

# **NEC CORPORATION**

## **General Description and Block Diagram**

### **5.8 GHz UNLICENSED DIGITAL MICROWAVE RADIO**

**October 3<sup>rd</sup>, 2007**

## **1.0 General Description**

This section provides information on the NEC 5.8 GHz digital microwave radio system for the plesiochronous digital hierarchy (PDH) hierarchy (PDH). The 5.8 GHz 15/28/45 MB digital microwave radio system is designed to transmit DS-1 and DS-3 level signals. It operates in the 5.8 GHz radio frequency band using the 32, 128 or 64 QAM Quadrature Amplitude Modulation (QAM) method and has a transmission capacity of 8 x 1.544 MB, 16 x 1.544 MB or 1 x 45 MB. Included herein are system description and subsystem description.

### **1.1 Functional Description**

#### **1.1.1 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.

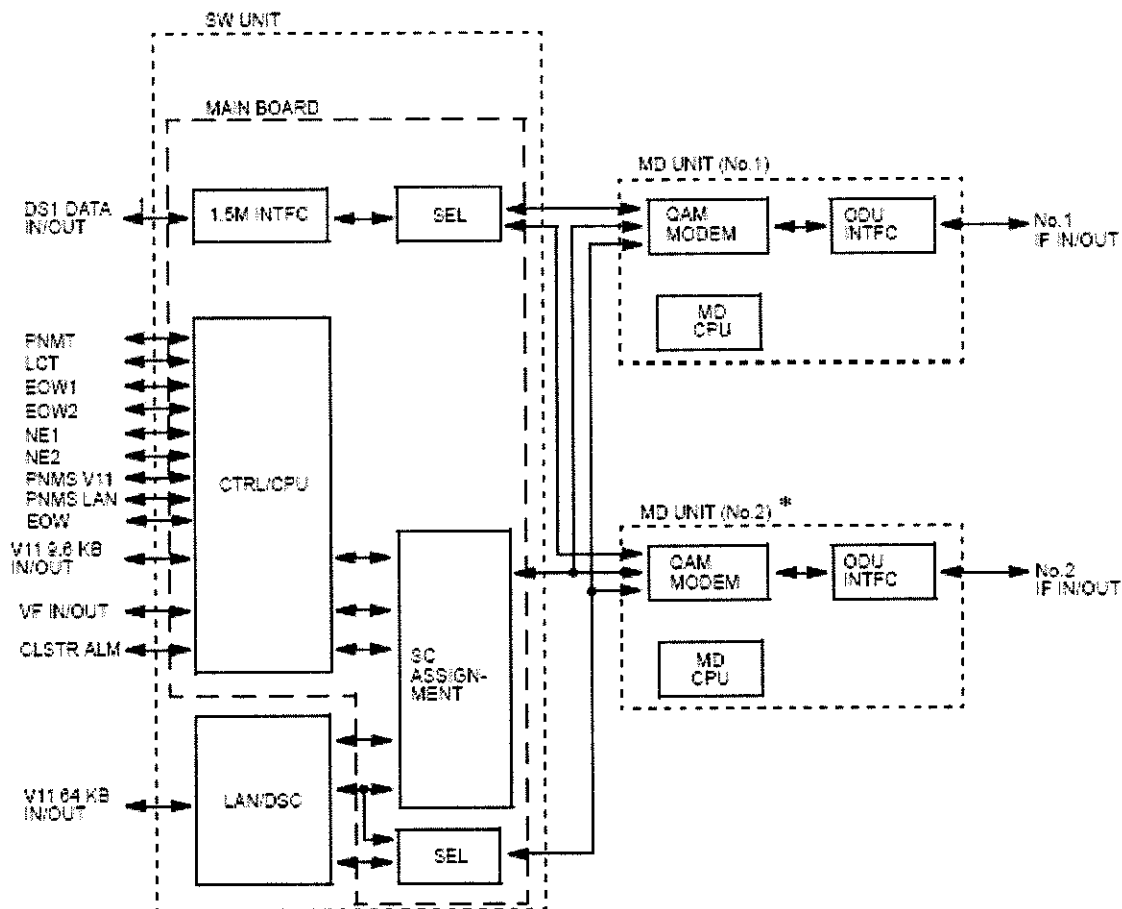
In the QAM MODEM module, the data signal is speed-converted into radio frame format and time slots are made. Then additional bits for the digital service channel (DSC), orderwire (OW) and supervisory (SV) signals are inserted into the time slots. Moreover, error correction FEC bits are inserted, coded 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.

#### **1.1.2 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.

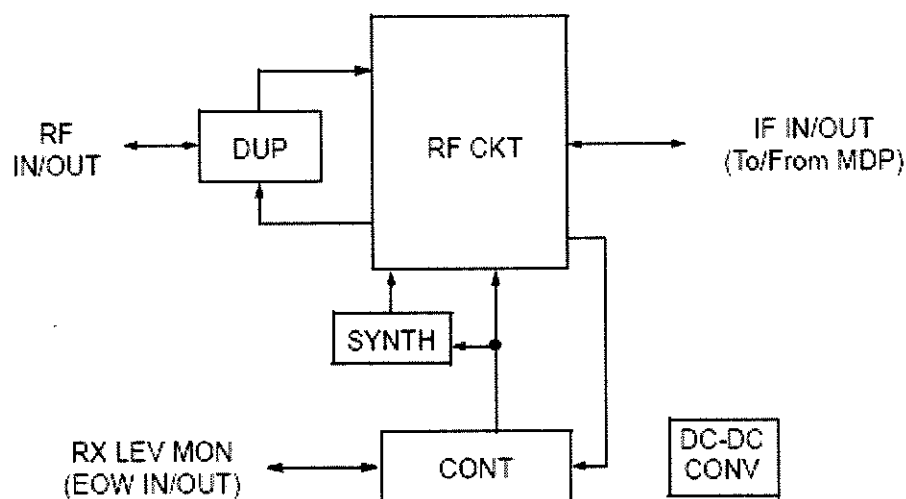


### 1.1.3 Transmitter Section

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.

### 1.1.4 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.



## **1.2 System Configuration**

The system consists of the Modulator-Demodulator (MDP), Transmitter-Receiver (TRP) and the Antenna (see Fig. 1-1 to Fig 1-4). The MDP types are as follows:

- MDP-15MB5T-1A/D: 8 x 1.5 MB, Fixed bit rate type (Indoor Unit)
- MDP-28MB7T-1A/D: 16 x 1.5 MB, Fixed bit rate type (Indoor Unit)
- MDP-50MB6T-1A/D: 1 x 45 MB, Fixed bit rate type (Indoor Unit)
- TRP-6G-6AA-25: 5.8 GHz ODU (Outdoor Unit)

The 5.8 GHz 15/28/45 MB microwave radio system is a single hop (point-to-point) system between two terminal stations, and is configured in the 1+1 (Hot Standby) or 1+0 (Expandable) system.

## **1.3 NLite L Radio Standard Features**

- Frequency band of 5725 to 5850 MHz (Unlicensed).
- DS1 and DS3 Traffic capacities.
- International Telecommunications Union (ITU)//FCC compliant.
- Consisting of lightweight ODU (Outdoor Unit), IDU (Indoor Unit) and Antenna

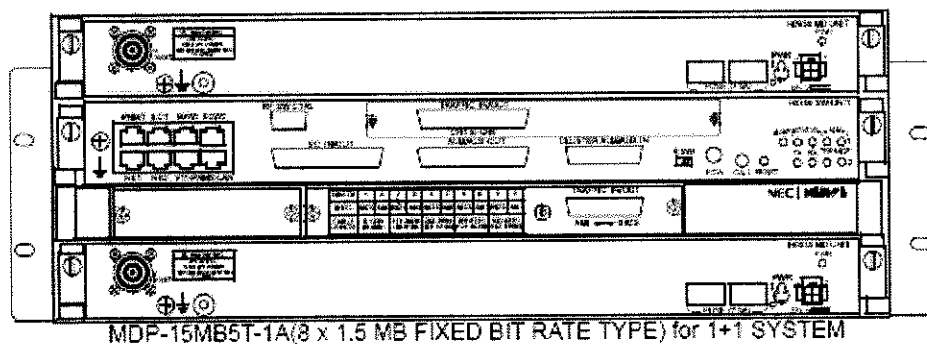


FIGURE 1-1

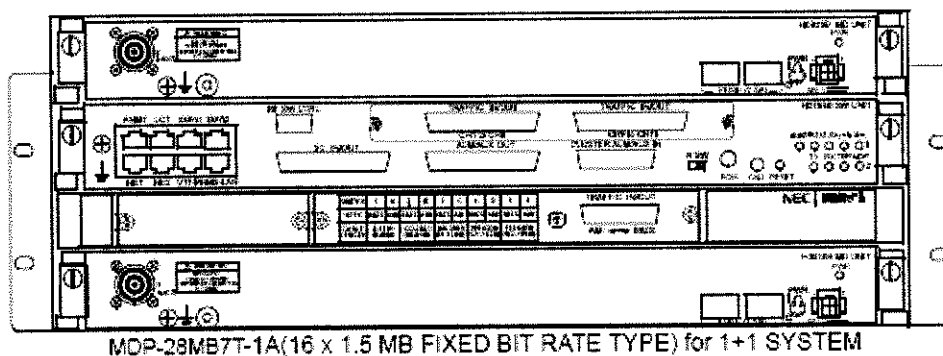


FIGURE 1-2

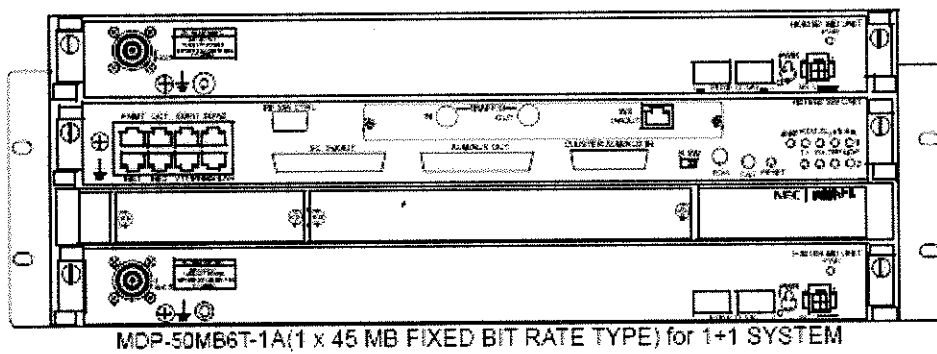


FIGURE 1-3

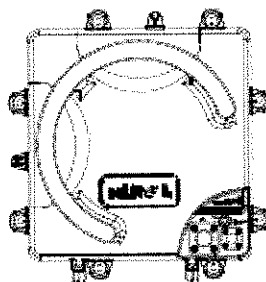


FIGURE 1-4

## **1.4 RADIO CONFIGURATIONS**

The system consists of the Modulator-Demodulator (MDP), Outdoor Unit (ODU) and the Antenna. The MDP types are as follows:

- MDP-15MB5T-1A/D: 8 x 1.5 DS1
- MDP-28MB7T-1A/D: 16 x 1.5 DS1
- MDP-50MB6T-1A/D: 1 x DS3

## **1.5 NLite L Radio Operation Features**

### **1.5.1 Power Requirements**

The NLite L Radio requires from 20.5 to 60 V dc primary power with positive or negative ground. The DC-DC CONV module on the MDP produces regulated +5.3 and +3.6 V DC power from  $\pm 48/\pm 24$  V DC input power for the component modules in the MDP. Also, this module produces a regulated -43 V DC power from the -48 VDC 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.

### **1.5.2 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. The monitoring items are as follows:



## **Performance Monitoring**

- 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)

### **1.5.3 Switching Control**

#### **1.5.3.1 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.

#### **1.5.3.2 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.

#### **1.5.4 Automatic Transmitter Power Control**

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

#### **1.5.5 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.
- Main DS1 far-end loopback (DS1 LB2) at the CTRL module.
- IF loopback (IF-LB) at the MODEM module