic in the Node cannot transit between the two Topologies. The tagged Ethernet traffic with same VLANs can transit between the two Topologies. This means that the same VLAN ID can be associated to both the Instances belonging to the two Topologies in the NE acting as Node.

Frequency agility

6.51 Frequency Agility provides the ability to provision the working RF frequency within the supported sub-band of the transceiver. This provides benefits for spare parts, order processing, and frequency coordination.

Link identifier

6.52 Link Identifier coding blocks unwanted received signals from being propagated further downstream. The number of microwave links, especially in urban areas, creates a problem of possible interferences during installation and turn-on phase.

6.53 The digital frame incorporates link identity coding capabilities to prevent the capture of an unwanted signal. In case of “Link Identifier Mismatch” all the traffic is dropped.

Loopback

6.54 To facilitate installation, commissioning, remote maintenance, and troubleshooting various radio loopbacks are supported by the system.

6.55 The system supports the following radio loopback types:

- [Core facing radio digital loopback](#)
- [Radio facing circuit loopback](#)
- [Core facing IF cable loopback](#)
- [Core facing RF loopback](#)

6.56 For a detailed description of radio loopbacks, refer to [Loopback](#) in this manual.

Performance monitoring

6.57 To facilitate commissioning, remote maintenance, and troubleshooting various radio PM counters are supported by the system.

6.58 The system supports the following radio PM counters:

- [Adaptive modulation PM](#)

- [Radio analog PM](#)
- [Radio ethernet PM](#)
- [Radio hop PM](#)
- [Radio link PM](#)
- [Radio QoS PM](#)
- [Radio RSL PM](#)

6.59 For a detailed description of radio PM, refer to [Performance monitoring](#) in this manual.

Power monitoring

6.60 The radio transceivers incorporate a detector for Tx power measurement. It is used to provide measurement of forward power as a performance parameter, and to provide a calibration input for transmitter operation over temperature and output range.

6.61 Viewed Tx power ranges always match the capabilities of the radio transceivers for a given modulation. When modulation is changed, the CT automatically adjusts/restricts Tx Power to be within valid range.

Radio direction label

6.62 Radio Direction Label provides an aid to users in the identification of radio directions. Radio direction labels may be up to fifteen characters in length. Labels are supported on Radio LAG. The radio direction label is displayed on applicable Craft Terminal screens (Cross-Connection, Port Segregation, Equipment Tree, etc.)

Radio L1 LAG

6.63 Layer1 Link Aggregation allows the aggregation of multiple links in order to obtain a unique logical connection with increased traffic capacity.

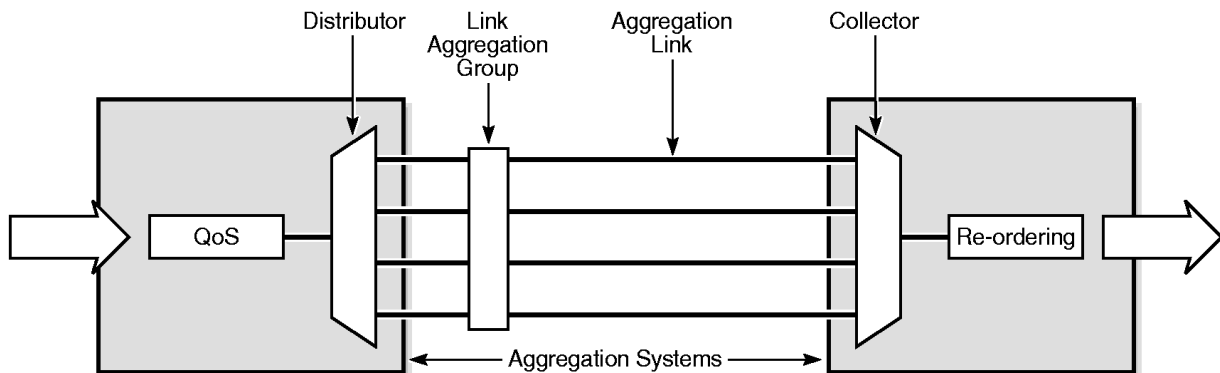
6.64 A Layer1 Link Aggregation Group (L1 LAG) represents the group of links bundled together between two Aggregation Systems (NEs connected through the L1 LAG).

6.65 Each Aggregation System comprises the following entities:

- QoS: performs buffering and scheduling functions based on the L1 LAG aggregated bandwidth
- Distributor: spreads the traffic over aggregation links belonging to L1 LAG according to a distribution algorithm
- Collector: receives traffic from aggregation links belonging to L1 LAG and combines them together to create a single traffic flow
- Re-ordering: based on Sequence Number fields inserted at the transmitter side, restores the original traffic ordering

A block diagram of L1 Link Aggregation system is shown in Figure 6-7.

Figure 6-7. L1 LAG block diagram Update



*one direction only represented

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6.66 In Layer1 Link Aggregation, the Distributor performs a packet-based traffic distribution over multiple links regardless of the content of the packets. Distributor takes into account the number of bytes sent over a specific link and loads links according to the available bandwidth. As a consequence, Layer1 Link Aggregation allows a traffic load balancing independently of traffic content. Since the distribution does not depend on Layer2 or Layer3 header content, this kind of Link Aggregation is called Layer1 (i.e., associated to the physical layer).

6.67 L1 LAG ports are supported on MPT-HC, MPT-HL, and MPT-XP radio interfaces configured with P8ETH SFP ports.

6.68 Supported L1 LAG port configurations:

- up to eight L1 LAG ports per NE

- up to four MPT-HC/XP ports per L1 LAG port
- up to four MPT-HL ports per L1 LAG port
- static and adaptive modulation

6.69 Members of a L1 LAG port must be configured:

- All the same radio interface type (MPT-HC/XP or MPT-HL)
- All radio interfaces configured with the same modem profile
 - modulation type (mode)
 - channel spacing (Reference Channel Spacing)
 - modulation
 - option
- MPT-HC/MPT-HL/MPT-XP radio interface must be configured with P8ETH card. The following radio configurations are supported:
 - 1+0 MPT-HC/XP connected to P8ETH SFP port
 - 1+0 MPT-HL connected to P8ETH SFP port
 - 1+1 MPT-HL connected to P8ETH SFP port
- radio interfaces must reside on the same horizontal shelf row (i.e., MSS-8 shelf, slots 3 and/or 4)

6.70 Radio interfaces configured for adaptive modulation must be configured with Modulation and Supported Modulation parameters set to the same value (i.e., if Modulation is 64 QAM, Supported Modulation must also be set to 64 QAM).

Types of L1 link aggregation

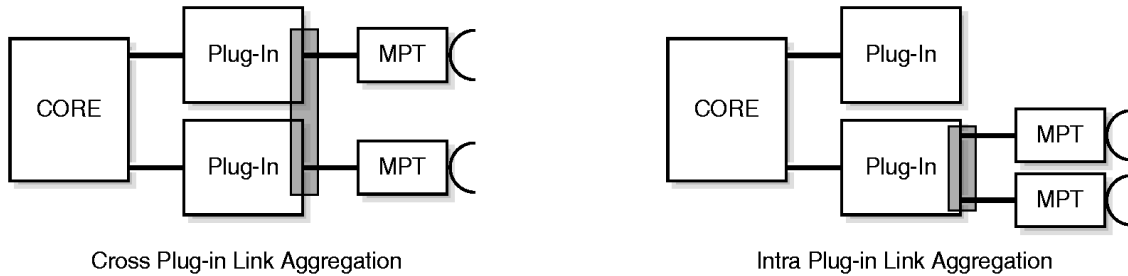
6.71 L1 Link Aggregation is implemented inside the P8ETH card.

6.72 Two configuration are supported to create L1 LAG:

- Intra plug-in LAG
- Cross Plug-in LAG

A block diagram of L1 Link Aggregation configurations is shown in Figure 6-8.

Figure 6-8. Types of L1 LAG Update



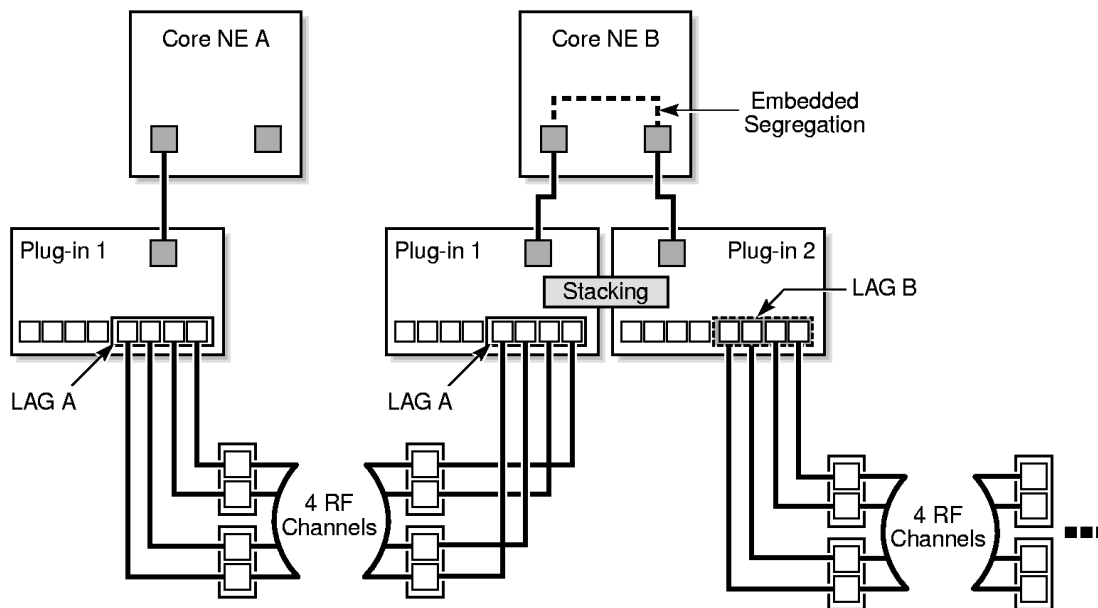
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Intra Plug-in L1 link aggregation scenario

6.73 Intra plug-in LAG is a LAG with MPT-HCs/HLs/XPs connected to the same P8ETH card.

6.74 An example of Intra Plug-in LAG implementation is shown in Figure 6-9. Site A is configured with four radio links in an Intra Plug-in LAG configuration. Site B is configured with two intra Plug-in LAGs to implement a radio repeater configuration.

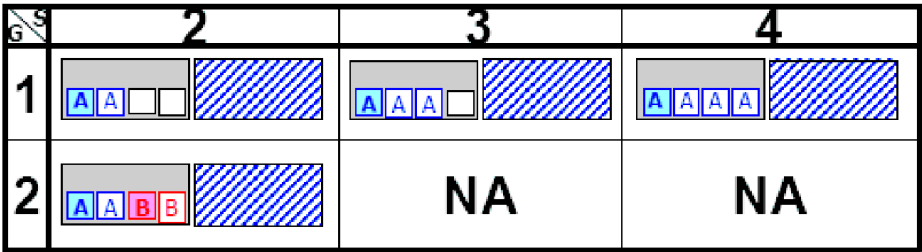
Figure 6-9. Intra plug-in L1 link aggregation scenario—Update



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- 6.75** In the event of a radio link failure, the capacity of the LAG is reduced by the capacity of the radio link.
- 6.76** In the event of a Plug-in (P8ETH) failure, the associated LAG direction is lost.
- 6.77** Single P8ETH card, Intra Plug-in supported L1 LAG configurations are shown in Figure 6-10. Dual P8ETH cards, Intra Plug-in supported L1 LAG configurations are shown in Figure 6-11.

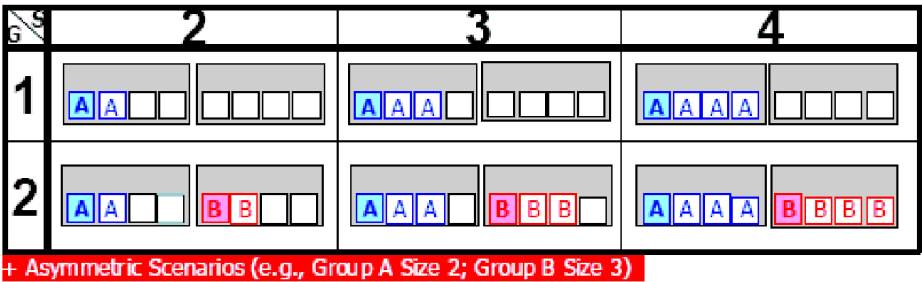
Figure 6-10. Single P8ETH 1+0 intra plug-in L1 LAG configurations Update



G = number of Link Aggregation Groups
S = LAG Size (Number of Radio Protection Groups in the LAG)
Links with the same letter (A or B) belong to the same group
Diagram shows two MSS Slots on the same row. SFP Ports represented only (from EAS Port5 to Port8)
Master Ports indicated in bold

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Figure 6-11. Dual P8ETH 1+0 intra plug-in L1 LAG configurations Update



G = number of Link Aggregation Groups
S = LAG Size (Number of Radio Protection Groups in the LAG)
Links with the same letter (A or B) belong to the same group
Diagram shows two MSS Slots on the same row. SFP Ports represented only (from EAS Port5 to Port8)
Master Ports indicated in bold

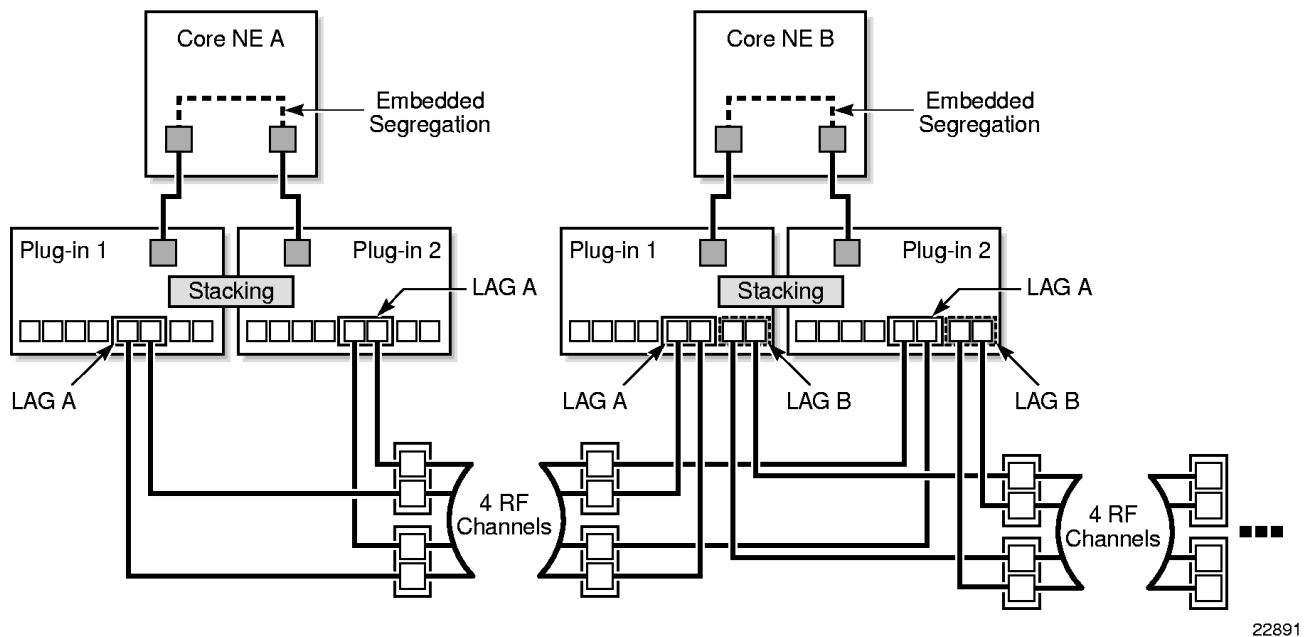
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Cross plug-in L1 LAG sceneries

6.78 Cross Plug-in LAG is a LAG with MPT-HCs/HLs/XPs connected to two P8ETH cards on the same MSS row.

6.79 An example of Cross Plug-in LAG implementation is shown in Figure 6-12. Site A is configured with four radio links in a Cross Plug-in LAG configuration. Site B is configured with two Cross Plug-in LAGs to implement a radio repeater configuration.

Figure 6-12. Cross plug-in L1 link aggregation scenario Update



6.80 In the event of a radio link failure, the capacity of the LAG is reduced by the capacity of the radio link.

6.81 In the event of a Plug-in (P8ETH) failure, the LAG capacity is reduced, but the LAG direction is maintained utilizing the remaining radio interfaces supported by the other Plug-in.

6.82 Supported Cross Plug-in L1 LAG configurations are shown in Figure 6-13.