20W RF Repeater System Operating Manual

May 2003

YURASYS

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1. Introduction

The On-Frequency RF Repeater is defined as a full duplex RF amplifier intended to be used in cellular mobile telephone systems to extend the coverage area of a base station.
It is a high-tech, high efficiency service system that able to improve communication quality at low cost. It shall receive, amplify and retransmit signals from a donor base station in one direction (forward channel), and signals from mobile stations in the reverse direction (reverse channel) at indoor as well as outdoor.

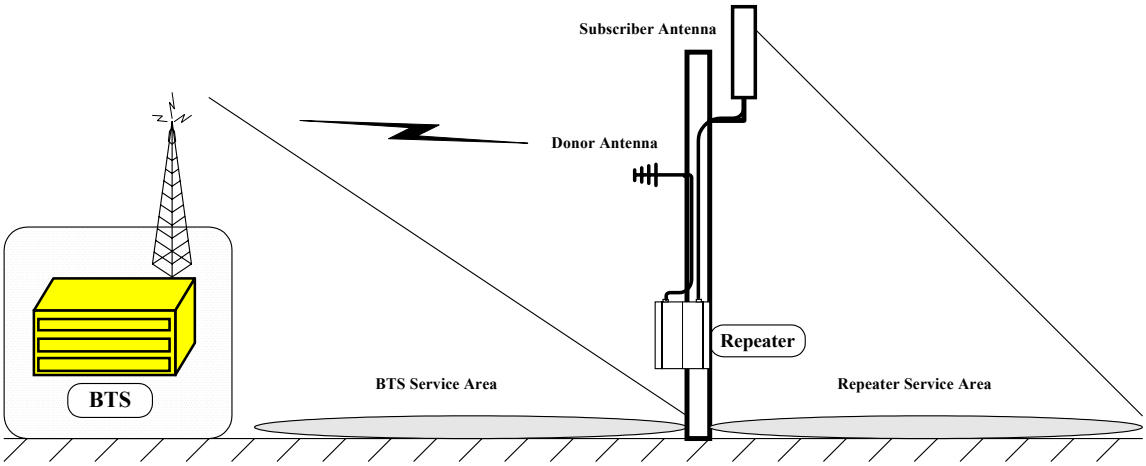

Figure 1 RF Repeater System Structure (Outdoor Case)

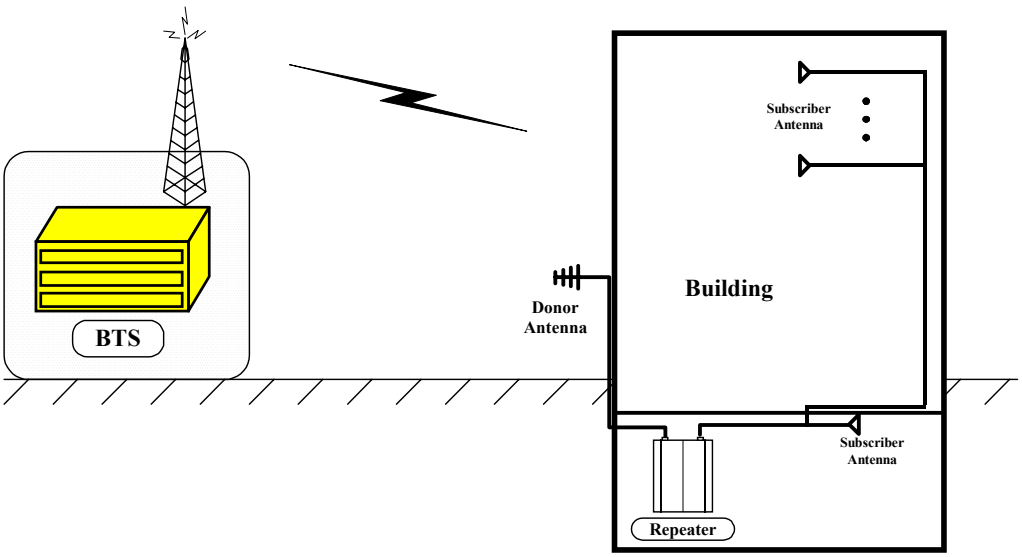

Figure 2 RF Repeater System Structure (Indoor Case)

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2. Product Features

2.1. Key Characteristics

- Comply with relevant regulations for spectrum usage.
- 1900MHz, 43dBm(20W) output power for Down (Forward) Link and 30dBm(1W) output power for Up (Reverse) Link
- BTS vendor Free Remote Repeater
- Reliable operation and fail safe under fault conditions
- Intelligent Automatic Level Control Algorithm.
- User definable temperature threshold alarm
- Easy to expand and maintain
- Flexible equipment placement
- Door Key Lock
- Best solution for residential and small indoor shadow areas
- Eliminate non-service areas by repeating RF signals from BTS
- Compact design, Fanless Cooling System
- Customized coverage applications over limited area
- Supports Indoor and Outdoor Case

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2.2. Front View

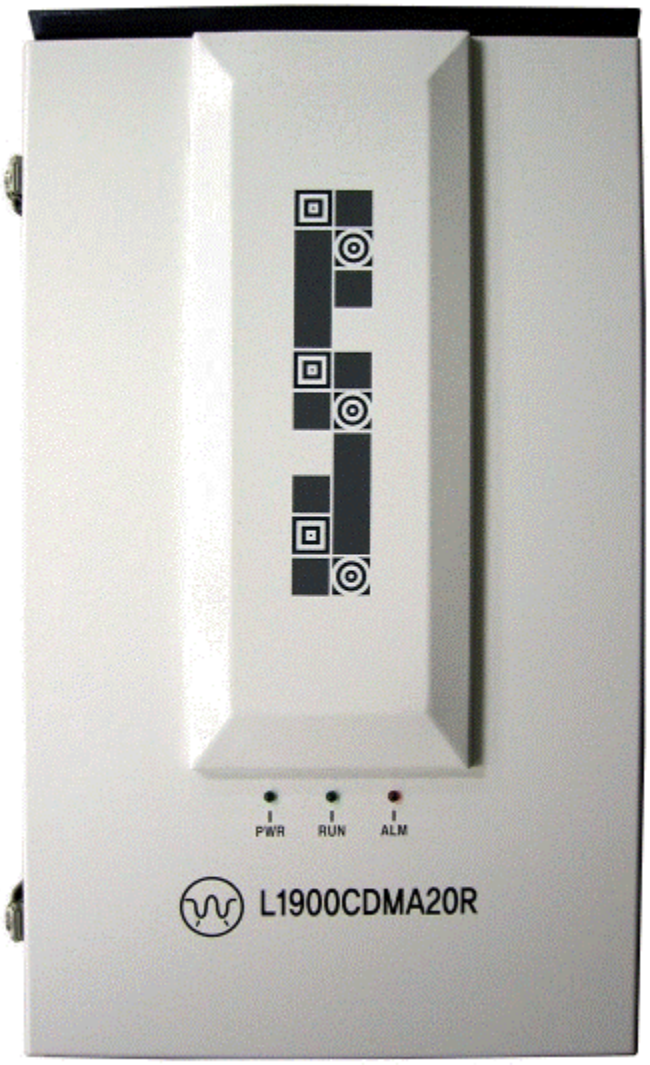

Figure 3 Front View

Front Panel LEDs: See section 2.7

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2.3. Bottom View

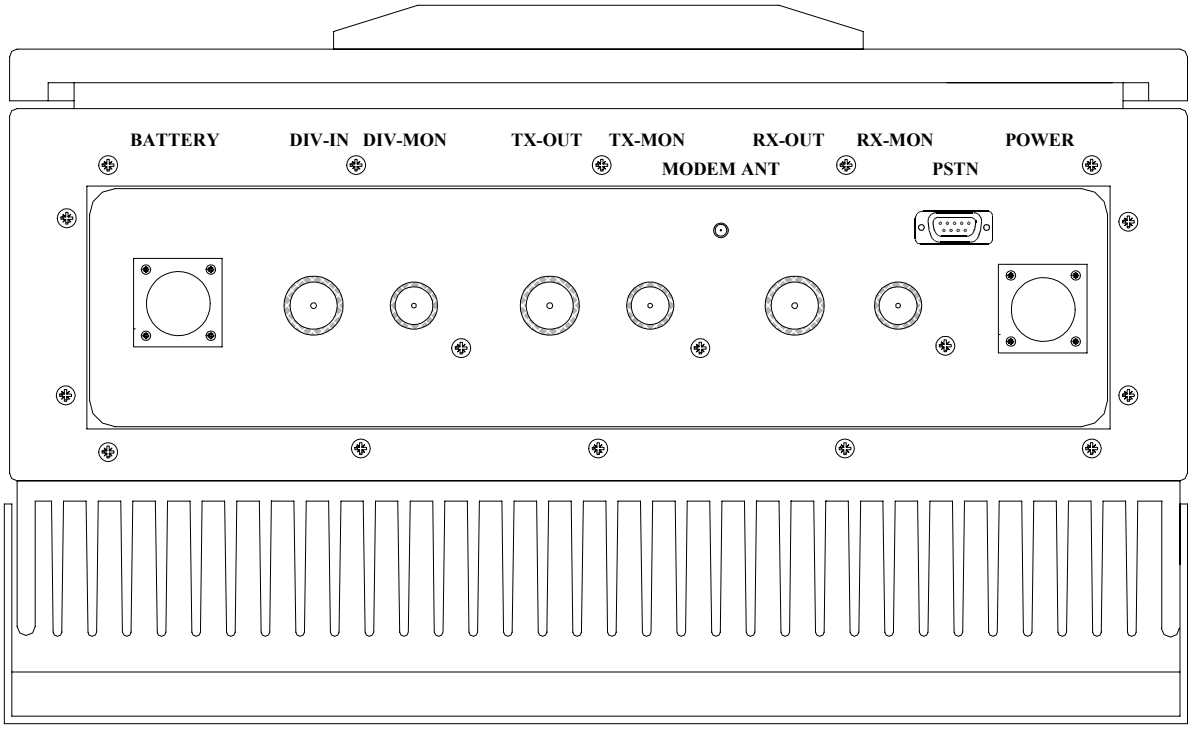

Figure 4 Bottom View

Battery: Battery Connection Port (A: +24V Use, B: GND, C: No Use)
DIV-IN: Reverse Diversity Link Input Port (N-Type Female)
DIV-MON: Reverse Diversity Link Monitoring Port (N-Type Female)
TX-OUT: Reverse Link Input / Forward Link Output Port (N-Type Female)
TX-MON: Forward Link Output Monitoring Port (-30dB, N-Type Female)
MODEM ANT: CDMA Modem Antenna Port (SMA Female)
RX-OUT: Forward Link Input / Reverse Link Output Port (N-Type Female)
RX-MON: Reverse Link Output Monitoring Port (-30dB, N-Type Female)
PSTN: PSTN Dial-up Modem Connection Port (9 Pin D_sub)
POWER: Power Source (110V ~ 220V/AC) Inlet

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2.4. Front Panel LED Display

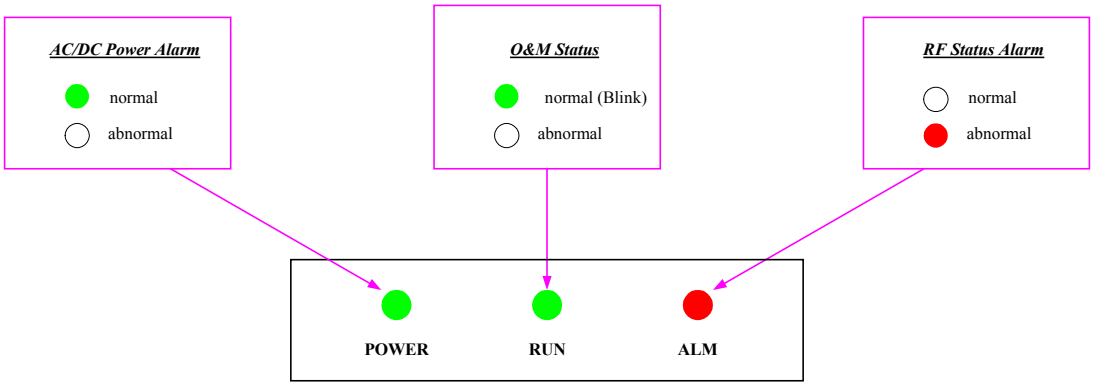

Figure 5 Front Panel LED

There are three LEDs implemented as detection and alarm notification facilities at front panel for conditions that will degrade performance of the Repeater or impair operation and control program and control board. A detailed description of each LED is as follows.

- **POWER**: This LED shows the external AC feeding status or the internal DC status of repeater.
  Normal: Green LED on
  Abnormal: LED off

- **RUN**: This LED shows the status of over control and status monitoring program or control board.
  Normal: Green LED blinks every second
  Abnormal: Green LED off if program or control board malfunctions.

- **ALM**: This LED shows the alarm status of internal circuitry of any RF module or power supply unit.
  Normal: Red LED off
  Abnormal: Red LED on

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1.1 The Inner View at a Glance

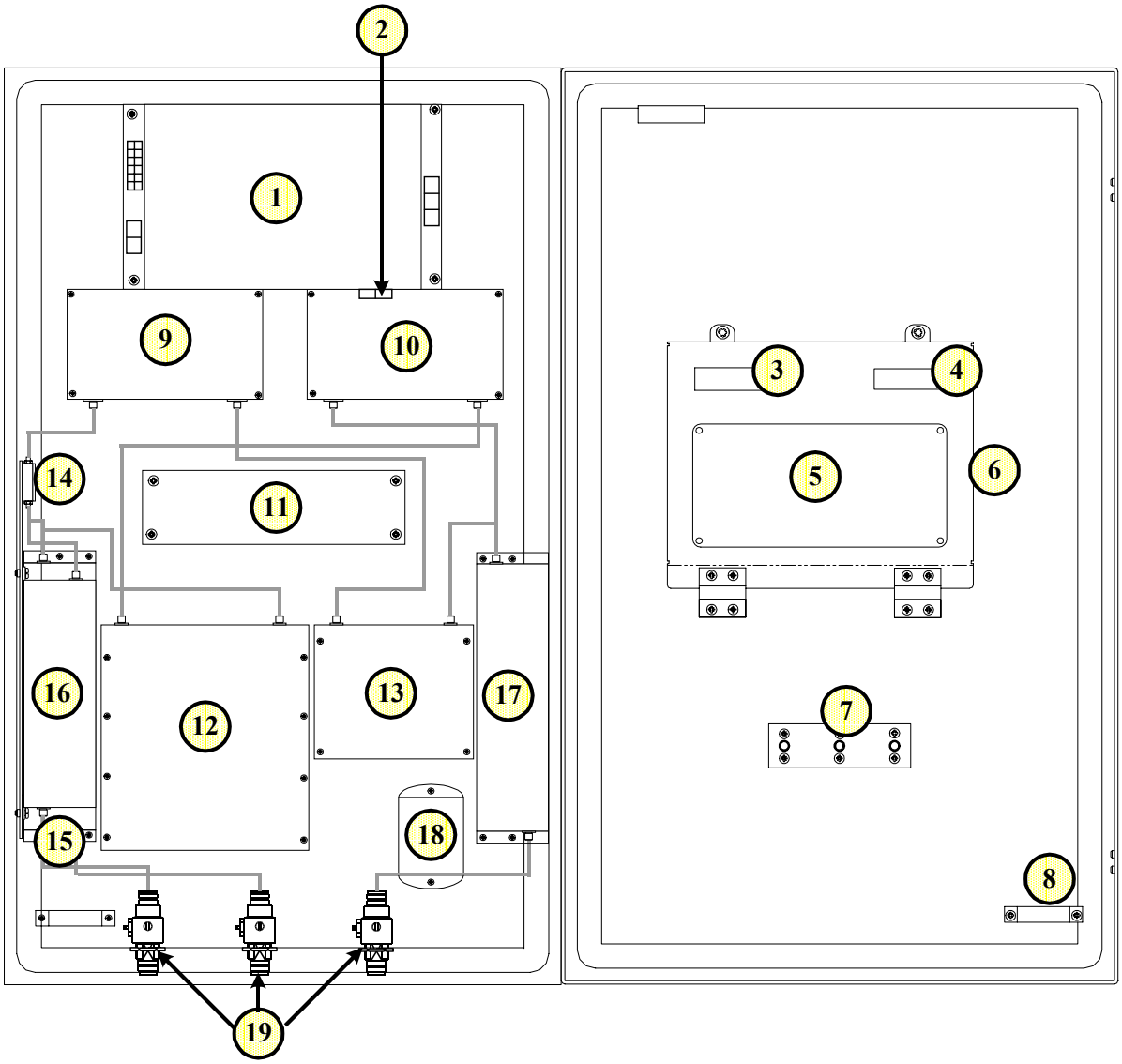

Figure 6 Inner View of RF Repeater at a Glance

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1. AC/DC Power Supply Unit
2. Power Switch (On/Off)
3. VFD Panel
4. Key Pads: Menu, Up, Down, Enter, Esc
5. Control Board
6. NMS: Control and Monitoring Port with Notebook (9-pin D_Sub Male)
7. LEDs (Power, Run, Alarm)
8. Door Sensor
9. LNA + Converter Module (RVS)
10. LNA + Converter Module (FWD)
11. Sub Control Board
12. HPA (FWD)
13. HPA (RVS)
14. 2-Way Splitter (for Diversity Link)
15. Duplexer (To connect with Tx-Out Port)
16. BPF (for Diversity Link)
17. Duplexer (To connect with Rx-Out Port)
18. EMI Noise Filter
19. Arrestors + Couplers (-30dB)

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3. Specification

3.1. Electrical Specification

- Input/Output Frequency Range
  - Forward Link Direction: 1930~1990MHz
    (Input port: from BTS, Output Port: to Mobile Station)
  - Reverse Link Direction: 1850 ~ 1910MHz
    (Input port: from Mobile Station, Output Port: to BTS)
- Bandwidth: 5MHz or 10MHz (Option)
- Input Level
  - Forward Link: -52 ~ -32dBm/Total
  - Reverse Link: -119 ~ -55dBm/Total
- Maximum input level: + 10dBm (Without Damage)
- Gain Control Range, Step and Accuracy
  - Forward Link Direction: 65 ~ 95dB, 1dB Step
  - Reverse Link Direction: 60 ~ 90dB, 1dB Step
- Attenuation Accuracy : ±1dB@0dB~20dB, ±1.5dB@21dB~30dB
- ALC : > 10dB (not over Max Power ±2.0dB)
- Pass band Flatness: 3dBp-p, max @CW Test
- RF Output Level
  - Forward Link Output: 43dBm(20W)/Total
  - Reverse Link Output: 30dBm(1W)/Total
- Channel Bandwidth: 1.23MHz
- Forward Link Spurious Emissions:
  - Fc ±885KHz: -45dBc (min) @ 30KHz RBW
  - Fc ±1.98MHz: -55dBc (min) @ 30KHz RBW
- Reverse Link Spurious Emissions:
  - Fc ±885KHz: -45dBc (min) @ 30KHz RBW
  - Fc ±1.98MHz: -55dBc (min) @ 30KHz RBW
- Noise Figure (FWD, RVS Single): < 4dB
  (RVS Main + Div): < 7dB
- Propagation Delay: < 5 μs
- In/Out VSWR: < 1.5:1
- Waveform Quality (FWD) > 0.950 @ full nominal rated power
- Waveform Quality (RVS) > 0.960 @ full nominal rated power
- Over VSWR Protection
- Over Temperature Protection (Shutdown and Restart)
- Frequency Stability: < 0.05ppm
- In band Spurious(>±2.25MHz):< -13dBm/1MHz
- Out band Spurious: < -36dBm/1kHz @ 9kHz~150kHz,

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< -36dBm/10kHz @ 150kHz~30MHz
< -36dBm/100kHz @ 30MHz~1GHz
< -30dBm/1MHz @ 1GHz~12.56GHz
< -47dBm/100kHz @ 806MHz~849MHz
< -47dBm/100kHz @ 869MHz~960MHz
< -47dBm/100kHz @ 3.4GHz~3.53GHz

(ANSI J-STD-008 Compliant)

3.2. Controller (External OMC) Interface

- Control Method
  - Dedicated Terminal with RS-232C (External)
  - ASYNC, Full Duplex
  - Protocol: HDLC, 57600bps

- Control Items
  - Repeater ID
  - Repeater Type
  - S/W Version
  - Over Temperature Threshold Level
  - Forward / Reverse HPA On/Off
  - Forward / Reverse ALC On/Off
  - Forward / Reverse Temperature Compensation On/Off
  - Forward / Reverse ALC Level
  - Forward / Reverse Over Power Level
  - Forward / Reverse Attenuation Value
  - Forward / Reverse Band Selection

- Alarm and Status Display Items
  - Repeater ID
  - Current ambient Temperature
  - Over Temperature threshold Level
  - Forward / Reverse Current Output Power Level
  - Forward / Reverse Attenuation Level
  - Forward / Reverse current Gain
  - Forward / Reverse HPA Power On/Off Status
  - Forward / Reverse ALC On/Off Status
  - Forward / Reverse ALC Level
  - Forward / Reverse Over Power Level
  - Forward / Reverse Frequency Band
  - Forward / Reverse Frequency Lock Fail Alarm
  - Forward / Reverse Over Power Alarm (based on the setting value)
  - Forward / Reverse HPA VSWR Alarm

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- Forward / Reverse HPA Over Temperature Alarm
- Forward / Reverse HPA Over Power Alarm
- Power Supply AC / DC / Battery Fail Alarm
- Door Open Alarm
- Password Required to prevent from illegal user
- Record Alarm History (contents, date)

3.3. Mechanical Specification

- Size: 735.0mm(H) × 456.0mm(W) ×270.0mm(D)
- Net Weight: 45Kg, Max
- Connectors
  - Input / Output ANT Port: N Type – female
  - Monitoring Port: N Type – female
  - Frame Ground: Hex Nut (6M)
  - RS232C: 9P D-SUB, Female (on MCU Panel External)
- Door Lock: Key
- Heat Dissipation: Natural Conduction
- Housing Class: IP55

3.4. Power Specification

- Main AC Input: AC/110 ~ 220V
- DC Output: 27V, 9V
- Power Consumption: 350W Maximum
- Battery Back-up: Repeater can operate normally for 4~6 hour

3.5. Environmental Specification

- Operating Temperature: -30℃ ~ +55℃
- Humidity: 95%, Relative

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5. Operation and Maintenance

With local Notebook on site, users can set multiple threshold levels, power tables, control certain functions and retrieve alarms as shown on display monitor.
All the control or settings are done by only NMS function at right now.

5.1. H/W Connection Diagram

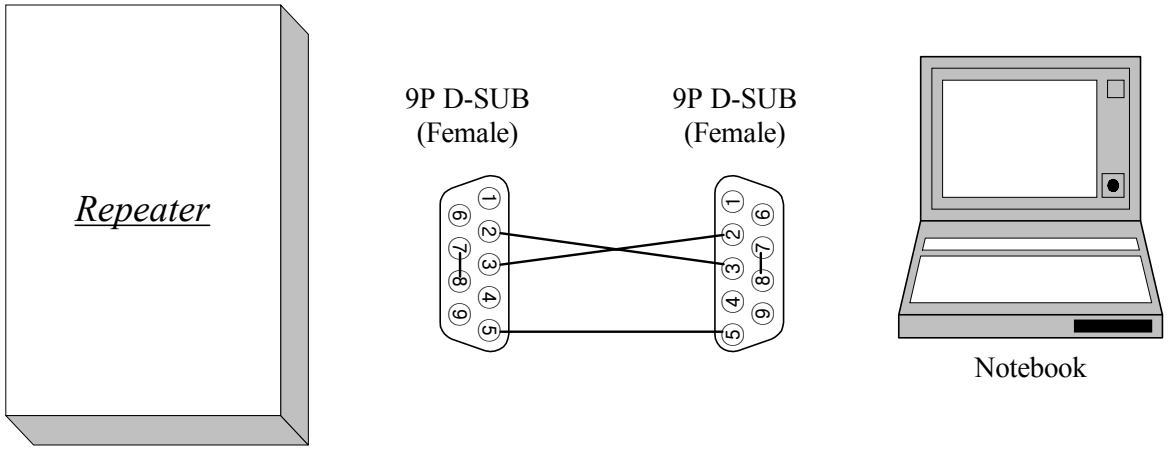

Figure 8 NMS Connection Diagram

5.2. Required PC Configuration

- O/S: Windows 95/98/ME/NT/2000/XP
- Above Pentium II Standard Notebook with RS-232C
- Required Memory: above 64KB
- Display Resolution : 1024 × 768 preferable.
- Serial Cable: Twisted 9 pin Female-to-Female (refer to Figure 8.)

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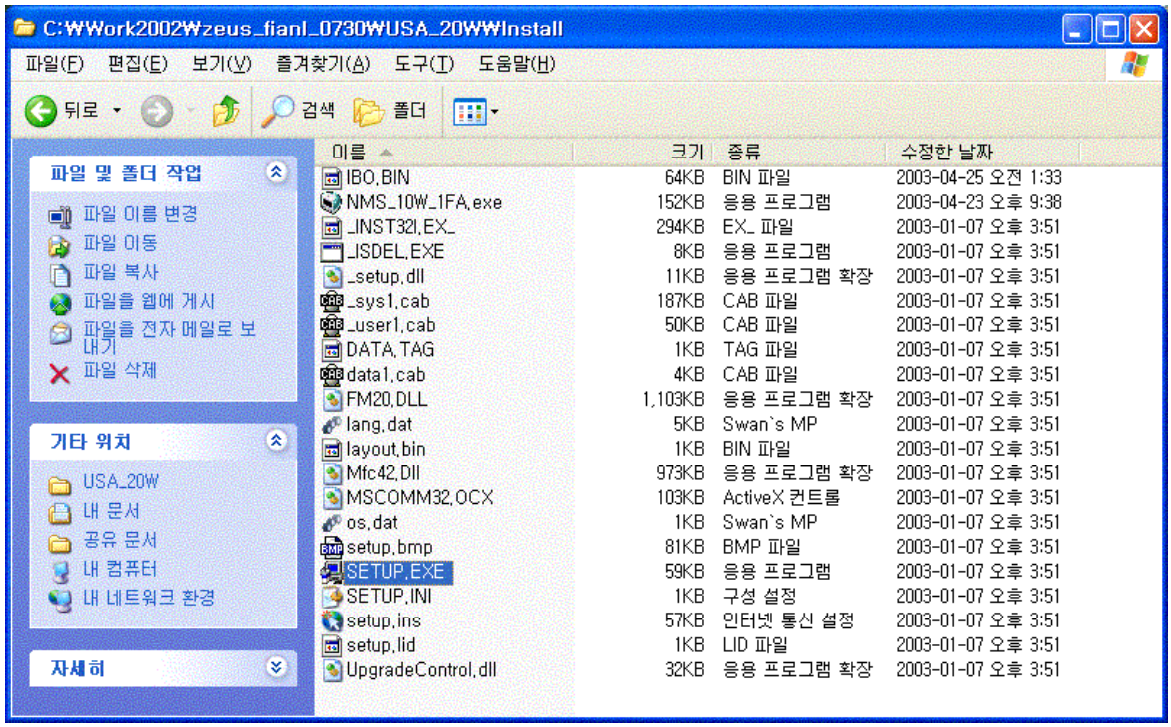
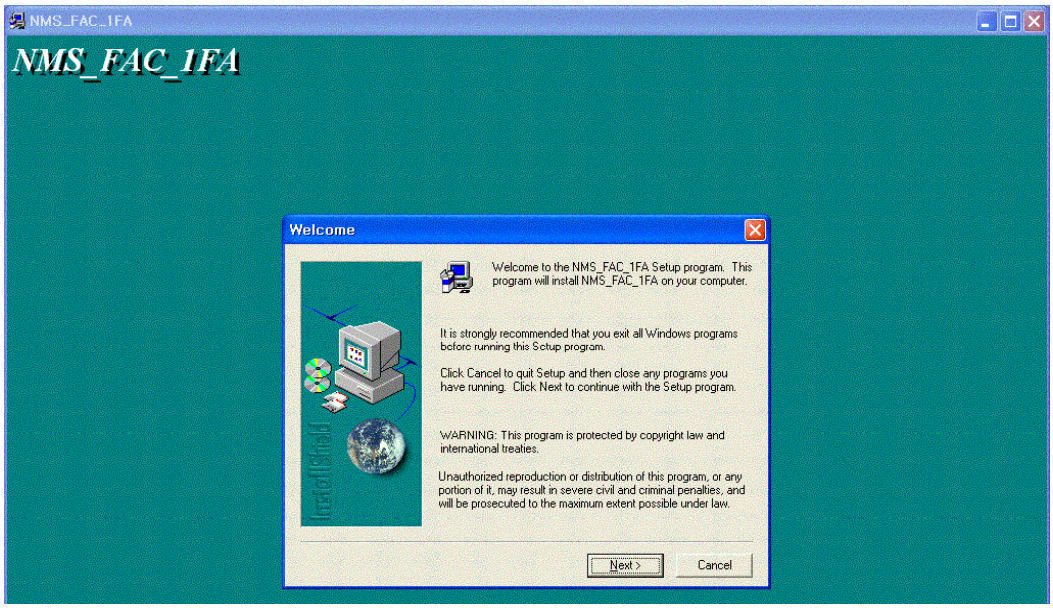
5.3. Installing the program

1) Unzip “Install.zip’ file



2) Click “setup.exe” file



3) Click “Next>” Button

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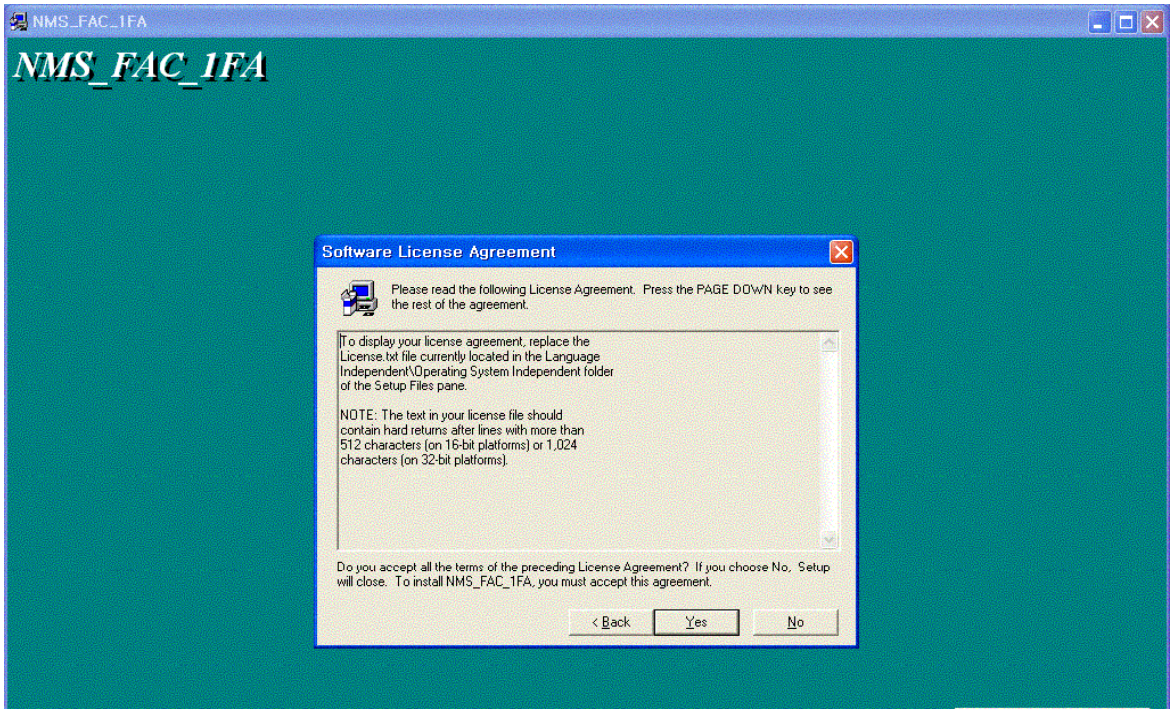
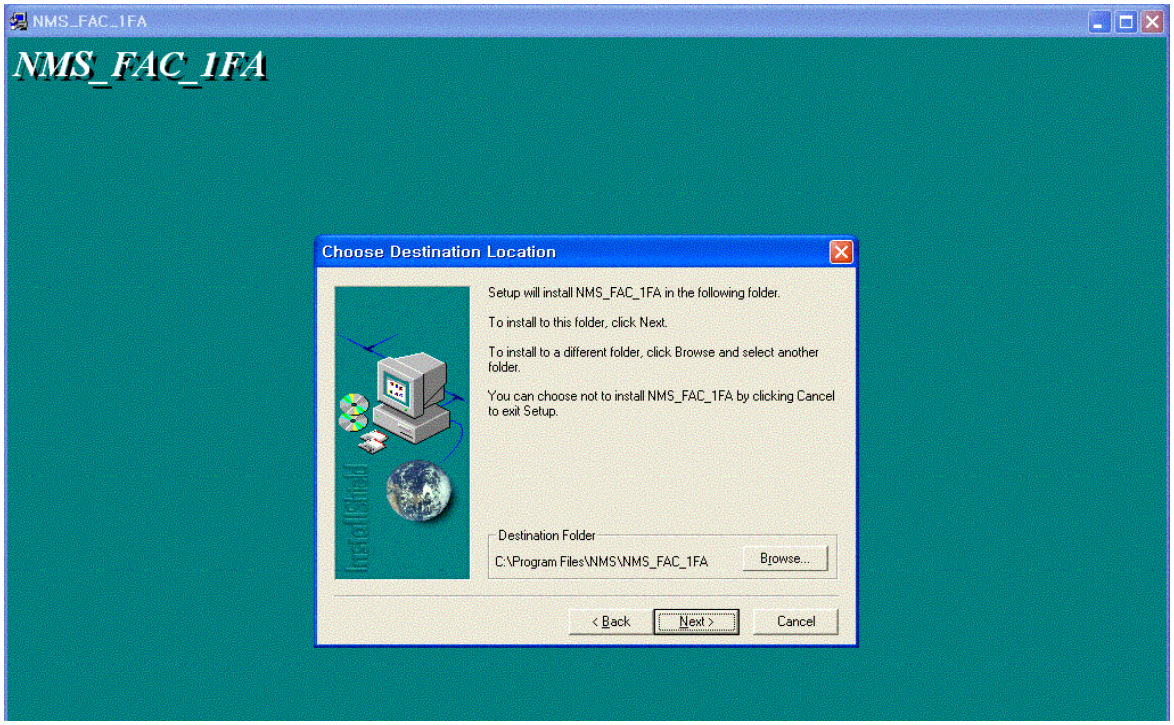


4) Click “Yes” Button



5) Click “Next>” Button

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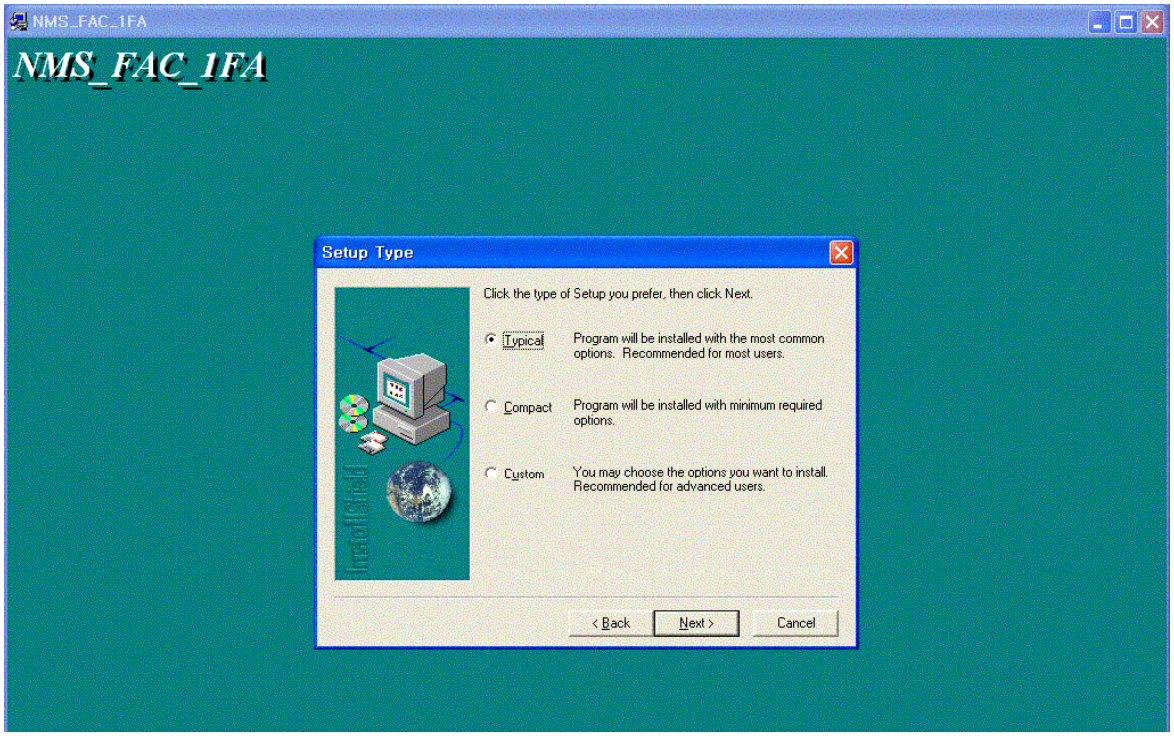
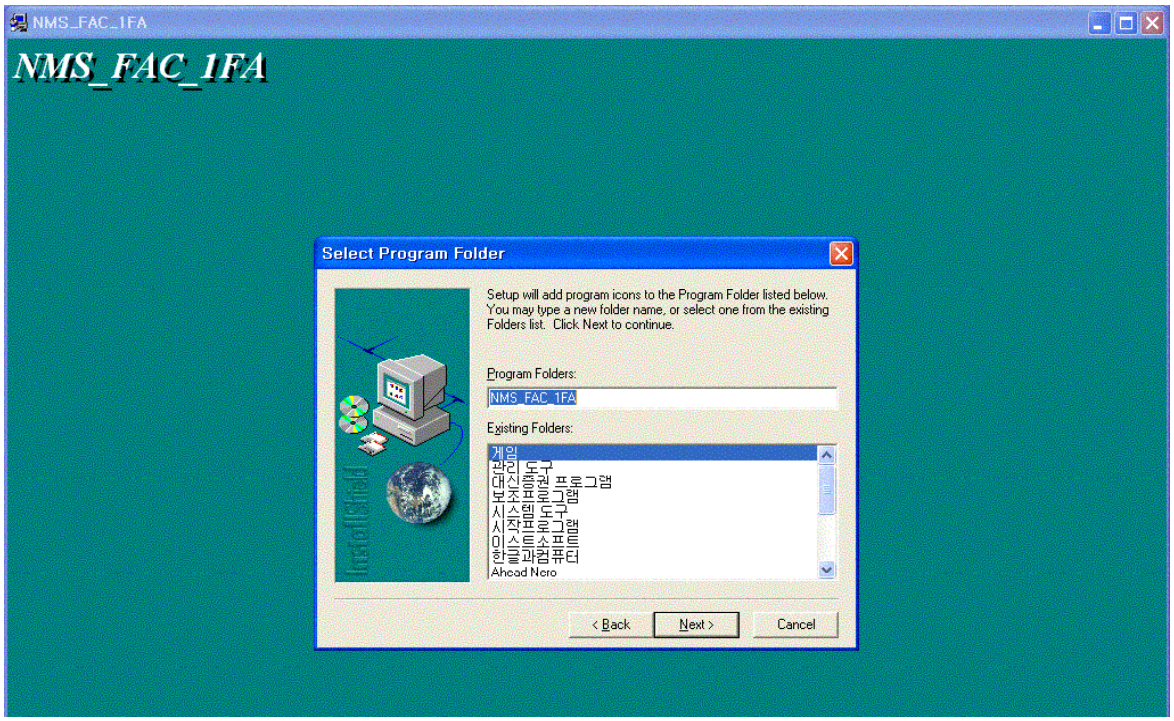


6) Click “Next>” Button



7) Click “Next>” Button

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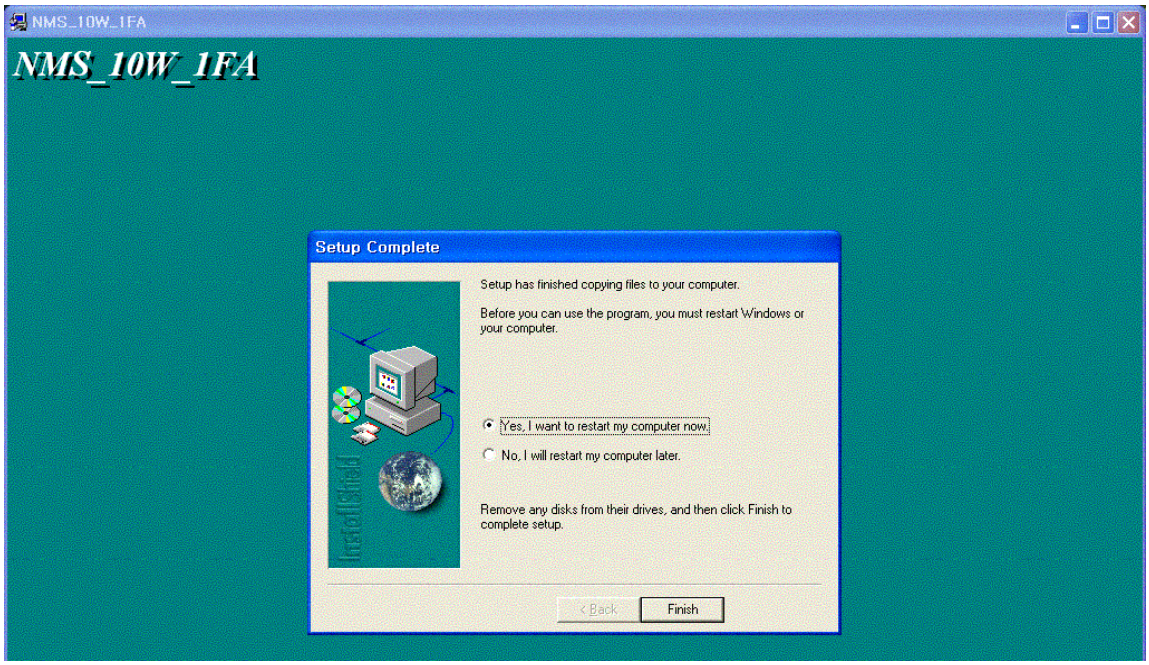
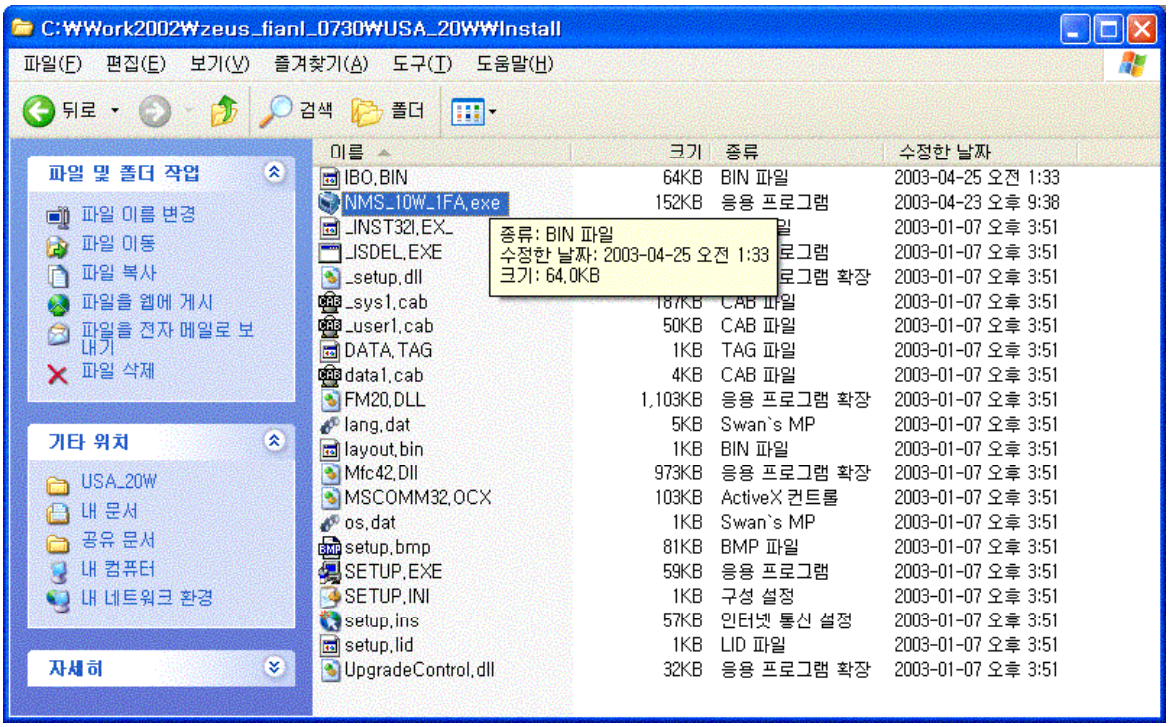
8) Click “Finish” Button



9) To executive the program Click “NMS_10W_1FA.exe” file



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5.4. Menu and Command

< File >

- Upgrade F/W: Up grade the program of control board
- Exit: Terminate program

< Communication >

- Comm Connect:
  Menu for establishing communication connection with repeater
  The password input dialog box is opened.
  If valid password is entered, communication is established.
  If invalid password is entered, error message occurs and no communication connection is established.
- Comm Disconnect:
  Disconnect the connection and close the communication port

< View >

- Debug Dialog:
  Monitoring function of internal memory of controller.
  For fix the bug of manufacturing time.
  Do not use normal user not related with manufacturing or development.
- Gain Table:
  Set the analog values of repeater output power.
  Valid setting is needed for correct decision of output power by controller.
  After communication connection is established, you can use it.
  Forward / Reverse output power values on control window are displayed using this.
  Do not use normal user not related with manufacturing or development.
- Temp. Table:
  Set the gain compensation attenuation values according to temperature.
  After communication connection is established, you can use it.
  Forward / Reverse Temp. Comp on control window is operated using this table.
  Do not use normal user not related with manufacturing or development.
- Freq. Table:
  Set the frequency values to select band by controlling the PLL.
  After communication connection is established, you can use it.
  Do not use normal user not related with manufacturing or developing.

< Change >

- Supervisor Control Values:
  Present system parameter setting and other functions for tuning for manufacturing
  After communication connection is established, you can use it.

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Refer to Supervisor Control Values Section for details.
Do not use normal user not related with manufacturing or development.

- User Control Values:
  Present repeater control and setting functions for normal user
  You can use after communication connection is established.
  Refer to User Control Values Section for details.
- Alarm Mask:
  Set the alarm item for reporting to OMC center.
  After communication connection is established, you can use it.
  Not available now.
- Password:
  To change password.
  After communication connection is established, you can use it.
- EEPROM:
  Read the parameters (Gain Table, Temp Table, Frequency Table) of repeater and save as file.
  Read the parameters from file and write to controller.
  Read and write operation of parameter is performed for all set of parameters.
  You can use after communication connection is established.
- Communication:
  Set the serial communication parameters.
  You can use while communication connection is not established.

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5.5. Firm Ware Downloading

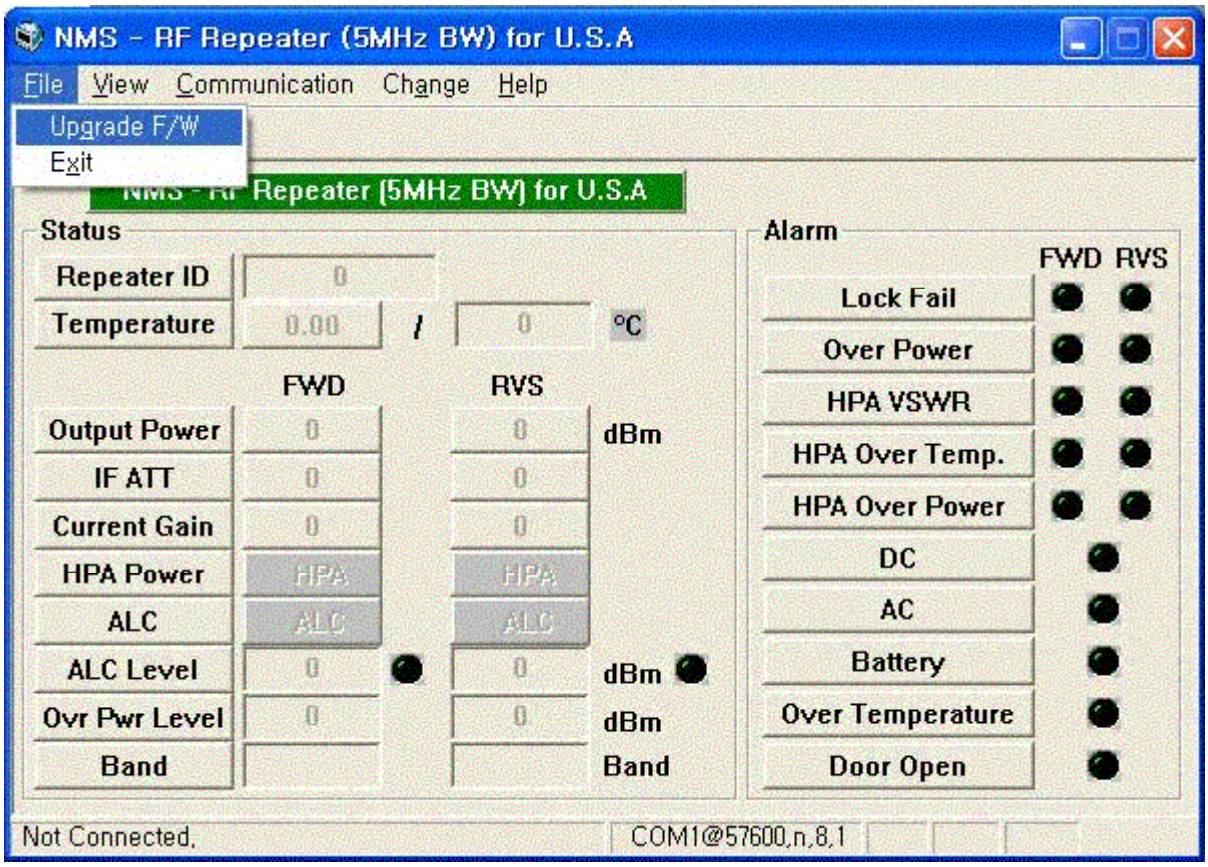

Figure 9 Upgrade firmware click window

1) Click (***File > Upgrade F/W***)

< Usage >

Downloading the program to control board for up grading firmware. User must set the proper value and recommended values are below.

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2) Select File

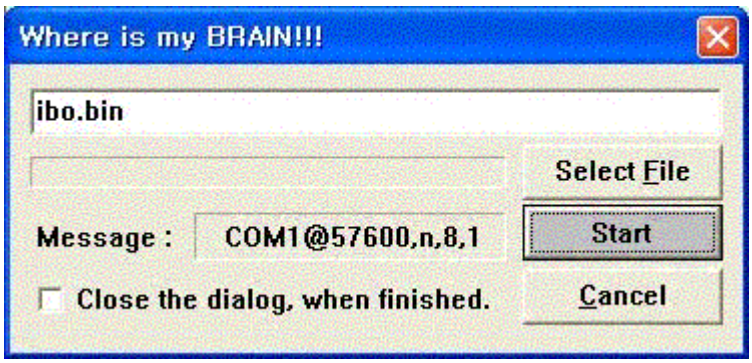

Figure 10 Firmware Up grade window

Click the < ***Select File*** > button

< Usage >

Select the correct file for downloading.

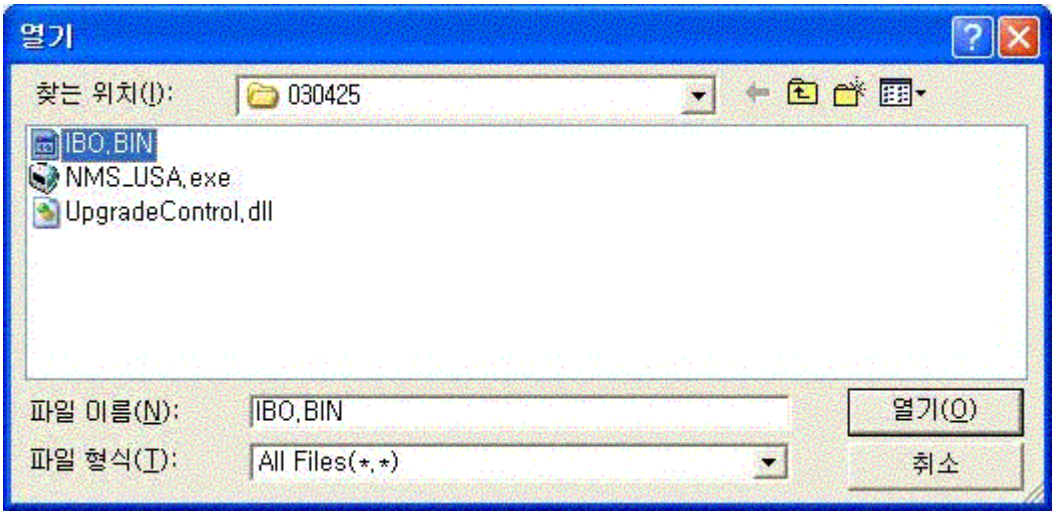

Figure 11 File Select Window

Select ***IBO.bin*** file

Click the <열기(O)> button

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Start downloading

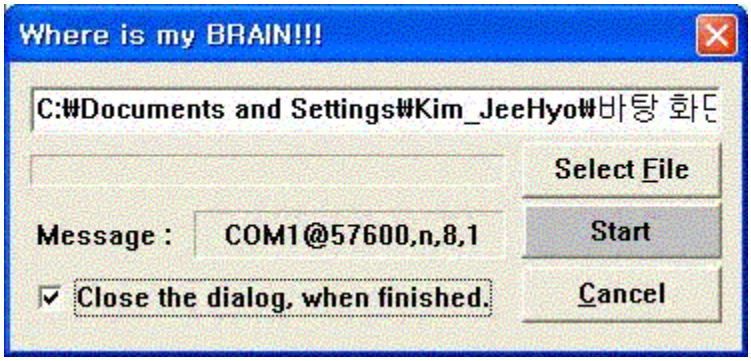

Figure 12 Finish selecting File Window

Click the check box (Close the dialog, when finished.)
Click the < *Start* > button

Turn Off the power supply
Turn On the power supply again

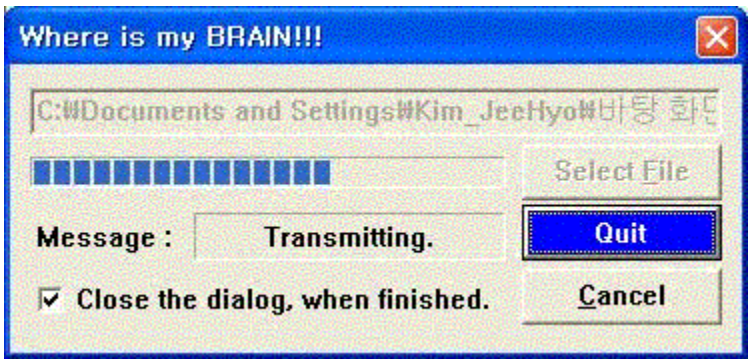

Figure 13 Download Progressing Window

The left side of *Select File* button is displayed in blue stream, it is a normal condition.

After fulfilling the bar with blue stream, you can use the control program as it was before.

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5.6. Display

5.6.1. Password

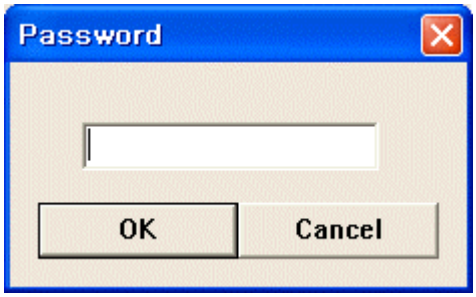
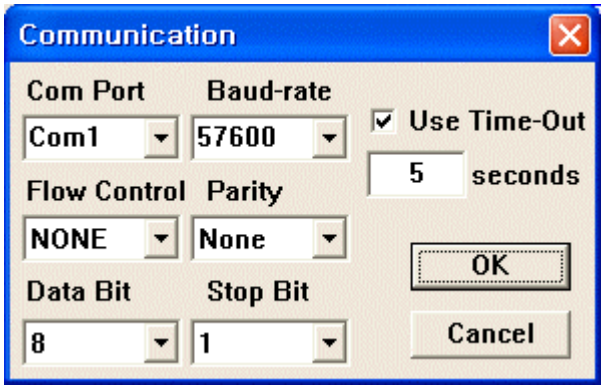


Figure 14 Login Window of NMS Program

Password: 123
And then Click "OK" button

5.6.2. Communication



< Usage >

Set the communication parameters for communication with repeater. User must set the proper value and recommended values are below.

< Items >

Com Port: Communication port in computer that the communication cable is connected
Normally Com1 or Com2 is used.

Baud-rate: **57600 bps**
Flow Control: NONE
Parity: None
Data bit: 8
Stop Bit: 1

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5.6.3. Main display

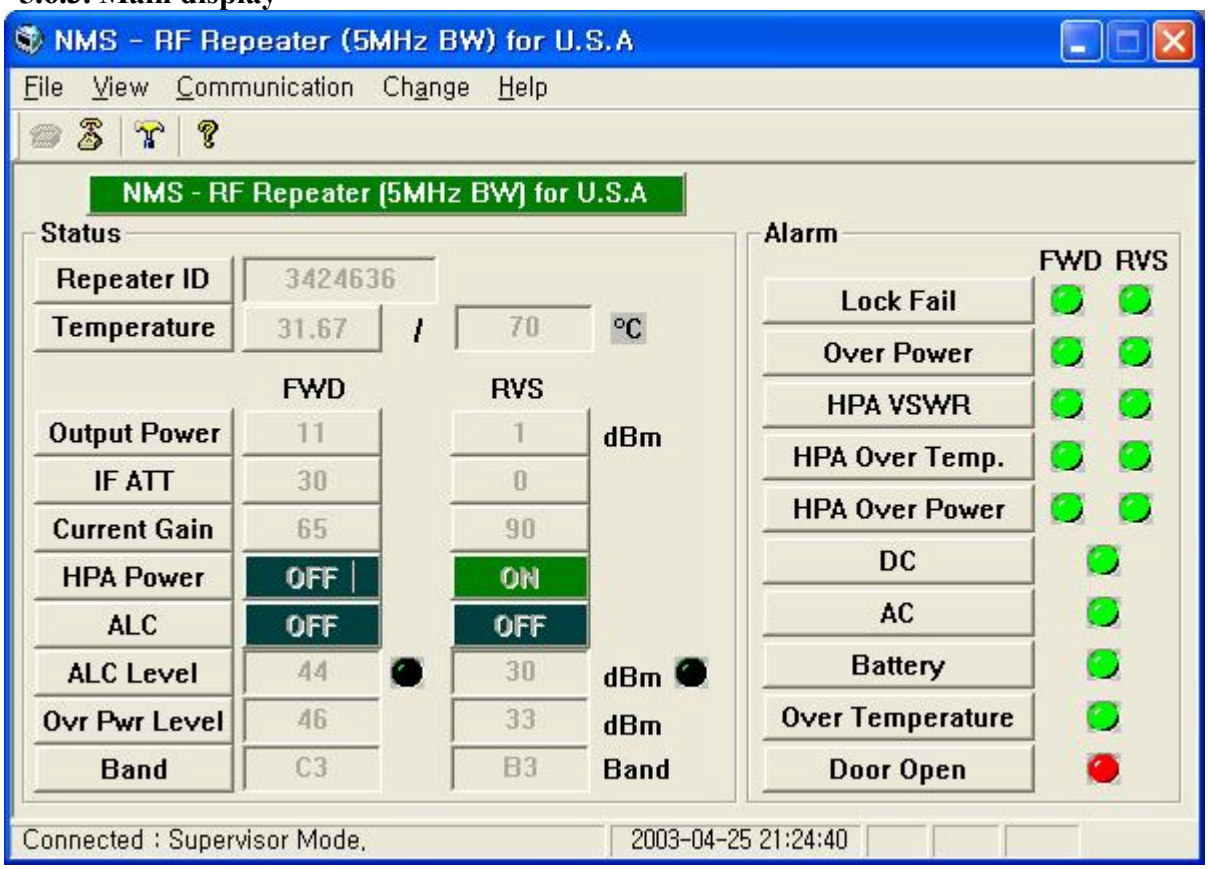

Figure 15 Main Display of NMS Program

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Main display contains the current setting values and status and alarm conditions.

0 : Current value display. (Convex)
Temperature: Current temperature inner side of repeater.
Output Power: Forward / Reverse Current output power values
IF ATT.: Forward / Reverse Current attenuation value
Current Gain: Forward / Reverse actual gain including ALC.
HPA: Status of HPA On/Off.
ALC: ALC control method (Level/Limit)

50 : User control setting parameter display (Concave)
Repeater ID: Repeater ID setting value.
Temperature: Over Temperature Alarm threshold level.
ALC Level: Forward / Reverse ALC control Level
Ovr Pwr Level: Forward / Reverse over power alarm threshold set by user.

Alarm : Indicate the alarm condition of each module.
Notation of Polarity and related connector is FWD/RVS
Lock Fail: PLL lock fail Alarm (FWD/RVS)
Over Power: Current output power level is above Over Ovr Pwr Level set by user during 0.5 second.
HPA VSWR: VSWR alarm of HPA is maintained during 0.5 second.
HPA Over Temp: Over Temperature alarm of HPA. If the temperature of HPA is over 87℃, HPA will shutdown and restart at 71℃
HPA Over Power: Over Power alarm of HPA. If occurred, HPA is shutdown
DC: DC output of PSU alarm status (i.e. DC power short because of module fail)
AC: AC input of PSU alarm status. If AC fail is occurred, Battery back up will be started
Battery: Battery needs to be charged.
Over Temperature: Temperature is above over temp set value during 0.1 second.
Door Open: Repeater Door is open.

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5.6.4. User Control Values

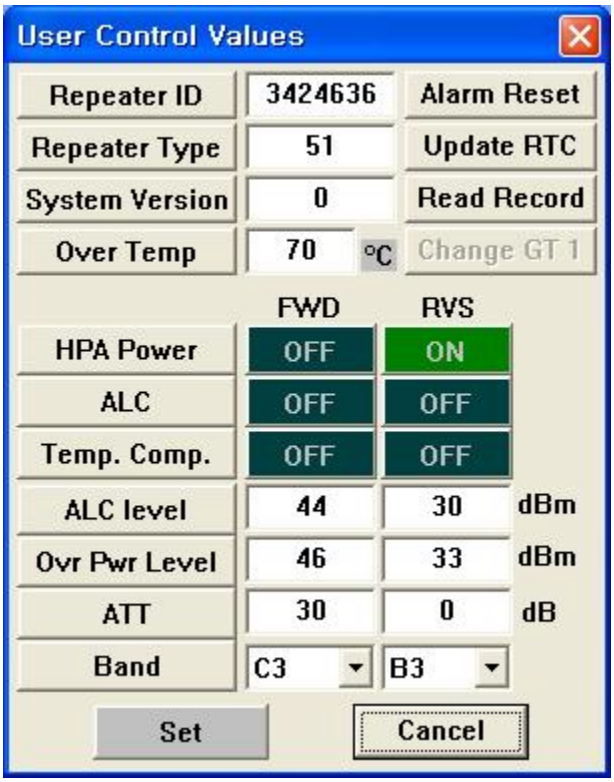

Figure 16 Window of User Control Values

< Usage >

Values in edit boxes can be modified directly, and on/off controls and ALC controls can be modified by click the button. After modification, press SET button to write the value setting to controller. If you want close the window without writing the values to controller, press CANCEL button or OK button to close the window with writing to controller.

All values except HPA power and LNA power are saved in EEPROM and can be read after next power on.

< Items >

Repeater ID: ID of repeater.
Set any value user want as long as 9 digits in decimal.

Repeater Type: Repeater type for help the user classifying the repeater.
Any value from 0 to 255 can be written.

System Version: System version for help user classifying repeater version in same type
Any value from 0 to 255 can be written.

Over Temp. : Over temperature alarm limit value.

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If current temperature exceeds this value more then 0.1 second then Over Temperature alarm occurs, and the repeater system is shutdown (Unit: Centigrade)

Alarm Reset: Resets the HPA in shutdown state and clears the alarm.

If over output power alarm occurs, controllers turn off the HPA for 10 seconds. After 10 seconds controller turn on the HPA and recheck the status. If alarm remains then do the same operation 2 times more. If alarm remains after third check, controller performs the same three times recheck operation with duration 10 minutes, and 30 minutes. If alarm remains after 9th check then controller off the HPA and wait manual alarm reset command from maintenance guy.

HPA Power: HPA Power On/Off Control.

After setting the button with desired status by clicking then press SET button.

In some condition like HPA module error, HPA may not be on.

ALC: Select the ALC On/Off Status.

After set the button with desired value by clicking then press SET button.

ALC level: High level limit value for ALC

Ovr Pwr Level: Over power level to display alarm.

ATT: User must set the desired system gain without ALC attenuation.

Band: User must set the desired frequency band using Figure 17.

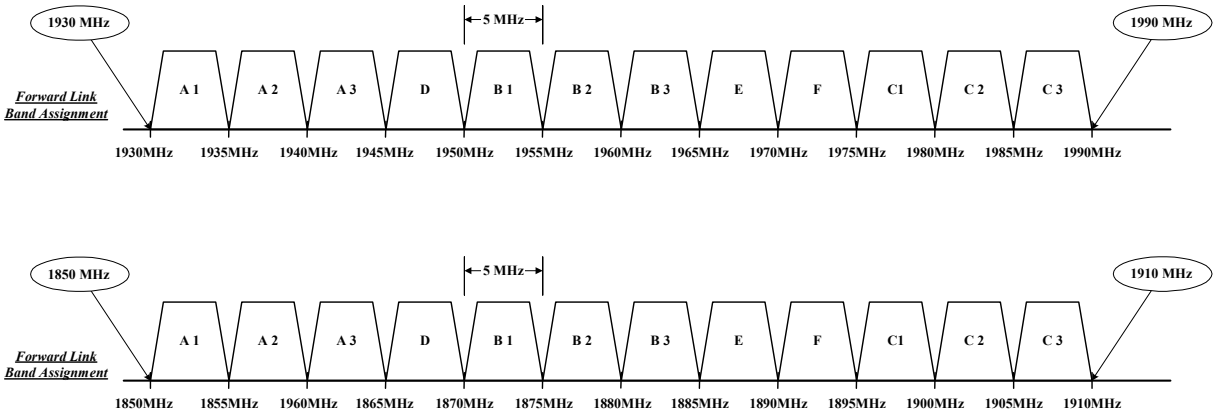

Figure 17 Frequency Band Selection Table

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5.6.5. Alarm Mask

Figure 18 Window of Alarm Mask

< Usage >

Select the alarms to be reported to OMC center. User can select the each alarm item to report. If any alarm occurs by checking on, controller calls the OMC center and reports the alarm and if alarm occurs by checking off, controller will not report the alarm to center

5.6.6. Change Password

Figure 19 Window of Change Password

< Usage >

Change the user login password. User can change the password by entering the old password in old password edit box and new password with desired new value in new password edit box and same new password in password confirm edit box and press OK button.

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5.6.7. Supervisor Control Values

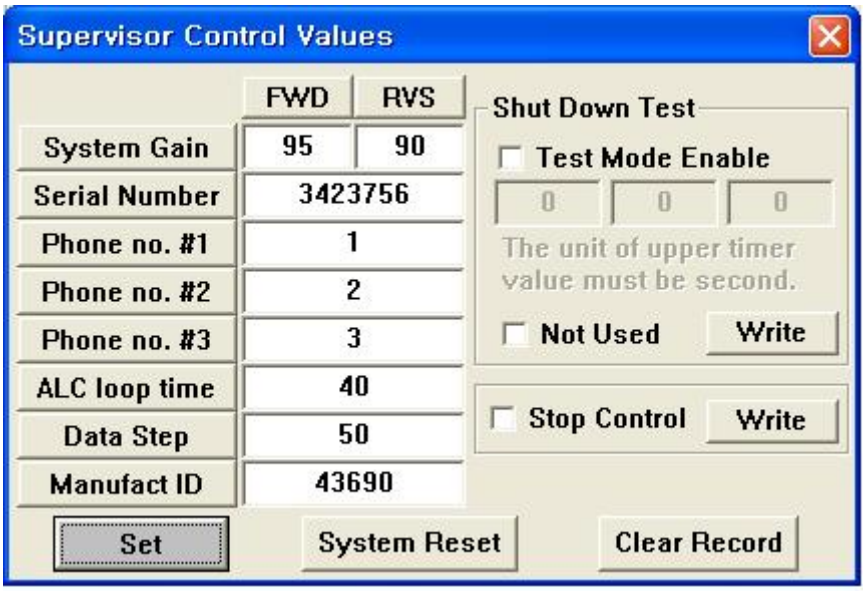

Figure 20 Supervisor Control Window

< Usage >

Set the parameters for supervisor and manufacturer (System Gain, Serial Number, Phone Number for OMC, ALC loop time, Data Step, Manufacturer ID). Functions used to help tuning and testing of the repeater include System Reset, Shutdown Test and Stop). For updating the values set the edit boxes and press SET button. And for Shutdown Test and Stop Control Flag, make the items with desired values and press WRITE button of related category.

<< Supervisor Control Values are set at factory, Please don't change the values without permission >>

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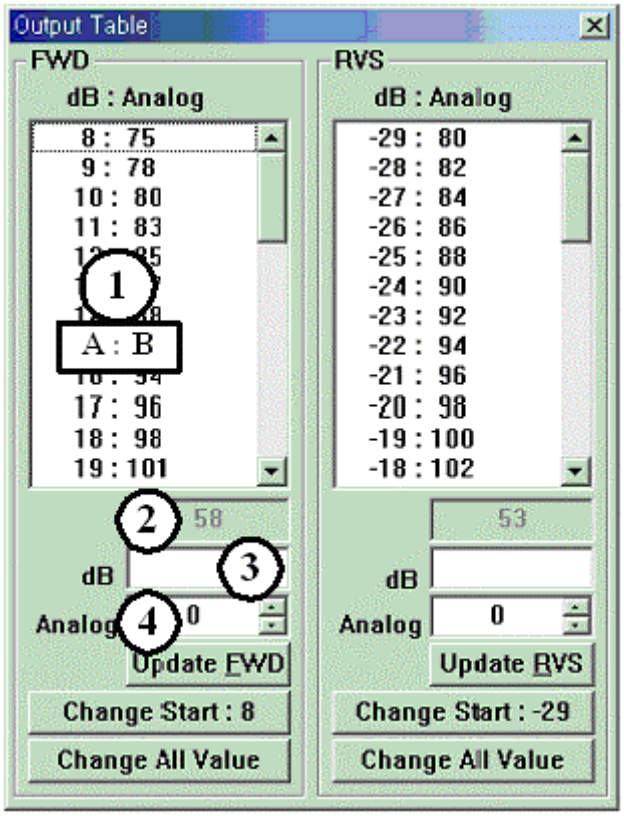
5.6.8. Gain Table



< Usage >

Use this dialog box to set the start dB (the lowest out power table value), Gain Table and Analog values for each output power value.
ALC and over power alarm process will operate with this table value
The value of disabled edit box is the current analog output value of each direction.

< Items >

1. **dB: analog:** Display the target dBm and the detected analog value.
2. Display the Current detected output power analog value.
3. **dB**: Write the target output power (dBm)
4. **Analog**: Write the detected analog value of each out put power in dBm.
5. **Update FWD/RVS**: After writing the target dB and Analog, Press this button to download the value to control board.

Change Start: The lowest output power value to make gain table.
To set the lowest output power value, write dB box with –10 ~ 20 value.
FWD/RVS can have different lowest output power value.

Change All Value: To change the analog value.

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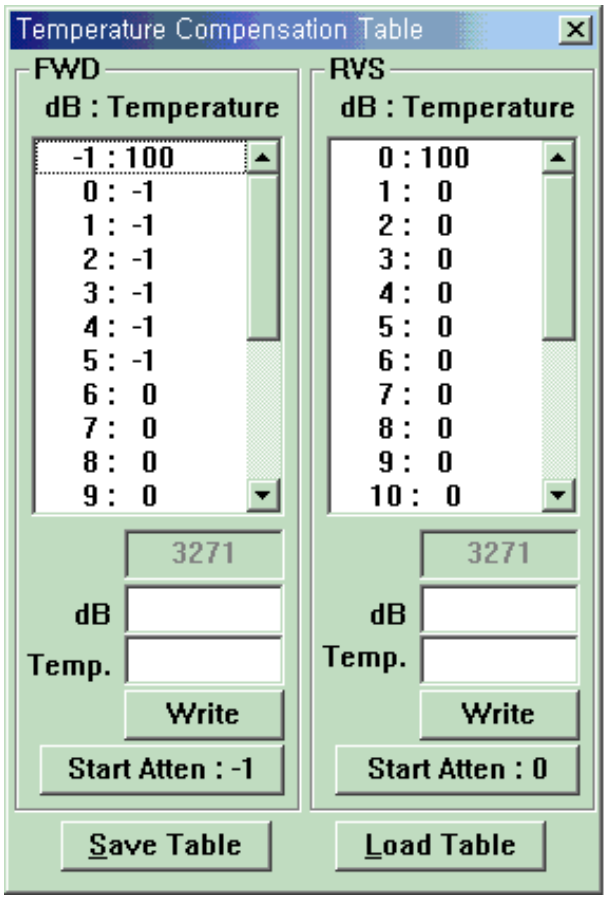
Press this button to change the detected power level uniformly. After clicking this button and writing the value (-100~100), the all of related analog value is changed.

If double clicking the desired output power in dB:Analog box, dB value appears in dB edit box and related analog value appears in analog edit box. You can modify the analog value directly. And if pressing Update button, the next dB value and analog value are selected automatically.

5.6.9. Temp. Table



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< Usage >

Use this dialog box to set the gain compensation values according to temperature.
Temperature Compensation Process will operate with this table value
The value of disabled edit boxes is current temperature.

< Items >

dB: Temperature: Display the relative attenuation value and the target temperature.
Display the Current detected current temperature analog value.
dB: Write the target attenuation value (dB)
Temp: Write the wanted temperature value to compensate the gain (Unit : Centigrade)
Write: After writing the target dB and Temperature, Press this button to download the value to control board.
Start Atten: Lowest gain compensation value.
To set the lowest gain compensation value press the Start Atten. : x button and write the value and press OK.
FWD/RVS can have different lowest gain compensation value.
Save Table: Read table values from control board and save them to Notebook PC.
Load Table: Load the saved table values to download them to control board.

After control board reads the current temperature and compares it with the temperature table value. And add the related table attenuation value to the current attenuation value. For example, see the FWD direction in above figure. If the current temperature is 4, repeater read the related attenuation value (-1) from table. After adding –1 to the current FWD attenuation value, control board will set it to Frequency converter module (FWD) automatically.

If double clicking the desired temperature compensation value in dB: Temperature, dB value appears in dB edit box and related temperature value appears in Temp. edit box. You can modify the dB value directly. And if pressing Write button, the next dB value and temperature value are selected automatically.

<< Temp. Table is set at factory, Please don't change the values without permission >>

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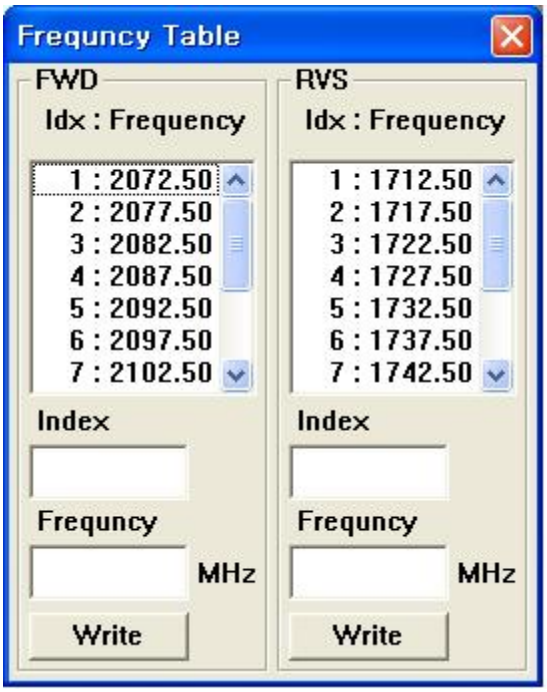
5.6.10. Freq. Table



< Usage >

Use this dialog box to set the local frequency values to control PLL. Band on Control Window will be operated with this table. This repeater system uses 140MHz IF frequency. Forward link uses higher side local frequency but reverse link uses lower side.

< Items >

idx: Frequency Display the relative frequency band and the target local frequency.
Index: Write the relative frequency band (1=A1, 2=A2, 3=A3, 4=D, ⋯, 11=C2, 12=C3)
Frequency: Write the local frequency values
Write: After writing the relative band index and local frequency, Press this button to download the value to control board.

If double clicking the band in idx: Frequency box, the relative index appears in Index edit box and the set local frequency value appears in analog edit box. You can modify it directly. After control board reads the local frequency, orders Converter module (FWD or RVS).

<< Freq. Table is set at factory, Please don't change the values without permission >>

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5.7. VFD and Keypad

5.7.1. Description

- 2 rows and 16 column LCD
- Five button Keypad: ***[MENU], [UP], [DOWN], [ENTER], [ESC]***

5.7.2. Control and Monitoring Items

- Alarm: Lock, Over Power, HPA VSWR/Over Temp/Over Power PSU DC / AC / Battery, Over Temperature Door Open
- Status: Repeater ID, Manufacturer ID, S/W Version, Current ambient Temperature, Over Temperature Level, HPA On/Off, ALC On/Off, Temperature Compensation On/Off, Attenuation value, Current Gain, Frequency band.

5.7.3. Operation Basics

- Press *[MENU]* Key to move the activated digit toward right direction.
- Press the *[ENTER]* Key; the active menu is shifted to second screen.
- *[UP], [DOWN]* Key can shift the active menu to the lower and upper parts or change the setting value.
- The second screen can monitor the status of repeater. The '*' marked item can be controlled and no marked items can only monitor.
- If you move to first screen menu, press the *[ESC]* Key.
- The third screen can execute the control items, change the value or On/Off status with *[UP], [DOWN]* key and set the value with *[ENTER]* Key

5.7.4. Menu

First Screen	Second Screen	Remarks
1.ALARM	Lock : Good/Alarm	(FWD, RVS)
	Over Power : Good/Alarm	(FWD, RVS)
	HPA VSWR : Good/Alarm	(FWD, RVS)
	HPA Over Temp: Good/Alarm	(FWD, RVS)
	HPA Over Power: Good/Alarm	(FWD, RVS)
	DC : Good/Alarm	
	AC : Good/Alarm	
	Battery : Good/Alarm	
	Over Temp : Good/Alarm	
	Door Open : Good/Alarm	
2.STATUS	*SW VER : X.X	
	Current Temp : -25 ~ 127	

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	*Over TEMP : -25 ~ 127	
	*TEMP COMP : ON/OFF	
	*FWD ATT : 0 ~ 30	
	*RVS ATT : 0 ~ 30	
	*FWD HPA : ON/OFF	
	*RVS HPA : ON/OFF	
	*FWD ALC Level : 11 ~ 45	
	*RVS ALC Level : 1 ~ 33	
	*FWD ALC : ON/OFF	
	*RVS ALC : ON/OFF	
	*FWD Over Power: 11 ~ 45	
	*RVS Over Power : 1 ~ 33	
3. Supervisor	Not used	

Third Screen: Digit values of Attenuation / Output Power / Temperature and On/Off status

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