6.695 This loopback requires an external Tx to Rx connection to guarantee operation.

6.696 This loopback is traffic affecting.

Line facing PDH (DS1/DS3) loopback

6.697 Line facing PDH loopback is a local loopback which loops the receive line signal (from the line) onto the transmit signal (towards the Line). This loopback type is shown in Figure 6-62.

Figure 6-62. Core and Line Facing PDH Loopback

6.698 This loopback is drop and continue.

6.699 This loopback is configured using the Craft Terminal.

Radio facing PDH (DS1/DS3) loopback

6.700 Radio facing PDH loopback is a remote loopback which loops the receive tributary signal (from the Core) onto the transmit signal (towards the Core). This loopback type is shown in Figure 6-62.

6.701 This loopback may be activated for each DS1/DS3 tributary port.

6.702 This loopback is loop and continue.

6.703 This loopback is configured using the Craft Terminal.

Loopback time-out

6.704 The system supports a loopback time-out mechanism to avoid the risk of a permanent disconnection from the Craft Terminal to a remote NE after executing a loopback.

6.705 The time--out period is entered into the management system expressed in days/hours/minutes.

6.706 The maximum time-out period is 4 days.

6.707 The default time-out period is 5 minutes

Loopback activation

6.708 Loopbacks can be activated by local or remote management systems. The activation command includes the duration of the loopback (time-out).

6.709 Core facing and Radio facing loopbacks are not supported at the same time.

6.710 The time-out period starts at the activation time and expires at the end of the time-out period.

6.711 The operator has the option to deactivate the loopback during the activation period.

6.712 The operator also has the option to extend the time-out period during the activation period. In this case, the time-out period is re-initiated. The specified time period starts over from the new activation date, overwriting the previous activation date and time-out values.

Network Management

6.713 The system supports the following network managers:

- Alcatel-Lucent 1350 OMS
- Alcatel-Lucent 1352 CM (Compact Manager)
- Alcatel-Lucent 1353 NM
- Alcatel-Lucent 5620 SAM

Performance monitoring

6.714 Performance Monitoring (PM) is supported by the system. PM is performed through the PM Tool. PM data is collected in 15 minute and 24 hour time periods. PM counters the system supports are described in the following paragraphs.

Ethernet user port PM

6.715 PM of the Ethernet physical interface statistics related to the Tx and Rx packets are supported on all user Ethernet interfaces. The available Ethernet PM counters are:

- Total Number of Tx Packets
- Total Number of Tx Bytes
- Total Number of Tx Discarded Packets
- Total Number of Tx Unicast Packets
- Total Number of Tx Broadcast Packets
- Total Number of Tx Multicast Packets
- Total Number of Rx Packets
- Total Number of Rx Bytes
- Total Number of Rx Discarded Packets
- Total Number of Rx Unicast Packets
- Total Number of Rx Broadcast Packets
- Total Number of Rx Multicast Packets
- Total Number of Rx Errored Packets

Adaptive modulation PM

6.716 PM of the Tx modulation scheme is monitored when adaptive modulation is enabled. For 1+1 HSB radio configurations, the statistics are related to the active radio channel. PM tracks the amount of time elapsed in each modulation technique.

L1 radio LAG ethernet port PM

6.717 PM of the L1 Radio LAG Ethernet port statistics related to the Tx packets are supported on all L1 Radio LAG Ethernet ports. The available Ethernet PM counters are:

- Total Transmitted Octets (TTO)—Equals the number of good transmitted Octets on the port
- Total Transmitted Frames (TTF)—Equals the total number of good transmitted frames on the port
- Total Discarded Frames (TDF)—Equals the number of transmitted frames discarded on the port

- Available Capacity—Equals the available capacity of the L1 radio LAG Lowest Index Port
- Used Capacity—Equals the ratio of TTF to Capacity of the L1 radio LAG Ethernet flow
- TTO Throughput—Equals the TTO Throughput of the L1 radio LAG Ethernet flow
- TDF Ratio—Equals the ratio of TDF to TTF of the L1 radio LAG Ethernet flow

Radio analog PM

6.718 PM of the local analog Tx and Rx power levels are supported on MPT-HC and ODU300. PM counters are available for each radio hop and link (in 1+1 Rx side only). The available radio analog PM counters are:

- Tx Minimum Power Level
- Tx Maximum Power Level
- Tx Average Power Level
- Rx Minimum Power Level
- Rx Maximum Power Level
- Rx Average Power Level

Radio ethernet PM

6.719 PM of the radio Ethernet statistics related to the Tx radio link are supported for each radio direction. The available Radio Ethernet PM counters are:

- Total Number of Tx Packets
- Total Number of Tx Bytes
- Total Number of Tx Discarded Packets

Radio hop PM

6.720 PM of the radio hop section (before radio protection switching) is supported for each radio hop. The available Radio hop PM counters are:

- Errored Seconds (ES)

- Severely Errored Seconds (SES)
- Background Block Errors (BBE)
- Unavailable Seconds (UAS).

Radio link PM

6.721 PM of the protected radio channel (after radio protection switching) is supported for each radio link. The available Radio link PM counters are:

- Errored Seconds (ES)
- Severely Errored Seconds (SES)
- Background Block Errors (BBE)
- Unavailable Seconds (UAS).

Radio QoS PM

6.722 PM of the radio QoS queues (queues 1 to 5) related to Ethernet traffic for each radio direction are supported. The available Radio Qos PM counters are:

- Number of Tx Packets
- Number of Tx Bytes
- Number of Tx Discarded Packets
- Number of Rx Packets
- Number of Rx Bytes

Radio RSL PM

6.723 PM of the local Receive Signal Level (RSL) and Transmit Signal Level (TSL) is supported for each MPT-HL radio link. For radio links configured with 1+1 RPS, the RSL of the active channel in monitored. The available Radio RSL PM counters are:

- Lowest RSL
- Highest RSL
- Average RSL

- Lowest TSL
- Highest TSL
- Average TSL

PDH PM

6.724 PM of the incoming and outgoing signals associated with a DS1 PDH signal is supported. The available DS1 PDH PM counters are:

- Errored Second (ES)—When a defect second is set or if there is at least one or more errored blocks
- Severely Errored Seconds (SES)—When a defect second is set and if the errored block count is greater or equal to 30% of the blocks in one second
- Background Block Error (BBE)—The number of block errors in a one second period and the second is not an SES
- Unavailable Seconds (UAS)—A time period starting after ten consecutive SES events are detected. The qualifying ten consecutive SES seconds are included in the UAS time period. Ending upon the detection of ten consecutive non SES events. These non SES seconds are not included in the UAS time period

Port segregation

6.725 This feature is based on the port based VLAN feature supported by the Ethernet switch and allows the following behavior: all traffic received/transmitted from one user Ethernet port or radio direction can not be exchanged with specific user Ethernet ports/radio directions.

6.726 The default configuration foresees:

- Every user Ethernet port is cross-connected to all Radio directions (bidirectional connection)
- All the Radio directions are cross-connected between them (bidirectional connection)
- All the user Ethernet ports are cross-connected between them (bidirectional connection)

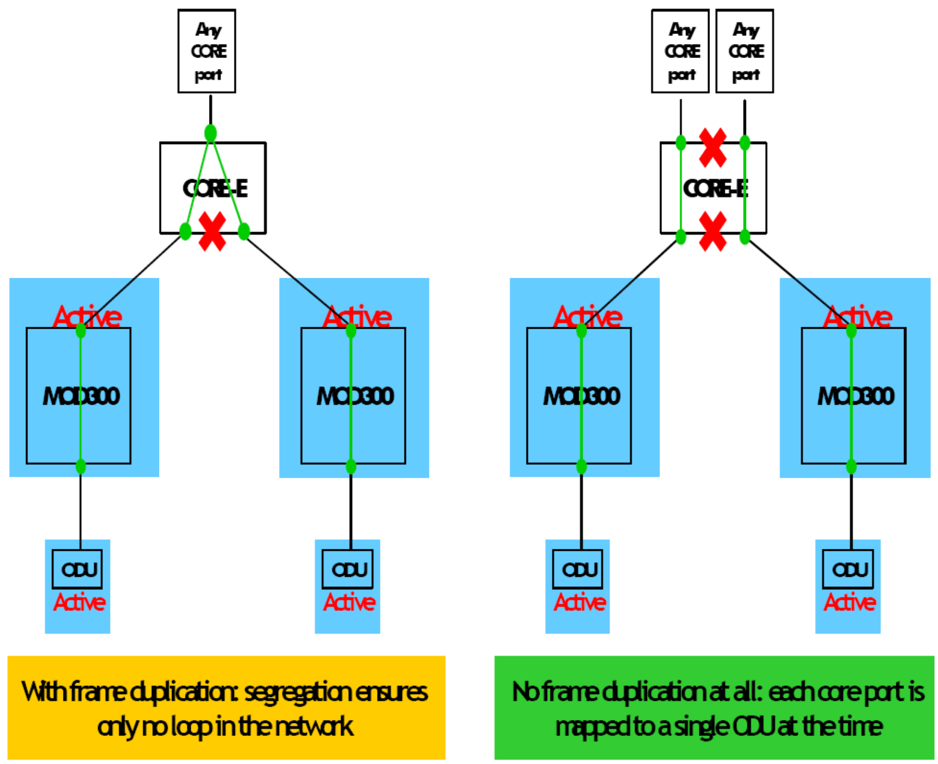
PRELIMINARY

6.727 By ECT/NMS it is possible to change this default configuration. When TDM flow cross-connections are defined and involve TDM ports, port segregation involving these ports are implicitly prohibited.

Port segregation and frame duplication

6.728 The Operator must be aware that application of port segregation between an User Port and radio ports in 1+0 configuration (segregated among them) towards the same NE can lead to duplication of broadcast, multicast of flooding traffic.

Figure 6-63. Port segregation ODU300



TDM ports

6.729 Port Segregation is not supported for TDM ports (DS1/DS3/OC-3) by ECT/NMS. At system level TDM ports are segregated among them and not segregated from Radio directions involved in TDM flows cross-connections.

MPT access ports

6.730 For MPT Access peripheral ports, port segregation can be applied by operator at two different points:

- between MPT Access peripheral ports connected to MPT-HC/XPs: to segregate connected MPT-HC/XPs
- between them between MPT Access peripheral port connected to MSS backplane and the other backplane ports: to segregate all connected MPT-HC/XPs towards User Ports or other radio directions.

6.731 In case only one MPT is connected to MPT Access peripheral port, the port segregation behavior is the same as with ODU300 radio direction.

6.732 Assuming 2 MPT-HC/XPs in 1+0 configuration are connected to same MPT Access peripheral, since that is the only configuration supported within this release with more than one MPT on same MPT Access peripheral, three scenarios have to be considered:

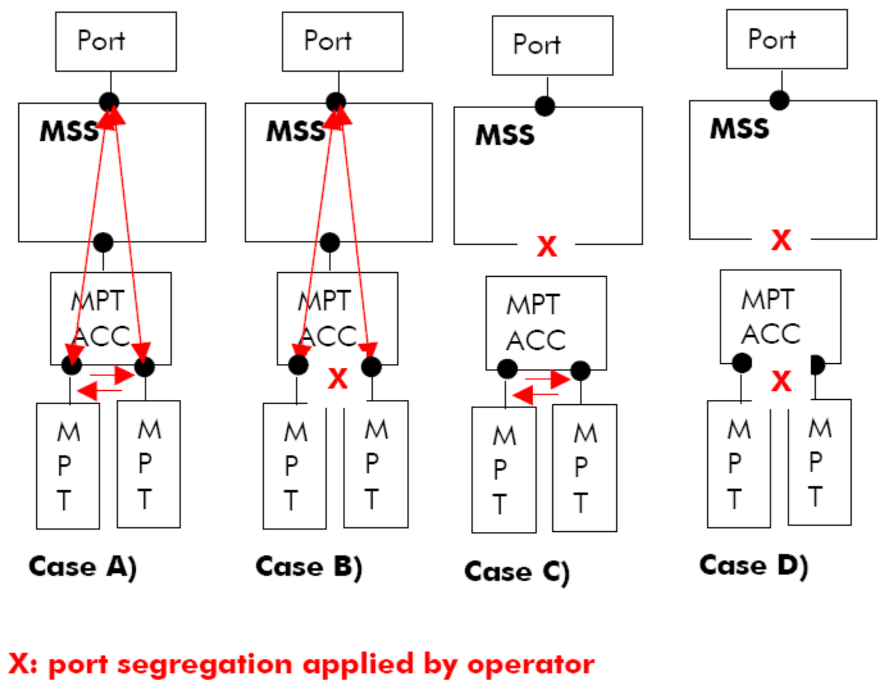
1. no port segregation is applied by operator between MPT Access peripheral ports and to MPT Access peripheral port towards backplane: in this case, all the involved ports can exchange the data among them (case A);
2. port segregation is applied by operator between MPT Access plug-in ports, while no port segregation is applied by operator to MPT Access peripheral port towards backplane: in this case, the two MPT-HC/XPs cannot exchange data (case B); in this case, frame duplication for broadcast, multicast and flooding traffic will surely occur in case the two radio directions are towards the same NE;
3. no port segregation is applied by operator between MPT Access plug-in ports, while operator applies segregation to MPT Access peripheral port towards backplane. This case represents an MPT Access peripheral isolated from MSS backplane, in such case, the two MPT-HC/XPs can only exchange data between them (case C).

A fourth scenario for application of port segregation is possible, but in this release is not applicable:

PRELIMINARY

4. port segregation is applied by operator between MPT Access peripheral ports and MPT Access peripheral port towards backplane, no traffic can be exchanged between MPT-HC/XPs and with MSS with the current number of supported MPT Access peripheral ports. No check has been implemented to forbid this application of port segregation since it can be applied in future releases where use of all MPT Access peripheral ports is supported (case D).

Figure 6-64. Port segregation scenario: MPT access



MPT-HC/XPs number for each MPT plug in

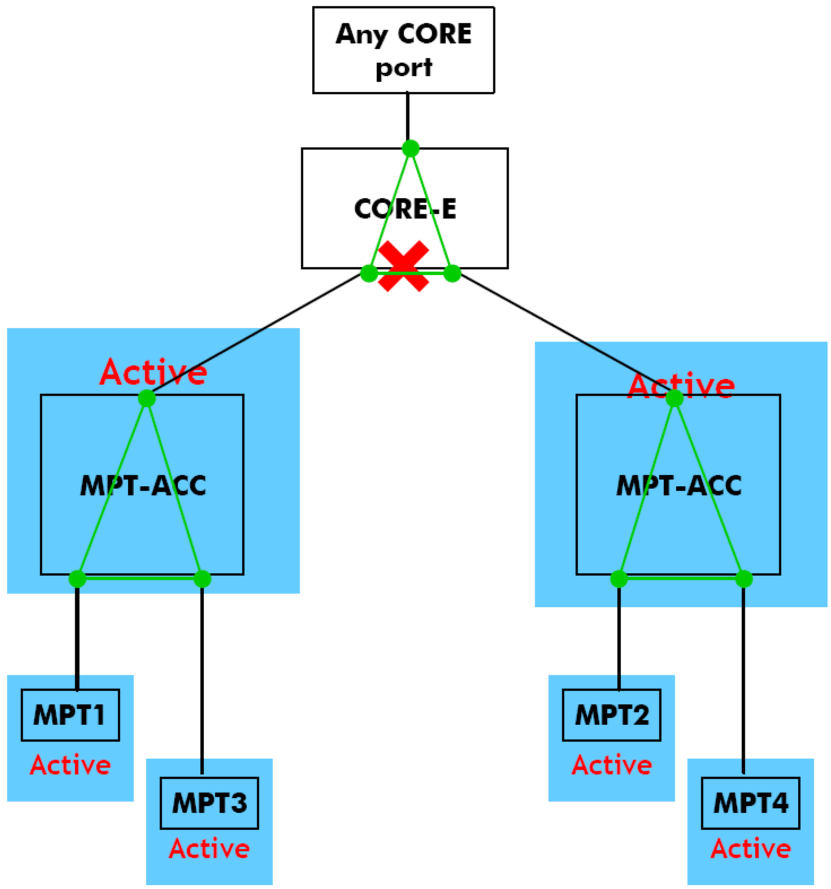
6.733 If port segregation is applied by operator to an MSS User port and to MPT Access plug-in port towards backplane, MPT ODUs connected to same MPT Access plug-in will have the same segregation.

6.734 This application of port segregation by operator has no consequence on the capability to provision up to 2 MPT ODUs on the same MPT Access plug-in (in 1+0).

6.735 Below it is reported an example of applicable port segregation configuration by operator.

6.736 In this case the goal of port segregation is the MPT1-MPT3 pair does not exchange traffic with MPT2-MPT4 pair.

Figure 6-65. Port segregation scenario: MPT access



ODU300

6.737 In case the Core-E user port is segregated from ODU300 radio: consequently, the ODU300 is segregated from the Core-E user port and vice versa.

6.738 In case of protected radio direction, the spare radio direction must have the same port segregation configuration.

6.739 Any previous port segregation configuration for spare radio direction must be deleted by operator.

ODU300 and MPTACC

6.740 If port segregation is applied by operator to an ODU300 radio port and to MPT Access plug-in port towards backplane, all the MPT Access ports are segregated from the ODU300 radio port and vice versa.

MPT-HC/XPs protected on different plug-ins

6.741 When two MPT-HC/XPs are provisioned for 1+1 protected configuration on two different MPT Access peripherals, the MPT Access plug-in ports towards backplane will not implicitly segregated each other.

6.742 Otherwise, when it will be supported in future release the possibility to connect another MPT to the same MPT Access peripheral(s), it would not possible to have it in repeater configuration with the protected MPT pair.

6.743 Operator is allowed to apply port segregation to MPT Access peripherals hosting an MPT pair in 1+1, but since connection to other MPT on same plug-in is not supported in this release, only the segregation of MPT Access port towards the backplane is effective.

6.744 The spare radio direction must have the same port segregation configuration (for MPT Access plug-in port towards backplane).

6.745 Any previous port segregation configuration for spare radio direction must be deleted by operator.

Remote inventory

6.746 Remote Inventory (RI) provides operators with the capability to remotely determine what equipment is installed in the system. RI data contains information programmed in the factory to indicate the configuration, capability, and compatibility of the installed MSS cards, ODU300, MPT-HC, MPT-HL, and MPT-XP transceivers.

Security

6.747 The system provides a mechanism to protect access to the NE.

User authentication

6.748 Communication access is accomplished using Username and Password authentication.

6.749 An NE supports a maximum of twenty-three provisioned users.

User profile management

6.750 NE rejects username and passwords that do not meet complexity parameters. These complexity parameters are as follows:

- Username length: Username must not exceed twenty characters in length.
- Password length: Passwords must not be less than eight and not longer than twenty characters in length.
- Password composition: Passwords must be composed of UPPER case, lower case, numeric, and special characters.

6.751 Access privileges to the system are controlled using four user profiles. User profiles privileges are as follows:

- Administrator: Full access to the NE including security parameters.
- CraftPerson: Users assigned to installation and maintenance tasks at the radio site. Full access to the NE except security parameters.
- Operator: Users assigned to operational tasks at the network level, not at the radio site.
- Viewer: Users who require read only access.

SNMP operating mode (SNMPv3 support)

6.752 The SNMP operating mode of the NE can be set using the WebEML or the web interface.

6.753 The following SNMP operating modes are supported:

- SNMPv2: Only SNMPv2 or v1 managers can access the NE. This is the default operating mode.
- SNMPv3: Only SNMPv3 managers can access the NE.

6.754 SNMPv3 addresses security problems by adding two new features on top of the existing SNMPv1 and SNMPv2 network management protocols:

- Authentication using hashing and time stamps.
- Confidentiality using encryption.

6.755 SNMPv3 is based on the following:

- The User based Security Model (USM), which provides strong user authentication, data integrity, privacy(encryption) and time stamp management (timeliness),
- The View base Access Control Model (VACM), which provides a mechanism for managing what information is available to users.

6.756 Authentication is provided using the HMAC-MD5-96 standard authentication protocol.

6.757 The SNMP operating mode is stored in permanent memory on a Flash card.

SNMPv2 community string

6.758 The system supports SNMPv2 Community String (CS).

6.759 Two Community Strings are supported, “Get CS” and “Set CS”.

6.760 CS must not be less than six and not longer than ten characters in length. Only alphanumeric characters are supported.

Stacking for EAS/MPT access cards

6.761 Two EAS cards or two MPT Access cards installed on the same row (i.e. slot #3 and slot #4) are automatically configured in stacking configuration.

6.762 The benefits of stacking are:

- The intra-board traffic between the two cards dies not transit through the Core-E card (no traffic impact in case of Core-E switch).
- Each port of the cards can be individually segregated from the other ports.

Synchronization

6.763 All 9500 MPR-A radios in the network must be synchronized to the same clock. One radio in the network is provisioned Master. All other radios in the network must be provisioned Slave. The slave radios all sync to the clock provided by the master.

Normal operation

6.764 During normal operation, the master can be provisioned to get sync clock from two separate sources: an internal local oscillator (most common source) or external clock from customer provided equipment. The slave radios can be provisioned to receive the sync clock from one of two sources: clock recovered by the radio receiver or the sync clock from another radio in the network. Normally at a repeater, the sync clock is received over the RF path and recovered by the radio receiver. A typical slave terminal uses the clock from an adjacent radio.

Failed primary operation

6.765 With the exception of the master when the radio is provisioned to sync off the local oscillator, the provisioned secondary sync source is enabled if the primary source fails. When the master, provisioned to accept sync clock at the CSM-E (Control and Switching Module) from an external source, fails, the internal free-running local oscillator is enabled. Provisioning choices for the secondary source for slave radios are dependent upon the choices made from the primary source. Refer to the following descriptions for details.

Sync switching

6.766 With the exception of the master when the radio is provisioned to sync from the local oscillator, the sync clock source is switched from primary to secondary if the primary source fails. Sync clock switching provisioning is dependent on the role of the radio in the network (master or slave) and on user preference. A revertive switching feature is a provisioning option that restores the sync clock to the original source when the alarm on the primary source is cleared. If revertive switching is not selected, the secondary sync source will continue to provide sync clock, and if the secondary source fails, must be manually switched to the primary source.

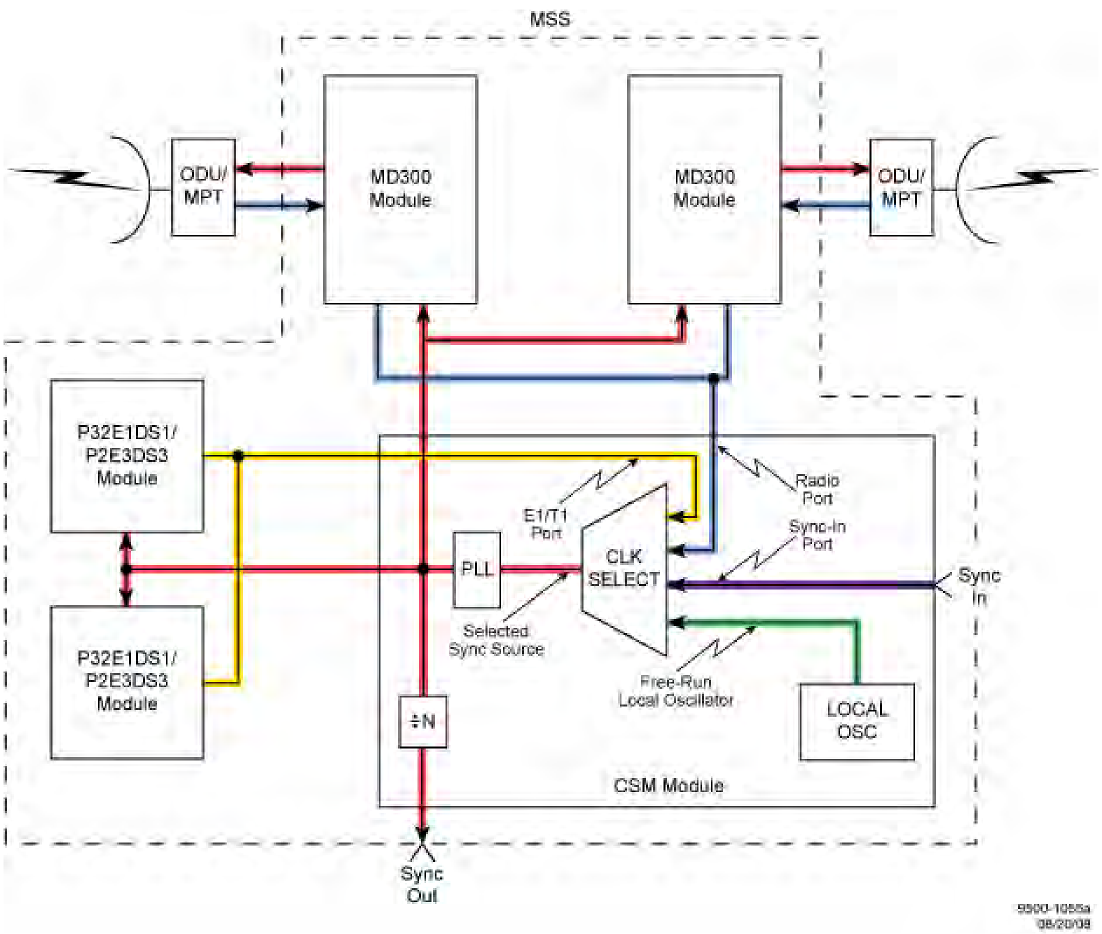
6.767 The MPT-HL sends out Do Not Use signals (DUS) in the following situations:

- The MPT-HL is not receiving reliable timing information from the Ethernet port, or there is a timing issue with a P8ETH or MPTACC peripheral.
- An NE upstream of the MPT-HL and an NE downstream of the MPT-HL are using the MPT-HL as a synchronization source. This creates the possibility of a timing loop.

6.768 If the NE receiving the DUS is using the MPT-HL as a synchronization source, the DUS will trigger a synchronization switch.

PRELIMINARY

Figure 6-66. Synchronization block diagram



Synchronization for PDH/SDH/DATA

Synchronization overview

6.769 PDH/SDH data flow is fragmented and the fragments are transmitted over a Packet Switched Network (PSN);

6.770 The received fragments need to be reassembled in the original PDH/SDH data flow at the "original bit rate"

6.771 Three main methods can be used to recover at the Rx site, the original bit rate:

- **Differential clock recovery (DCR)**: recalculation of the original clock based of the Delta respect to a reference clock that is available at both Tx and Rx site (**Differential**: used in case of clock distribution on the whole network. It's more reliable than Adaptive; also used in TDM2TDM traffic (MPR to MPR)). This method can be selected for each DS1/DS3/OC-3 stream.

- **Adaptive clock recovery (ACR)**: based on the average rate at which the packets (fragments) arrive at RX site (**Adaptive**: simpler network, but performances depends on the PDV (Packet Delay Variation) in the Network. Always used when the reference clock isn't distributed on the whole network). This method can be selected for each DS1/DS3/OC-3 stream.

- **Node Timing**: timing from the network clock as defined in G.8261. The enabling of the Node Timing is applied to all DS1/DS3/OC-3s of the PDH/SDH unit.

- This feature (called either "network clock re-timing" or "node timing" or, according to G. 8261 wording, "network-synchronous operation for service clock") introduces an additional possibility to recover the clock.

- Node timing is a way to recover the clock quite popular in the industry of service routers and site aggregator boxes. This feature inside the 9500 MPR-A platform is adding interworking capabilities with third parties service routers and circuit emulations gateway.

- In node-timing working mode, all the DS1/DS3/OC-3s are re-sampled with the network element clock. This means that, as also reported in G8261, this method does not preserve the service timing (DS1/DS3/OC-3 clock).

- Recovered DS1/DS3/OC-3 clock is according to G. 823 synchronization masks.

6.772 The available clock recovery techniques with TDM2TDM and SDH2SDH profiles are:

- DCR: differential clock recovery

- Node timing

6.773 The available clock recovery techniques with TDM2ETH profile are:

- ACR: adaptive clock recovery (if a common reference clock is not available)

- DCR: differential clock recovery

- Node timing.

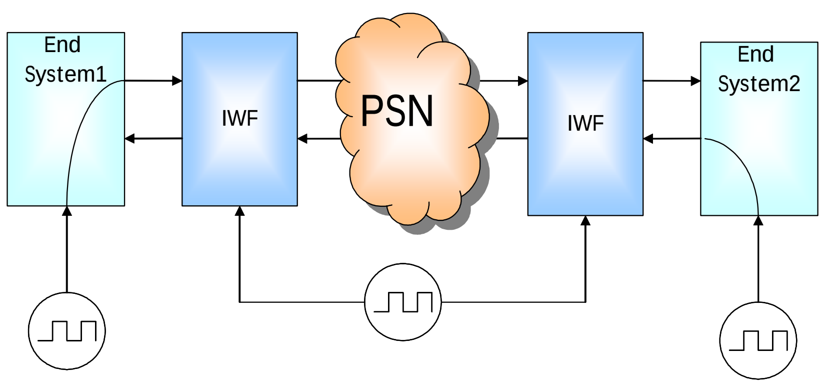
Note

NOTE: In meshed networks (rings) do not close the synchronization configuration.

N.B. If the NODE TIMING is enabled, the CT still propose the possible selection between ACR and DCR: in this specific case, the meaning of this option is not related to the clock recovery algorithms but rather to the MRF8 frame format.

Differential clock recovery

Figure 6-67. Differential clock recovery

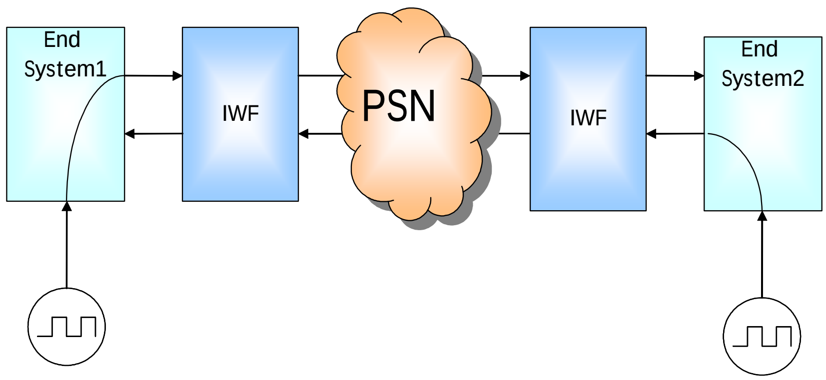


6.774 Common reference clock IS available at both Ends.

6.775 IWF system, at RX side, generate output clock based on RTP TimeStamps which are sent together with each Fragments.

Adaptive clock recovery

Figure 6-68. Adaptive clock recovery



6.776 Common reference clock is NOT available at both Ends.

6.777 IWF system, at RX side, generate output clock based on data arrival rate: TDM clock is slowly adjusted to maintain the average fill level of a jitter buffer at its midpoint.

Synchronization protection

6.778 In order to get any node in a meshed network or ring topology network always locked for each node the synchronization sources and the automatic selection process are defined, as described in the following points.

6.779 Sync status messages are supported by Synchronous Ethernet interfaces (User Ethernet interfaces working in synchronous operation mode) or radio interfaces (ODU 300 or MPT).

6.780 SSM carries information about the quality level of the source clock from clock to clock along the network. There are a number of pre-defined quality levels (QL) corresponding to existing clock specifications i.e. QL-PRC, QL-SSU-A, QL-SSU-B, QL-SEC and QL-DNU. The last message means 'Do Not Use'. This signaling system is used for controlling protection switching in case of link or clock failures and protecting against sync loops. Of course, SSM also exists in Synchronous Ethernet. It works in exactly the same way as in SDH and SONET. The only difference is the communication channel used for transferring the SSM from clock to clock. In SDH and SONET the SSM is contained in the SSM Byte (SSMB) of the STM-n or OC-n frame overhead. Synchronous Ethernet uses 'Ethernet Synchronization Messaging Channel' or ESMC. It consists of special Ethernet frames. The important point to note here is that there is a perfect continuity between SDH and SONET on side, Hybrid NEs and Synchronous Ethernet on the other.

6.781 SSM messages represent the quality level of the system clocks located in the various network elements. SSM contains the Clock Quality Level (QL) and Quality Level Priority (QLP). QLP is optional. Quality level refers to the holdover performance of a clock.

6.782 SSM messages shall be received and monitored on interfaces that are configured as sync sources and with SSM support enabled; otherwise received messages shall be ignored and silently discarded. In this case, The default (initial) value for the QL is DNU and QLP is Undefined until a valid QL/QLP is received over the interface. When a valid QL is received by an interface providing a sync source signal, the carried SSM-QL is assigned as the clock QL of this interface and used by the system clock selection algorithm. Lack of reception of an SSM within a five-second period results in the QL of the interface being set to QL-FAILED and QL Priority being set to Undefined. Loss of ESMC defect is raised and it is cleared on receipt of the first SSM.

6.783 SSM messages are generated on interfaces with SSM enabled. These messages are generated once per second.

6.784 Given two sync sources, the NEC will use QL/QLP to determine the selected sync source. The selected QL/QLP will be sent out over interfaces with SSM enabled.

6.785 The selection process works always in QL-enabled mode, the selected synchronization clock source is used to lock the NEC. The QL of the selected synchronization clock source determines the QL of the NEC, unless the NEC is in Holdover mode.

6.786 The selection process has two nominated synchronization clock source inputs:

- Primary clock source input;
- Secondary clock source input.

6.787 For such sources the following selection criteria are defined:

- Clock Source Fail when the source is not available;
- Clock Source Degrade when the frequency of the source is away from its nominal value with the following rules: the degrade alarm will never be asserted if the actual frequency is within ±10 ppm of its nominal value; the degrade alarm will always be asserted if the actual frequency is not within ±50 ppm of its nominal value;
- Clock Source Quality Level (QL) according to ITU-T G.781;

- Clock Source Quality Level Priority

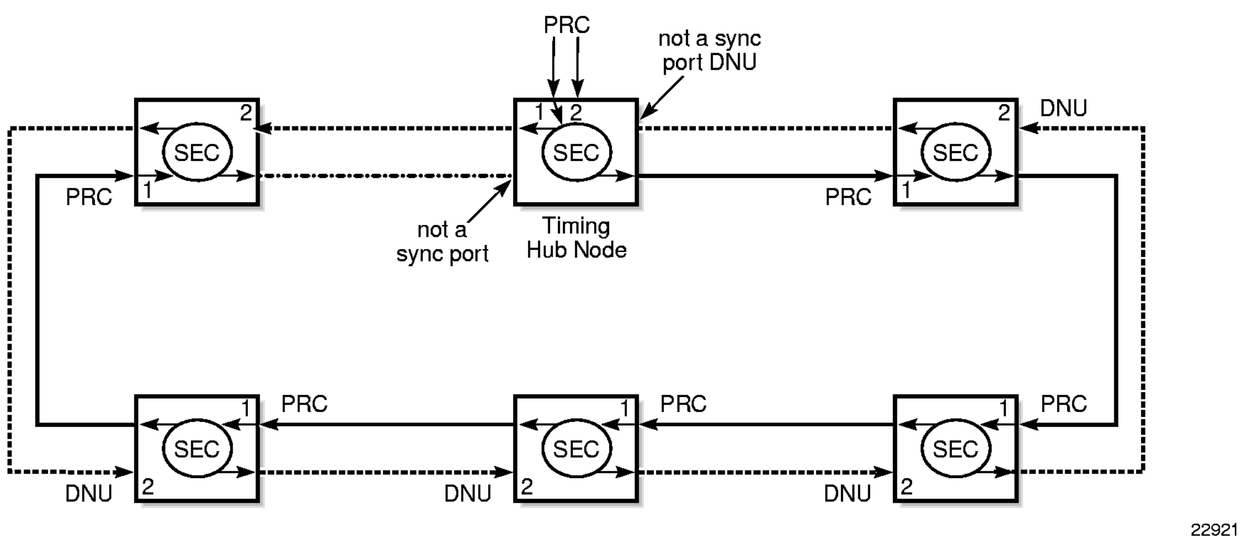
6.788 The QL-DNU and QL Priority Undefined are advertised over the synchronization interface that is currently selected to avoid sync loops.

6.789 When a Signal Fail or Signal Degrade defects are detected on a synchronization clock source input, the Quality Level of this source input is set to QL-FAILED value.

6.790 When the NEC goes into holdover, the QL is set to QL-SEC/QL-EEC1.

6.791 Figure 6-69 to 6-71 is a ring example using DNU to prevent loops and used during protection switching:

Figure 6-69. Ring network with SSMs and port priorities normal situation



PRELIMINARY

Figure 6-70. Ring network in restoration process - last node switched reference

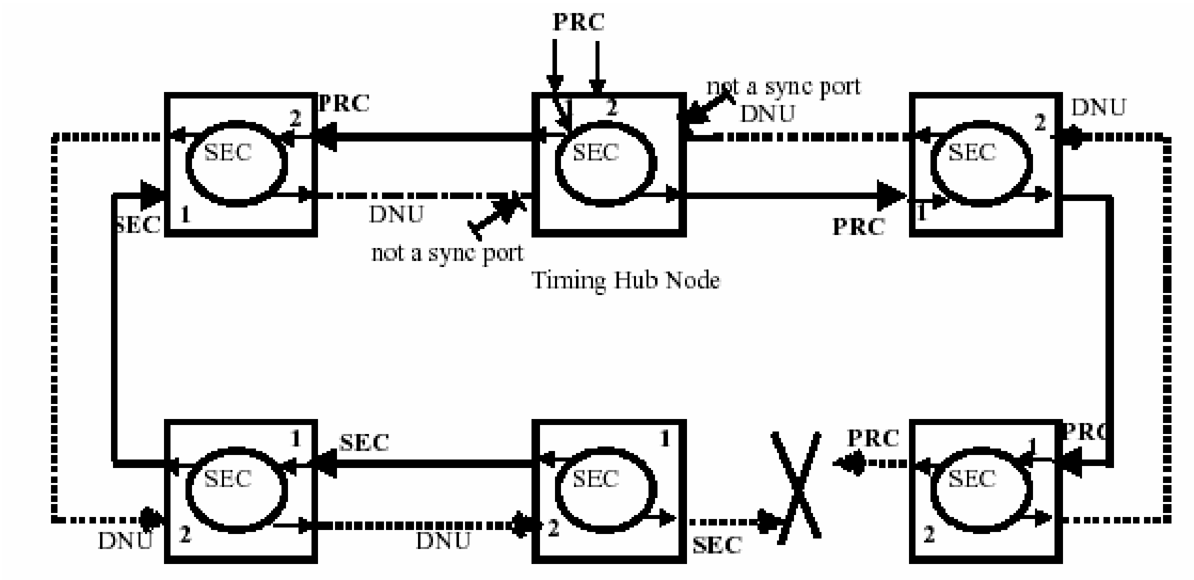
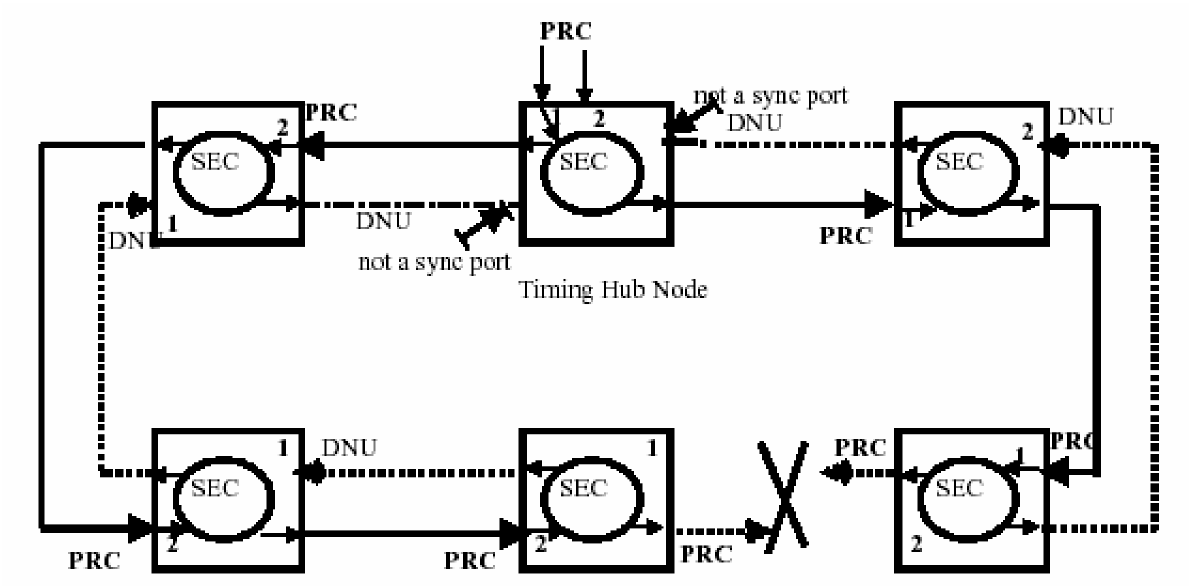


Figure 6-71. Ring network in restoration process - final situation



6.792 SSM ESMC messages are queued in Q6. SSM are sent one per second, so the bandwidth is very low. 32 octets but future extensions could be larger.

Synchronization quality level

6.793 According to Table 8 of ITU-T G.781 the Clock Source Quality Level is identified by the following SSM Codes:

- 0010 - QL-PRC for timing quality generated by a primary reference clock as defined in ITU-T G.811;
- 0100 - QL-SSU-A for timing quality generated by a type I or V slave clock as defined in ITU-T G.812;
- 1000 - QL-SSU-B for timing quality generated by a type VI slave clock as defined in ITU-T G.812;
- 1011 - QL-SEC/QL-EEC1 for timing quality generated by a SEC or EEC as defined in ITU-T G.813/ITU-T G.8262;
- 1111 - QL-DNU (Do Not Use).

Table 6-O. SSM quality levels

Quality Level	Order
QL-PRC	Highest
QL-SSU-A	|
QL-SSU-B	|
QL-SEC/QL-EEC1	|
QL-DNU	|
QL-FAILED/QL-INV	Lowest

6.794 Any other SSM Code values different from the ones listed above must be considered as an Invalid Quality Level (QL-INV).

6.795 The QL of the NEC is advertised over radio interfaces and Synchronous Ethernet interfaces.

Quality level priority

6.796 A QL Priority parameter is defined for each node and assigned to synchronization clock sources and to the NEC.

6.797 The QL Priority values are identified by the following codes:

- 0x01 - Master1
- 0x10 - Slave1

- 0x00 - Undefined

Table 6-P. SSM quality levels

Quality Level Priority	Order
Master1	Highest
Slave1	|
Undefined	Lowest

6.798 The QL Priority of the NEC is advertised, together with the QL, over radio interfaces.

6.799 The equipment shall be ready to advertise the QL Priority of the NEC over Synchronous Ethernet interfaces too.

6.800 The QL Priority is a proprietary parameter (not foreseen in G.781) introduced with the aim to deal with a ring or meshed scenario where, due to a lack of external synchronization sources and failure on the synchronization distribution path on the MPR wireless network, the synchronization distribution network is partitioned in more than one isle each of them locked to a different oscillator in Holdover or Free-Run mode.

Hold-off and wait-to-restore

6.801 In order to proper manage the QL-FAILED (Clock Source Fail or Clock Source Degrade) the automatic selection process must take into account the Hold-Off time and Wait-To-Restore time defined in ITU-T G.781:

- The Hold-Off time ensures that short activation of signal fail are not passed to the selection process. The QL value of QL-FAILED is passed to the selection process after the Hold-off time. In the meantime, the previous QL value is passed to the selection process. The Hold-Off time is the same for each input of the selection process and it is fixed to 500 ms.

- The Wait-To-Restore time ensures that a previous failed synchronization source is only again considered as available by the selection process if it is fault free for a certain time. When a Signal Fail or Signal Degrade defects are cleared, the Wait-To-Restore time is applied before the new QL value is passed to the selection process. In the meantime, the quality level QL-FAILED is passed to the selection process. The Wait-To-Restore time is the same for each input of the selection process and it is configurable in the range of 0 to 12 minutes in steps of 10 seconds. The default value is 5 minutes. When changed before its expiration, the WTR time restart from the new value without take into account the previous remaining time to expiration.

The WTR time is also applied when a LOS of ESMC defect is cleared on a synchronization clock source, also in that case the quality level QL-FAILED is passed to the selection process until the WTR time expires.

Synchronization sources assignment

6.802 The physical interfaces to be assigned to Primary and Secondary synchronization sources can be selected from the following:

1. Free Run Local Oscillator:
   - is not affected by any alarm (no Fail, no Degrade)
   - Quality Level value is fixed to QL-SEC/EEC1 (G.812/G8262)
   - QL Priority is Master1 if the NEC is configured as Master
   - QL Priority is Slave1 if the NEC is configured as Slave
2. DS1 which is enabled on input traffic interface:
   - meets the interface requirements in G.824, Section 6
   - the specific DS1 port must be selected
   - For these sources the Fail alarm has to be detected by CRU when LOS, AIS, or LOF (in case of DS1s framed) occurs
   - Default value for Quality Level is QL-SSU-A (G.812)
   - QL Priority is Master1 if the NEC is configured as Master
   - QL Priority is Slave1 if the NEC is configured as Slave.
3. synchronization signal available from the dedicated Sync-In port

   must be configured from the following options:

   a. 2.048 MHz, electrical levels according to G.703, clause 13

   b. 5 MHz, + 6 dBm into 50 ohm, sine-wave

   c. 10 MHz, + 6 dBm into 50 ohm, sine-wave

   d. 1.024 MHz, electrical levels according to G.703, clause 13 with the following exception:

      timing properly scaled from 2.048 MHz to 1.024 MHz.

- Fail alarm is detected by CRU when LOS occurs
- Default value for Quality Level is QL-SSU-A (G.812)
- QL Priority is Master1 if the NEC is configured as Master
- QL Priority is Slave1 if the NEC is configured as Slave

4. The Symbol Rate of the RX signal of any available Radio:
   - the specific Radio Port must be selected
   - Fail alarm must be detected by CRU when a DEM-Fail or a Loss of Radio Frame occurs
   - When SSM support is enabled, the QL and QL Priority are acquired from ESMC PDUs received on the selected radio interface
   - When SSM support is disabled, the default value for Quality Level is QL-SSU-A (G.812)
   - QL Priority is Master1 if the NEC is configured as Master
   - QL Priority is Slave1 if the NEC is configured as Slave

5. A Synchronous Ethernet clock source available at enabled User Ethernet traffic interface:
   - electrical or optical interface configured in synchronous operation mode
   - at 1000 Mbit/s
   - the specific User Ethernet port must be selected
   - from ITU-T G.8261 point of view, the MSS is Synchronous Ethernet equipment, equipped with a system clock (NEC) following the ITU-T G.8262 recommendation.
   - When SSM support is enabled, the QL is acquired from ESMC PDUs received on the specific Synchronous Ethernet interface
   - by default, the QL Priority is not advertised by ESMC PDUs
   - QL Priority is Master1 if the NEC is configured as Master
   - QL Priority is Slave1 if the NEC is configured as Slave

- when the QL Priority is advertised by ESMC PDUs, the QL Priority is acquired from them
- when the SSM support is disabled, the default Quality Level is QL-SSU-A (G.812)

  QL Priority is Master1 if the NEC is configured as Master

  QL Priority is Slave1 if the NEC is configured as Slave
- electrical User Ethernet interfaces perform link auto negotiation to determine the master/slave role for clock delivery over the link
- The clock slave role must be configured as part of auto negotiation parameters in order to use the interface as Synchronous Ethernet clock source input, either as Primary or Secondary. This check is performed by CT/NMS but not by EC.
- The clock master role must be configured as part of auto negotiation parameters in order to use the interface as Synchronous Ethernet clock source output to distribute NEC to other equipment.
- For Synchronous Ethernet clock sources from electrical User Ethernet ports the Fail alarm will be raised when Loss of Synch (i.e. Ethernet Link Down) occurs.
- For Synchronous Ethernet clock sources from optical User Ethernet ports the Fail alarm will be raised when Loss of Optical signal occurs.

6. Any OC-3 (STM1) available at SDH input traffic interface:
   - the specific OC-3 (STM1) port must be selected
   - Fail alarm will be raised when LOS, LOF, TIM, MS-AIS, or High BER occurs
   - Default value for Quality Level is QL-SSU-A (G.812)
   - QL Priority is Master1 if the NEC is configured as Master
   - QL Priority is Slave1 if the NEC is configured as Slave.
7. Any L1 Radio LAG with administrative state enabled.
   - NE selects one of the LAG members according to current alarm status

- in case of synchronization failure to the current reference, the NE performs a selection switch to another member of the LAG
- When SSM support is enabled, the QL Priority is advertised by ESMC PDUs, the QL Priority is acquired from them
- when the SSM support is disabled, the default Quality Level is QL-SSU-A (G.812)

8. None of the above, this means that no physical synchronization interface is assigned to the synchronization clock source input. In case of failure of the other clock source input the CRU enters the Holdover state.

Synchronization sources assignment rules

6.803 Some rules have to be followed while assigning the Primary and Secondary clock sources:

6.804 The NEC has to be defined (configured) as Master or Slave.

- If a specific interface is chosen as Primary, it cannot be selected as Secondary too.
- If a DS1 is chosen as Primary source, another DS1 coming from the same peripheral cannot be selected as Secondary source and vice-versa.
- If an MPT-HC/XP radio interface is chosen as Primary source, another MPT radio interface connected to the same MPT Access peripheral cannot be selected as Secondary source and vice-versa.
- If an MPT-HC/HL/XP radio interface is chosen as Primary source, another MPT-HC/HL/XP radio interface connected to the same P8ETH can be selected as Secondary source and vice-versa
- If an OC-3 (STM1) is chosen to be Primary source, another OC-3 (STM1) coming from the same peripheral cannot be selected as Secondary source and vice-versa.

Allowed synchronization sources assignment

6.805 Only one Master is allowed in the network.

6.806 If Master:

- The Restoration Mode must be chosen between Revertive and Non-Revertive;

- The Primary clock source input must be chosen among 1), 2), 3), 5) or 6).
- If the selected Master Primary clock source input is 1):

  the Master Secondary clock source input doesn't need to be selected because the Primary is never supposed to fail.
- If the selected Master Primary clock source input is 2), 3), 5) or 6):

  the Master Secondary clock source input must be selected among 1), 2), 3), 5), 6) or 8).

6.807 If Slave:

- The Restoration Mode is fixed to Revertive.
- The Primary clock source input must be chosen among 3), 4), 5), or 7).

  Slave Primary clock source input is allowed to be 3) or 5) for full indoor configuration and for Piling configuration.
- The Secondary clock source input must be chosen among 1), 2), 3), 4), 5), 6), 7), or 8).

6.808 When SSM is enabled on the secondary reference, the user should ensure that the QL and QLP will not exceed the normal QL and QLP of the primary reference.

Note: Any link that has been assigned as a timing reference at both ends (Primary source on one side and Secondary source on the other side) must have SSM support enabled on both synchronization sources at either side of the link.

QL and QL priority configuration

6.809 In the current release the QL of synchronization interfaces is not configurable by the operator and, when applicable, takes the default values.

6.810 The QL Priority of the node is not configurable by the operator.

Synchronization source with MPT

6.811 In order to use the symbol rate of the Rx signal of an MPT as selectable synchronization source for the NEC, the following is needed:

- if an Optical Ethernet connection is used, then the optical Ethernet port of MPT must be locked, at transmission, to symbol rate of the Rx signal;
- if an Electrical Ethernet connection is used, it shall be Synch-E capable, meaning that a common clock at physical layer level, not locked to the NEC, is available between MSS and MPT for a differential clock recovery method based on custom time-stamp protocol (referred to Symbol Rate of the air Rx Signal).

Synchronization source with MPT PFoE Access peripheral

6.812 MPT Access peripheral performs the clock recovery for each connected MPT-HC/XP. One of the MPT-HC/XPs can be selected to be the Primary synchronization source.

Protected radio configuration with one MPT PFoE access peripheral

6.813 When MPT-HC/XPs in protected configuration are connected to only one MPT Access peripheral, the MPT Access peripheral selects the MPT-HC/XP in EPS active state as the clock signal to be used for synchronization source.

Protected radio configuration with 2 MPT PFoE access peripheral

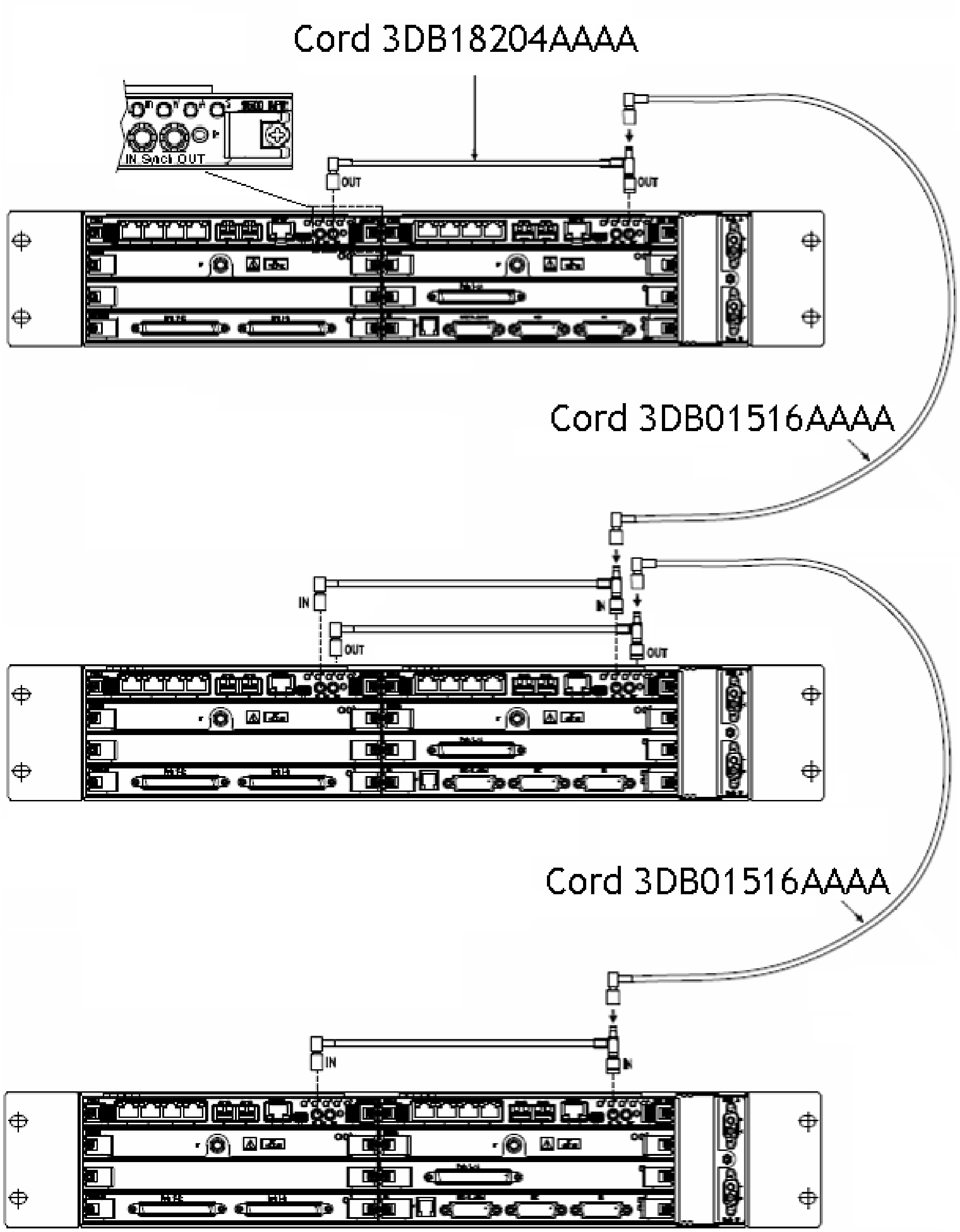
6.814 When MPT-HC/XPs in protected configuration are connected to two MPT Access peripherals, both MPT Access peripheral, for the radio direction configured as synchronization Source, forwards its own recovered clock signal.

6.815 This clock will be then selected according to the correspondent EPS state for MPT and MPT Access peripheral.

Synchronization connection in stacking configuration with core protection

6.816 In case of Stacking configuration with Core protection the two MPR must be synchronized as shown in Figure 6-72

Figure 6-72. Synchronization connection in stacking configuration with core protection



Functional block diagram

6.817 The 9500 MPR-A supports protected radio and not protected radio configurations.

PRELIMINARY

6.818 See Figure 6-73 for a block diagram of a typical split mount protected radio configuration.

6.819 See Figure 6-74 for a block diagram of a typical full indoor mount protected radio configuration.

6.820 See Figure 6-75 for a block diagram of a typical split mount not protected radio configuration.

6.821 See Figure 6-76 for a block diagram of a typical full indoor mount not protected radio configuration.

Figure 6-73. Protected split mount radio

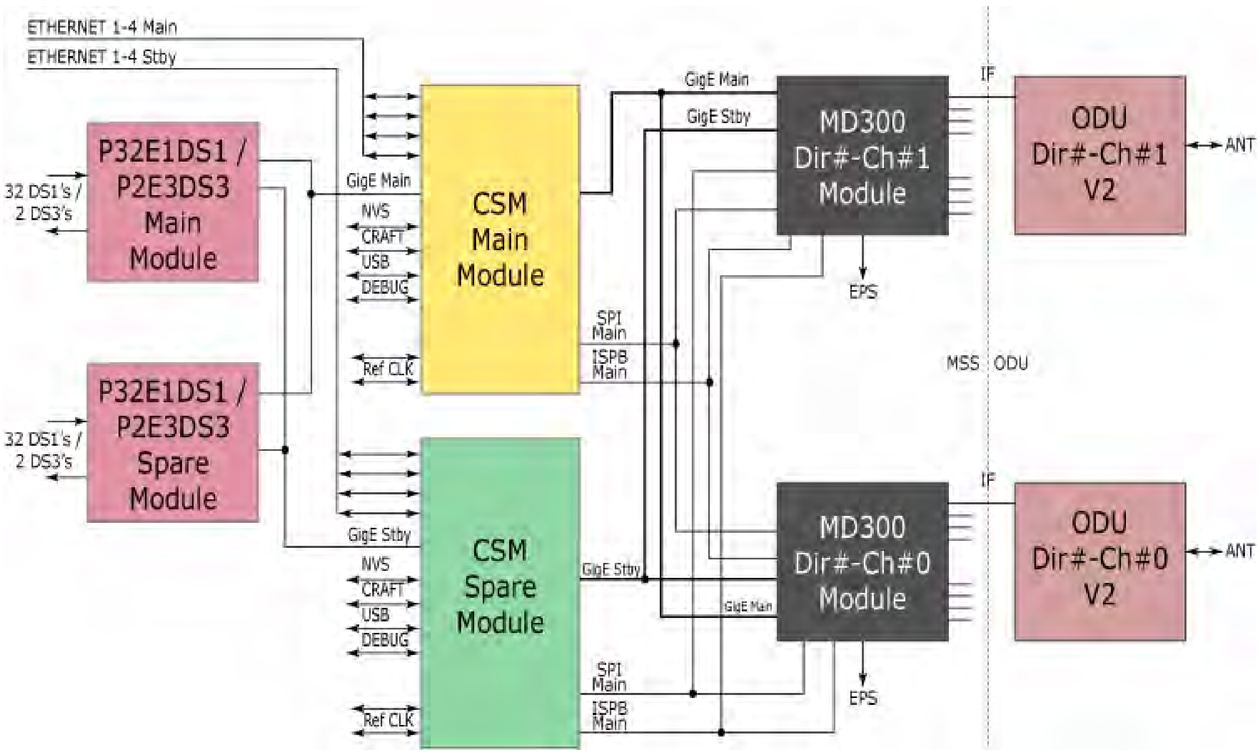


Figure 6-74. Protected full indoor mount radio

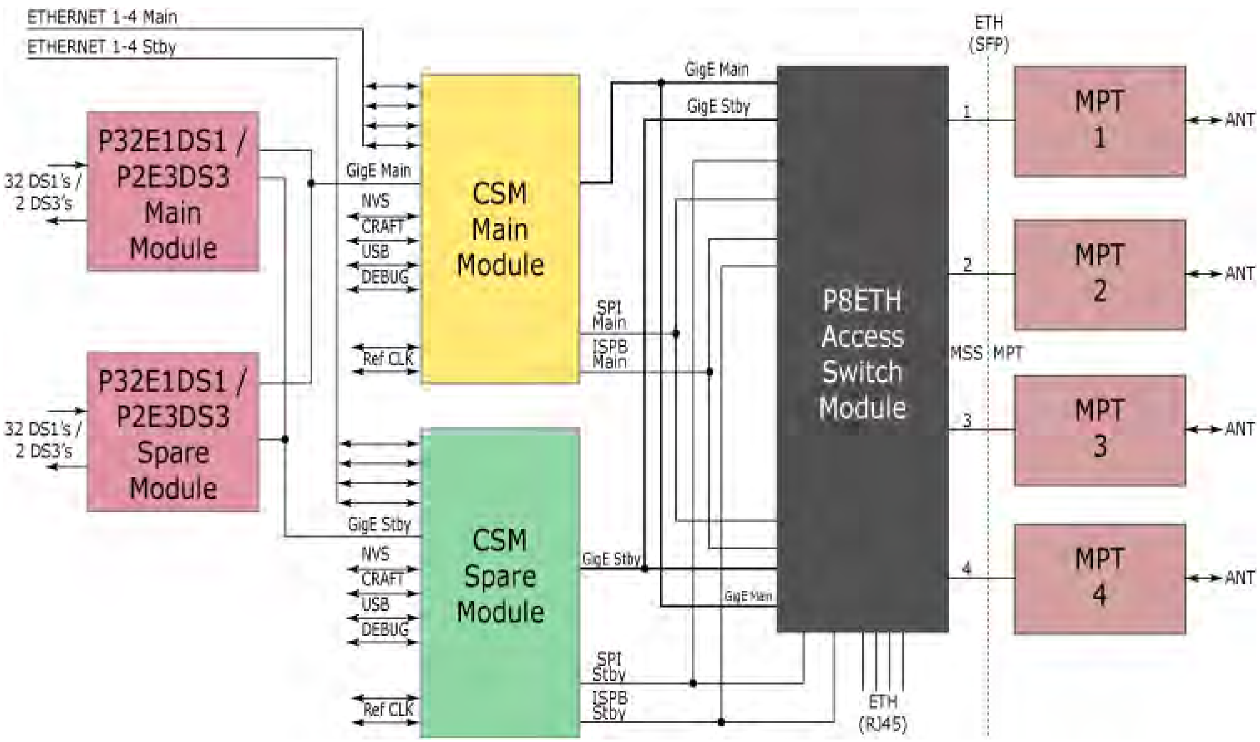
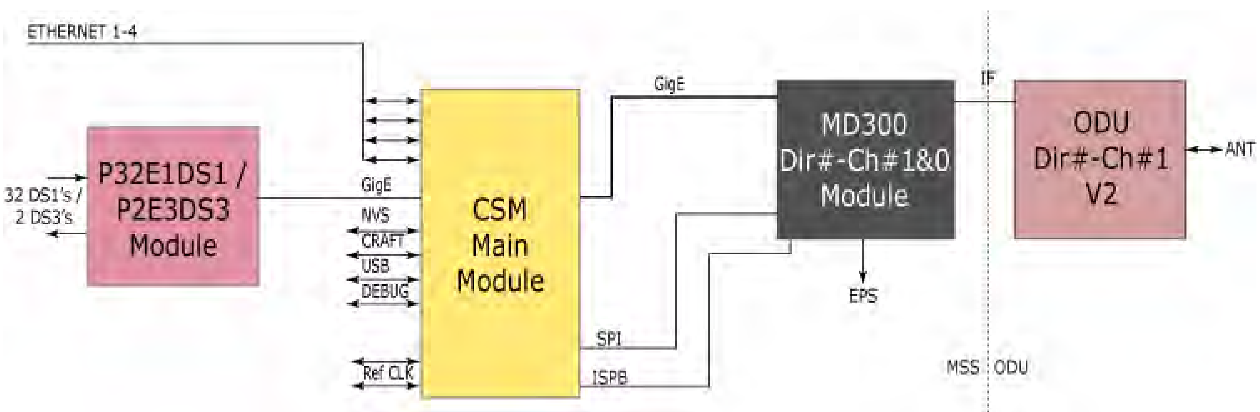
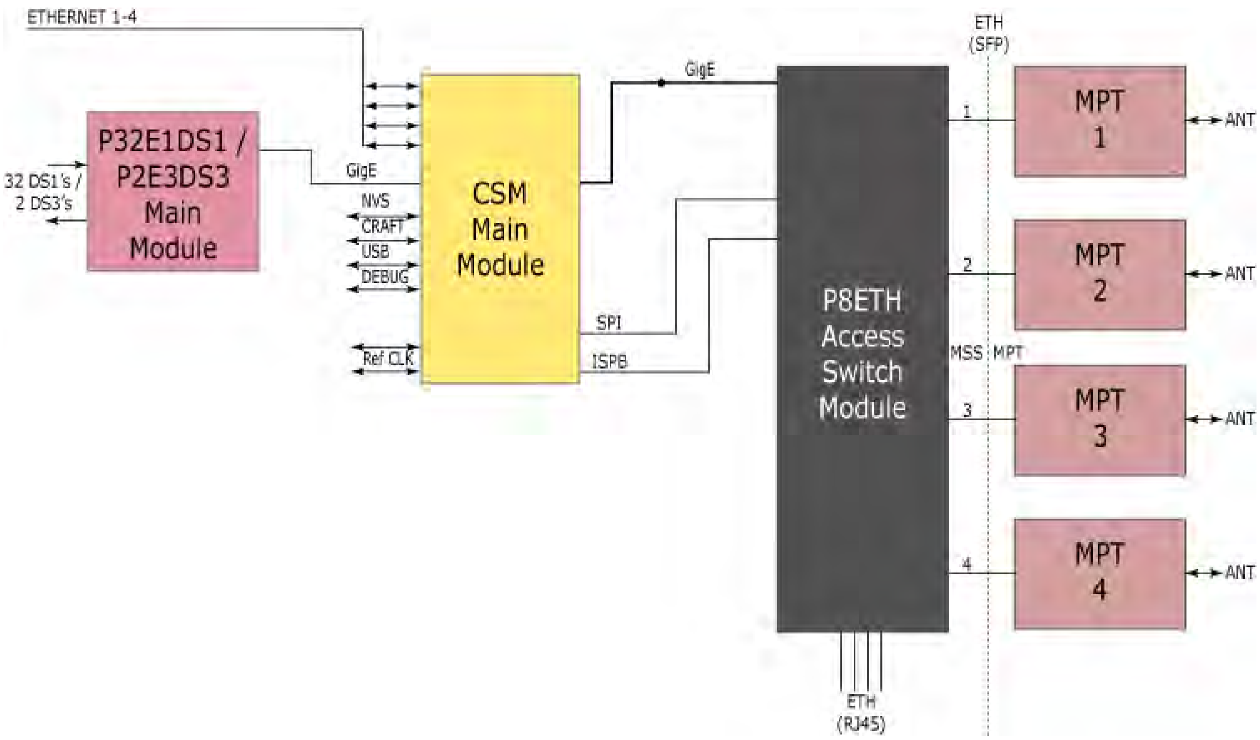


Figure 6-75. Not protected split mount radio



PRELIMINARY

Figure 6-76. Not protected full indoor mount radio



Core-E unit

6.822 The Core-E unit provides the following hardware support:

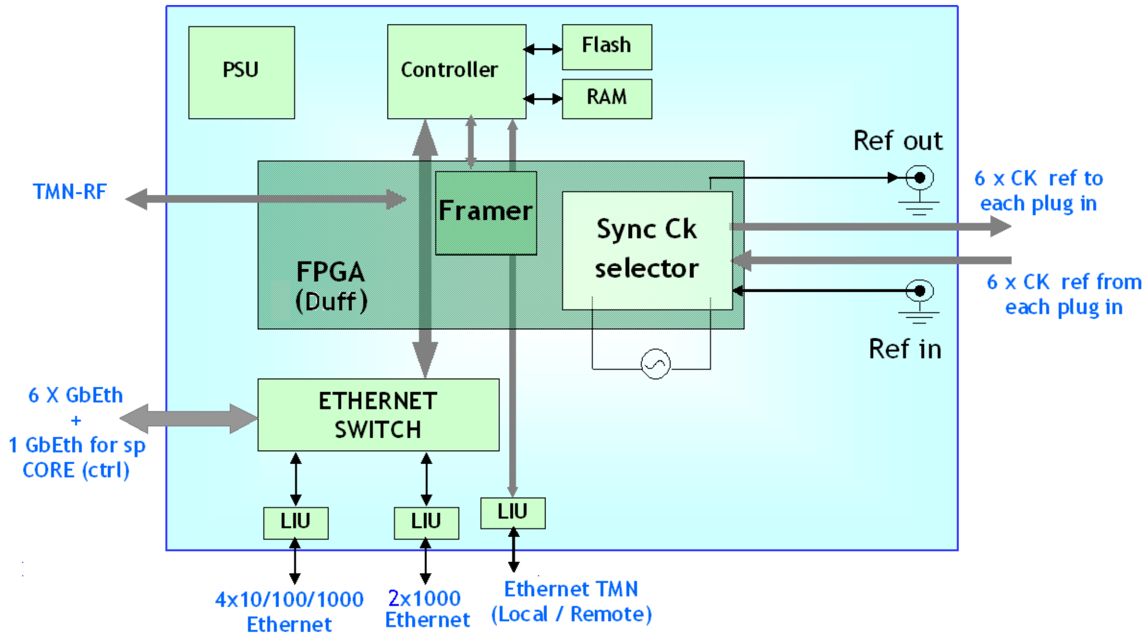
6.823 Based on packet technology with 7 GbEth serial internal interfaces between Core-E and peripherals (jumbo frames 9728 bytes allowed)

6.824 4x10/100/1000 Ethernet electrical embedded interface (RJ45): port #1 to port #4

6.825 2x1000 base-Lx or Sx (SFP optical interface) or 2x1000 base-T (SFP electrical interface) available with an optional plug-in: port #5 and port #6

6.826 Port #1 through port #6 support interconnection directly to MPT-HC/XP.

Figure 6-77. Core-E card block diagram



Main functions

- Controller
- Layer 2+ Eth Switch, VLAN management & MAC based
  - Ethernet MAC learning
  - Cross-connect function for PDH and Data payload traffic
  - For any “packetized” data flow, the layer 2 switch is in charge to manage the EPS protection
  - QoS management.
- Selection of the synchronization clock distributed to all plug-in.

6.827 The Core-E unit has the option to equip 1GigE Ethernet interface in the SFP ports (port #5, port #6). These ports can be used to connect Ethernet user traffic or to connect directly an MPT-HC/XP.

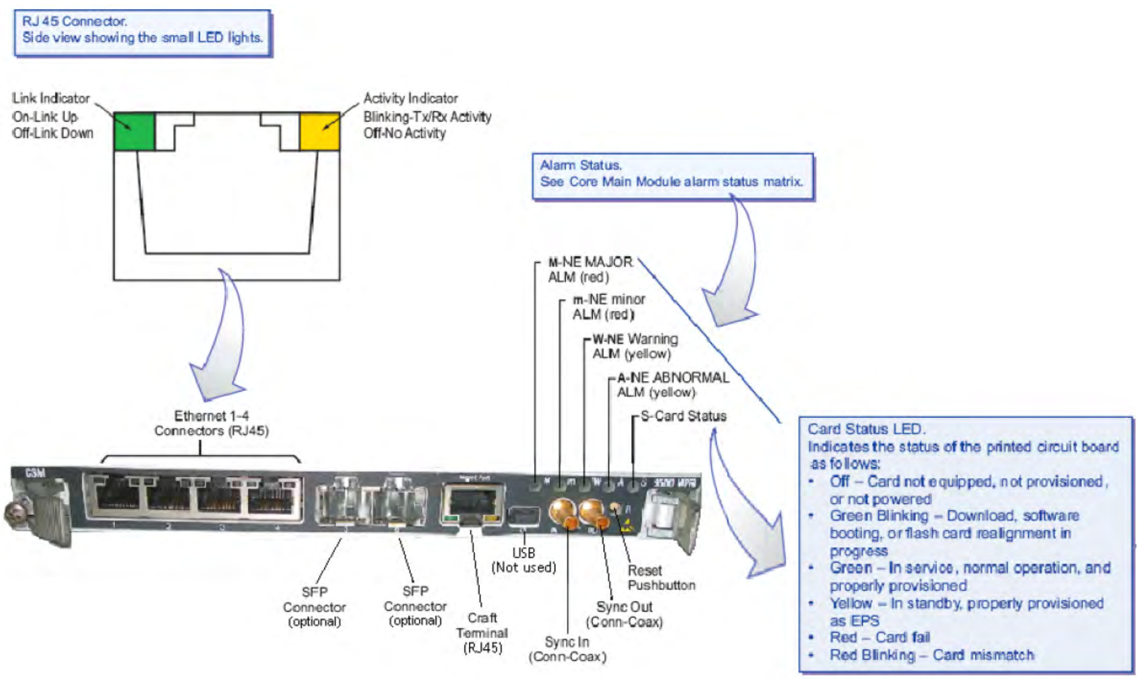
6.828 Three modules are available:

- 1000BASE-LX (optical)

- 1000BASE-SX (optical)
- 1000BASE-T (electrical)

6.829 The flash card stores the licence type, the equipment software, the equipment MIB and the equipment MAC address.

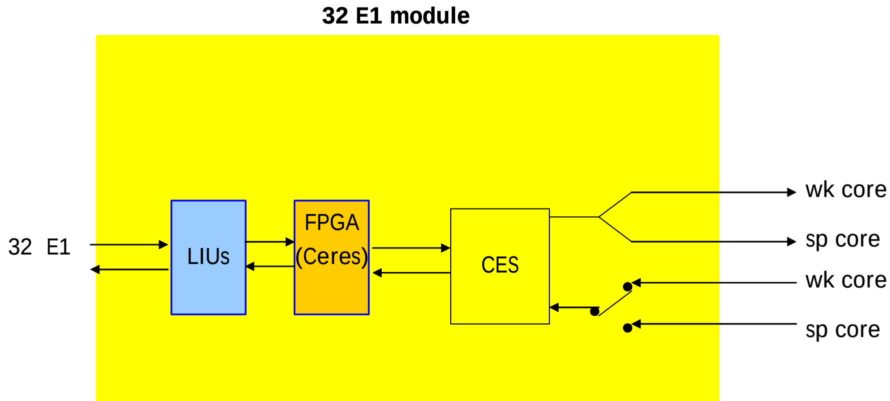
Figure 6-78. Core-E Card front panel view



6.830 **Warning**: The optional optical SFP plug-in, which may be installed in port #5 and port #6 of the Core-E unit, contains a Class 1 laser source. The laser source is placed in the left side of the SFP plug-in. According to the IEC 60825-1 the explanatory label is not included on the equipment due to the lack of space.

P32E1DS1 32xE1/DS1 PDH card

Figure 6-79. P32E1DS1 PDH card block diagram



6.831 In the TX direction, the DS1 PDH card (DS1 Access) processes and encapsulates up to 32 DS1 input lines into Ethernet packets that are sent to the Core-E card(s).

6.832 In the RX direction, the DS1 Access card extracts data from the Ethernet data packets and processes the data to provide up to 32 DS1 output lines.

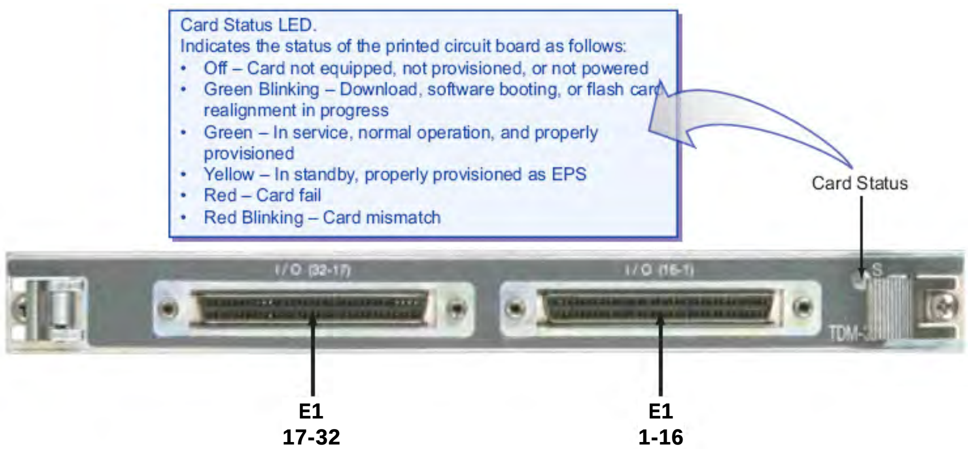
6.833 The 32xDS1 Local Access Module performs the following macro functions:

- Termination of 32 DS1 signals (32 DS1 bi-directional interfaces according ITU-T G.703 on the front panel)
- Framed DS1 bi-directional alarm management
- Bi-directional Performance Monitoring on Framed DS1
- Encapsulation/Extraction of those PDH data flows into/from standard Ethernet packets Inter Working Function
- Reconstruction of the original PDH Timing meeting G823/824.
- Selection of the Active Core-E
- Sending/getting those standard Eth packets to the Core-E module
- Communication with the Controller for provisioning and status report

PRELIMINARY

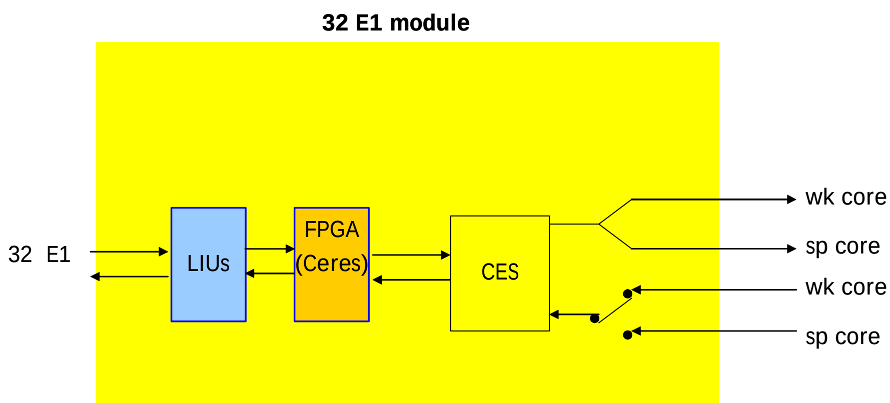
6.834 The module communicates with the Core-E modules through two GbEth Serial copper bi-directional interfaces on the backplane.

Figure 6-80. P32E1DS1 PDH card front panel



P2E3DS3 2xE3/DS3 PDH card

Figure 6-81. P2E3DS3 PDH card block diagram



6.835 In the TX direction, the DS3 PDH card (DS3 Access) processes and encapsulates up to 2 DS3 input lines into an Ethernet packets that are sent to the Core-E card(s).

6.836 In the RX direction, the DS3 Access card extracts data from the Ethernet data packets and processes the data to provide up to 2 DS3 output lines.

6.837 The 2xE3DS3 Local Access Module performs the following macro functions:

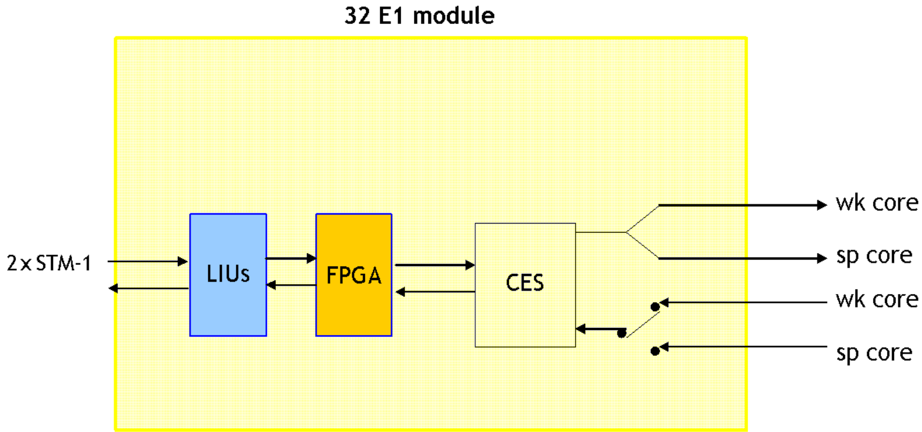
- Termination of 2 DS3 signals (2 DS3 bi-directional interfaces according ITU-T G.703 on the front panel)
- Framed DS3 bi-directional alarm management
- Bi-directional Performance Monitoring on Framed DS3
- Encapsulation/Extraction of those PDH data flows into/from standard Ethernet packets Inter Working Function
- Reconstruction of the original PDH Timing meeting G823/824.
- Selection of the Active Core-E
- Sending/getting those standard Eth packets to the Core-E module
- Communication with the Controller for provisioning and status report

6.838 The module communicates with the Core-E modules through two GbEth Serial copper bi-directional interfaces on the backplane.

Figure 6-82. P2E3DS3 PDH card front panel

SDHACC 2xOC-3 SDH card

Figure 6-83. SDHACC SDH card block diagram



6.839

6.840 This unit can manage up to 2xOC-3 by installing two optional STM-1/OC-3 SFP plug-ins (electrical or optical).

6.841 The OC-3 unit can be used in OC-3 transparent mode.

6.842 The OC-3 unit can support up to 2 transparent OC-3 interfaces.

6.843 Link options include:

- 1+0 non-protected operation
- 1+1 EPS protection (available ONLY with the optical interface)

6.844 When the protection of the unit is required (1+1 EPS protection), two OC-3 units must be installed.

6.845 Clock source from the incoming OC-3 signal can be selected as Network Element source clock. In the event the clock source is lost, clocking falls back to the internal clock or to other of any synch in options.

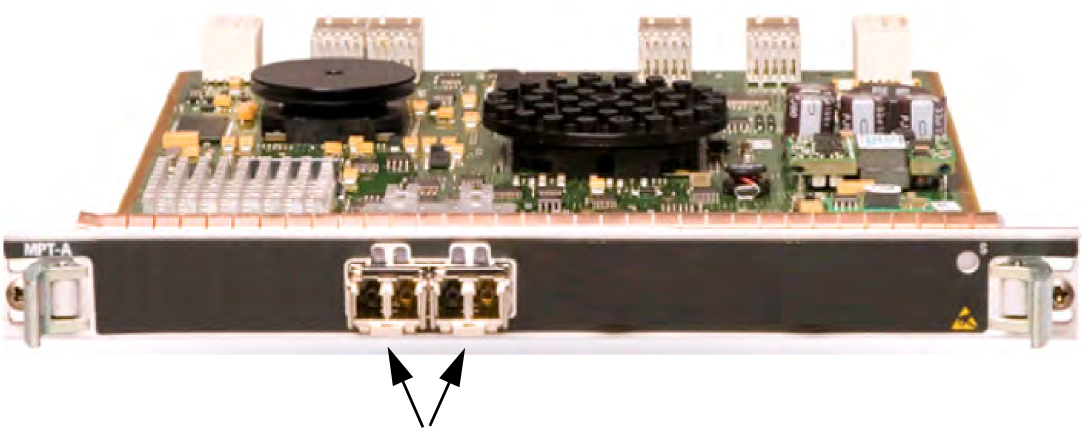
6.846 In the Tx direction, the OC-3 Local Access unit processes and encapsulates up to 2xOC-3 input lines into an Ethernet packet that is sent to the Core-E card(s).

6.847 In the Rx direction, the OC-3 Local Access unit extracts data from the Ethernet data packets and processes the data to provide up to 2 OC-3 output lines.

- The 2xOC-3 Local Access Unit performs the following macro functions:
- Transparent or channelized transport of the OC-3
- Encapsulation/Extraction of the OC-3 into/from standard Ethernet packets Inter Working Function
- Reconstruction of the original OC-3 Timing
- Selection of the Active Core-E
- Sending/getting those std Eth packets to the Core-E module
- Communication with the Controller for provisioning and status report

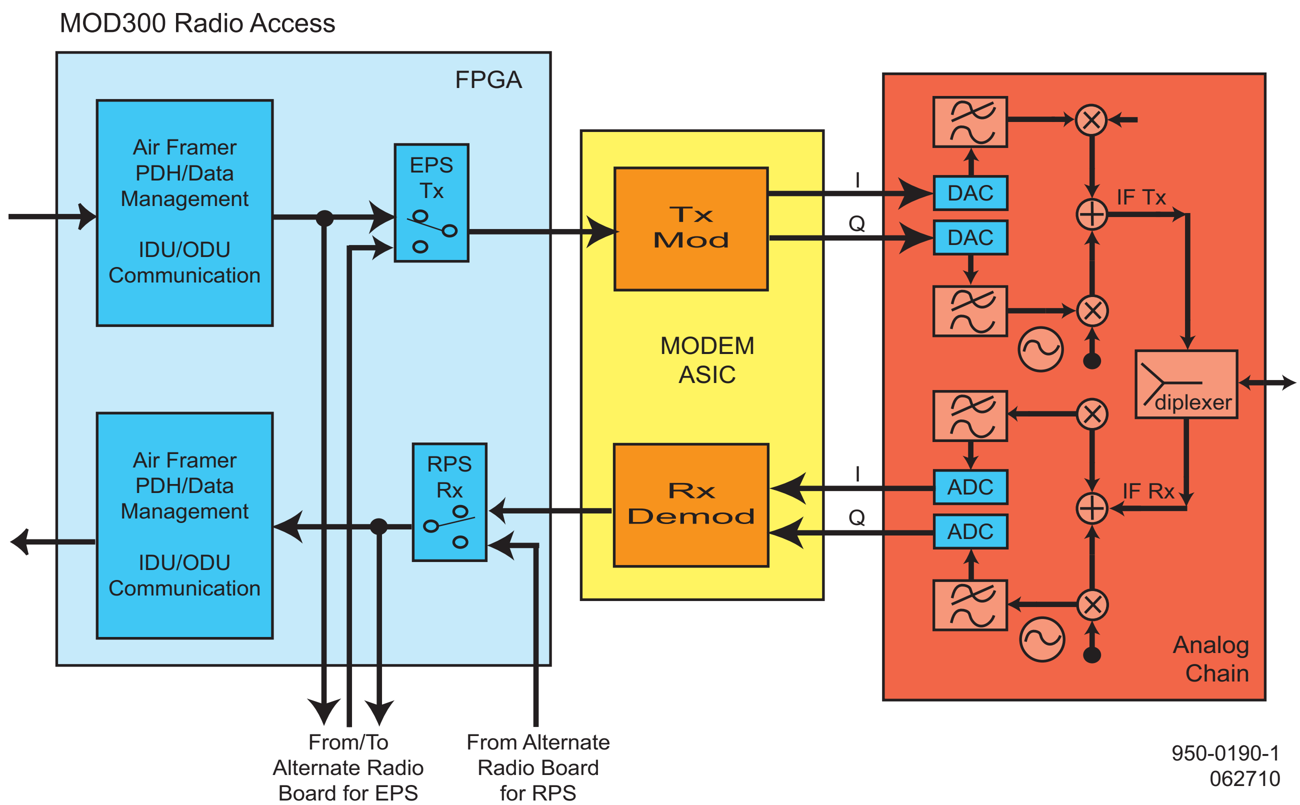
6.848 The unit communicates with the Core-E modules through two GbEth Serial copper bi-directional interfaces on the backplane.

Figure 6-84. SDHACC SDH card front panel



Modem radio interface card

Figure 6-85. Modem radio interface card block diagram



6.849 In Tx direction, the MODEM unit generates the IF signal to be sent to an Outdoor Unit. Such signal contains a Constant Bit Rate signal built with the Ethernet packets coming from the Core-E; those packets are managed in a different way depending on their own native nature.

Digital framer

- Classification of incoming packets from the Core-E (QoS)
- Fragmentation
- Air Frame Generation (synchronous with NE clock)

Digital modulator

TX analog chain

- DAC & low pass filtering
- Modulation to 311 MHz IF TX

6.850 In Rx direction, the MODEM 300 Module terminates the IF signal coming from the ODU300 extracting the original CBR and then the original Ethernet packets to be given the Core-E which distributes them to the proper Module.

RX analog chain

- 126 MHz IF RX demodulation to I & Q
- low pass filtering & ADC

Digital demodulator

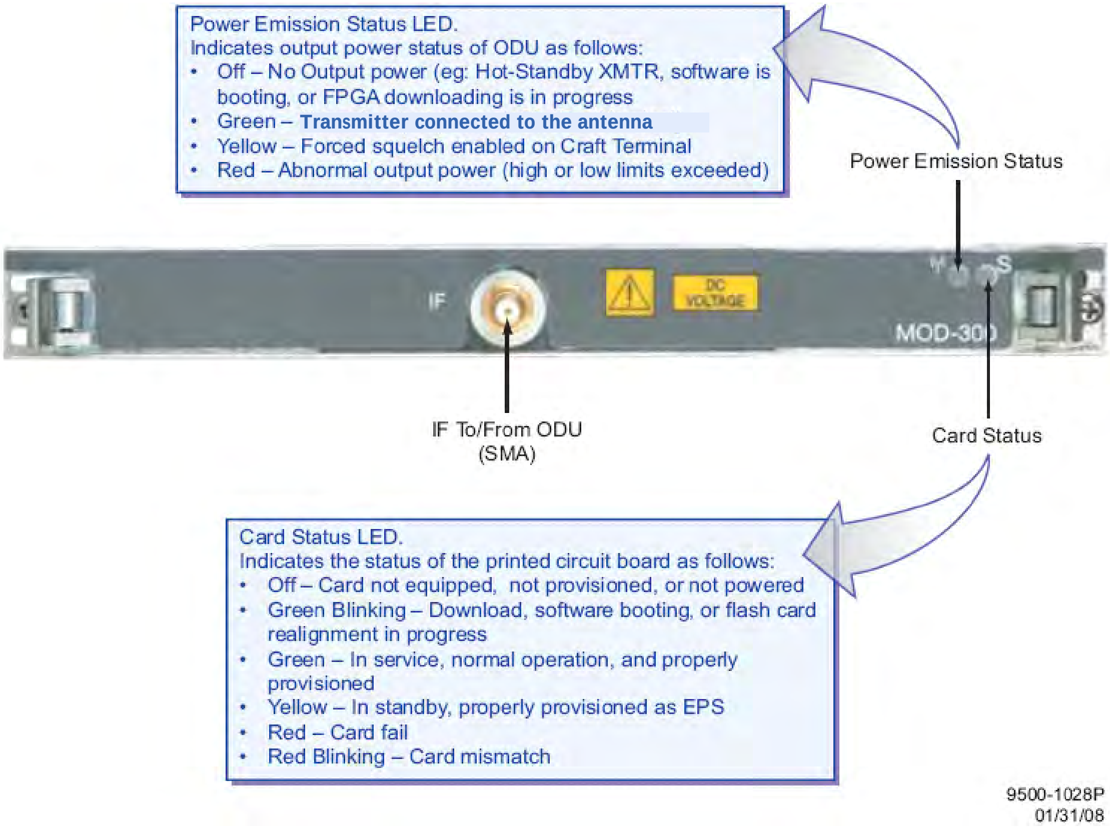
- Carrier & CK recovery
- Equalization
- Error Correction

Digital deframer

- RPS (hitless)
- Defragmentation

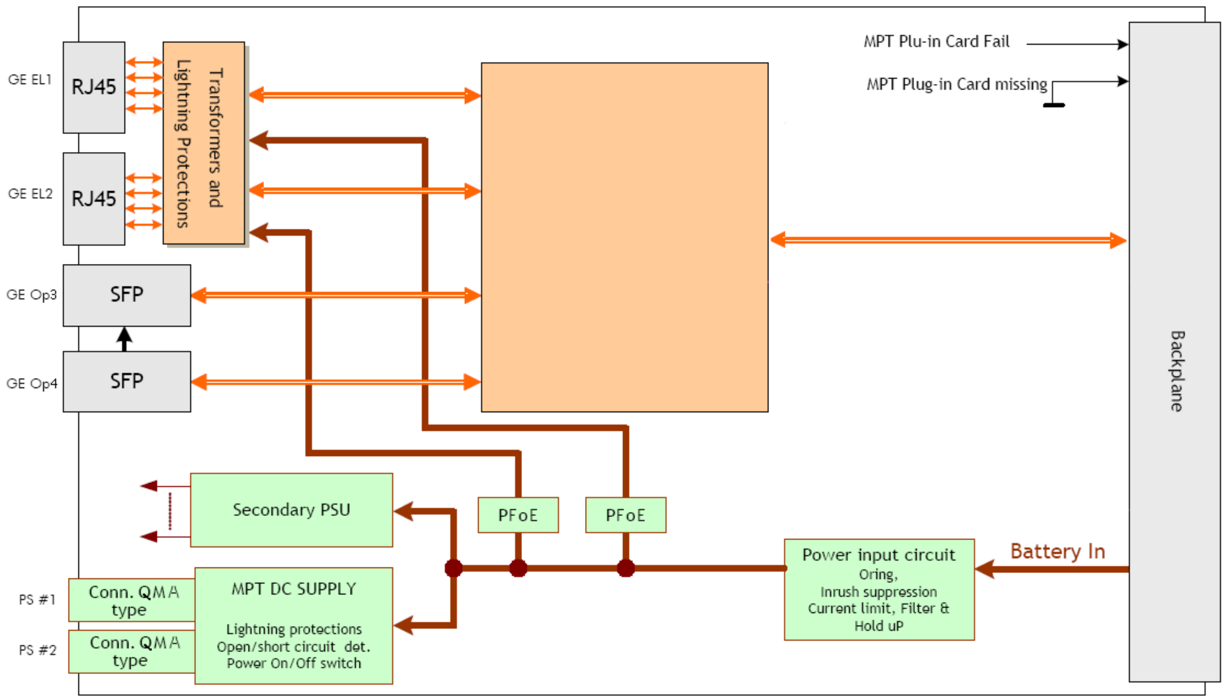
PRELIMINARY

Figure 6-86. Modem unit



MPT access unit (with PFoE)

Figure 6-87. MPT access unit (with PFoE) block diagram



6.851 The MPT Access Unit is the interface for two MPT-HC/XPs.

6.852 Two MPT-HC/XP can be connected to one MPT Access unit.

6.853 The two MPT-HC/XPs can be configured in unprotected or protected configuration.

6.854 The connection to the MPT-HC/XP can be realized:

1. by using two cables:
   - one DC power supply cable to send the power supply to the MPT-HC/XP
   - one Gigabit Ethernet cable (electrical or optical) to send the Ethernet traffic and the Ethernet control frames to the MPT-HC/XP

2. or by using only one electrical Ethernet cable and enabling the PFoE (Power Feed over Ethernet) function (Ethernet traffic + Power Supply on the same cable).

6.855 When an optical port has to be used, an SFP plug-in must be installed.

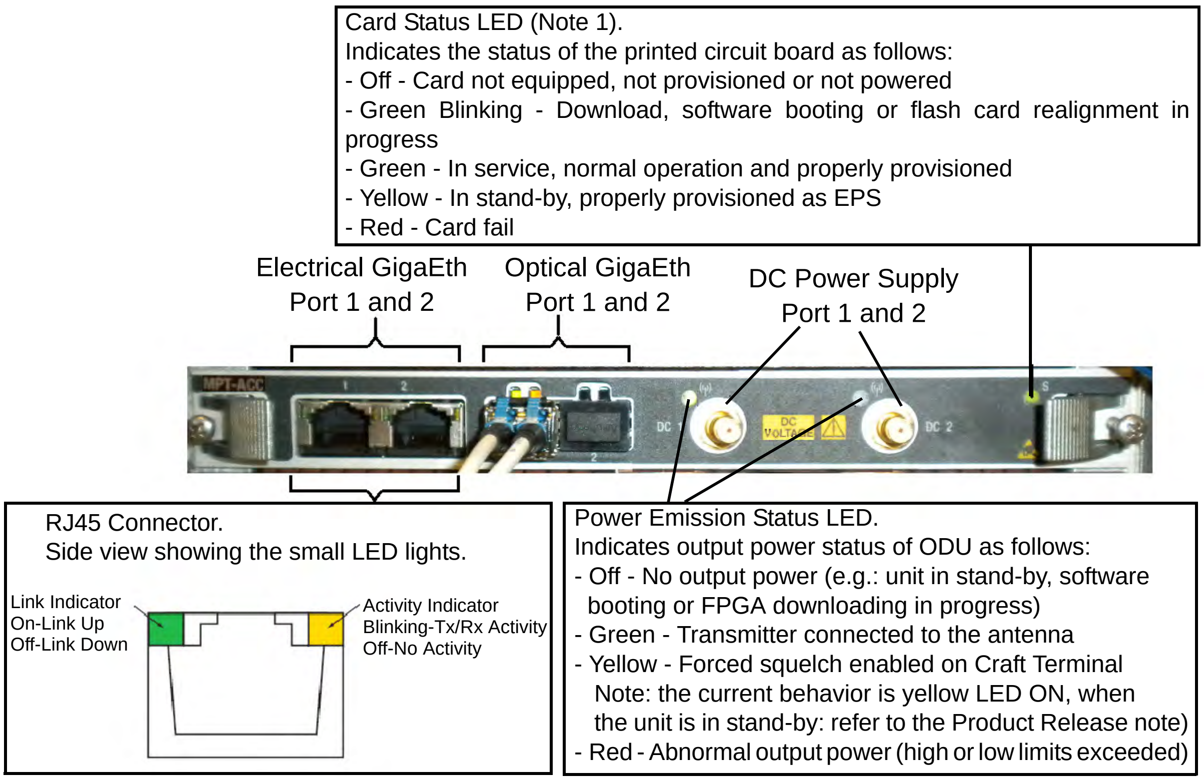
6.856 When port #1 is enabled (optical or electrical), the associated Power Supply port is #1.

6.857 When port #2 is enabled (optical or electrical), the associated Power Supply port is #2.

Main functions

- Provide the power supply interface and the Ethernet interface
- Provide the Power Feed over Ethernet function
- Lightning and surge protection
- Ethernet and power interface supervision
- EPS/HSB management function
- Clock distribution function
- L2 packet based Proprietary clock algorithm
- Ethernet link quality monitor function
- Radio Link Quality notification through MPR Protection Protocol frames
- Communication with Core controller for provisioning and status report.

Figure 6-88. MPT access unit (with PFoE)



Note 1: The GREEN and YELLOW colors of the Card Status LED have different meaning, if two MPT-HC/XPs are connected:

- MPT-HC/XP in 1+0 not protected is provisioned:
  - YELLOW color is not applicable (traffic impact if MPT Access card is unplugged)
- 1 MPT-HC/XP in 1+1 EPS protection is provisioned, with mated MPT-HC/XP provisioned on another MPT Access card:
  - GREEN if provisioned MPT-HC/XP is EPS Active
  - YELLOW if provisioned MPT-HC/XP is EPS Standby (no traffic impact if MPT Access card is unplugged)
- 1 MPT-HC/XP in 1+1 EPS protection is provisioned, with mated MPT-HC/XP provisioned on another MPT Access card, 1 MPT in 1+0 is provisioned on same MPT-HC/XP Access card:
  - YELLOW color is not applicable (traffic impact if peripheral is unplugged)

PRELIMINARY

- 2 MPT-HC/XPs in 1+1 EPS protection are provisioned, with mated MPT-HC/XP provisioned on a different MPT Access card:
  - GREEN if at least one of provisioned MPT-HC/XP is EPS Active
  - YELLOW if both MPT-HC/XPs are EPS Standby (no traffic impact if MPT Access is unplugged)
- 2 MPT-HC/XPs in 1+1 EPS protection on the same MPT Access card are provisioned:
  - YELLOW color is not applicable (traffic impact if peripheral is unplugged)

Warning: The optional SFP plug-in, which may be installed in the MPT Access card, contains a Class 1 laser source. The laser source is placed in the left side of the SFP plug-in.

6.858 According to the IEC 60825-1 the explanatory label is not included on the equipment due to the lack of space.

ODU300

6.859 The ODU300s include a waveguide antenna port, type-N female connector for the ODU IF cable, a BNC female connector (with captive protection cap) for RSSI access, and a grounding stud.

6.860 The ODU300s, are designed for direct antenna attachment via a 9500 MPR-A-specific mounting collar supplied with the antennas.

6.861 ODU300 polarization is determined by the position of a polarization rotator fitted within the antenna mounting collar.

6.862 A remote ODU300 mounting kit is also available as an option. These may be used to connect an ODU to a standard antenna, or to a dual-polarized antenna for co-channel link operation.

6.863 ODU300s are fixed for Tx High or Tx Low operation.

6.864 Where two ODU300 are to be connected to a single antenna for hot-standby or frequency diversity configurations, a direct-mounting coupler is used. They are available for equal or unequal loss operation. Balanced loss is nominally 3 dB. Unbalanced loss is nominally 1/6 dB.

6.865 The ODU300 assembly meets the ASTME standard for a 2000 hour salt-spray test, and relevant IEC, UL, and Bellcore standards for wind-driven rain.

6.866 The ODU300 housing comprises:

- Cast aluminium base (alloy 380)
- Pressed aluminium cover (sheet grade alloy 1050).
- Base and cover passivated and then polyester powder coated
- Compression seal for base-cover weatherproofing
- Carry-handle

Figure 6-89. ODU300 and antenna, integrated mount configuration

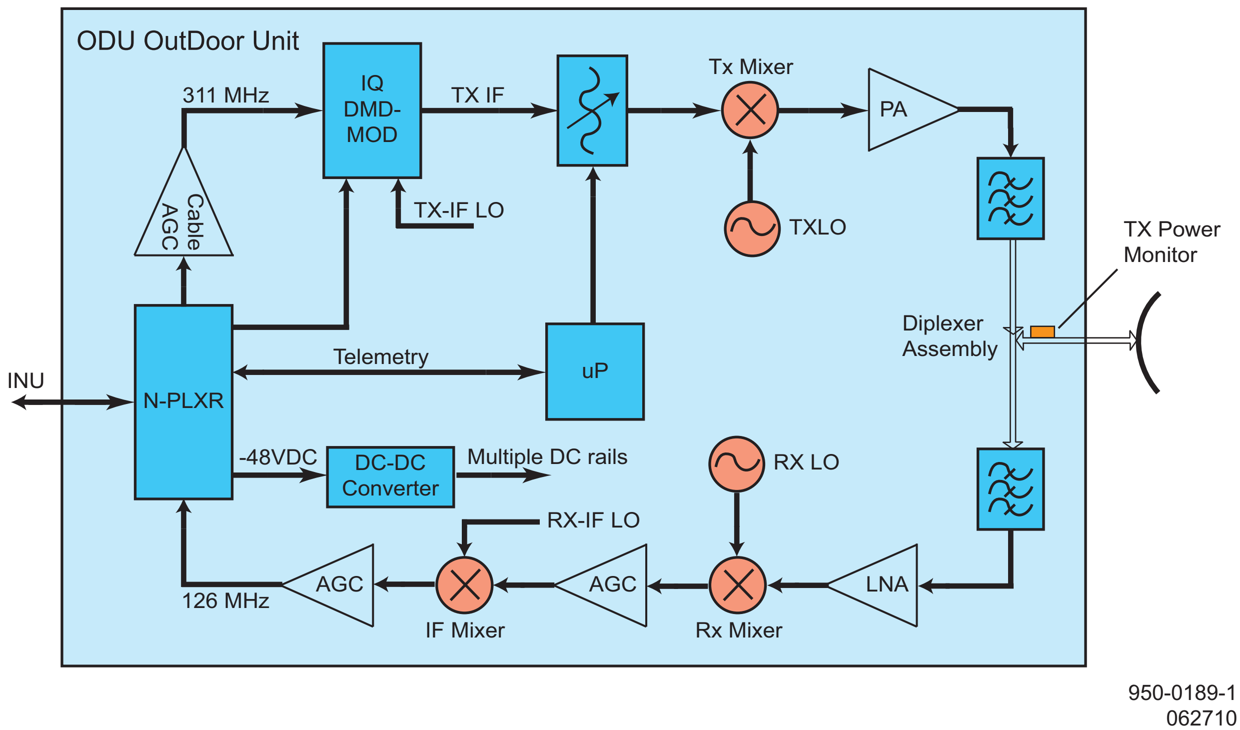
6.867 ODU300s are frequency-band specific, but within each band are capacity-independent up to their design maximums.

ODU300 block diagram

Figure 6-90 shows the ODU300 block diagram.

PRELIMINARY

Figure 6-90. ODU300 block diagram



6.868 The quadrature modulated 311 MHz IF signal from the MSS is extracted at the N-Plexer and passed via a cable AGC circuit to an IQ demodulator/modulator.

6.869 Here the 311 MHz IF is demodulated to derive the separate I and Q signals using the 10 MHz synchronizing reference signal from the MSS.

6.870 These I and Q signals modulate a Tx IF, which has been set to a specific frequency between 1700 and 2300 MHz, such that when mixed with the Tx local oscillator signal (TXLO) in the subsequent mixer stage, provides the selected transmit frequency. Both the IF and Tx local oscillators are synthesizer types.

6.871 Between the IQ modulator and the mixer, a variable attenuator provides software adjustment of Tx power.

6.872 After the mixer, the transmit signal is amplified in the PA (Power Amplifier) and passed via the diplexer to the antenna feed port.

6.873 A microprocessor in the ODU300 supports configuration of the synthesizers, transmit power, and alarm and performance monitoring. The ODU microprocessor is managed under the NCC microprocessor, with which it communicates via the telemetry channel.

6.874 A DC-DC converter provides the required low-voltage DC rails from the -48 Vdc supply.

6.875 In the receive direction, the signal from the diplexer is passed via the LNA (Low Noise Amplifier) to the Rx mixer, where it is mixed with the receive local oscillator (RXLO) input to provide an IF of between 1700 and 2300 MHz. It is then amplified in a gain-controlled stage to compensate for fluctuations in receive level, and in the IF mixer, is converted to a 126 MHz IF for transport via the ODU300 cable to the MSS.

6.876 The offset of the transmit frequencies at each end of the link is determined by the required Tx/Rx split. The split options provided are based on ETSI plans for each frequency band. The actual frequency range per band and the allowable Tx/Rx splits are range-limited within 9500 MPR-A to prevent incorrect user selection.

6.877 A power monitor circuit is included in the common port of the diplexer assembly to provide measurement of transmit power. It is used to confirm transmit output power for performance monitoring purposes, and to provide a closed-loop for power level management over the specified ODU300 temperature and frequency range.

ODU300 coupler

6.878 The ODU300 coupler is used in the 1+1 HSB or 1+1/2x(1+0) FD co-polar configurations.

6.879 The coupler can be equal type (3 dB/3 dB insertion loss) or unequal type (1.5 dB on the main path/6 dB on the secondary path).

6.880 The couplers are connected between the cabinets and the antenna.

MPT-HC/XP

6.881 MPT-HC/XP (Microwave Packet Transport) is a Microwave Equipment capable to transport the Ethernet traffic over an RF radio channel.

6.882 The MPT-HC/XP includes a waveguide antenna port, type-N female connector for the DC connection, a maintenance connector (with captive protection cap) for RSSI access, 1 electrical GE interface, 2 GE optical interfaces (1 for data, 1 for RPS) and a grounding stud.

6.883 The MPT-HC/XP can be installed on an integrated antenna or on standard poles, wall or pedestal mount, with an appropriate fastening system.

6.884 The MPT-HC/XP (one or two depending on the configuration 1+0 or 1+1, each one with a solar shield) incorporates the complete RF transceiver and can be associated with an integrated or separate antenna.

6.885 The cabinet is a very compact and robust weatherproof (IP 67) container, designed to be compatible with hot and very sunny climatic zones.

6.886 The MPT-HC/XP/9558HC can be rapidly installed on standard poles with an appropriate fastening system. The pole mounting is the same for 1+0 or 1+1 configurations from 5.8 to 38 GHz.

6.887 The MPT-XP can be rapidly installed on standard poles with an appropriate fastening system. The pole mounting is the same for 1+0 or 1+1 configurations from 6 to 8 GHz.

6.888 The MPT-HC/XP is fixed by means of quick latches. This system allows to change the MPT-HC/XP without altering antenna pointing.

6.889 For L6, 11 GHz to 38 GHz, the MPT-HC polarization is determined by the rotation of the nose fitted in the antenna port of the MPT-HC in 1+0 configuration and by the position of a polarization rotator fitted within the coupler in 1+1 configuration.

6.890 For 5.8 to 8 GHz, the MPT-HC polarization is determined by the rotation of the MPT-HC/XP/9558HC mounted to the antenna port in 1+0 configuration and by the position of a polarization rotator fitted within the coupler in 1+1 configuration.

6.891 For 6 to 8 GHz, the MPT-XP polarization is determined by the rotation of the MPT-XP mounted to the antenna port in 1+0 configuration and by the position of a polarization rotator fitted within the coupler in 1+1 configuration.

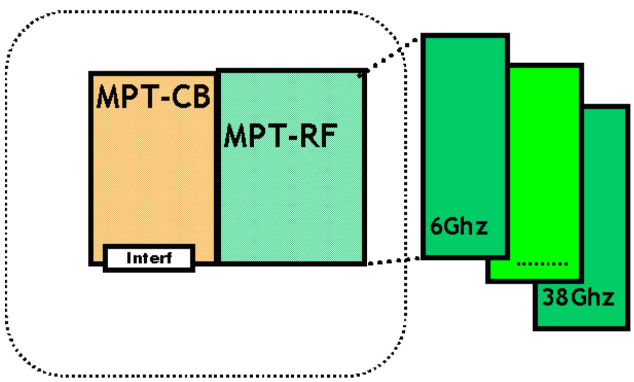
6.892 Where two MPT-HC/XP have to be connected to a single antenna for hot-standby or frequency diversity configurations, a direct-mounting coupler is used. They are available for equal or unequal loss operation. Equal loss is nominally 3 dB. Unequal is nominally 1/10 dB.

6.893 Two MPT-HC/XP mechanical solutions are adopted. One with embedded diplexer for cost optimization (L6, 11 GHz to 38 GHz), where the branching (diplexer) is internal to the MPT-HC cabinet; this type of MPT-HC is identified by one Logistical Item only. One with external diplexers (5.8 GHz to 8 GHz), where the branching (diplexer) is external to the MPT-HC/XP/9558HC cabinet; this type of MPT-HC/XP/9558HC is identified by two Logistical Items.

6.894 MPT-HC/XP is broken down to the following sections:

- **MPT-CB**: Common Belt section. This section is Frequency independent, and all the features relevant to this unit are common to all the MPT RF options.
- **MPT-RF**: Radio Frequency section that is frequency dependent.

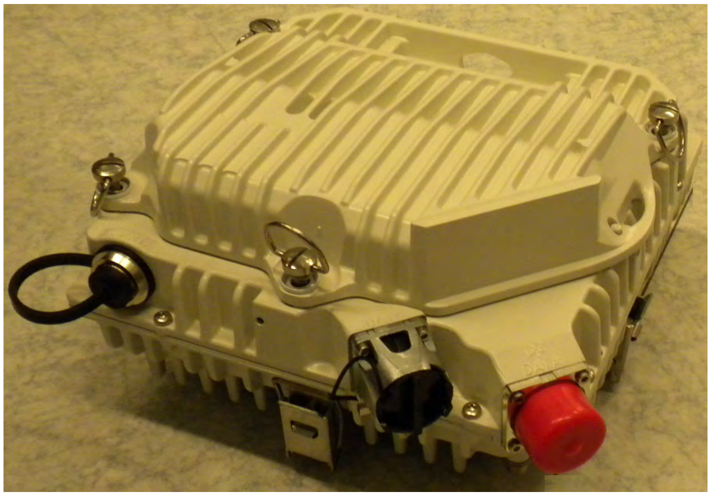
Figure 6-91. MPT system



6.895 The MPT-HC/XP interface is based on a Gb Ethernet, that can be either optical or electrical depending on the needs and the cable length. If the optical port has/have to be used (data and/or RPS port), the corresponding SFP plug-in must be installed by opening the Cobox.

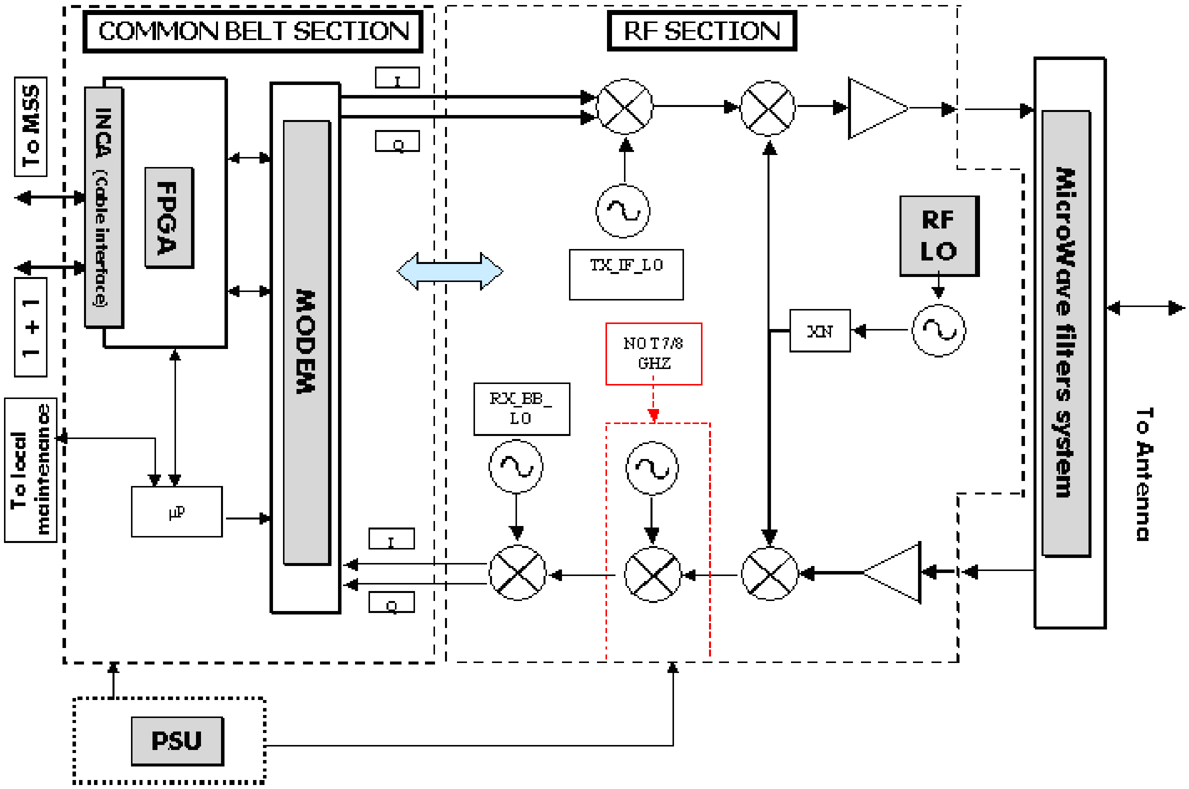
PRELIMINARY

Figure 6-92. 5.8 to 38 GHz MPT-HC/XP/9558HC housing



MPT-HC/XP block diagram

Figure 6-93. MPT-HC/XP block diagram



Common belt section

6.896 The Common Belt section is frequency independent. It is the digital section of the MPT-HC/XP.

6.897 The main functions are the following:

- Interfaces the MSS for traffic transport and MSS communication messages in both directions, through one Gigabit Ethernet optical or electrical cable.
- Micro-Processor for
  - Indoor - MPT-HC/XP dialogue
  - Inter-MPT-HC/XP dialog in 1+1 configurations
  - HW configuration and monitoring of all MPT-HC/XP parts
  - Dynamic regulation process such as ATPC
- Transport of the system reference clock (synchronization)
- Switches the traffic and management to the correct port (processor port, radio port)
- Performs traffic adaptation if needed
- Performs Quality of Service and policing on flow to be sent over the radio link.
- Modulation and demodulation of the resulting modem frame
- In 1+1 configuration manages the switching, forwarding received modem frame to the second MPT-HC/XP and sending built modem frame to the second MPT-HC/XP.

Power supply interface

6.898 It is provided by a RJ45 connector, with the positive to ground.

6.899 The power supply is coming from the MSS in the range of -40,5 V to -58 V. MPT-HC/XP input voltage range is from -28 V to -58 V.

Lightning protection

6.900 The lightning protection is internal to the MPT-HC/XP. No external protection must be used.

6.901 This protection applies to:

- the Ethernet electrical cable
- the XPIC cable

INCA module

6.902 The INCA module hosts the physical Ethernet interfaces:

- One optical SFP device for traffic interface.
- One electrical device for traffic interface.
- One optical SFP device for 1+1 protection interface with the associated MPT-HC/XP.

6.903 In order to reach 500m the MPT-HC/XP uses an SFP Multi-Mode 805 nm with a 50/125 fibre.

Tx side

6.904 Following the flow from user Ethernet port to radio, the section performs:

- Reception of incoming Ethernet frames from the optical or electrical user interface (through INCA)
- Recovery of the clock coming from the MSS
- Management of the 1+1 EPS protection layer 2 messages
- Switch of the management frames from user port to internal processor
- Generation of MPT-HC/XP to MPT-HC/XP messages needed for radio link (ATPC, ACM,...)
- Compression of the TDM2Eth frames header (TDM2TDM - MEF8, TDM2ETH - MEF8)
- Management of the Quality of Service
- Fragmentation of the Ethernet frames
- Shaping of the traffic to adapt it to radio bandwidth
- Tx Modem frame building

- In 1+1 duplication of the built Tx modem frame and sending to the second MPT-HC/XP through the protection coupling port
- In 1+1, reception of the Tx modem frame coming from the second MPT-HC/XP
- In 1+1, switch of the Tx modem frame between the local and the one coming from second MPT-HC/XP depending on the EPS position
- Tx Radio frame building (FEC, pilots,...)
- Synchronization of the symbol rate to the MSS recovered clock
- Modulation in I and Q analogue signals to be sent to the RF section.

Rx side

6.905 Following the flow from radio to user Ethernet port, the section performs:

- Reception of the I and Q analogue signals coming from the RF section
- Demodulation of the Rx radio frame into Rx modem frame
- In 1+1, Recovery of the symbol clock and duplication to the second MPT-HC/XP
- In 1+1, duplication of the Rx modem frame and sending to the second MPT-HC/XP through the protection coupling port
- In 1+1, reception of the Rx modem frame coming from the second MPT-HC/XP
- In 1+1, hosts the RPS decision machine
- In 1+1, switch of the Rx modem frame between the local and the one coming from second MPT-HC/XP depending on the traditional RPS position and the modem frames quality
- Enhanced RPS
- In 1+1, switch of the recovered clock between the local and the one coming from second MPT-HC/XP depending on the traditional RPS position
- Deframing of the Rx modem frame
- Re-assembly of fragmented Ethernet frame
- Decompression of TDM2Eth frames header

- Extraction of MPT-HC/XP to MPT-HC/XP messages needed for radio link (ATPC, ACM,...)
- Management of service channels frames
- Switch of the management frames from internal processor to user port.
- Management of the 1+1 EPS protection layer 2 messages
- Send the recovered clock to the MSS
- In 1+1 EPS, transmit or not the Ethernet frames to the MSS depending on the EPS position

RF section

6.906 There are two architectures, the difference between these two architectures are only on Rx side:

- For the first one (used in MPT-HC/XP band 7/8 GHz) there are only two frequency conversions between RF input frequency and base band frequency. 7/8 GHz MPT-HC/XPs are not supported in this release.
- For the second one (used for all other MPT-HC/XP bands) there are three frequency conversions

6.907 The block diagrams of these two architectures are shown hereafter.

Figure 6-94. 7/8 GHz MPT-HC/XP architecture

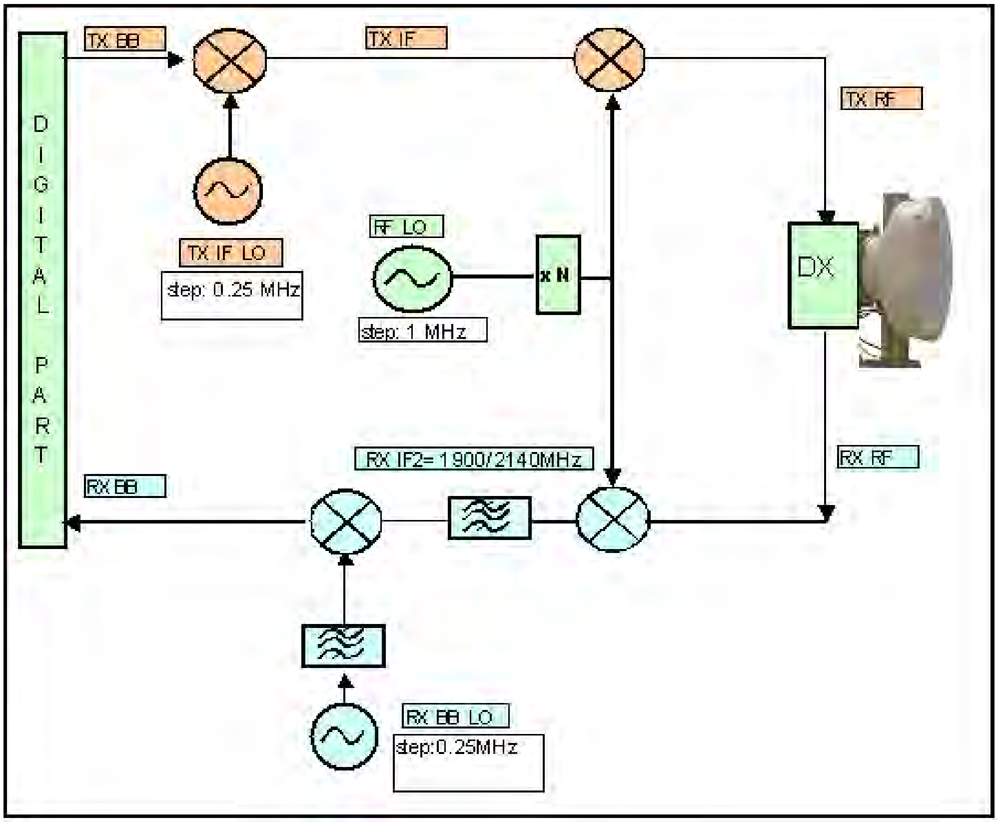
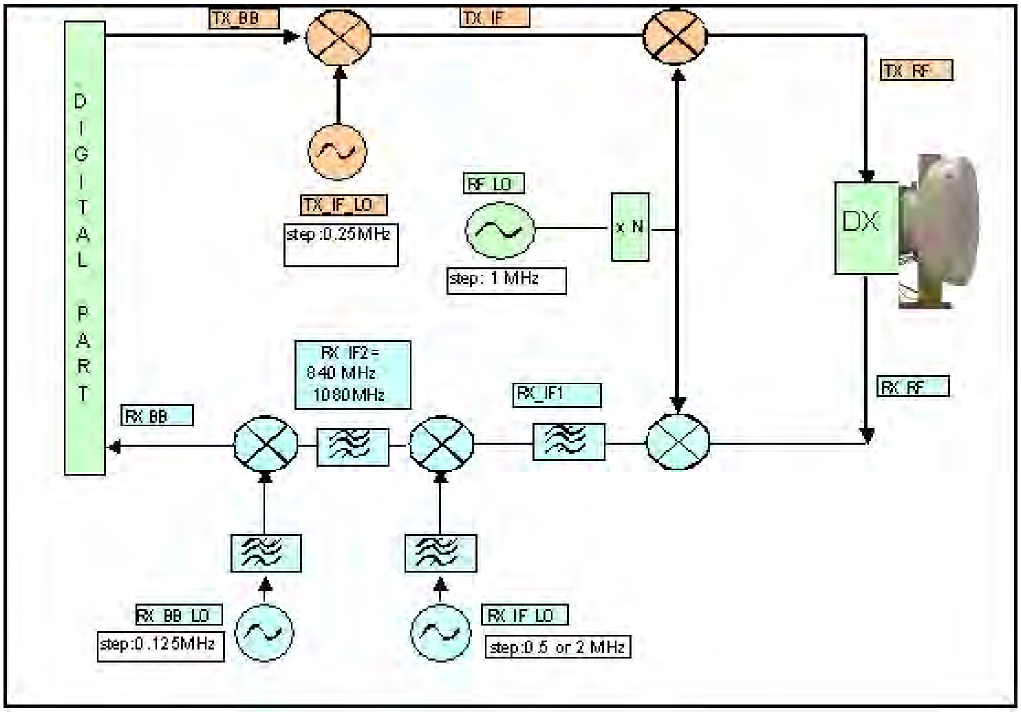


Figure 6-95. 11 to 38 GHz MPT-HC architecture



Main functions

1. TX block:
- IF TX Quadrature modulator
- IF Tx Synthesizer
- RF Up-Converter
- Output power management
2. Tx_Rx Common block:
- RF_LO Synthesizer
3. Rx block:
- LNA
- RF Down Converter
- First IF amplification and overload management

- First IF down conversion
- Second IF amplification and filtering (not present in 7/8 GHz)
- Quadrature demodulator
- Base band filter and AGC loop

MPT-HC/XP coupler

6.908 The coupler is used in the 1+1 HSB or 1+1/2x(1+0) FD co-polar configurations.

6.909 The coupler can be equal type (3 dB/3 dB insertion loss) or unequal type (1 dB on the main path/10 dB on the secondary path).

6.910 The couplers are connected between the MPT and the antenna.

IP addressing

Local NE interface

6.911 The NE TMN_RF interface (hereafter referred to as the Local NE interface) is an unnumbered Point-to-Point interface. It uses a single IP address with fixed 32-bit (all ones) netmask as an endpoint identifier. The Local NE interfaces is always active and cannot be disabled. This Local NE IP address is the same as the Mgmt Port IP address (if enabled) or ETH Port 4 IP address (if enabled) but not both. Refer to TMN communication channels for details.

Mgmt port interface

6.912 The Mgmt Port is provisioned independently from the Local NE interface, and unlike the Local NE interface, the Mgmt Port can be disabled if not needed. Refer to the Core-E (Control and Switching Module) provisioning for details.

6.913 When addressing the Mgmt Port interface, you may follow CIDR guidelines and use Variable Length Subnet Masks (VLSM) as defined in RFC-1519 and in RFC-1878. The longest usable netmask for the Mgmt Port interface is 30 bits (Netmask 255.255.255.252).

6.914 If the Mgmt Port interface is enabled, it is recommended that it be assigned the same IP address as the Local NE interface. This allows the radio to be known throughout the network by only one IP address, and eliminates a potential problem of one radio appearing to be two different pieces of equipment to an SNMP manager.

6.915 It should be noted that the factory default IP address assigned to the Local NE and Mgmt Port is 10.0.1.1. Use of this IP address within the radio network should be avoided, since installing a new 9500 MPR-A could possibly cause a disruption of the network if that address is already in use.

ETH port 4 interface

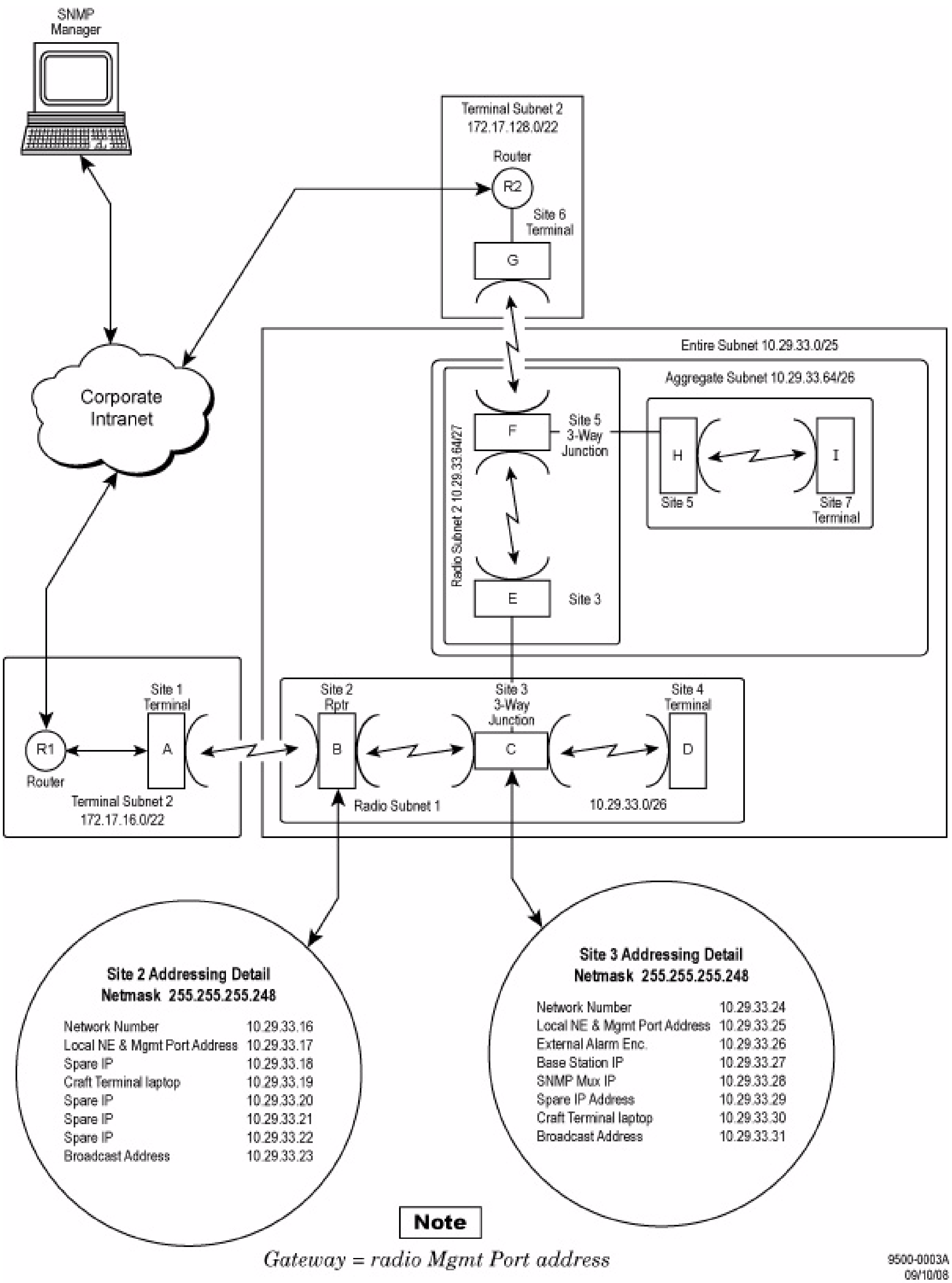
6.916 A backup for the Mgmt Port is provided by enabling Ethernet Port 4 to transport TMN data. The ETH Port 4 interface is provisioned independently from the Local NE interface and Mgmt Port interface, and can be disabled if not needed. Refer to the Core-E (Control and Switching Module) provisioning for details.

6.917 ETH Port 4 and Mgmt Port IP addresses must be different. If the ETH Port 4 interface is enabled, and the Mgmt Port interface is disabled, it is recommended that it be assigned the same IP address as the Local NE interface.

Typical interconnect/addressing method

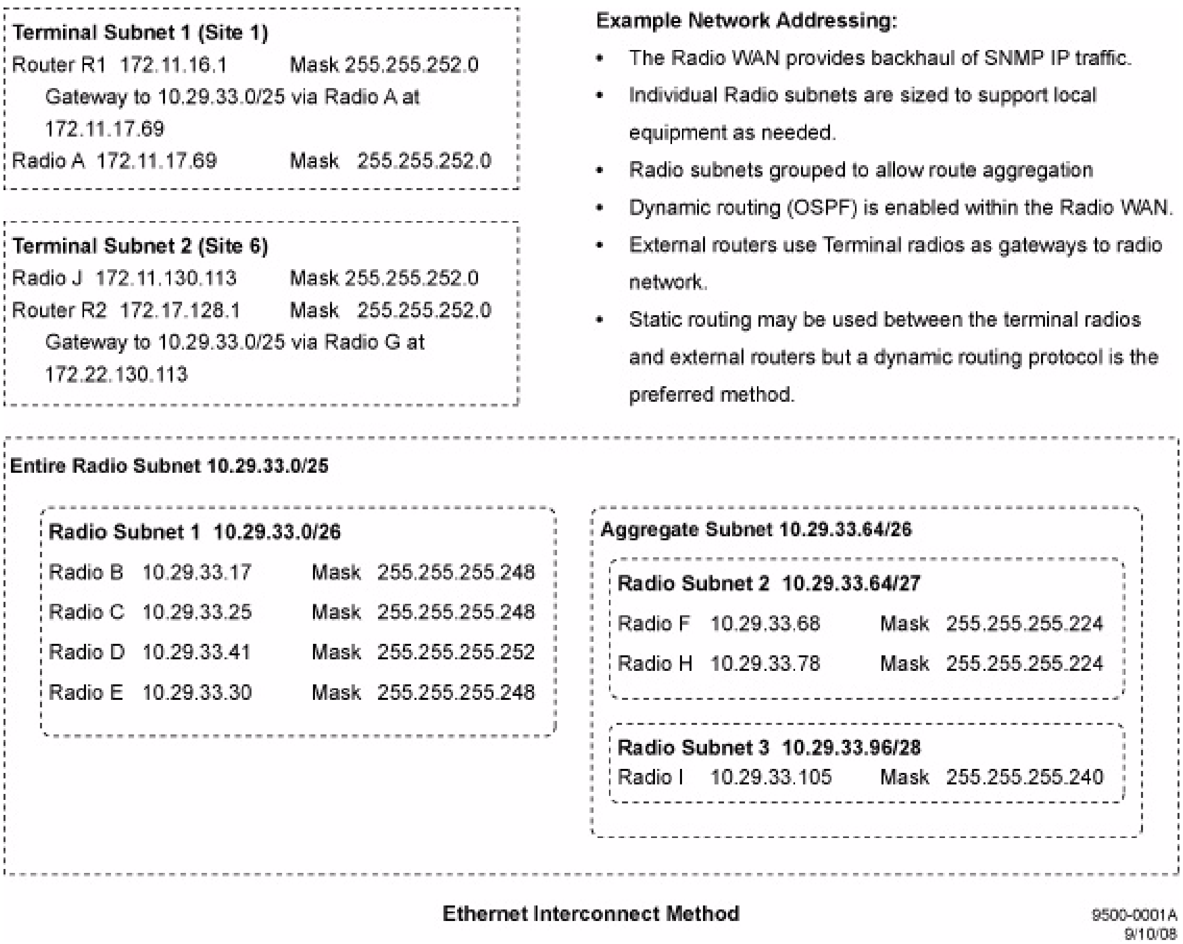
6.918 See Figures 6-96 and 6-97 for a typical interconnect and addressing method, using the Local NE interface to connect sites and Mgmt Port interface to connect radios at each site.

Figure 6-96. Typical interconnect/addressing method



PRELIMINARY

Figure 6-97. Typical interconnect/addressing method details continued



6.919 Note the various subnet masks used. The use of VLSM allows subnets to be sized as appropriate for the amount of external equipment to be deployed. This helps minimize the number of unused or unusable addresses.

Network provisioning

6.920 Refer to the following example of Network provisioning and description of the provisioning screens.

Addressing examples

6.921 Addressing depends on the type of backhaul required; i.e., external or radio WAN.

- For external backhaul, address the Local NE and Mgmt Port as a member device of the external LAN with a single address.

- IF the Radio is providing backhaul for IP traffic, the recommended addressing scheme is to assign a small subnet to each radio. The radio and Mgmt Port can share one IP address from the subnet and the remaining address(es) of the subnet can then be used to address additional local equipment. The local equipment can then use the radio as the default gateway for IP transport. To assign radio subnets, follow the general procedures shown in Radio Level Subnet Addressing.

Assumptions

- OSPF will be enabled within the radio network.
- The recommended configuration is such that the Ethernet port will have the same IP address as the radio.
- Radios that attach directly to external networks (Corporate LAN/WAN) should be addressed as members of the subnet to which they attach.

IP address assignments

6.922 Since the size of the Static Routing table is limited, IP Address assignment should strive to minimize the size of the Static Routing table.

- In general, IP addresses should increase (or decrease) as distance increases away from terminals or junction. This allows the use of route aggregation when specifying static routes.
- The static routing table size is inversely related to IP address efficiency. Although there is less impact when used with OSPF, a side effect of minimizing the static routing table size can leave more unused/unusable addresses.

Radio level subnet addressing

6.923 Assign Radio Level Subnets as follows:

1. Radios connected by RF, or PPP links must each get their own subnet.
2. Radios connected by Ethernet need to share a subnet. Each radio will use one address from the Ethernet subnet.
3. Determine the radio and external equipment configuration at each site/radio.
4. Size the Ethernet subnet based on the number of devices that will be attached, both known and anticipated.

5. Determine the number of required addresses at each radio, and round this number up to the next highest usable hosts number; see Table 1. From the usable hosts number, select the size of the radio subnet. The minimum amount of address space to assign to a radio subnet is 4 addresses (2 usable host addresses).

Table 6-Q. Commonly used subnet masks and associated subnet sizes

ETHERNET SUBNET MASK	MASK BITS	HOST BITS	TOTAL NUMBER OF ADDRESSES IN RANGE[1]	USABLE HOST ADDRESSES[1]
255.255.255.254	31	1	2	0 (unusable)
255.255.255.252	30	2	4	2
255.255.255.248	29	3	8	6
255.255.255.240	28	4	16	14
255.255.255.224	27	5	32	30
255.255.255.192	26	6	64	62
255.255.255.128	25	7	128	126
255.255.255.0	24	8	256	254

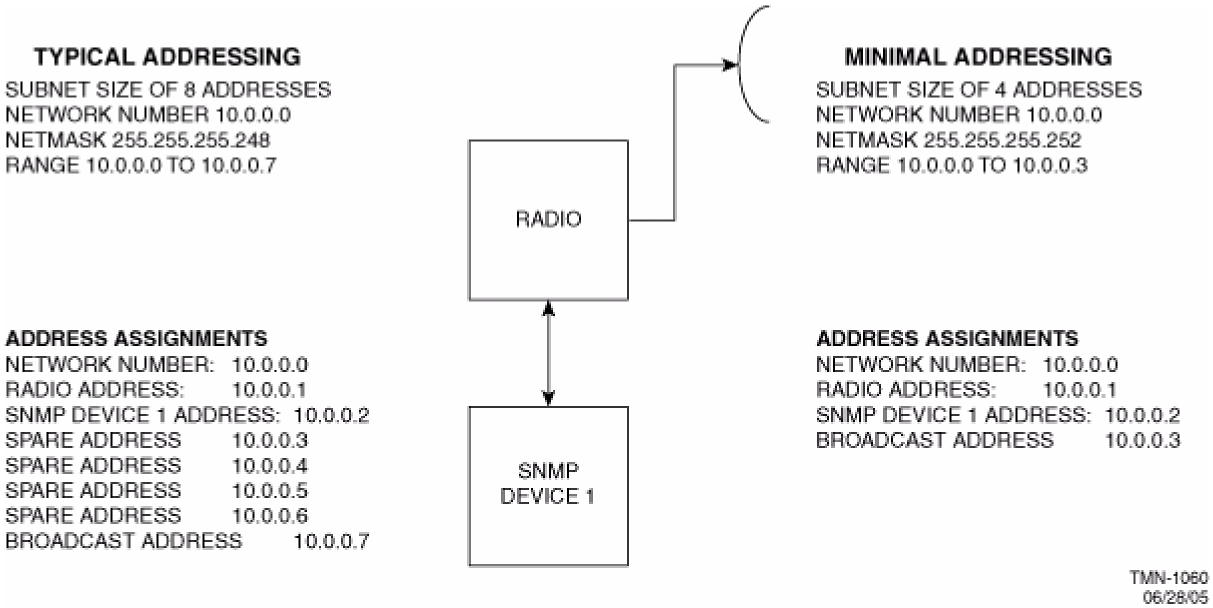
[1] The first and last addresses of a subnet are reserved for the network number and broadcast address respectively. This makes the number of usable host addresses two less than the total number of addresses in the subnet.

Example:

6.924 A radio has a single SNMP device attached via the Ethernet. Planned future expansion will add two more SNMP devices for a total of four devices. From Table 6-Q, the nearest usable subnet size provides for a total of 6 usable addresses. This correlates to a required radio subnet size of 8, and an Ethernet Subnet mask of 29 bits (255.255.255.248).

6.925 Of the 6 usable addresses, one is for the radio, three are for the SNMP devices, and the remaining two unassigned addresses are for future expansion. See Figure 6-98 and Figure 6-100 for examples.

Figure 6-98. Typical terminal addressing



Larger subnet areas

1. Group radio subnets into larger subnet areas. Larger subnet areas normally consist of:
   - All radios from a Terminal to a Junction.
   - All radios between two Junctions.
2. Start at one end of a group and begin assigning addresses to each radio subnet in sequential order.

Future expansion

6.926 Reserve addresses and design routing tables to allow for the following:

1. Future expansion/extension of Backbone.
2. Future addition of local TCP/IP equipment at each site.
3. Future Spurs or Spur extensions to be assigned addresses in the same subnet.

6.927 It is possible to disable the Ethernet interface of the TMN card, assign only one IP address to the radio, and still use the radio WAN for IP transport. This method is discouraged because it leaves no IP addresses available within the radio WAN for expansion or addition of new Ethernet equipment at radio sites.

CAUTION Possibility of service interruption. Obtaining additional address space in the future may require readdressing of the entire network. Readdressing of a radio network requires a site visit for each radio affected and, until the process is complete, radio WAN communications (SNMP management and WAN IP transport) could possibly be unavailable.

Addressing terminals

6.928 (See Figure 6-98 and Figure 6-99)

External LAN attached

6.929 For terminals attached to external LAN see Figure 6-99. When attached to external LAN, proceed as follows:

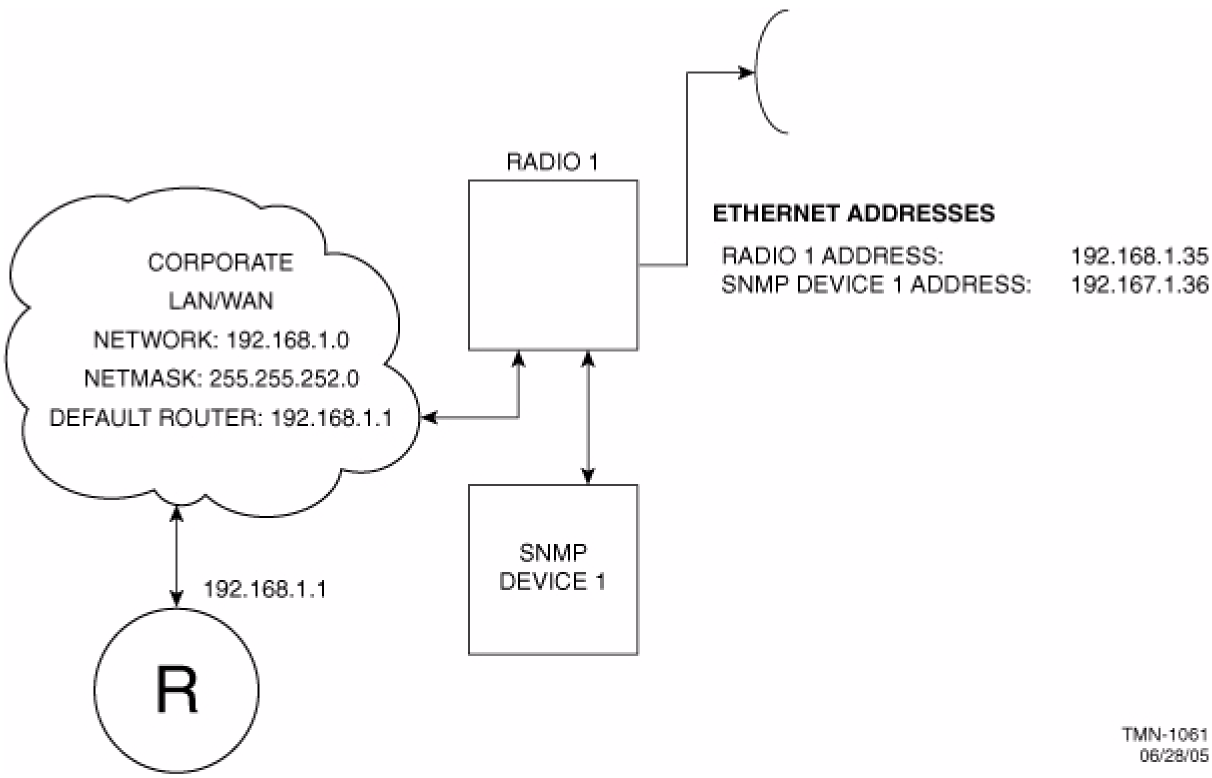
1. Address both the WAN and LAN interfaces of the radio as a member device in the external LAN and enable OSPF.
2. Interfacing to external routers
   a. If external routers use OSPF, the radio network can be integrated with the external OSPF design.
   b. If the external routers do not support dynamic routing, or if it is desired to keep the radio network dynamic routing separated from the external network, set a static route in the radio to point to the default gateway in the external LAN. Configure the external router to use the radio as a gateway to the radio network.

External LAN not attached

6.930 For terminals not attached to external LAN, proceed as follows:

1. Assign an IP Subnet to the Radio and enable OSPF, otherwise set the default route in the radio to point to the “RF” interface.
2. Set the default route in all local Ethernet equipment to point to the Radio.

Figure 6-99. Typical terminal attached to external LAN



Addressing back-to-back terminals, Other asynchronous radios, and repeaters

Preferred addressing method

6.931 See Figure 6-100.

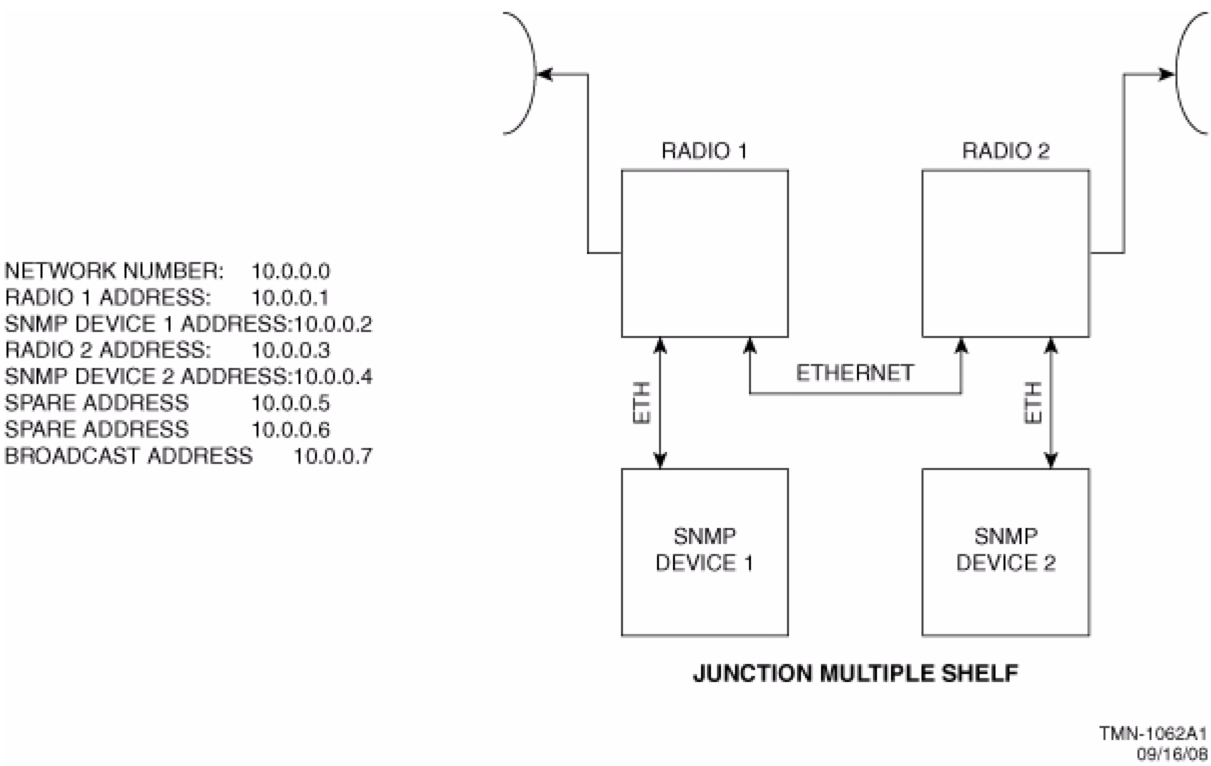
1. Assign one subnet for the site, address radios as members of that subnet and enable OSPF.
2. Interconnect the radios using Ethernet (Avoid loops or other problematic connections).
3. Provision the default gateway of any locally attached Ethernet equipment to point to a radio.

Alternate addressing method

6.932 See Figure 6-100

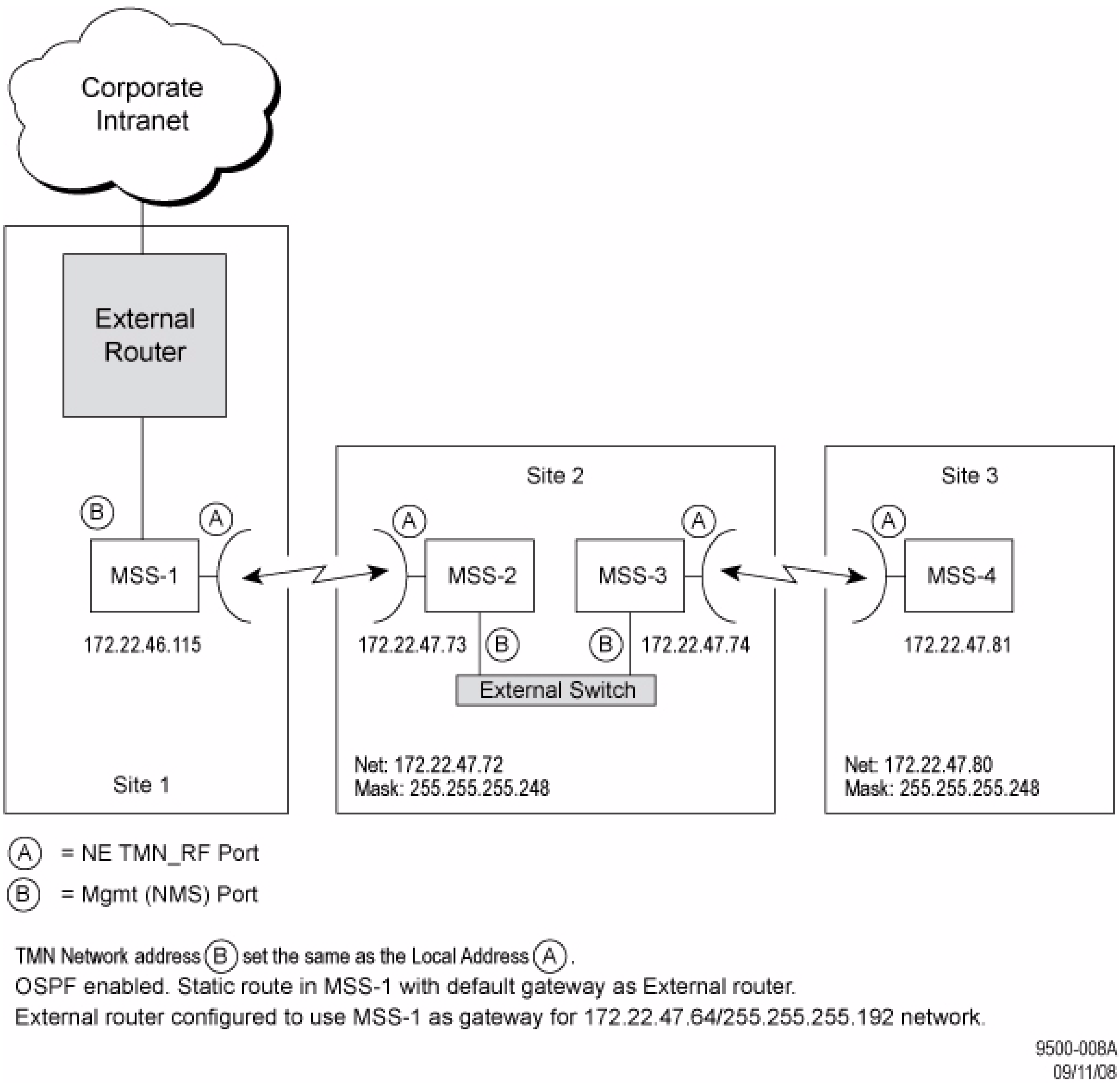
1. Assign a separate subnet to each radio.
2. Assign each radio an address from its Ethernet subnet.
1. Local Ethernet Equipment
    a. Address as part of the radio subnet to which the equipment connects.
    b. Set the default gateway to point to the radio to which the equipment is attached.

Figure 6-100. Back-to-back terminal and repeater configuration addressing



Network provisioning

Figure 6-101. Back-to-back terminal and repeater configuration addressing



Network provisioning example

- Site 1
  - MSS-1: See Figure 6-102 through Figure 6-107
- Site 2

  - MSS-2: See Figure 6-108 through Figure 6-112
  - MSS-3: See Figure 6-113 through Figure 6-117
- Site 3
  - MSS-4: See Figure 6-118 through Figure 6-123

MSS-1

Figure 6-102. MSS-1: NETO logon window

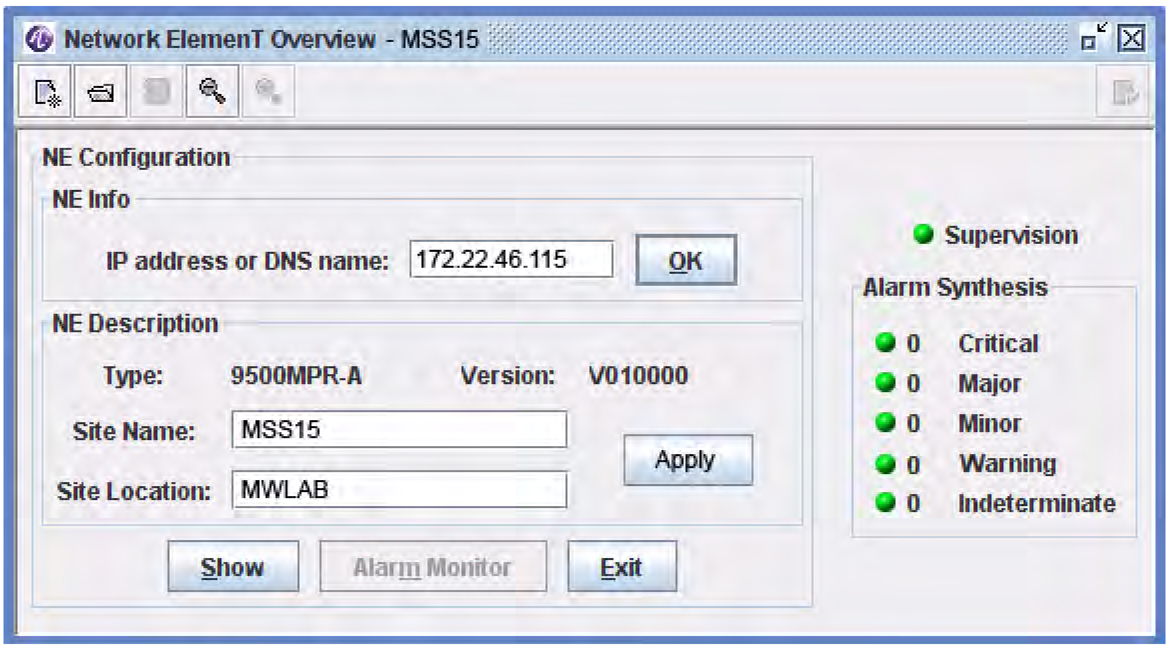


Figure 6-103. MSS-1: ethernet interface provisioning

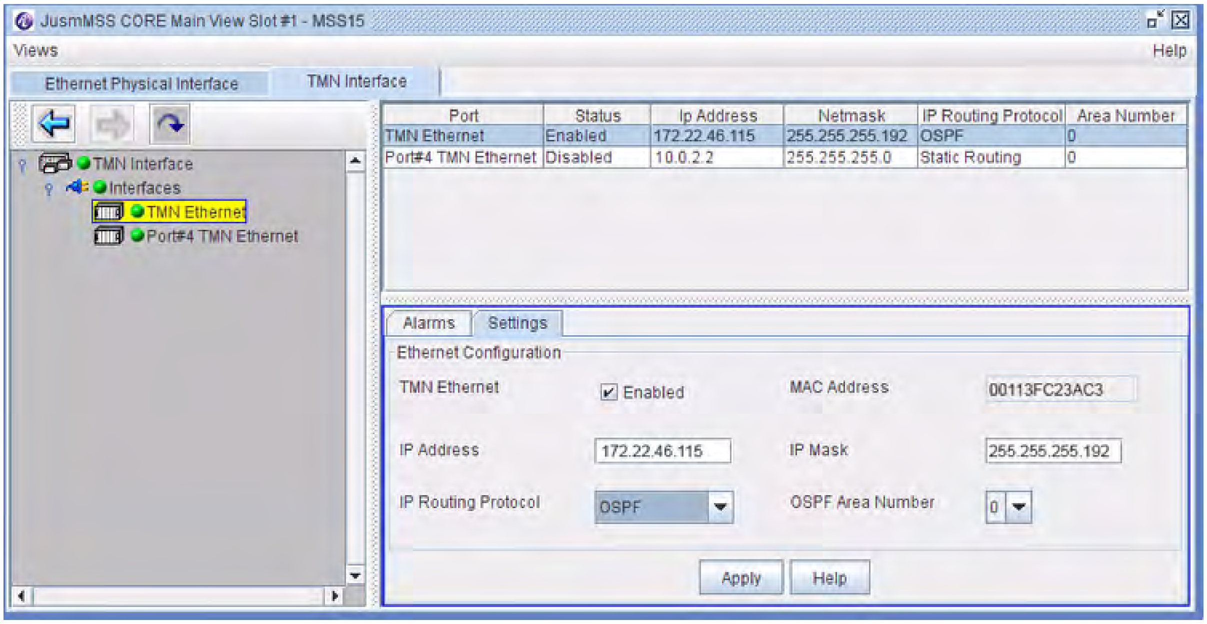
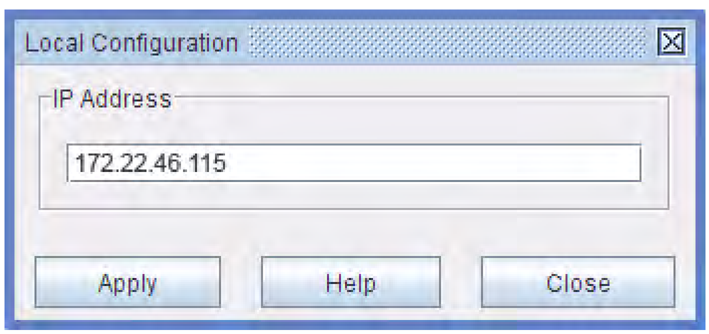


Figure 6-104. MSS-1: local configuration window



PRELIMINARY

Figure 6-105. MSS-1: IP static routing configuration window

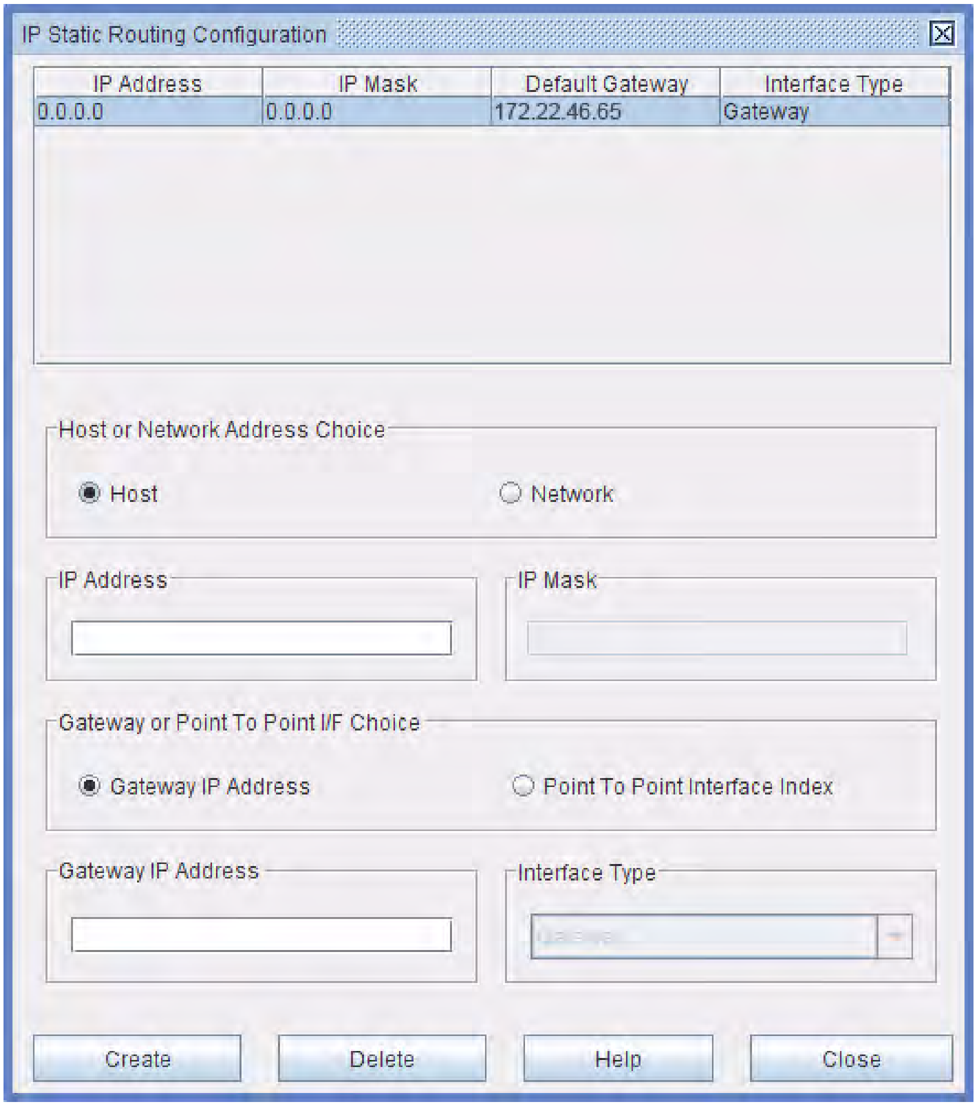
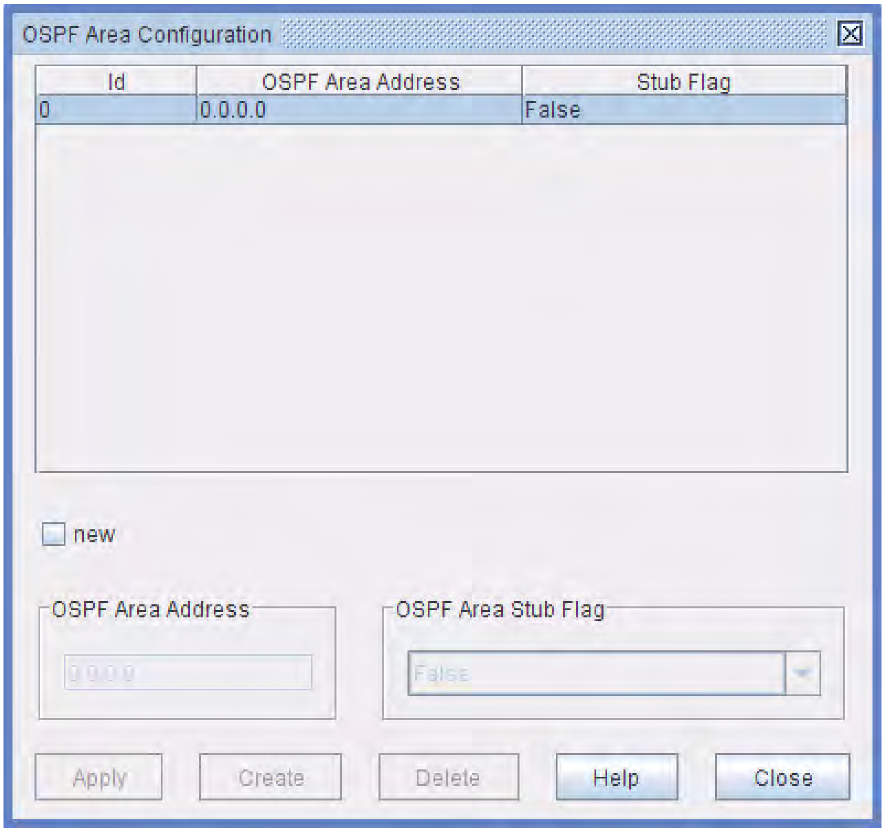
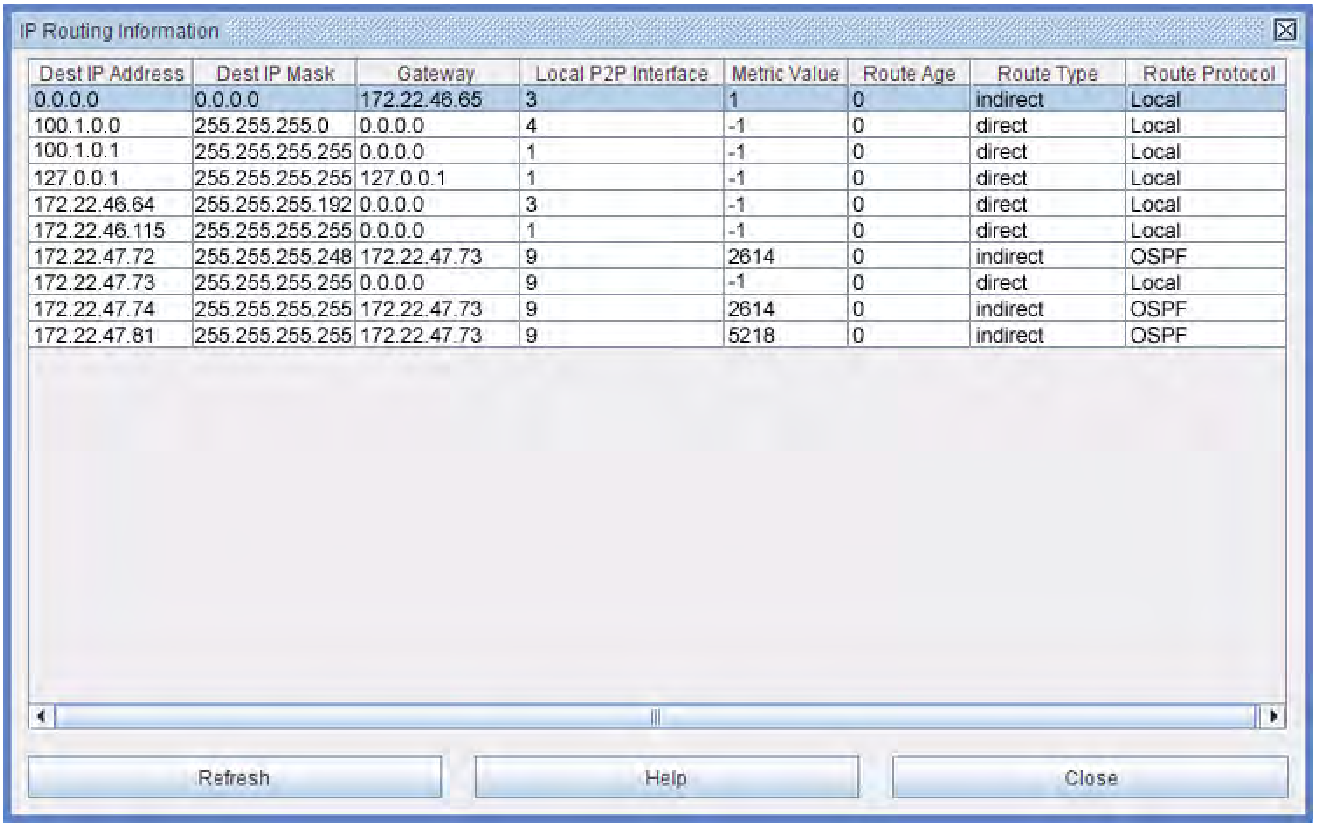


Figure 6-106. MSS-1: OSPF area configuration



PRELIMINARY

Figure 6-107. MSS-1: IP routing information window



IP Routing Information

Dest IP Address	Dest IP Mask	Gateway	Local P2P Interface	Metric Value	Route Age	Route Type	Route Protocol
0.0.0.0	0.0.0.0	172.22.46.65	3	1	0	indirect	Local
100.1.0.0	255.255.255.0	0.0.0.0	4	-1	0	direct	Local
100.1.0.1	255.255.255.255	0.0.0.0	1	-1	0	direct	Local
127.0.0.1	255.255.255.255	127.0.0.1	1	-1	0	direct	Local
172.22.46.64	255.255.255.192	0.0.0.0	3	-1	0	direct	Local
172.22.46.115	255.255.255.255	0.0.0.0	1	-1	0	direct	Local
172.22.47.72	255.255.255.248	172.22.47.73	9	2614	0	indirect	OSPF
172.22.47.73	255.255.255.255	0.0.0.0	9	-1	0	direct	Local
172.22.47.74	255.255.255.255	172.22.47.73	9	2614	0	indirect	OSPF
172.22.47.81	255.255.255.255	172.22.47.73	9	5218	0	indirect	OSPF

Refresh | Help | Close

MSS-2

Figure 6-108. MSS-2: NETO logon window

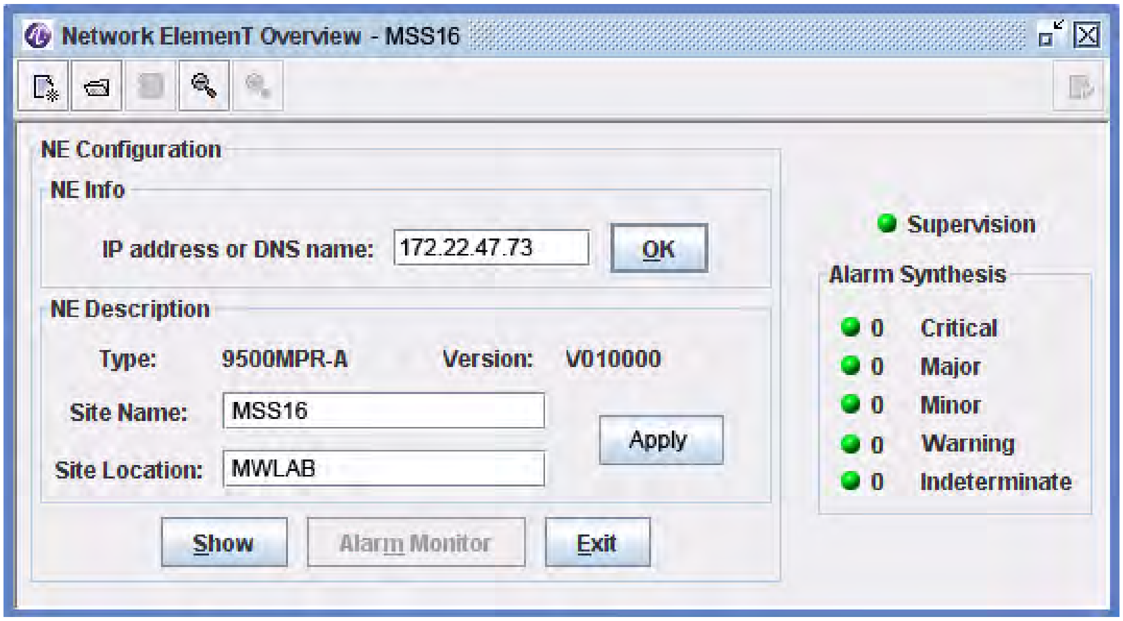
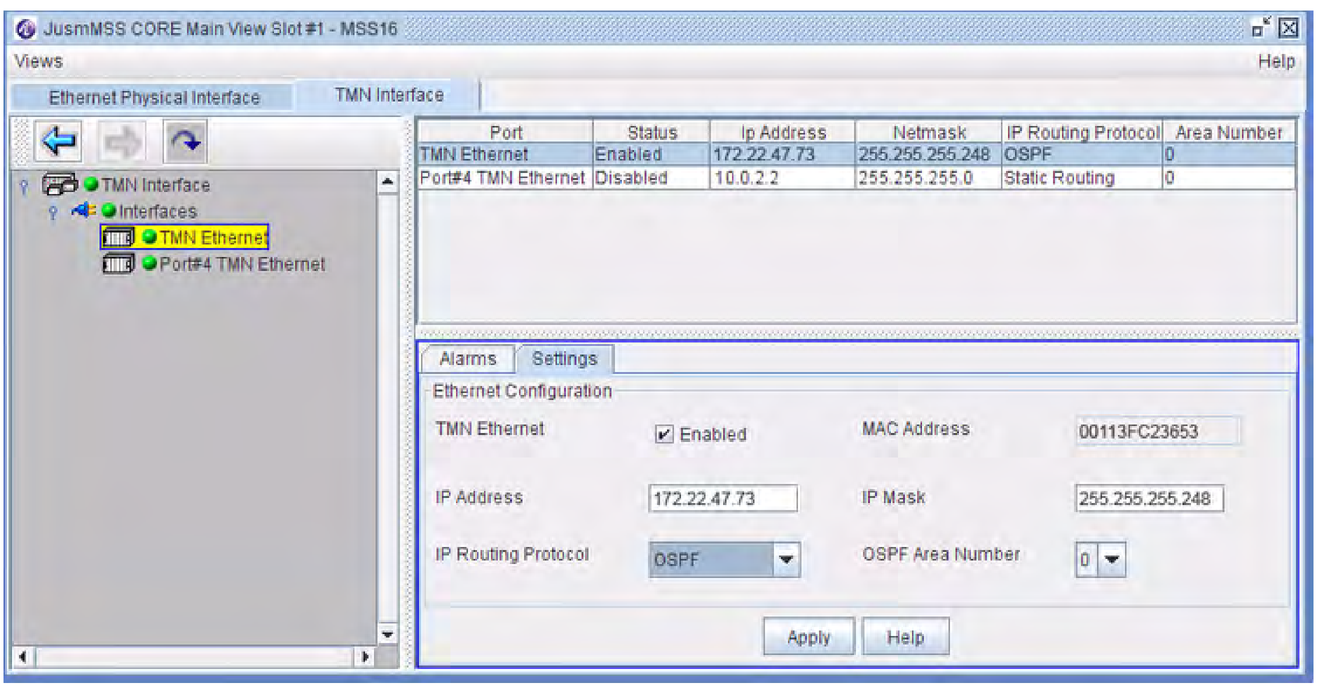


Figure 6-109. MSS-2: TMN ethernet interface window



PRELIMINARY

Figure 6-110. MSS-2: local configuration window

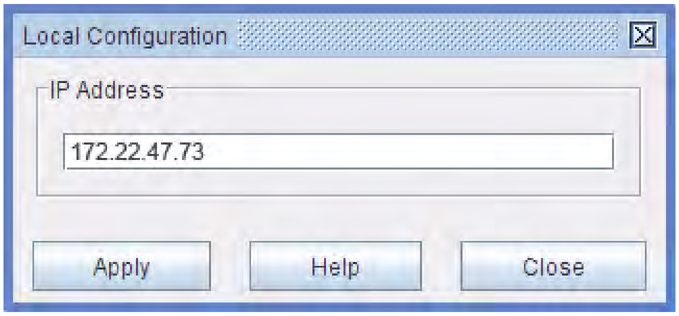


Figure 6-111. MSS-2: OSPF area configuration

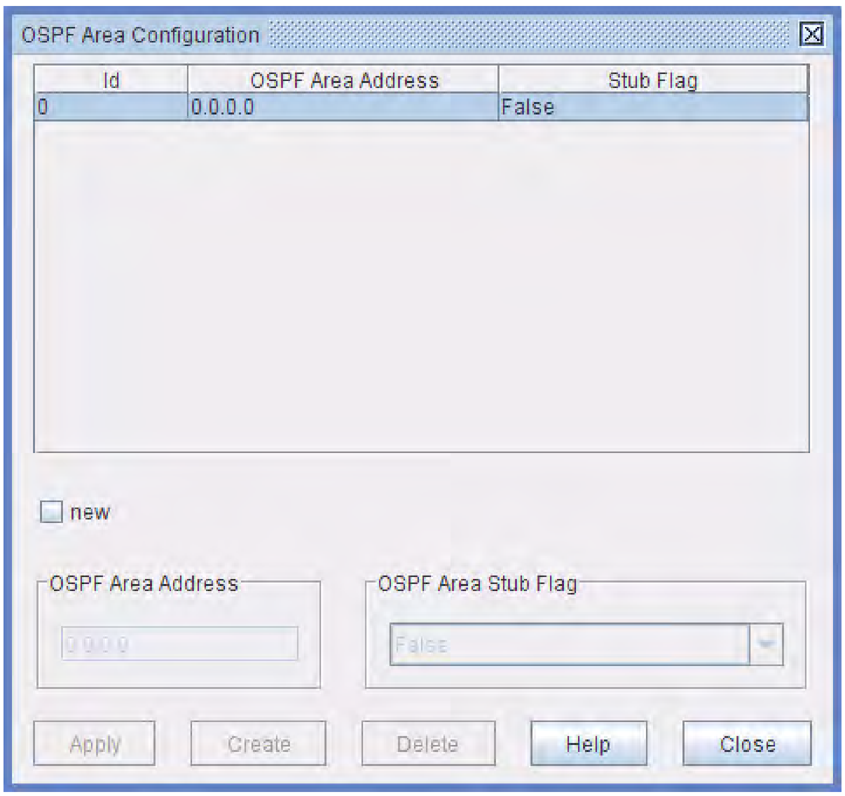
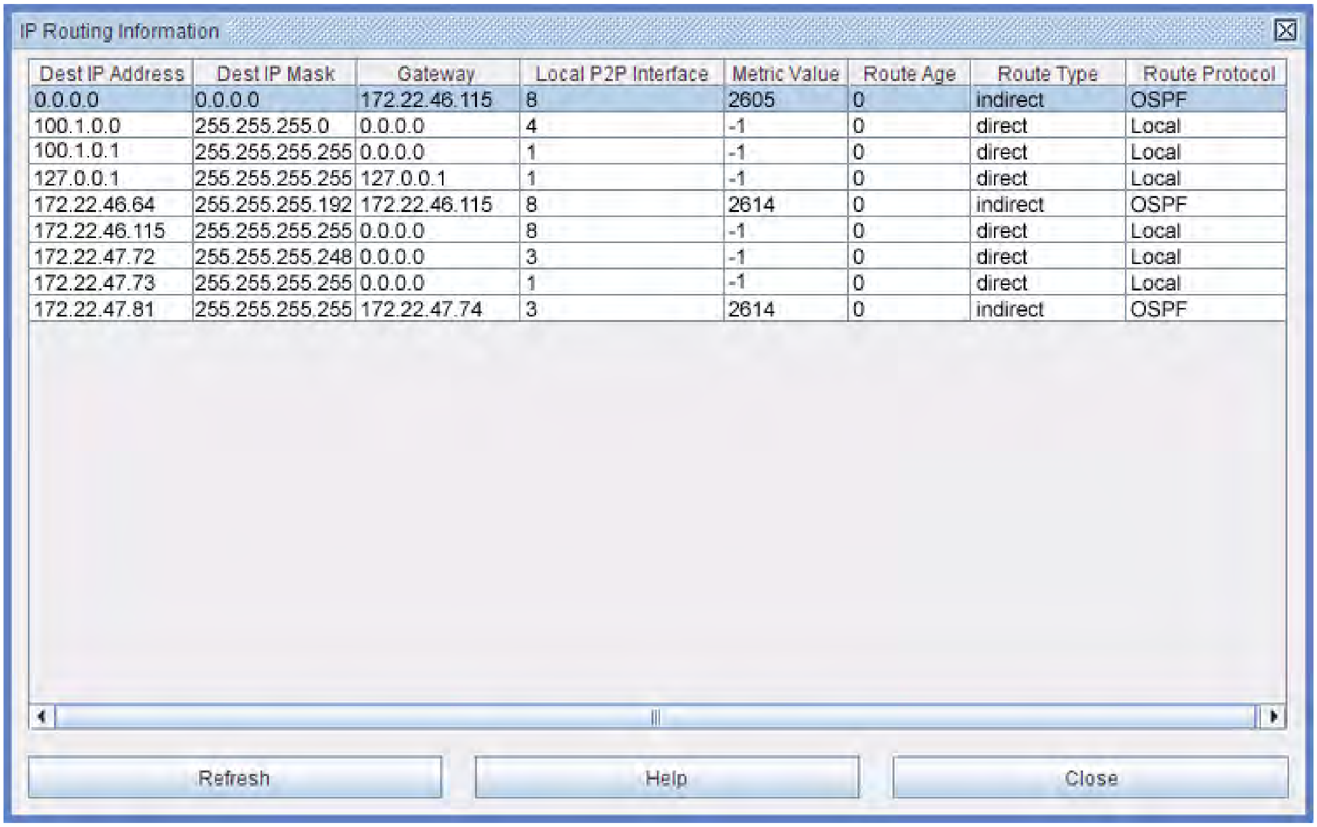


Figure 6-112. MSS-2: IP routing information window



IP Routing Information

Dest IP Address	Dest IP Mask	Gateway	Local P2P Interface	Metric Value	Route Age	Route Type	Route Protocol
0.0.0.0	0.0.0.0	172.22.46.115	8	2605	0	indirect	OSPF
100.1.0.0	255.255.255.0	0.0.0.0	4	-1	0	direct	Local
100.1.0.1	255.255.255.255	0.0.0.0	1	-1	0	direct	Local
127.0.0.1	255.255.255.255	127.0.0.1	1	-1	0	direct	Local
172.22.46.64	255.255.255.192	172.22.46.115	8	2614	0	indirect	OSPF
172.22.46.115	255.255.255.255	0.0.0.0	8	-1	0	direct	Local
172.22.47.72	255.255.255.248	0.0.0.0	3	-1	0	direct	Local
172.22.47.73	255.255.255.255	0.0.0.0	1	-1	0	direct	Local
172.22.47.81	255.255.255.255	172.22.47.74	3	2614	0	indirect	OSPF

Refresh | Help | Close

PRELIMINARY

MSS-3

Figure 6-113. MSS-3: NETO logon window

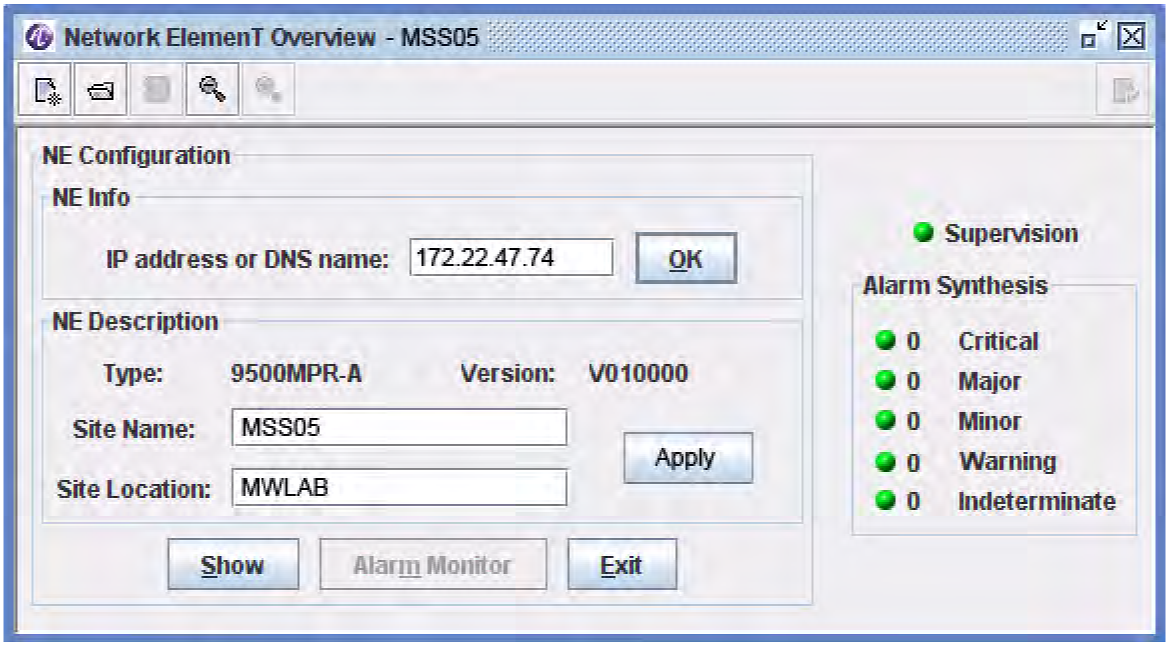


Figure 6-114. MSS-3: TMN ethernet interface provisioning

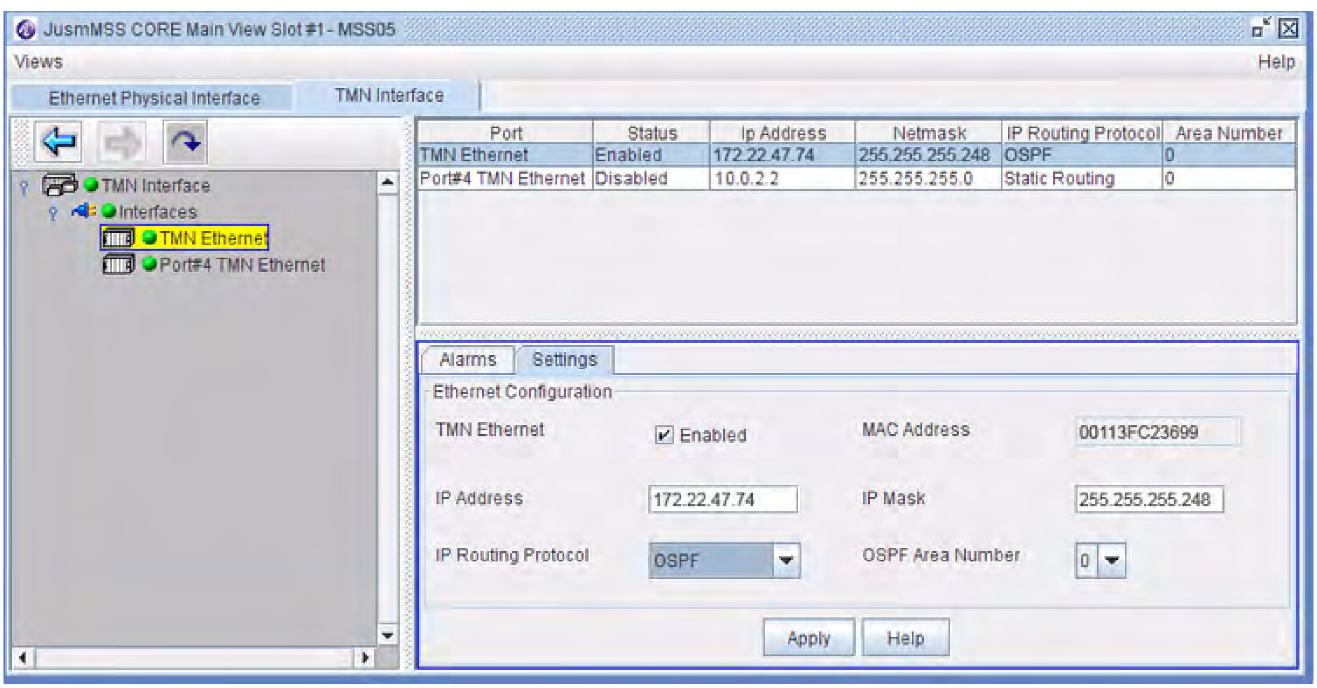


Figure 6-115. MSS-3: local configuration window

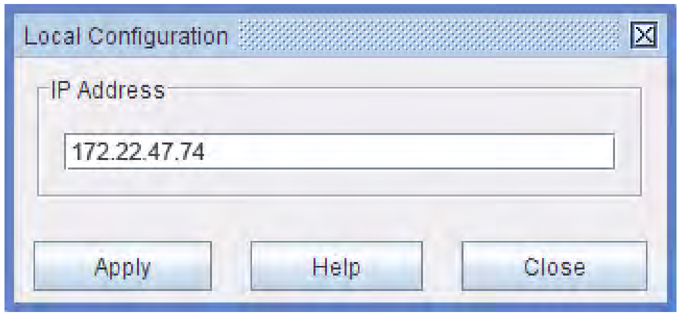
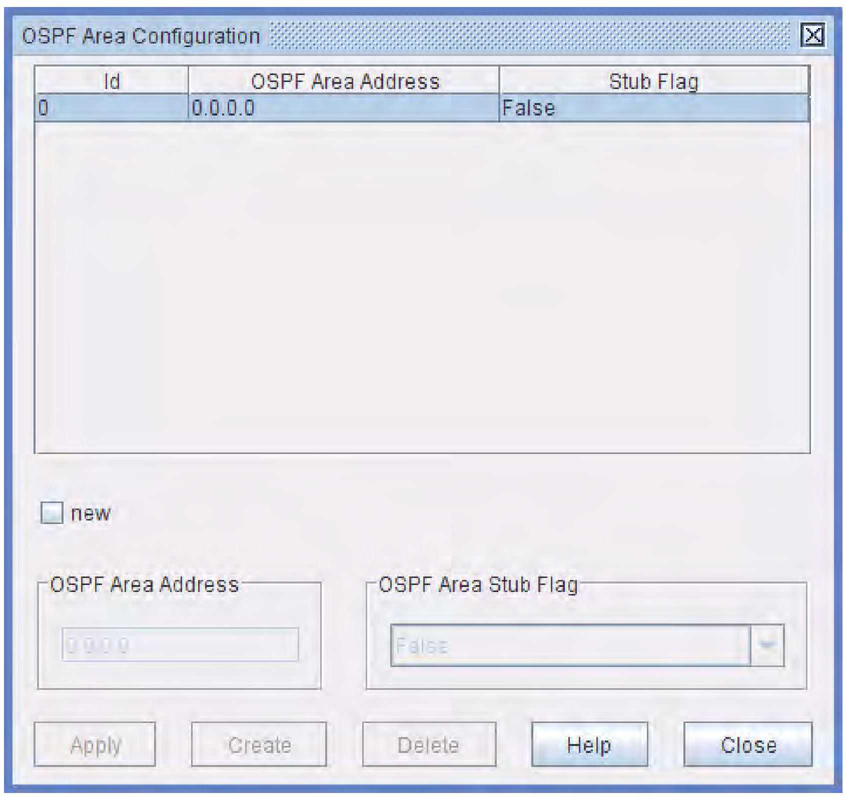
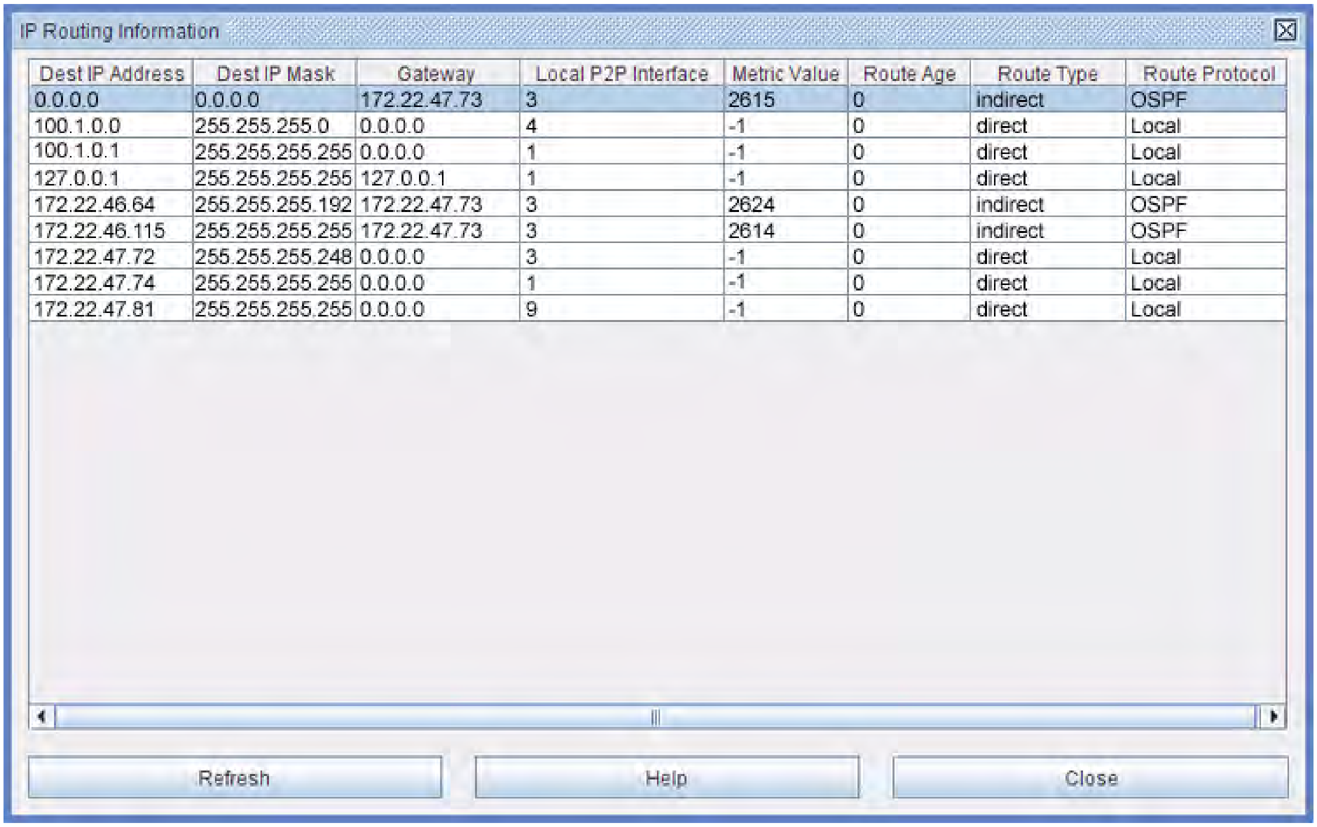


Figure 6-116. MSS-3: OSPF area configuration



PRELIMINARY

Figure 6-117. MSS-3: IP routing information window



Dest IP Address	Dest IP Mask	Gateway	Local P2P Interface	Metric Value	Route Age	Route Type	Route Protocol
0.0.0.0	0.0.0.0	172.22.47.73	3	2615	0	indirect	OSPF
100.1.0.0	255.255.255.0	0.0.0.0	4	-1	0	direct	Local
100.1.0.1	255.255.255.255	0.0.0.0	1	-1	0	direct	Local
127.0.0.1	255.255.255.255	127.0.0.1	1	-1	0	direct	Local
172.22.46.64	255.255.255.192	172.22.47.73	3	2624	0	indirect	OSPF
172.22.46.115	255.255.255.255	172.22.47.73	3	2614	0	indirect	OSPF
172.22.47.72	255.255.255.248	0.0.0.0	3	-1	0	direct	Local
172.22.47.74	255.255.255.255	0.0.0.0	1	-1	0	direct	Local
172.22.47.81	255.255.255.255	0.0.0.0	9	-1	0	direct	Local

MSS-4

Figure 6-118. MSS-4: NETO logon window

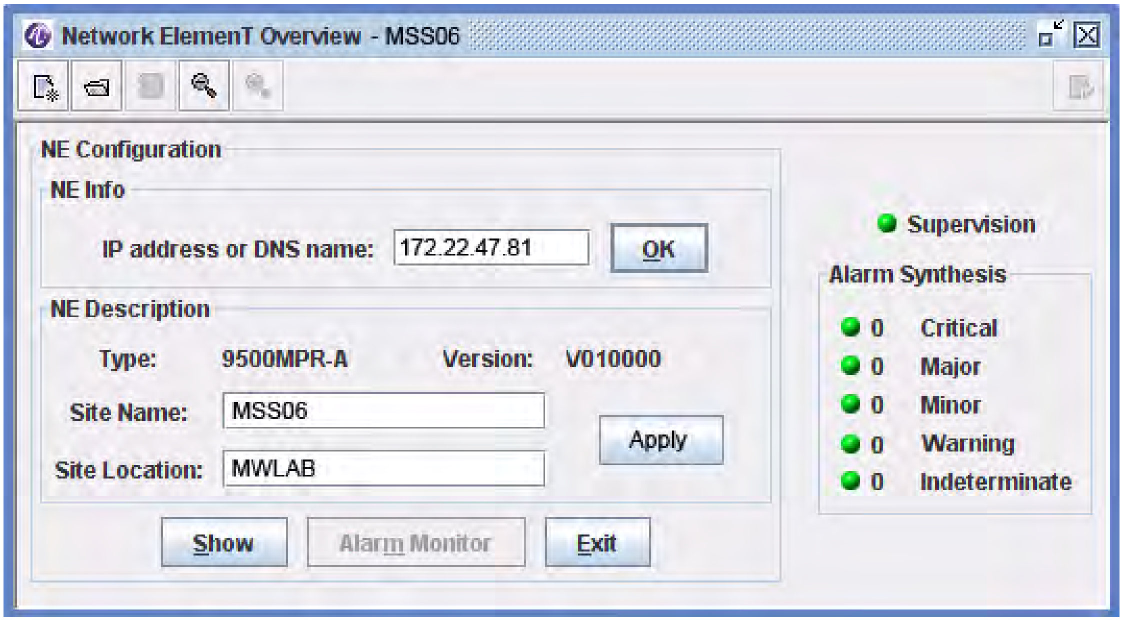


Figure 6-119. MSS-4: TMN ethernet interface provisioning

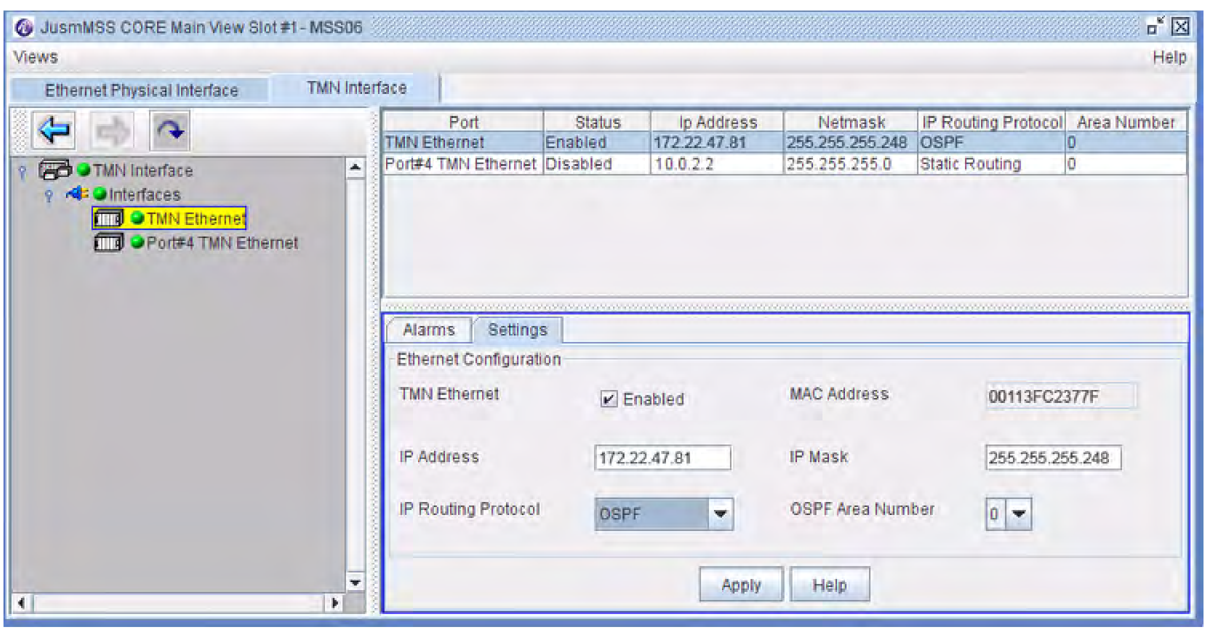


Figure 6-120. MSS-4: local configuration window

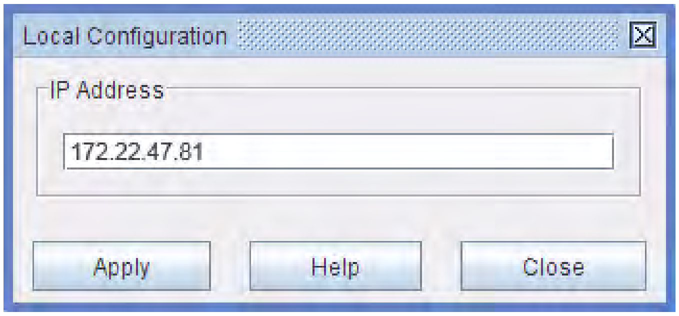


Figure 6-121. MSS-4: IP static routing configuration window

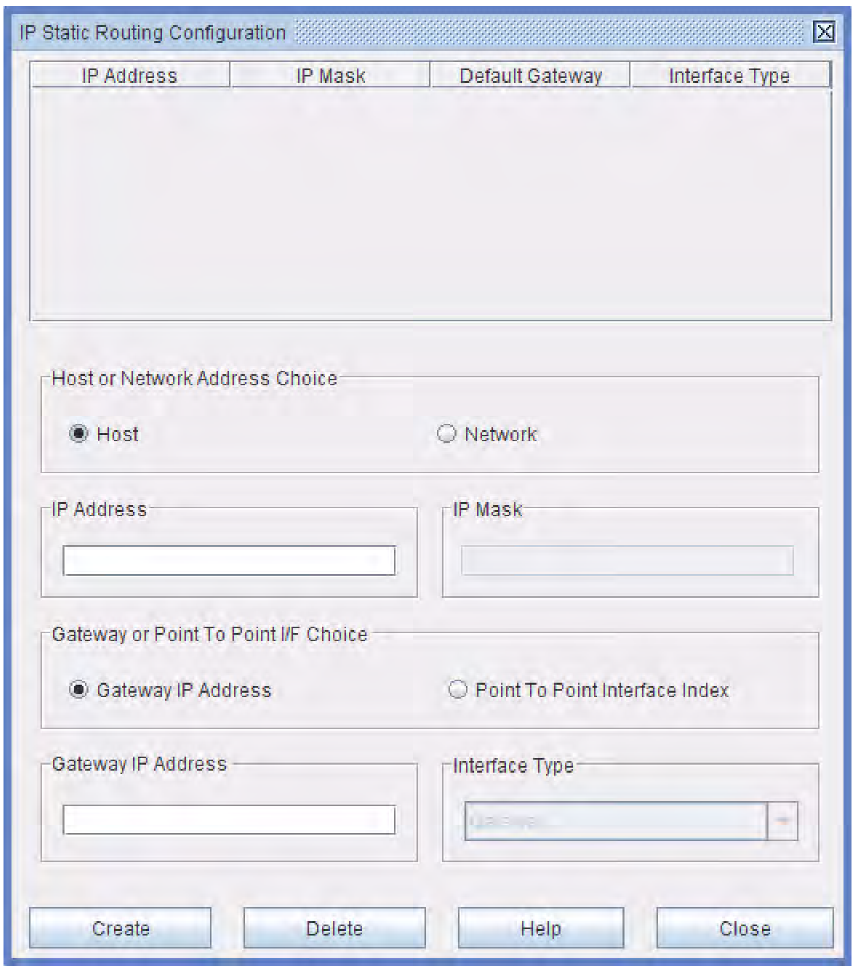
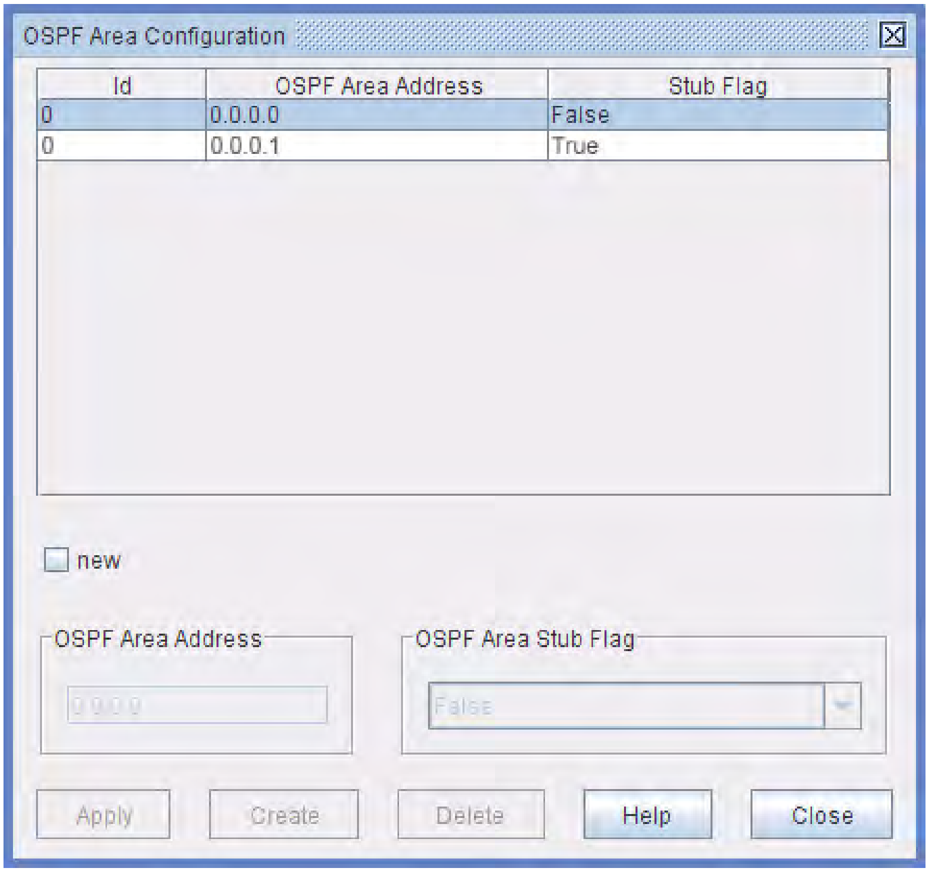
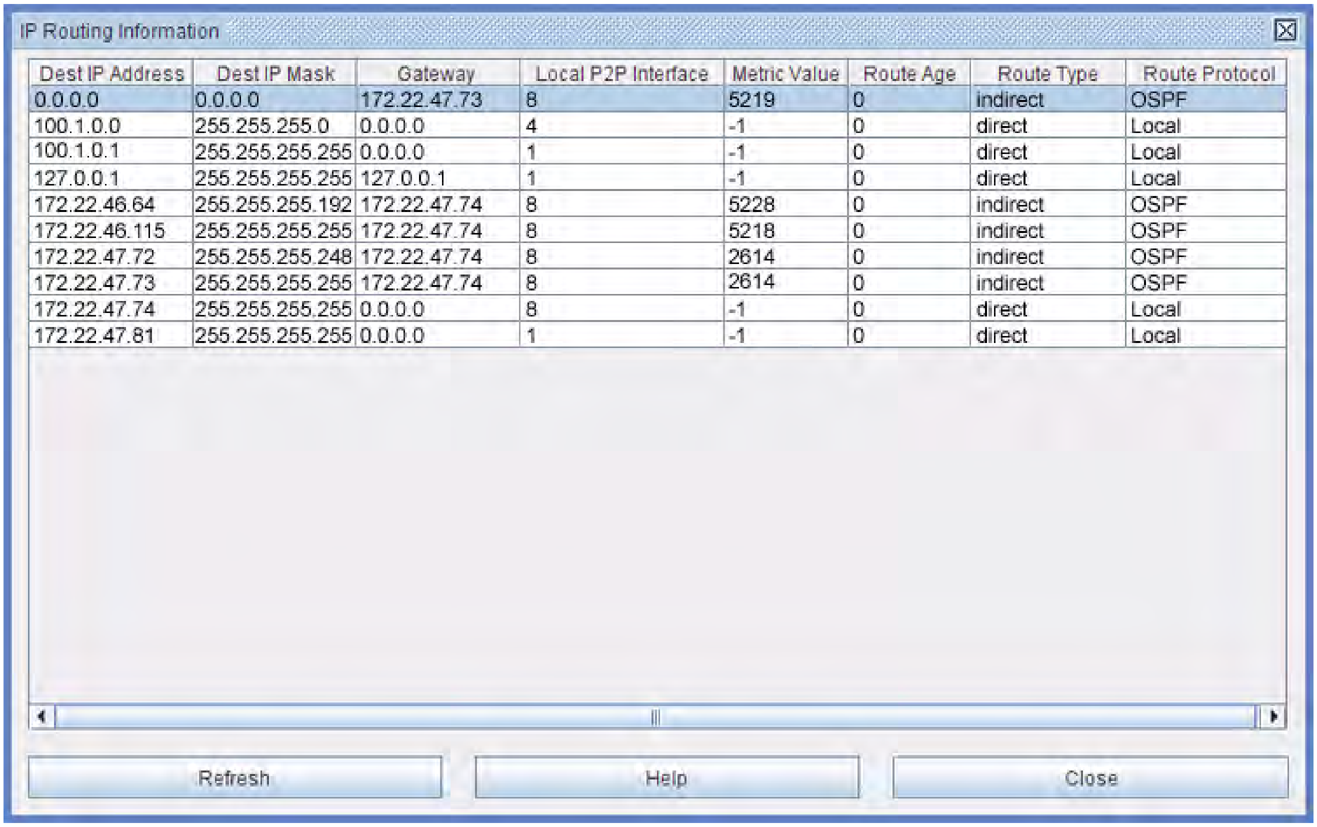


Figure 6-122. MSS-4: OSPF area configuration



PRELIMINARY

Figure 6-123. MSS-4: IP routing information window



Dest IP Address	Dest IP Mask	Gateway	Local P2P Interface	Metric Value	Route Age	Route Type	Route Protocol
0.0.0.0	0.0.0.0	172.22.47.73	8	5219	0	indirect	OSPF
100.1.0.0	255.255.255.0	0.0.0.0	4	-1	0	direct	Local
100.1.0.1	255.255.255.255	0.0.0.0	1	-1	0	direct	Local
127.0.0.1	255.255.255.255	127.0.0.1	1	-1	0	direct	Local
172.22.46.64	255.255.255.192	172.22.47.74	8	5228	0	indirect	OSPF
172.22.46.115	255.255.255.255	172.22.47.74	8	5218	0	indirect	OSPF
172.22.47.72	255.255.255.248	172.22.47.74	8	2614	0	indirect	OSPF
172.22.47.73	255.255.255.255	172.22.47.74	8	2614	0	indirect	OSPF
172.22.47.74	255.255.255.255	0.0.0.0	8	-1	0	direct	Local
172.22.47.81	255.255.255.255	0.0.0.0	1	-1	0	direct	Local

TMN communication channels

6.933 TMN traffic is assigned to QoS queue 6 which is a higher priority than Ethernet traffic queues, but lower than MEF8 (TDM2TDM and TDM2ETH) traffic queues.

6.934 TMN bandwidth is not reserved, which allows user traffic, up to the maximum capacity of the radio link when the TMN port is idle. TMN traffic must be considered when configuring CIR flows.

6.935 When deploying external devices using the TMN channel, care must be taken to avoid using more bandwidth than is available on the radio link. It is recommended to use a user Ethernet port to attach remote devices for monitoring instead of the TMN port.

6.936 See the different NE TMN_RF Port scenarios. TMN routing in the 9500 MPR-A consists of a 3-port router and associated circuits in the Core-E (Control and Switching Module) plus CT screens for configuring automatic (OSPF) and manual (static) routing.

Port functions

- NE TMN_RF Port (Local NE) - TMN channel carried by Ethernet frames in the dedicated TMN port (on the front panel of the Core-E module) (this port is normally used to connect the LCT)
- Mgmt Port - Primary function TMN data channel, up to 512 kbit/s channel inside Radio frame. Secondary function- CT access
- Eth Port 4 - Primary function- provisioned Ethernet and transport Ethernet traffic. Secondary function - TMN channel carried by Ethernet frames in Ethernet tributary 4 (on the front panel of the Core-E module)
- Two TMN In-band interfaces (by using the Ethernet traffic ports)

NE TMN_RF port scenarios

- NE TMN_RF Port Belongs to Subnet 2
- NE TMN_RF Port Belongs to Subnet 1
- NE TMN_RF Port Belongs to Separate Subnet 3

Figure 6-124. NE TMN_RF port belongs to subnet 2

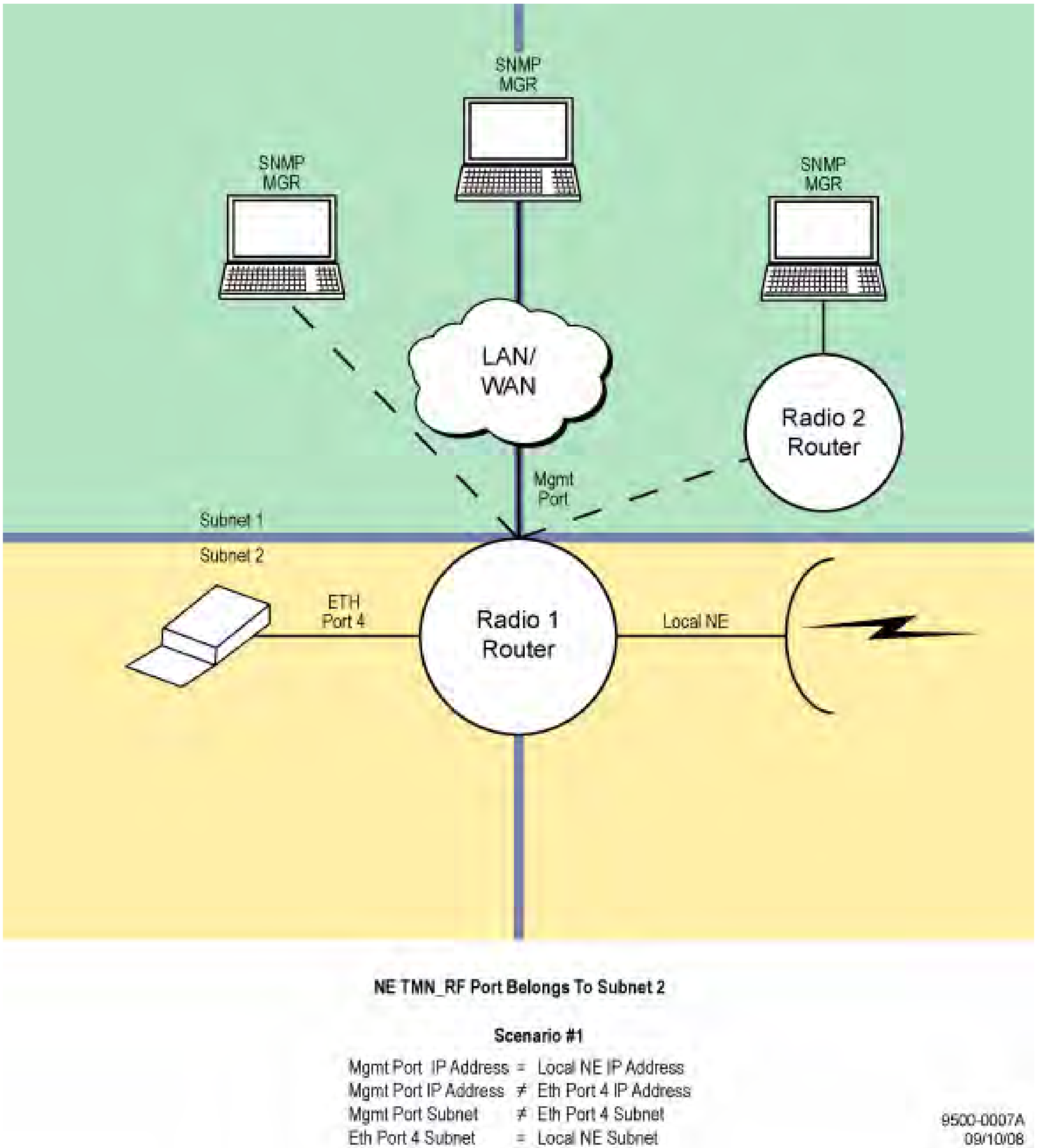


Figure 6-125. NE TMN_RF port belongs to subnet 1

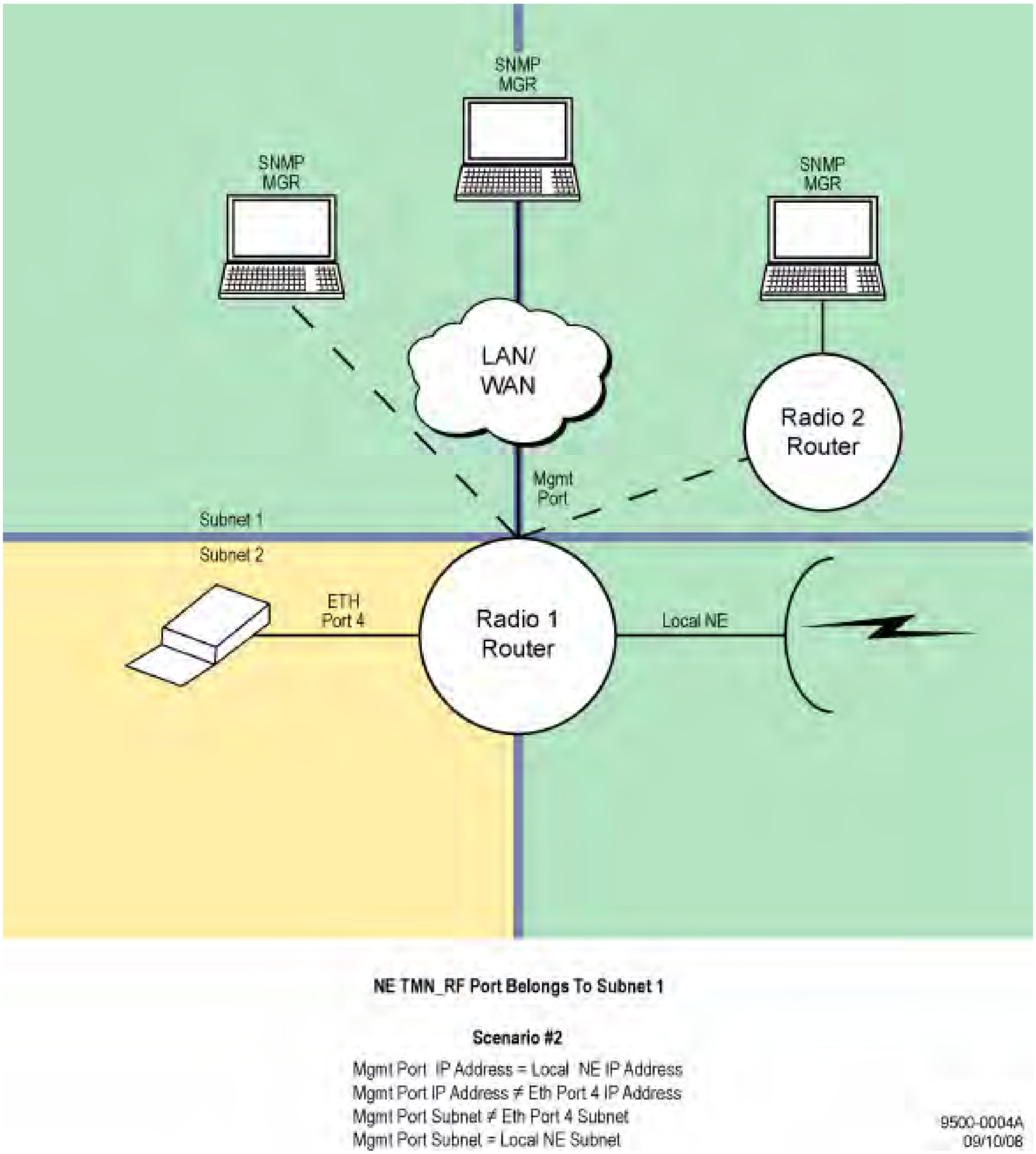
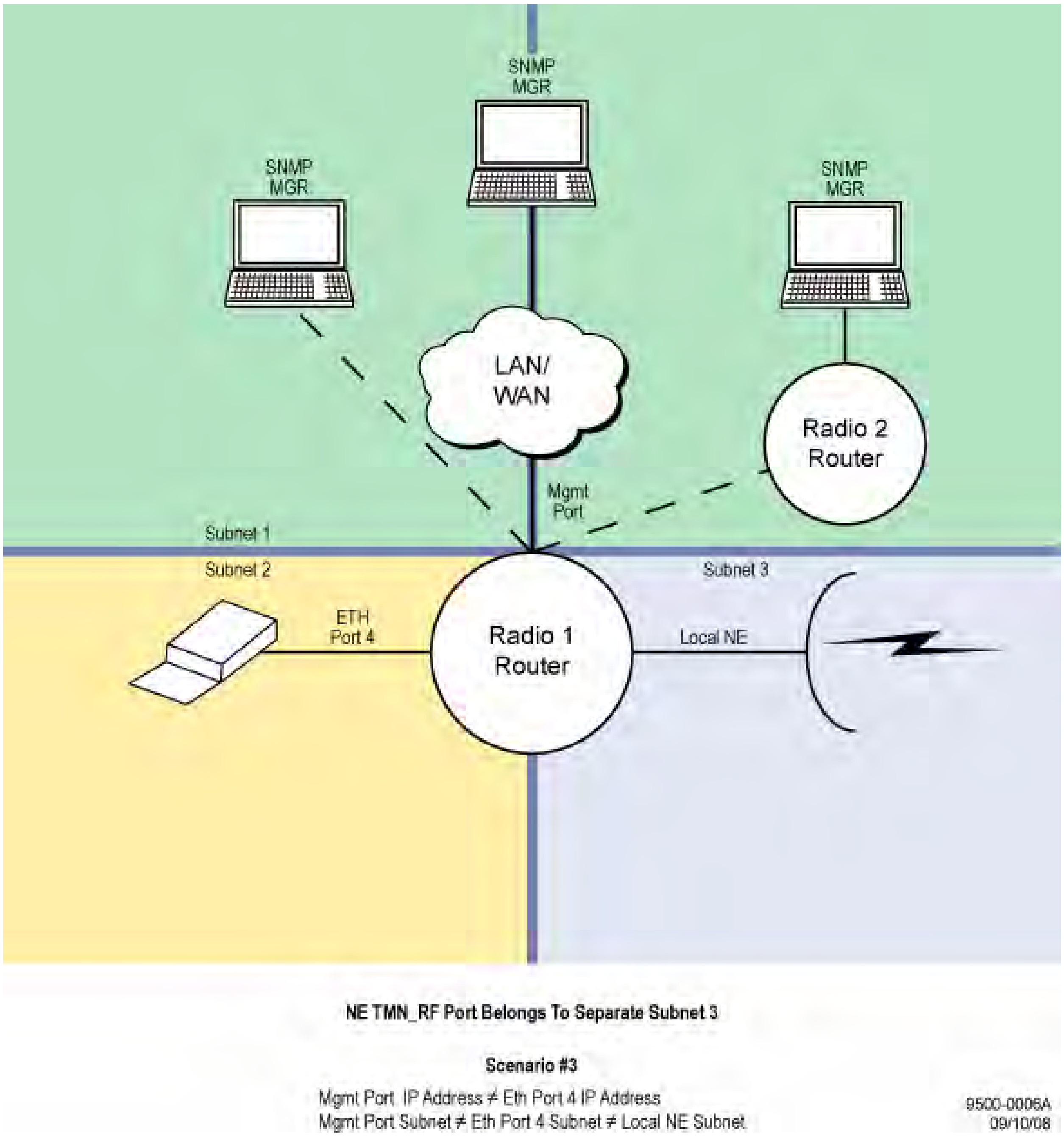


Figure 6-126. NE TMN_RF port belongs to separate subnet 3



Open shortest path first (OSPF)

- The preferred method for routing within the radio WANs.
- Uses a simplified OSPF implementation.

- Configuration requires only an Area ID and Mask.
- Supports redundant WAN paths, allowing linear, tree, ring, mesh and other WAN topologies. If redundant paths are available, OSPF can reconfigure routes to work around a failed link.
- Dynamically assigns a routing metric to redundant paths based on route cost, where the route cost is determined by the speed of the interface used and the hop count to a destination.
- Does not perform route aggregation.
- Supports a maximum of 250 routes within a single OSPF area.

Static routing

- Usually used at radio WAN border routers to specify a default gateway to:
  - use for reaching external networks when the external network does not use a supported dynamic routing protocol.
  - control the exchange of dynamic route information between the radio WAN and the external network.
- Static routing only supports provisioning a single route to a given destination at any radio. Route metrics and redundant routes are not supported. This limits the useful WAN topologies to linear and tree configurations when using Static Routing.
- Maximum of 25 static route entries per radio.
  - To minimize the number of static route entries required, the radio network addressing plan should allow for maximum route aggregation.
  - Static routes directed out the PPP interfaces use the interface name as the route destination; rf, rptr, or (front) ppp.

Protection schemes

Protection schemes with MOD300/ODU300

6.937 Supported Protection types:

- RPS (Radio Protection Switching) Hitless for each radio direction (RPS-RX)

PRELIMINARY

– RPS is distributed in MOD300 cards before termination to the MOD300 radio frame circuitry.

- EPS (Equipment Protection Switching) for both transmit and receive signals

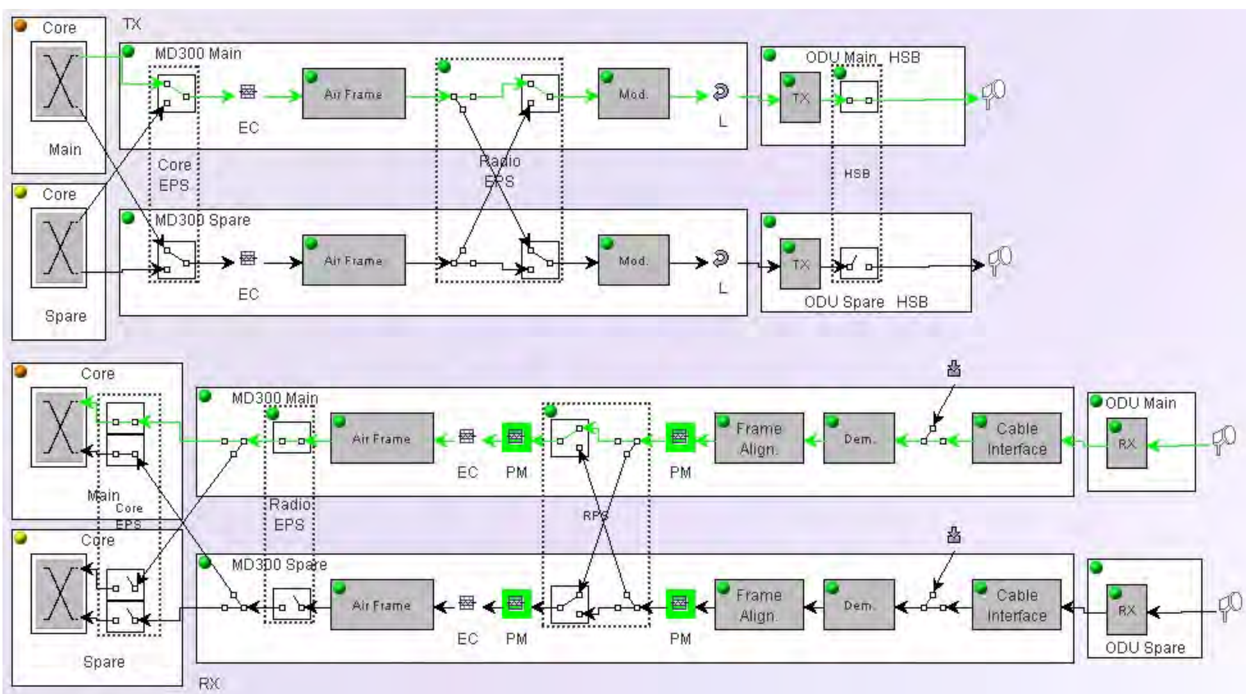
  – Tx direction: Both Working and Spare cards send their own signal to the mate MOD300 card. The Core-E selects either the main or spare signal.

  – Rx direction: The Core-E selects either the main or spare signal. The other signal is squelched.

- HSB-TPS (Hot StandBy - Transmission Protection Switch)

  – The Core-E selects either the main or spare signal. The other signal is squelched.

Figure 6-127. MOD300/ODU300 protection scheme block diagram



RPS switching criteria

6.938 The switching criteria are:

- SF (Signal Fail): generated from transmission and equipment alarms affecting the Rx radio section:

- Demodulation Fail
- IDU-ODU cable loss
- LOF of aggregate signal radio side
- Main and spare ODU, IDU HW failures (card fail)
- HBER (high BER)
- EW (Early Warning)

EPS switching criteria

6.939 The switching criteria are:

- Peripheral Card Fail (switching off of the peripheral included)
- Peripheral Card Missing
- LOS of all the tributaries (of course only in case of PDH local access peripheral protection) managed via SW.

HSB switching criteria

6.940 The switching criteria are:

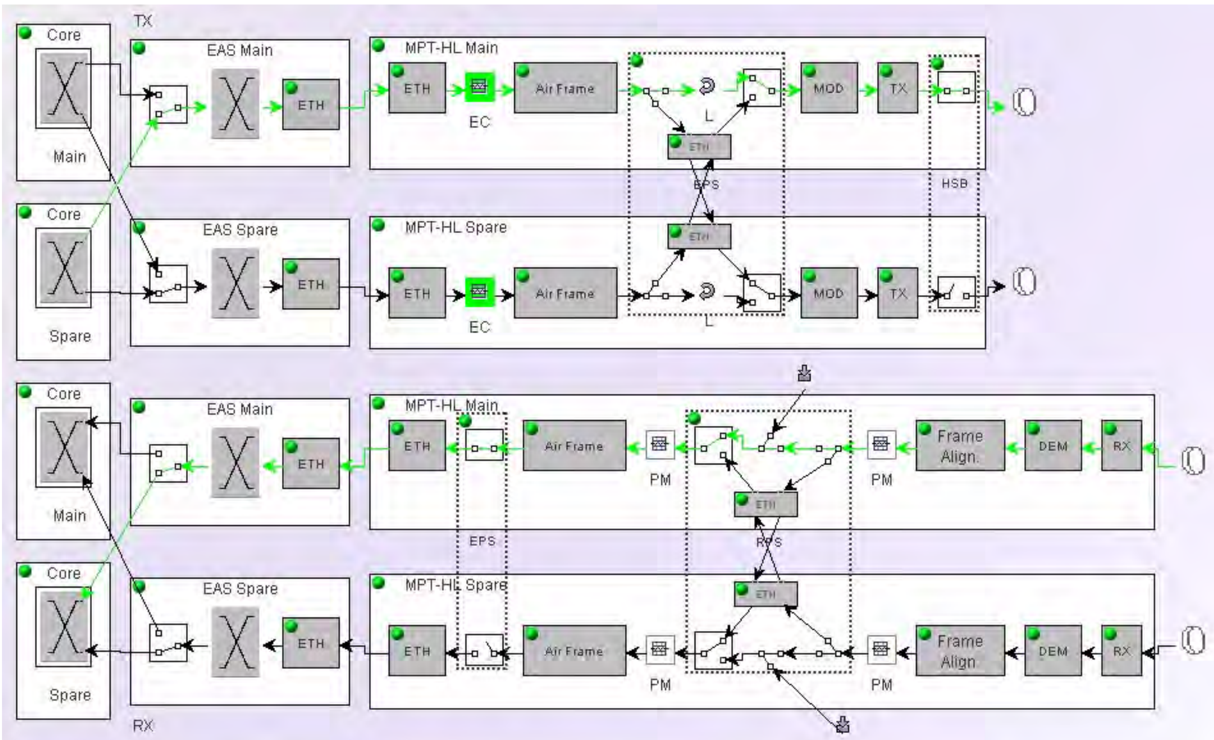
- Radio Interface Peripheral Card Fail (switching off of the peripheral included)
- Radio Interface Peripheral Card Missing
- MSS-ODU cable loss
- ODU TX chain alarm (this is an OR of the following alarms: LOS at ODU input, modfail, txFail, ODU card fail).
- Incompatible Shifter alarm
- Incompatible Frequency alarm
- Incompatible Power alarm
- Incompatible Modulation Parameters alarm
- Common Loss Alarm

Protection schemes with MPT-HL

6.941 Supported Protection types:

- RPS (Radio Protection Switching) Hitless for each radio direction (RPS-RX)
  – RPS is distributed in MPT-HL Transceivers before termination to the MPT-HL Transceiver radio frame circuitry.
- EPS (Equipment Protection Switching) for both transmit and receive signals
  – Tx direction: Both Working and Spare MPT-HL Transceiver send their own signal to the mate MPT-HL Transceiver. The Core-E selects either the main or spare signal.
  – Rx direction: The Core-E selects either the main or spare signal after MPT-HL Transceiver radio frame circuitry. The other signal is squelched.
- HSB-TPS (Hot StandBy - Transmission Protection Switch)
  – The Core-E selects either the main or spare signal. The other signal is squelched.

Figure 6-128. MPT-HL protection scheme block diagram



RPS switching criteria

6.942 The switching criteria are:

- SF (Signal Fail): generated from transmission and equipment alarms affecting the Rx radio section:
- Demodulation Fail
- MPT-HL link failure
- LOF of aggregate signal radio side
- Main and spare IDU HW failures (card fail)
- HBER (high BER)
- EW (Early Warning)

EPS switching criteria

6.943 The switching criteria are:

- MPT-HL Transceiver Fail (switching off of the peripheral included)
- MPT-HL Transceiver Missing
- LOS of all the tributaries (of course only in case of PDH local access peripheral protection) managed via SW.

HSB switching criteria

6.944 The switching criteria are:

- MPT-HL Transceiver Fail (switching off of the peripheral included)
- MPT-HL Transceiver Missing
- IDU TX chain alarm (this is an OR of the following alarms: LOS at IF input, modfail, txFail, IDU card fail).
- Incompatible Shifter alarm
- Incompatible Frequency alarm
- Incompatible Power alarm
- Incompatible Modulation Parameters alarm
- Common Loss Alarm

Protection schemes with MPT-HC/XP

6.945 To implement the 1+1 configuration an optional external module (RPS or XPIC+RPS) and optical cable may be connected from one MPT-HC/XP to the second MPT-HC/XP. In Figure 6-129 Ethernet port 2 of one MPT-HC/XP is connected to Ethernet port 2 of the second MPT-HC/XP.

NOTE: In Figure 6-129 the two MPT are connected to two different MPT Access units, but they can also be connected to the same MPT Access Unit.

Supported protection types:

- RPS (Radio Protection Switching) Hitless for each radio direction
  - RPS can be implemented with or without the external module and interconnection cable between the two MPT-HC/XP.
  - When no external module and interconnection cable is used, the 1+1 RPS messages are exchanged in the MSS-4/MSS-8 shelf.

   - When the external modules and interconnection cable is used, the 1+1 RPS messages are exchanged between the MPT-HC/XPs.

- EPS (Equipment Protection Switching) for the MPT-HC/XP

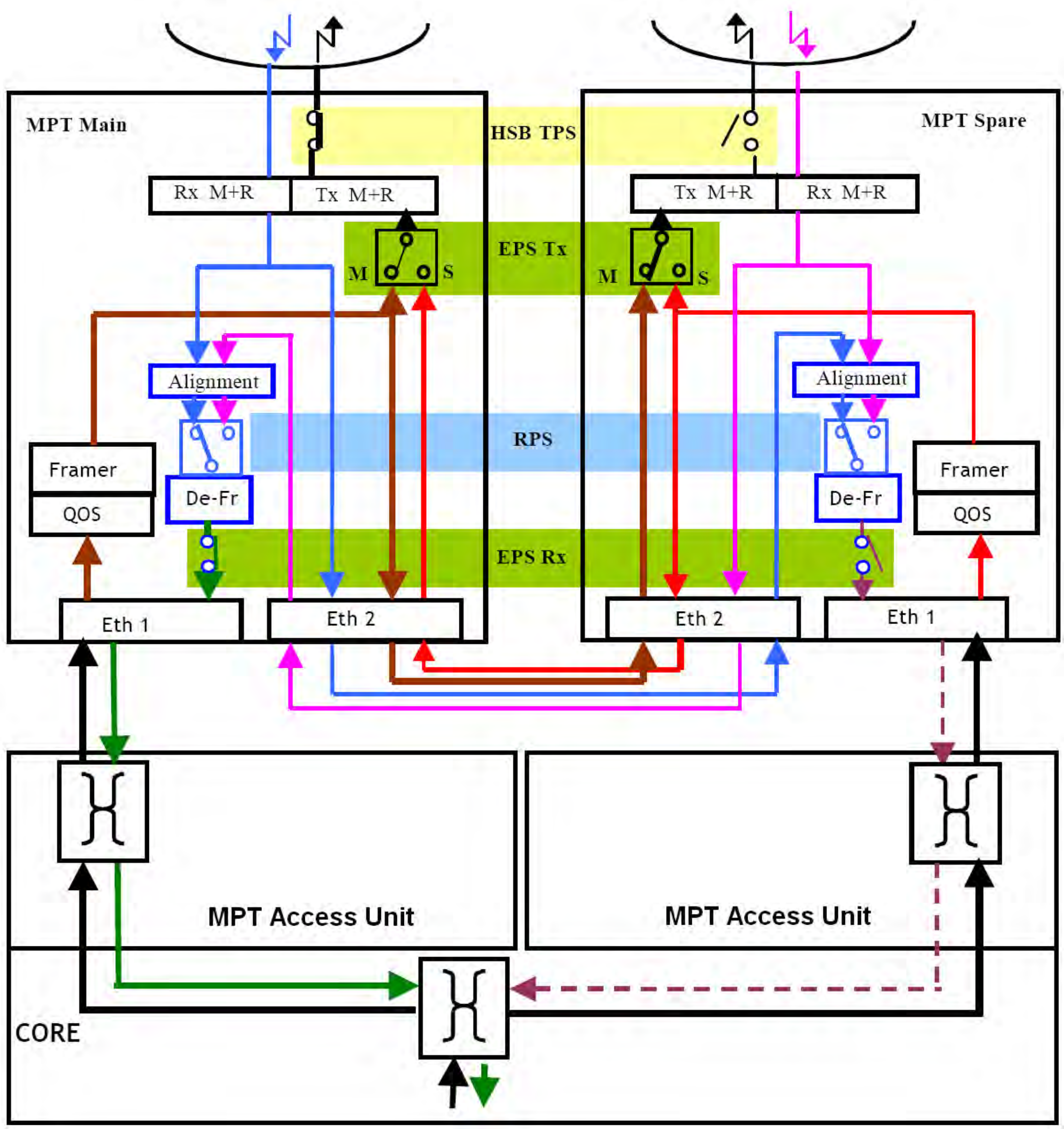
   - EPS protects the MPT-HC/XP and the cables connecting it to the MSS.

- HSB-TPS (Hot StandBy - Transmission Protection Switch)

   - Spare ODU module is squelched.

PRELIMINARY

Figure 6-129. MPT-HC/XP protection schemes



RPS switching criteria

6.946 The switching criteria are:

- SF (Signal Fail): generated from transmission and equipment alarms affecting the Rx radio section
- Rx Fail

- Demodulation Fail
- LOF of aggregate signal radio side
- inter-MPT coupling link failure
- HBER (high BER) based on the demodulated erroneous blocks ratio
- EW (Early Warning) based on MSE

6.947 Moreover, MPT-HC/XP supports a further embedded functionality called "Enhanced RPS". Enhanced RPS is a frame-based protection mechanism, aimed to reach a quick reaction time and increasing significantly the quality of the radio interface in the Rx side. It assumes the alignment between the 2 received radio channels and it is based on frame by frame selection of the "best" frame between the frames received from the Main and the Spare radio channel. The Enhanced RPS assumes that the "classical" RPS criteria are used to give indication about the "preferred" channel, whose frame has to be selected, when the frame-based choice between the 2 streams is not possible (e.g. due to the frame alignment error). The Enhanced RPS switching criterion depends on the presence of errors in the decoded LDPC word.

EPS switching criteria

6.948 The switching criteria are:

- MPT Access Card Fail
- MPT Access Card Missing
- IDU-ODU Connection Failure
- ICP alarm
- LOS of all the tributaries (of course only in case of PDH local access peripheral protection) managed via SW.
- Mated MPT Access card Failure

HSB switching criteria

6.949 The switching criteria are:

- MPT-HC/XP Access Card Fail status
- IDU-ODU Connection Failure
- ICP alarm

- Incompatible Shifter alarm
- Incompatible Frequency alarm
- Incompatible Power alarm
- Incompatible Modulation Parameters alarm
- Mated MPT-HC/XP Access card Failure
- Inter-MPT-HC/XP coupling link failure. Where there is a cross configuration (EPS on Spare & TPS on main), HSB (TPS) will switch and align with EPS position, if there is an inter-MPR coupling link failure.

Core-E protection

6.950 The logic of this protection is distributed in each access and radio peripheral unit. All the switching criteria coming from both the Core units, are available (via backpanel) to each peripheral in order to allow to each logic to take the same decision.

6.951 Both the Cores (main and spare) send their signals to all the traffic peripherals.

6.952 Core protection supports two different types of protection:

- Traffic/services protection (protection of all the transport functions with the exception of the control platform)
- Control Platform protection

6.953 In order to provide this protection the Flash Cards on the two Core boards are kept aligned (in terms of SW and configuration data) both in case of new operations done by the management systems and in case of Flash Card replacement.

User ethernet interfaces protection

6.954 In order to support User Ethernet interfaces protection using an external device, the User Ethernet ports of the Core in standby status are switched off.

6.955 The switch on of the User Ethernet interfaces when the Core in standby status becomes active, due to operator commands or automatic switch, is done within few seconds. In case of Optical Ethernet interface, the Lambda, Link Length, Connector and Gigabit Ethernet Compliance Code information are read from the active Core.

TMN local ethernet interface protection

6.956 In order to support TMN Local Ethernet interface protection using an external device, the relevant Ethernet port of the Core in standby status is switched off.

6.957 The switch on of the TMN Local Ethernet interface when the Core in standby status becomes active, due to operator commands or automatic switch, is done within 5 seconds.

6.958 In order to avoid impact on the Core, the external device used for the TMN Local Ethernet interface protection is kept separate from the one used for protection of User Ethernet interface.

6.959 **Note:** When the Core-e unit is protected, it is suggested to protect the Ethernet data ports also to avoid loosing of traffic after a Core switch. If the Ethernet cables are not protected, it is recommended to enable “LOS as switch criteria” and to enable “Static LAG”.

External synchronization interface protection

6.960 The Protection of the external synchronization interface is supported. The output port on the stand-by Core is muted.

Node-timed PDH interface protection

6.961 In case of node-timed PDH interface the protection of the NE Clock provided by Core is supported.

Core protection restoration mode

6.962 The restoration mode is always non revertive: the Core main becomes active as soon as it has recovered from failure or when a switch command is released.

Core-E protection switching criteria

6.963 The switching criteria are:

- Core Card Fail
- Core Card Missing
- Control Platform operational status failure
- Flash Card realignment in progress
- Flash Card failure

6.964 If the “Ethernet LOS Criteria” feature has been enabled the following additional switching criteria are added:

- Card Fail of SFP optical module
- Card Missing of SFP optical module
- LOS of any Electrical User Ethernet interfaces, including the LOS of the forth User Ethernet interface working as TMN Local Ethernet interface.

N.B. In case of stand-by Flash Card realignment in progress, the application SW refuses/removes a manual switch command.

7. Engineering specifications

7.1 This section provides basic information and specifications relating to signal interfaces, alarm interfaces, and control interfaces. Information about connection points, connector types, and pin assignments are also provided.

Rack specifications

7.2 Refer to table 7-A for standard rack specifications. Refer to table 7-B for seismic rack specifications.

Power specifications

7.3 Refer to table 7-C for MSS-8 shelf primary power interface specifications. Refer to table 7-D for MSS-4 shelf primary power interface specifications. Refer to table 7-E for 9500 MPR-A system power requirement specifications. Refer to table 7-F for MPT-HL shelf primary power interface specifications.

Environmental specifications

7.4 Refer to table 7-G for environmental condition specifications.

Component weights

7.5 Refer to table 7-H for engineering specifications (component weights).

Radio profiles

Radio Specification

7.6 Radio specification for transmit power, receiver threshold, and system gain, refer to the 9500 MPR-A Engineering Support Documentation manual (PN 3EM23957AL), System Application Rules document, 3EM227840000BGZZA.

ODU300 — static modulation

7.7 Static modulation radio profile support in ODU300 split mount radio configuration. Refer to Table 7-I for static modulation radio profiles supported.

ODU300 — high gain static modulation

7.8 High Gain Static modulation radio profile support in ODU300 split mount radio configuration. Refer to Table 7-J for high gain static modulation radio profiles supported.

ODU300 — adaptive modulation

7.9 Adaptive modulation radio profile support in ODU300 split mount radio configuration. Refer to Table 7-K for adaptive modulation radio profiles supported.

NOTE: When radio is configured for Adaptive Modulation, a PDH to RADIO, ETH to ETH, ETH to RADIO, and RADIO to RADIO cross connect is limited to 4 QAM DS1 capacity. Refer to Modem Profile table for 4 QAM capacity.

NOTE: The modem profiles in Table 7-K are not compatible with profiles applicable to previous releases.

MPT-HC — static modulation

7.10 Static modulation radio profile support in MPT-HC split mount radio configuration. Refer to Table 7-L for static modulation radio profiles supported.

MPT-HC — high gain static modulation

7.11 High Gain Static modulation radio profile support in MPT-HC split mount radio configuration. Refer to Table 7-M for high gain static modulation radio profiles supported.

MPT-HC — XPIC static modulation

7.12 XPIC Static modulation radio profile support in MPT-HC split mount radio configuration. Refer to Table 7-N for XPIC static modulation radio profiles supported.

MPT-HC — high gain XPIC static modulation

7.13 High Gain XPIC Static modulation radio profile support in MPT-HC split mount radio configuration. Refer to Table 7-O for high gain XPIC static modulation radio profiles supported.

MPT-HC — adaptive modulation

7.14 Adaptive modulation radio profile support in MPT-HC split mount radio configuration. Refer to Table 7-P for adaptive modulation radio profiles supported.

NOTE: When radio is configured for Adaptive Modulation, PDH to RADIO, ETH to ETH, ETH to RADIO, and RADIO to RADIO cross connects are limited to the 4 QAM DS1 capacity. Refer to Modem Profile table for 4 QAM capacity.

MPT-HC — XPIC adaptive modulation

7.15 XPIC adaptive modulation radio profile support in MPT-HC split mount radio configuration. Refer to Table 7-Q for XPIC adaptive modulation radio profiles supported.

NOTE: When radio is configured for XPIC with Adaptive Modulation, PDH to RADIO, ETH to ETH, ETH to RADIO, and RADIO to RADIO cross connects are limited to the 64 QAM DS1 capacity. Refer to Modem Profile table for 64 QAM capacity.

MPT-XP — static modulation

7.16 Static modulation radio profile support in MPT-XP split mount radio configuration. Refer to Table 7-R for static modulation radio profiles supported.

MPT-XP — XPIC static modulation

7.17 XPIC Static modulation radio profile support in MPT-XP split mount radio configuration. Refer to Table 7-S for XPIC static modulation radio profiles supported.

MPT-XP — adaptive modulation

7.18 Adaptive modulation radio profile support in MPT-XP split mount radio configuration. Refer to Table 7-T for adaptive modulation radio profiles supported.

NOTE: When radio is configured for Adaptive Modulation, PDH to RADIO, ETH to ETH, ETH to RADIO, and RADIO to RADIO cross connects are limited to the 4 QAM DS1 capacity. Refer to Modem Profile table for 4 QAM capacity.

MPT-XP — XPIC adaptive modulation

7.19 XPIC adaptive modulation radio profile support in MPT-XP split mount radio configuration. Refer to Table 7-U for XPIC adaptive modulation radio profiles supported.

NOTE: When radio is configured for XPIC with Adaptive Modulation, PDH to RADIO, ETH to ETH, ETH to RADIO, and RADIO to RADIO cross connects are limited to the 64 QAM DS1 capacity. Refer to Modem Profile table for 64 QAM capacity.

MPT-HL transceiver — static modulation

7.20 Static modulation radio profile support in MPT-HL all indoor mount radio configuration. Refer to Table 7-V for static modulation radio profiles supported.

MPT-HL transceiver — high gain static modulation

7.21 High Gain Static modulation radio profile support in MPT-HL all indoor mount radio configuration. Refer to Table 7-W for high gain static modulation radio profiles supported.

MPT-HL transceiver — adaptive modulation

7.22 Adaptive modulation radio profile support in All Indoor mount radio configuration. Refer to Table 7-X for adaptive modulation radio profiles supported.

Signal interface

7.23 System signal interfaces comply with customer interface specifications. Supported signal interfaces include the following: DS1, DS3, 10/100/1000 BaseT (electrical) Ethernet, and Gigabit (GigE optical) Ethernet SFP cable connectors.

Signal cable connections

7.24 Each P32E1DS1 DS1 card provides two 68-position SCSI connectors. Each SCSI connector supports sixteen (Tx and Rx) DS1 connections for customer DS1 cable interconnect for unprotected P32E1DS1-equipped MSS-8 shelf for a total of thirty-two DS1 connections per P32E1DS1 card.

7.25 Optional DS1 D-Connector patch panel provides four 37-position D-Sub connectors for customer DS1 cable interconnect for the P32E1DS1 equipped MSS-8 shelf. There are thirty-two (Tx and Rx) DS1 connections available on the DS1 D-Connector patch panel and feed each DS1 signal to both the main and spare P32E1DS1 cards in protected P32E1DS1 configurations.

7.26 Optional DS1 RJ-45 patch panel provides thirty-two RJ-45 connectors for customer DS1 cable interconnect for the P32E1DS1 equipped MSS-8 shelf. There are thirty-two (Tx and Rx) DS1 connections available on the DS1 RJ-45 patch panel and feed each DS1 signal to both the main and spare P32E1DS1 cards in protected P32E1DS1 configurations.

7.27 Four mini-BNC connectors on the 2-port P2E3DS3 card provide two (Tx and Rx) DS3 mini-BNC connections for customer DS3 cable interconnect for unprotected P2E3DS3-equipped MSS-8 shelf. Optional mini-BNC to BNC cables are available to provide a typical DS3 interface.

7.28 Optional DS3 Hybrid 3 dB splitters provide (Tx and Rx) DS3 BNC connections and feed each DS3 signal to both main and spare P2E3DS3 cards.

7.29 Four RJ-45 connectors on the Core-E card provides access to the four 10/100/1000 Base-T Ethernet ports for customer 10/100/1000 Base-T Ethernet interconnect.

7.30 One GigE optical SFP port on the Core-E card provides customer access to the GigE optical port on the Core-E card.

7.31 Four RJ-45 connectors on the P8ETH card provide access to the four 10/100/1000 Base-T Ethernet ports for customer 10/100/1000 Base-T Ethernet interconnect.

7.32 Four GigE optical SFP ports on the P8ETH card provides customer access to the four GigE optical ports on the P8ETH card. Optionally, the four GigE optical SFP ports are used to interface MPT-HL transceiver cards.

DS1 interface

7.33 Refer to table 7-Y for the DS1 interface specifications. See figure 7-1 for the asynchronous DS1 format template. The template specifies the signal waveshape boundaries. DS1 waveshape at the 9500 MPR-A must fit within the template bounds. See figures 7-2, 7-3, and 7-4 for DS3 jitter characteristics.

PRELIMINARY

DS3 interface

7.34 Refer to table 7-Z for the DS3 interface specifications. See figure 7-5 for the asynchronous DS3 format template. The template specifies the signal waveshape boundaries. DS3 waveshape at the DSX must fit within the template bounds. See figures 7-6, 7-7, and 7-8 for DS3 jitter characteristics.

Control interface

7.35 One RJ-45 connector on the Core-E cards provide access to the NMS (MGMT) Craft port.

7.36 Optionally, Core-E 10/100/1000 BaseT Ethernet interface port 4 can be configured for TMN Ethernet interface.

7.37 Optionally, Core-E 10/100/1000 BaseT Ethernet interface ports 1 through 4 and/or Core-E GigE SFP port 5 and/or 6 can be configured to support In-band TMN VLAN traffic.

Rack specifications

Table 7-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.
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 7-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.
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.

Power specifications

Table 7-C. Primary power interface specifications — MSS-8 shelf

ITEM	CHARACTERISTICS
1. Location	
PDU	A power in (APWR) B power in (BPWR) Separate power return (GND)
Top of bay	CO bay ground
Function	Separates office primary power and ground from rack
2. Input voltage	
-48 Vdc (nominal) systems	-40.8 to -57.6 Vdc An absolute input voltage less than -40.8 V dc for -48 Vdc systems does not damage equipment. Low input voltage shutdown occurs when the voltage is -32.0 to -36.0 V dc for greater than 100 ms. Turn-on voltage is -34.0 to -40.8 V dc, not less than 2 V dc greater than shutdown voltage.
+24 Vdc (nominal) systems +24 Vdc office applications require the optional +24/-48 Volt Converter card.	+19 to +36 Vdc An absolute input voltage less than +19 V dc for +24 Vdc systems does not damage equipment. Low input voltage shutdown occurs when the voltage is +18.0 to +19.0 V dc for greater than 100 ms. Turn-on voltage is +19.0 to +20.0 V dc, not less than 1 V dc greater than shutdown voltage.

Table 7-C. Primary power interface specifications — MSS-8 shelf (cont.)

ITEM	CHARACTERISTICS
3. Isolation	Positive primary power return is internally connected to CO ground.
4. Input power	Power consumption varies with system size, fill, and options provided.
5. Power consumption	Expected worst case power consumption of a fully equipped shelf at -48 V dc (subtract 20% for typical power):
MSS-8 shelf (fully equipped)	423 W
MSS-8 shelf equipped with +24/-48 Volt Converter	383 W (348 W max total output power including any connected ODUs plus converter efficiency (90% - 92%))
6. Typical Configurations:	
MSS-8 Shelf equipped w/2 Core-E, 2 P8ETH, 4 P32E1DS1 cards, and 1 FAN	140 W
MSS-8 Shelf equipped w/1 Core-E, 1 MOD300, 2 P32E1DS1 cards, 1 ODU[1], and 1 FAN	121.5 W
MSS-8 Shelf equipped w/2 Core-E, 2 MOD300, 2 P32E1DS1 cards, 2 ODU[1], and 1 FAN	204 W
MSS-8 Shelf equipped w/2 Core-E, 4 MOD300, 2 P32E1DS1 cards, 4 ODUs[1], and 1 FAN	329 W
MSS-8 Shelf equipped w/2 Core-E, 6 MOD300, cards, 6 ODUs[1], and 1 FAN	423 W

[1] ODU300 TABLE 7-C is not resident within the MSS-4/8 shelf, But it's power is supplied through the MOD300 card. Thus the ODU300 power consumption must be included with the MSS-4/8 shelf for fusing/circuit breaker consideration. For heat dissipation calculations, the ODU300 should be excluded from MSS-4/8 shelf power consumption.

Table 7-D. Primary power interface specifications — MSS-4 shelf

ITEM	CHARACTERISTICS
1. Location	
PDU	A power in (APWR) B power in (BPWR) Separate power return (GND)
Top of bay	CO bay ground
Function	Separates office primary power and ground from rack
2. Input voltage	

Table 7-D. Primary power interface specifications — MSS-4 shelf (cont.)

ITEM	CHARACTERISTICS
-48 V (nominal) systems	-40.8 to -57.6 volts An absolute input voltage less than -40.8 V dc for -48 V systems does not damage equipment. Low input voltage shutdown occurs when the voltage is -32.0 to -36.0 V dc for greater than 100 ms. Turn-on voltage is -34.0 to -40.8 V dc, not less than 2 V dc greater than shutdown voltage.
3. Isolation	Positive primary power return is internally connected to CO ground.
4. Input power	Power consumption varies with system size, fill, and options provided.
5. Power consumption	Expected worst case power consumption of a fully equipped shelf at -48 V dc (subtract 20% for typical power):
MSS-4 shelf (fully equipped)	423 W
6. Typical Configurations:	
MSS-4 Shelf equipped w/1 Core-E, 1 P8ETH, 1 P32E1DS1 cards, and 1 FAN	74 W
MSS-4 Shelf equipped w/2 Core-E, 4 P32E1DS1 cards, and 1 FAN	140 W
MSS-4 Shelf equipped w/1 Core-E, 1 MOD300, 1 P32E1DS1 cards, 1 ODU[1], and 1 FAN	121.5 W
MSS-8 Shelf equipped w/2 Core-E, 2 MPTACC cards, 4 MPT-HC[2], and 1 FAN	204 W

[1] ODU300 is not resident within the MSS-4/8 shelf, But it's power is supplied through the MOD300 card. Thus the ODU300 power consumption must be included with the MSS-4/8 shelf for fusing/circuit breaker consideration. For heat dissipation calculations, the ODU300 should be excluded from MSS-4/8 shelf power consumption.
[2] MPT-HC is not resident within the MSS-4/8 shelf, But it's power may be supplied through the MPTACC card. Thus the MPT-HC power consumption could be included with the MSS-4/8 shelf for fusing/circuit breaker consideration. For heat dissipation calculations, the MPT-HC should be excluded from MSS-4/8 shelf power consumption.

PRELIMINARY

Table 7-E. Power consumption — MSS-4/8 shelf cards

ITEM	MAXIMUM POWER CONSUMPTION	TYPICAL POWER CONSUMPTION
+24/-48 Volt Converter[1]	35 W	28 W
AUX	10 W	9 W
Core-E (CORE-E)	20 W	16 W
FAN 2U Card (MSS-8)	8 W	8 W
FAN 2U Card w/Alarms (MSS-8)	25 W	22 W
FAN 1U Card (MSS-4)	5 W	5 W
MOD300 Radio Interface	23 W	21
MPTACC	17 W	13.5 W
MPT-HC[2]	39 W	37 W
MPT-HC[2] with 1+1 RPS module	40 W	38 W
MPT-HC[2] with XPIC+RPS module	47 W	45 W
MPT-XP	70 W	67 W
MPT-XP with 1+1 RPS module	70 W	67 W
MPT-XP with XPIC+RPS module	78 W	73 W
ODU300[3]	45 W for ODUs < 15 GHz 30 W for ODUs > 15 GHz	
P2E3DS3 DS3 PDH Interface	15.5 W	9 W
P8ETH Ethernet Access Switch	15 W	12
P32E1DS1 DS1 PDH Interface	15.5 W	

[1] +24/-48 Volt Converter power consumption equals 8% typical, 10% maximum, of MSS-8 shelf and connected ODUs power consumption.
[2] MPT-HC is not resident within the MSS-4/8 shelf, But it's power may be supplied through the MPTACC card. Thus the MPT-HC power consumption could be included with the MSS-4/8 shelf for fusing/circuit breaker consideration. For heat dissipation calculations, the MPT-HC should be excluded from MSS-4/8 shelf power consumption.
[3] ODU300 is not resident within the MSS-4/8 shelf, But it's power is supplied through the MOD300 card. Thus the ODU300 power consumption must be included with the MSS-4/8 shelf for fusing/circuit breaker consideration. For heat dissipation calculations, the ODU300 should be excluded from MSS-4/8 shelf power consumption.

Table 7-F. Primary power interface specifications — MPT-HL shelf

ITEM	CHARACTERISTICS
1. Location	
PDU	A power in (slot 1) B power in (slot 2) Separate power return (GND)
Top of bay	CO bay ground
Function	Separates office primary power and ground from rack

Table 7-F. Primary power interface specifications — MPT-HL shelf (cont.)

ITEM	CHARACTERISTICS
2. Input voltage	
-24/48 V (nominal) systems	-20.4 to -57.6 volts An input voltage less negative than -20.4 V dc for -24/48 V systems does not damage equipment. Low input voltage shutdown occurs when the voltage is less negative than -17.0 V dc for greater than 100 ms. Turn-on voltage is -20.0 V dc or more negative.
+24/48 V (nominal) systems	+20.4 to +57.6 volts An input voltage less than +20.4 V dc for +24/48 V systems does not damage equipment. Low input voltage shutdown occurs when the voltage is +17.0 V dc or less for greater than 100 ms. Turn-on voltage is +20.0 V dc or greater.
3. Isolation	Positive primary power return is isolated from CO ground by more than 100 kilohms as measured per Telcordia TA-EOP-000295.
4. Input power	Power consumption varies with system size, fill, and options provided.
5. Power consumption	Expected worst case power consumption of a fully equipped shelf at -48 V dc (subtract 20% for typical power):
MPT-HL shelf (fully equipped)	280 W
MPT-HL Transceiver	140 W
6. Typical Configurations:	
MPT-HL shelf equipped w/1 MPT-HL Transceiver	140 W
MPT-HL shelf equipped w/2 MPT-HL Transceivers	280 W

Environmental specifications

Table 7-G. Environmental condition specifications

ITEM	ASSEMBLY	OPERATING	NONOPERATING

PRELIMINARY

Table 7-G. Environmental condition specifications (cont.)

1. Ambient temperature[1]	MPT-HL, MSS-8, MSS-4	-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	MPT-HL, MSS-8, MSS-4, Power Injector	5 to 85%[3] (without condensation)	0 to 95% (without condensation)
	MPT-HC, MPT-XP, ODU300,	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-8, MSS-4, MPT-HL	Forced air	
5. Vibration and shock	MSS-8, MSS-4, MPT-HC, MPT-HL, 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 +50 °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).

Component weights

Table 7-H. 9500 MPR-A engineering data (component weight)

COMPONET	WEIGHT (LBS)
MSS-8 shelf (fully equipped)	6 kg (13.2 lb.)
MPT-HL shelf (fully equipped)	12.3 kg (27.0 lb.)
ODU300	5.9 kg (13 lb.)

Radio profiles

Table 7-I. Radio profiles: ODU300, static modulation

CHANNEL FREQUENCY	MODULATION SCHEME	BANDWIDTH / MAXIMUM DATA PAYLOAD CAPACITY			
		10 MHz	30 MHz	40 MHZ	50 MHz
Lower 6 GHz	**64QAM**		131.09 Mbps		
	128QAM	52.64 Mbps	160.17 Mbps		
	256QAM		183.3 Mbps		
Upper 6 GHz	128QAM	52.64 Mbps			
7/8 GH	32QAM	37.32 Mbps	114.22 Mbps		
	64QAM		131.09 Mbps		
	128QAM	52.64 Mbps	160.17 Mbps		
	256QAM		183.30 Mbps		
11 GHz	32QAM			152.29 Mbps	
	128QAM	52.64 Mbps	160.17 Mbps	213.94 Mbps	
	256QAM		183.30 Mbps	245.19 Mbps	
15 GHz	16QAM			122.03 Mbps	
	32QAM	37.32 Mbps	114.22 Mbps	152.29 Mbps	
	128QAM	52.64 Mbps	160.17 Mbps	213.94 Mbps	
	256QAM		183.30 Mbps	245.19 Mbps	
18 GHz	32QAM	37.32 Mbps	114.22 Mbps	152.29 Mbps	190.80 Mbps
	128QAM		160.17 Mbps	213.94 Mbps	267.70 Mbps
	256QAM		183.30 Mbps	245.19 Mbps	306.77 Mbps

PRELIMINARY

Table 7-I. Radio profiles: ODU300, static modulation (cont.)

CHANNEL FREQUENCY	MODULATION SCHEME	BANDWIDTH / MAXIMUM DATA PAYLOAD CAPACITY			
		10 MHz	30 MHz	40 MHZ	50 MHz
23 GHz	32QAM	37.32 Mbps	114.22 Mbps	152.29 Mbps	190.80 Mbps
	128QAM	52.64 Mbps	160.17 Mbps	213.94 Mbps	267.70 Mbps
	256QAM		183.30 Mbps	245.19 Mbps	306.77 Mbps
38 GHz	256QAM				306.77 Mbps

Table 7-J. Radio profiles: ODU300, high gain static modulation

CHANNEL FREQUENCY	MODULATION SCHEME	BANDWIDTH / MAXIMUM DATA PAYLOAD CAPACITY		
		30 MHz	40 MHZ	50 MHz
Lower 6 GHz	256QAM	160.17 Mbps		
7/8 GHz	128QAM	131.09 Mbps		
	256QAM	160.17 Mbps		
11 GHz	128QAM	131.10 Mbps	183.30 Mbps	
	256QAM	160.17 Mbps	213.94 Mbps	
15 GHz	128QAM	131.10 Mbps	183.30 Mbps	
	256QAM	160.17 Mbps	213.94 Mbps	
18 GHz	128QAM	131.10 Mbps	183.30 Mbps	228.00 Mbps
	256QAM	160.17 Mbps	213.94 Mbps	267.70 Mbps
23 GHz	128QAM	131.10 Mbps	183.30 Mbps	228.63 Mbps
	256QAM	160.17 Mbps	213.94 Mbps	267.70 Mbps
38 GHz	256QAM			267.70 Mbps

Table 7-K. Radio profiles: ODU300, adaptive modulation[1]

CHANNEL FREQUENCY	MODULATION SCHEME	BANDWIDTH / DATA PAYLOAD CAPACITY
		30 MHz
Lower 6 GHz	4 QAM[2]	42.950 Mbps
	16 QAM[2]	85.024 Mbps
	64 QAM[2]	131.099 Mbps
	128 QAM	158.169 Mbps
	256 QAM	180.926 Mbps

Table 7-K. Radio profiles: ODU300, adaptive modulation[1]

CHANNEL FREQUENCY	MODULATION SCHEME	BANDWIDTH / DATA PAYLOAD CAPACITY
		30 MHz
Upper 6 GHz	4 QAM[2]	
	16 QAM[2]	
	64 QAM	
	128 QAM	158.169 Mbps
	256 QAM	180.926 Mbps
7/8 GHz	4 QAM	42.950 Mbps
	16 QAM	85.024 Mbps
	64 QAM	131.099 Mbps
11 GHz	4 QAM[2]	42.950 Mbps
	16 QAM[2]	85.024 Mbps
	64 QAM[2]	131.099 Mbps
	128 QAM	158.169 Mbps
	256 QAM	180.926 Mbps
15 GHz	4 QAM	42.950 Mbps
	16 QAM	85.024 Mbps
	64 QAM	131.099 Mbps
18 GHz	4QAM	42.950 Mbps
	16QAM	85.024 Mbps
	64 QAM	131.099 Mbps
	128 QAM	158.169 Mbps
	256 QAM	180.926 Mbps
23 GHz	4 QAM	42.950 Mbps
	16 QAM	85.024 Mbps
	64 QAM	131.099 Mbps

[1] Note: The modem profiles in Table 7-K are not compatible with profiles applicable to previous releases.
[2] Subject to FCC Part 101 Rules.