9500 MPR (Microwave Packet Radio)
System Overview

101. The Alcatel-Lucent 9500 Microwave Packet Radio (MPR) provides a solution for smooth transition of backhaul networks from TDM to IP. The 9500 MPR covers the frequency range from 6 GHz to 9 GHz utilizing the baseband processing and trib interfaces, and the Outdoor Unit (ODU) for Release 1.0. For Release 2.0, an MPT-HL (Microwave Packet Transport—Long Haul) Transceiver shelf (Indoor Unit=ODU) will be offered as an option to the ODU, to work in conjunction with the MSS shelf to provide an ANSI solution utilizing standard waveguide for growth and expansion.

102. The 9500 MPR provides a nodal solution as opposed to a single link approach to radio networking. The 9500 MPR supports up to 6 RF links for operation on the same or different frequency bands. The ODU for each link is connected to plug-in Radio Interface card inside the site aggregator (MSS shelf). For R2.0, when using the Indoor Transceiver (MPT-HL) shelf with RF filters in lieu of the ODU, the signal is carried to/from the Ethernet Access Switch (MSS shelf), via SFP cable to the MPT-HL transceiver shelf.

103. The typical 9500 MPR radio is made up of 2 or 3 main components. MSS Shelf (provides TDM and Ethernet access and management) ODU (provides the radio and antenna link for split systems) or MPT-HL Shelf (Radio Transceiver – IDU) used with Diplexer filters or Stacking Waveguide filters, providing the RF interface.

104. The 9500 MPR supports a mix of non-protected and protected configurations for a single link, repeater or junction radio site.

105. Customer interfaces are customized by plug-in cards for TDM and Ethernet. The Ethernet interfaces is included in the Core Module. Trib paths may be customized with non protection and protection configurations.

106. The MSS shelf and ODU are connected by a single coaxial cable carrying the main traffic. The remote power supply voltage for the ODU and auxiliary information. The MSS implements grooming, routing, switching and protection utilizing packet architecture.

Drawing Index:

Sheet 1: Index and System Overview
Sheet 2: MSS Shelf Functional Description
Sheet 3: TDM Circuit Service Profile
Sheet 4–6: MSS Shelf Configurations
Sheet 7: ODU Slot/Port Population
Sheet 8: ODU Protection Configurations
Sheet 9: ODU Features
Sheet 10: Receiver threshold/transmit power table

System Application Rules

9500 MSS–8 Shelf

Main Side

Protect/Spare Side

Main "A Power"

Spare "B Power"
9500 MPR RADIO
MSS Shelf Functional Description

201. MSS—8 Shelf
The MSS-8 Shelf incorporates the baseband processing and includes optional tributary interfaces and as well as supervision. The MSS is:
- One 10/100/1000 Base-T Ethernet user interface. Port 4 is dedicated to SNMP if required, otherwise used as ports 1-3.
- One Port – GigE Optical SFP user interface.
- 7 Gigabit Ethernet serial interfaces towards any peripheral modules and to standby core module (each link carries payload traffic, service and maintenance signals).
- Core module houses the microprocessor unit implementing EC and RC functionality.
- A software key (Flashcard) for each Core.

Management Port
- 1 Ethernet interface port used for provisioning and maintenance functions. (User Interface Screen), plus Debug function.

Sync Interface
- 1 Sync_CLK input via 1.0 to 2.3 coaxial connector that can be used as source for the Network Element clock.
- 1 Sync_CLK output via 1.0 to 2.3 coaxial connector that provides the NE Clock. (Customer side is pin 1 mount BNC).

MSS Controller
The MSS has a one layer control architecture implemented by a microprocessor. The controller resides on the Core board. When spare Core is present, there are two redundant controllers.

Ethernet Switch
The switch provides complete interconnection between all the peripherals and ethernet connected to the MSS node. The cross-connection between the peripherals is known of via the 1.225 GHz clk. The switch performs address learning (haut bridging), standard B02.1Q management (VLAN), Layer 2 switching (MAC Address, VLAN), OoS per port (In particular B02.1P and DiffServ).

Switch Ports
The ethernet switch manages 4 different port types:
- Management port: SPI bus microprocessor can access all the internal configuration registers.
- Microprocessor port: via the SPI interface, the switch sends and receives certain types of internal control traffic (i.e. VLAN tag).
- User ports: five independent GigE ports in which a customer can introduce traffic.
- Internal ports: these ports are used to connect all the peripherals installed in the MSS shelf.

203. Core Module continued...

Core Module
The Core Module provides the following core module functions:
- Ethernet Switch:
  - The Ethernet Switch performs Quality of Service (QoS) mechanism control all streams, if QoS is disabled, all traffic inside the switch has the same priority.
  - (This means that for each switch port there is only one queue, FIFO – First packet in, First packet out). For further Ethernet switch detail, see the instruction manual.

204. Added R1.1 features are:
- Point-to-point VLAN support, which forces Ethernet traffic with a specific VLAN to a selected radio port without flooding other radio or Ethernet ports.
- Adaptive Modulation: 8/16/64 QAM in support of 10 MHz and 30 MHz channels.
- 50 MHz channel BW for 15 and 18 GHz frequency bands.

205. Transport Modules
DS1 Tributary (P32E1091)
The 32 x DS1 Tributary Module performs the following core module functions:
- Termination of 32 DS1 signals.
- Framed DS1 bi-directional alarm management.
- BI-directional Performance monitoring on framed DS1.
- Encapsulation/Extraction of POS data from/to standard ethernet packets into Working Function (WF).
- Selection of active core.
- Sending/Receiving standard ethernet packets to Core module.
- Communication with controller for provisioning and status report.

The module communicates with the Core modules via two GigE serial copper bi-directional interfaces on the backplane.

DS3 Tributary (P32E3033)
The 2 x DS3 Tributary Module performs the following core module functions:
- Termination of 2 DS3 signals.
- Framed DS3 bi-directional alarm management.
- BI-directional Performance monitoring on framed DS3.
- Encapsulation/Extraction of POS data from/to standard ethernet packets into Working Function (WF).
- Selection of active Core.
- Sending/Receiving standard ethernet packets to Core module.
- Communication with controller for provisioning and status report.

206. Mod300
In the Transmit direction, the Mod 300 generates the IF signal to be sent to the ODU. The signal contains a constant bit rate built within the ethernet packets coming from the Core module. Those packets are managed, depending on their own native nature, according to data awareness requirement.

In the Receive direction, the Mod 300 terminates the IF signal coming from the ODU, extracting the original CBR and then the original ethernet packets to be given to the Core, and then on to the proper module.

207. Ethernet Access Module
TBS for R.2.0

System Application Rules
301. The detail for the implementation Agreement for the Emulation of PDI circuits over Ethernet Networks can be found in the (MEF) document. These details fall outside the scope of this document. Refer to the Metro Ethernet Forum (MEF) for detailed information including circuit emulation, functional layering and encapsulation of TDM circuit.

CES and Interworking Function

302. A Circuit Emulation Service (CES) is a bi-directional service consisting of two symmetrical data flows in opposite directions. For each direction of the emulated circuit, there is a pair of CES interworking functions (IWF). The Metro Ethernet Network, WDM-bound IWF handles the packetization of the TDM data, encapsulation into ethernet frames and forwarding into the ethernet network. The corresponding TDM-bound IWF extracts the TDM data from the ethernet frames, and recreates the TDM service.

303. The 9500 MPR crossconnects the TDM circuits in this manner, and then transports the TDM packets to ethernet frames. The emulation takes place in the tributary modules.

304. When provisioning TDM tributary modules in the 9500 MPR, i.e., P2321/031 and P2630/33, the following Service Profiles are:

- TDM/TDM
- TDM/EQTH

The bit rates associated with each Service Profile dictate the number of packetized TDM circuits that may be carried over a radio link.

305. Legacy TDM circuit bit rate for DS1 and DS3 are:
- 1.544 Mbps (DS1)
- 44.736 Mbps (DS3)

306. When the TDM circuits are packetized via circuit emulation in the DS1/DS3 tributary modules, the bit rate changes from the legacy value to the Service Profile values for TDM/TDM and TDM/EQTH.

307. The following bit rates are used for 9500 MPR Radio Link:

- The packetized bit rates for DS1 and DS3 utilizing TDM/EQTH are: 1.644 Mbps (DS1), 46.757 Mbps (DS3)

The packetized bit rates for DS1 and DS3 utilizing TDM/EQTH are:
- 1.644 Mbps (DS1), 46.757 Mbps (DS3)

These rates include the overhead structure, and are used to calculate equivalent TDM circuit capacity against total radio link capacity. A different value is required when the switch in the Core cross-connects the packetized TDM circuits to an Ethernet port. See those values below.

308. When legacy TDM circuitry is packetized for Ethernet transport, some or all of the circuits may pass thru an Ethernet port. We refer to this as Ethernet transport, or the packetized TDM circuits are passing through the Core and the switch is cross-connecting them to a Ethernet port. When transport is over an Ethernet link, the bit rate for DS1 and DS3 are as follows:

- The following bit rates are used for 9500 MPR Ethernet Link:

The packetized bit rates for DS1 and DS3 utilizing TDM/EQTH are:
- 2.335 Mbps (DS1), 67.659 Mbps (DS3)

These Ethernet bit rates should be used as TDM circuit equivalent values and subtracted from the provisioned Ethernet port value, i.e., 10BaseT, 100BaseT or GigE.

309. System Application Rules
### 9500 MPR RADIO

#### MSS Shelf Configurations

**Un–protected ETH Terminal**
W/Without DS1/DS3 Trib

<table>
<thead>
<tr>
<th>Core Main</th>
<th>Core Optional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radio Access</td>
<td>32 DS1/2 DS3</td>
</tr>
</tbody>
</table>

The Core Module with Ethernet switch provides ethernet access and cross-connect functions between all peripheral ports, including ETH and TDM. Core may or may not be protected. The un–protected M0D300 module feeds IF to a single ODU. There is no EPS (Equipment Protection Switching) or RPS (Radio Protection Switching). TDM Tribs are optional. DS1 or DS3 Tribs or both may be selected as un–protected single modules or protected pairs. DS1 Tribs provide access to 32 DS1 circuits, and DS3 Tribs provide access to 2 DS3 circuits.

**See sheet 6 for MSS–8 Shelf Slot Population**

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**Protected Radio ETH Terminal**
W/Without DS1/DS3 Trib

<table>
<thead>
<tr>
<th>Core Main</th>
<th>Core Optional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radio Access</td>
<td>Radio Access</td>
</tr>
<tr>
<td>32 DS1/2 DS3</td>
<td></td>
</tr>
</tbody>
</table>

The Core Module with Ethernet switch provides ethernet access and cross-connect functions between all peripheral ports, including ETH and TDM. Core may or may not be protected. The protected M0D300 modules feed IF signals to 2 ODUs. An ODU coupler is optional for single antenna designs. (shown). TDM Tribs are optional. DS1 or DS3 Tribs or both may be selected as un–protected single modules or protected pairs. DS1 Tribs provide access to 32 DS1 circuits, and DS3 Tribs provide access to 2 DS3 circuits.

Note: TDM protection pairs require DS1 panels or DS3 hybrid splitters that are external to the MSS–8 shell. See the Equipping Option pic–list tables, 3EM277940000/22ZA.

---

**Un–protected ETH Repeater**
W/Without DS1/DS3 Add/Drop

<table>
<thead>
<tr>
<th>Core Main</th>
<th>Core Optional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radio Access</td>
<td>Radio Access</td>
</tr>
<tr>
<td>32 DS1/2 DS3</td>
<td></td>
</tr>
</tbody>
</table>

This configuration builds on the un–protected Terminal, and adds a second M0D300 and ODU to create a repeater. The un–protected M0D300 modules feed IF to 2 ODUs for 2 separate radio links. There is no EPS or RPS. TDM modules will not be required to pass packetized circuits thru repeater sites if drop and insert is not required.

**Protected Radio ETH Repeater**
W/Without DS1/DS3 Add/Drop

<table>
<thead>
<tr>
<th>Core Main</th>
<th>Core Optional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radio Access</td>
<td>Radio Access</td>
</tr>
<tr>
<td>Radio Access</td>
<td>Radio Access</td>
</tr>
<tr>
<td>32 DS1/2 DS3</td>
<td></td>
</tr>
</tbody>
</table>

This configuration builds on the protected Terminal, and adds a second set of M0D300 and ODUs to create a repeater. The protected M0D300 modules feed IF to 4 ODUs for 2 separate radio links. An ODU coupler is optional for single antenna designs. TDM modules will not be required to pass packetized circuits thru repeater sites if drop and insert is not required.

Note: TDM protection pairs require DS1 panels or DS3 Hybrid splitters that are external to the MSS–8 shell. See the Equipping Option pic–list tables, 3EM277940000/22ZA.
9500 MPR RADIO

MSS Shelf Configurations

3-way Junction (Node)

<table>
<thead>
<tr>
<th>Core Main</th>
<th>Core Optional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radio Access</td>
<td>Radio Access</td>
</tr>
<tr>
<td>Radio Access</td>
<td>Radio Access</td>
</tr>
<tr>
<td>Radio Access</td>
<td>Radio Access</td>
</tr>
</tbody>
</table>

See sheet 6 for MSS-8 Shelf Slot Population

Node up to 6 directions

<table>
<thead>
<tr>
<th>Core Main</th>
<th>Core Optional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radio Access</td>
<td>Radio Access</td>
</tr>
<tr>
<td>Radio Access</td>
<td>Radio Access</td>
</tr>
<tr>
<td>Radio Access</td>
<td>Radio Access</td>
</tr>
</tbody>
</table>

The node configuration shown provides 3 separate directions for ethernet data. This 3-way junction is shown without protection. There are 3 MSS-8 slots available for TDM access if drop and insert is required.

The node configuration can provide up to 6 directions for ethernet data. This 6-way is unprotected. There are no slots left in this configuration for TDM drop and insert, ethernet drop and insert only. However, a second MSS shelf may be used to provide slot access for TDM modules. An ethernet link from MSS to MSS will carry the TDM circuits for radio link access, (not supported in R1.0)
9500 MPR RADIO
MSS–8 Shelf Slot Population

Stand alone MSS–8 Ethernet (4 RJ–45 Ports) for 10E/100E/GigE and 1 GigE SFP Port.
The MSS–8 shelf kit includes an fan unit and power cables, but is unpopulated otherwise. One or two
Core modules may be used in the MSS–8 shelf. The Core Module includes an Ethernet switch
which provides cross–connect functions between all peripheral ports. The MSS Shelf may be used
as a standalone unit to provide Ethernet link access only without using a radio link. The Core
Module provides access via (4) RJ–45 ports that may be provisioned for 10E, 100E, and GigE Ethernet,
and a single GigE SFP port. The Core also includes the switch management port. The Main side
Core module is dedicated to slot 1 and is required for minimum function. Slot 2 is dedicated to
Protect side Core and is optional. There are 6 available slots in the MSS–8 shelf available for TDM
modules and MOD300 Radio interface modules required for Radio link access to an ODU. The 6
slots (2 thru 6) may be configured as shown below.

Add MOD300 Module for ODU/Radio Link Access

The MOD300 provides IF and DC to the ODU to complete RF transmission for each radio link.
Select the qty of MOD300 modules based on the ODU protection configurations shown on sheet 7.
Each MOD300 module supports a single ODU for Radio link Access. One MOD300 module is required
to provide 1×O (Non–DVB) access to a single ODU. Two MOD300 modules are required for all of
the 1+1 configurations, including Hot Standby, Hot Standby W/space, and Frequency Diversity.
These configurations require the MOD300 modules to be placed in the shelf as protection pairs,
(Adjacent slot placement) to obtain protection provisioning. The third MOD300 shown in the diagram
supports a spur leg off of a standard router (1×3 way junction). If no TDM drop and insert
functions are required in a multi–junction node, the MSS shelf can support up to 6 MOD300/ODU
as all the slots in the MSS–8 shelf will be available. The MOD300 modules may go into any of the
6 available slots. If 1 or 2 slots are required for radio access, then 4 or 5 slots will be available
for TDM access modules.

Add P32E1DS1 Trib Modules for TDM Access

Each P32E1DS1 Trib module provides access to 32 DS1 circuits. A single module may be used for
un–protected access, or a pair of modules may be used and provisioned as a protected pair, to
provide 32 DS1 access. Protected pairs must occupy adjacent slots to be provisioned as a “Pair.”
The diagram shows 2 pairs of modules providing access to 64 DS1 circuits. If all four modules are
used in unprotected mode, 128 DS1 circuits would be available, leaving 2 MSS–8 slots available
for MOD300 Radio access. Each protected P32E1DS1 module pair require 1 protection panel to
split/combine 32 DS1 circuits external to the MSS–8 shelf. See Equipping Options for protection
panel options.

Add P2E3DS3 Trib Modules for TDM Access

Each P2E3DS3 Trib module provides access to 2 DS3 circuits. A single module may be used for
un–protected access, or a pair of modules may be used and provisioned as a protected pair, to
provide 2 DS3 access. Protected pairs must occupy adjacent slots to be provisioned as a “Pair.”
The diagram shows 2 protected pairs providing access to 4 DS3 circuits. Each protected P2E3DS3
module pair require 2 hybrid splitters to split/combine 2 DS3 circuits external to the MSS–8 shelf.
See Equipping Options for hybrid splitter options.

Select ODU’s to complete Radio Link

The MSS–8 shelf MOD300 provides 300 MHz IF signal and DC to the ODU. The ODU includes the
transmit/receive unit (transceiver), frequency synthesizer, and diplexer filters. The ODU’s provide the
RF and support all of the different frequency bands and channel plans to complete the 9500 MPR
split package configurations. See the ODU protection configurations and detail on sheet 7, and B.
### ODU Equipment Protection Configurations

<table>
<thead>
<tr>
<th>Outdoor Configurations</th>
<th>Outdoor Units</th>
<th>ODU Coupler</th>
<th>Antenna Configurations</th>
<th>Application Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Stby (1+0)</td>
<td>1 ODU</td>
<td>No Coupler</td>
<td>1 Antenna single polarization</td>
<td>No radio or path protection with this configuration.</td>
</tr>
<tr>
<td>Hot-Stby (1+1)</td>
<td>2 ODU tuned to same frequency</td>
<td>Coupler required 3dB or 1.5/6 dB</td>
<td>1 Antenna single polarization</td>
<td>Provides ODU protection, but coupler reduces system gain.</td>
</tr>
<tr>
<td>Hot-Stby W/space (1+1)</td>
<td>2 ODU tuned to same frequency</td>
<td>No Coupler</td>
<td>2 Antenna single polarization</td>
<td>Provides full ODU equipment protection.</td>
</tr>
<tr>
<td>Freq Div (1+1) co-polar</td>
<td>2 ODU tuned to different frequency</td>
<td>Coupler required 3dB or 1.5/6 dB</td>
<td>1 Antenna single polarization</td>
<td>Provides ODU and path protection: coupler reduces system gain.</td>
</tr>
<tr>
<td>Freq Div (1+1) cross-polar</td>
<td>2 ODU tuned to different frequency</td>
<td>No Coupler</td>
<td>1 Antenna two polarization</td>
<td>Provides ODU and path protection: both vertical and horizontal with single antenna.</td>
</tr>
</tbody>
</table>

### System Application Rules

- **Available Configurations**
  - Non Standby (1+0)
  - Hot Standby (1+1)
  - Freq Diversity (1+1)

- **ODU**
  - Single Antenna no Coupler
    - One Polarization
  - Single Antenna W/Coupler
    - One Polarization
  - Two Antenna no Coupler
    - Cross Polarization
  - Remote Mount Antenna V/H

- **Available Configurations**
  - Hot Standby (1+1)
  - Hot Standby W/Space
  - Freq Diversity (1+1)
801. The ODU (Outdoor Unit Transceiver) provides the RF function of the split package radio design when used with an MSS shelf populated with a MOD300 module. The MOD300 provides 300 MHz IF signal with DC to the ODU. The ODU includes the transmit/receive unit (transceiver), frequency synthesizer, and diplexer filters. Each transceiver uses a fixed frequency offset to define transmit/receive separation limits.

802. The Lightning Arrestor includes a mounting bracket, RT angle Type N connector, Grid lug, and mounting hardware. See figure 1.

803. The mounting bracket bolts onto the ODU Grid stud as shown.

804. The Grid lug mounts to the bracket stud on the side of the lightning arrestor as shown.

805. Note: Failure to replace the RSSI BNC weatherproof cap may damage the ODU.

806. Special Note: ODU Synthesizer uses in Frequency Channel Plans
The ODU synthesizer steps in 250 KHz increments, (0, 250, 500, 750, etc). The ODU reports the step size to the MSS and is hard-coded at 250 KHz. Frequency channel plans that don’t fall on 250 KHz increments, will require the user to set the frequency to the closest allowed value. Because there is enough margin in the spectrum mask to allow operating off-center by up to 125 KHz, users must select a synthesizer frequency no further away than 125 KHz from the desired channel, (this value can be above or below the channel frequency). See example 1 Plan table.

Example: 30 MHz (REGULAR T) Plan

<table>
<thead>
<tr>
<th>Offset</th>
<th>Synthesizer</th>
<th>Channel Freq</th>
<th>Channel Freq</th>
<th>Synthesizer</th>
<th>Offset</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 KHz High</td>
<td>5945.25</td>
<td>6197.74</td>
<td>6197.75</td>
<td>10 KHz High</td>
<td></td>
</tr>
<tr>
<td>100 KHz Low</td>
<td>5974.75</td>
<td>6229.86</td>
<td>6227.00</td>
<td>10 KHz High</td>
<td></td>
</tr>
<tr>
<td>N/A</td>
<td>6004.50</td>
<td>6256.54</td>
<td>6256.50</td>
<td>40 KHz Low</td>
<td></td>
</tr>
</tbody>
</table>

Figure 1

IF Type N Connector (from Mod 300)

Lightning Arrestor

Grid lug support

RSSI BNC (Connector included)

Type N RT Angle Connector (included)

Lightning Arrestor (Polyphaser)

IF Type N Connector (from Mod 300)

RSSI BNC (Antenna Alignment)

Waveguide Feedthrough

System Application Rules
9500 MPR RADIO
Receiver Threshold and Transmit Power

<table>
<thead>
<tr>
<th>Channel BW</th>
<th>Modulation</th>
<th>Radio Capacity</th>
<th>Eth or Equivalent</th>
<th>Transmit Power</th>
<th>6 GHz Band</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>MBPS Equiv DS1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 MHz</td>
<td>128 QAM</td>
<td>52.54</td>
<td>31 DS1</td>
<td>1 (1)</td>
<td>-72.5 dBm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-74.0 dBm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>24.5 dBm</td>
</tr>
<tr>
<td>30 MHz</td>
<td>128 QAM</td>
<td>162.17</td>
<td>95 DS1</td>
<td>3 (6)</td>
<td>-67.7 dBm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-69.3 dBm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>24.5 dBm</td>
</tr>
<tr>
<td>30 MHz</td>
<td>256 QAM</td>
<td>183.30</td>
<td>116 DS1</td>
<td>4 (0)*</td>
<td>-64.0 dBm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-68.5 dBm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>22.5 dBm</td>
</tr>
<tr>
<td>6 GHz Band</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>* 4 DS3 must use TDM2ETH format w/1024 byte payload</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Channel BW</th>
<th>Modulation</th>
<th>Radio Capacity</th>
<th>Eth or Equivalent</th>
<th>Transmit Power</th>
<th>15 GHz Band</th>
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<tbody>
<tr>
<td></td>
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<td>MBPS Equiv DS1</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 MHz</td>
<td>32 QAM</td>
<td>37.332</td>
<td>22 DS1</td>
<td>N/A</td>
<td>-77.5 dBm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-79.0 dBm</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>19.5 dBm</td>
</tr>
<tr>
<td>10 MHz</td>
<td>128 QAM</td>
<td>52.64</td>
<td>31 DS1</td>
<td>1 (1)</td>
<td>-71.0 dBm</td>
</tr>
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<td></td>
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<td></td>
<td></td>
<td>-72.5 dBm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>18.0 dBm</td>
</tr>
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<td>40 MHz</td>
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<th>Eth or Equivalent</th>
<th>Transmit Power</th>
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</tbody>
</table>

* 4 DS3 must use TDM2ETH format w/1024 byte payload

901. The Ethernet capacity in MBPS is the total capacity for the given channel BW and modulation shown.

902. Threshold shown is typical for 10E-6 BER, and may only be measured at the ODU RF input.

903. Transmit power is measured at the ODU RF output.

904. Circuit Emulation: TDM2/1DM is the default service profile for radio links in the 5900 MPR Network. See sheet 3 for detail.

The service profiles for circuit emulation are:

| TDM2/1DM | Always Differential (default setting) |
| DS1/DS3  | 121 byte payload                      |
| TDM2ETH  | Differential or Adaptive              |
| DS1      | 192 byte payload                     |
| DS3      | 1024 byte payload                    |
| ETH2ETH  | transparent to the 5900 network       |

System Application Rules

12/30/2001

Sheet Application Rule
### 9500 MPR RADIO
#### Power Consumption

- **MSS Shelf modules**
  - **CSM (Core Module)**: 16 Watts
  - **Fan Unit**: 8 Watts
  - **MOD300 Module**: 23 Watts
  - **ODU Transceiver**: 30 Watts
  - **DS1 Trib (P32E1DS1)**: 16 Watts
  - **DS3 Trib (P2E3DS3)**: 16 Watts
  - **Eth Access Switch**: TBD

- **Un-protected Ethernet Terminal with DS1 Trib**
  - **Qty**: 1
  - **Power**: 16 Watts

- **Un-protected Ethernet Repeater with DS1 Trib**
  - **Qty**: 1
  - **Power**: 8 Watts
  - **2 MOD300 Module**: 46 Watts
  - **ODU Transceiver**: 60 Watts
  - **DS1 Trib (P32E1DS1)**: 32 Watts
  - **Total Power (Watts)**: 178

- **Un-protected 3-Way Junction with DS1 Trib**
  - **Qty**: 2
  - **Power**: 32 Watts
  - **1 CSM (Core Module)**: 16 Watts
  - **1 Fan Unit**: 8 Watts
  - **2 MOD300 Module**: 46 Watts
  - **2 ODU Transceiver**: 60 Watts
  - **1 DS1 Trib (P32E1DS1)**: 16 Watts
  - **Total Power (Watts)**: 146

- **Un-protected 6-Way Node no Drop/Insert**
  - **Qty**: 2
  - **Power**: 32 Watts
  - **1 CSM (Core Module)**: 16 Watts
  - **1 Fan Unit**: 8 Watts
  - **2 MOD300 Module**: 46 Watts
  - **2 ODU Transceiver**: 60 Watts
  - **2 DS1 Trib (P32E1DS1)**: 32 Watts
  - **Total Power (Watts)**: 284

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**System Application Rules**