NEC CORPORATION

iPasolink 5.8 GHz Microwave Radio

General Description

5.8 GHz UNLICENSED DIGITAL MICROWAVE RADIO

August 4th, 2012

1.0 General Description

This section provides information on the NEC iPasolink 5.8 GHz digital microwave radio system for the SONET digital hierarchy (SDH) hierarchy (PDH). The 5.8 GHz 150 MB digital microwave radio system is designed to transmit LAN signals. It operates in the 5.8 GHz radio frequency band using the 128/256 QAM Quadrature Amplitude Modulation (QAM) method. Included herein are system description and subsystem description.

1.1 Functional Description 1.1.1

Modulator Section

The GbE LAN signals received from the terminal equipment enter the LAN INTFC module in the INTFC UNIT. The LAN traffic is converted into a serial the data 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), 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 ODU 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 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 LAN INTFC module.

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), Out-Door Unit (ODU) and the Antenna.

The 5.8 GHz 155 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 iPasolink Radio Standard Features

- Frequency band of 5725 to 5850 MHz (Unlicensed).
- GbE LAN traffic interface.
- International Telecommunications Union (ITU)//FCC compliant.
- Consisting of lightweight ODU (Outdoor Unit), IDU (Indoor Unit) and Antenna.

1.4 RADIO CONFIGURATIONS

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

• MDP: NWA064931, Indoor Unit

• ODU: TRP-6G-1D, Outdoor Unit

1.5 iPasolink Radio Operation Features

1.5.1 Power Requirements

The iPasolink radio requires from 22 V to 56 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 ±48/±24 V DC input power for the component modules in the MDP. Also, this module feeds -48 VDC input power for use by the TRP. The power to the ODU is supplied through the coaxial cable which is also used for the IF and other signals. The DC-DC CONV module of the ODU produces +7/+9/+10 and -15 V DC power for the component modules from the -48 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 ODU. While TX switching, either initiated manually or automatically, may cause a 30 msec 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 ODU.

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:

- IF loopback (IF-LB) at the MODEM module