5.8 GHz 15/28/50 MB
PDH DIGITAL MICROWAVE RADIO SYSTEM
NLite L
(PDH 1+0/1+1 SYSTEM)

SECTION I DESCRIPTION

CONTENTS

CONTENTS

1. GENERAL

This section provides descriptive information on the 5.8 GHz 15/28/45 MB digital microwave radio system for the plesiochronous digital hierarchy (PDH).

The 5.8 GHz 15/28/50 MB digital microwave radio system is designed to transmitting DS-1 or DS-3 level signals. It operates in the 5.8 GHz radio frequency band using the 32 QAM or 128 QAM Quadrature Amplitude Modulation (QAM) method and has a transmission capacity of 8 x 1.544 MB or 16 x 1.544 MB, for 1 x DS-3 64 QAM is utilized. Included herein are system description and subsystem description.

(This page is intentionally left blank.)

2. SYSTEM DESCRIPTION

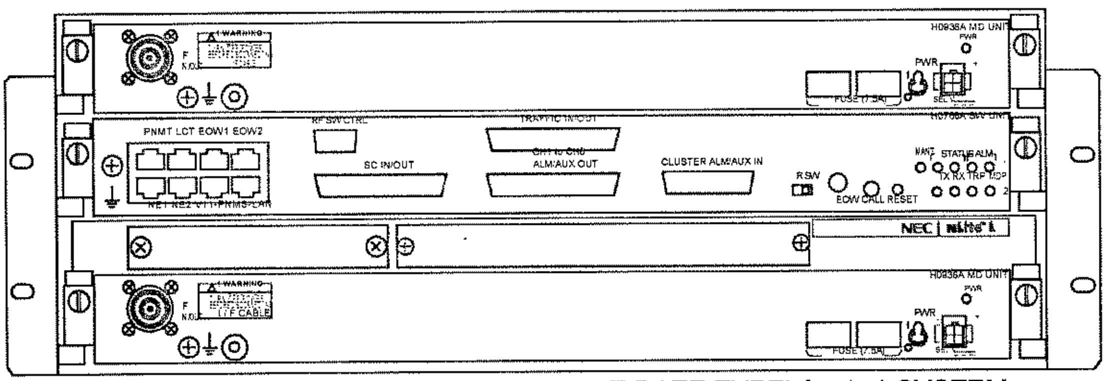
The system description outlines the system configuration, system performance, RF channel plan, alarm and control, protection switching, and power supply.

2.1 System Configuration

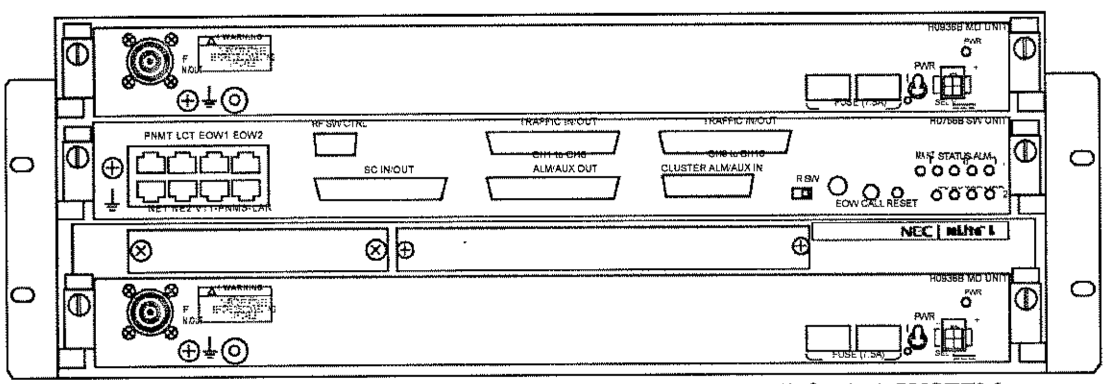
The system consists of the Modulator-Demodulator (MDP), Transmitter-Receiver (TRP) and the Antenna (see Fig. 2-1 to Fig 2-2). The MDP types are as follows:

- MDP-15MB5T-1A: 8 x 1.5 MB, Fixed bit rate type
- MDP-28MB7T-1A: 16 x 1.5 MB, Fixed bit rate type
- MDP-50MB6T-1B: 1 x 45 MB, Fixed bit rate type

The 5.8 GHz 15/28/50 MB microwave radio system is a 1-hop (point-to-point) system between two terminal stations, and is configured in the 1+1 (Hot Standby) or 1+0 (Expandable) system.

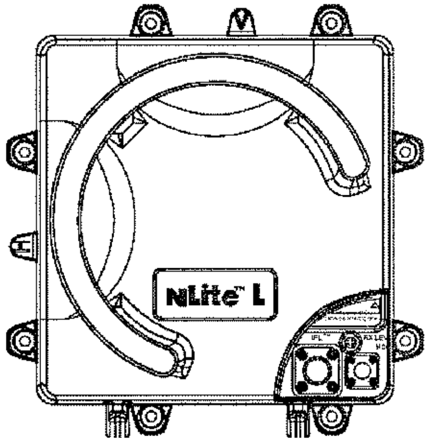


MDP-15MB5T-1A(8 x 1.5 MB FIXED BIT RATE TYPE) for 1+1 SYSTEM



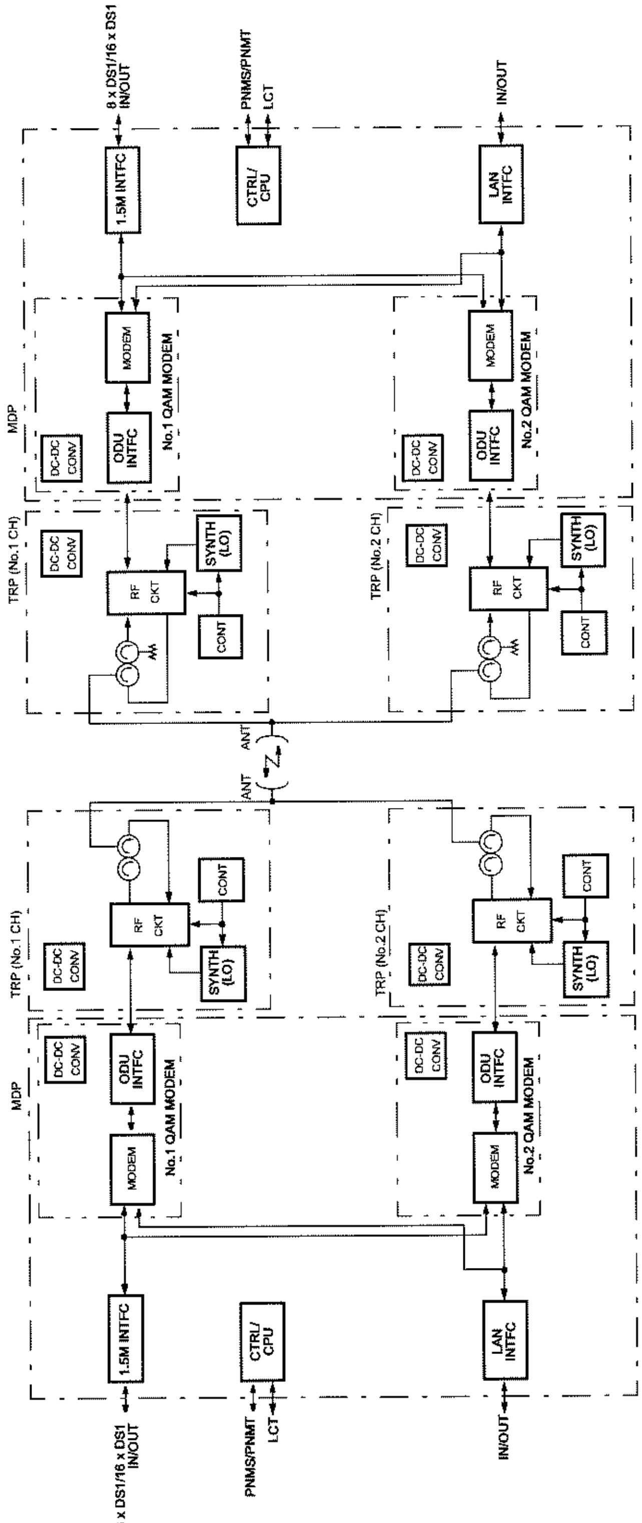
MDP-28MB7T-1A(16 x 1.5 MB FIXED BIT RATE TYPE) for 1+1 SYSTEM

Fig. 2-1 Outline of MDP



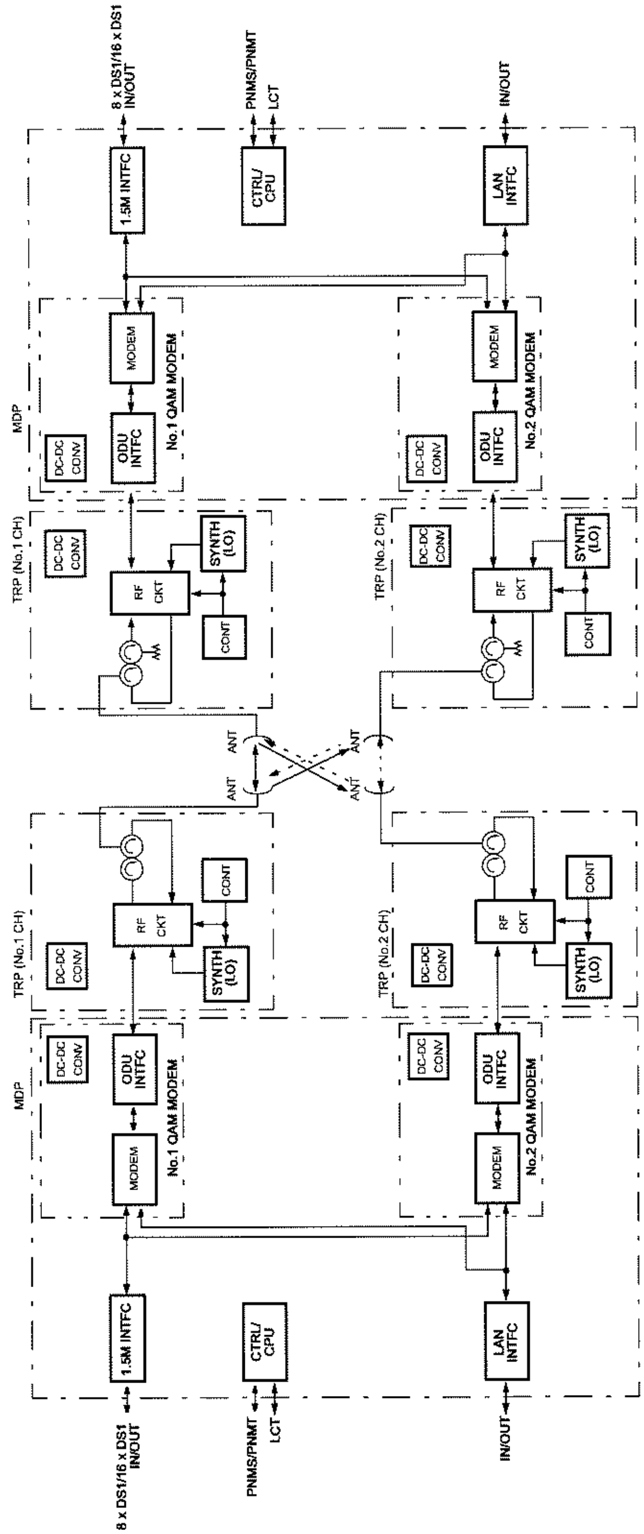
5.8 GHz BAND TRP

Fig. 2-2 Outline of TRP



ANT	: Antenna
CONT	: Control
DC-DC CONV	: DC-DC Converter
DSC	: Digital Service Channel
MDP	: Indoor Unit (Modulator-Demodulator)
INTFC	: Interface
LCT	: Local Craft Terminal
LO	: Local Oscillator
MODEM	: Modulator Demodulator
TRP	: Outdoor Unit (Transmitter-Receiver)
OW	: Orderwire
PNMS	: Pasolink Network Management System
PNMT	: Pasolink Network Management Terminal
RF CKT	: Radio Frequency Circuit
SEL	: Selector
SYNTH	: Synthesizer

Fig. 2-3 Digital Microwave Radio System – Hot-standby System Block Diagram



ANT	: Antenna
CONT	: Control
DC-DC CONV	: DC-DC Converter
DSC	: Digital Service Channel
MDP	: Indoor Unit (Modulator-Demodulator)
INTFC	: Interface
LCT	: Local Craft Terminal
LO	: Local Oscillator
MODEM	: Modulator Demodulator
TRP	: Outdoor Unit (Transmitter-Receiver)
OW	: Orderwire
PNMS	: Pasolink Network Management System
PNMT	: Pasolink Network Management Terminal
RF CKT	: Radio Frequency Circuit
SEL	: Selector
SYNTH	: Synthesizer

Notes: ←→ : *When the No.1 channel TX side is working.*
←- - -→ : *When the No.2 channel TX side is working.*

Fig. 2-4 Digital Microwave Radio System – Hot-standby/Space Didversity System Block Diagram

2.2 System Performance

The system performance characteristics of the 10.5 GHz 15/28 MB digital microwave radio system are listed in Table 2-2.

Table 2-1 System Performance (Typical Value)

A. Major Specification	
Transmission Signal	DS1 & DS3
Transmission Capacity	8 x 1.544 Mbps (8 x DS1)/ 16 x 1.544 Mbps (16 x DS1)/ 1 x 44.736 Mbp/s (1 x DS3)
Modulation	32 QAM (for 8 x DS1)/ 128 QAM (for 16 x DS1)/ 64 QAM (for 1 x DS3)
Demodulation	Coherent detection
Forward Error Correction (FEC)	MLCM/RS DFE
Equalizer	B8ZS or AMI for DS1 (ANSI T1, 102)
Data Interface	
Impedance	
8 x DS1/16 x DS1 System	100 ohms, balanced
1 x DS3 System	75 ohms, unbalanced
Service Channel	
•EOW	1 CH
• RS-232C (*1)	1 CH
• V.11 (*1)	2 CH

Table 2-1 System Performance (Typical Value) (Cont'd)

TX Power Control	ATPC/MTPC 0 to 23 dB (1 dB step) (8 x DS1) 0 to 20 dB (1 dB step) (16 x DS1 & 1 x DS3))
TX Switching System	Mute output power of the reserve TRP (HS/HS) in split system.
RX Switching System	Hitless switch
Switching Range	Dynamic
Delay Equalization Range	more than +/−250 ns in total
Switching Criteria	Remote and Auto (F ASYNC ALM, LOW BER ALM)
Loopback Function	LB 1 (Far End, CH by CH basis)
	LB2 (Near End, CH by CH basis)
	IF (MODEM loop back)
Performance Monitoring (* 1)	BBE, ES, SES, UAS, OFS (total)
	TX power level, RSL, BER
	Relay contact (Form-C); 7 items (4 alarm items mapping allowed)
Measurement	
Alarm Output	Relay contact (Form-C) 4 Items
Housekeeping Alarms (* 1)	Photo-coupler 6 items

Table 2-1 System Performance (Cont'd) (Typical Value)

B. System Parameter for Split Type

Item		Specification		Condition/Remarks
Transmission Capacities		8/16 x DS1	1 x DS3	
Transmit Power	5.8 GHz	+25 dBm		Typical
System Gain	5.8 GHz	105 dB	96.5 dB	@10^{-6}, Guarantee —3 dB
MDP-TRP IFL Cable Length (Split type)		200 m		RG-14/U, RG-224/U or Equivalent
Ambient Temperature	MDP	0°C to +50°C		Guarantee
	TRP	—33°C to +50°C		
	MDP	—10°C to +55°C		Workable
	TRP	—40°C to +55°C		
	MDP/TRP	—40° C to +70° C		Storage
Relative Humidity		Less than 90% at 50°C (Non-condensing)		
Power Supply Voltage		36 to 60 V DC Input Floating		

Table 2-1 System Performance (Cont'd) (Typical Value)

C. OVERALL	
MDP-TRP Interconnection Cable	Single coaxial cable, 50 ohms impedance
I/F Line Cable (Type and Maximum Cable Length)	• 200 m (5D-FB coaxial cable or equivalent) • 300 m (8D-FB coaxial cable or equivalent) • 350 m (10D-FB coaxial cable or equivalent) • 450 m (12D-FB coaxial cable or equivalent)
Primary Voltage (Safety Extra-Low Voltage (SEL V))	• —48 V DC (—36 to —60 V) or +48 V DC (+36 to +60 V)
Power Consumption (MDP + TRP)	110 W or less
Dimension	
MDP	482 mm (W) x 159 mm (H) x 300 mm (D)
TRP	
• 5.8 GHz	240 mm (W) x 243 mm (H) x 124 mm (D)
Weight	
MDP	Approx. 10 kg, 1+0 system (Including optional module) Approx. 14 kg, 1+1 system (Including optional module)
TRP	
• 5.8 GHz	Approx. 5 kg
Temperature Range	
Guaranteed Operation	
MDP	0°C to +50°C
TRP	—33°C to +50°C
Workable Operation	
MDP	—10°C to +55°C
TRP	—40°C to +55°C
Transport and Storage	
MDP	—40°C to +70°C
TRP	—40°C to +70°C
Relative Humidity	Less than 90% at 50°C (Non-condensing)
Altitude	Up to 4,000 m

2.3 RF Channel Plan

Radio frequencies for the NLite L 5.8 GHz is as follows:

- FCC 10.5 GHz Band : 5725 Mhz to 5850 Mhz

The actual TX frequency of the TRP should be within the TX radio frequency band of the RF CKT in the TRP and is entered using the local craft terminal (LCT). The corresponding RX frequency is automatically set after the TX frequency is entered.

For details, refer to Appendix in Description section.

The frequency spacing between adjacent channels should be taken as following system.

- 8 x DS1 system : 3.75 MHz
- 16 x DS1 system : 5 MHz
- 1 x DS3 system: 10 MHz

2.4 Alarm and Control

The alarm and control system is shown in Fig. 2-6. The functions of the alarm and control circuit are as follows:

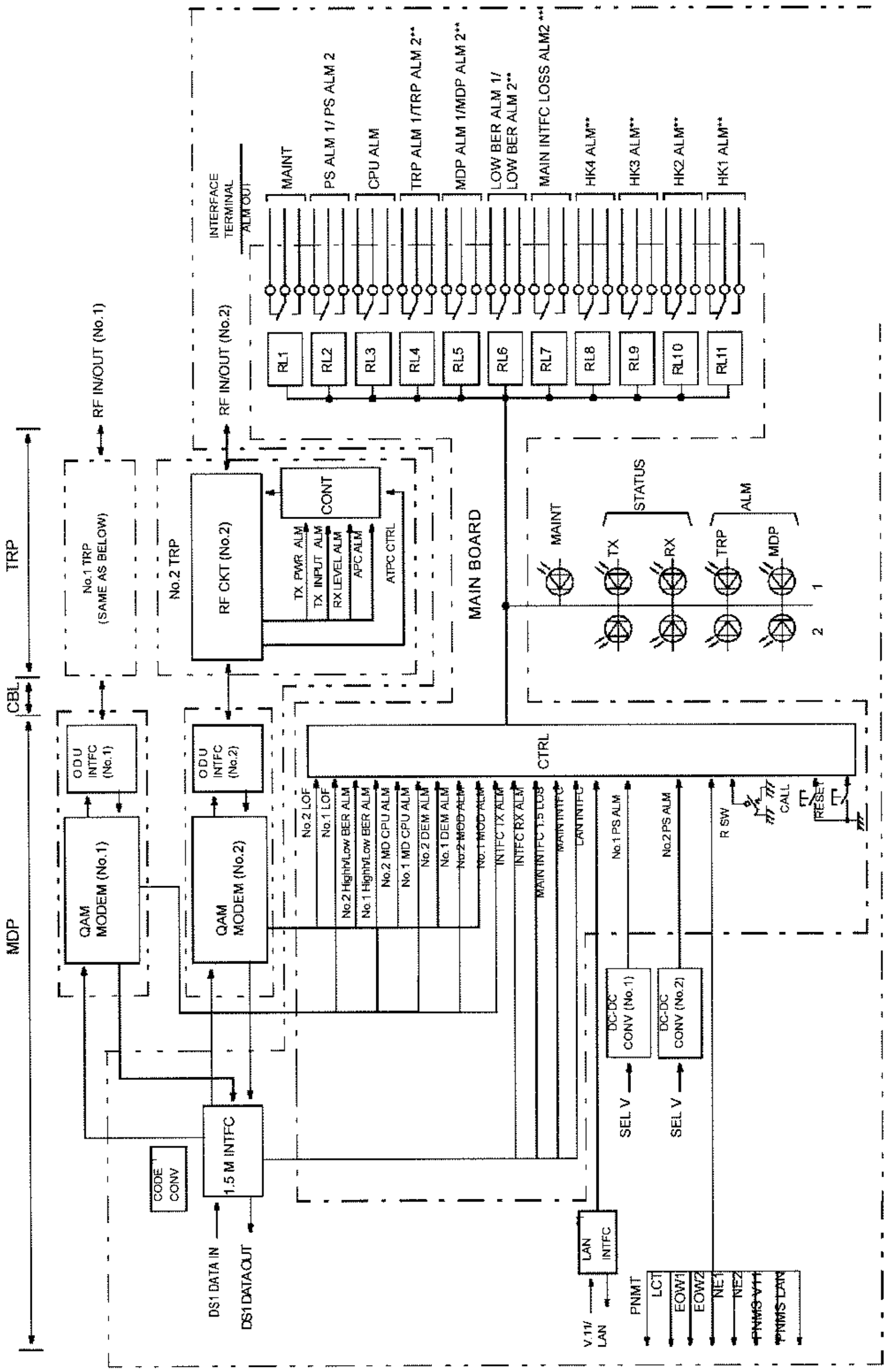
- Alarm indication and reporting
- Performance monitoring/metering data reporting
- Automatic transmitter power control
- Loopback control
- Network Management (Optional)

2.4.1 Alarm Indication and Reporting

Alarm indication and reporting functions are provided with the MDP. Summary alarm indicators using LED's are provided for the TRP and MDP, separately. When the TRP is detected any alarm by the alarm detector in the TRP are sent to the CTRL module in the MDP. This causes the TRP alarm indicator on the MDP front panel to turn on. Similarly, any MDP related alarms that are detected will cause the MDP alarm indicator on the MDP front panel to turn on. External reporting of alarms is also provided through closed relay contacts accessible via the front panel interface (see Table 2-3).

Table 2-2 Alarm Indication and Reporting

Equipment	Unit	Alarm Initiated	Alarm Initiating Module	Alarm Condition	LED Indication on MDP	Remote Alarm Reporting
MDP	MD UNIT (No.1/No.2)	MOD ALM	MODEM	Alarm detected of TX side of MD UNIT	No.1 MDP ALM or No.2 MDP ALM	MDP ALM 1 or MDP ALM 2 MOD ALM 1 or MOD ALM 2
		DEM ALM	MODEM	Input IF signal is lost	No.1 MDP ALM or No.2 MDP ALM	MDP ALM 1 or MDP ALM 2 DEM ALM 1 or DEM ALM 2
		MD CPU ALM	MODEM	Communication between modules failure	No.1 MDP ALM or No.2 MDP ALM	MDP ALM 1 or MDP ALM 2
		LOF	MODEM	Frame synchronization is lost	No.1 MDP ALM or No.2 MDP ALM	MDP ALM 1 or MDP ALM 2 LOF 1 or LOF2
		HIGH BER ALM	MODEM	BER is worse than preset value (3 x 10^{-4})	No.1 MDP ALM or No.2 MDP ALM	DEM ALM 1 or DEM ALM 2 HIGH BER ALM 1 or HIGH BER ALM 2
		LOW BER ALM	MODEM	BER is worse than preset value (3 x 10^{-7})		DEM ALM 1 or DEM ALM 2 LOW BER ALM 1 or LOW BER ALM 2
		MODEM	MODEM	MODEM module failure	No.1 MDP ALM or No.2 MDP ALM	MDP ALM 1 or MDP ALM 2 MOD ALM 1 or MOD ALM 2 DEM ALM 1 or DEM ALM 2 LOF1orLOF2 BER ALM 1 or BER ALM 2
		POWER SUPPLY	DC-DC CONV	DC-DC CONV module failure	No.1 MDP ALM or No.2 MDP ALM	MDP ALM 1 or MDP ALM 2 PS ALM 1 or PS ALM 2
	SW UNIT	INTFC TX ALM	Main Board	TX side interface clock is lost	No.1 MDP ALM and No.2 MDP ALM	MDP ALM 1 and MDP ALM 2 TX INTFC ALM
		INTFC RX ALM	Main Board	RX side interface clock or bipolar output signal is lost	No.1 MDP ALM and No.2 MDP ALM	MDP ALM 1 and MDP ALM 2 RX INTFC ALM
		MAIN INTFC 1.5M LOS	Main Board	Main channel (CH1-CH16*) input data is lost	No.1 MDP ALM and No.2 MDP ALM	MDP ALM 1 and MDP ALM 2 MAIN INTFC 2M LOS/ MAIN INTFC 34M LOS
		MAIN INTFC	Main Board	Main interface module failure	No.1 MDP ALM and No.2 MDP ALM	MDP ALM 1 and MDP ALM 2 INTFC TX ALM, INTFC RX ALM or MAIN INTFC 2M LOS
		SUB INTFC (optional)	LAN DSC	Sub interface module failure (including SUB INTFC alarm)	No.1 MDP ALM and No.2 MDP ALM	MDP ALM 1 and MDP ALM 2 SUB INTFC ALM
T R P (No.1/No.2)	□	TX PWR ALM	RF CKT	Transmit RF power increases/decreases approx. 3 dB from normal	No.1 TRP ALM or No.2 TRP ALM	TRP ALM 1 or TRP ALM 2 TX PWR ALM 1 or 2
		TX INPUT ALM	RF CKT	TX IF input signal from MDP is lost	No.1 TRP ALM or No.2 TRP ALM	TRP ALM 1 or TRP ALM 2 TX INPUT ALM 1 or 2
		RX LEVEL ALM	RF CKT	Receiver input level decreases below squelch level	No.1 TRP ALM or No.2 TRP ALM	TRP ALM 1 or TRP ALM 2 RX LEVEL ALM 1 or 2
		APC ALM	SYNTH/RF CKT	Local oscillator is unlocked	No.1 TRP ALM or No.2 TRP ALM	TRP ALM 1 or TRP ALM 2 APC ALM 1 or 2
		CABLE ALM	□	Communication between the TRP and MDP is lost	No.1 TRP ALM or No.2 TRP ALM	TRP ALM 1 or TRP ALM 2 COMM ALM 1 or TRP ALM 2
MDP/TRP	□	MAINT	□	The equipment is in maintenance mode. In this mode, the following control operations can be performed. • ATPC manual control • Loopback • TX mute • RF frequency • TX/RX SW manual • CW	MAINT	MAINT



8 x DS1 / 16 x DS1 SYSTEM

*Notes:1. * Optional. (supplied in future)*
*2. ** These alarm items can be set by the LCT. (released after Dec., 2003)*

Fig. 2-3 Alarm and Control Functional Block Diagram

2.4.2 Performance Monitoring/Metering Data Reporting

To monitor the transmission quality, the equipment is provided with the performance monitoring and the metering functions. The CTRL module polls the different modules and gathers PM/Metering information. A "invalid" displayed in the PM results screen indicates that the value is illegal. A "MAINT" is displayed if the PM results are obtained while the equipment is in maintenance mode. When the equipment clock setting is changed or the power is turned on/off, the PM value is judged to be invalid. The monitoring items are as follows:

Performance Monitor (released after Dec., 2003)

- Out of Frame Second (OFS)
- Background Block Error (BBE)
- Errored Seconds (ES)
- Severely Errored Seconds (SES)
- Unavailable Second (UAS)

Metering

- TX POWER
- RX LEVEL
- TRP PS MON
- BER (Bit Error Rate)

2.4.3 Automatic Transmitter Power Control

The automatic transmit power control (ATPC) function automatically varies the TX output power according to path conditions. In the SHF and EHF band, fading exerts heavy influences on propagation, causing the receive signal level at the opposite station to vary. The ATPC function operates by controlling the transmit output power of the opposite station according to the variation of the received signal level at the local station. ATPC provides the following advantages:

- Improvement in up fading characteristics
- Improvement in residual BER characteristics
- Reduction of interference to intra system
- Reduction of interference to inter system

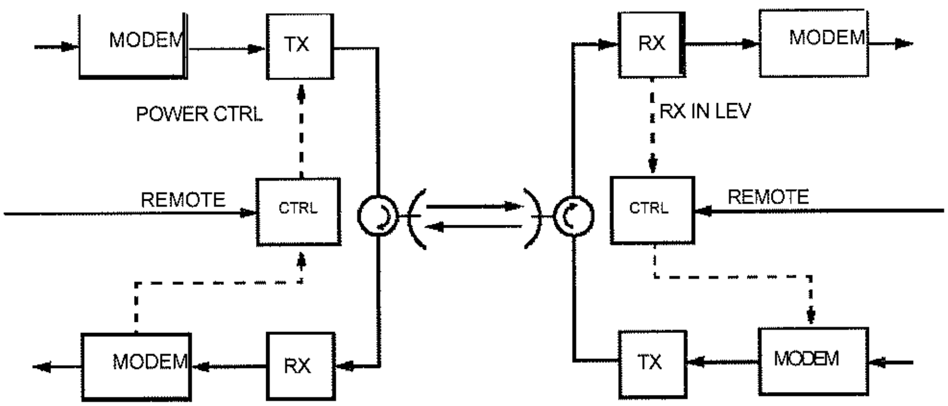
A functional block diagram of the ATPC operation is shown in Fig. 2-6. ATPC improves the BER characteristics under adverse changes in climatic conditions and reduces the possibility of interference. To implement ATPC, the received level (RX LEV) is detected by the receiver (RX) and passed on to the CPU on the CTRL circuit of the MODEM module. The CPU then determines whether the transmit output power needs to be controlled. This is based on the transmit output power, the minimum and maximum values of the output control range (ATPC range), ATPC is relevant for the receiving threshold (RX Threshold) level that were previously specified value using the LCT or PNMT.

A control signal (POWER CTRL), whose function is to maintain the RX signal by lowering or raising the TX output power of the opposite station, is generated by the MODEM module through the CPU circuit. This control signal is based on the result of comparison between the current receiver input level and the preset receiving threshold level. This control signal is sent to the opposite station to control its transmit output power.

At the opposite station, this control signal is detected by the MODEM module. It the MODEM module, in accordance with this control signal, produces a control that will either raise, lower or maintain the current TX output power.

TRANSMITTING STATION RECEIVING STATION

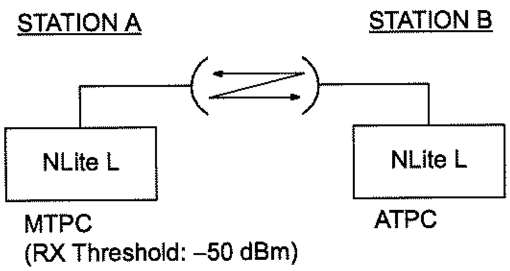
Fig. 2-4 ATPC, Functional BLock Diagram



The ATPC Control System of the NLite L transmits the information on the receiving level to the opposite station and controls the transmission level of its local station in accordance with the receiving level of the opposite station. Transmission level control can be used not only for setting the same operation (ATPC-ATPC) between local station and opposite station but also for operation in combination of stations with different operation (MTPC-ATPC, ATPC-MTPC) between own station and opposite station. The station set in MTPC mode is not controlled by the information from opposite station but is fixed in its transmitting output level.

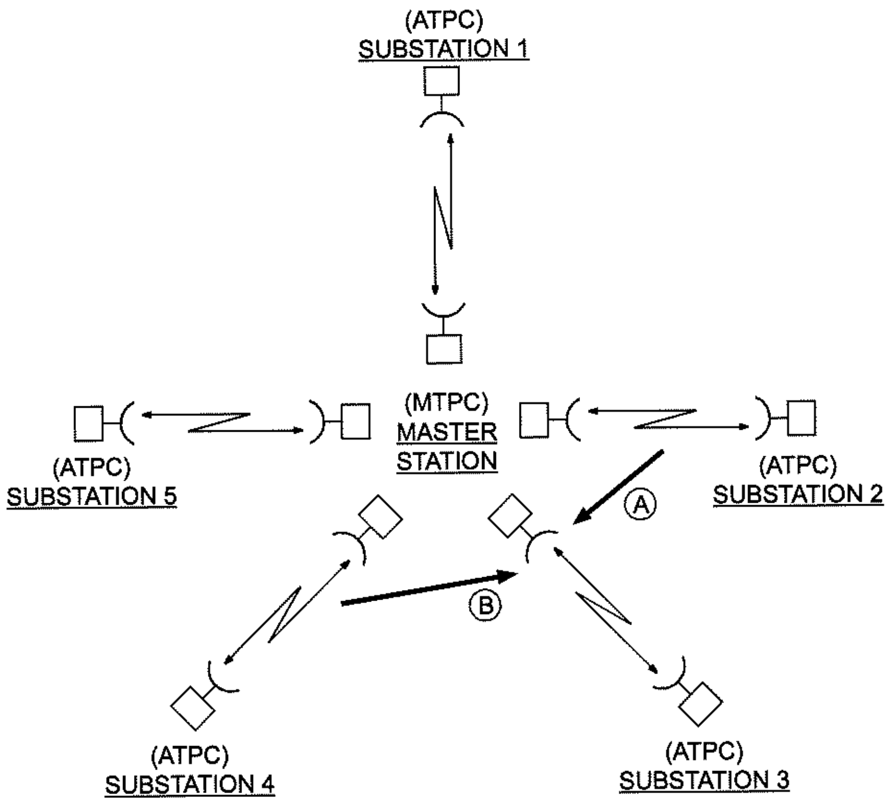
Even if the station is set in the MTPC mode, the opposite station is likely to be set in the ATPC mode. Therefore, setting the RX Threshold (Receiving threshold level) is required for controlling the transmission level of the opposite station. Between the stations that are respectively set in the MTPC mode, however, the setting is disabled.

The following is an example of operation between stations set in MTPC-ATPC mode.



The transmitting level of station B is controlled so that the receiving level of station A in the above figure reaches the RX Threshold set level (–50 dBm) set in station A. This method is used in station A for reducing the level of interference to other route. As station A is set in the MTPC mode, the transmitting level is kept unchanged.

Then an example of using MTPC-ATPC is shown below. As shown in the figure, in the master station communicating with many substations, waves gather from substations possibly causing interferences. Therefore, substations must be set in the ATPC mode to minimize the diffraction (interference) to other routes while reducing the receiving levels from individual substations to the minimum. In substations, there is little possibility of occurring interferences; therefore, the master station is set in the MTPC mode to permit transmission at a constant level.



Ⓐ Ⓑ : Diffraction to other route.

2.4.4 Loopback Control

The loopback function is provided for checking the system quality during maintenance and/or to quickly isolate a fault location. The control is performed by the LCT, the PNMT or the PNMS.

The following types of loopback are provided:

- DS1 near-end loopback (DS1 LB1) at the CTRL module ((a) in Fig. 2-7).
- Main DS1 far-end loopback (DS1 LB2) at the CTRL module ((b) in Fig. 2-7).
- IF loopback (IF-LB) at the MODEM module ((c) in Fig. 2-7).

Notes: 1. While the IF loopback is in execution, monitoring of the opposite and the subsequent stations are disabled on the PNMS and PNMT.

2. Loopback control will interrupt the radio link connection.

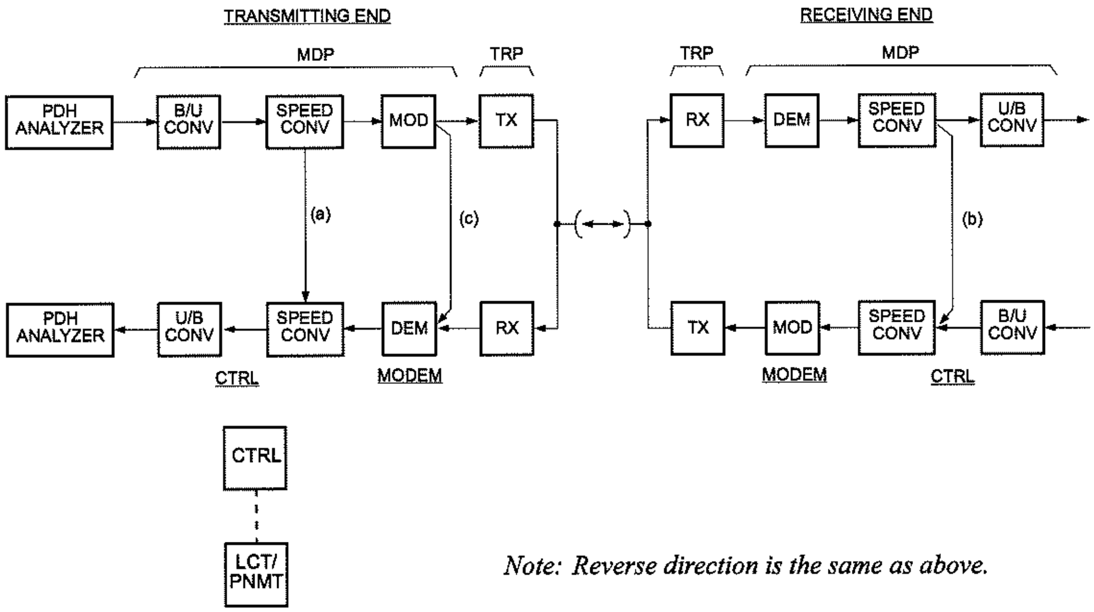


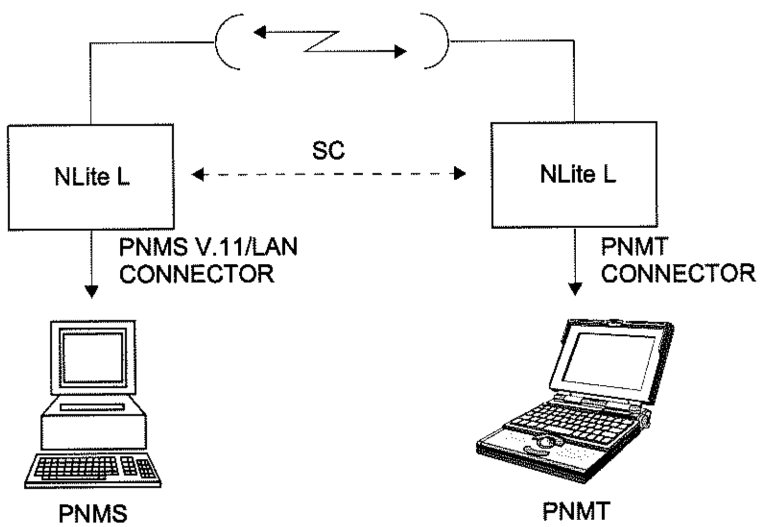
Fig. 2-7 Loopback Location

2.4.5 Network Management (Optional) (released after Jan., 2004)

The Network Management System (NMS) configuration is shown in Fig. 2-8. The pasolink network management system (PNMS) is connected to the PNMS V.11/LAN connector of the MDP located at the designated maintenance center while the pasolink network management terminal (PNMT) is connected to the PNMT connector on the MDP of remote stations. The PNMT/PNMS provides monitoring and control of the actual microwave link status and its associated NLite L equipment. Status information form and control signals to remote stations are transmitted using one of the SC channels.

Note: This SC channel is multiplexed on the main signal for subsequent transmission to the opposite station. If the IF loopback is executed the SC channels of the station under maintenance will also be looped back, thereby making it impossible to monitor or control the opposite and the subsequent stations

For detailed information, refer to the related PNMS or PNMT manual.



PNMS : Pasolink Network Management System
PNMT : Pasolink Network Management Terminal

Fig. 2-8 Network Management System

2.5 Protection Switching

Protection switching is provided for the TX and RX sections in the Hot Standby (HS) system and is performed by automatic control and manual control.

The TX protection switching is performed by the mute control on the No.1 and No.2 channel TRPs at the transmitting end of the Hot Standby system in the split type. The RX protection switching is performed by the Hitless Switch (HL SW)* on the SW UNIT of the MDP at the receiving end of the Hot Standby system.

Note: The hitless switching of Main DS1 data is performed when the detected BER exceeds the internally preset value (3×10^{-7}) in automatic switching mode. When switching is performed by manual control or by an alarm event, hit is occurred by switching. The hitless switching is not applied for DSC signals.

The manual control should be performed in maintenance status. This is because automatic switching is implemented by hardware logic and manual switching is implemented by software logic. That is, automatic switching and manual switching are completely independent and different switching conditions. Then, note that when the operator reverts to automatic switching after performing manual switching, the channel will be re-selected by the automatic switch control.

2.5.1 Switching Control

(a) TX Switching

The TX switching is performed by manual or automatic control.

The manual control is executed by operator from the LCT in maintenance status. The automatic switching that is initiated by detection of a failure in the transmit section of the MDP or TRP. While TX switching, either initiated manually or automatically, may cause a instantaneous interruption of the transmission. Automatic and manual TX switching have the following operational features:

- Manual switching:

  Selects TRP of either No.1 or No.2 even if TRP is alarm status. The manual switching control has priority over the automatic switching control.

- Automatic switching:

  The switching is performed when the modulator alarm is detected in the MDP or when the TX IF input alarm, TX power alarm or APC alarm is detected in the TRP.

In the automatic switching mode, No.1 channel can be given Priority or Non-priority. Under the priority mode, when switchover has been performed from No.1 CH to No.2 CH caused by No.1 CH alarm, reversal switchover is performed automatically from No.2 CH to No.1 CH when alarm condition of the No.1 is restored. Under the Non-priority mode, the switchover is performed alternately from No.1 CH to No.2 CH or vice versa according to the alarm status.

The TX switching condition is shown on the LCT and by the TX1 and TX2 STATUS indicators on the SW UNIT.

(b) RX Switching

The RX switching is performed by the HL SW on the SW UNIT of the MDP in the Hot Standby system.

The RX switching is performed by manual or automatic control.

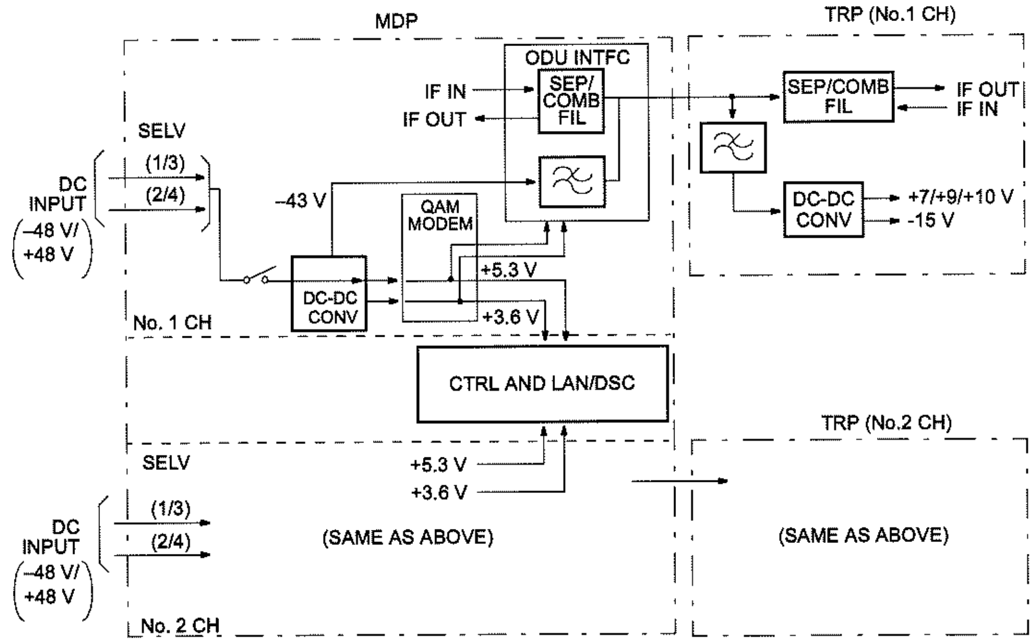
The manual control is executed by operator from the LCT in maintenance status. The automatic switching that is initiated by detection of a failure in the receive section of the MDP or TRP.

The switching priority and switching conditions for automatic and manual switching are identical to those of TX switching. The switching condition is shown on the LCT and by the RX1 and RX2 STATUS indicators on the SW UNIT.

2.6 Power Supply

The power supply system block diagram is shown in Fig. 2-9. The DC-DC CONV module on the MDP produces regulated +5.3 and +3.6 V DC power from ±48/±24 V DC input power for the component modules in the MDP. Also, this module produces a regulated –43 V DC power from the –48 V DC input power for the TRP.

The power to the TRP is supplied through the coaxial cable which is also used for the IF and other signals. The DC-DC CONV module of the TRP produces +7/+9/+10 and –15 V DC power for the component modules from the –43 V DC power supplied from the MDP.



Note: The common (CTRL and LAN/DSC) modules are supplied DC power from the DC-DC CONV modules of both No. 1 and No. 2 to protect the system.

Fig. 2-9 Power Supply System Block Diagram

(This page is intentionally left blank.)

3. SUBSYSTEM DESCRIPTION

Described herein are composition and functional operation of each module of the MDP and the TRP.

INDOOR UNIT

3.1 Composition

The following equipment are composed of appropriate plug-in units as listed in Table 3-1. The component unit/modules are arranged on a shelf as shown in Fig. 3-1.

Table 3-1 MDP Equipment

Code No.	Equipment Name	Capacity	Modulation
H0763A	MDP-15MB5T-1A	8 x DS1	32 QAM
H0763B	MDP-28MB7T-1A	16 x DS1	128 QAM

- MDP-15MB5T-1A: 8 x DS1, Fixed bit rate type
- MDP-28MB7T-1A: 16 x DS1, Fixed bit rate type

Table 3-2 MDP Component

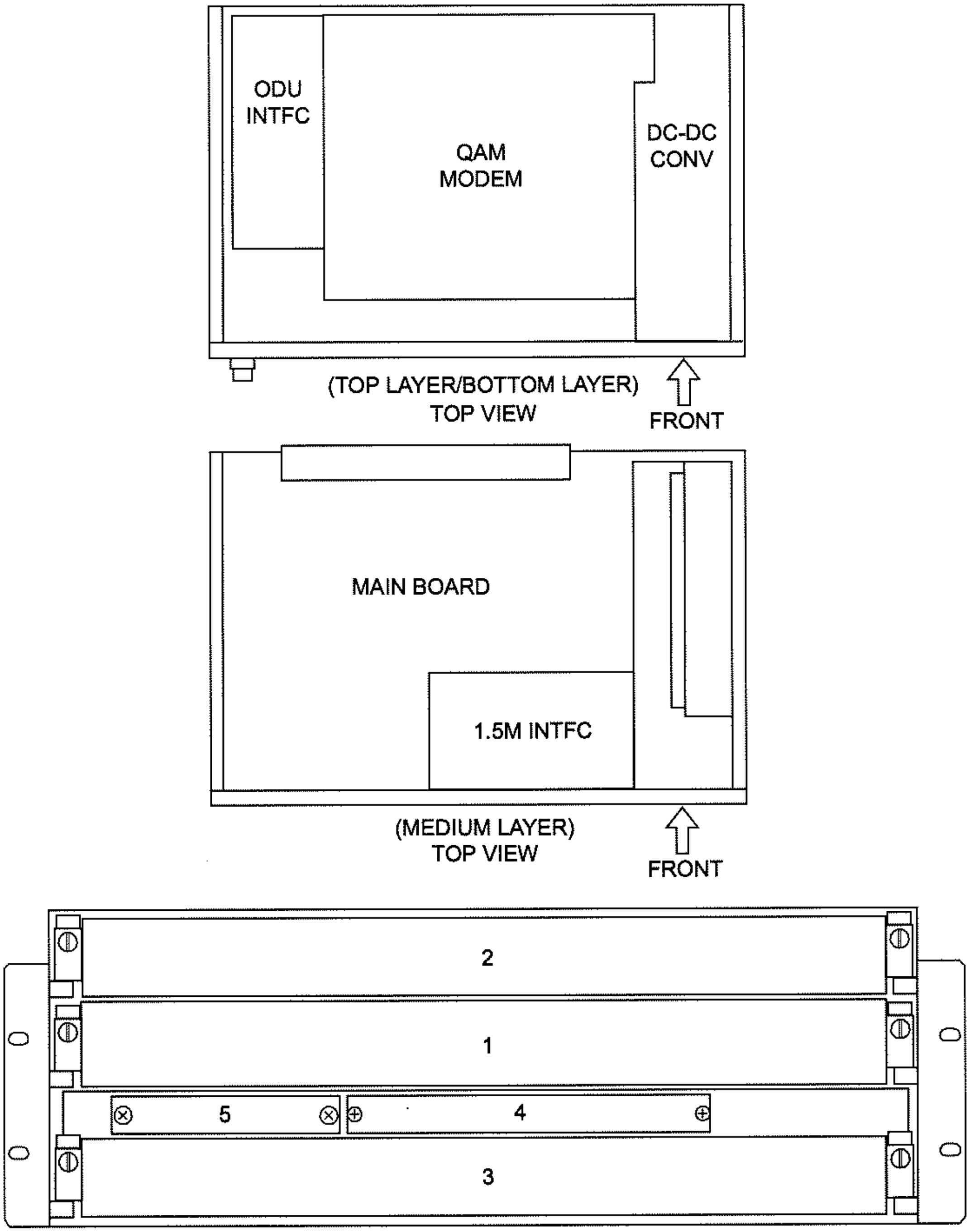
Location No.*	Unit Name	MDP-15MB5T-1A (8 × DS1)	MDP-28MB7T-1A (16 × DS1)	Remarks
1	H0766A SW UNIT	√	—	
	H0766B SW UNIT	—	√	
2	H0936A MD UNIT	√	—	No. 1 CH
	H0936B MD UNIT	—	√	
3	H0936A MD UNIT	√	—	No. 2 CH
	H0936B MD UNIT	—	√	
4	H0935A CODE CONV	√	√	optional (*3)
5	H0934A LAN INTFC	√	√	optional (*4)

Notes: 1. √ : Applicable, — : Not Applicable

*2. *Location numbers are referred to those in Fig. 3-1.*

3. Supplied after Dec., 2003.

4. Supplied in future.

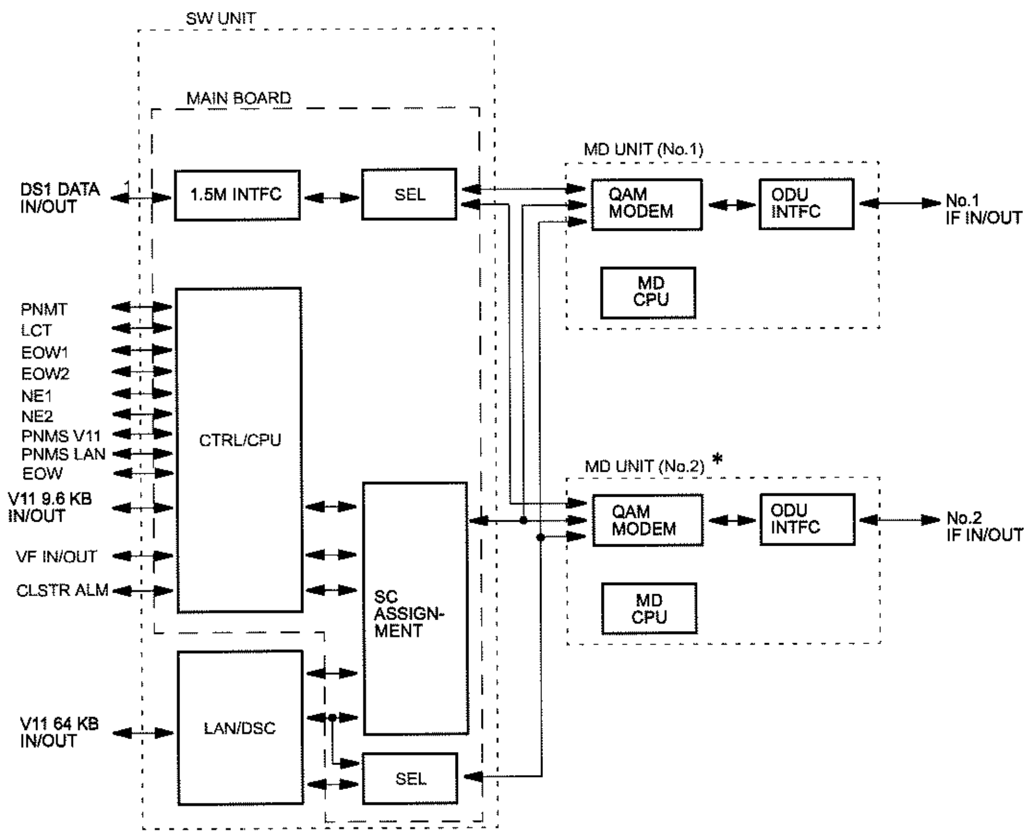


Notes: 1. Location numbers are referred to those in Table 3-1.
*2. * For details, refer to Note 7 of Fig. 3-3 in Chapter 3.*

Fig. 3-1 MDP Component Unit/Module Arrangement

3.2 Functional Operation

A block and level diagram of the MDP is shown in Fig. 3-2. Functional operations of the TRP are described separately for the modulator section and demodulator section.



Notes: 1. *The recommended cable, 8D-FB, has 15 dB (at 140 MHz)/26 dB (at 340 MHz) loss at the maximum length of 300 meters (1,000 feet).*

2. *For details of SC Assignment and Sub Interface, refer to Fig. 3-3.*

3. ** Not provided for 1+0 system.*

Fig. 3-2 MDP Block and Level Diagram

3.2.1 Modulator Section

The DS1 signals received from the terminal equipment enter the 1.5M INTFC module in the SW UNIT. The 1.5M INTFC extracts the clock component from the data signal. Then the code format of DS1 signal is converted from B8ZS or AMI into Non-Return-To-Zero (NRZ) with extracted clock signal and fed to the QAM MODEM module.

In the QAM MODEM module, the data signal is speed-converted into radio frame format and time slots are made. Then additional bits for the digital service channel (DSC), orderwire (OW) and supervisory (SV) signals are inserted into the time slots. Moreover, error correction FEC bits are inserted, coded and string-converted into the data signal rows for modulation. The signal is then modulated with local oscillator signal into a 340 MHz IF signal, and is fed to the ODU INTFC module.

In the ODU INTFC module, the 340 MHz IF signal is multiplexed with the DC power and control signal, etc. which are fed to the TRP after the undesired amplitude-frequency characteristics due to the IF line cable is compensated.

3.2.2 Demodulator Section

At the ODU INTFC module, the control signal is separated from the 140 MHz IF signal received from the TRP. 140 MHz IF signal is fed to the QAM MODEM module after the undesired amplitude-frequency characteristics due to the IF line cable length and the signal level are compensated.

The 140 MHz IF signal from the ODU INTFC module is demodulated at the QAM MODEM module, then regenerated to the baseband signal composed of the radio frame. After the detection and correction of errors that occurred through the radio link are corrected, and radio frame synchronization is established. Then the DSC,WS, OW and SV signals inserted in the transmitter side are extracted from the time slots. The time slots for additional bits are removed, and fed to the 1.5M INTFC module.

The NRZ-coded data signal is converted into the original DS1 B8ZS or AMI data signal and fed to terminal equipment.

TRP UNIT

The composition and functional operation of the TRP are described in this chapter.

3.3 Composition

The component modules are arranged on the shelf as shown in Fig. 3-4.

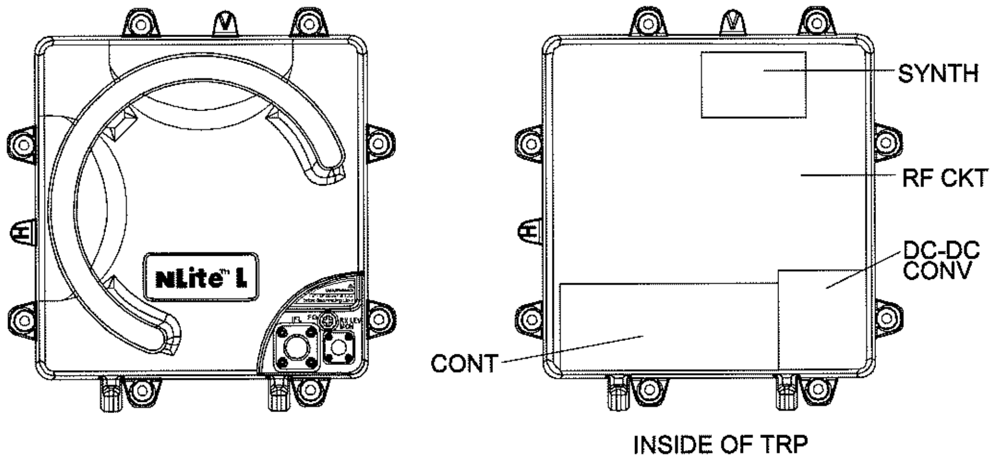


Fig. 3-3 TRP Component Module Arrangement

3.4 Functional Operation

The block diagram of the TRP is shown in Fig. 3-5. Functional operations of the TRP are described separately for the transmitter section and receiver section.

3.4.1 Transmitter Section

An alarm/control signal, Engineering Orderwire (EOW) signal and DC component which are composed of the IF signal are separated through the multiplexer (MPX) circuit. The alarm/control signal, and EOW signal are applied to the CONT module. The DC component is applied to the DC-DC CONV module to produce regulated DC voltages which are used in the TRP. The 340 MHz IF signal applied from the MDP is converted into the RF signal by mixing with a local signal generated at the SYNTH module. The RF signal is fed to the BPF which eliminates undesired components caused through the IF-RF conversion. The RF signal from the BPF is amplified and controlled the level by the ALC and ATPC function. The amplified RF signal is sent to the antenna through the BPF and circulator.

3.4.2 Receiver Section

The RF signal received from the antenna is amplified to the required level by the RF amplifier. The RF signal is converted into the 140 MHz IF signal by mixing with a local signal generated by the SYNTH module. The 140 MHz IF signal is AGC controlled and fed to the MDP through the MPX circuit which combines the alarm/control signal, EOW signal and monitoring signal.

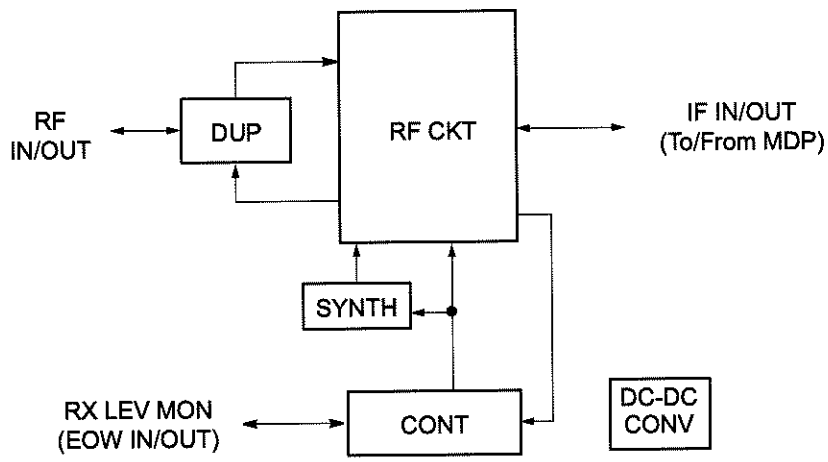


Fig. 3-4 TRP, Block Diagram

(This page is intentionally left blank.)