L54 Series Digital STL Radios
User Manual

Ver 1.0.1

1 Safety Precautions

PLEASE READ THESE SAFETY PRECAUTIONS!

RF Energy Health Hazard 

This symbol indicates a risk of personal injury due to radio frequency exposure.
The radio equipment described in this guide uses radio frequency transmitters.
Do not allow people to come in close proximity to the front of the antenna while the transmitter is operating. The antenna will be professional installed on fixed-mounted outdoor permanent structures to provide separation from any other antenna and all persons.
WARNING: RF Energy Exposure Limits and Applicable Rules for 6-38 GHz. It is recommended that the radio equipment operator refer to the RF exposure rules and precaution for each frequency band and other applicable rules and precautions with respect to transmitters, facilities, and operations that may affect the environment due to RF emissions for each radio equipment deployment site.

Appropriate warning signs must be properly placed and posted at the equipment site and access entries.

Protection from Lightning

Article 810 of the US National Electric Department of Energy Handbook 1996 specifies that radio and television lead-in cables must have adequate surge protection at or near the point of entry to the building. The code specifies that any shielded cable from an external antenna must have the shield directly connected to a 10 AWG wire that connects to the building ground electrode.

Do not turn on power before reading documentation. This device has a -48 VDC direct current input.

Protection from RF Burns

It is hazardous to look into or stand in front of an active antenna aperture. Do not stand in front of or look into an antenna without first ensuring the associated transmitter or transmitters are switched off. Do not look into the waveguide port of an ODU (if applicable) when the radio is active.

Risk of Personal Injury from Fiber Optics

DANGER: Invisible laser radiation. Avoid direct eye exposure to the end of a fiber, fiber cord, or fiber pigtail. The infrared light used in fiber optics systems is invisible, but can cause serious injury to the eye.

WARNING: Never touch exposed fiber with any part of your body. Fiber fragments can enter the skin and are difficult to detect and remove.

Warning – This is a Class A product

Warning – This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Warning – Turn off all power before servicing

Warning – Turn off all power before servicing.

Safety Requirements

Safety requirements require a switch be employed between external and internal power supplies.

Proper Disposal

The manufacture of the equipment described herein has required the extraction and use of natural resources. Improper disposal may contaminate the environment and present a health risk due to the release of hazardous substances contained within. To avoid dissemination of these substances into our environment, and to lessen the demand on natural resources, we encourage you to use the appropriate recycling systems for disposal. These systems will reuse or recycle most of the materials found in this equipment in a sound way. Please contact CarrierComm or your supplier for more information on the proper disposal of this equipment.

2 System Descriptions

2.1Overview

L54 series of PDH digital microwave radios, and integrated design
incorporating high & new technology such as FPGA, ASIC and digital signal processor (DSP).

The L54 is designed for short-haul, high-reliability, easy-toinstall, and low-cost point-to-point communication links. Applications include PCS/PCN micro-cell fixed network infrastructure, cellular back-haul interconnections. And now the L54 has been used in applications such as military and private networks for government, educational institutions, banks and commercial organizations.

The L54 is designed for data rates including 4x 2.048 Mb/s (4E1), 8x 2.048 Mb/s (8E1), 16x 2.048 Mb/s (16E1), 10/100BASE-T+ 1/2/4 E1 (14MHz or 28MHz) in protected and unprotected configurations.

Indoor Units (IDUs) are muilti fuctional; configure flexial, small, and reliable, support capacities including 4E1, 8E1, 16E1, 10/100BASE-T+1/2/4E1. And IDU supports 2 auxialy data channels, a phone channel, a 10BASE-T and RS232 network management channel. Meanwhile, we can get the BER, RSL and working status of equipment, and control the working status by NMS or LCD panel.

2.2 Features

- High perfermance and integrated design incorporating high & new technology
- Minimal installation time
- Single coaxial cable connection between Indoor and Outdoor Units
- Adjustable transmit output power
- Frequency/channel setting via LCD panel or NMS
- Diagnostic loopbacks accessible via LCD panel or NMS
- 253 different Device ID codes
- Selectable traffic capacity
- The same IDU support all different service pulgin, such as 4/8/16E1, 10/100BASE-T
- Software adaptive service pulg in
- Auxiliary Alarm input and Relays output
- Digital Modulator and Demodulator, Forward-Error-Correction (FEC)
- High sensitivity and high system gain
- Low power consumption, use 3.3V and 1.5V working voltage
- Standard radio IF frequencies on the cable: 310MHz/70MHz
- No cable length settings or adjustments required, RG-6/U cable up to 100m
- Protection Switch Option available
- SNMP (NMI) Option available
- WEB Server supported for network management
- 1 Rack Unit (RU) high, 19” wide
- The same IDU support all different service pulgin
- 4 external alarm input sensor as standard
- 5 alarm relay outputs as standard
- Front panel keypad access to control and diagnostics features

Control:

- Link Capacity select
- Frequency of operation
- Transmitter Power adjustment
- Dvice ID
- Tributary status
- Transmitter On/Off
- ATPC

Diagnostics:

- Beep and Light Alarm
- RSSI
- Current BER
- Alarm summary status
- Transmitter Power Status
- Auto Locate Alarm and display

2.3 Software Controlled Features

The L54 is based on full software control and system configuration. Use of the software-based features is through the front LCD panel keypad and display on each IDU, or through Internet Explorer running in PC. The RJ-45 connector on the IDU front panel provides a 10BASE-T interface to a standard IBM compatible PC running Microsoft Windos@. The software functions include all commands to configure a terminal, the alarms and monitor performance. The configuration of both the local and remote terminals can be displayed and changed from one end of the link. In additional, if connect network interfaces together, multi terminals are managed from one terminal.

We can monitor transmit/receive frequencies, transmit power level, device ID code, receive level alarm points, remote and local loopbacks, etc. See Figure 2.1 for LCD panel.

Figure 2-1 LCD Panel

The IDU keys are Up, Down, Left, Right, Clear and Enter. These front panel keys provide all of the on-site controls required to install, test, and commission a link. This can be done without any external test equipment, resulting in major time and cost savings.

Internet Explorer based on PC is also available to control, configure and monitor a L54 terminal using the 10BASE-T interface WEB based on the IDU. The WEB Server based Internet Explorer main screen is shown in Figure 2-2.

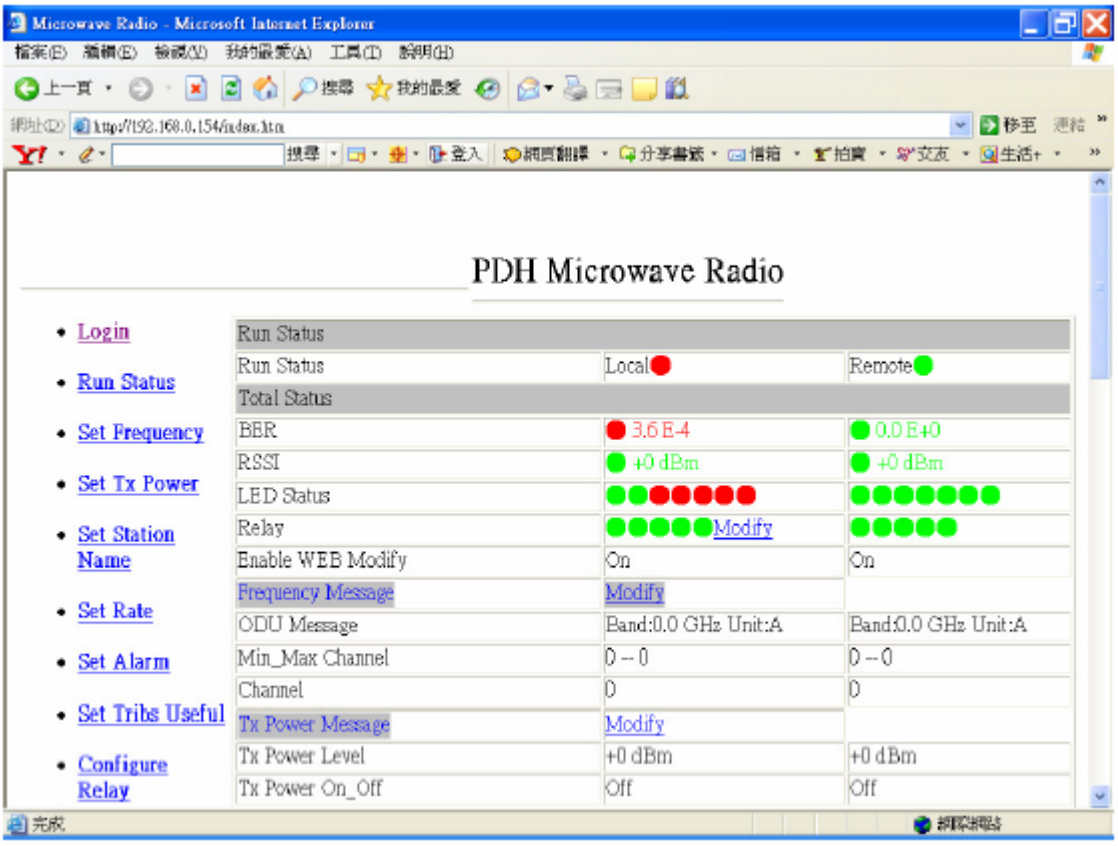


Figure 2-2 WEB based main screen

2.4 Basic Structure

A universal radio basic structure concept has been implemented for the L54 product line. A radio terminal consists of three components: IDU, ODU and Antenna. A single coaxial cable is required to interconnect the IDU with the ODU. This single cable feeds DC power to the ODU from the IDU and supports bi-directional traffic, alarm and control signals.

This basic structure is used for the full frequency range from 1 to 23 GHz to maximize flexibility, commonality of spare parts and interchangeability. This universal radio basic structure is illustrated in Figure 2-3. The primary frequency dependent components are the antenna and several modules within the ODU including the transmit hybrid, receive hybrid and diplexer. The IDU is frequency independent and the ODU is capacity independent. The network management system supports digital microwave radios of all bands. NMS interface and auxiliary data interfaces are available in the IDU to support Network Management, Auxiliary Data Channels, 1+1 Protection Interface or other custom interfaces.

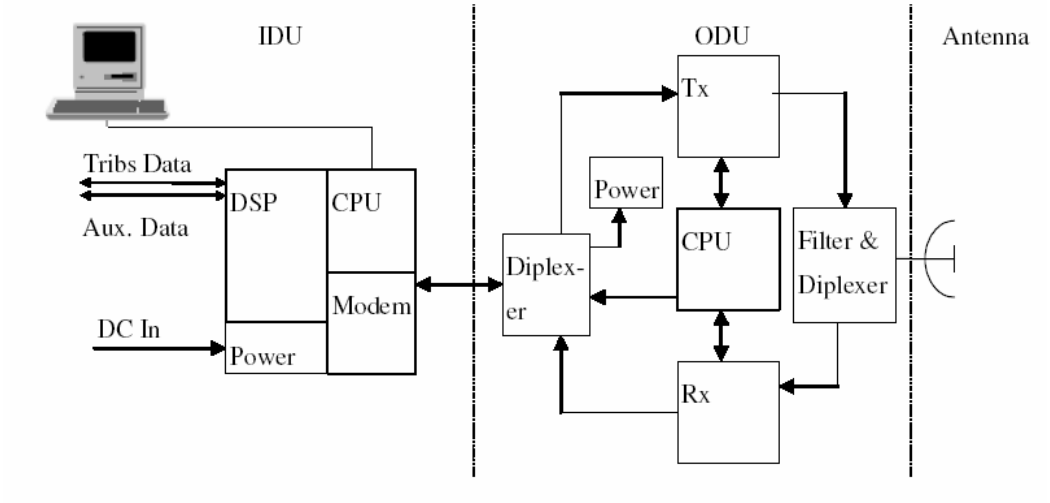


Figure 2-3 L54 Product Basic Structure

Tributary data and service channels, radio overhead and network management information at the local terminal are fed to the IDU. The IDU DSP converts the tributary data to TTL level signals and multiplexes them with the service channels onto an aggregate data stream. The IDU digital modem modulates the aggregate signal to create an Intermediate Frequency (IF) signal. The IF signal is superimposed with DC power and sent to the ODU on a coaxial cable. The ODU converts the IF signal to a Radio Frequency (RF) signal to the antenna of the remote terminal. At the remote terminal ODU, the received signal is converted back to an IF signal. The IF signal is fed through the coaxial cable to the IDU, where it is demodulated and de-multiplexed into tributary data and the auxiliary service channels. The link is full duplex (bi-directional), fully symmetrical and transparent to the data stream.

2.4.1 IDU

The L54 IDU is a 1RU rack-mountable assembly designed for 19-inch rack/cabinet installations. All IDUs are compatible with standard 19-inch EIA and ETSI rack mount standards. Each IDU is designed to support one of four capacities: 4E1/8E1/16E1, and 10/100BASE-T+1/2/4E1data rates. Different services have different interface, another way, different service should configure different service plug-in. The IDU is independent of any frequency band thus simplifying maintenance and lowering the overall cost of sparing.

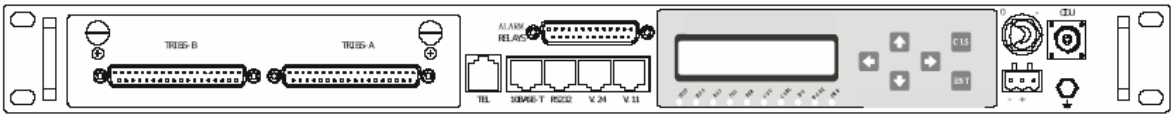


Figure 2-4 IDU for 4/8/16 E1(75ohm unbalnaced) service card

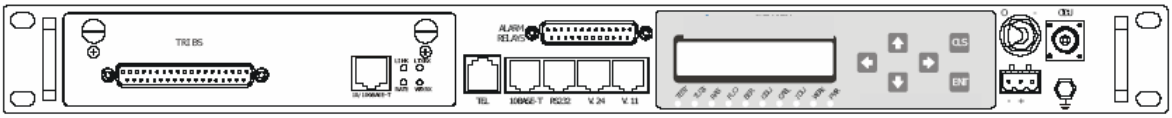


Figure 2-5 IDU for 10/100BASE-T+1/2/4 E1 (75ohm unbalnaced) service card

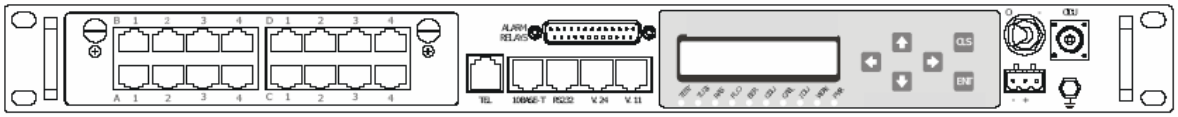


Figure 2-6 IDU for 4/8/16 E1 (120ohm balnaced) service card

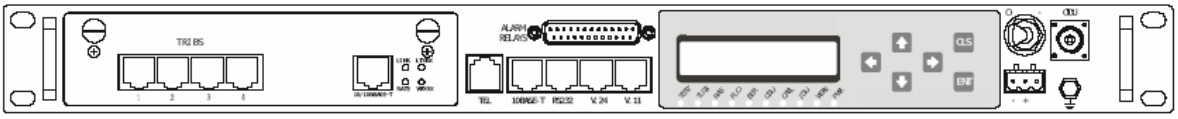


Figure 2-7 IDU for 10/100BASE-T+1/2/4 E1 (120ohm balnaced) service card

Figure 2-8 IDU for 1 +1

See Figure 2-9 for IDU panel with no plug-in card. See Figure 2-10 for 4/8/16E1 75ohm unbalanced plug-in. See 2-11 for 4/8/16E1 120ohm balanced plug-in. See Figure 2-12 for 10/100BASE-T+1/2/4E1 120ohm balanced plug-in.

Position of service card

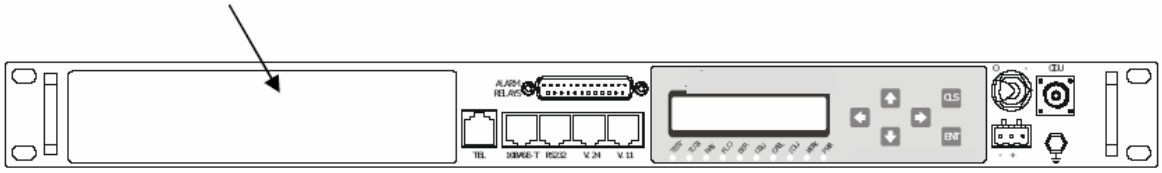


Figure 2-9 IDU without service card

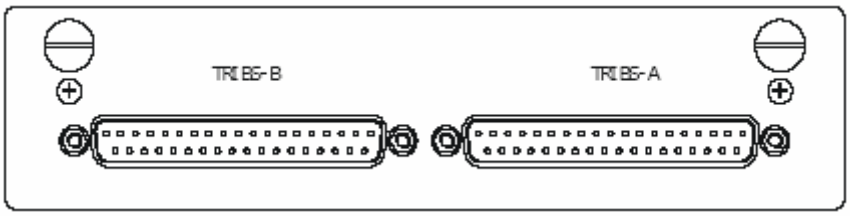


Figure 2-10 4/8/16 E1 (75ohm unbalanced)service card

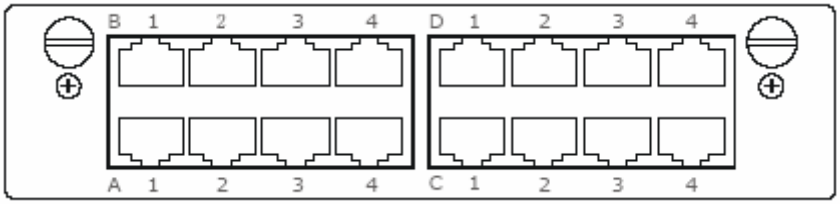


Figure 2-11 4/8/16E1 (120ohm balanced) service card

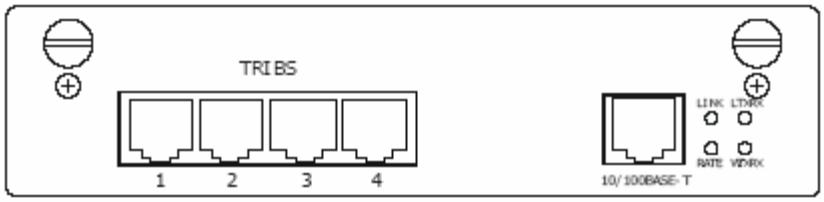


Figure 2-12 10/100BASE-T+1/2/4E1 (120ohm balanced) service card

- The SC4E1-Be for service card of 2E1, plugin port 1,2 of TRIBS to connect, the others not effectively.

See Figure 2-13 for IDU 1+1 mode panel with no plug-in card. See Figure 2-14 for 4E1 120ohm balanced plug-in. See 2-15 for 4 ports 10/100BASE-T plug-in.

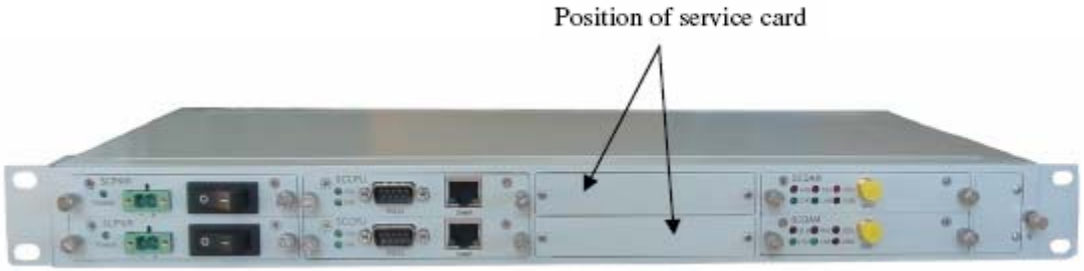


Figure 2-13 IDU 1+1 without service card

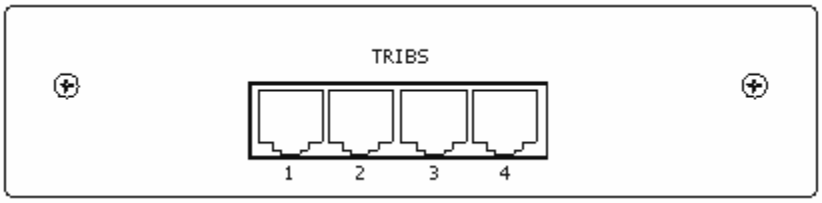


Figure 2-14 4E1 (120ohm balanced) service card

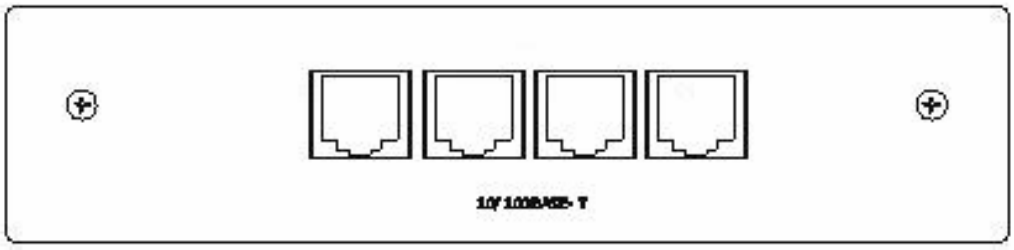


Figure 2-15 4 Prots 10/100BASE-T service card

The main functions of the IDU are data interface card (plug-in), frame multiplexing, diplexer, modulator, demodulator, DC-DC converter, and CPU alarm/status monitoring and site-to-site communications. See Figure 2-16 for block diagram of the IDU.

The optional service plug-in cards are carried Tributary Service Data, multiplexed with Auxiliary Data, EOW Data and CPU site-to-site communication messages in Frame-Mux block. The multiplexed data will be modulated, forms QPSK signal with 310MHz carrier, and send to ODU by IF cable through diplexer.

The QPSK IF signal with 70MHz carrier received by ODU will be demodulated required frame data. And the frame data will be demultiplexed by frame-diplexer to EOW signal, Auxiliary Data, CPU site-to-site communication messages and service data. The EOW signal is sent to phone interface, the Auxiliary Data is sent to Auxiliary Data interface, the CPU messages is sent to CPU for management, and the service data send to service plug-in card.

The CPU in IDU monitors the device running, and communicates with NMS.
The DC-DC module in IDU is feed by -48V and supports 3.3V, 5V and 1.5V for system
The IDU-ODU communicating module supports communication between IDU and ODU. The IDU can configure frequency and monitors status of ODU by this module.

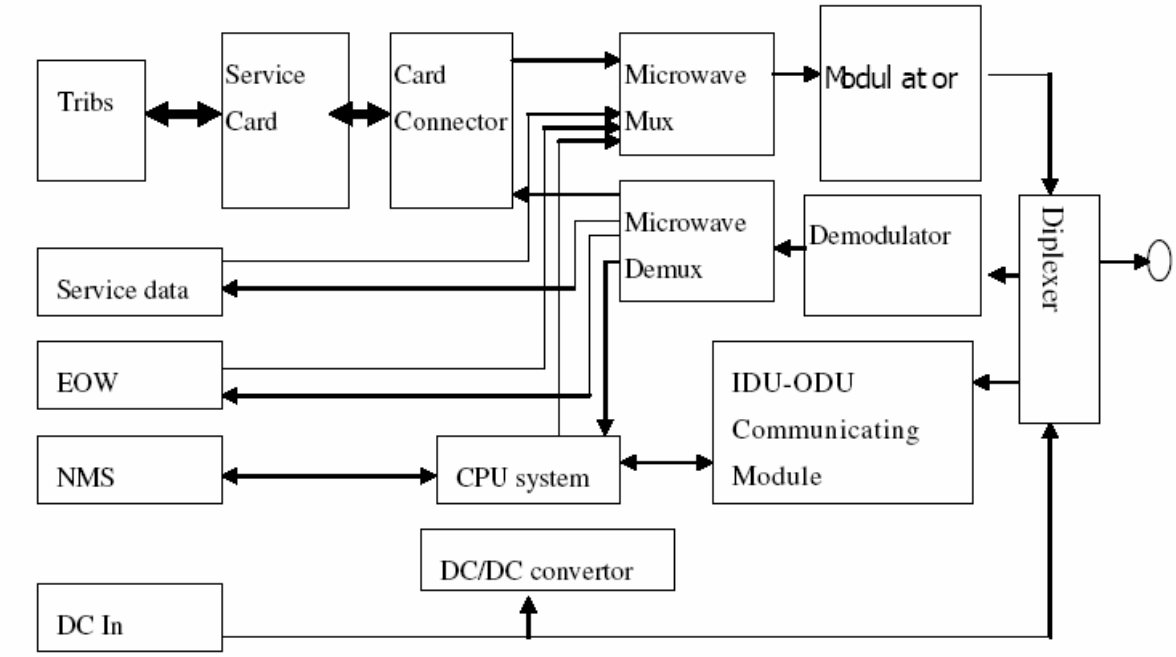


Figure 2-16 Block diagram of the IDU

The modulator of QPSK modem in IDU has functions list below: See Figure 2-17.

Convolutive Coder with 7/8 puncture rate.

Digital interpolation filters

I/Q modulater with 310MHz IF signal.

IF signal amplifier.

PLL module with 310MHz for modulate

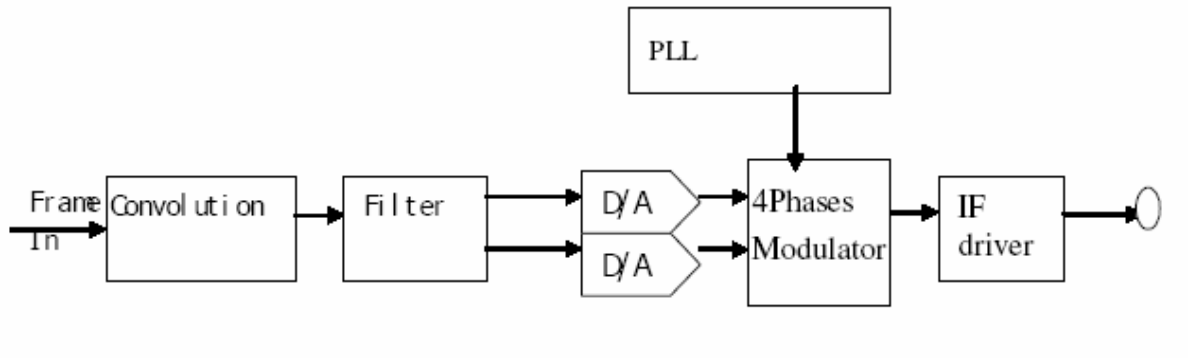


Figure 2-17 Block diagram of the QPSK modulator

The demodulator of QPSK modem in IDU has functions list below: See Figure 2-18.

70MHz IF AGC

Carrier Recovery and Derotator Loop

Timing Recovery

Nyquist Root and Interpolation Filters

FEC Modes

I/Q demodulater with 70MHz IF signal

PLL module with 70MHz for demodulate

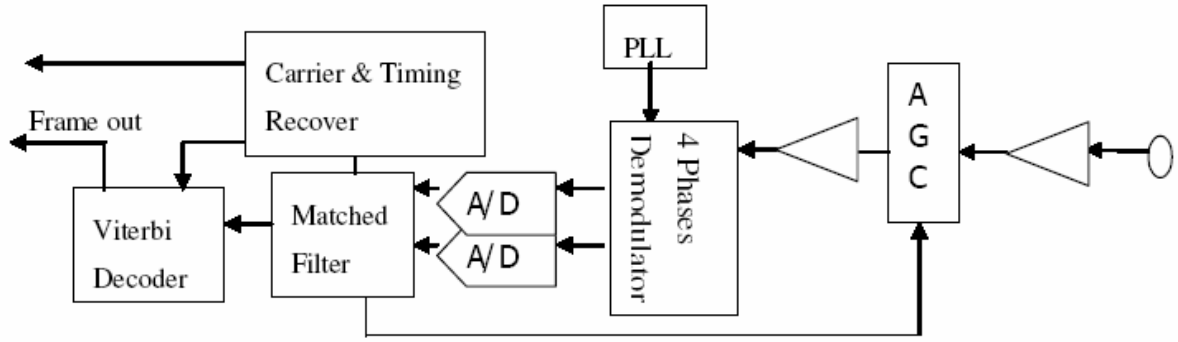


Figure 2-18 Block diagram of the QPSK demodulator

The 4/8/16E1 Service pulg-in card in IDU has functions detailed in Figure 2-19.

16 trabutary datas are fed to the 4/8/16E1 service card in IDU. The DSP in service card converts the tributary datas to TTL level signals and multiplexes them onto four E2 data streams. The 4 E2 data streams are fed to mother board of IDU througth a connector.
Samely, the 4 E2 data streams received from remote by IDU mother board are de-multiplexed into 16 tributary datas by the DSP in service card. And also, the sevice card monitors alarms of tribs, and controls tributary loopback. The interface of tributary has two types, such as 120ohm balanced and 75ohm unbalanced.

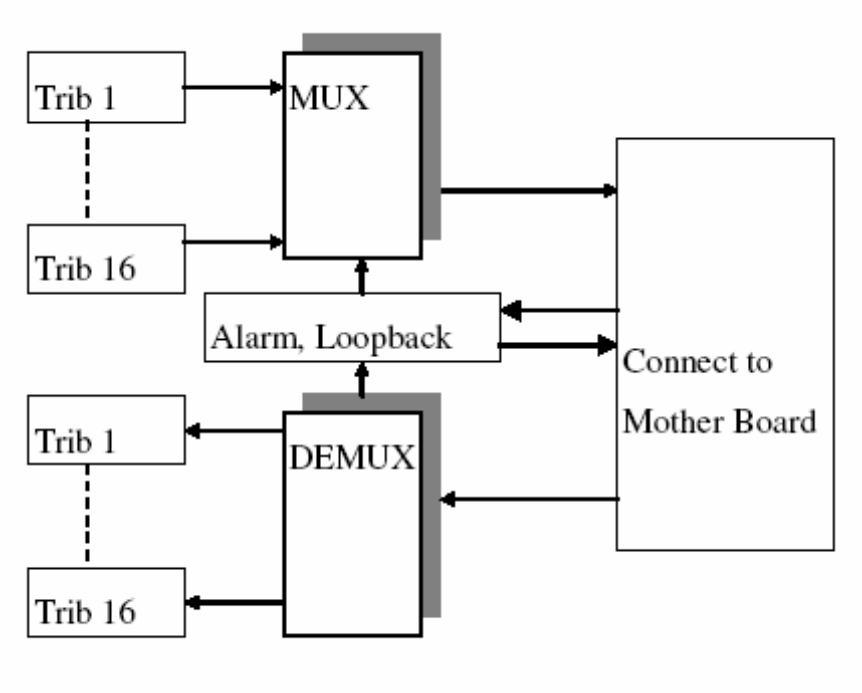


Figure 2-19 Block diagram of the 4/8/16E1 service card

The 10/100BASE-T+1/2/4E1 Service pulg-in card in IDU has functions detailed in Figure 2-20.

4 tributary datas and 1 10/100base-t data are fed to this service card in IDU. The DSP in service card converts the tributary datas and 10/100base-t data to TTL level signals, and multiplexes them onto four E2 data streams.
The 4 E2 data streams are fed to mother board of IDU througth a connector. Samely, the 4 E2 data streams received from remote by IDU mother board are de-multiplexed into 4 tributary datas and 1 10/100base-t data by the DSP in service card. And also, the sevice card monitors alarms of tribs, and controls tributary loopback. The interface of tributary has two types, such as 120ohm balanced and 75ohm unbalanced.

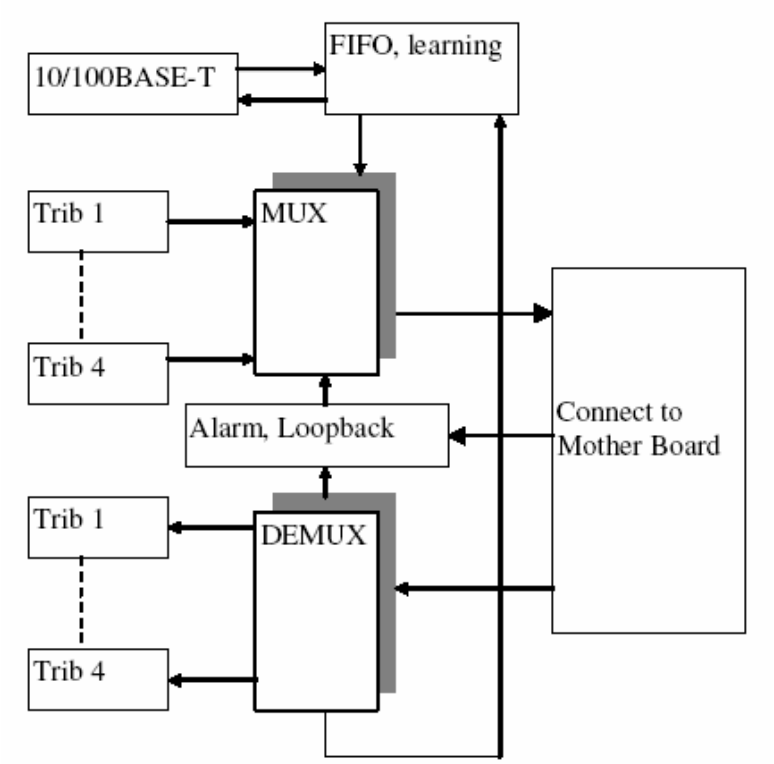


Figure 2-20 Block diagram of the 10/100BASE-T+1/2/4E1 service card

The Tx IF signal is superimposed with DC power and sent to the ODU on a coaxial cable.

The Rx IF signal is fed through the coaxial cable to the IDU. And the communicating between IDU with ODU is an OOK signal fed into the coaxial cable. See figure 2-21.

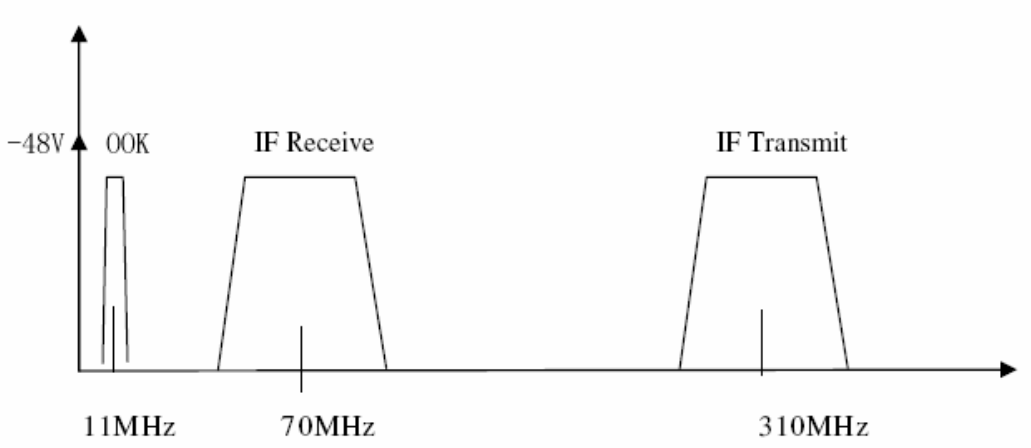


Figure 2-21 Signals in IF Cable

2.4.2 ODU

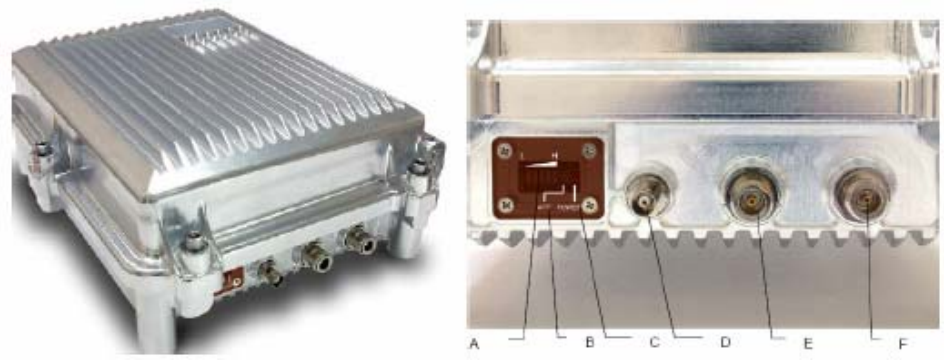


Figure 2-22 ODU and Connector

- Antenna Alignment Indicator: If there is no electric meter during set up, this indicator helps to define the antenna alignment. Higher the signal strengh indicates better antenna alignment.
- B. ACT Indicator (ACT): This indicator lights up on receiving signal from the IDU.
- C. Power Indicator: ODU's power indicator light. When all the connection cables are well connected, switch ON the IDU's power. The ODU will be provided a power of -48VDC through the IF cables by the IDU.
- D. Receive Signal Strength Indicator (RSSI): For better antenan alignment between two terminals at a longer distance, please rotate and open the BNC 50_. Use muilt-meter to measure the RSSI voltage. Weak voltage indicates weak signal received, strong signal indicates the most accurate andle position.
- E. Antenna Interface (TO ANT): Use N-type coaxial cable to connect the Antenna.
- F. IP Port (N-Type 50_): Transmission includes transmitter 310MHz, receiver 70MHz, telemetry signal, and DC -48V. Maximum transmitter of 100M possible when using RG-6 cable. Maximum transmission 200M possible when using RG-8 cable.

- At E & F interface, please entwine waterproof tape at the connection point so as to prevent rainwater or mositure from the device. Narural damage is not warranted.

3 Options

3.1 Protection Systems

The L54 Digital Microwave Radio linking is operated in protected configuration by the addition of an indoor rack-mounted protection switching shelf and another standby radio terminal.

The ODU arrangements may use either one antenna with a waveguide coupler or two antennas.

The switching protection shelf may be operated in one of three modes:

Hot-Standby

Only one transmitter is on-line at any one time. Both main and standby terminals are tuned to the same frequency.
A fault detected in the on-line radio terminal results in a switch of traffic to the off-line radio terminal.
The ODU arrangements may use either one antenna with a waveguide coupler or two antennas.

Frequency Diversity

The main and standby radios are transmitting simultaneously and are tuned to different frequencies to avoid interference. A fault detected in a traffic-carrying radio terminal results in a switch of customer traffic to the standby radio link.
The ODU arrangements may use either one antenna with a waveguide coupler or two antennas.

Space Diversity

The main and stand-by radios are set up in Hot Stand-by mode, but are connected to their own antennas. The spatial separation of the antennas, combined with hitless receive switching, provides the Space Diversity function on the receiving end of the link.

3.2 Network Management

Since all control, configuration and monitoring functions of the radio are already software controlled from the 10BASE-T port; the radio is ideally suited to interface with external Network Management Systems.

The standard NMI option offers SNMP compatibility for management of radio systems. With the use of a browser such as “HP Openview” or “SNMPc”, the operator may view and configure any radio terminal in a network from a single point.

Options to support other Network Management protocols can also be easily accommodated as the NMI is built on a powerful hardware platform.

For details regarding installation of NMI option, refer to Section 9.

3.3 110~220VAC to -48VDC converter

Figure 3-1 110~220VAC to -48VDC converter

We also support a 110~220VAC to -48VDC convertor for 100~240VAC power input.
See Figure 3-8.

Features:

3KA surge protection
Output Over current protection
Output Over voltage protection
Wide AC input voltage range: 100VAC~240VAC

Table 3-1 110~220VAC to -48VDC converter technical data:

Parameter	Specification
AC input voltage range	100VAC~240VAC
Input frequency	50~60Hz
Output current	1.37A
Output shorted protection	Yes
Standard DC Output Voltage	48VDC
PF	Greater than 75%（full load）
Dimension	147 x 755.5 x 43.2mm
Weigth	0.55Kg
Conditions	
Operating Temp.	0～+50℃
Operating humidity	20%～90%
MTBF	300,000 hours
Safety standards	GB4943，UL60950，EN60950
EMC Standards	GB9254，EN55022 ClassB EN61000-3-2，3 EN61000-4-2，3，4，5，6，8，11

4 Installations

4.1 General

This Section assumes that pre-planning of the link has occurred; i.e. path budgeting and survey to ensure good line-of-sight between the two link ends and cable run estimations.

Installation task is listed below:

- Equipment and Tools Required
- Equipment Inventory
- Cable Installation
- ODU Installation
- IDU Installation

4.2 Required Installation Equipment

4.2.1 Tools

The only tools needed to install the L54 Digital Microwave Radio are:

- Basic electrician toolkit (incl. voltmeter)
- Adjustable wrench (5-20mm)
- Tools suitable for IF cable, ground line, service data line.i.e. nipper, plier, iron, and so on.

4.2.2 Equipment

Assuming the installer has the necessary radio equipment and antenna, the only other items needed are:

- RG-6/U length cable that to suit installation. See Section 4.5 for advice on which cable to use.
- At least two N-type connectors is suitable for termination of the RG-6/U cable.
- To ground the IDU, a suitable length of green PVC insulated 14gauge wire (1.5 mm^2 conductor) minimum is required, plus a suitable crimp lug to attach wire to the IDU ground post (4 mm / 0.064 in. diameter).
- To power the IDU, suitable lengths of different colored PVC insulated 14 gauge wire (1.5mm^2 conductor) are required. Recommend the use of red for 0 V power connections and black for negative power connection.
- To connect alarm relay outputs and external input sensor from IDU to other co-located equipment; a suitable length of 25-pin tin-plated PVC insulated copper cable, a male DB25 connector and cover._ enough cable ties to secure all cable runs.

4.3 Equipment Inventory Check

Verify inventory of L54 Digital Microwave Radio components before beginning installation.
Ensure the part description detailed on the outside of each box corresponds to the components required for the installation; i.e. correct ODU frequency band, T-R spacing, capacity, service interface, and IDU configuration. The radio configuration is determined by the Customer Specific Data Sheet that has been agreed upon by the customer. See 10.2 for an example showing the factory default settings.

The basic components of IDU required are contained in a box: refer to table 4-1

Table 4-1 Package List

item	Quantity	Components	Description
1	1	IDU	IDU device
2	1	ODU	ODU device
3	See Discription	Sevice data connectors	4E1(75Ω):8 CC4 Connectors, 1 CC4-8G Adaptor 4E1(120Ω): 6 RJ-45 Connectors 8E1(75Ω): 16 CC4 Connectors,1 CC4-16G Adaptor 8E1(120Ω):12 RJ-45 Connecotrs 16E1(75Ω):32 CC4 Connectors,2 CC4-16G Adaptors 16E1(120Ω):24 RJ-45 Connectors 10/100BASE-T+1/2/4E1(75Ω): 8 CC4 Connectors, 2 RJ-45 Connectors,1 CC4-8G Adaptor 10/100BASE-T+1/2/4E1(120Ω):8 RJ-45 Connectors
4	1	DC Power	Green DC power connector for IDU, 2-pin
5	1	Cable	RG-6 Cable(100M)
6	1	Mount Kit	Rack mountin kit for ODU
7	1	User manual	CD package
8	1	Leaflet	Quick Install Guid

4.4 Requirement of room

The room fitment should be finished and dry. The line-slot or line-through-slot, illuminance, AC power, DC power should be ready.

Airiness, air-condition establishment should be supplied. Temperature and humidity should be accord with installation conditions.

Earthing of the building should be finished and checked out.

4.5 Cable Installation

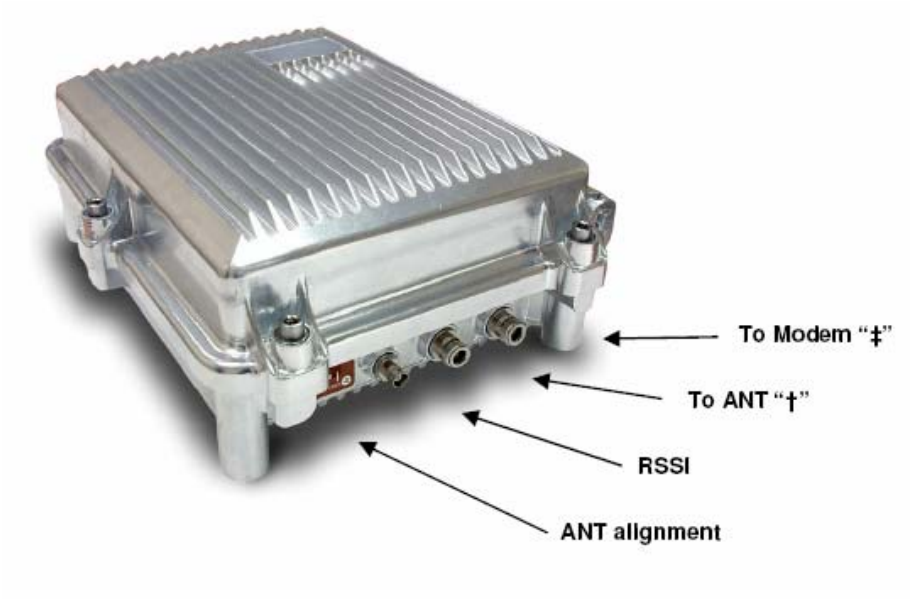
Only one cable is required to connect the IDU to the ODU. TNC to N-type of the cable must be terminated with male connectors. The TNC to N-type male connectors for RG/6U cable are supplied with radio equipment. Cable length required by the customer as the length required depends upon cable length used for each installation, and limited with cable type used and power supply voltage as follows:

Table 5-2 Cable Length Limitations:

Cable Type	Nominal Power Supply Voltage	Cable Length Limitation
RG-6/U	48V	100m

Caution:
Power for the ODU is carried on the coaxial cable connecting the IDU and ODU. Ensure that power to the IDU is turned off before connecting or removing the cable from the ODU.

4.6 ODU Installation



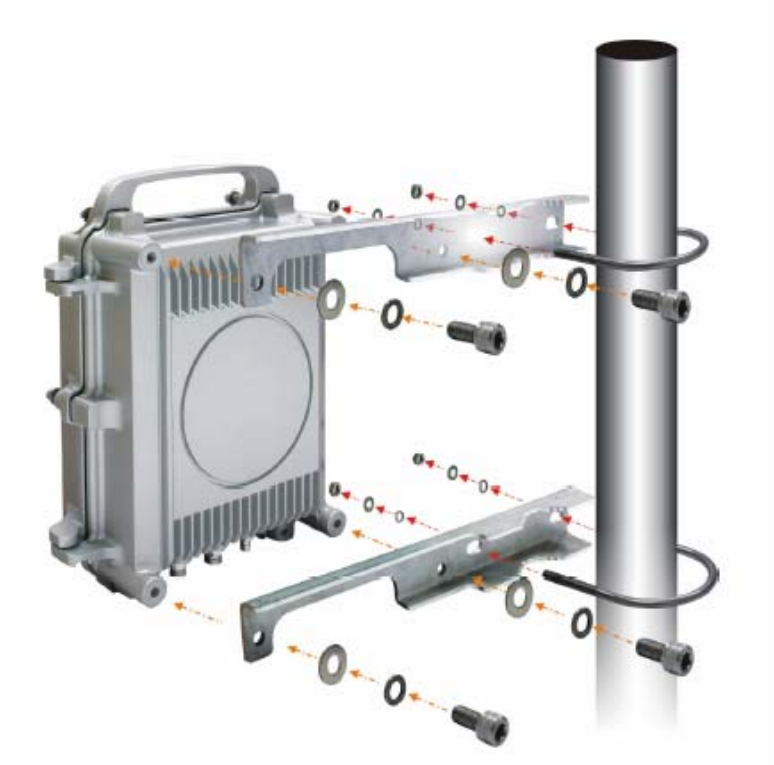


Figure 5-4 Connectors and Mounting of ODU

4.7 IDU Installation

The IDU requires only 1RU of vertical rack space and 254 mm rack depth. No space above or below the IDU is required for ventilation purposes. IDUs may be stacked adjacently in racks. The connections of 4/8/16E1 (75ohm unbalanced) IDU are descripted in Figure 4-4. The deffrents between diffrent service-type connections only are main services; refer to service card descriptions in section 1.

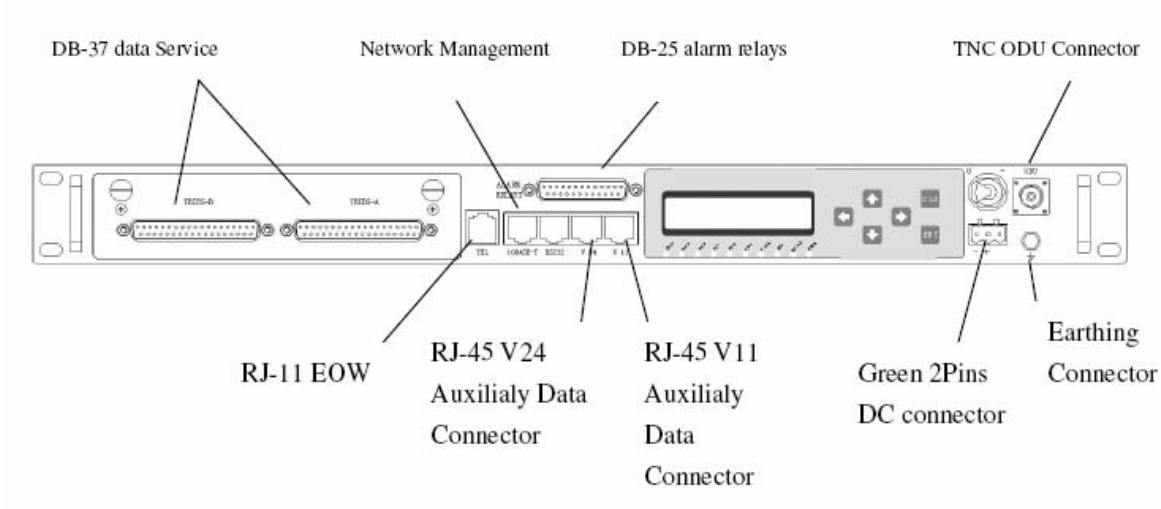


Figure 4-5 Connectors of IDU for 4/8/16E1 75ohm unbalanced Service card

IDU Installation Procedure

Step 1. Position the IDU as required in the equipment rack.

Step 2.Lay in, secure with cable ties and terminate ground cable.

Step 3. Tighten the TNC connector on the IDU “ODU” connectors.

Step 4. Install tributary data signal cables on the IDU “TRIB” connectors. Use 75ohm CC4 male connectors and CC4-8G or CC4-16G connectors for 4/8/16E1 unbalanced systems, RJ-45 plugs for 4/8/16E1 balanced systems and 10/100BASE-T system. Refer to the Table 4-4 for RJ-45 and DB37 wiring details.

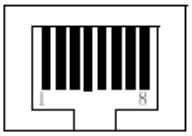
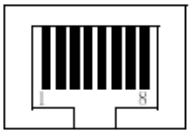
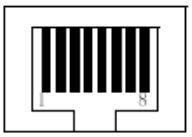
Step 5. If required, install alarm relay wiring to female DB15 connector on IDU front panel. Refer to the Table 4-3.

Step 6. If required, install auxally data wiring to RJ-45 connector on IDU front panel. Refer to the Table 5-3.

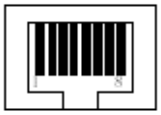
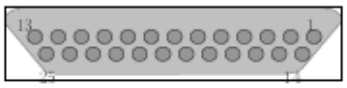
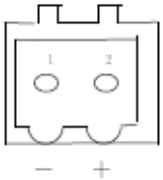
Step 5. Install phone wiring to RJ-11 phone connector on IDU front panel.

Step 8. The L54 requires DC power -48V (-40VDC ~ -60VDC) via a 2-pin connector. Ensure that the plug provided in the installation kit is wired as detailed in table 5-3. Recommend use of 1.5mm 2 conductor wire. Make sure power is off before power on the device.

Table 4-3 IDU External Connection Pins Detailed Description

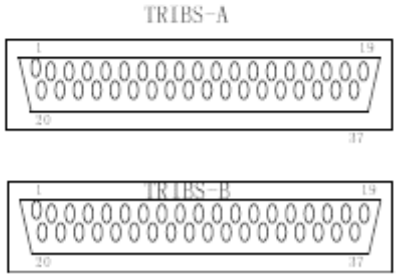
HANDSET(IDU Front Panel) 4-pin Panel Mounted Female RJ11 Connector 	Pins	Assigment	Description
	1	N/ C	No Connection
	2	TIP	TIP
	3	RING	RING
	4	N/ C	No Connection
10BASE-T Connector (IDU Front Panel) 8-pin Panel Mounted Female RJ45 Connector 	Pins	Assigment	Description
	1	TPTX+	Transmited Data Output+
	2	TPTX -	Transmited Data Output-
	3	TPRX+	Received Data Input+
	4	N/ C	No Connection
	5	N/ C	No Connection
	6	TPRX -	Received Data Input-
	7	N/ C	No Connection
	8	N/ C	No Connection
RS232 Connector (IDU Front Panel) 8-pin Panel Mounted Female RJ45 Connector 	Pins	Assigment	Description
	1	TXD	RS232 TXD output
	2	TXD	equal to pin #1
	3	RXD	RS232 RXD input
	4	RXD	equal to pin #3
	5	N/ C	No Connection
	6	N/ C	No Connection
	7	GND	Device Ground
	8	GND	Device Ground
V.24 Connector(IDU Front Panel) 8-pin Panel Mounted Female RJ45 Connector 	Pins	Assigment	Description
	1	GND	Device Ground
	2	TXC	RS232 TXC output
	3	GND	Device Ground
	4	RXD	RS232 RXD input
	5	TXD	RS232 TXD output
	6	GND	Device Ground
	7	RXC	RS232 RXC output
	8	GND	Device Ground

Continuous Table 4-4 IDU External Connection Pins Detailed Description

V.11 Connector(IDU Front Panel) 8-pin Panel Mounted Female RJ45 Connector 	Pins	Assigment	Description
	1	GND	Device Ground
	2	GND	Device Ground
	3	RXDB-	RS422 RXD input B-
	4	RXDA+	RS422 RXD input A+
	5	TXDB-	RS422 TXD output B-
	6	TXDA+	RS422 TXD output A+
	7	GND	Device Ground
	8	GND	Device Ground
AlarmRelay I/O (IDU Front Panel) 25pin D-type Female Connector 	Pins	Assigment	Description
	1	GND	Device Ground
	14	RELAY 1A	normally closed output #1
	2	RELAY 1B	normally open output #1
	15	RELAY 1C	common connection #1
	3	RELAY 2A	normally closed output #2
	16	RELAY 2B	normally open output #2
	4	RELAY 2C	common connection #2
	17	RELAY 3A	normally closed output #3
	5	RELAY 3B	normally open output #3
	18	RELAY 3C	common connection #3
	6	RELAY 4A	normally closed output #4
	19	RELAY 4B	normally open output #4
	7	RELAY 4C	common connection #4
	20	RELAY 5A	normally closed output #5
	8	RELAY 5B	normally open output #5
	21	RELAY 5C	common connection #5
	9	ALM1B	External alarm input sense #1B
	22	ALM1A	External alarm input sense #1A
	10	ALM2B	External alarm input sense #2B
	23	ALM2A	External alarm input sense #2A
	11	ALM3B	External alarm input sense #3B
	24	ALM3A	External alarm input sense #3A
	12	ALM4B	External alarm input sense #4B
	25	ALM4A	External alarm input sense #4A
	13	GND	Device Ground
DC (IDU Front Panel) 	Pins	Assigment	Description
	1	VOINP-	DC IN-
	2	VOINP+	DC IN+

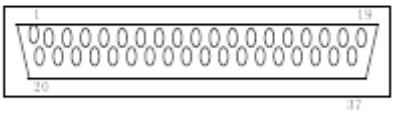
Continuous Table 4-4 IDU External Connection Pins Detailed Description

16XE1 MUX
37pin D-type Male Connector
The PINs Description for 16XE1 MUX.
The right column is listing TRIBS-A Interface PINS.
The TRIBS-B and the TRIBS-A pins is each relative, the first E1 tributary output or input data of the first group of TRIBS-A is the second E1 tributary output or input data of the first group of TRIBS-B that is TRIBS-A and TRIBS-B between difference.
For example:
TRIBS-A.4 the first E1 tributary data output of the first group
TRIBS-B.4 the first E1 tributary data output of the second group
TRIBS-A.21 the first E1 tributary data input of the first group
TRIBS-B.21 the first E1 tributary data input of the second group
TRIBS-A.4 the second E1 tributary data output of the third group
TRIBS-B.4 the second E1 tributary data output of the fourth group
TRIBS-A.21 the second E1 tributary data input of the third group
TRIBS-B.21 the second E1 tributary data input of the fourth group



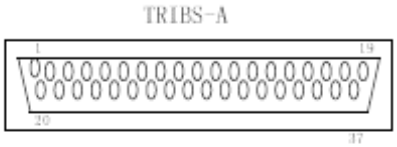
Pins	Assigment	Description
1	GND	Device Ground
2	GND	Device Ground
3	GND	Device Ground
4	OA1	1st E1 output of Group A
5	GND	Device Ground
6	GND	Device Ground
7	GND	Device Ground
8	OA2	2nd E1 output of Group A
9	GND	Device Ground
10	GND	Device Ground
11	GND	Device Ground
12	OA3	3rd E1 output of Group A
13	GND	Device Ground
14	GND	Device Ground
15	GND	Device Ground
16	OA4	4th E1 output of Group A
17	GND	Device Ground
18	GND	Device Ground
19	GND	Device Ground
20	OC1	1st E1 output of Group C
21	INA1	1st E1 input of Group A
22	INC1	1st E1 input of Group C
23	GND	Device Ground
24	OC2	2nd E1 output of Group C
25	INA2	2nd E1 input of Group A
26	INC2	2nd E1 input of Group C
27	GND	Device Ground
28	OC3	3rd E1 output of Group C
29	INA3	3rd E1 input of Group A
30	INC3	3rd E1 input of Group C
31	GND	Device Ground
32	OC4	4th E1 output of Group C
33	INA4	4th E1 input of Group A
34	INC4	4th E1 input of Group C
35	GND	Device Ground
36	GND	Device Ground
37	GND	Device Ground

Continuous Table4-4 IDU External Connection Pins Detailed Description

	Pins	Assigment	Description
8XE1 MUX	1	GND	Device Ground
37pin D-type Male Connector	2	GND	Device Ground
The PINs Description for 8XE1 MUX.	3	GND	Device Ground
The right column is list TRIBS-A	4	OA1	1st E1 output of Group A
Interface PINS.	5	GND	Device Ground
The TRIBS-B and the TRIBS-A pins is each	6	GND	Device Ground
relative, the first E1 tributary output or input	7	GND	Device Ground
data of the first group of TRIBS-A is the	8	OA2	2nd E1 output of Group A
second E1 tributary output or input data of	9	GND	Device Ground
the first group of TRIBS-B that is TRIBS-A	10	GND	Device Ground
and TRIBS-B between difference.	11	GND	Device Ground
For example:	12	OA3	3rd E1 output of Group A
TRIBS-A.4 the first E1 tributary data output	13	GND	Device Ground
of the first group	14	GND	Device Ground
TRIBS-B.4 the first E1 tributary data output	15	GND	Device Ground
of the second group	16	OA4	4th E1 output of Group A
TRIBS-A.21 the first E1 tributary data input	17	GND	Device Ground
of the first group	18	GND	Device Ground
TRIBS-B.21 the first E1 tributary data input	19	GND	Device Ground
of the second group	20	N/ C	No Connection
	21	INA1	1st E1 input of Group A
	22	N/ C	No Connection
TRIBS-A	23	GND	Device Ground
	24	N/ C	No Connection
	25	INA2	2nd E1 input of Group A
	26	N/ C	No Connection
	27	GND	Device Ground
TRIBS-B	28	N/ C	No Connection
	29	INA3	3rd E1 input of Group A
	30	N/ C	No Connection
	31	GND	Device Ground
	32	N/ C	No Connection
	33	INA4	4th E1 input of Group A
	34	N/ C	No Connection
	35	GND	Device Ground
	36	GND	Device Ground
	37	GND	Device Ground

Continuous Table 4-4 IDU External Connection Pins Detailed Description

8XE1 MUX
37pin D-type Male Connector
The PINs Description for 4XE1 MUX.
The right column is list TRIBS-A
Interface PINS.

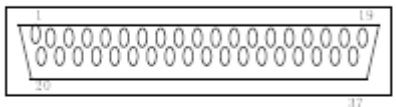


Pins	Assigment	Description
1	GND	Device Ground
2	GND	Device Ground
3	GND	Device Ground
4	OA1	1st E1 output of Group A
5	GND	Device Ground
6	GND	Device Ground
7	GND	Device Ground
8	OA2	2nd E1 output of Group A
9	GND	Device Ground
10	GND	Device Ground
11	GND	Device Ground
12	OA3	3rd E1 output of Group A
13	GND	Device Ground
14	GND	Device Ground
15	GND	Device Ground
16	OA4	4th E1 output of Group A
17	GND	Device Ground
18	GND	Device Ground
19	GND	Device Ground
20	N/ C	No Connection
21	INA1	1st E1 input of Group A
22	N/ C	No Connection
23	GND	Device Ground
24	N/ C	No Connection
25	INA2	2nd E1 input of Group A
26	N/ C	No Connection
27	GND	Device Ground
28	N/ C	No Connection
29	INA3	3rd E1 input of Group A
30	N/ C	No Connection
31	GND	Device Ground
32	N/ C	No Connection
33	INA4	4th E1 input of Group A
34	N/ C	No Connection
35	GND	Device Ground
36	GND	Device Ground
37	GND	Device Ground

Continuous Table 5-4 IDU External Connection Pins Detailed Description

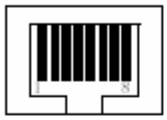
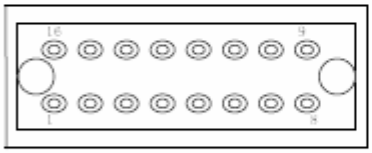
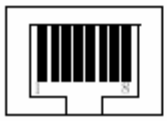
LAN+1/2/4E1 MUX

37pin D-type Male Connector for E1
8-pin Panel Mounted Female RJ45 Connector for LAN
The PINs Description for LAN+1/2/4E1 MUX.
The right column is list E1 interface PINS.



Pins	Assigment	Description
1	GND	Device Ground
2	GND	Device Ground
3	GND	Device Ground
4	O1	1st E1 Data Output
5	GND	Device Ground
6	GND	Device Ground
7	GND	Device Ground
8	O2	2nd E1 Data Output
9	GND	Device Ground
10	GND	Device Ground
11	GND	Device Ground
12	O3	3rd E1 Data Output
13	GND	Device Ground
14	GND	Device Ground
15	GND	Device Ground
16	O4	4th E1 Data Output
17	GND	Device Ground
18	GND	Device Ground
19	GND	Device Ground
20	GND	Device Ground
21	IN1	1st E1 Data Input
22	GND	Device Ground
23	GND	Device Ground
24	GND	Device Ground
25	IN2	2nd E1 Data Input
26	GND	Device Ground
27	GND	Device Ground
28	GND	Device Ground
29	IN3	3rd E1 Data Input
30	GND	Device Ground
31	GND	Device Ground
32	GND	Device Ground
33	IN4	4th E1 Data Input
34	GND	Device Ground
35	GND	Device Ground
36	GND	Device Ground
37	GND	Device Ground

Continuous Table 4-4 IDU External Connection Pins Detailed Description

LAN+1/2/4E1 8-pin Panel Mounted Female RJ45 Connector for LAN The PINs Description for LAN+1/2/4E1 MUX. The right column is list LAN interface PINS. 	Pins Assigment Description 1 TX+ Transmited Data Output+ 2 TX- Transmited Data Output- 3 RX+ Received Data Input+ 4 D1+ No Define 5 D1- No Define 6 RX- Received Data Input- 7 D2+ No Define 8 D2- No Define
CC4-8G DB37 to CC4 Converter The converter is used the DB37 connector convert to CC4 Coaxial Cable connector .It is used 75Ohm unbalanced E1 data communication. Each pin is Coaxial Cable connector in the under figure 	Pins Assigment 1 Input 1st 2 Output 1st 3 Input 2nd 4 Output 2nd 5 Input 3rd 6 Output 3rd 7 Input 4th 8 Output 4th 9 Input 5th 10 Output 5th 11 Input 6th 12 Output 6th 13 Input 7th 14 Output 7th 15 Input 8th 16 Output 8th
LAN+1/2/4E1（120Ohm balanced） There is four RJ48 connector in LAN+1/2/4E1（120Ohm balanced）for E1. 4/8/16E1（120Ohm balanced） There is four RJ48 connector in 4/8/16E1(120Ohm balanced）for E1. The column for each RJ48 connector pins describe 	Pins Assigment Description 1 RXRING Received Data Input+ 2 RXTIP Received Data Input- 3 No Connection 4 TXRING Transmited Data Output+ 5 TXTIP Transmited Data Output- 6 No Connection 7 No Connection 8 No Connection

5 Commissioning

5.1 General

This section assumes that the L54 Digital Microwave Radio terminal has been successfully installed, following the guidelines outlined in Section 5.

This section descripts L54 commissioning procedures, including connection, power on, setup and antenna alignment.

5.2 Commissioning Tools Required

The only tools needed to commission the L54 are:

- Voltmeter (customer supplied)
- BNC cable for connection to ODU AGC monitoring point (customer supplied)
- Appropriate tool for securing the antenna azimuth and elevation adjustment mechanisms (customer supplied)

5.3 Connections

Step 1: Ensure the following connections are made to the IDU before applying power. See Figure 6-1 for connection illustration.

main service cables, note: main service cables have different cable type depend upon service type, figure 6-1 lists interface for 4/8/16e1 75ohm non-balanced servce, others interface cable type illusted in section 1.

IDU chassis ground, ODU cable

If required, connections for Alarm Relays and External Alarm Input Sensor may be connected to other monitoring equipment at the site, and Auxiliary Data Channels.

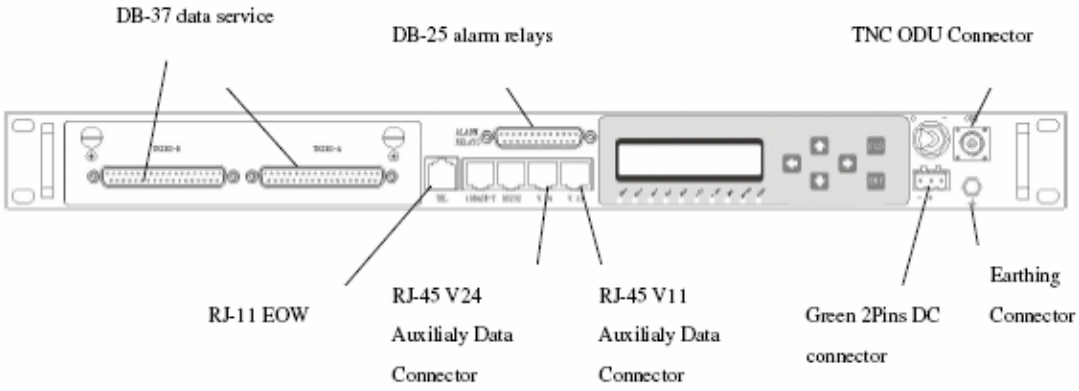


Figure 5-1 Connectors of IDU for 4/8/16E1 75ohm unbalanced Service card

Step 2: Once all connections have been made, apply power to the IDU by connecting energized power connector. The L54 will now begin the start up self-diagnostic sequence. If the L54 does not appear to power up, check the applied voltage and power line, ground line. Be care the poritor of 2-pin power connector, do not make wrong position.

5.4 Power on

For your personal safety when handling, installing, or replacing ODUs, you must Switch off the IDU and disconnect the IDU/ODU cable from the ODU before removing the ODU.

When an ODU/IDU pair is powered up together, the IDU front panel “CABL” LED will light on, while the system performs its self-diagnostics. If IDU and ODU are properly connected, “CABL” LED will be light off. If “CABL” led remains on the display after a few seconds, verify that the ODU is present and check continuity of the IDU/ODU cable connection.

When an ODU/IDU pair is powered up together, the IDU LCD panel will display ” 

”, while the system performs its self-diagnostics.

Caution.
Once power has been applied to the IDU, the N-type connector marked “ODU” on the IDU front panel will be energized. Ensure that the power is off before connecting or disconnecting cable to the IDU or ODU.

5.5 Setup Routine

This setup routine need only be performed when an IDU/ODU pair is first powered up together. The follow setup procedures are run by LCD panel, no computer and network management system needed. Serveral parameters are not necessary to configure. See section 6 for a more detailed account of keypad operations and other common operating procedures.

5.5.1 Power on

The L54 requires DC power via a 2-pin connector. When an IDU/ODU pair is powered up for the first time, “CABL” on the front panel LED will light on while the unit performs a self-check for ODU-IDU compatibility. If the units are correctly installed, “CABL” will light off. If “CABL” remains light on after a few seconds, check for one of the following:

- ODU not installed
- Improper cable connection

5.5.2 Login

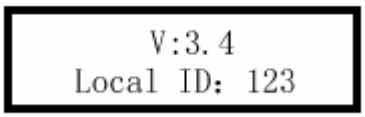
After powering up, the front panel will display ‘‘ 

”

Note: The L54 logs the operator out of the front panel after a period of inactivity longer than 30 minutes.

5.5.3 Device ID Code

- When the panel display 

,use the ↑ and ↓ keys on the IDU until the panel display “ 

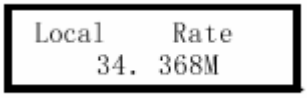
”press ENT to ready set the device ID code.

- Use the ←,→, ↑ and ↓ _keys on the IDU to select a different link ID code in the range 1-255.
- Press **ENT** to set the link ID code.
- The IDU will display the new setting.

❖ The Local ID’s number and the IP adress of device is this same.

5.5.4 Capacity configure

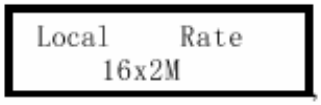
This RF bandwidth is 28MHz, note the frequency plan. The IDU will display



.

4/8/16E1 service card configure:

- Use the ↑ and ↓ _keys on the IDU until the panel display “ 

”.
- Use the ←,→ _keys on the IDU to select SET menu, press **ENT**.
- Use the ↓ _key on the IDU to select display 

press **ENT**.
- Use the ↑ and ↓ _keys on the IDU to select the required capacity.

- Press **ENT** to set the traffic capacity.
- The IDU will display the new setting.

The RF bandwidth is 7MHz for 4E1, 14MHz for 8E1, 28MHz for 16E1, note the frequency plan.

10/100BASE-T+1/2/4E1 service card configure:

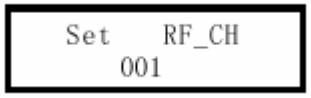
- Use the ↑ and ↓ _keys on the IDU until the panel display “ 

”.
- Use the ←,→ keys on the IDU to select **SET** menu, press **ENT.**
- Use the ↓ _key on the IDU to select display 

, press **ENT**.
- Use the ←,→ keys on the IDU to select E1 menu, press **ENT**.
- Use the ↑ and ↓ _keys on the IDU to select the E1 required capacity. The avalible capacity is 0x2M, 1x2M, 2x2M and 4x2M.
- Press **ENT** to set the E1 capacity, and the LAN capacity will auto change.
- The IDU will display the new setting.
- Use the ←,→ keys on the IDU to select LAN menu, press **ENT**.
- Use the ↑ and ↓ _keys on the IDU to select the LAN required capacity. The LAN avalible capacity is based n*2M. The active rate of 2M is 2.112Mbps, i.e. n=5, the LAN capacity is 10.56Mbps.The LAN rate will be selectable with 8E1(14MHz RF bandwidth) and 16E1(28MHZ RF bandwidth),i.e. if E1 capacity is 2x2M, then the LAN capacity can be set to 12M or 28M.
- Press **ENT** to set the LAN capacity.
- The IDU will display the new setting.

The RF bandwidth is 14MHz when E1 capacity plus LAN capacity is 16M.
The RF bandwidth is 28MHz when E1 capacity plus LAN capacity is 32M.

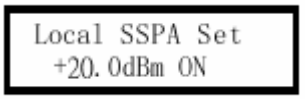
5.5.5 Transmit Frequency

- Use the ↑ and ↓ _keys on the IDU until the panel display “ 

”, press ENT.
- Use the ←,→ keys on the IDU to select T menu, press **ENT**.
- Use the ←,→, ↑ and ↓ _ keys on the IDU to select the required transmit frequency Channel.
- Press **ENT** to set the transmit frequency Channel.
- The IDU will display the new setting.

Note: The T-R spacing is set in the channel plan installed in the factory so that receiver frequency changes to track the transmitter; therefore, changing frequency on one end of the link automatically changes the frequency at the other end of the link.

5.5.6 Transmit Power

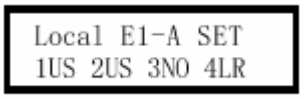
- Use the ↑ and ↓ _keys on the IDU until the panel display “ 

”, press **ENT**.
- Use the ←,→ keys on the IDU to select “dBm” menu, press **ENT**.
- Use the ←,→ .keys on the IDU to select the required transmit power.
- Press **ENT** to set the transmit power.
- The IDU will display the new setting.
- Use the ←,→ keys on the IDU to select “OFF/ON” menu, press **ENT**.
- Use the . and . keys on the IDU to select ON.
- Press **ENT** to set the transmit power is ON.
- The IDU will display the new setting.

5.5.7 Tributary Configuration

Configurations for 4/8/16E1 service card and 10/100BASE-T+1/2/4E1:

Step 1: Configure tributarys of Group A

- Use the ↑ and ↓ _keys on the IDU until the panel display “ 

”, press ENT.
- Use the ←,→ keys on the IDU to select “1” menu.
- Use the ↑ and ↓ _keys on the IDU to select the required status of tributary #1. If tributary #1 should be used, select US, otherwise select **NO**.
- Use the → keys on the IDU to select “2” menu.
- Use the ↑ and ↓ _keys on the IDU to select the required status of tributary #2. If tributary #2 should be used, select US, otherwise select **NO**.
- Use → the keys on the IDU to select “3” menu.
- Use the ↑ and ↓ _keys on the IDU to select the required status of tributary #3. If tributary #3 should be used, select US, otherwise select **NO**.
- Use the → keys on the IDU to select “4” menu.
- Use the ↑ and ↓ _keys on the IDU to select the required status of tributary #4. If tributary #4 should be used, select US, otherwise select **NO**.
- Press **ENT** to set the tributary #1 to #4 of group A.

The L54 terminal is now set up and running. The operator may leave the keypad as the L54 will automatically log out the keypad if no activity has taken place within a 30 minute period.

Set up the remote L54 terminal in the same manner as described above.

When the antennas are aligned, the L54 link will be ready to pass operational traffic.

5.6 Antenna Alignment

For antenna installation, follow the instructions provided by the manufacturer; instructions should be packaged with the antenna.

- RSSI voltage measurement via the BNC connector on the ODU, used for fine alignment,

- When the ODU BNC weatherproof cap is removed, the ODU will emit an audible “chirping” to aid antenna alignment. The rate of “chirps” is proportional to the RSSI voltage and therefore the receive signal level.

The tools required to fine-align the antennas:

- Appropriate tool to adjust the azimuth and elevation mechanism securings
- Voltmeter
- Cable connected ODU monitoring point (BNC) and Voltmeter.

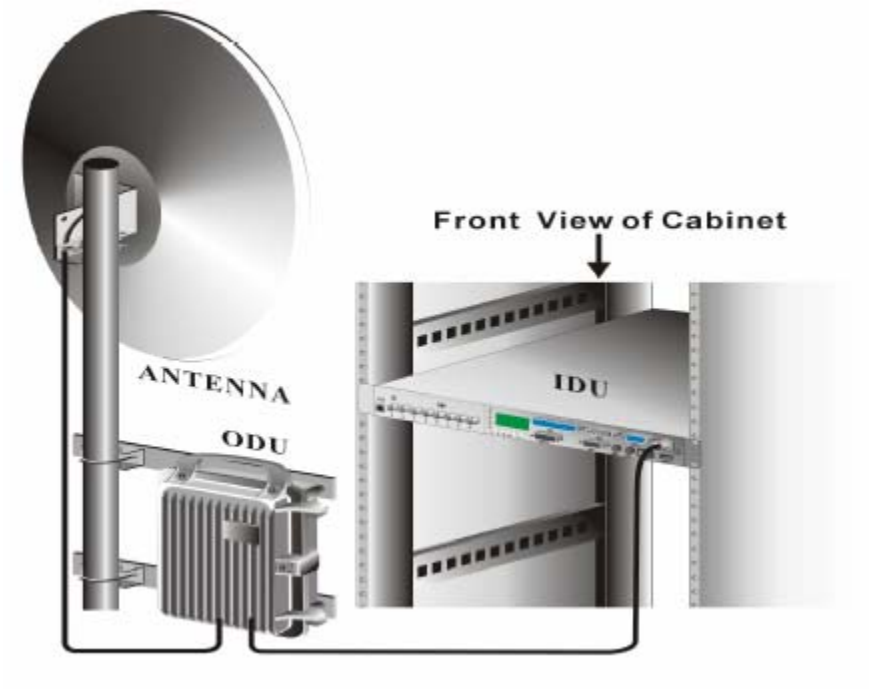


Figure 5-2 Connectnig of Single Anttena

6 Operations

6.1 General Use of the LCD panel

The keypad composed with 6 keys and 1 LCD and 10 LEDs of the LCD panel enable the operator to configure the terminal and diagnose terminal faults by displaying unambiguous alarms and clear real-time system status.

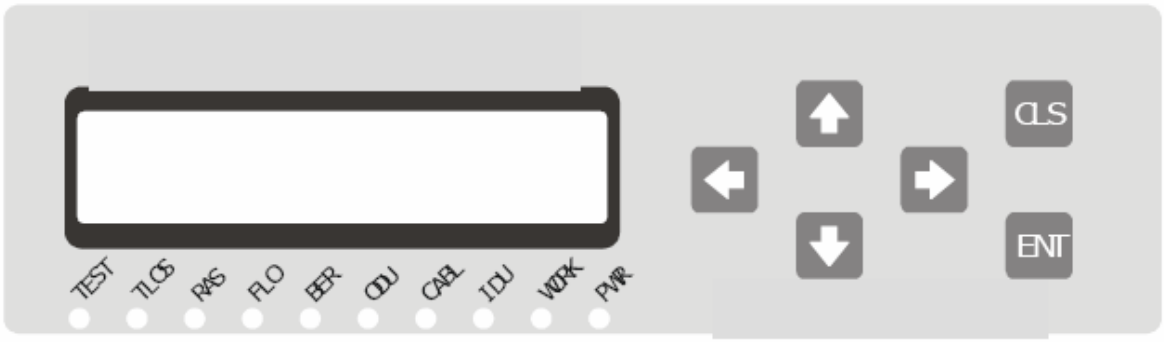


Figure 6-1 LCD Panel

LCD display:

This LCD display can display 2*16 symbols, used for display parameters and working status of L54 radio.

LEDs:

The LEDs are TEST, TLOS, RAS, FLO, BER, ODU, CABL, IDU, WORK, PWR

TEST LED is yellow, WORK and PWR are green, and others are red when light on.

6 keys: Menu selection to set parameter.

The beeper will beep up one time when press key is valided, otherwise beep up 2 times.

There have two status of operating in LCD panel, one is displaying status, and another one is modifying status.

Displaying Status

The L54 enters displaying status after power on first. At this time, press the ↑ and ↓ keys on the IDU to scroll screen up or down; Press the ←,→ keys on the IDU to display local or remote screen or to display other screens of defferent parameters in same group. And hold if no more screens can be scrolled, beeps two times for indicating. When press CLR key, it will back to the first screen.

The values of parameter will be refreshed every two seconds. And will be displayed as “xxx” if value is not valid when interrupted with remote terminal or interrupted with ODU.

The screen has options for selecting or modifying when cursor is flickering. And use the ←,→ keys on the IDU to select or modify one of multi options. The screen will jumps to the selected option when prees **ENT** key at cusor indicated option. If cursor is on the modifying option, and we press **ENT** key, the screen will enters modifying status.

Backlight of LCD:

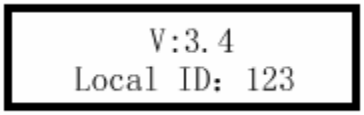
Backlight will on and remains 20 seconds when prees anykey for enhances the readbality of LCD unit in offices with even brighter service environments. The backlight will flicker when alarm accored (prefer to section 9.3). After one hour for no press any key, the LCD will off for more life, at this time, the LCD will display nothing. And the LCD will on and display again when pressing any key. Sometimes, the LCD may display wrong symbol, so we correct this display by press CLR key for 6 times.

The Device ID and LCD panel menu options:

The LCD display screens are descripted list below:

The initial screen is displayed after power on, or press CLS key on another screen.

Press ↓ _keys to appear similar following message:



This screen display device type, software version, local or remode device ID. The ID is used for identifying device; it can be modified for monitor. The ID code is same as the last code of IP addr in IDU. The IP address will be modified when modifying the ID. So The ID code and the device IP address is this same.

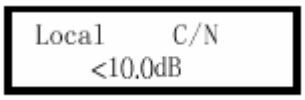
And then press ↓ _keys to appear similar following message:

This screen displays a menu: INFOR for status message screen, SET for editing message screen, OTHER for auxilialy message screen. Move the cursor to a menu, and press **ENT** key to enter.

6.1.1 INFO

This screen displays IDU IFRSSI gain from IDU for RX IF signal. This gain indicates RX IF signal in coxial cable fed to IDU is correct. Press <- or -> keys to view remote message.

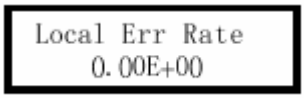
Press ↓ keys to appear similar following message:



This screen displays inner C/N received IFsignal in IDU. The value displays between 10dB with 19dB, displays as "<10" when smaller than 10, and displays as ">19" when greater than 19

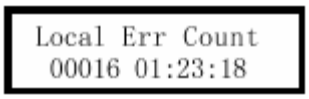
Press ←,→ keys then view remote message.

Press ↓ keys to appear similar following message:



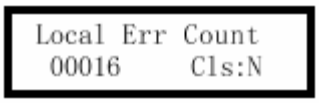
This screen displays BER with FEC, i.e. BER=1.40x10-6 for this screen. Press ← key to view remote message, and press → keys to view viterbi BER message similary as below.

Press ↓ keys to appear similar following message:



This screen displays error bit count with FEC. The error bit number displays between 0 with 65535. The time of count displays as Hours: Minutes: Seconds; and the miximum hours is 255. These parameter can be cleared to 0.

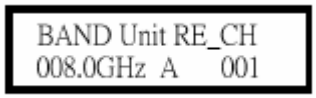
Press **ENT** _key to appear similar following message:



Use the ↑ and ↓ _keys on the IDU to select "**Y** ", and press **ENT** key to clear counter and count timer.

Press → key several times to appear similar following messages:

Press ↓ _keys to appear similar following message:

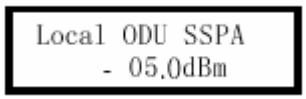


This screen displays frequency of local frequency, the " A " shows A site frequency, and the " B" shows the B site frequency. " 001" show frequency channel number, channel number define by factory set, i.e. 001 ~ 002 or more .These values are read from ODU, if read falure, will display "XXXXXGHz A xxx"

Press ↓ _keys to appear similar following message:

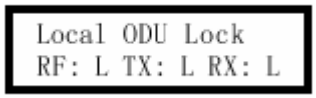
This screen displays RSSI of ODU, These values are read from ODU, if read falure, will display "XXXdBm"

Press ↓ _keys to appear similar following message:



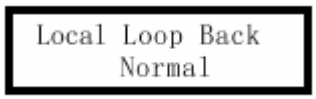
This screen displays TX output power of ODU, These values are read from ODU, if read falure, will display "XXXdBm"

Press ↓ _keys to appear similar following message:



This screen displays PLL status of ODU. The RF indicates the RFLO is locked or not; the TX indicates the TX LO is locked or not, and the RX indicates the RX LO is locked or not. These display "L" for locked or "N" for not locked. These values are read from ODU, if read failure, will display "X".

Press ↓ _keys to appear similar following message:



This screen displays loop back testing status of ODU. For message descriptions list below:

Normal: Normal operating

Frame: Frame loop back testing

Port:Port loopback (from service card)testing.

IDUIF: IDU IF loopback testing, test the modem is operating correctly or not.

ODU_L: ODU Local loopback testing, test the ODU is operating correctly or not.

Press ↓ __keys to appear service card message. The messages of different service cards displayed in LCD are different. See 6.1.1.1~6.1.1.2

6.1.1.1 Messages of 4/8/16E1 service card

Three E1 service cards are current available: a 4E1 version, an 8E1 version and a 16E1 version.

And two interfaces for E1 service card are current available: a 75ohm unbalanced and a 120ohm balanced.

All E1 service cards have same messages for displaying list below:

This screen displays alarm messages of service card. Four tributaries of E1 data form a group data. And so 16 tribs of E1 data form 4 groups: E1-A, E1-B, E1-C and E1-D. Every group have there own alarm message. Press ←,→ keys then display local or remote alarm messages of 4 groups. But group E1-C and group E1-D will not be displayed if rate is set to 8E1 or 4E1, and also group E1-B will not be displayed if rate is set to 4E1.

The alarm will be displayed if alarm accured. Alarm messages are: RAD (Remote alarmed for this group), AIS (This Group of Remote is all "1" alarm), or OOF (This group of local is frame loss) and GLOS (This group of local is all "1").

Press ↓ _keys to appear similar following message:

This screen displays status of use 4 E1s of group: Displaying "IN" means data fed in this tributary; displaying "LS" means no data in this tributary; displaying "NU" means this tributary is configured to be unused.

Applying data to a tributary whose configuration has been set to "NU" WILL not cause a tributary LOS alarm; however, the tributary will pass traffic.

6.1.1.2 Messages of 10/100BASE-T+1/2/4E1 service card

Two interfaces for 10/100BASE-T+1/2/4E1 service card are current available: a 75ohm unbalanced of E1 interface and a 120ohm balanced or E1 interface.

All 10/100BASE-T+1/2/4E1 service cards have same messages for displaying list below:

The E1 avalible capacity is 0x2M, 1x2M, 2x2M and 4x2M.

When set the E1 capacity, the LAN capacity will auto change.

The LAN avalible capacity is based n*2M. The active rate of 2M is 2.112Mbps, i.e. n=5, the LAN capacity is 10.56Mbps.The LAN rate will be selectable with 8E1(14MHz RF bandwidth) and 16E1(28MHZ RF bandwidth),i.e. if E1 capacity is 2x2M, then the LAN capacity can be set to 12M or 28M.

This screen displays E1 alarm messages of LAN service card. Four tributaries of E1 data form a sigle group data.

The alarm will be displayed if alarm accured. Alarm messages are same as E1 service cards.

Press ↓ _keys to appear similar following message:

This screen displays status of use 4 E1s of a single group, and means are same as E1 service card.

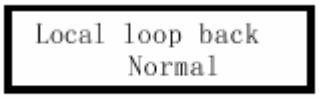
6.1.2 SET

These parameters in the screens under **SET** menu can be edited, including local and remote IDU or ODU.

Press **ENT** key when move cursor to **SET** menu in the screen “ 

” to enter the screens under SET menu.

Failure will be occurred for modifying remote parameters, because communication of local to remote are failed when changing several parameters of local. And most parameters will be stored in EEPROM for Power-Down-Store. The following screens descript how to edit parameters under SET menu.



This screen shows parameter of loopback configure. The parameter will be lost when power off and is “Normal” when power on. Press **ENT** key if modifying required.

Use the ↑ and ↓ keys to select the required loopback mode. Press **ENT** to set loopback mode.

Now the screen displays new loopback mode. The options of loopback mode are descripted in table 6-1.

Note: Tributaries will be interrupted when loop back is configured. And the remote configure may be restoring impossible when set one of remote loop back modes such as IDUIF, ODU_L at local.

Table 6-1 loop back items

Items	Description
Normal	No loopback, normal operating.
Port	Port loopback: loopback from service card in local IDU.
Frame	Frame loopback, loopback from frame multiplexer in local IDU.
IDUIF	IDU IF loopback, loop back from modem in local IDU.
ODU_L	ODU loopback, loop back from ODU in local IDU

This screen shows parameter of system capacity when use 4/8/16E1 service card. The options are shown as rates such as 4x2M, 8x2M and 16x2M. And the RF bandwidths are 7MHz for 4x2M, 14MHz for 8x2M and 28MHz for 16x2M.

The link will be lost, if the rates are different between local and remote. At this time, the link is recovered when set the local rate to the rate as same as remote. The rates are stored in EEPROM.

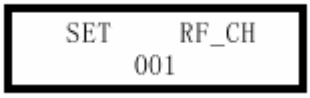
This screen shows tow parameters of system capacity when use 10/100BASE-T+1/2/4E1 service card. The first parameter is the option for using E1 tributaries. The second parameter is the option LAN capacity.

The E1 avalible capacity is 0x2M, 1x2M, 2x2M and 4x2M.

The LAN avalible capacity is based n*2M. The active rate of 2M is 2.112Mbps, i.e. n=5, the LAN capacity is 10.56Mbps.The LAN rate will be selectable with 8E1(14MHz RF bandwidth) and 16E1(28MHZ RF bandwidth),i.e. if E1 capacity is 2x2M, then the LAN capacity can be set to 12M or 28M.

The following steps may be operated for changing these parameters.

- Use the ←,→ keys on the IDU to select E1 menu, press **ENT**.
- Use the ↑ and ↓ _keys on the IDU to select the E1 required capacity. The avalible capacity is 0x2M, 1x2M, 2x2M and 4x2M.
- Press **ENT** to set the E1 capacity, and the LAN capacity will auto change.
- The IDU will display the new setting.
- Use the ←,→ keys on the IDU to select LAN menu, press **ENT**.
- Use the ↑ and ↓ keys on the IDU to select the LAN required capacity.
- Press **ENT** to set the LAN capacity.
- The IDU will display the new setting.



This screen shows RF channel number. The parameter is the option for RF channel , and the channel number depend on factory or customize.

Note: In systems of 7/8GHz 13GHz and 15GHz frequency, the spacing is set in the channel plan installed in the factory so that receiver frequency changes to track the transmitter; therefore, changing frequency on one end of the link automatically changes the frequency at the other end of the link.The frequency is no used in systems of 7/8GHz 13GHz and 15GHz frequency. These parameters are stored in EEPROM of IDU.

The following steps may be operated for changing these parameters.

- Use the ←,→ keys on the IDU to select menu, press ENT.
- Use the ↑ and ↓ keys on the IDU to select the required transmit channel.
- Press **ENT** to set the transmit channel.
- The IDU will display the new setting.

The number of tributaries in 4/8/16E1 service card is 16 maximum. Every 4 tribs makes a gourp. The 16E1 service card has 4 groups defined as group A, group B, group C and group D.

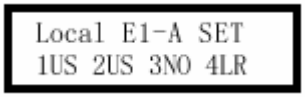
The 8E1 service card has 2 groups defined as group A, group B.
The 4E1 service card has only 1 group defined as group A.
The group A is shown as “E1-A” in the screen of setting, and the group B as “E1-B”, the group C as “E1-C”, and the group D as “E1-D”. The parameters in these screens are options of 4 tribs for according group. Every trib can be configured with one of options sucha as “US”, “NO”,”LR”.

“US” means the trib will be apply data.
“NO” means the trib will not be apply data.
“LR” means the trib will be loopbacked to remote.

Note: Applying data to a tributary whose configuration has been set to “NO” WILL not cause a tributary LOS alarm; however, the tributary will pass traffic.

These parameters are stored in EEPROM.

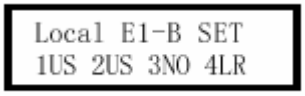
Configure group A:

- Use the ↑ and ↓ keys on the IDU until the panel display “ 

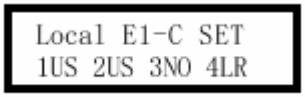
”, press ENT.
- Use the ←,→ keys on the IDU to select “1” menu.
- Use the ↑ and ↓ _keys on the IDU to select the required status of tributary #1. If tributary #1 should be used, select US, otherwise select NO.
- Use the → keys on the IDU to select “2” menu.
- Use the ↑ and ↓ _keys on the IDU to select the required status of tributary #2. If tributary #2 should be used, select US, otherwise select NO.
- Use the → keys on the IDU to select “3” menu.
- Use the ↑ and ↓ _keys on the IDU to select the required status of tributary #3. If tributary #3 should be used, select US, otherwise select NO.
- Use the → keys on the IDU to select “4” menu.
- Use the ↑ and ↓ _keys on the IDU to select the required status of tributary #4. If tributary #4 should be used, select US, otherwise select NO.

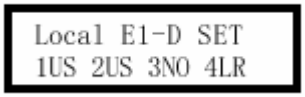
Press **ENT** to set the tributary #1 to #4 of group A.

Configure Group B, C, D:

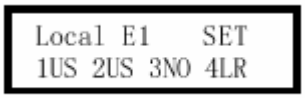
- Use the → key on the IDU until the panel display “ 

”

And “ 

” and “ 

”, use the same way of configure group A to configure group B, C and D.



For 10/100BASE-T+1/2/4E1 service card, the number of tributaries in 4/8/16E1 service card is 4 maximum. Only one group of tribs should be configured. The group is shown as “E1” in the screen of setting. The parameters and options defined for 10/100BASE-T+1/2/4E1 service card are same as defined for 4/8/16E1 service card.

These parameters are stored in EEPROM.

- Use the ↑ and ↓ _keys on the IDU until the panel display

“ ”, press **ENT**.

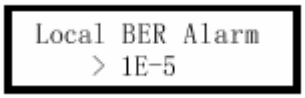
- Use the ←,→ keys on the IDU to select “dBm” menu, press **ENT** .
- Use the ←,→ keys on the IDU to select the required transmit power.
- Press **ENT** to set the transmit power.
- The IDU will display the new setting.
- Use the ←,→ keys on the IDU to select “OFF/ON” menu, press ENT.
- Use the ↑ and ↓ _keys on the IDU to select ON or OFF.
- Press **ENT** to set the transmit power is ON or OFF.
- The IDU will display the new setting.

This screen shows two parameters of ATPC. The first parameter is the option of the value of ATPC level. The second parameter is the option of switching the ATPC on or off.

The local IDU sets remote transmission power to control local RSSI is in range of ATPC level +/-5dB.

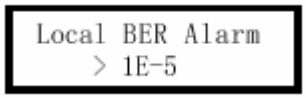
These parameters are stored in EEPROM.

- Use the ↑ and ↓ keys on the IDU until the panel display " ", press **ENT**.
- Use the ←,→ keys on the IDU to select "dBm" menu, press **ENT**.
- Use the ←,→ . keys on the IDU to select the required ATPC level.
- Press **ENT** to set the ATPC level.
- The IDU will display the new setting.
- Use the ←,→ keys on the IDU to select "OFF/ON" menu, press **ENT**.
- Use the ↑ and ↓ _keys on the IDU to select ON or OFF.
- Press **ENT** to set the ATPC is ON or OFF.
- The IDU will display the new setting.

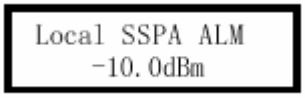


This screen shows the parameter of BER alarm threshold. The options are 1E-3, 1E-4, 1E-5 and 1E-6(prefer to section 9.2).

These parameters are stored in EEPROM.



- Use the ↑ and ↓ keys on the IDU until the panel display " ", press **ENT**.
- Use the ↑ and ↓ _keys on the IDU to select 1E-3, 1E-4, 1E-5 or 1E-6.
- Press **ENT** to set the BER alarm threshold.
- The IDU will display the new setting.



This screen shows transmit power alarm threshold. Alarm will occurs when transmit power is lower than alarm threshold.

These parameters are stored in EEPROM.

- Use the ↑ and ↓ _keys on the IDU until the panel display “ Local SSPA ALM -10.0dBm ”, press **ENT**.

- Use the ←,→ keys on the IDU to select the transmit power alarm threshold.
- Press **ENT** to set the threshold.
- The IDU will display the new setting.

Local RSSI ALM
-045dBm

This screen shows RSL alarm threshold. Alarm will occurs when RF received level is lower than the alarm threshold.

These parameters are stored in EEPROM.

- Use the ↑ and ↓ _keys on the IDU until the panel display “ Local RSSI ALM -045dBm ”, press ENT.

- Use the ←,→ keys on the IDU to select the RSL alarm threshold.
- Press **ENT** to set the threshold.
- The IDU will display the new setting.

J-LCD Alarm: OFF
Beep Alarm: OFF

This screen shows two parameters of alarm options: J-LCD Alarm and Beep Alarm.

The LCD will show and flicker the screens witch alarm occurred when the option of J-LCD Alarm is ON and no press any key for 20 seconds. And the LCD will show resently screen for J-LCD Alarm is OFF.

The Beeper can be closed when Beep Alarm is OFF.

These parameters are stored in EEPROM.

6.1.3 OTHERS

The Others menu has serveral screens for displaying or modifying the other parameters listed below:

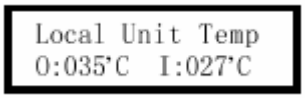
This screen shows 4 alarm inputs.

The alarm input is located in the local IDU DB25 ALARM RELAYS connector (see Table 4-5).

“IN” means alarm condition occurred.
“NO” means alarm condition not occurred.

This screen shows 5 relay outputs.

The relay output is located in the local IDU DB25 ALARM RELAYS connector (see Table 4-5).
“On” means the relay is open.
“Of” means the relay is closed.



This screen shows temperature of IDU and ODU, O: (ODU) and I: (IDU)..

There have 5 screens to show alarm relays configure in local: Relay 1, Relay 2, Relay 3, Relay 4 and Relay 5.

The relay output can be configured with multi alarm conditions. These conditions are relative of “OR”.

The alarm conditions are listed in Table 6-2.

The alarm condition is no affectivity to the relay output if select “N”.

To set relay 1 output:

- Use the ↑ and ↓ _keys on the IDU until the panel display “ 

”, press ENT.

Use the ←,→ keys on the IDU to select the alarm condition, and use the ↑ and ↓ _keys to select Y or N.

- Press **ENT** to set the relay1 output when all required alarm conditions are configured.

Table7-2 Discrete Alarm Descriptions

TLOS	Trib Fault
RAS	Remote alarm
FLOS	Frame loss
BER	BER alarm
RFLK	RF PLL unlocked
CABL	cable Failure
SSPA	Transmit power
TXLK	Transmit PLL
RSSI	Receive Level
RXLK	Receive PLL
IDUT	IDU temp (>70℃ OR<-10℃)
LIN1	Local Auxiliary Input 1
LIN2	Local Auxiliary Input 2
LIN3	Local Auxiliary Input 3
LIN4	Local Auxiliary Input 4
RIN1	Remote Auxiliary Input 1
RIN2	Remote Auxiliary Input 2
RIN3	Remote Auxiliary Input 3
RIN4	Remote Auxiliary Input 4

To set Web Modify: Eable/Disable browser function

Use the ↑ and ↓ _keys on the IDU until the panel display “ WEB Modify Enable ”,

- Use the ←,→ keys on the IDU to select the alarm condition, and use the ↑ and ↓ _keys to select Enable or Disable.

- Press **ENT** to set the relay1 output when all required alarm conditions are configured.

IP Address
192.168.000.015

This screen displays IP address. The parameter can be modified, used for WEB server and SNMP.

Subnet Mask
255.255.255.000

This screen displays Subnet Mask. The parameter can be modified, used for WEB server and SNMP.

Default Gateway
192.168.000.001

This screen displays Default Getway IP address. The parameter can be modified, used for WEB server and SNMP.

Agent
192.168.000.002

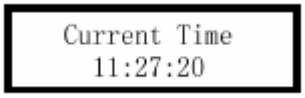
This screen displays Agent IP address. The parameter can be modified, used for SNMP.

MAC Address
B6EEC0009FAF

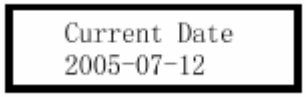
This screen displays Mac address. The parameter can be modified,used for WEB server and SNMP.

Broadcast Addres
FFFFFFFFFFFF

This screen displays Broadcast Mac address.The parameter used for WEB server and SNMP.



This screen displays current time. The parameter can be modified, used for counter, log, etc.



This screen displays current date. The parameter can be modified, used for counter, log, etc.

6.2 Configure with WEB server

We can monitor and contoll the terminal by using Internet Expoler to access WEB server included in the IDU.

Enter the web address of terminal in the address column of Internet Expoler (See Figure 7-2), then touch to the web page of login (See Figure 7-3).

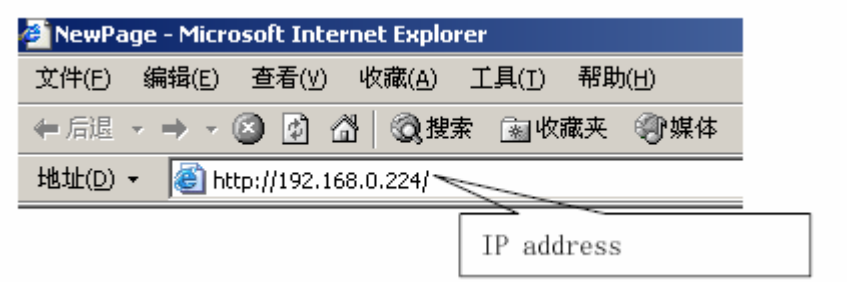
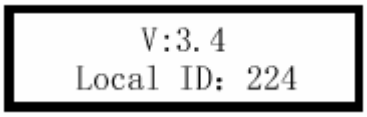


Figure 6-2 Enter IP address of device in IE

The initial screen is displayed after power on, or press CLS key on another screen.

Press ↓ _keys to appear similar following message:



This screen display device type, software version, local or remode device ID. The ID is used for identifying device; it can be modified for monitor. The ID code is same as the last code of IP addr in IDU. The IP address will be modified when modifying the ID. And The ID code will be modified when modifying the IP address.

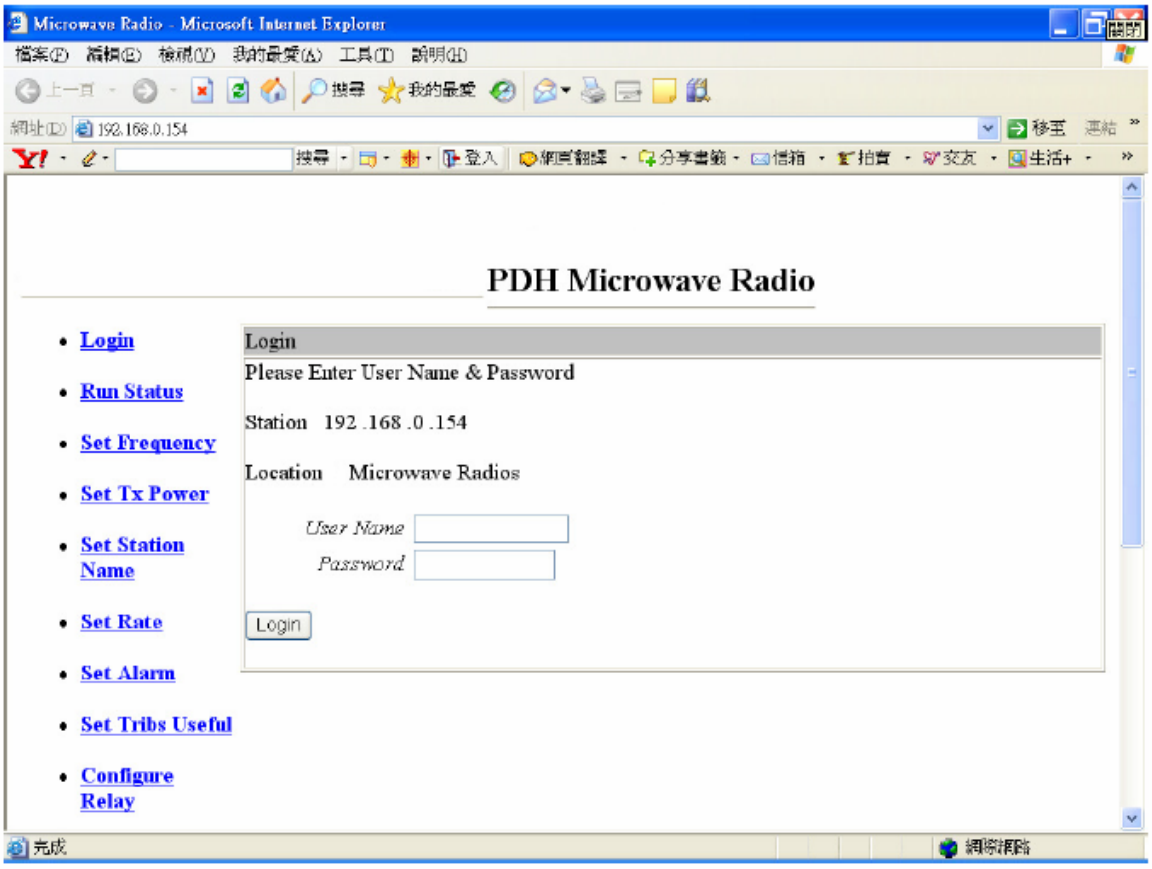


Figure 6-3 WEB page of Login

There are ADMIN users can operate this WEB page: The ADMIN can modify parameters of terminal.

Enter the User name and password.

The passwords are " ADMIN " default(must be this same), can be modified by the access PAGE.

If the passwords are lost, please call service.

After login successfully, the Run-status WEB page will be displayed.

Run Status:

This is the main screen to monitor all parameters of local and remote terminal. The parameters are defined as same as LCD panel in IDU. The LEDs in WEB page indicates the LEDs on the front panel in IDU except LEDs such as TEST, WORK, PWR. See Figure 6-4.

The sumbols are colored as green when normal or red when alarm. The parameters are colored as black for configured value by system or user.

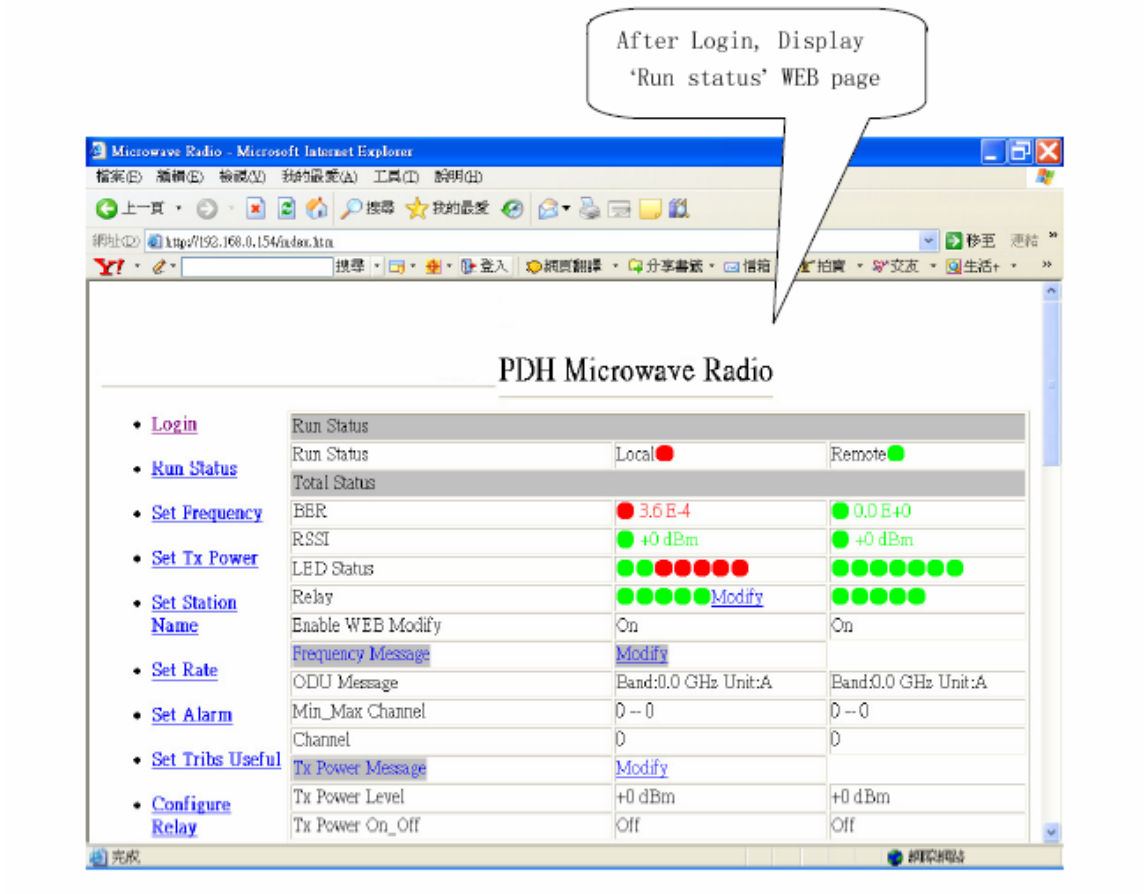


Figure 6-4 Web page of Run Status

Frequency Configuration:

Two parameters are list below for configure in this web page:

TX and RX Frequency.

In systems of 7/8GHz 13GHz and 15GHz frequency, the T-R spacing is set in the channel plan installed in the factory so that receiver frequency changes to track the transmitter; therefore, changing frequency on one end of the link automatically changes the frequency at the other end of the link.The RX frequency is no used in systems of 7/8GHz 13GHz and 15GHz frequency.

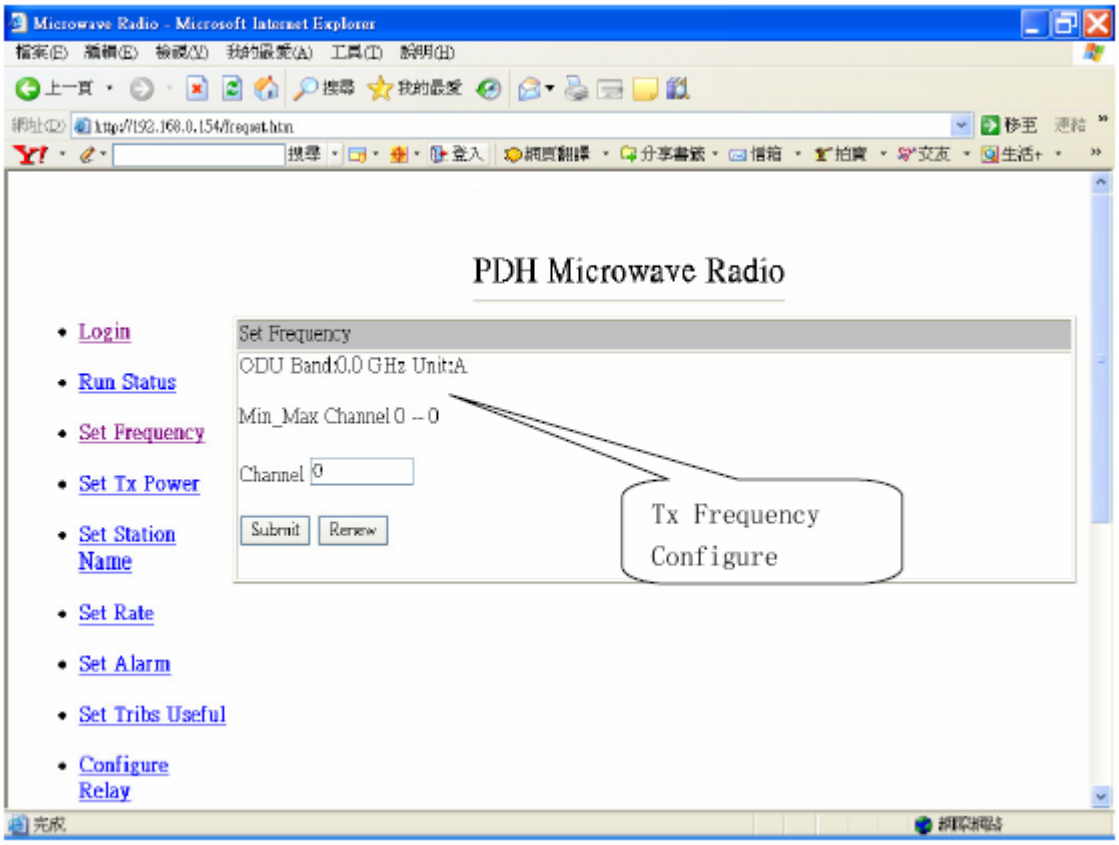


Figure 6-5 Frequency Configuration

Transmit Configure:

There are 4 parameters for transmit configuration:

Transmit power;
Transmit on/off;
ATPC monitor level

- ATPC on/off; (It's unvalidity.)

See Figure 6-6.

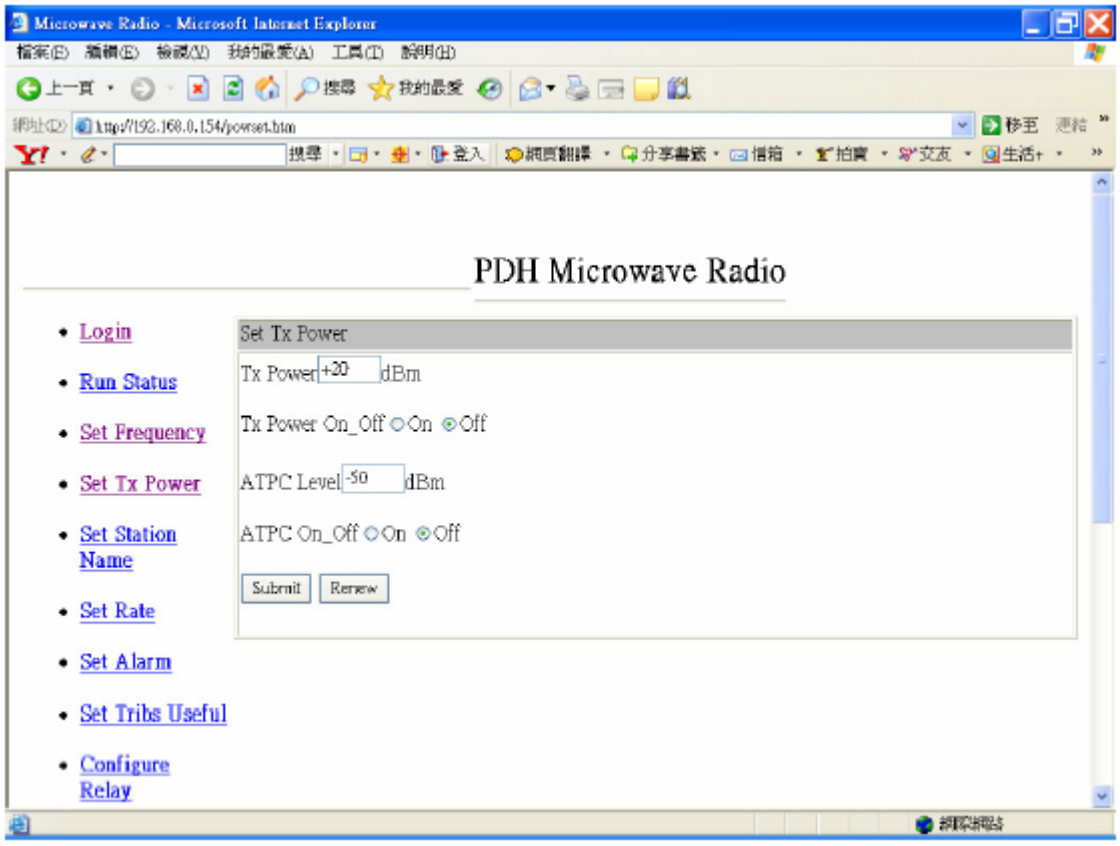


Figure 6-6 Transmit Configuration

Station configuration

For site management, the IDU contains two names each consisted with 12 symbols: Station Name and Company Name. See Figure 6-7.

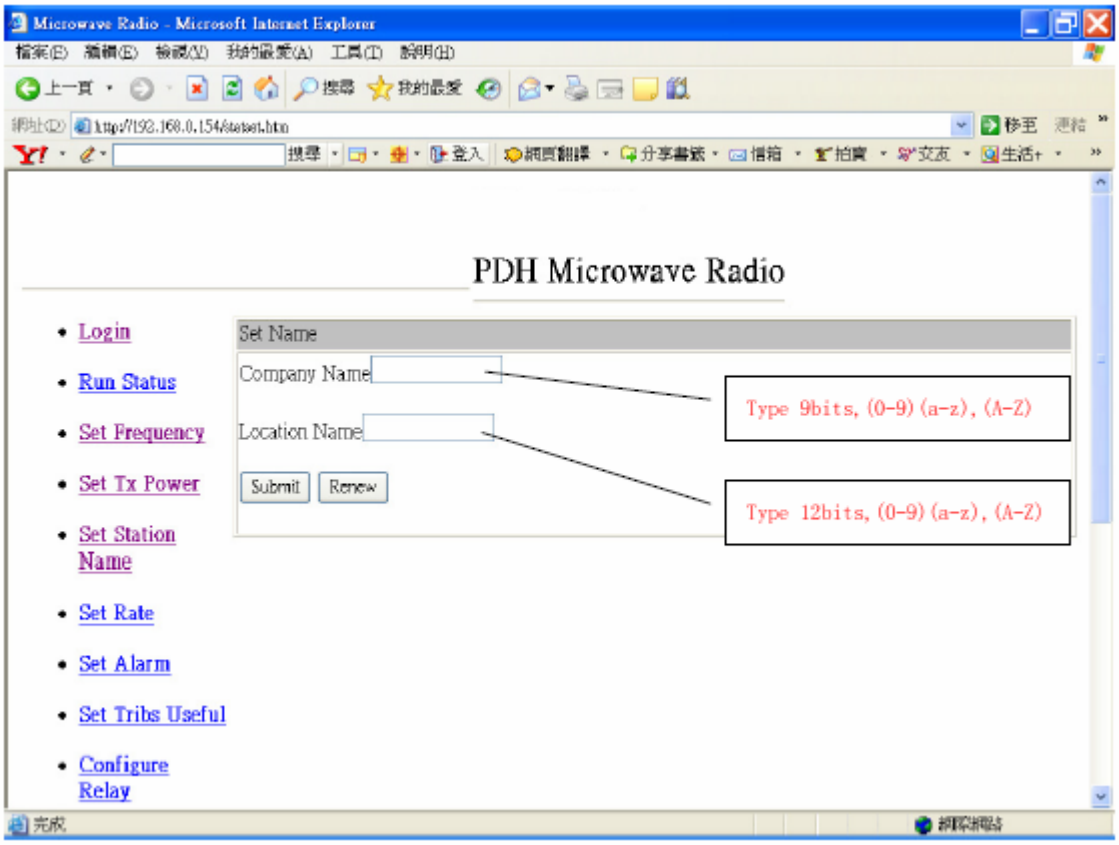


Figure 6-7 Station Name Configuration

Traffic capacity configuration

The traffic capacity can be configured with required rate by this web page. The options are shown as rates such as 7MHz, 14MHz, 28MHz and 56MHz. When use 4/8/16E1 service card, the RF bandwidths are 7MHz for 4x2M, 14MHz for 8x2M, 28MHz for 16x2M, and 56MHz is not used. The RF bandwidths should be set to 14MHz or 28MHz for 10/100BASE-T+1/2/4E1 or 4/8/16E1 servicr card.

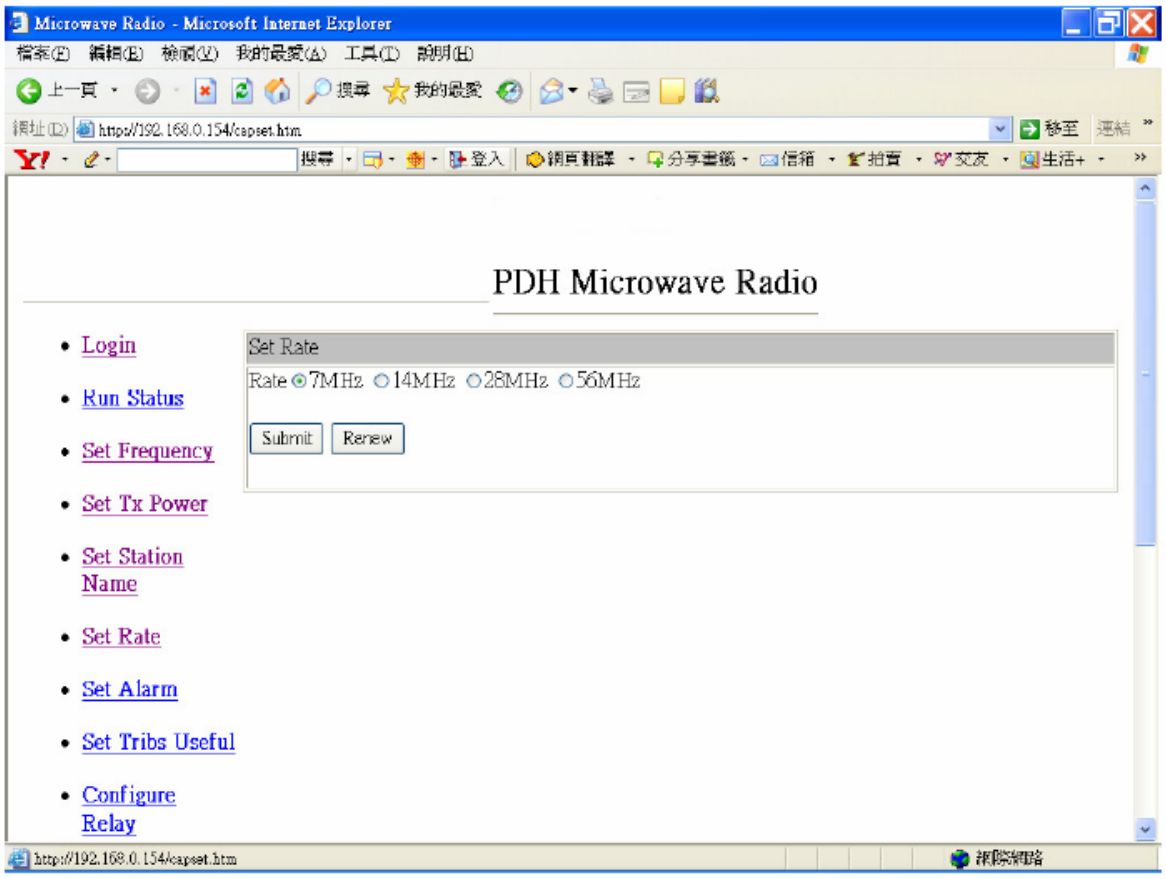


Figure 6-8 Rate Configuration (capacity)

Configure thresholds of alarms:

See Figure 6-9 for configure thresholds of BER alarm and RSL alarm.

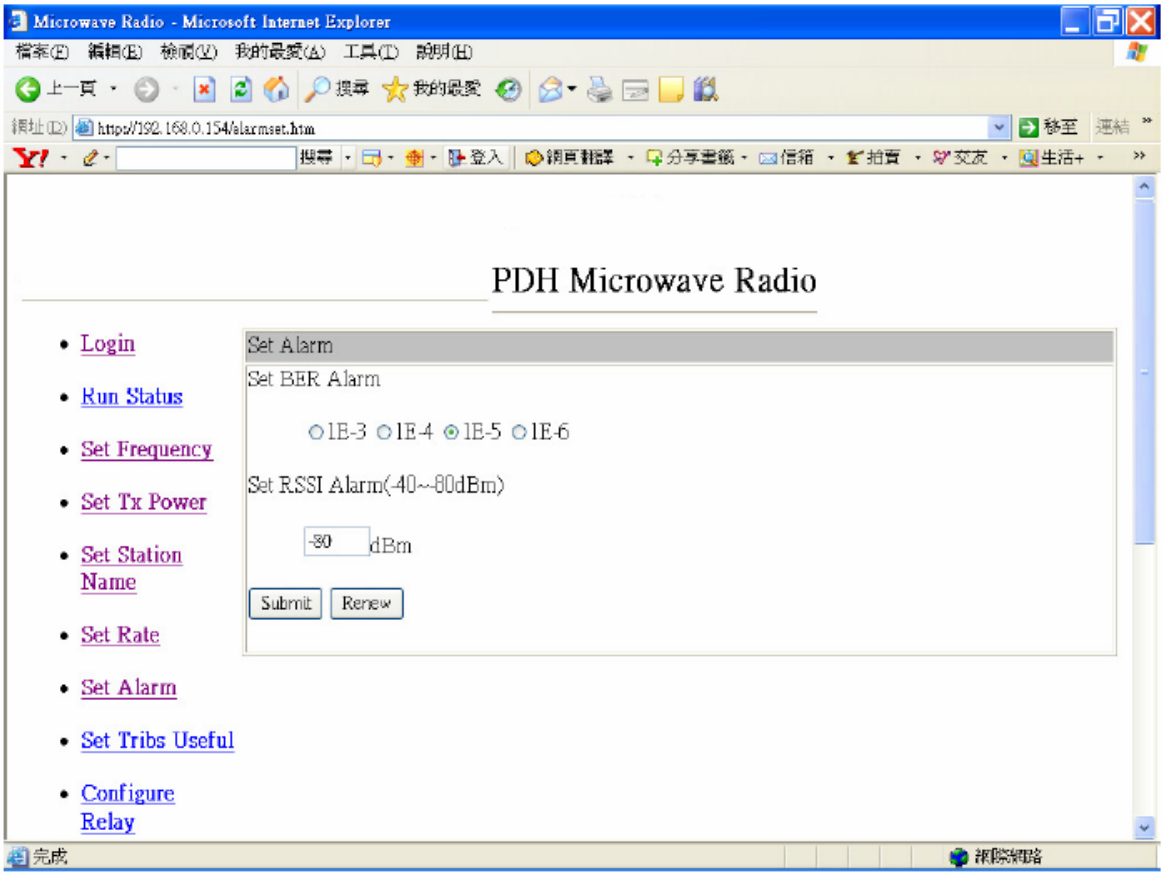


Figure 6-9 Alarm Configurations

Tributary configuration: See Figure 6-10

GA1~GA4: The Tribs 1 to 4 for group A
GB1~GB4: The Tribs 1 to 4 for group B
GC1~GC4: The Tribs 1 to 4 for group C
GD1~GD4: The Tribs 1 to 4 for group D
Configurations of GA1~GA4 are valid for 4E1 servicr card.
Configurations of GA1~GA4 and GB1~GB4 are valid for 8E1 servicr card.
Configurations of all tribs are valid for 16E1 servicr card.
Configurations of GA1~GA4 are valid for 10/100BASE-T+1/24E1 servicr card.

Applying data to a tributary whose LOS alarm has been set to "NO" will not cause a tributary LOS alarm; however, the tributary will pass traffic.

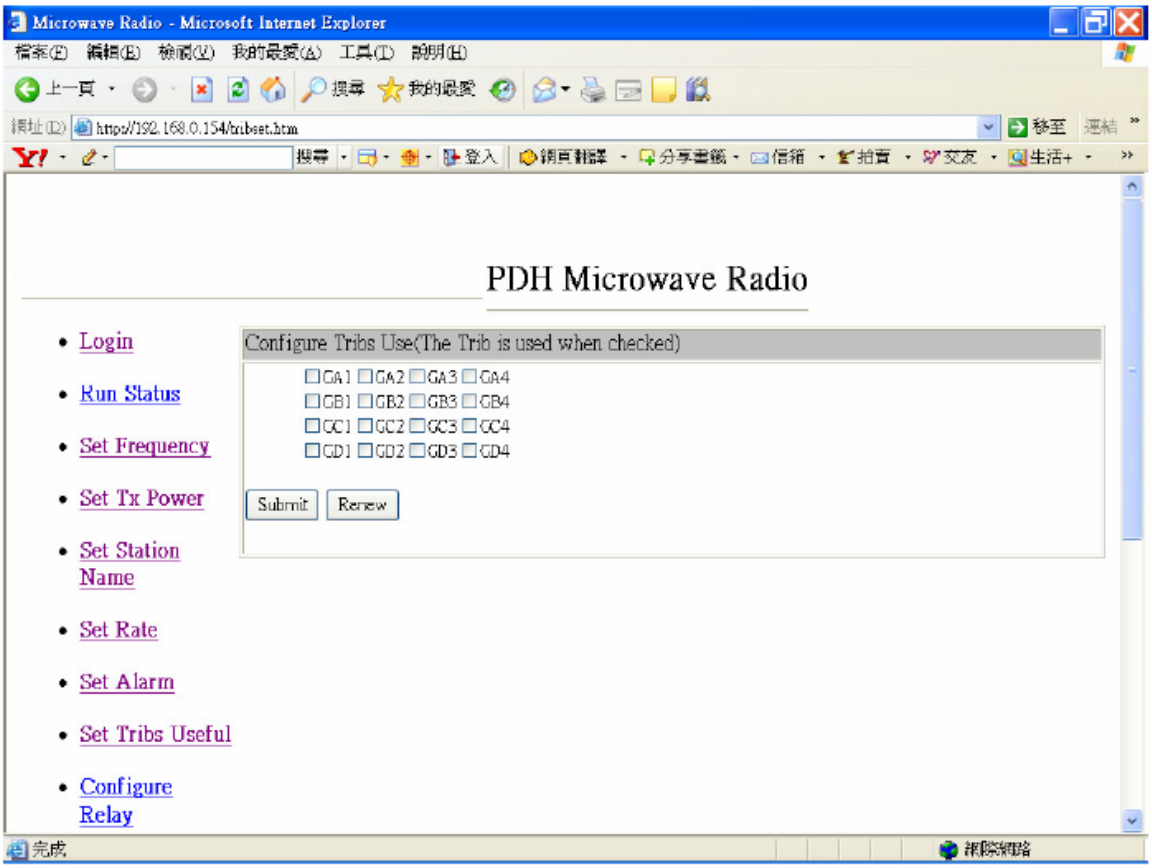


Figure 6-10 Tribs use configuration

Alarm Relays configuration:

See Figure 6-10 to configure alarm relays, i.e, and Cable alarm to relay 1.

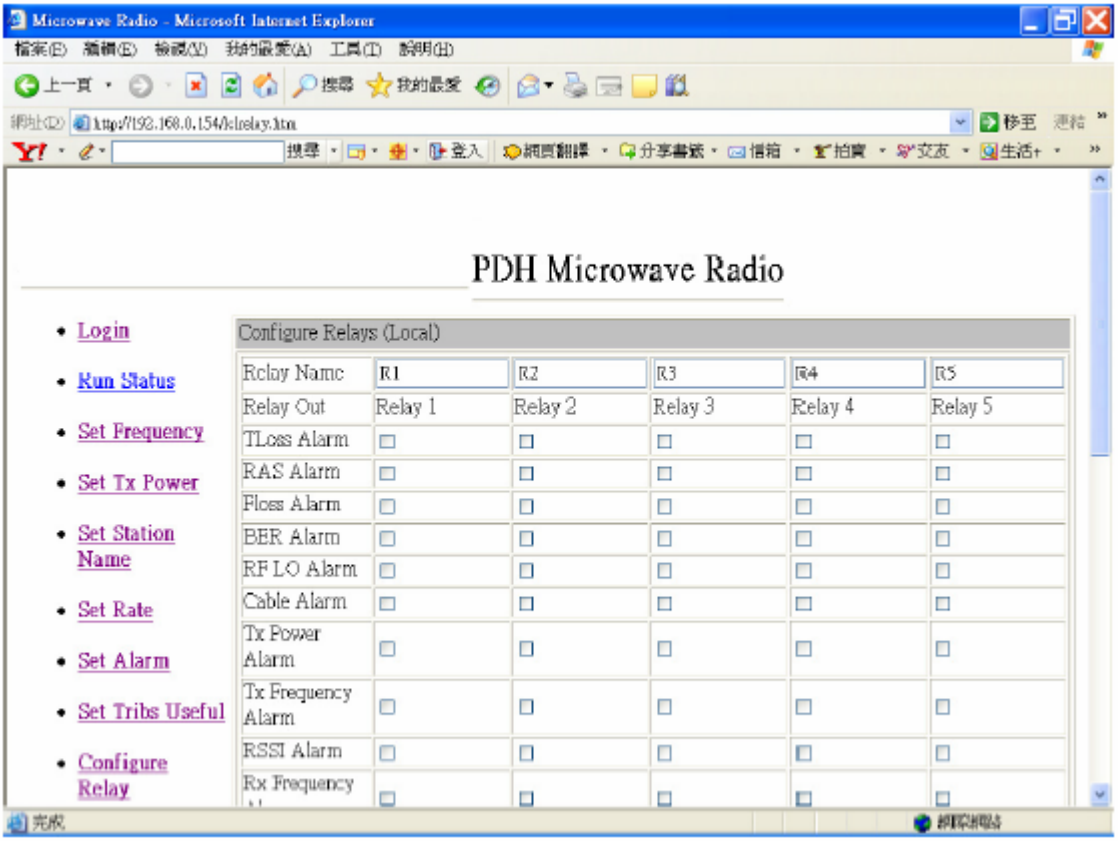


Figure 6-10 Alarm Relays Configuration

Protection Configuration:

The function is valid as save as the panel of protected switch when the IDU work in protection mode, prefer to section 7.2.

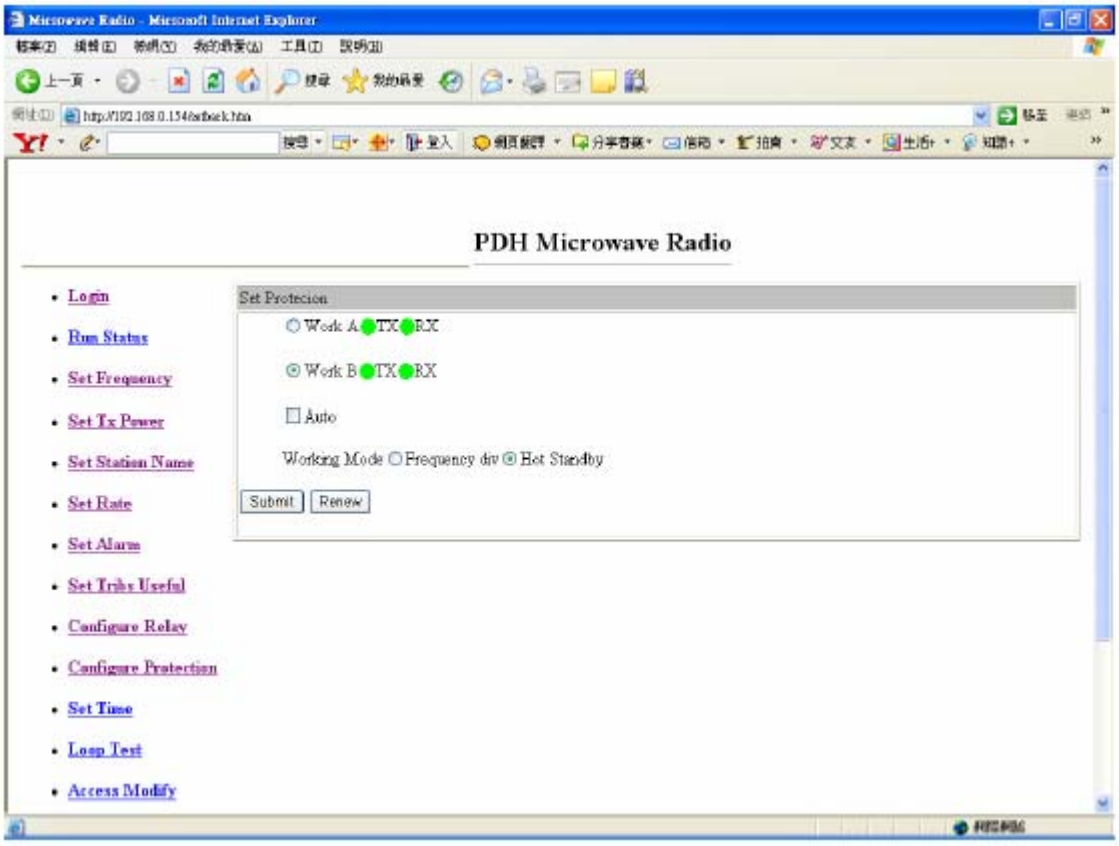


Figure 6-11 Protection system Configuration

Device Date time configuration:

Two parameters can be configured: Device Date time and Count-time for Stat…

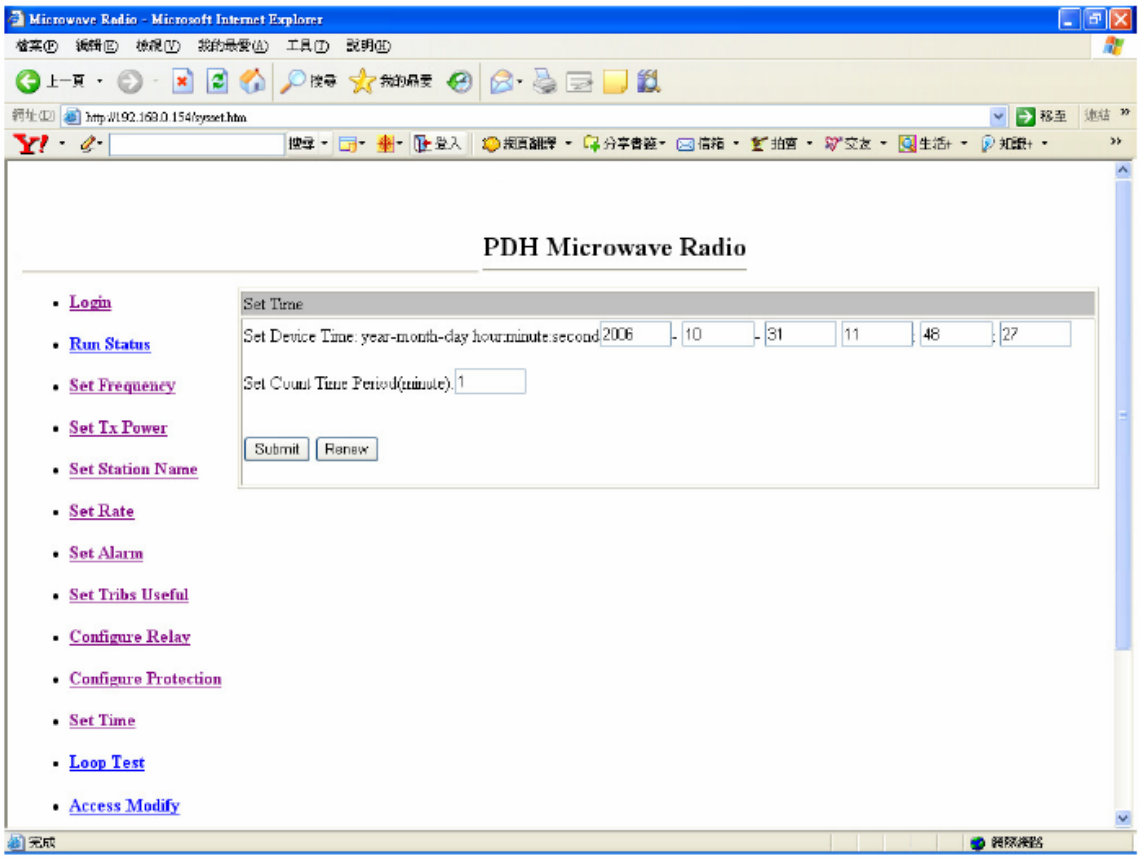


Figure 6-12 Device Time Configurations

Testing:

Used for LOOP back testing. See Figure 6-13.

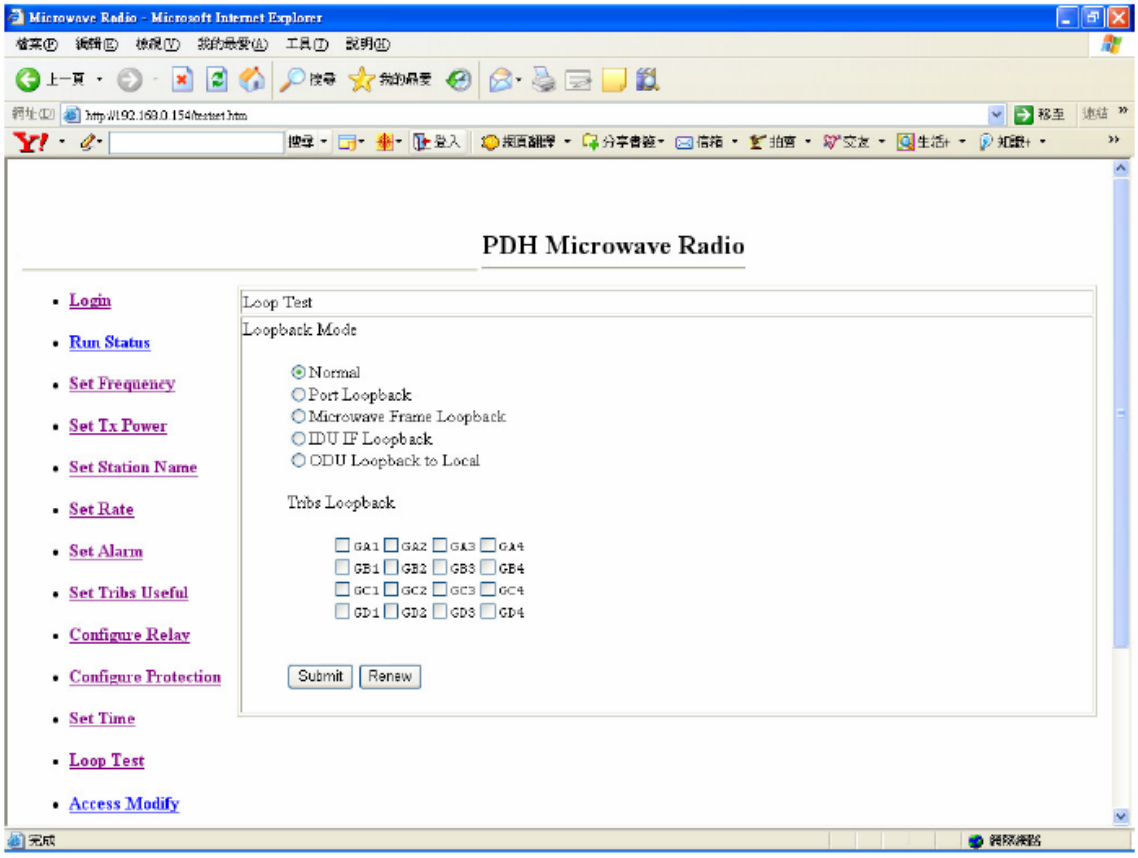


Figure 6-13 Loop Test Configurations

Access Modifying:

Use this Access Modifying to modify password. See figure 6-14.

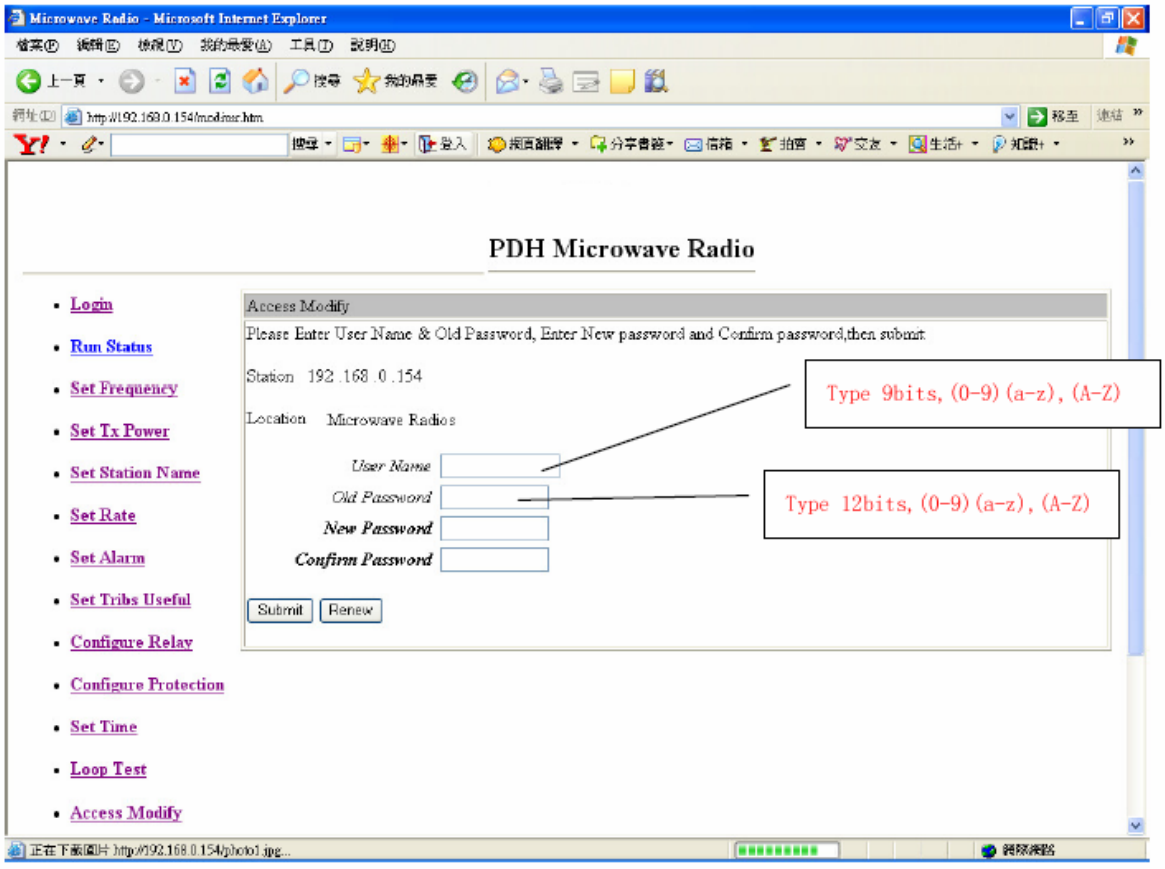


Figure 6-14 Access Modifying

Log:

The Log records parameters configuration, login, etc. See 6-15.

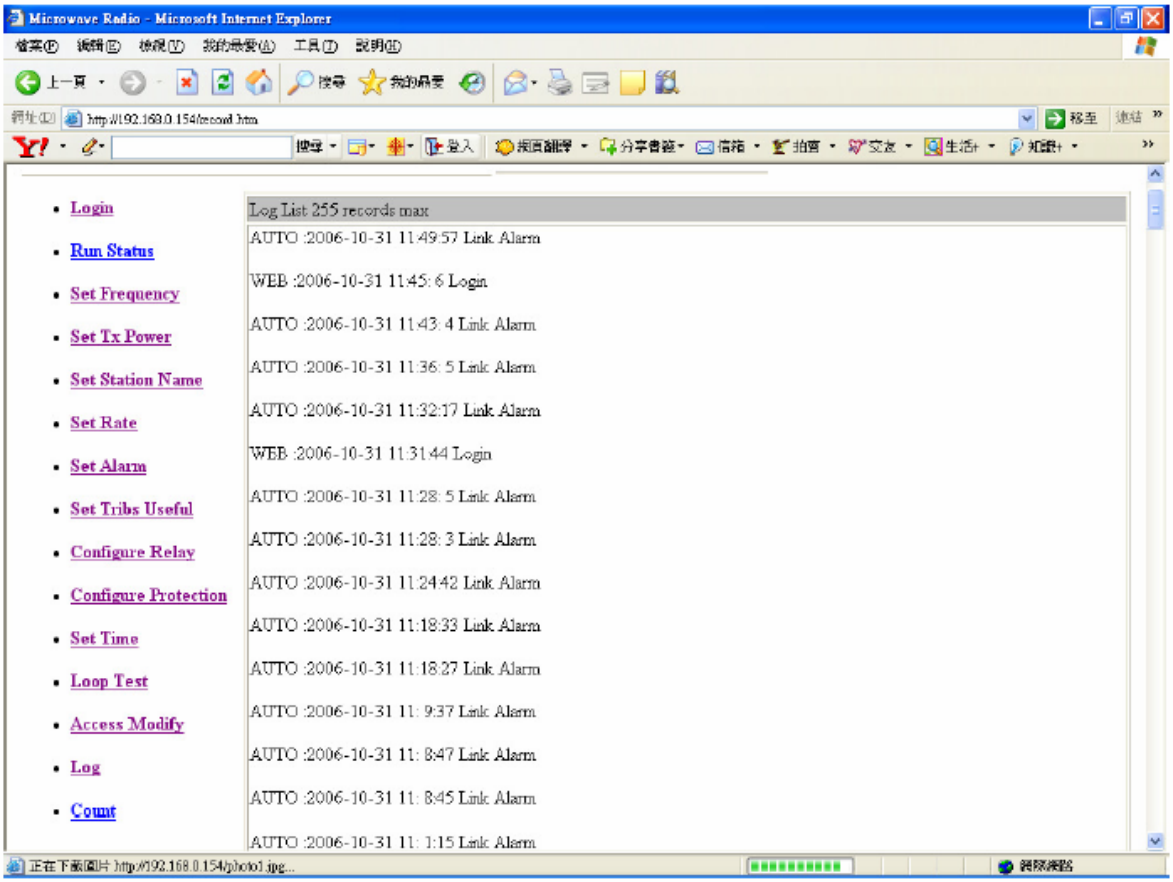


Figure 6-15 Logs

Stat.:

Stat. is used for link performance stat. The records of Stat. are: BER, RSL and transmit power every count-time of Stat. See Figure 6-16.

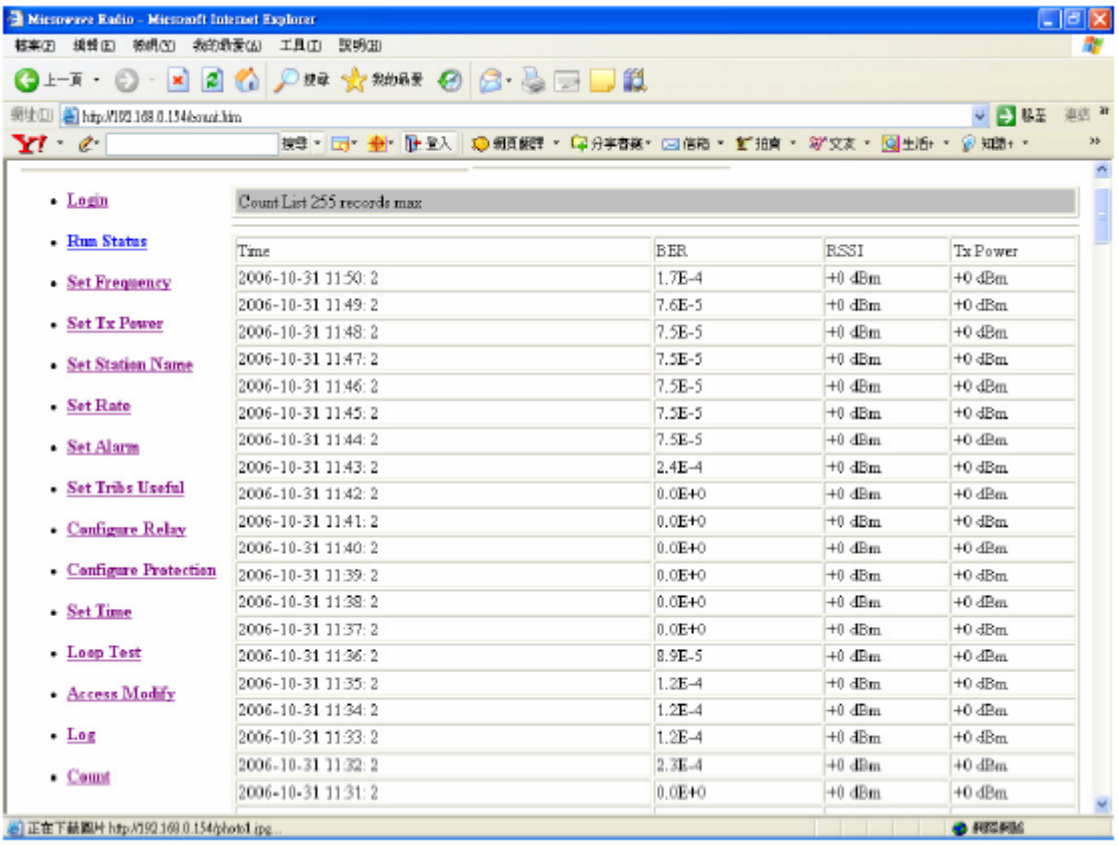


Figure 6-16 Stat.

7 Protection systems

7.1 General

Protection Systems are used to improve link reliability and availability. The L54 Protection System may operate in one of the following modes, depending on customer requirements:

Hot Standby: Both terminals are powered on, and set to the same frequency, but one terminal's transmitter is muted to prevent interference.

Frequency Diversity: Both terminals' transmitters are powered on, but use different frequencies to avoid interference.

Space Diversity: The main and stand-by radios are set up in Hot Stand-by mode, but are connected to their own antennas. The spatial separation of the antennas, combined with hitless receive switching, provides the Space Diversity function on the receiving end of the link.

The ODU arrangements may use one antenna with a waveguide coupler, when the antenna is larger, i.e. 1.8m. See figure 8-1.

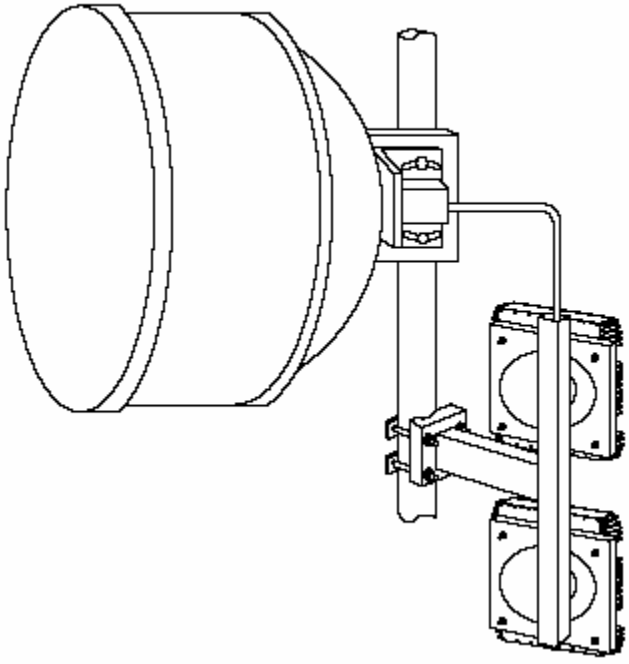


Figure 7-1 Connectnig of Single Anttena/Dual ODUs

The IDU arrangement is similar for all four protection modes. The protection switch provides connection between two IDUs, each of which connects to an ODU.

7.2 Switching Conditions and Operation

The protected system provides link continuity in the event that a fault occurs in the primary radio. The switch is activated by an alarm condition in the primary link. The following alarm conditions will trigger a switch from primary to secondary IDU:

1. Loss of lock on transmit signal
2. Loss of transmit power
3. Frame loss (Receive)
4. BER alarm
5. DC power loss
6. Cable fault
7. Low receive level

The switch is activated by an alarm condition in the primary link. See table 7-1 switch alarm Condition

Table 7-1 switch alarm condition

item	condition	Switching Function Activated
1	Loss of lock on transmit signal	Transmit
2	Loss of transmit power	transmit
3	Frame loss (Receive)	receive
4	BER alarm	Receive(hitless)
5	DC power loss	Transmit and receive
6	Cable fault	Transmit and receive
7	Low receive level	Receive(hitless)

7.3 Protection switch

The key component to protected system operation is the Protection Switch. All service cards (4E1, 8E1, 16E1 and 10/100base-t) are mounted in protection system.See Figure 7-2.

Figure 7-2 IDU protection systems

The service card in IDUs will be replaced by switch-connection card. And the service card will mounted in protection switch. Traffic connections between the protection shelf and IDUs are made on the front panel. The traffic interfaces are SCSI68 and RJ-45.

The protection switch monitors both co-located IDUs and, upon an alarm status change in either IDU, makes a decision as to which of the IDU should be on-line (carrying traffic). Alarm, status, and power connections to the controller from IDUs are made at the snmp of each unit.

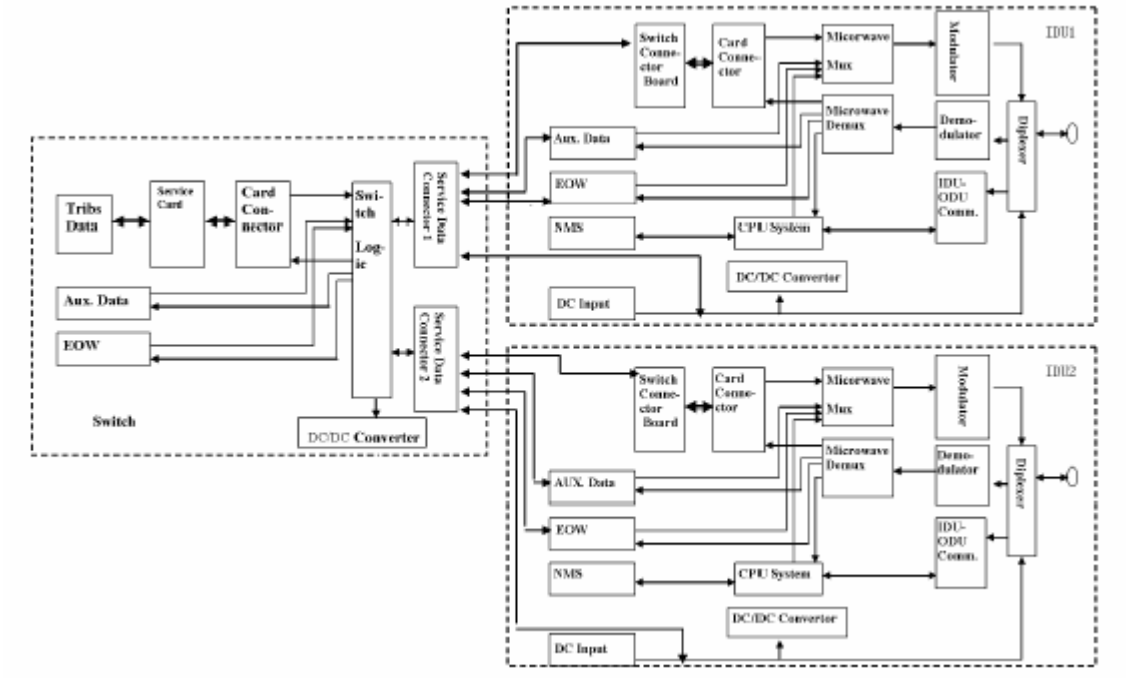
The choice of operation in Hot Standby or Frequency Diversity or Space diversity protection mode is suit for all service card, including 4E1,8E1,16E1, and 10/100BASE-T services.
The choice of operation in Hot Standby or Frequency Diversity is set by the redundant system controller.

7.4 Protected system theory

Except the service card, the IDU in unprotected system is same as in protected system. In unprotected system, the service card is mounted in IDU.

In protected system, the switch-connect card is mounted in IDU, and the service card is mounted in Protection Switch to supplying services such as 4E1,8E1,16E1,10/100BASE-T+1/2/4E1 and 1E3 services.

See Figure 7-13, it descripts the based theory of protection switch. The Protection Switch consists of DC/DC power, hitless switch system, switch state mechanical, service connector, and auxiliary data connector. Figure 7-13 Bbased theory of protection switch



7.5 ODU configuration

A protected configuration typically consists of redundant IDUs and ODUs and a waveguide coupler to connect the two ODUs to a single antenna port. If desired a second antenna may be used instead of the waveguide coupler, providing protection against an antenna falling out of alignment. The dual ODU/dual antenna configuration is required for Space Diversity systems. The following descriptions assume all protected systems are configured with a single antenna and a waveguide coupler.

7.6 Protected Mode

7.6.1 Hot Standby Protection Mode

The main and standby radios are tuned the same frequency. Transmitters of the off-line radio are muted. When a fault is detected, the on-line terminal is muted, the standby terminal is unmuted, and traffic is switched to the newly unmuted terminal. This system can be dual ODU/dual antenna configuration or dual ODU/single antenna configuration.

7.6.2 Frequency Diversity Protection Mode

The main and standby radios are typically set up at least two channels apart to avoid interference. Both radios are unmuted and ready to pass data. When a fault is detected on the active radio, the traffic is switched to the stand-by radio. This system can be dual ODU/dual antenna configuration or dual ODU/single antenna configuration.

7.6.3 Space Diversity Mode

The main and stand-by radios are set up in Hot Stand-by mode, but are connected to their own antennas.

Both antennas, separated by a specific distance, are receiving the signal transmitted from the on-line radio at the other end of the link. If a fault occurs in the receiving end of the link, the traffic is switched to the stand-by radio without causing errors (hitless receive switching). As in Hot Stand-by mode, a fault detected in the on-line transmitter causes that transmitter to mute and the stand-by radio to un-mute.

7.7 System Installation

7.7.1 General

This section covers only procedures unique to installing a protection system. Where necessary, references to Section 4 (Installation) are made for specific guidelines on how to install ODUs, IDUs, and cables.

7.7.2 Installation Equipment Required

7.7.2.1 Tools

Same is unprotected installation. Refer to section 4.2.1.

7.7.2.2 Equipment

Hot-standby, frequency diversity, space diversity protection system:

Protection switch installation kits, See table 7-3. Refer to section 5.

Table 7-3 Protection Switch Installation Kit Parts List

Item	Quantity	Description
1	1	6dB coupler
2	1	IDU
3	3	RF Cable (ODU to Antenna)
4	1	Switcher mounted with required service card.
5	2	ODU
6	2	IF cable (IDU to ODU)

7.7.3 Requirement of room:

Same as section 4-4

7.7.4 Cable Installation

Same as section 4-5

7.7.5 ODU Installation

Same as section 4-6

7.7.6 IDU and Protection Switch Installation

The protected IDUs and protection switches require only 254mm rack depth and 1RU of vertical rack space. No space above, below or between the units is required for ventilation purposes as the whole system dissipates less than 25 W.

Step 1: Install each IDU in a rack with a 1RU space between them for 1+1 Protection System. Follow the guidelines given in Section 4.6.1.

Step 2: Position the protection switch in between the IDUs.

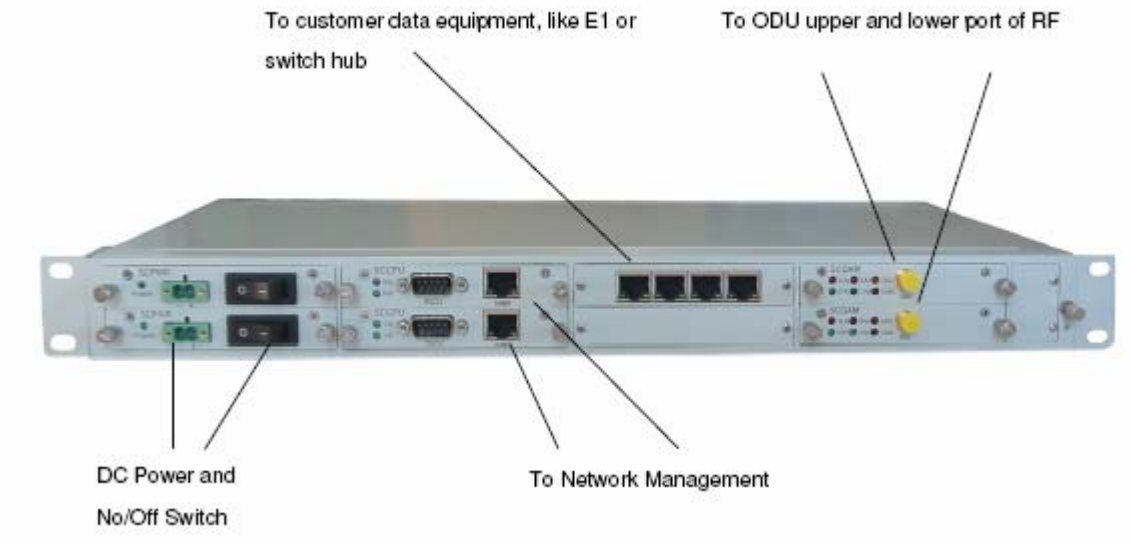
Step 3: Install the cables.

Step 4: Connect cable from ODU nearest coupler flange to the upper IDU to ODU port of RF and cable from ODU farthest from coupler flange to the lower IDU to ODU port of RF . This provides the least amount of insertion loss to the primary side.

Step 5: Install customer's data signal cables to the tributary connectors on the protection switch using CC4 connectors and DB37-CC4 adaptors (for 75ohm E1s), RJ-45 connectors(for 10/100BASE-T and 120ohm E1s).

Step 6: Install DC power to IDU via the 2-pin connectors.

Note: The protection switch has code download capability through the "A" protection connector. This enables code to be downloaded to the controller without disturbing traffic on "B".
And LCD panel is option by customer need.



7.8 Commissioning The Protection System

Before applying power to the system, select the relevant protection mode of operation for the installation on the redundant system controller front panel using the two-position rocker switch located on the right side of the shelf. Select “A” on-line using the three-position rocker switch located on the protection switch front panel.

7.8.1 Hot Standby Protection Mode

Use Section 5 as a general guide, but read the following instructions first:

1. Verify that **all** interconnect cables are installed.
- Power up IDU.
- Set upper IDU Traffic Capacity, Frequency, Transmit Power, Link ID Code and Tributary Configuration per section 5.5.

4. Press HS key in the switch.
- Select “B” on-line using the three position rocker switch located on the protection switch front panel.
- Set lower IDU Traffic Capacity, Frequency, Transmit Power, Link ID Code and Tributary Configuration per section 4.5.

Note The setup of the both upper and lower L54’s must be identical for correct system operation.

7. Align the antenna using the guidelines given in Section 5.6.
- Select “A” then “AUTO” function on the switch using the three position rocker switch located on the front panel.
- LEDs for IDU should be normal: WORK led flicker, POWER led light on, and the other leds light off.
- The B, B TX and FD LEDs for switch should be light off, the others should be light on.

This indicates that B is functional and standing by.
The Hot Standby Protection System is now ready to carry traffic.

7.8.2 Frequency Diversity Mode

Use Section 5 as a general guide, but read the following instructions first:

1. Verify that **all** interconnect cables are installed.

Power up the upper IDU only. Set upper IDU Traffic Capacity, Frequency, Transmit Power, Link ID Code and Tributary Configuration per Section 6.5.

3. Press FD key in the switch.

4. Power up the lower IDU and select “B” on-line using the three position rocker switch located on the protection switch front panel.

5. Set lower IDU Traffic Capacity, Frequency, Transmit Power, Link ID Code and Tributary Configuration per Section 6.5.

Note: The setup of the lower L54 must be identical to the upper except for frequency. Frequencies used on “A” and “B” terminals must be different for system to operate. Frequencies will have been assigned by the customer’s frequency planning department.

6. Align one antenna system at a time using the guidelines given in Section 6.6.

7. Select “A” then “AUTO” function on the controller using the three position rocker switch located on the front panel.

LEDs for 2 IDUs should be normal: WORK led flicker, POWER led light on, and the other leds light off.

The HS and B LEDs for switch should be light off, the others should be light on.

This indicates that B is functional and standing by.
The Frequency Diversity Protection System is now ready to carry traffic.

7.8.3 Space Diversity Mode

Space Diversity requires the dual ODU/dual antenna configuration.
Use Section 5 as a general guide, but read the following instructions first:

1. Verify that **all** interconnect cables are installed.

Power up the upper IDU only. Set upper IDU Traffic Capacity, Frequency, Transmit Power, Link ID Code and Tributary Configuration per Section 6.5.

3. Press HS key in the switch.

Select “B” on line using the three position rocker switch located on the protection switch front panel.

Set lower IDU Traffic Capacity, Frequency, Transmit Power, Link ID Code and Tributary
Configuration, section 5.5.

Note ***the setup of the both upper and lower L54’s must be identical for correct system operation.***

6. Align the antenna using the guidelines given in Section 5.6.

Select “A” then “AUTO” function on the switch using the three position rocker switch located on the front panel.

LEDs for 2 IDUs should be normal: WORK led flicker, POWER led light on, and the other leds light off.

The B, B TX and FD LEDs for switch should be light off; the others should be light on.

This indicates that B is functional and standing by.
The Space Diversity Protection System is now ready to carry traffic.

8 Network Management Systems (NMS)

8.1 Overview

The NMS of microwave radio is used for monitor device's operating status, calculate the performance of microwave link, locate fault and control operating mode of microwave radio.

The NMS of microwave radio is divided into 3 stages.

The first stage is device stage, completed by CPU in the IDU, which monitors and controls the device modules including collecting alarms, calculating performances, configuration, safety protection, etc.

The second stage is completed by IBM compatible PC, which connects IDU with RJ-45 cable using the protocol of TCP/IP. In this stage, we can monitor and contorl the microwave link by a PC with graphic interface.

The third stage is completed by PC which running NMS software such as SNMPc, HP OpenView etc. This stage is used for monitor all devices by monitor PCs connected with the IDU of microwave link.

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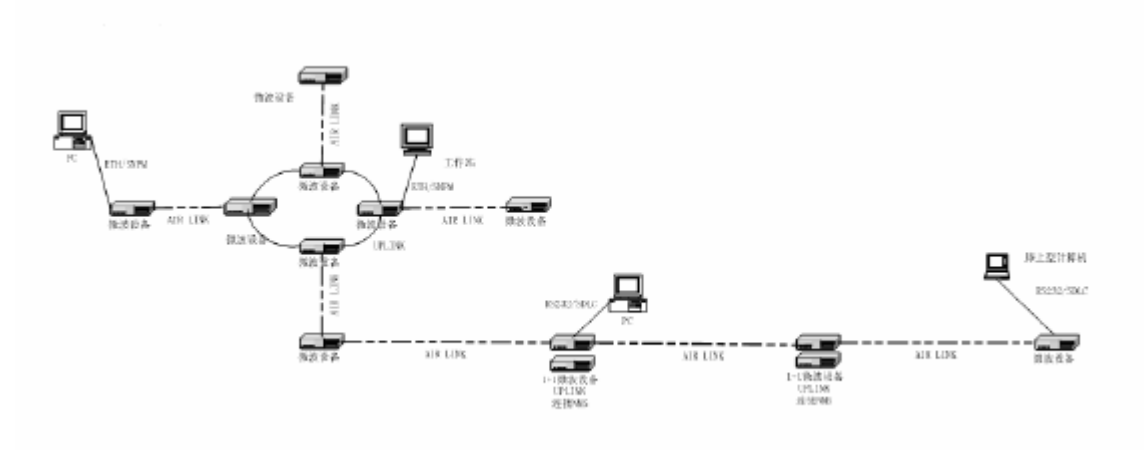


Figure 8-1 Microwave links of Transmission network

8.1.1 Connections of NMS

The IDU have two interfaces for NMS connection: Ethernet and RS232.
The RS232 is used for software update, here is reserved.
The Ethernet is used for SNMP/NMS.

The protocols are:

- Ethernet: TCP/IP, SNMP, HTTP
- RS232: TTY, SLIP(reserved)

The SNMP protocol is in the IDU connects PC by Ethernet with RJ-45 port in IDU.

8.1.2 Configuration for NMS's IP

The configurations for NMS IP in IDU are:
IP address of IDU
Subnet Mask of IDU
Netgate of IDU

Agent IP address: The IP address is used for SNMP TRAP message. This message is generated by IDU and send to NMS PC. So the IP address is address of NMS PC.

MAC address: The MAC address is located on the IDU. It is set at the factory and can be changed.

Broadcase address: The MAC address is located on the IDU. It is set at the factory and can be changed.

If the addresses listed above needs to be verified or changed, please use the LCD panel on the IDU as described in Section 5.

8.2 Connectors

The connectors of NMS in IDU are: RS232 and Ethernet listed below:

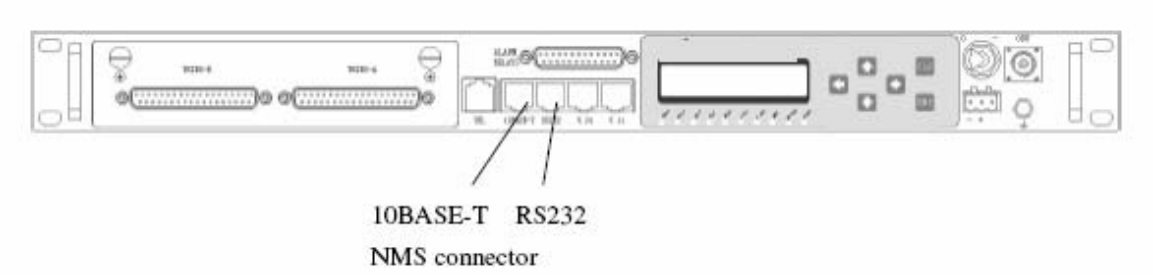


Figure 8-3 NMS connector on IDU

The RS232 for software update use RJ-45 connector.
The Ethernet for SNMP/NMS use RJ-45 connector.

8.3 Installation

8.3.1 Installation Equipment Required

8.3.1.1 Tools

A basic electrician's toolkit.

8.3.1.2 Equipment

Items included with SNMP/WEB NMS:

Standard Ethernet cable

8.3.2 Installation Procedure

Connect the Ethernet cables to the Ethernet port on the IDU. For management via a network, a standard Ethernet cable is used to connect to a hub, switch or any other Ethernet equipment. For a laptop computer, a standard Ethernet cable with an RJ45 connector is used.

9 Troubleshooting

9.1 General

This section describes the features available to assist the operator in tracking and correcting L54 radio problems. These features include a series of discrete alarm functions that will assist in tracking both configuration errors and radio failure conditions using the front panel controls at one end of a working radio link. The five multi-function LED alarm indicators on the front panel can be mapped to five alarm relays for connecting to external alarm reporting systems. The factory default mapping of the relays is shown in Table 7- 1

9.2 Discrete Alarm Descriptions

Trib fault

Alarm condition indicates LOS (loss-of-signal) condition detected on the tributary input. If alarm occurs, check continuity of data connections to L54 IDU.

Note. Set tributary configuration to "NO" if data is not applied to a tributary whose tributary is unused as detailed in Section 6.1.2 & 6.2.2

Service Card Alarms

Alarm condition indicates alarm conditions detected on the service card. There have different alarm depend on different service card. For 4/8/16E1 service card, alarms list below:

RAD, Frame loss in remote service card
AIS, all one in remote service cards
OOF: Frame loss in local service card
GLOS: All one in local service card.

The action required to resolve the fault will depend upon all the accompanying alarms. Recommend use of loopback features in LCD panal to locate the problem.

Remote alarm

The remote terminal has detected alarms. To correct them please check remote terminal.

Frame loss:

Alarm condition indicates the remote terminal has detected alarms. To correct them please check remote terminal.

The action required to resolve the fault will depend upon all the accompanying alarms in remote terminal. Recommend use of loopback features to locate the problem.

Note. The most common reason for this alarm occurrence will be due to a link fade, such as that occurring during excessive rainfall.

BER alarm

Alarm condition indicates the received BER has exceeded the preset *Alarm* threshold. The action required to resolve the fault will depend upon all the accompanying alarms. Recommend use of loopback features to locate the problem.

Note. The most common reason for this alarm occurrence will be due to a link fade, such as that occurring during excessive rainfall.

Cable Fault

Alarm condition indicates microprocessor communications between the IDU and ODU have failed.

The fault is most probably with the cable connection, it may be either open or shorted. Use of a multi-meter to measure DC cable resistance will determine if the cable is open or shorted:

1. Disconnect power to the IDU
2. Remove the N-type ODU connector from the IDU
3. Measure the DC resistance between the centre pin and the outer of the N-type connector terminating the cable;

If resistance is between 1 M and 10M

- This is correct
- Suspect IDU or ODU circuitry
- Replace IDU
- If alarm persists, swap replacement IDU for original and replaces ODU.

If resistance is less than 1M :

- Check the cable thoroughly over whole length and at both ends for damage or reasons that would cause low cable resistance.
- If in doubt reterminate both ends of cable with new N-type connectors.
- Remeasure cable resistance (with it disconnected at both ends), resistance should be unmeasurable or open circuit.
- If cable resistance is unchanged, replace entire cable run, terminating with new N-type connectors.

If resistance is unmeasurable:

- Cable is open circuit
- Check the cable thoroughly over whole length and at both ends for damage or reasons that would cause an open circuit condition (e.g. connector not terminated correctly and/or badly corroded or cable cut)
- If in doubt re-terminate both ends of cable with new connectors.

Re-measure cable resistance (with it disconnected at both ends), resistance should be unmeasurable or open circuit.

- If cable resistance is unchanged; replace cable, terminating with new connectors.
- If cable is cut, replace entire cable run, terminating with new connectors.

Transmit power

Alarm condition indicates low power output from final stage of microwave power amplifier.

If this alarm occurs, please confirm transmit power is on first, and then replace the ODU if the alarm is not dispeared.

TX PLL

Alarm condition indicates the transmitter phase-locked-loop has lost lock.

If this alarm occurs on its own, replace the ODU.

If this alarm occurs in conjunction with the RX *PLL and RF PLL*, replace the IDU (reference source failure).

Receive PLL

Alarm condition indicates the receiver phase-locked-loop has lost lock.

If this alarm occurs on its own, replace the ODU.

If this alarm occurs in conjunction with the TX *PLL and RF PLL*, replace the IDU (reference source failure).

RF PLL

Alarm condition indicates the receiver phase-locked-loop has lost lock.

If this alarm occurs on its own, replace the ODU.

If this alarm occurs in conjunction with the TX *PLL and RX PLL*, replace the IDU (reference source failure).

Receive Level

Alarm condition indicates the receive RF level is below the preset threshold.

If alarm occurs on its own, verify RSL, RF path between L54 terminals, antenna alignment and remote terminal transmitter power output setting.

If alarm occurs in conjunction with others, the action required to resolve the fault will depend upon the activated alarm. Use of the loopbacks in LCD panel is recommended to locate the problem

Note. The most common reason for this alarm occurrence will be due to a link fade, such as that occurring during excessive rainfall.

IDU temperature:

Alarm condition indicates the IDU temperature is over range, check local temperature conditions of IDU are over range or not.

IDU inner voltage:

Alarm condition indicates the inner voltages in IDU are over range, check local DC power fed to the IDU. If the DC pwer connections are no problem, please replace IDU.

9.3 Troubleshooting Using the Front Panel LCD &LED

9.3.1 Summary LED Alarm Display

10 LEDs are list below:

The TEST LED is yellow.
The WORK LED and PWR LED are green. And the others are red. See Table 9-1.

Table 9-1 LED status

LED	LED Description	Light off	Light on
TEST	LoopBack Test	Normal	Opreate with Loop back mode
TLOS	Tributary LOSS	Normal	Tributary LOSS
RAS	Remote Alarm	Normal	Remote Fault
FLO	Frame loss	Normal	Received frame synchronization may be intermittent.
BER	BER Alarm	Normal	Received BER exceeds BER alarm threshold,
ODU	ODU alarm	Normal	ODU fault
CABL	Cable Fault	Normal	Cable Fault
IDU	IDU alarm	Normal	IDU fault
WORK	CPU working	IDU Fault	It is normal when light is on for 1s and off for 1s, otherwise is fault.
PWR	Power working	No Power IN	Normal

9.3.2 LCD screens of ALARMS

The LCD will show and flicker the screens witch alarm occurred when the option of J-LCD Alarm is ON and no press any key for 20 seconds or press CLR first and then press ENT. See Table 9-2.

Table 9-2 LCD screens of ALARMS

Screens	Description	Stage	This LED lights on
Local Supply 5V:4.95 3.3V:3.27	IDU inner voltage	1	IDU
Local ODU Lock RF:L TX:L RX:L	ODU PLLs	2	ODU
Local Alarm E1-A OOF	Service card alarms	3	IDU
Local E1-A SIG 1IN 2LS 3NU 4LR	Tributraies LOS	4	TLOS
Local Err Rate 1.40E-06	BER	5	BER
Local ODU RSSI - 28dBm	RSL	6	ODU
Local ODU SSPA + 05.2dBm	Transmit Power	7	ODU
Local Unit Temp O:35'C I:27'C	IDU/ODU temperature	8	IDU/ODU

The parameters of these screens are defined in section 6.When multi alarms are generated, the stage of lowest number will displayed first.

9.4 Troubleshooting Quick Reference Guide

Table 9-3 Troubleshooting Quick Reference Guide

Condition	Lighted LEDs	LCD Display	Description	Corrective Action
Tributary input loss	TLOS、IDU	Local E1-A SIG 1IN 2LS 3NU 4LR	Display "LS" if Tribs input loss	Configure new tributary Check existing tributary connections
Service card Alarm	IDU	Local Alarm E1-A RAD AIS OOF GLOS	Alarm in Service card	Check service card
Remote Alarm	RAS		Alarm in Remote	Check remote terminal
Frame Loss Alarm	FLO、IDU、BER		Received frame synchronization may be intermittent.	Check local conditions for excessive rainfall . Check link path for obstructions . Check antenna alignment . Check remote transmitter output power . Check for interference from another link in vicinity
BER Alarm	BER	Local Err Rate 1.40E-06	Received BER exceeds BER alarm threshold,	Check local conditions for rainfall Check link path for obstructions . Check antenna alignment . Check remote transmitter output power . Check for interference from another link in vicinity
Cable Fault	CABL、FLO、IDU、BER		Cable shorted or open circuit	Check cable connection IDU-ODU
Transmit Power	ODU	Local ODU SSPA + 05.2dBm	Transmit Power is below Transmit Power alarm threshold	Close ATPC, check transmitter
Tx PLL unlocked Rx PLL unlocked RF PLL unlocked	ODU	Local ODU Lock RF:L TX:N RX:N		Replace ODU

9.5 Alarm Relays

The alarm relays are presented on the front panel of the IDU. “Form C” relay outputs are presented on the L54 IDU front panel *ALARM RELAYS* DB25 connector.

- Each relay output is mapped to provide an alarm summary of discrete alarm conditions within the L54 terminal.
- The relays are intended for use with a customer’s existing external alarm collection and monitoring system (e.g. SCADA) when the NMI feature is not used.

The pinout of the *ALARM RELAYS* connector is as detailed table 4-4
The default alarm relays configuration is as detailed table 10-6.

9.6 Loopbacks

For additional troubleshooting, local &remote loopback paths can be configured.

9.6.1 Local Loopback

Local Port Loopback:

This loopback is used for locating faults in equipment and cable connections to the local L54 by routing each tributary input (data from customer) directly to the corresponding tributary output (data to customer). Any combination of tributaries may be configured for loopback. Figure 9-1 shows the loopback path. The incoming data stream from the remote terminal for the tributaries configured in loopback will be affected.

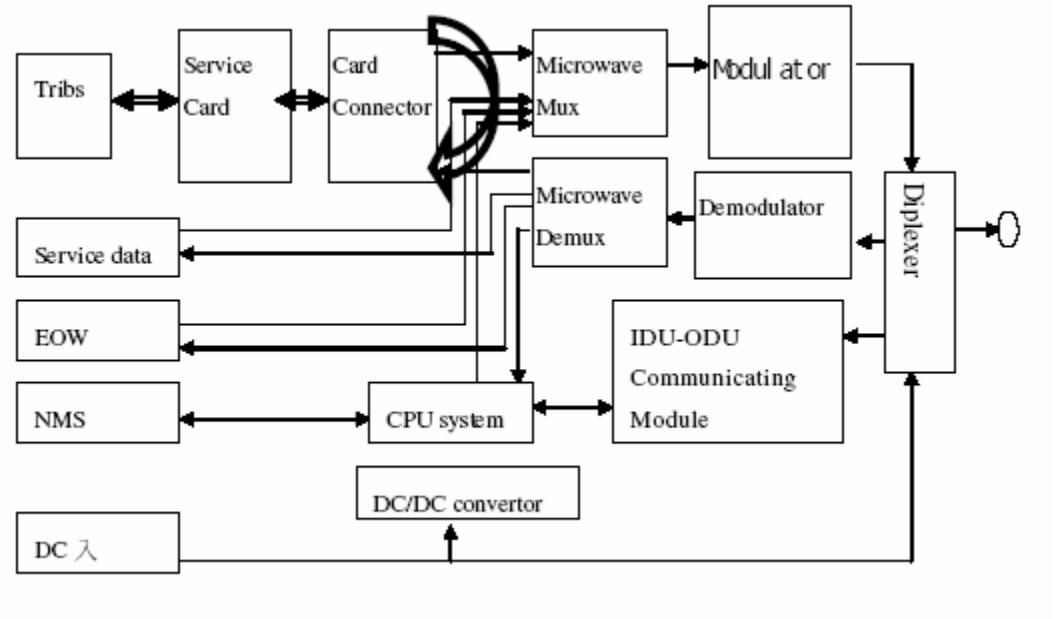


Figure 9-1 Local Port Loopback

Local Frame Loopback:

This loopback is used for locating faults in equipment by routing a tributary input (data from customer) directly to the corresponding tributary output (data to customer). Any combination of tributaries may be configured for loopback. Figure 9-2 shows the loopback path. The incoming data stream from the remote terminal for the tributaries configured in loopback will be affected.

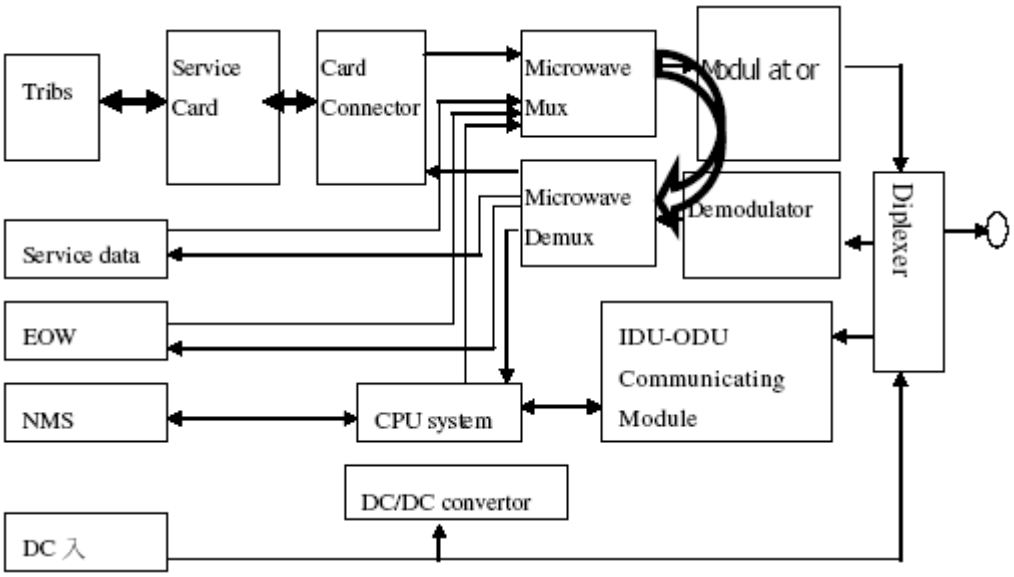


Figure 9-2 Local Frame Loopback

9.7 Maintenance

No regular maintenance of the L54 installation is necessary. If a fault occurs, the system is sufficiently well alarmed and has diagnostics to allow the operator to rapidly and precisely locate the source of the fault condition.

9.8 Repairing

Once the fault has been identified, repairing it refer to prohotol of repairing and description in technical support.

Also, see the Troubleshooting Quick Reference Guide in section 9.4.

10 Technicaal data

10.1 Specification

Table 10-1 General Specification

Parameter	Specification
Radio	L54
Systems Configurations	Non-Protected (1+0), hot standby system (HD) (1+1) Space (SD) and frequency (FD) diversity (1+1)
RF Channel Selection	LCD panel Controlled or via NMS
Modulation Type	QPSK
Digital Line Code	HDB3 for E1
Digital I/O Connectors	E1 75 Ω unbalanced DB-37 or BNC by Order E1 120 Ω balanced RJ-48 10/100BASE-T 100 Ω balanced RJ45
Intermediate Frequency	TX 310MHz/ RX 70MHz
Residual BER	10^{-11} or better
Loopbacks	Port Loopback, Frame Loopback, IDU IF Loopback, Remote Line Loopback.
Alarm inputs	4 photo-couplers
Relay Outputs	Five Form "C" Relays
MTBF	180,000Hours

Table 10-2 Controlling ODU specifications

Item	specifications
Capacities & RF Channel	7MHz/4E1 14MHz/8E1 28MHz/16E1
Transmitter	
Transmitter Mute	On/off
310MHz Frequency Stability	±30ppm
Attenuation Range	12 dB
Attenuation step	1 dB
Receiver	
Receiver c/n (1x10-6 BER)	11dB
RSSI	Shown as 'dBm'

Table 10-3 Mechanical specifications

Mechanical	
Dimension	IDU: 482X44X254 (mm) ODU: 392x310x156(mm)
Weight	IDU: 3kg(1+0) ODU:6.8kg
IDU-ODU Interconnection	Single Cable,RG-6 Type,50 . unbalanced Maximum Distance: Up to 100 m. IDU Connector Type: "TNC" Male

Table 10-4 Transmitter & Receiver

Operation Frequency		2400~2483.5/5725~5850MHz	
Communication Mode		Frequency Division Duplex, FDD	
Modulation		QPSK	
TX Output Power		≤ 22dBm	
RX Dynamic Range		-84dBm ~ -15dBm	
		2.4GHz	5.8GHz
Sensitivity (10^{-3} BER)	2E1	≤ -89dBm	≤ -89dBm
	4E1	≤ -86dBm	≤ -86dBm
	8E1/8E1+LAN	≤ -83dBm	≤ -83dBm
	16E1/16E1+LAN	≤ -80dBm	≤ -80dBm
Sensitivity (10^{-6} BER)	2E1	≤ -87dBm	≤ -87dBm
	4E1	≤ -84dBm	≤ -84dBm
	8E1/8E1+LAN	≤ -81dBm	≤ -81dBm
	16E1/16E1+LAN	≤ -77.5dBm	≤ -77.5dBm
Frequency Selection	2E1	4 Channel	8 Channel
	4E1	2 Channel	4 Channel
	8E1/8E1+LAN	1 Channel	2 Channel
	16E1/16E1+LAN	1 Channel	1 Channel
BER During Normal Propagation		≤ 10^{-10}	≤ 10^{-10}
Receiver Max Input		≤ -10dBm	≤ -10dBm
Receiver Max Input with no BER		≤ -15dBm	≤ -15dBm
Frequency Stability		±10ppm	±10ppm
Gain Flatness (anywhere)		RX: ± 1 dB TX: ± 1dB	
TX & RX Isolation		60dB	
RSSI (BNC)		for Antenna Alignment	

Table 10- 5 Others specifications

ENVIRONMENTAL	
Temperature Range	IDU: -10～+50℃ ODU: -30~+60℃
Relative Humidity	IDU: 20%～95% ODU: 0~100%
SERVICE CHANNELS	
Digital Data Channel 1	Configure 1: BitRate: 0~9600bps Protocol: RS232C Interface:RJ45 Configure 2: BitRate: 64kbps Protocol: RS232C Interface:RJ45
Digital Data Channel 2	BitRate: 0~9600bps Protocol: RS422 Interface:RJ45
Engineering Orderwire	Frequency Response: 300-3400 Hz Impedance: 600 ，balanced Interface RJ-11
NMS Data Channel 1	BitRate: 9600bps Protocol: RS232C Interface:RJ45
NMS Data Channel 2	BitRate: 10Mbps Protocol: 10BASE-T Interface:RJ45
POWER SUPPLY	
Standard Input	-40VDC to –60VDC
Power Consumption	IDU : 8 Walts ODU: 40Walts

10.2 Default configuration

Table 10- 6 Default software configuration

Parameters	Options	Std Default
Device ID code	2~254	222
Receive Frequency	Float	
Transmit Frequency	Float	
Capacity	4E1：4E1 8E1：4E1，8E1 16E1：4E1，8E1，16E1 10/100BASE-T+1/2/4E1： 8x2M+0E1，16x2M+0E1， 7x2M+1E1，15x2M+1E1， 6x2M+2E1，14x2M+2E1， 4x2M+4E1，12x2M+4E1	4E1：4E1 8E1： 8E1 16E1：16E1 10/100BASE-T+1/2/4E1： 7x2M+1E1
LCD Auto locate Alarm	ON，OFF	OFF
BEEP alarm	ON，OFF	OFF
Tribs Loopback	LR，NO	NO
Tribs Using	US，NO	US
ODU Transmit Power	0~25dBm	22dBm
ATPC level	-40~-60dBm	-50dBm
Transmit ON/OFF	On，Off	Off
ATPC on/off	On，Off	Off
BER alarm threshold	10^{-3}，10^{-4}，10^{-5}，10^{-6}	10^{-6}
RSL alarm threshold	-20~-80dBm	-70dBm

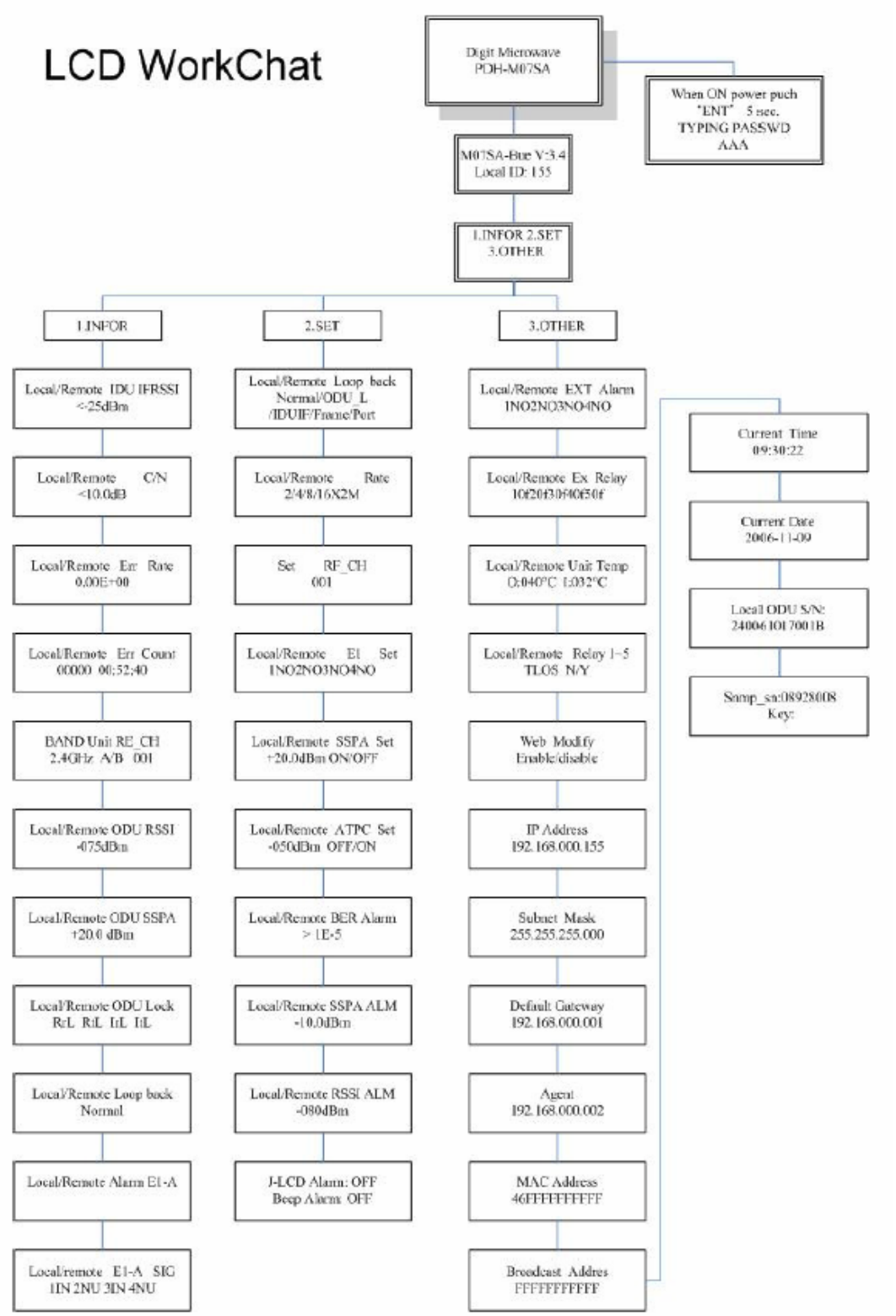
Continuous Table 10- 7 Default software configuration

Parameters	Options	Std Default
IP address	IP address	192.168.0.222
Sumnet Mask	IP address	255.255.255.0
Default Gateway	IP address	192.168.0.1
SNMP Agent IP address	IP address	192.168.0.2
MAC address	6 hexs	
Broadcast MAC address	6 hexs	FFFFFFFFFFFF
Password for ADMIN	12 symbols	1122
Name for Relay 1	12 symbols	Tribs
Name for Relay 2	12 symbols	TX
Name for Relay 3	12 symbols	RX
Name for Relay 4	12 symbols	RSL
Name for Relay 5	12 symbols	Aux

Table 10- 8 Alarm Relay Configuration

	Relays					Condition	Options
	1	2	3	4	5		
Default Relay Name	Tribs	Tx	RX	RSL	Aux		
Tribs Fault	√						
Remote Fault							
Frame Loss			√				
BER Alarm			√			10-4	10-3，10-4，10-5，10-6
RF PLL		√	√				
Cable Fault		√	√	√			
Transmit Power		√					
TX PLL		√					
Receive Level			√	√		-70	-60~-80
RX PLL			√				
Receive Unlocked			√				
IDU Temperature							
Local Aux input 1					√		
Local Aux input 2					√		
Local Aux input 3					√		
Local Aux input 4					√		
Remote Aux input 1					√		
Remote Aux input 2					√		
Remote Aux input 3					√		
Remote Aux input 4					√		

Table 10- 9 LCD Configuration



11 Symbols and abbreviations

11.1 Symbols

- dB deciBel
- dBm deciBel relative to 1 milliwatt
- GHz GigaHertz
- kHz kiloHertz
- Mbit/s Megabits per second
- MHz MegaHertz
- ppm parts per million

11.2 Abbreviations

- AC alternating current
- ACAP Adjacent Channel Alternate Polarization
- ACCP Adjacent Channel Co-Polarization
- ATPC Automatic Transmit Power Control
- BBER Background Block Error Rate
- BER Bit Error Rate
- C/I Carrier to Interference ratio
- CMI Coded Mark Inversion
- CSmin minimum practical Channel Separation (for a given radio-frequency channel arrangement)
- CW Continuous Wave
- DRRS Digital Radio Relay Systems
- EMC ElectroMagnetic Compatibility
- ERC European Radiocommunications Committee
- ESR Errored Seconds Ratio
- IF Intermediate Frequency
- IPI Inter-Port Isolation
- LO Local Oscillator
- NFD Net Filter Discrimination
- PDH Plesiochronous Digital Hierarchy
- PRBS Pseudo Random Binary Sequence
- RBER Residual BER
- RF Radio Frequency
- RFC Remote Frequency Control
- RSL Receive Signal Level
- RTPC Remote Transmit Power Control
- Rx Receive
- TMN Telecommunications Management Network
- TX Transmit