

SpectralWave MN2300

Multi Service Transport Node

TECHNICAL DESCRIPTION

CONTENTS

1. OVERVIEW	2
1.1 General.....	2
1.2 Features Summary.....	2
1.3 General Specifications	4
1.4 SDH Mapping.....	5
2. NETWORK APPLICATIONS	6
2.1 Various Network Applications	6
3. PHYSICAL DESCRIPTION.....	7
3.1 Basic Configuration	7
4. BRIEF PACKAGE INTRODUCTION	7
5. OAM&P	9
5.1 Configuration Management.....	9
5.2 Fault Management.....	9
5.3 Performance Monitoring.....	10
6. Management System.....	11
7. TECHNICAL SUMMARY	12
7.1 System Parameters.....	12
7.2 Interfaces	12
7.2.1 STM-16 /4 /1 Optical Interface.....	12
7.2.2 Gigabit Ethernet.....	12
7.2.3 STM-1 Interface (electrical)	13
7.2.4 45Mbit/s	13
7.2.5 34Mbit/s	13
7.2.6 2Mbit/s	13
7.2.7 Synchronization Interface	13
7.2.8 Internal Order wire Interface	13
7.2.9 Overhead User Channel.....	13
7.2.10 LCT Interface	14
7.2.11 NMS Interface.....	14
7.3 Environment and Mechanical	
Construction.....	14
7.3.1 Power Requirements	14
7.3.2 Environment.....	14
7.3.3 Mechanical Construction	14

1. OVERVIEW

1.1 General

The SpectralWave MN2300 is a multi-service optical transport system designed to simplify service provider networks, dramatically reducing both operational and capital expenditures. The system enables the delivery of SDH services and advanced data services-including FE and GE rapidly, efficiently and cost-effectively. With only 4U high, the compact MN2300 supports line rates as high as STM-16. It provides versatile service access capabilities and an unprecedented price/performance ratio.

The SpectralWave MN2300 measures as 531mm (Height) × 436mm (Width) × 281mm (Depth). The equipment consists of service processing and interface card slots. Multiple SpectralWave MN2300 can be installed in one rack, or together with other equipment, digital distribution frame (DDF) and/or optical distribution frame (ODF).



Figure 1.1 MN2300Shelf

1.2 Features Summary

The SpectralWave MN2300 realizes high service access ability in one single sub-rack:

- 4 × 2.5G SDH optical interface (I-16, S-16.1, L-16.1, L-16.2)
- 32 × 622M SDH optical interfaces (S-4.1, L-4.1, L-4.2)
- 32 × 155M SDH optical interfaces (S-1.1, L-1.1, L-1.2)
- 24 × GE optical interfaces
- 48 × 10M/100M Ethernet interfaces (electrical/optical)
- 378 × E1 (75Ω, 120Ω) interfaces
- 15 × E3/DS3 interfaces
- 20 × E4/STM-1e interfaces

The main features of the MN2300 are listed below:

a) High performance Ethernet interface

The MN2300 Ethernet service cards use the GFP (ITU-T G.7041) to map the Ethernet service into VC payload for transparent transmission.

1. Mapping 10M Ethernet traffic into VC-12-Xv ($X \leq 5$)
2. Mapping 100M Ethernet traffic into VC-12-Xv ($X \leq 46$) or VC-3-Xv ($X=1 - 2$)
3. Mapping 1000M Ethernet traffic into VC-3-Xv ($X=1 - 21$) or VC-4-Xv ($X=1 - 7$)
4. The value of N can be adjusted by MN9100 NMS or LCT.

b) High Flexibility

According to network requirements, the SpectralWave MN2300 can be configured as an STM-16, STM-4, or STM-1 system to support TM, ADM, and MADM NE types.

c) L2SW function

The MN2300 supports integrated L2SW functions as shown below for efficient statistical multiplexing of Ethernet frames.

- IEEE 802.1q Port/Tag VLAN
- IEEE 802.1d
- Spanning Tree Protocol
- IEEE 802.1w Rapid Spanning Tree Protocol
- IEEE 802.1p Prioritization
- IEEE 802.3x Flow Control
- IEEE802.3ad Link Aggregation
- Jumbo Frame, etc.

d) Various service support and scalable configuration

The MN2300 provides various interface packages, such as Gigabit Ethernet, Fast Ethernet, STM-4, STM-1, 45M_DS3, 34M_E3 and, E1_2M. The MN2300 has 8 interface package slots.

e) 80x80 VC-4 and 2016x2016 VC-12 matrix for flexible service support

The matrix of the MN2300 has flexible granularity of 80X80 VC-4 and 2016X2016 VC-12. This composite matrix enables VC-12 traffic grooming among VC-4 containers.

f) Multiple Protection Method

The SpectralWave MN2300 supports multiplex section protection (MSP), sub-network connection protection (SNCP), spanning-tree protocol (STP), rapid spanning-tree protocol (RSTP), ATM VP-Ring, LCAS and RPR protection (Steering and Wrapping).

The SpectralWave MN2300 also supports such equipment-level protection as 1+1 hot redundancy of system main control cards, power modules and timing (clock) modules. 1+1 hot redundancy of switch matrix. This system also provides card failure protection (CFP) for E1, E3/DS3 and E4/STM-1e services.

g) Strong data service management capacity

The SpectralWave MN2300 has strong Ethernet service access capacity, utilizing Generic Framing Procedure (GFP) to encapsulate data service. The SpectralWave MN2300 supports VC-12/VC-3/VC-4 mapping, virtual concatenation, Ethernet point to point transparent transmission, point to multiple points, multiple points to multiple points and shared ring service. It also supports IEEE 802.1Q, 802.1P, 802.1D, 802.1AD, 802.3X protocols to provide current control, port rate restriction and LCAS functionalities. The SpectralWave MN2300 provides up to 48 10M/100M Ethernet interfaces or 12 Gigabit Ethernet (GE) interfaces.

1.3 General Specifications

Table 1.1 shows interface types, the number of ports per package, protection types and matrix capacity supported by MN2300.

Characteristics of the optical interfaces supported are provided in Section 7 of this document.

Table 1.1 MN2300 General Specifications

	Interface	Ports per Package () means maximum ports per Equipment	Protection			
			2-Fiber MS-SP Ring	SNCP	Linear MSP	Package
Main Shelf						
Line Interface and Protection Support	STM-16 Optical	1(4)	O	O	O	
	STM-4 Optical	1,2 or 4 (32)	O	O	O	1+1, 1:1
	STM-1 Optical	1,2 or 4 (32)		O	O	1+1, 1:1
	STM-1 Electrical	4 (20 w/o protection) (16 with protection)		O		1:N N=1 to 4
	Gigabit Ethernet	4 (24)				-
	Fast Ethernet	8 (48)				-
	DS3-45 Mbit/s	3 (15 w/o protection) (12 with protection)				1:N N=1 to 4
	E3-34 Mbit/s	3 (15 w/o protection) (12 with protection)				1:N N=1 to 4
	E1-2 Mbit/s	63 (378 w/o protection) (315 with protection)				1:N N=1 to 5
Cross-connect Level	80 x 80 VC-4, 96 x 96 VC-3, 2016 x 2016 VC-12 VC-4-Xv, VC-3Xv, VC-12-Xv Virtual Concatenation (VCAT)					

1.4 SDH Mapping

The MN2300 design is based on all relevant ITU-T SDH Recommendations and specifications from ETSI.

Lower speed signals are multiplexed to higher speed SDH signals using the standard SDH multiplexing paths, as shown in Figure 1.2.

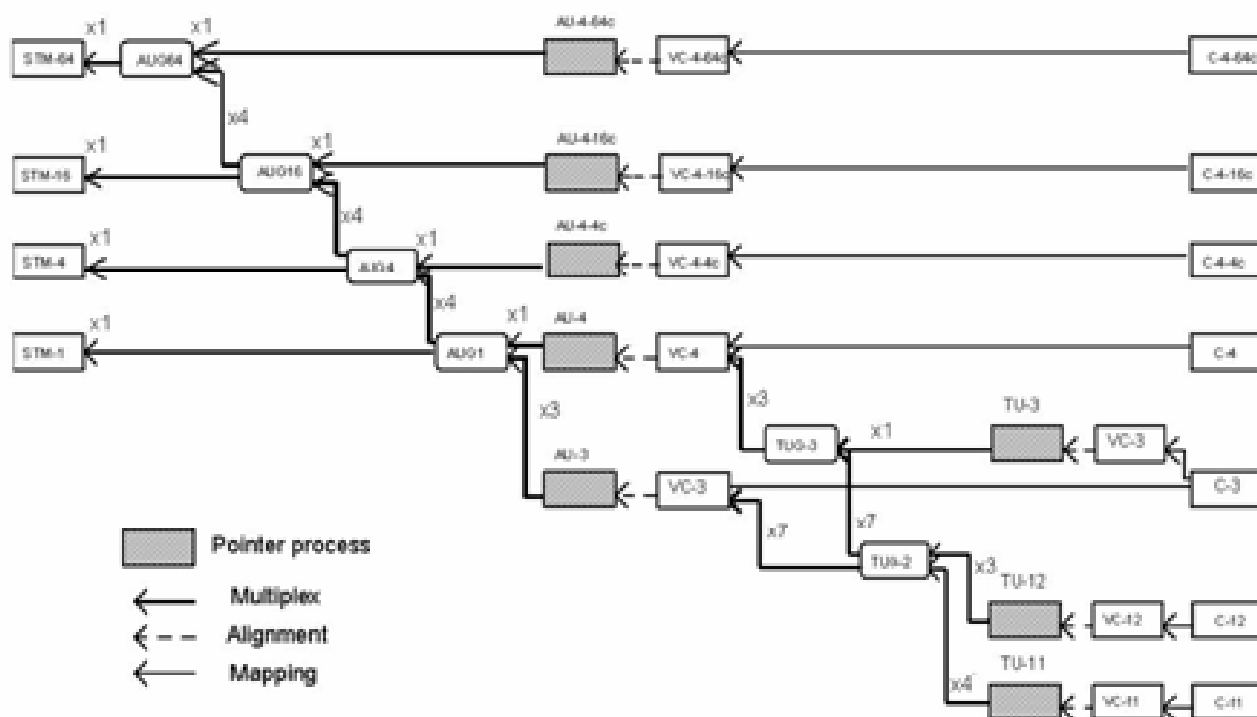


Figure 1.2 MN2300 Multiplexing Structure

2. NETWORK APPLICATIONS

2.1 Various Network Applications

The high versatility of MN2300 allows it to be configured as either an STM-4 system, or even an STM-1 system as needed for networking. SpectralWave MN2300 is applicable to access networks, local networks and MANs, featuring the widest network applicability.

The MN2300 supports various network topologies and protection types summarized as follows:

- Linear with line protection
- 2-Fiber MS-SP Ring
- 2-Fiber SNCP

- Overlapping DNI
- Overlapping SNI
- Multiple Rings
- Mesh virtual ring with path protection

The MS-SP Ring is supported on MN2300 ring networks of STM-1/4. The SNCP is supported on STM-4/1 optical interfaces.

The versatile ability for network applications enables the MN2300 to offer highly reliable, economical, expandable and optimized network solutions.

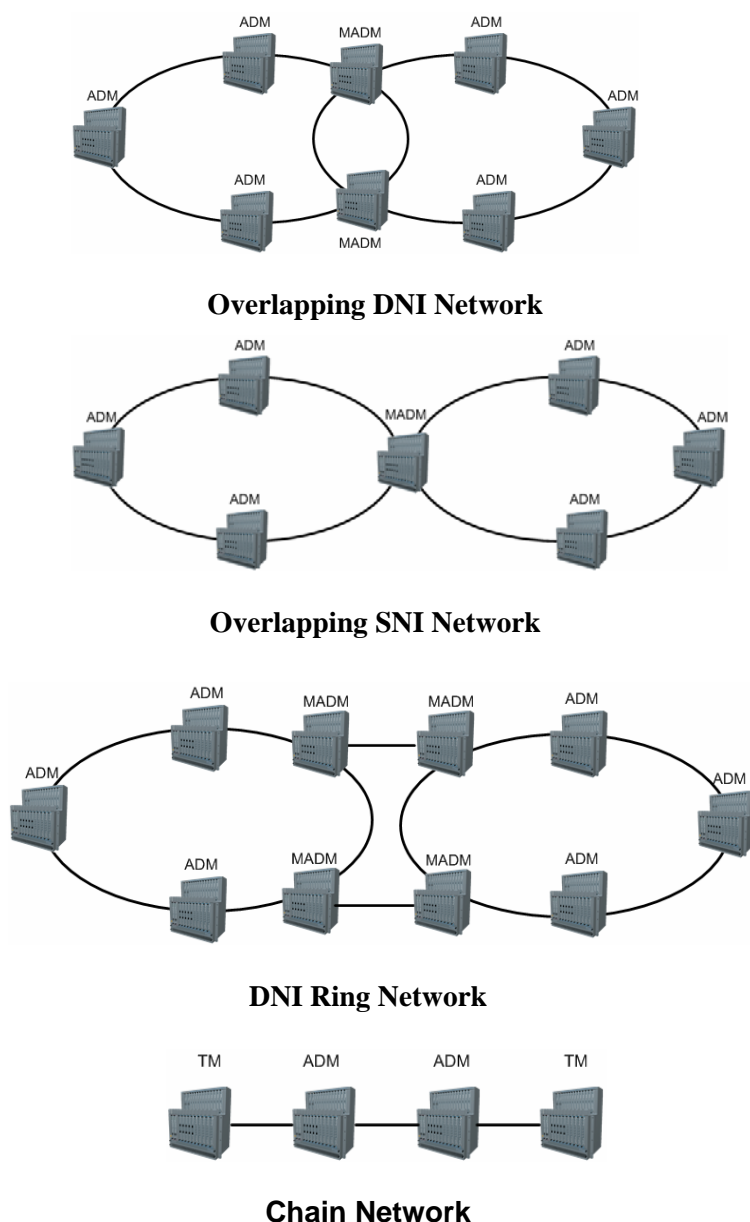


Figure 2.1 MN2300 Network Applications

3. PHYSICAL DESCRIPTION

3.1 Basic Configuration

The SpectralWave MN2300 is a modularization designing with plug-in cards that can be plugged into or pulled out of the sub-rack. To plug in or pull out any card not in the working traffic path will not cause any traffic interruption. Following 3.1 illustrates the SpectralWave MN2300 sub-rack slot configuration.

IU10-2 Line/Tributary Interface	IU12 Special Use Module
IU10-1 Line/Tributary Interface	IU11 Special Use Module
IU9-2 Line/Tributary Interface	IU10 Line/Tributary Processing
IU9-1 Line/Tributary Interface	IU9 Line/Tributary Processing
IU8-2 Line/Tributary Interface	IU8 Line/Tributary Processing
IU8-1 Line/Tributary Interface	IU7 Line/Tributary Processing
IU7-2 Line/Tributary Interface	IU6 Line/Tributary Processing
IU7-1 Line/Tributary Interface	IU5 Line/Tributary Processing
IU6-2 Line/Tributary Interface	IU4 Line Card
IU6-1 Line/Tributary Interface	IU3 Line Card
IU5-2 Line/Tributary Interface	Blank Cover Panel
IU5-1 Line/Tributary Interface	IU2 OAMP (Control/Power/Clock)
PWIN 2	IU1 OAMP (Control/Power/Clock)
PWIN 1	
FAN	

Figure 3.1 MN2300 Package Slots

4. BRIEF PACKAGE INTRODUCTION

The MN2300 major package functions are summarized below.

a) OAMP

The SpectralWave MN2300 OAMP card integrates main control, power and clock functionality. It implements the system control and clock processing functions and provides the system power supply. It also provides the system with such functions as on/off control, order wire phone and auxiliary data interfaces.

b) CLK Modules

Three working modes are available: lock, holdover and free run.

The locked clock source comes from eight service card slots (each service card slot provides one 8K clock source), or from external clock interfaces (2048kbit/s or 2MHz).

One external clock input interface and one external clock output interface are provided. Both the input and output interfaces can be independently set to work at 2048kbit/s or 2MHz. Both the impedances of the two clock interfaces are 75Ω and support SSM.

Master/Slave clock mode is supported by the OAMP/OAMP modules, which separately send clock signals to various slots via the dual clock buses to form a backup protection scheme.

c) XS16F01S Single port STM-16 Optical Interface Card

The XS16F01S is a 1 × STM-16 line card. It provides one 2.5G SDH interface with 80X80 VC-4 higher-order and 2016X2016VC-12 lower-order cross-connect capabilities.

d) S16F01S Single port STM-16 Optical Interface Card

The S16F01S is a 1 × STM-16 line card. It provides one 2.5G SDH interface with higher-order and lower-order cross-connect capabilities.

e) S04F04S/S01F04S 622M/155M Optical Interface Card

The S04F04S/S01F04S provides 622M/155M service interfaces and fulfills higher order and lower order cross-connect functionalities. The S04F04S/S01F04S corresponds to a 4 × 622M/155M optical interfaces processing card respectively.

LC type optical interface is used for the S04F04S/S01F04S. Depending on the transmission distance required, three different optical interfaces are provided.

f) PE1P63 E1 Electrical Processing Card

The PE1P63 service processing card in conjunction with the JPE1T32 or JNE1T32 interface card provides E1 service access.

The PE1P63 is the service processing card, which supports one of two interface card types. The JPE1T32 interface card supports CFP protection, while the JNE1T32 interface card does not support CFP protection.

The SpectralWave MN2300 supports 1:5 CFP on E1 services.

g) PE3P03 E3(34M)/ DS3(45M) Electrical Interface Card

The PE3P03 is the SpectralWave MN2300's E3 and DS3 service processing card. In conjunction with an interface card, each PE3P03 card can process three channels of E3 or DS3 signals. Two types of interface cards are available: the JPE3T03 (with protection) and the JNE3T03 (without protection). A switching card, JPSWITCH is required when the JPE3T03 is used. The JPSWITCH can only be inserted in IU7-2. The 1:4 CFP protection function is supported

h) S01P04 155 STM-1 Processing Card

The S01P04 is a 4 × STM-1 or 4 × E4 electrical processing card of the SpectralWave MN2300. It processes STM-1 overhead and pointer processing.

The S01P04 can operate in conjunction with the interface card JNE4T04 to access 4 × STM-1 or 4 × E4 traffic, without CFP protection. Or, it can operate in conjunction with the switch card JPSWITCH and the interface card JPE4T04 to access 4 × STM-1 or 4 × E4 services, with CFP protection supported. In the second situation, the 1:4 CFP protection function is supported.

i) EGFC08 8 ports FE or 4 ports FE plus 4 ports GE Card

EGFC08 is an Ethernet electrical/optical processing and interface card with powerful Layer 2 switch capability.

EGFC08 can provide eight 10/100M FE ports (10M/100MBASE-Tx/Fx) or four 10/100M FE ports (10M/100MBASE-Tx/Fx) + four GE ports (1000BaseSx/Lx-SFP). As different sub cards and SFP modules are used, a sub-card provides four FE electrical ports, four FE optical ports or four GE optical ports.

The sub-card with four GE optical ports must be inserted in the "FE/GE" slot (the 2nd slot) of the EGFC08 card.

There are 24 10/100M FE channels (internal interfaces) connect with EOS (Ethernet over SDH) bus in the EGFC08. Each of the 24 10/100M Ethernet services can be configured individually with n VC-12 (n=1- 46). It supports virtual concatenation (VCAT) and LCAS functions. The EGFC08 unit provides max. 6.8G switch capacity with 4GE and 4FE at LAN ports plus 24 FE at WAN ports

j) EGEF02 Gigabit Ethernet Card

EGEF02 is a dual-port Gigabit Ethernet (GE 1000BASE-Sx or 1000BASE-Lx) processing card. It is used to point-to-point transparently transmit the GE service in the network.

k) R04T08 622M RPR Card

The R04T08 implements RPR over SDH, provides flexibility and scalability for Ethernet service delivery in existing SDH networks. It allows definition of class of service, offers guaranteed bandwidth and ensures carrier class network availability, supports the characteristic needs of data service and handles Ethernet busy traffic by statistical multiplexing.

l) SAIC- System Alarm Interface Card

The SAIC is system alarm interface control card for the SpectralWave MN2300 system. It provides audio and visual alarms output interface, different system alarms cascade input/output interface and environment alarms input interface.

The SAIC can make alarm signals generated from the network element system in rack output to the front door of rack or PDP with the cooperation of SAICEXT interface module.

m) PWIN 48V Power Access Module

The PWIN is the SpectralWave MN2300's -48V power access module. It provides the following functions:

- Provides the PDC module with standby -48V power supply
- 48V power Over/Under voltage protection
- Lightning protection and power conditioning for -48V power
- Support alarm and monitoring for -48V power
- Support hot module swapping

n) EX232S04 Communication Card with Serial Extension Interface

For optical line transmission over a long distance, a rack-mounted EDFA is needed, which can be monitored and controlled through the EX232S04 card.

o) FAN Card

The FAN is a mandatory module of the SpectralWave MN2300 system for cooling.

5. OAM&P

The operation, administration, maintenance and provisioning (OAM&P) of the MN2300 can be controlled and monitored through the management system. Besides the security, following items are the basic operations controlled and stored at the OAM unit.

5.1 Configuration Management

The configuration management functions are used to provision the equipment to change configurations and query information for each package in the equipment.

The configuration of the equipment may be changed at any time to add/remove operational packages, change package configurations and specify alarm and reporting capabilities.

The configuration management functions include the followings:

- Set work/protection relation
- Query firmware version
- Establish cross-connect mapping
- Set timing source parameter
- Set overhead byte parameter

5.2 Fault Management

The fault management functions provide alarm monitoring capability through the management system, through external outputs to a station alarm system, and through LEDs mounted on the front of the MN2300

The fault management functions include the followings:

- Change/view alarm attributes
- Exercise switching
- Switch specified traffic or timing source over protection system
- Release switching / alarm state

5.3 Performance Monitoring

The performance monitoring (PM) functions can be used to continuously analyze the general quality of the transmission. If deterioration in the transmission quality is detected, alarms or warnings are issued to inform service personnel before service interruption occurs.

Performance Monitoring for all SDH layers are provided. Relevant data is collected by the OAMP card and reported to the management system. See Table 5.1 for a list of monitored parameters.

In addition, other layer monitoring functions are added, i.e. LAPS or GFP layer, VCAT, LAN and WAN port PM, etc.

Performance monitoring functions include the following:

- Collect/report PM data
- View status of specified PM type/PM item
- Initialize PM items
- Reporting

The performance history is stored in the OAMP until retrieving from the management system. Current 15-min. and current day history can be reported through the management system.

Table 5.1 PM Parameters (SDH)

Layer	Based On	PM Parameters
Regenerator Section	BIP-8 (B1)	BBE ES SES UAS
	OOF	OFS
Multiplex Section	BIP-N x 24 (B2)	BBE ES SES UAS
	MS REI (M1)	FE-BBE FE-ES FE-SES FE-UAS
Section Adaptation	PJ (AU-4)	PJE+ PJE-
HO Path	Path BIP-8 (B3)	BBE ES SES UAS
	Path REI (G1)	FE-BBE FE-ES FE-SES FE-UAS
LO Path	BIP (BIP-2) (B3)	BBE ES SES UAS
	Path REI (V5) (G1)	BBE FE-ES FE-SES FE-UAS
Multiplex Section Protection	Protection Switching	PSC PSD

6. Management System

The MN 2300 equipment can be managed by both SpectralWave MN9100 Network Management System (NMS) at the remote Network Operation Center (NOC) and/or locally by simply connecting the LCT. The SpectralWave MN9100 provides the Client/Server architecture.

Using the SpectralWave MN9100 the operator can configure all available equipment resources, since it is designed following the FCAPS functions defined by TMN, which includes: FM, CM, PM and SM.

- FM : Fault management;
- CM : Configuration Management;
- PM : Performance Management;
- SM : Security Management.

Figure 6.1 shows the SpectralWave MN9100 architecture sample.

For more detailed information regarding the NMS system, please refer to the SpectralWave MN9100 DEX-6891 document.

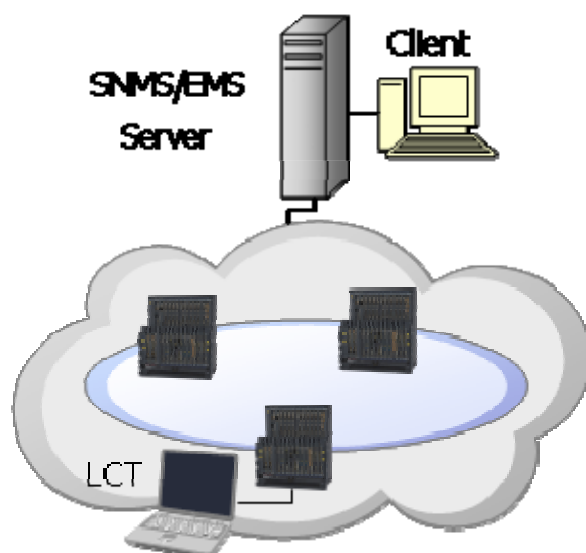


Figure 6.1 Network Management System

7. TECHNICAL SUMMARY

7.1 System Parameters

Interface Capacity:	Maximum 4 slots for STM-16 Maximum 8 slots for STM 4/1 Maximum 6 slots for GbE Maximum 6 slots for FE Maximum 5 slots for 34M/45M/STM-1E Maximum 6 slots for 2M
Cross-connect Capacity:	80 x 80 VC-4, 96 x 96 VC-3, 2016 x 2016 VC-12
Bit Error Rate:	$<1 \times 10^{-10}$ (G.957)
Synchronization:	
Internal oscillator accuracy:	± 4.6 ppm, free running
Hold-over stability:	G.813 Option 1 / 0.37ppm/day
Timing source:	STM-N, 2M Tributaries, External 2Mbit/s or 2MHz
Priority:	User programmable
Quality:	User programmable
SSM:	S1 byte on STM-N Sa bits on external 2Mbit/s

7.2 Interfaces

7.2.1 STM-16 /4 /1 Optical Interface

See Table 7.1 through 7.3

7.2.2 Gigabit Ethernet

1000BASE-SX	
Bit rate:	1.25Gbit/s ± 100 ppm
Code:	8B/10B
Optical fiber type:	50 μ m / 62.5 μ m MMF
Wavelength:	830 ~ 860nm
Average launch power:	-9.5 ~ -4 dBm
Receive power:	-17 ~ 0 dBm
Maximum transmission distance:	550m (50 μ m MMF) / 275m (62.5 μ m MMF)
Extinction ratio:	9dB
1000BASE-LX	
Bit rate:	1.25Gbit/s ± 100 ppm
Code:	8B/10B
Optical fiber type:	50 μ m / 62.5 μ m MMF, SMF
Wavelength:	1270 ~ 1355nm
Average launch power:	-11.5 ~ -3 dBm
Receive power:	-19 ~ -3 dBm
Maximum transmission distance:	550m (MMF) / 5km (SMF)
Extinction ratio:	9dB
1000BASE-T	
Bit rate	1000Mbit/s
Code	4D-PAM5
Cable type	Cat.5 UTP
Distance	100m

7.2.3 STM-1 Interface (electrical)

Bit rate: 155.520Mbit/s ± 4.6 ppm(normal) ± 20 ppm(MS-AIS receive)
 Impedance: 75 ohms unbalanced
 Code: CMI
 Pulse waveform: ITU-T Table 12/G.703, and Figure 22/23 G.703

7.2.4 45Mbit/s

Bit rate: 44.736Mbit/s ± 20 ppm
 Impedance: 75 ohms unbalanced
 Code: B3ZS
 Pulse waveform: ITU-T Table 6/G.703, Figure 14/G.703

7.2.5 34Mbit/s

Bit rate: 34.368Mbit/s ± 20 ppm
 Impedance: 75 ohms unbalanced
 Code: HDB3
 Pulse waveform: ITU-T Table 9/G.703, Figure 17/G.703

7.2.6 2Mbit/s

Bit rate: 2.048Mbit/s ± 50 ppm
 Impedance: 120 ohms balanced
 75 ohms unbalanced
 Code: HDB3
 Pulse waveform: ITU-T Table 7/G.703, Figure 15/G.703

7.2.7 Synchronization Interface

External input/output:	Pulse waveform:	ITU-T Table 7/G.703 Figure 15/G.703	ITU-T Table 11/G.703 Figure 21/G.703
	Bit rate:	2.048Mbit/s ± 4.6 ppm	2.048MHz ± 4.6 ppm
	Code:	HDB3 (2.048Mbit/s)	-
	Frame format:	ITU-T G.704 (2.048Mbit/s)	-
	Impedance:	75 ohms unbalanced	
	Number of ports:	2	
Line input		Any STM-n lines,	

7.2.8 Internal Order wire Interface

PCM coding: A-law ITU-T G.711
 Station calling: All calling, Selecting calling, Group calling
 by using 2-wire DTMF telephone set
 Telephone set Interface: 2-wire 600 ohms balanced

7.2.9 Overhead User Channel

Interface: RS232 with RJ-45 Connectors
 Bit rate: 19.2kbit/s
 Number of Interfaces: 3

7.2.10 LCT Interface

Interface Type:	Ethernet Port
Number of ports:	1
Connector:	Ethernet (10/100BaseT),

7.2.11 NMS Interface

Interface Type:	Ethernet Port
Protocol:	TCP/IP
Physical Interface:	Ethernet (10/100BaseT)

7.3 Environment and Mechanical Construction

7.3.1 Power Requirements

Supply Voltage:	-48V DC (-37.4V ~ -70.5V)
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7.3.2 Environment

Temperature:	5°C to +40°C (Normal Operating Range) 0°C to +50°C (Short Term Range)
Relative Humidity:	5 to 85%
Cooling:	Fan
EMC:	EN55022 (Class A) EN50024
Safety:	EN60950 EN60825

7.3.3 Mechanical Construction

Shelf:	531mm (H) x 436mm (W) x 281mm (D)
Wiring Access:	Front access for both electrical and optical connections

Note: This document describes the NEC standard equipment. If there is any conflict between this document and the system description and/or the compliance statement, the latter will supersede this document. The specifications or configuration contained in this document are subject to change without notice due to NEC's continuing design improvement.

Table 7.1 STM-16 Optical Interface Parameters

Digital signal	STM-16 according to ITU-T G.707				
Nominal bit rate	2488.320Mbit/s				
Application code	Intra-office	Short-haul	Short-haul	Long-haul	
(ITU-T Table 1/G.957, and G.691)	I-16	S-16.1	S-16.2	L-16.1	L-16.2
Operating wavelength range	1266-1360	1260-1360	1430-1580	1280-1335	1500-1580
Transmitter at reference point S					
Source type	MLM	SLM	SLM	SLM-LD	SLM-LD
Special characteristics					
• Maximum RMS width	4	-	-	-	-
• Maximum -20dB width		1nm	1nm	1nm	< 1nm
• Minimum side mode suppression ratio		30dB	30dB	30dB	30dB
Mean launched power					
• Maximum	-3dBm	0dBm	0dBm	3dBm	3dBm
• Minimum	-10dBm	-5dBm	-5dBm	-2dBm	-2dBm
Minimum extinction ratio	8.2dB	8.2dB	8.2dB	8.2dB	8.2dB
Optical path between S and R					
Attenuation range	0-7dB	0-12dB	0-12dB	10-24dB	10-24dB
Maximum dispersion	12ps/nm	NA	NA(note1)	NA	1600ps/nm
Minimum optical return loss of cable plant at S, including any connectors	24dB	24dB	24dB	24dB	24dB
Maximum discrete reflectance between S & R	-27dB	-27dB	-27dB	-27dB	-27dB
Receiver at reference point R					
Minimum sensitivity	-20dBm	-20dBm	-20dBm	-29dBm	-30dBm
Minimum overload	-3dBm	-3dBm	-0dBm	-9dBm	-9dBm
Maximum optical path penalty	1dB	1dB	1dB	1dB	2dB
Maximum reflectance of receivers measured at R	-27dB	-27dB	-27dB	-27dB	-27dB

Table 7.2 STM-4 Optical Interface Parameters

Digital signal	STM-4 according to ITU-T G.707			
Nominal bit rate	622.080Mbit/s			
Application code	Short-office	Long-haul		
(ITU-T Table 1/G.957)	S-4.1	L-4.1	L-4.1	L-4.2
Operating wavelength range	1274-1356nm	1274-1356nm	1274-1356nm	1480-1580nm
Transmitter at reference point S				
Source type	MLM-LD	MLM-LD	MLM-LD	SLM-LD
Special characteristics				
• Maximum RMS width	2.5nm	2.5nm	-	
• Maximum -20dB width	-	-	<1nm	<1nm
• Minimum side mode suppression ratio	-	-	30dB	30dB
•				
Mean launched power				
• Maximum	-8dBm	2dBm	2dBm	2dBm
• Minimum	-15dBm	-3dBm	-3dBm	-3dBm
Minimum extinction ratio	8.2dB	10dB	10dB	10dB
Optical path between S and R				
Attenuation range	0-12dB	10-24dB	10-24dB	10-24dB
Maximum dispersion	46/74ps/nm	NA(Note1)	1600ps/nm	1600ps/nm
Minimum optical return loss of cable plant at S, including any connectors	NA(Note2)	20dB	24dB	24dB
Maximum discrete reflectance between S & R	NA(Note2)	-25dB	-27dB	-27dB
Receiver at reference point R				
Minimum sensitivity	-30dBm	-30dBm	-30dBm	-30dBm
Minimum overload	-8dBm	-8dBm	-8dBm	-8dBm
Maximum optical path penalty	1dB	1dB	1dB	1dB
Maximum reflectance of receivers measured at R	NA(Note2)	-14dB	-27dB	-27dB

Table 7.3 STM-1 Optical Interface Parameters

Digital signal	STM-1 according to ITU-T G.707		
Nominal bit rate	155.520Mbit/s		
Application code	Short-haul	Long-haul	Long-haul
(ITU-T Table 1/G.957)	S-1.1	L-1.1	L-1.2
Operating wavelength range	1261-1360nm	1263-1360nm	1480-1580nm
Transmitter at reference point S			
Source type	MLM-LD	MLM-LD	SLM-LD
Special characteristics			
• Maximum RMS width	7.7nm	3nm	-
• Maximum -20dB width	-	-	1nm(SLM)
• Minimum side mode suppression ratio	-	-	30dB(SLM)
Mean launched power			
• Maximum	-8dBm	0dBm	0dBm
• Minimum	-15dBm	-5dBm	-5dBm
Minimum extinction ratio	8.2dB	10dB	10dB
Optical path between S and R			
Attenuation range	0-12dB	10-28dB	10-28dB
Maximum dispersion	96ps/nm	185ps/nm	N/A
Minimum optical return loss of cable plant at S, including any connectors.	NA(Note 2)	NA(Note 2)	20dB
Maximum discrete reflectance between S & R	NA(Note 2)	NA(Note 2)	-25dB
Receiver at reference point R			
Minimum sensitivity	-33dBm	-36dBm	-36dBm
Minimum overload	-8dBm	-10dBm	-10dBm
Maximum optical path penalty	1dB	1dB	1dB
Maximum reflectance of receivers measured at R	NA(Note 2)	NA(Note 2)	-25dB

Notes concerning Optical Interface Parameter Tables

Note 1: NA indicates that system is considered limited by attenuation and thus it does not have maximum dispersion values specified.

Note 2: NA indicates that system is not considered limited by reflection and thus it does not have maximum reflection values specified.