

October, 2003

APPENDIX MEASUREMENT PROCEDURE FOR 5.8 GHz 15/28/50 MB NLite L DIGITAL RADIO SYSTEM (1+0 SYSTEM)

1. GENERAL

This Appendix provides instructions for measuring transmit radio frequency (RF), transmit RF output power, RF occupied bandwidth and bit error rate (BER) at each station after the system line-up has been completed. These measurements are optional, so they do not appear in the annual maintenance schedule.

2. PRECAUTIONS

The following precautions must be carefully observed during maintenance.

Danger: The -43 V DC power is superimposed on the center conductor of the coaxial cable between the MDP and TRP. Connecting a measurement set directly to this port may damage the test equipment and touching the coaxial cable core may cause electrical shock. So, turn off the power switch on the MDP before disconnecting coaxial cable between the MDP and TRP.

Caution: To protect the internal circuits against electrostatic discharge, engineers are requested to wear a wrist band and connect it to the ground (G) terminal for Electrostatic Protection (ESP) before detaching the top cover (see Fig. A-1).

Caution: Do not turn on the power of the MDP leaving cable connection between the PC and LCT PORT of the MDP.

After all operation for maintenance have been completed, perform MAINT OFF setting.

Caution: It is recommended that you connect the MDP to TRP after the TX/RX frequency setting has been set on the MDP.

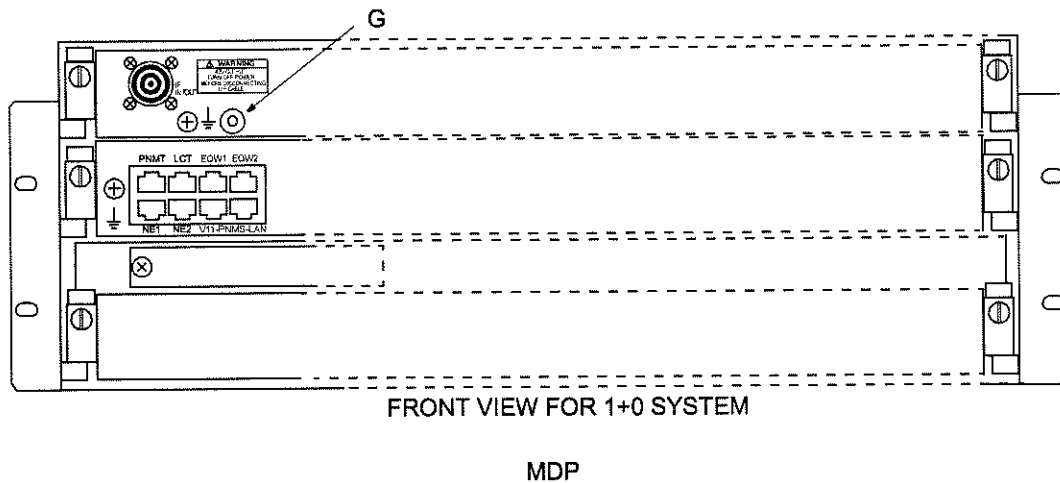


Fig. A-1 Location of Electro Static Protection Terminal

- (a) Before beginning measurement, notify the opposite station that measurement is about to begin.
- (b) During measurements, service will be interrupted.
- (c) After equipment start-up, allow the equipment to warm up for at least 30 minutes.
- (d) After completing the measurement, restore all connections to normal.
- (e) Before disconnecting the waveguide, connector or antenna from the RF IN/OUT of the TRP, turn off the PWR switch on the MDP or set TRP to TX mute condition (this control is performed by PC as shown in the following procedure).
- (f) During measurement, the MDP and TRP are set to maintenance ON condition using a PC as shown in following procedure.

3. TEST EQUIPMENT AND ACCESSORIES

The test equipment and special accessories listed in Table 1 are required for system maintenance. If recommended test equipment and accessories are not available, equivalents may be used.

Table A-1 Test Equipment and Accessories Required

TEST EQUIPMENT/ACCESSORY	TYPE/ORDERING CODE	Q'TY REQ'D
Frequency Counter	HP 53152A	1
Spectrum Analyzer	HP 8564EC	1
Power Meter	HP E4418B	1
Power Sensor	HP 8487A	1
BER Test Set	HP E7580A	1
OW/RX LEV Monitor* and Headset	_____	1
Personal Computer (PC) *	_____	1
Screwdriver	_____	1

Note: 1. * The OW/RX LEV Monitor operates on a dry battery (6F22/9V). When the OW/RX LEV Monitor will not be used for a long period, remove the battery to avoid damage from battery leakage and corrosion.

3.1 LCT Connection

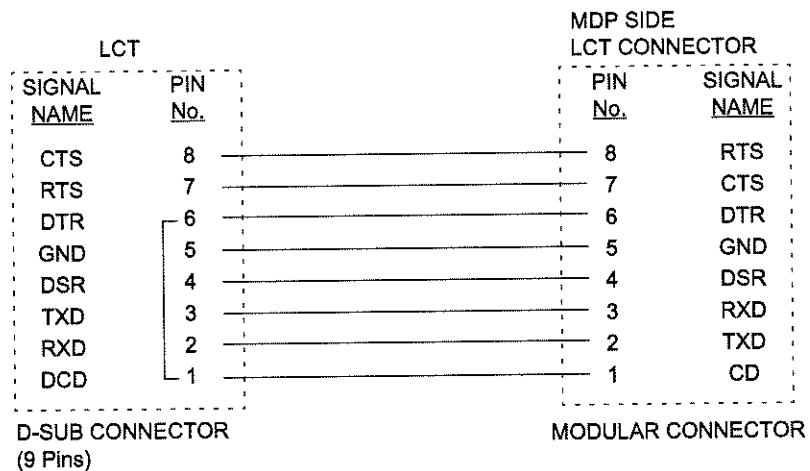


Fig. A-2 RS-232C Cable Pin Assignment

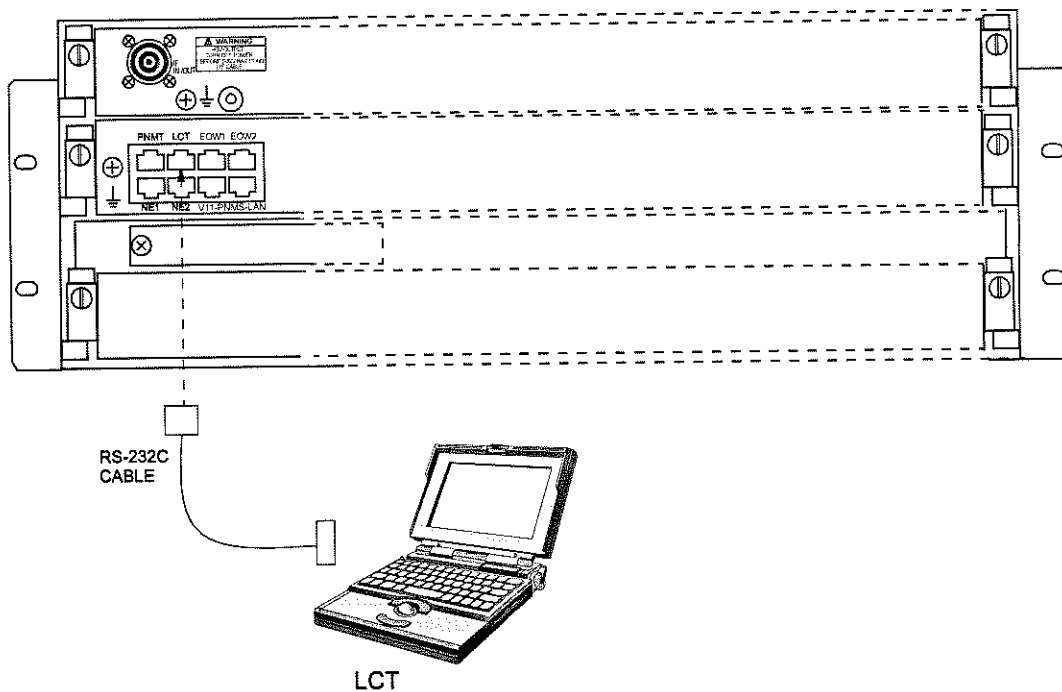


Fig. A-3 LCT Setup

The communication/serial port settings of the personal computer used as local craft terminal (LCT) is listed below.

- Bits per second: 19200
- Data bits: 8
- Parity: None
- Stop bits: 1
- Flow control: Hardware
- Emulation: VT100 Video Terminal
- Transmission: Add CR at end of line : No
(ASCII Sending)* (Send line ends with line feeds:No)*
Local echo : No
(Echo typed characters locally : No)*
- Receiving: CR: No
(ASCII Receiving)* (Append line feeds to incoming line ends : No)*
Return on the right edge: Yes
(Wrap lines that exceed terminal width : Yes)*
Force incoming data to 7-bit ASCII: No

* Windows HyperTerminal settings.

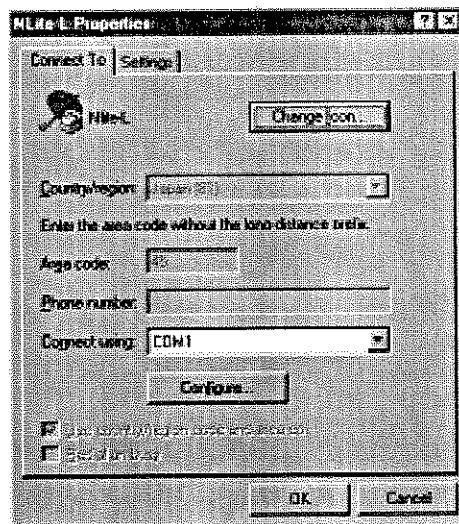
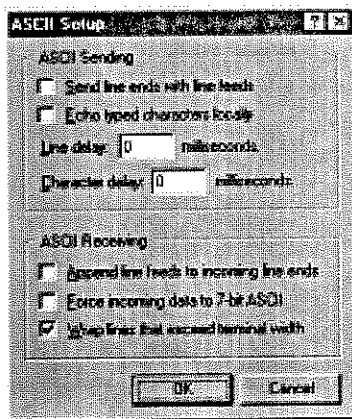
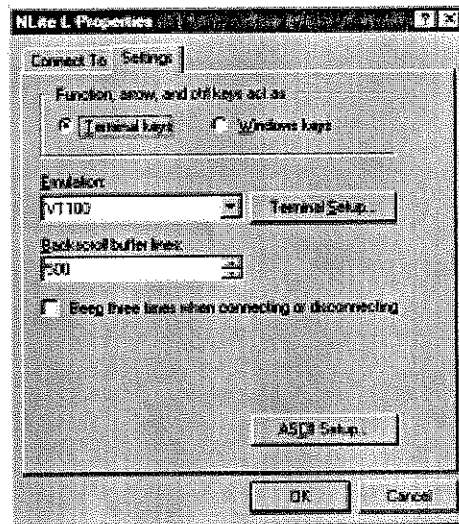
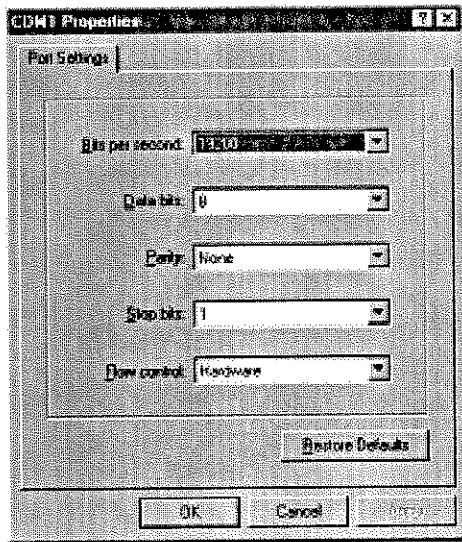
Microsoft and Windows are either registered trademark of Microsoft Corporation in the United States and other countries.

These display screens are shown in Fig. A-4.

Notes: 1. For operating the LCT properly, do not use the arrow keys "→, ↑, etc." (as generates the ESC code).

2. The operation check by HyperTerminal attached to Windows is performed by Windows 95/98. When using the HyperTerminal mode of Windows 2000 or other Windows operating system, the characters may not be displayed correctly.

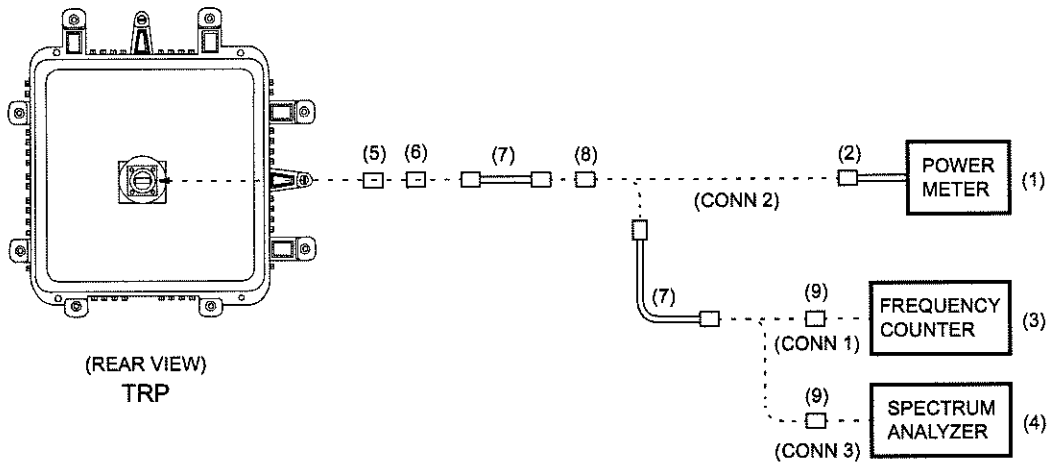
The cable connector pin assignments are shown in Fig. A-2. The length of the RS-232C cable between the personal computer and MDP should be less than 15 m.



Note: Please refer to the above screenshots as an example for the HyperTerminal Setting.

4. MEASUREMENT PROCEDURE

The general procedures for Loop back, transmit radio frequency (RF), transmit RF output power, RF occupied bandwidth and BER measurement are described below.



No.	TEST EQUIPMENT	REMARKS
1	Power Meter	
2	Power Sensor	
3	Frequency Counter	
4	Spectrum Analyzer	
5	WG Adapter	For 10-38 GHz band only
6	Transducer	For 10-38 GHz band only
7	RF cable	
8	Attenuator (20 dB)	
9	Adaptor	

Fig. A-4 Transmit Radio Frequency, Transmit RF Output Power and RF Occupied Bandwidth Measurements Setup

4.1 Maintenance Mode

Procedure

- | <u>Step</u> | <u>Procedure</u> |
|-------------|--------------------------------------------------------------------------------------------------|
| 1 | Connect the PC to the LCT PORT of the MDP using an RS-232C cable as shown in Fig. A-3, |
| 2 | Turn on the power switch on the PC. Then, start the communication software (e.g. HyperTerminal), |
| 3 | Access Login name "Admin" and enter valid password, |

```

Login : Admin
Password : *****

--- NEC PDH RADIO VER. X.XX.XX ---
0. Logout
1. Alarm / Status
2. Performance Monitor
3. Provisioning Data
4. System Configuration
5. Inventory Data
6. Relay / House Keeping
7. Maintenance
Enter Selection : 7
    
```

- 4 Press the "7" key for Maintenance and press the "Enter" key,

```

--- Maintenance ---
1. MAINT Mode (OFF)
2. Control
3. Reset CPU
4. Set Calendar
5. Password Setting
6. Program Download
Enter Selection : 1
    
```

- 5 Press the "1" key and "Enter" key,

```

--- MAINT Mode ---
1. On
2. Off
Enter Selection : 1
    
```


ProcedureStepProcedure

- 6 Press the "1" key and "Enter" key,

```

--- Maintenance ---
1. MAINT Mode (ON)
2. Control
3. Reset CPU
4. Set Calendar
5. Password Setting
6. Program Download
Enter Selection :

```

- 7 Check that the MAINT Mode turns to ON,

4.2 Transmit Radio Frequency Measurement

- (a) Test Setup and Accessories Required
See Fig. A-4 (CONN 1).

- (b) Procedure

StepProcedure

Caution: *During measurement, service will be interrupted.*

- 1 Set up as shown in Fig. A-4 (CONN 1),
- 2 Connect the PC to the LCT PORT of the MDP,
- 3 Turn on the power switch on the PC. Then, start up the communication software (e.g., HyperTerminal),
- 4 Set the MAINT Mode to ON (refer to para. 4.1),
- 5 Press the "2" key and "Enter" key, the following appears,

```

--- Control ---
1. RF Frequency
2. ATPC Manual Control
4. TX Mute
6. CW
7. IF Loopback
8. Main Signal Loopback (Near End)
9. Main Signal Loopback (Far End)
11. Antenna Alignment Mode
16. LAN Device Reset
Enter Selection :

```

Notes: Item 2 ATPC Manual Control is not displayed in MTPC mode.

ProcedureStepProcedure

- 6 Press the "6" key and "Enter" key on the Control menu, the following Modulation carrier on/off item is displayed,

```

--- CW ---
1. On
2. Off

Enter Selection : 1

This will affect the radio link connection.
Are You Sure ? (Y/N) : Y

Success !!

```

- 7 Press the "1" key and "Enter" key, press the "Y" key and "Enter" key, then, unmodulated signal is transmitted,
- 8 Check that the set up is as shown in Fig. A-4 (CONN 1),
- 9 Measure transmit radio frequency with the frequency counter,
Requirement:
- ± 10 ppm of assigned radio frequency
- 10 Disconnect frequency counter from RF IN/OUT terminal,
- 11 Press the "6" key and "Enter" key,
- 12 Press the "2" key and "Enter" key, and press the "Y" key, "Enter" key,

```

--- CW ---
1. On
2. Off

Enter Selection : 2

This will affect the radio link connection.
Are You Sure ? (Y/N) : Y

Success !!

```

- 13 Continue next measuring item, if not, restore all connections and reset the settings to normal.
-

4.3 Transmit RF Output Power Measurement

- (a) Test Setup and Accessories Required
See Fig. A-4 (CONN 2)
- (b) Procedure

<u>Step</u>	<u>Procedure</u>
-------------	------------------

Caution: During measurement, service will be interrupted.

- | | |
|---|----------------------------------------------------------------------------|
| 1 | Set up as in Fig. A-4 (CONN 2), |
| 2 | Connect the PC to the LCT PORT of the MDP (see Fig. A-3), |
| 3 | Set the MAINT Mode to ON on the PC (refer to para 4.1), |
| 4 | Press the “2” key and “Enter” key to display the “Control” menu on the PC, |
| 5 | Press the “2” key and “Enter” key for ATPC Manual Control, |

```

--- ATPC Manual Control ---
1. Manual
2. Auto
Enter Selection : 1

--- ATPC Manual Control ---
ATPC Manual PWR (MIN to MAX [dB])
Enter Selection : 0

This will affect the radio link connection.
Are You Sure ? (Y/N) : Y

Success !!

```

- | | |
|----|-------------------------------------------------------------------------------------------------|
| 6 | Press the “1” key and “Enter” key, |
| 7 | Press the “0” key and “Enter” key to set the 0 dB attenuation, |
| 8 | Press the “Y” key and “Enter” key, |
| 9 | Measure transmit RF output power using the power meter, |
| | Requirement: |
| | • 10.5 GHz Band: +21 dBm ±1.5 dB |
| 10 | Disconnect power meter from the RF IN/OUT terminal. |
| 11 | Continue next measuring item, if not, restore all connections and reset the settings to normal. |

4.4 RF Occupied Bandwidth Measurement

- (a) Test Setup and Accessories Required
See Fig A-4 (CONN 3)
- (b) Procedure

Step

Procedure

Caution: During measurement, service will be interrupted.

- 1 Set up as in Fig. A-4 (CONN 3),
- 2 Set functions of the spectrum analyzer as follows:
 - Bandwidth: 30 kHz (for 8×1.5 MB)
100 kHz (for 16×1.5 MB)
 - Vertical: 10 dB/div
 - Horizontal: 5 MHz/div
 - Frequency: Assigned transmit radio frequency
- 3 Connect the PC to the LCT PORT of the MDP (see Fig. A-3 CONN 3),
- 4 Set the MAINT Mode to ON (refer to para. 4.1),
- 5 Press the “2” key and “Enter” key to display the “Control” menu (refer to para. 4.3),
- 6 Press the “2” key and “Enter” key for ATPC Manual Control item (refer to para. 4.3),
- 7 Set the ATPC Manual PWR in ATPC Manual Control to 0 dB (refer to para. 4.3),
- 8 Press the “6” key and “Enter” key for CW item,
- 9 Press the “1” key and “Enter” key to set the CW to ON,

--- CW ---

1. On

2. Off

Enter Selection : 1

This will affect the radio link connection.

Are You Sure ? (Y/N) : Y

Success !!

<u>Step</u>	<u>Procedure</u>
10	Press the "Y" key and "Enter" key,
11	Set the appearance of carrier to the centre by turning frequency dial on the spectrum analyzer,
12	Adjust reference level dial on spectrum analyzer so that the CW signal level is set to 0 dB,
13	Repeat Step 5 to 8, and press the "2" key and "Enter" key to set the CW to OFF,
14	Confirm that the displayed spectrum on the spectrum analyzer is within the specified as shown in Fig. A-5,
15	Disconnect spectrum analyzer from RF IN/OUT terminal, restore RF connection to normal and reset the settings to normal.

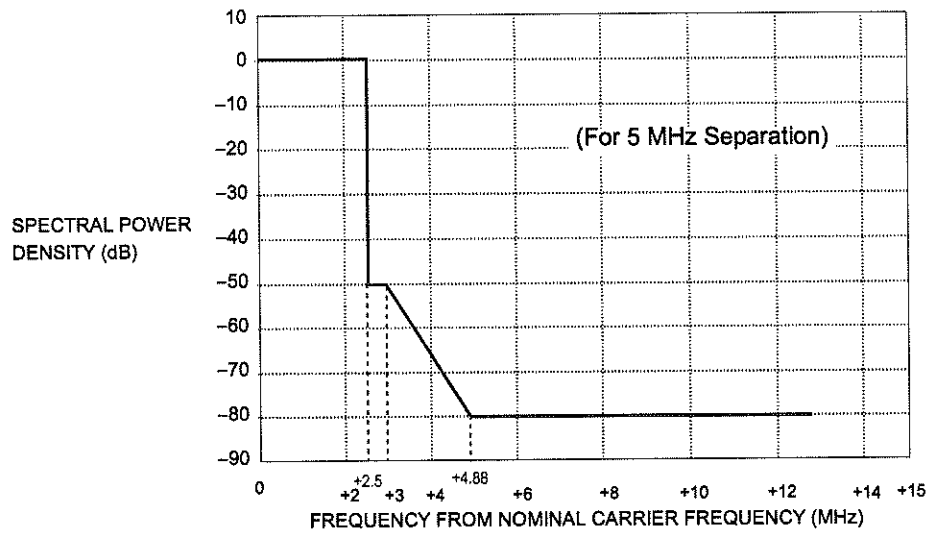
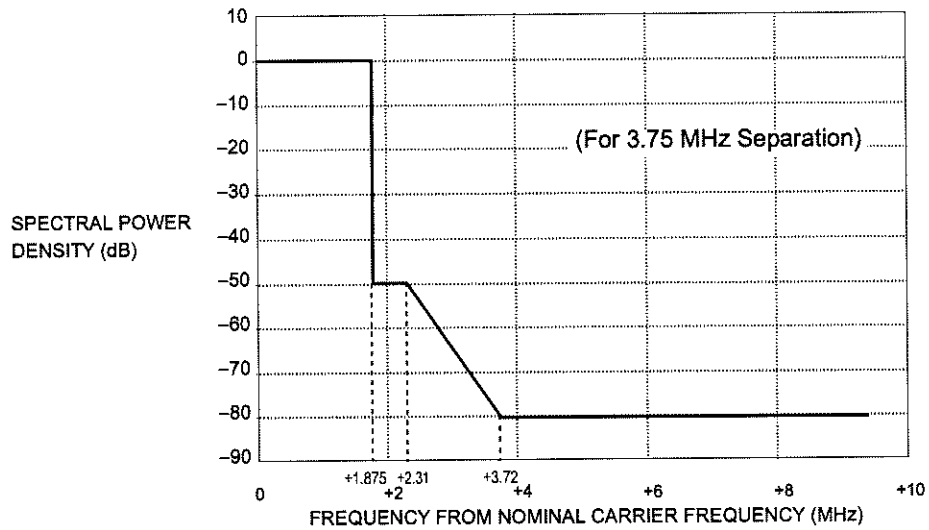


Fig. A-5 Limits of Spectral Power Density

5. BER MEASUREMENT

Perform BER measurement for 1.5 MB main channel in FE loop back between two stations. (BER measurement can not be performed on channels which are assigned to LAN signal.)

5.1 8/16 x 1.5 MB System

- (a) Test Setup and Accessories Required

See Fig. A-5.

- (b) Procedure

Step

Procedure

Caution: During measurement, service will be interrupted.

- 1 Set up the measuring circuit as shown in Fig. A-6,
- 2 At station A, set the output and input signal mode of the BER test set (SENDING/RECEIVING UNIT) as follows:
 - Bit rate: 1.544 Mbps (ANSI T1. 102)
 - Code format: B8ZS or AMI Code
 - Impedance: 100 ohms, balanced
- 3 At station A, connect the PC to the LCT of the MDP (see Fig. A-3),
- 4 Set the MAINT Mode to ON (refer to para. 4.1),
- 5 Press the "2" key and "Enter" key on the Maintenance menu to display Control items,
- 6 Press the "9" key and "Enter" key for Main Signal Loopback (Far End),
- 7 Press the "1" key and "Enter" key,

Enter Selection : 9

— Main Signal Loopback (Far End) —

1. Selected CH Loopback

2. All CH Loopback Off

Enter Selection : 1

- | <u>Step</u> | <u>Procedure</u> |
|-------------|-----------------------------------------------------------------------------------|
| 8 | Press the “channel number you want” and “Enter” key, then, the following appears, |

```

--- Main Signal Loopback (Far End) ---
Loopback Status      (CH01-08) : -----
                    (CH09-16) : -----
CH Select            (CH01-16) : 5

```

- Notes:*
1. “-” indication signifies control off condition.
 2. “*” indication signifies control on condition
 3. “#” indication signifies restricted channel condition.
 4. In case the FE loop back control has been applied from the opposite station, the “Z” is displayed.
 5. The FE loop back control is unavailable for the channel which is inhibited by “not used channel alarm”.

```

--- Main Signal Loopback (Far End) ---
1. On
2. Off
Enter Selection : 1

This will affect the radio link connection.
Are You Sure ? (Y/N) : Y

Success !!

```

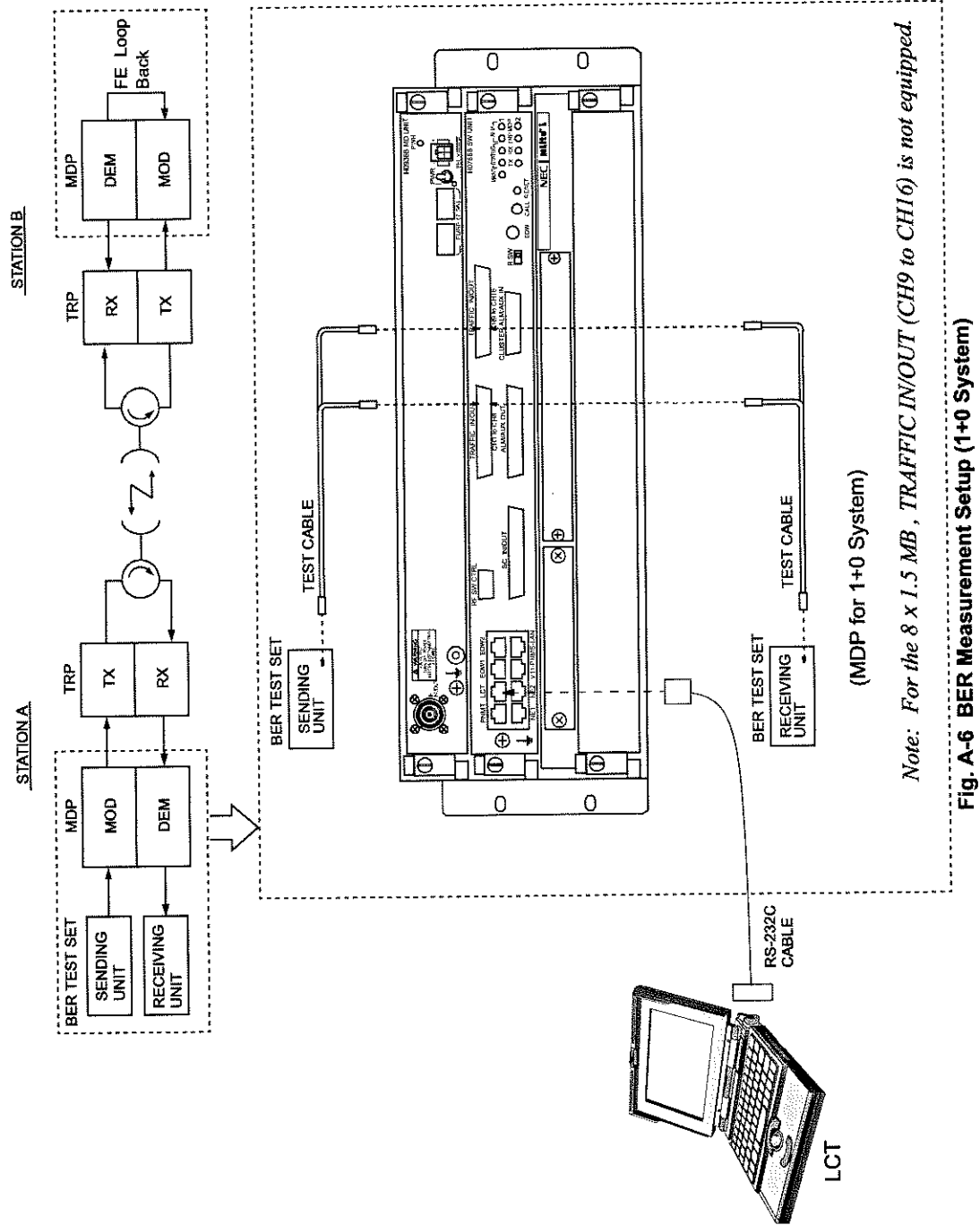
- | | |
|----|------------------------------------------------------------------|
| 9 | Press the “1” key and “Enter” key to perform loop back function, |
| 10 | Press the “Y” key and “Enter” key, |
| 11 | The associated channel at opposite station will be in loop back, |

```

--- Main Signal Loopback (Far End) ---
Loopback Status      (CH01-08) : ----*----
                    (CH09-16) : -----
CH Select            (CH01-16) : 5

```

- | | |
|----|-------------------------------------------------------------------------------------|
| 12 | Measure BER at each channel for 10 minutes to verify that it is indicated No Error, |
| 13 | Press the corresponding channel number and “Enter” key, |
| 14 | Press the “0” key and “Enter” key to restore loop back function, |
| 15 | Restore all connections to normal, |
| 16 | Restore the settings to normal. |
-



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