CM200D01

User Manual

2010

Content

IMPORTANT NOTE:

FCC RF Radiation Exposure Statement:

This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body.This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

1. Introduction

1.1. General Introduction

As an equipment to clear RF shadows inevitably generated between the adjacent cells of WCDMA and GSM, CM200D01 simultaneously supports both WCDMA and GSM and effectively repeats the signals between mobile terminals in weak coverage area and BTS.
This equipment is Dual Band Optical DAS that support 850MHz and 1900MHz bands simultaneously, and it is designed to support both GSM and WCDMA for each band.
This equipment provides the effective and flexible solution to service providers to improve quality of service for their subscribers.

The main objectives of CM200D01 are as follows:

- **Expansion of coverage**
- **Enhancement of service quality in areas such as tunnels or in-building**
- **Improvement in signal strength at places where the signal level is less than desired.**
- **Support dual bands of 850MHz and 1900MHz.**
- **Support dual mode of GSM and WCDMA for each band.**
- **RU power consumption and RU size optimization by built-in Crest Factor Reduction (CFR) technology for the WCDMA signal.**

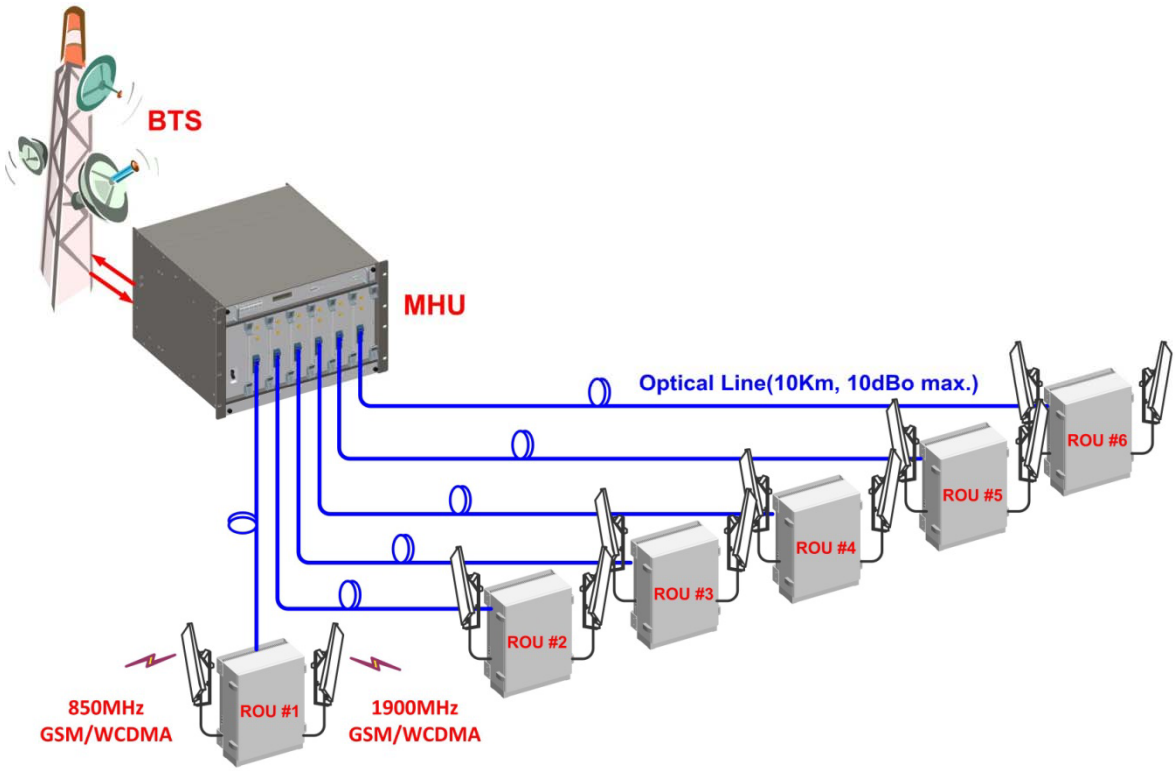
2. System Network Configuration

2.1. Network configuration

CM200D01 repeater is equipment to clear RF shadows, to fill coverage gaps existing among the adjacent cells and to enhance the quality of service by extending coverage of WCDMA and GSM.
The following network configuration is for a case where the MHU co-located with BTS (GSM or WCDMA) is connected with 6 RU's by optical cables. The coverage antennas are connected to each RU.

⇨ System configuration

- **MHU Capacity: 1 Optical Branch/DOU and 6 DOU/MHU (6 Optical Branch/MHU)**
- **System Connection: Optical cable between MHU and RU**
- **Optic Wavelength: 1310nm for FWD, 1550nm for RVS**
- **Max loss of optic cable (between MHU and RU): 2 ~ 10dBo**
- **2 ANT ports on RU. (Separate Ant. Ports for 850MHz and 1900MHz)**



[Network Configuration of Dual Band Optical DAS]

3. System Specifications

3.1. General Specifications

Item		CM200D01 MHU	CM200D01 RU
Enclosure Type		7U-Shelf type 19" standard rack mountable In-door use	Cabinet
Dimension (mm)	W ✖ H ✖ D	19"(482.4) X 310(7U) X 450mm	127(H) X 559(W) X 211(D)mm
Power Supply		120Vac (Tolerance ±10%), 60Hz	TBD
Power Connector		ID-NO3BEH	TBD
RF In/Out Port		SMA Female, rear side	N Type Female, bottom side
Optic Connector Type		FC/APC, front side	FC/APC, bottom side
Optic Wavelength		FWD: 1310nm / RVS: 1550nm	
Operating Temperature		-5℃ ~ 40℃	-5℃ ~ 50℃

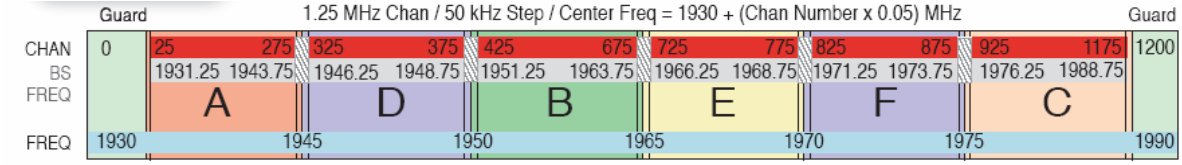
⇨ **Environmental requirement**

The repeater RU shall be operated in the temperature range of -5℃ ~ 50℃

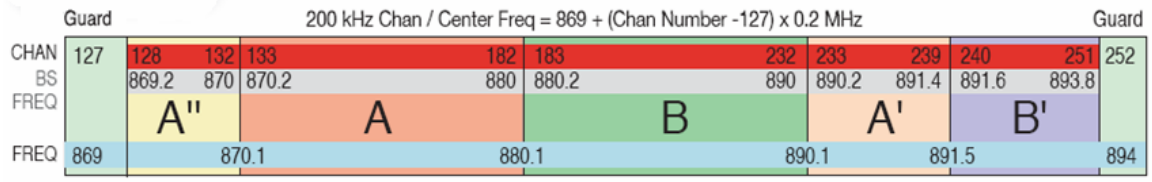
3.2. System specifications

3.2.1. Frequency allocation

✧ **1900MHz Band**



✧ **850MHz Band**



3.2.2. System Specifications

Item	Specification		Remarks
DL Frequency Range	Contiguous 25MHz Bandwidth in 1930 ~ 1990MHz Contiguous 25MHz Bandwidth of 869 ~ 894MHz		
UL Communication	Optical		
Frequency Stability	0.02PPM		
System Delay	DL: 8usec max. UL: 5usec max.		
Tx-Rx Isolation	100dB min. @Between RU Tx ANT and MHU Rx Output		
Impedance	50 Ohm		
Pass-Band Ripple	3dB max.		25MHz BW
FWD Input Power	-10 dBm/total, -5dBm/total is recommended at MHU IN		Each Band
FWD Output Power	40dBm /total for 1900MHz RU ANT Port 40dBm /total for 850MHz RU ANT Port		
RVS Input Power	-60dBm/total max. at RU each ANT Port		
RVS Output Power	-20dBm/total max. at MHU each Rx Output Port		
System Gain	50dB max.		
FWD Spurious	Comply to 3GPP2, FCC regulation		
RVS Noise Figure	5dB max. @ 40dB Gain		Max. Gain
Gain Control Range	FWD: 20dB by 1dB Step	RVS: 20dB by 1dB Step	RU OLC Gain
VSWR	1.5 : 1 max. @ All input/output ports		
Optical Wavelength	FWD: 1310nm	RVS: 1550nm	
RF I/O Connector	DU: SMA Female	RU: N-type Female	

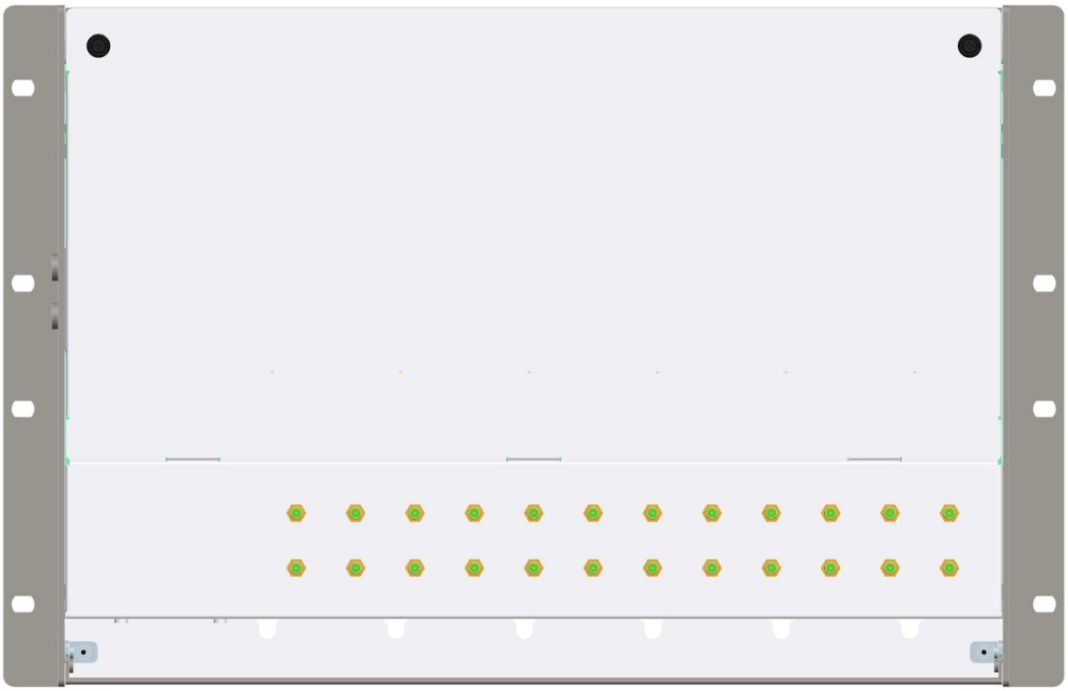
4. Mechanical Specifications

4.1. CM200D01 MHU

4.1.1. Mechanical Design

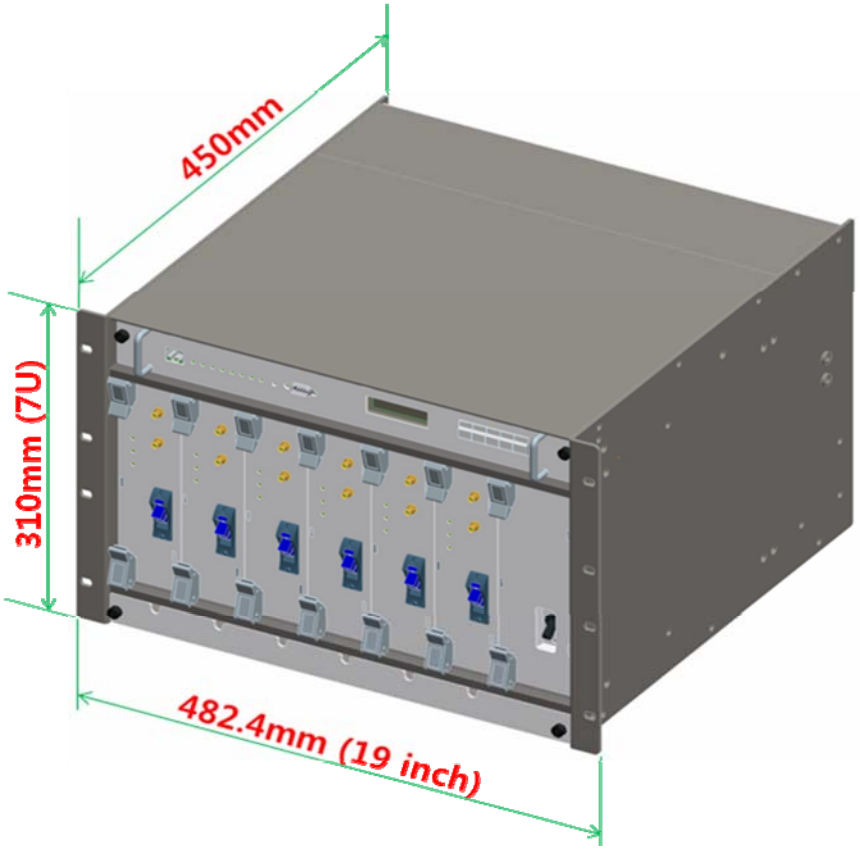
[FRONT]

[REAR]



[MHU Figure]

4.1.2. Dimension



4.1.3. Mechanical specification

No	Items	Specifications
1	Exterior view	1. Shelf attachable type to both INDOOR and OPEN RACK 2. W 19"(482.4) X H 310(7U) X D 450mm 3. Weight: 15.5 Kg (1DOU included)
2	Material	Aluminum (AL5052, AL6063) is mainly used for protection from corrosion by outdoor conditions.
3	Connector Type	1. Optic I/O: FC/APC at front side 2. RF I/O: SMA Female at rear side 3. Monitor port: SMA Female at front side
4	Power Input	1.Power: 110-120Vac, 60Hz 2.Connector: IN-NO3BEH
5	Ground	14SQ 2Hole ground pipe (right side of shelf) and M4 "O" rug ground (rear side of shelf)
6	Communication Port	9P D-SUB (GUI) and RJ-45 at front side

4.1.4. Descriptions of CM200D01 MHU

[Forward Path]

The signal from GSM or WCDMA BTS is fed to the RF input port of MHU. First, MHU RVS/FWD COMbiner(MRFCOM) module measures the input signal power level and combines the signal with te modem signal (360MHz). The combined signal then gets transmitted to RU via optical cable.

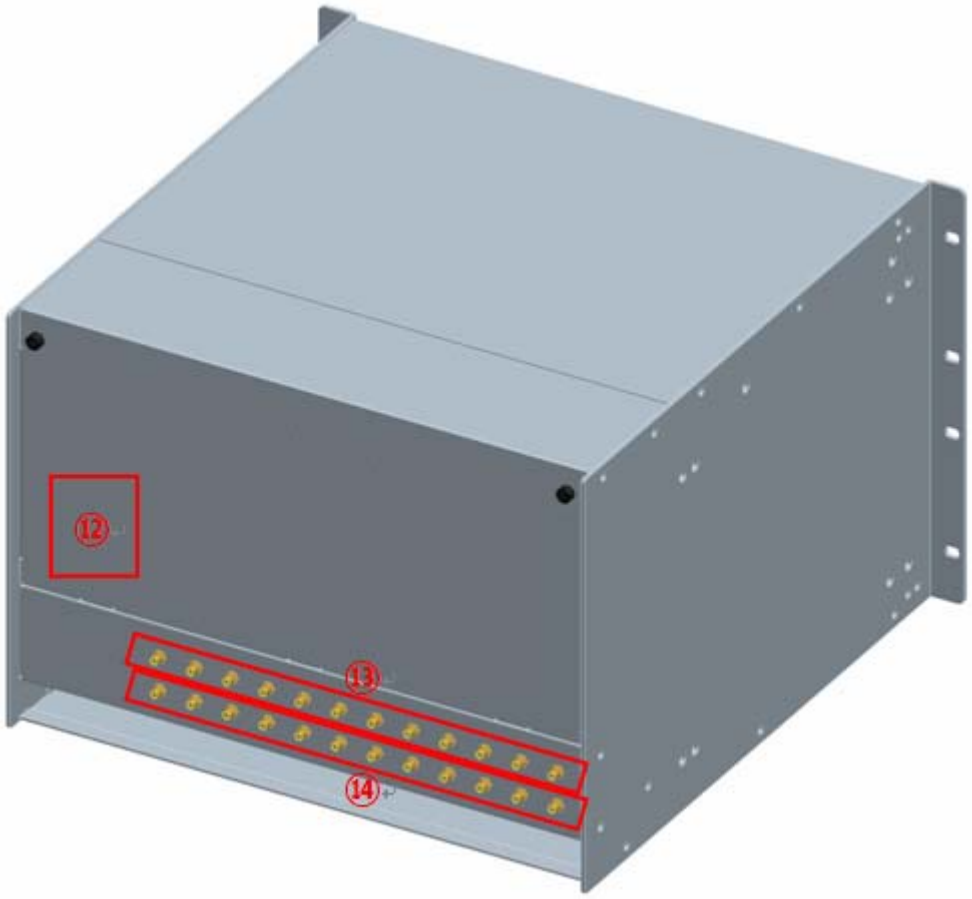
[Reverse Path]

The WCDMA or GSM RVS signal input from RU through the optic module is separated into RF and modem signal, and then RF RVS signal level is measured by the MRFCOM module. The RF signal then is fed to the BTS.

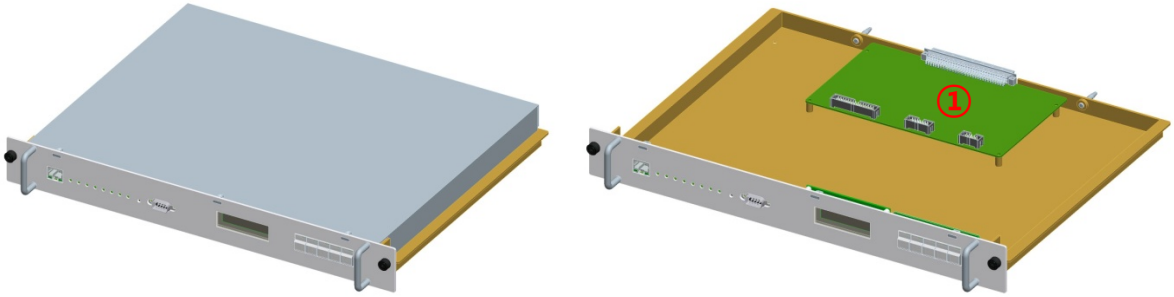
4.1.5. Port Configuration

No	Items		Description
1	TX_MON		Monitor port for MHU FWD input signal from BTS (-20dB)
2	RX_MON		Monitor port for MHU RVS output signal to BTS (-20dB)
3	LED1	RUN	Green Blinking: CPU run, OFF(Gray): CPU stop
		ALM	Summary Alarm of MHU, Green: Normal, Red: Alarm
		RU1	The status of communication with RU1, Green: Normal, Red: Alarm
		RU2	The status of communication with RU2, Green: Normal, Red: Alarm
		RU3	The status of communication with RU3, Green: Normal, Red: Alarm
		RU4	The status of communication with RU4, Green: Normal, Red: Alarm
		RU5	The status of communication with RU5, Green: Normal, Red: Alarm
		RU6	The status of communication with RU6, Green: Normal, Red: Alarm
		RESET	NMS board HW Reset
4	DEBUG		PC connection port for GUI S/W (9pin D-SUB)
5	DISPLAY		Key pad input display
6	DATA INPUT		Equipment status/check, control data input
7	Power Switch		AC110V power ON/OFF switch

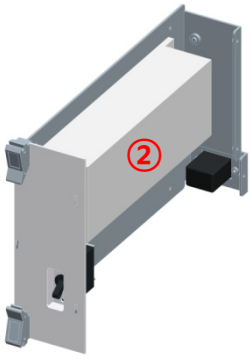
8	Optic Connector		FC/APC type optic connector
9	LED2	PWR	DC power supply status of the DOU Card
		LD	LD Alarm, Green: Normal, Red: Alarm
		PD	PD Alarm, Green: Normal, Red: Alarm
10	RJ45(To Master)		Connection port to the master for the NOC
11	NMS board		Sliding type
12	AC INPUT		External AC power input port (rear part)
13	Tx1900/Tx850 IN		MHU dual band FWD RF connection port from BTS (rear part)
14	Rx1900/Rx850 OUT		MHU dual band RVS RF connection port to BTS (rear part)



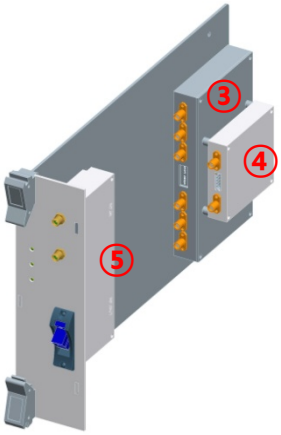
4.1.6. Module Composition



[NMS UNIT]



[PSU]



[DOU]

No	Module	Voltage Used	Remarks
①	MHU NMS Controller	9Vdc	
②	MHU PSU(Power Supply Unit)	9Vdc/6.5Vdc	
③	MRFCOM(MHU RVS FWD Combiner)	6.5Vdc	
④	MHU FSK Modem	9Vdc	
⑤	MHU Optical Transceiver Unit (DOU)	6.5Vdc	

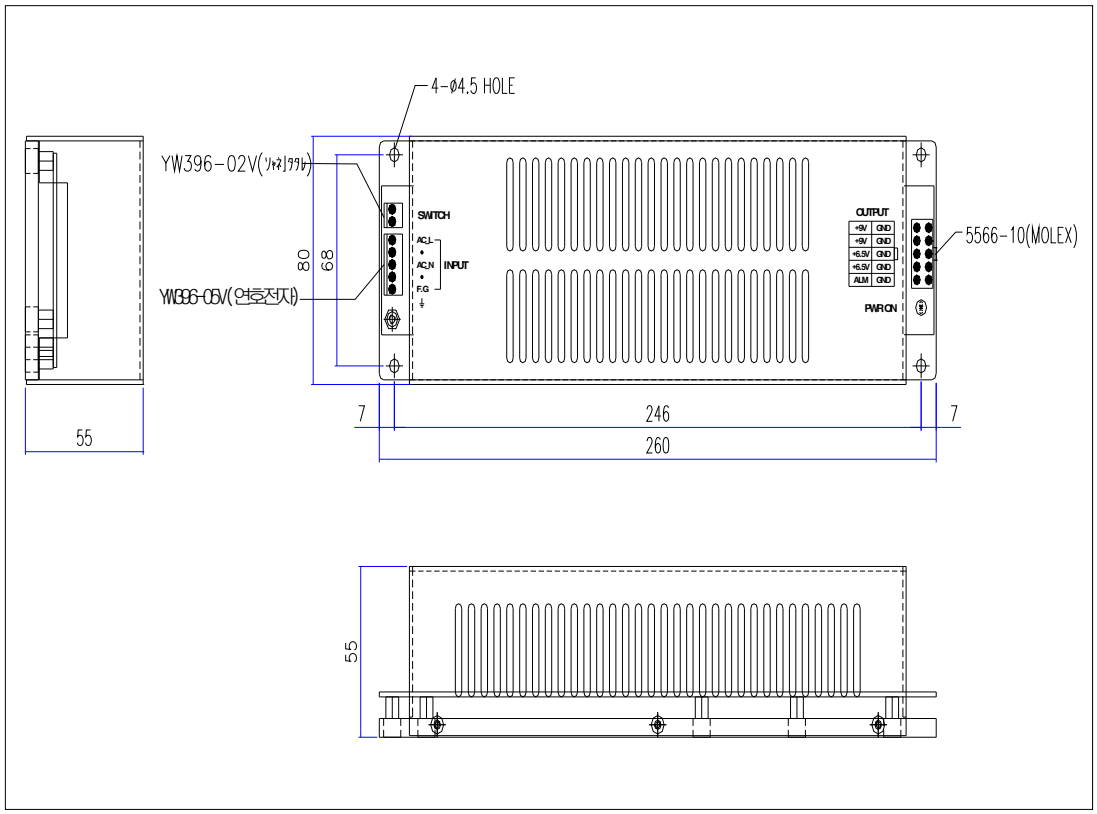
4.1.7. Function of modules

No	Module	Functions
1		[MHU NMS Controller] Monitors/controls the status and configurable items of each module in MHU
2		[PSU] Converts AC110V into DC9V and DC6.5V, and provide supply voltage to each module in MHU
3		[MRFCOM] Detects the FWD/RVS RF signal power level of input/output ports of the MHU. Also provides the connection pin to NMS controller and FSK modem. This module combines/divides the RF signal and FSK modem signal. Provides -20dB monitor port for Tx input/Rx output.
4		[FSK Modem] Data modem for MHU and RU communication MHU → RU frequency: 360MHz RU → MHU frequency: 340MHz
5		[DOM] Converts E/O(or O/E) the FWD and RVS signals. Wavelength: Tx 1310[nm], Rx 1550[nm]

4.1.8. PSU

PSU converts external AC110V into DC and supplies +9V, +6.5V to each module in MHU.

The drawing of PSU is as follows.



[PSU Capacity]

Output Voltage	Maximum current	Watt
+9V	3 A	59.5 W
+6.5V	5 A	

[PSU Pin Map]

SWITCH PIN Type: YW396-02V

Pin no.	1	2
Spec.	Switch_IN	Switch_Out

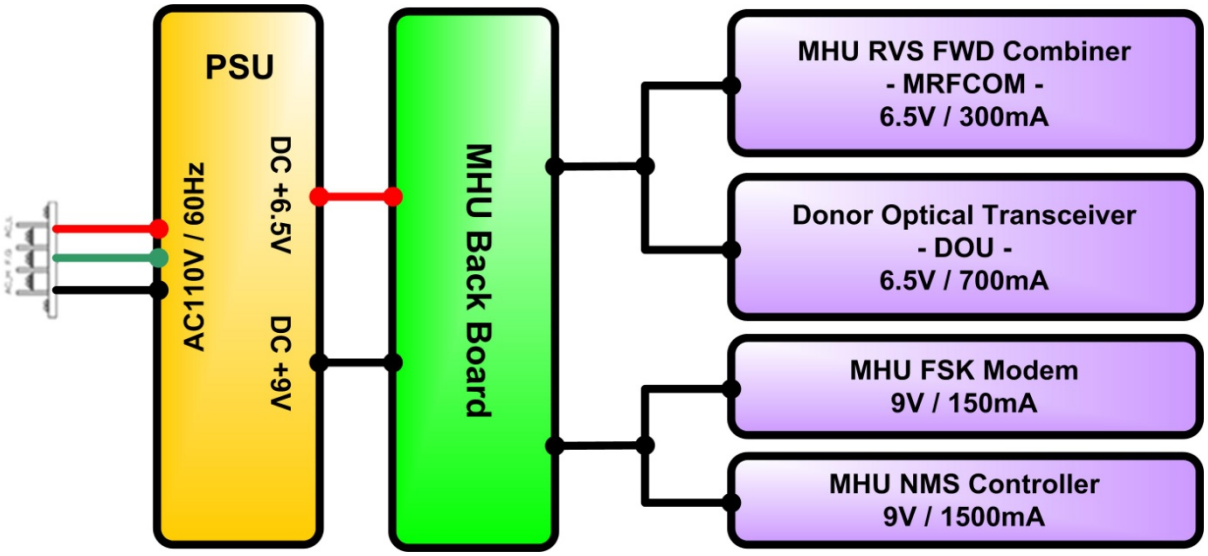
INPUT PIN Type: YW396-05V

Pin no.	1	2	3	4	5
Spec.	AC_L	N.C	AC_N	N.C	F.G

OUTPUT PIN type: 5566-10 (MOLEX)

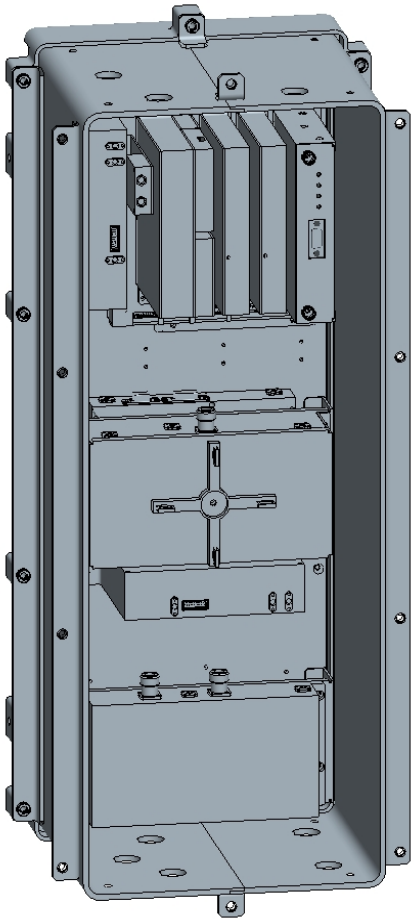
Pin no.	1	2	3	4	5
Spec.	ALARM	+6.5V	+6.5V	+9V	+9V
Pin no.	6	7	8	9	10
Spec.	GND	GND	GND	GND	GND

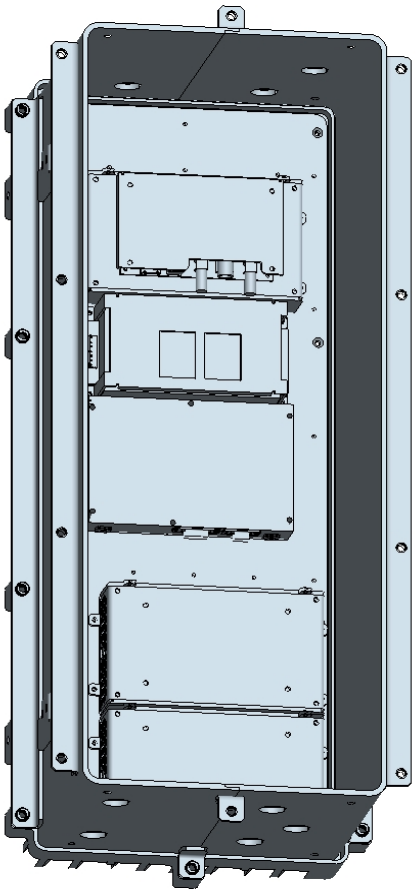
Power Distribution/Consumption Diagram

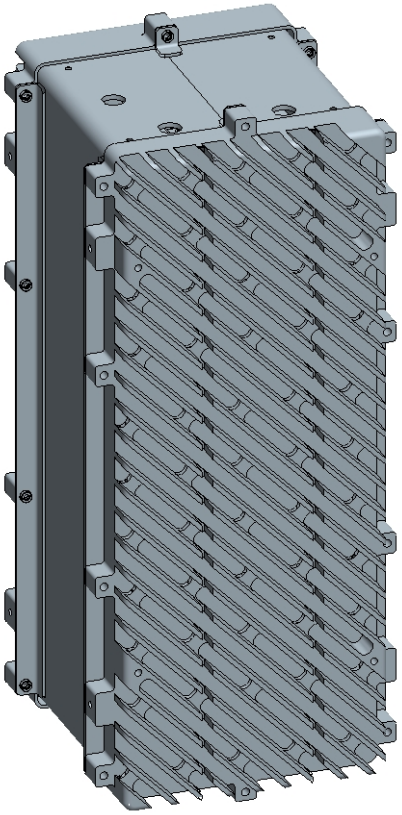


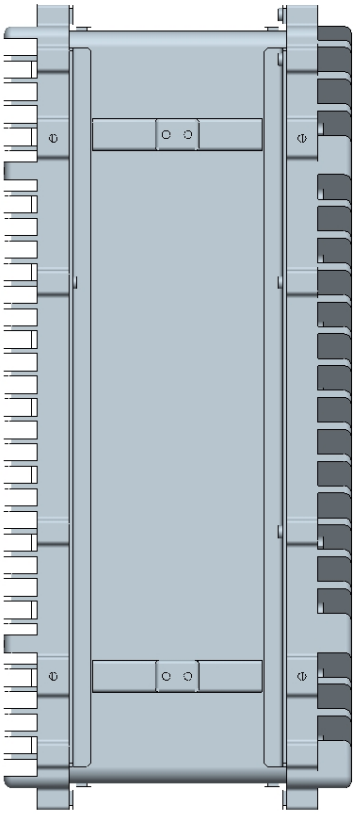
4.2. CM200D01 RU

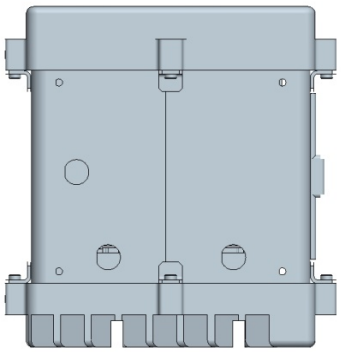
4.2.1. Mechanical Design

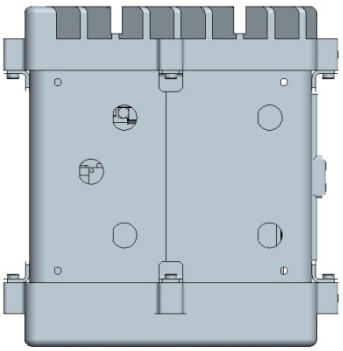






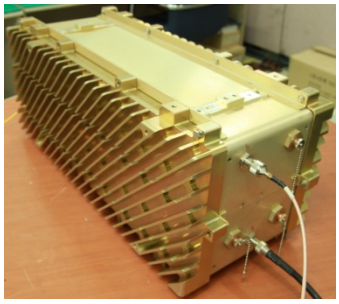




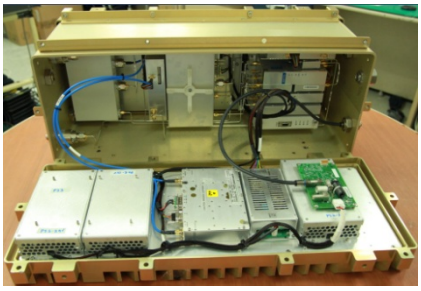


4.2.2. Dimension

⇨ **RU System picture and Size → 127(H) X 559(W) X 211(D) mm**



[Side]



[Inner Side]

[Front/Rear Side]

4.2.3. Mechanical Specification

No	Item	Description
1	Dimension & Weight	1. Dimension: 127(H) X 559(W) X 211(D) mm (plinth included) 2. Weight: TBD Kg
2	Method of Cooling	Natural convection (Heat-sink)
3	Door Locking Type	10 on each side using bolt lock
4	Optic Connector	1. Position: Cabinet inside 2. Connector type: FC/APC * Optic cable tray is provided inside of cabinet.
5	ANT PORT	1. located at the bottom side of cabinet 2. Connector Type: N Type Female
6	Power Input	1. Power: TBD 2. Position: bottom side of cabinet 3. Connector: TBD
7	Ground	TBD
8	Waterproof condition	IP65 compliant
9	Misc. Features	1. Easy to maintain 2. Pole mountable (i.e., telegraph pole) 3. Torque hinge used

4.2.4. Description of CM200D01 RU

[Forward path]

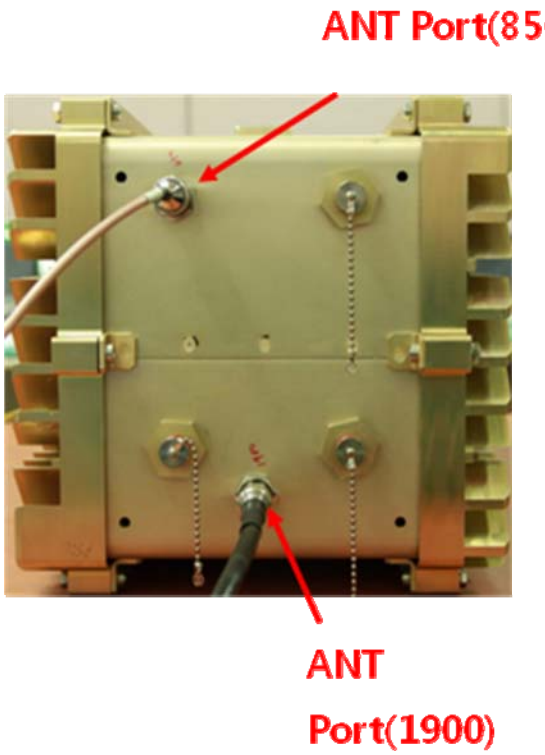
The RF and modem combined signals sent from the optic module of MHU is first divided into RF and modem signals at Divider in RU, then the 1900MHz Tx RF signal is amplified and filtered at the RFBS module, 850MHz Tx RF signal is amplified and filtered at the RFCHS module. The modem signal is conveyed to CPU of NMS controller through FSK modem. WCDMA signal is reduced by the Crest Factor passing through the CFR FPGA digital board inside RFBS and RFCHS. This technology enables reduction of PAPR for WCDMA signal increasing HPA efficiency. A higher efficiency HPA allows using a smaller enclosure with lower power consumption while decreasing OPEX for the service provider.

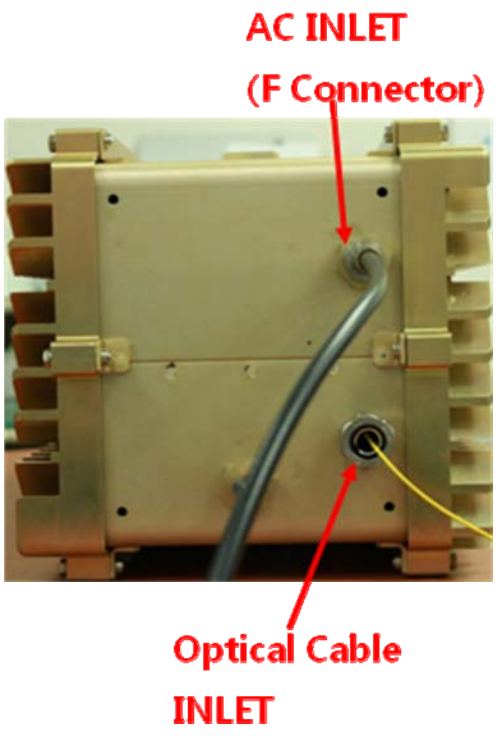
The GSM and WCDMA RF signals from the RFBS module is linearly amplified up to high power level on HPA, passed through the Front-End Filter Unit, and finally transmitted through an antenna.

[Reverse Path]

GSM and WCDMA Rx signals incoming from 1900MHz or 850MHz antenna are first passed by the Front-End Filter Unit, amplified by a low noise and high gain amplifier, filtered in RRBS(for 1900MHz band) or RRCHS(for 850MHz band), and combined with modem signal at combiner(RRCOM). The combined signal is then transmitted to MHU through the optic module.

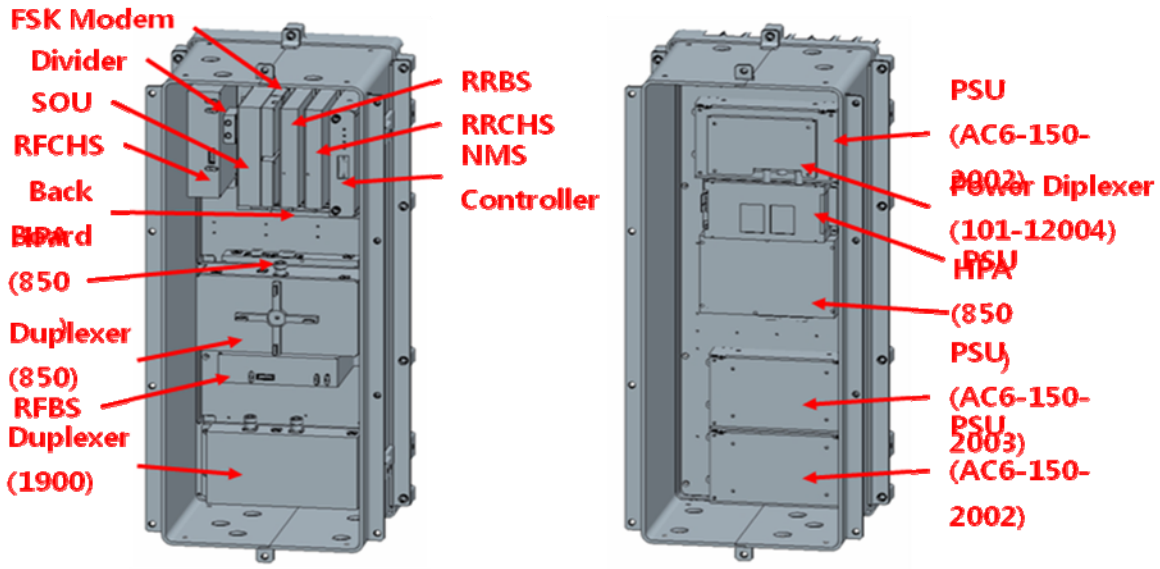
4.2.5. Port Configuration





No	Item	Description
1	AC INLET	Square wave AC Power Cable Connection Port
2	1900MHz ANT Port	1900MHz Band ANT RF Cable Connection Port
3	850MHz ANT Port	850MHz Band ANT RF Cable Connection Port
4	1900MHz Monitor Port	Monitor port coupled by -40dB relative to the output power of the 1900MHz ANT Port (Inside)
5	850MHz Monitor Port	Monitor port coupled by -40dB relative to the output power of the 850MHz ANT Port (Inside)
6	Optical Cable INLET	Optic cable connection Inlet

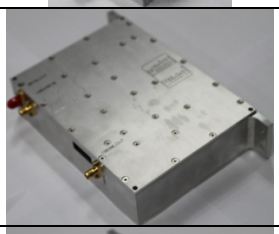
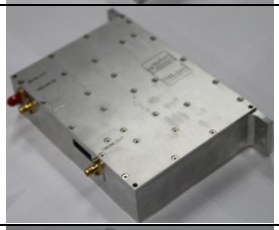
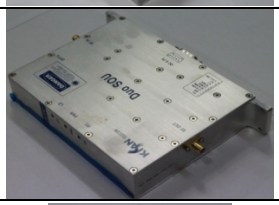
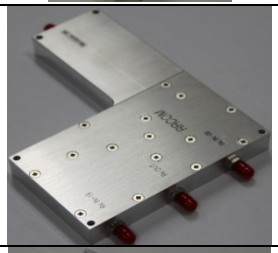
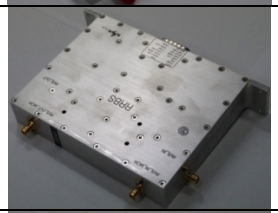
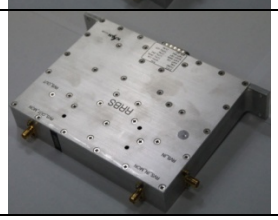
4.2.6. Module Composition of RU

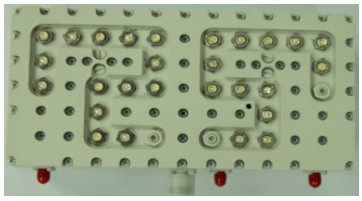
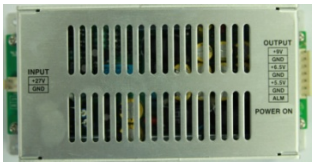
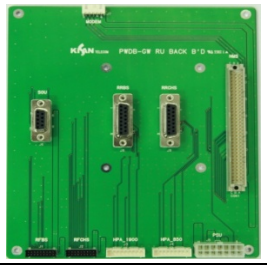


⇨ **Module operational voltage table**

No	Module	Voltage Used	Remarks
1	Divider		
2	RF FWD Band Selector for 1900MHz (RFBS)	6.5Vdc	
3	RF FWD Channel Selector for 850MHz (RFCHS)	6.5Vdc	
4	Slave Optical Transceiver Unit (SOU)	6.5Vdc	
5	RF Modem (FSK Modem)	9Vdc	
6	RU RVS COM for Signal combing (RRCOM)		
7	RU RVS Band Selector for 1900MHz (RRBS)	6.5Vdc	
8	RU RVS Band Selector for 850MHz (RRCHS)	6.5Vdc	
9	HPA for 1900MHz	29Vdc	
10	HPA for 850MHz	29Vdc	
11	FE-Duplexer(Front-End Filter Unit) for 1900MHz		
12	FE-Duplexer(Front-End Filter Unit) for 850MHz		
10	PSU	TBD	
11	NMS Controller	9Vdc	
12	Back Board Ass'y	6.5Vdc / 9Vdc	

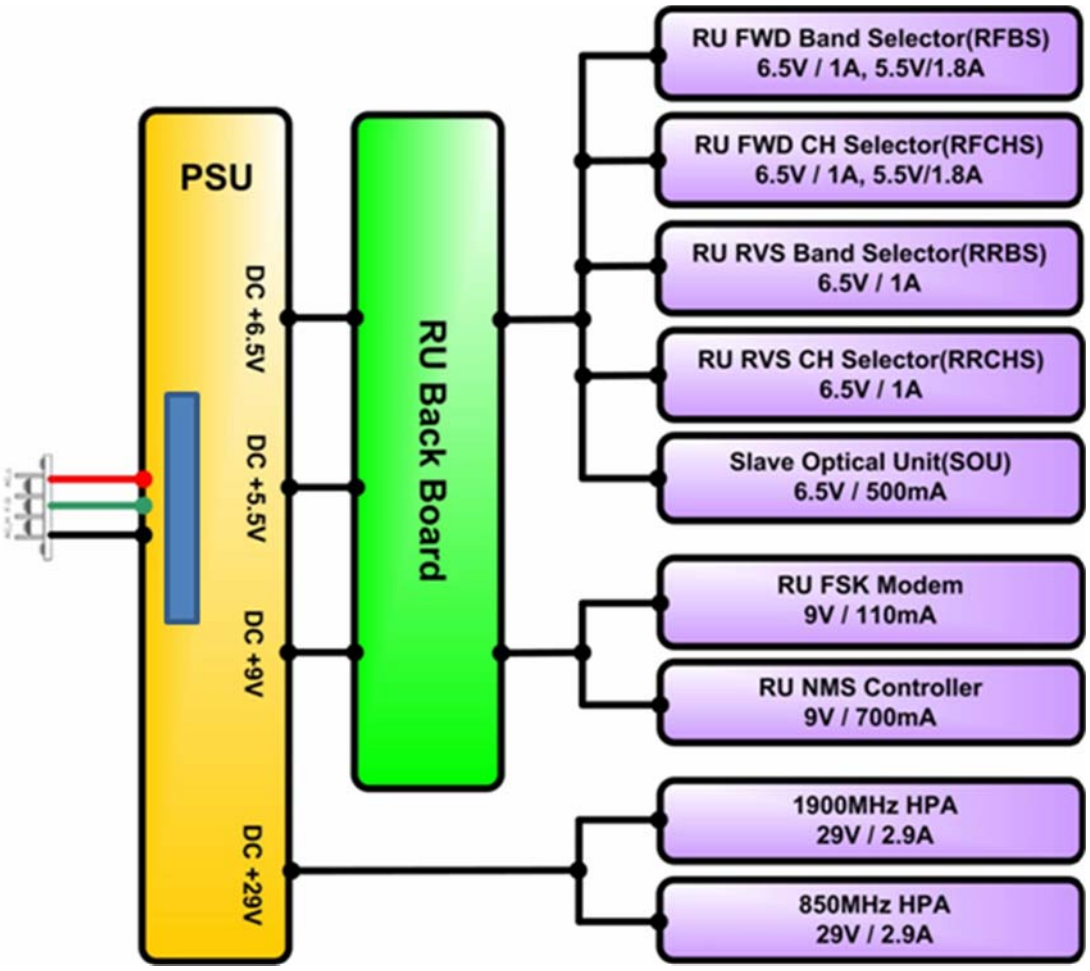
4.2.7. Function of Modules

No	Module	Description
1		[Divider] Divides signals into RF and modem signals and sends to RFBS/RFCHS and FSK modem.
2		[RFBS] Controls the gain of 1900MHz FWD path, filters FWD band, controls the crest factor of 1900MHz FWD signal, and performs the ALC function. Output of the module is sent to 1900MHz HPA.
3		[RFCHS] Controls the gain of 850MHz FWD path, filters FWD band, controls the crest factor of 850MHz FWD signal, and performs the ALC function. Output of the module is sent to 850MHz HPA.
3		[SOU] Performs E/O (or O/E) conversion for FWD and RVS signals. Wavelength: TX 1550[nm], RX 1310[nm]
4		[FSK Modem] Data modem for RU and MHU communication RU → MHU frequency: 340MHz MHU → RU frequency: 360MHz
5		[RRCOM] Combines RVS 850MHz, 1900MHz and Modem signals, and provides the combined signal to optical module in order to perform E/O conversion.
6		[RRBS] Amplifies RVS 1900MHz signal by low noise high gain, filters for the desirable band and controls the RVS path gain of RU.
6		[RRCHS] Amplifies RVS 850MHz signal by low noise high gain, filters for the desirable band and controls the RVS path gain of RU.

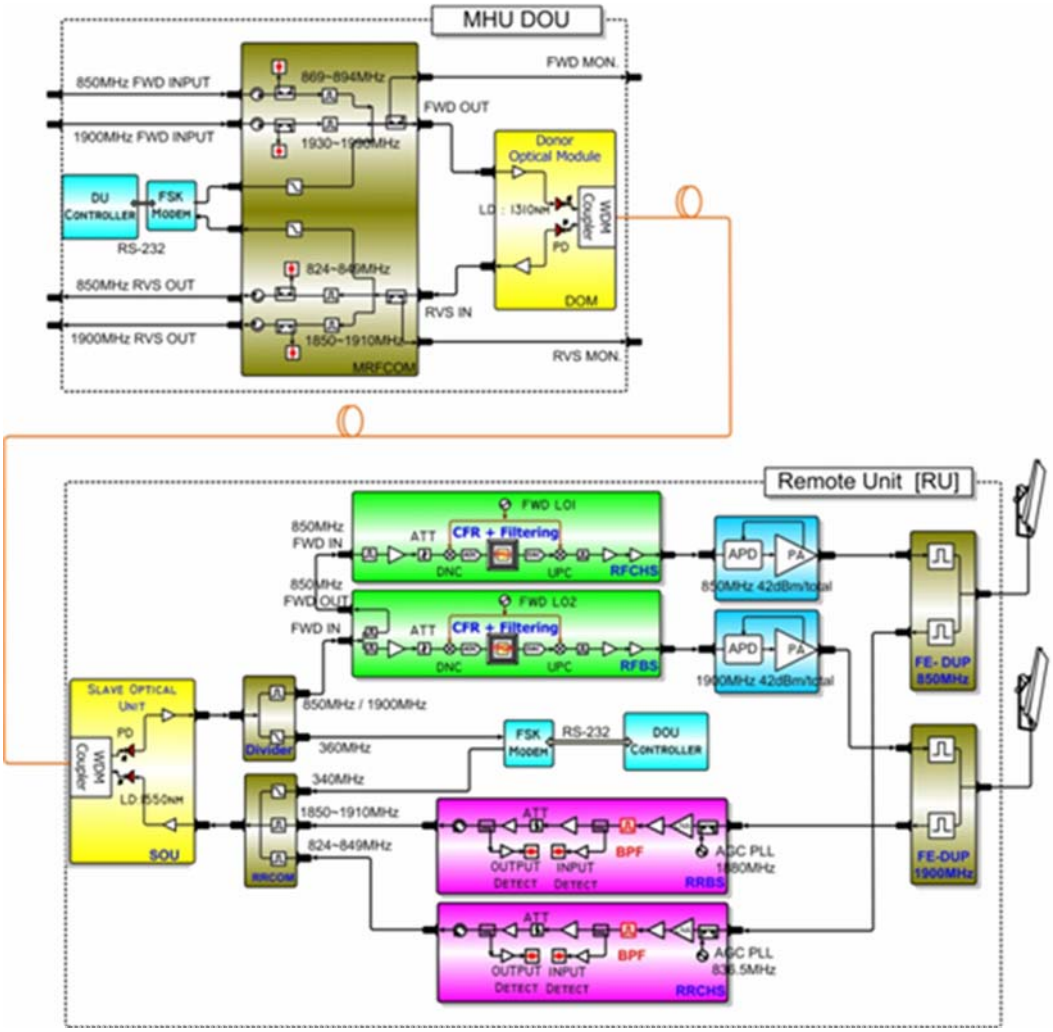
8		[1900MHz HPA] 16Watt(42dBm) High power amplifier that amplifies the RU 1900MHz signal by linearizer and sends to RU ANT through the 1900MHz FE-Duplexer.
8		[850MHz HPA] 16Watt(42dBm) High power amplifier that amplifies the RU 850MHz signal by linearizer and sends to RU ANT through the 850MHz FE-Duplexer.
		[1900MHz FE-Duplexer] Front end duplexer that passes through 1900MHz desired FWD and RVS frequency bands.
9		[850MHz FE-Duplexer] Front end duplexer that passes through 850MHz desired FWD and RVS frequency bands.
10		[PSU] Converts DC TBD V to DC 29V/9V/6.5V/5.5V, and distributes the necessary power to each modules.
11		[NMS Controller] Monitors the status of modules in RU and controls the configurable parameters of the RU modules.
12		[Interface BD] Provides operating voltage and monitors/controls signal to modules connected to interface B'D. Also provides a connection port to communicate with NMS B'D.

		**[PSU]** **Converts SQAC to DC 29V**
		**[PSU]** **Converts SQAC to DC 12V**
		**[Power Diplexer]** **Divide SQAC input**

⇨ **Power Distribution Diagram**



5. Block Diagram



6. Administration Program (RptMan-PWDUAL)

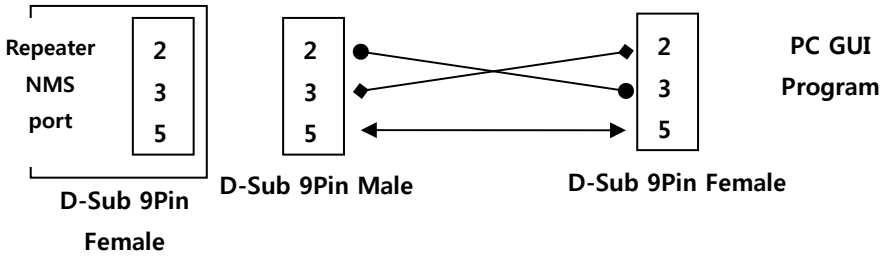
Administration program (RptMan-PWDUAL) is a management program for CM200D01 and provides status monitoring and controlling functions to users.

6.1. System Requirement

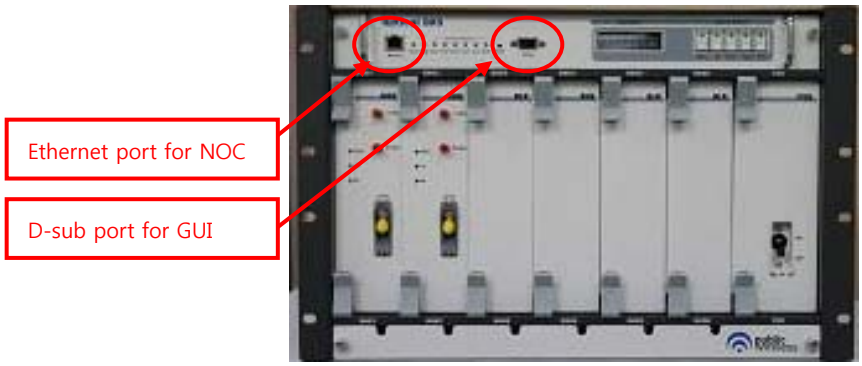
- ⇨ **System: Desktop or laptop PC**
- ⇨ **OS: Windows XP or later version**
- ⇨ **Resolution: 1024 ✖ 768 or more**
- ⇨ **Connection Cable: 9 pin serial cable (cross type)**

6.2. Cable connection

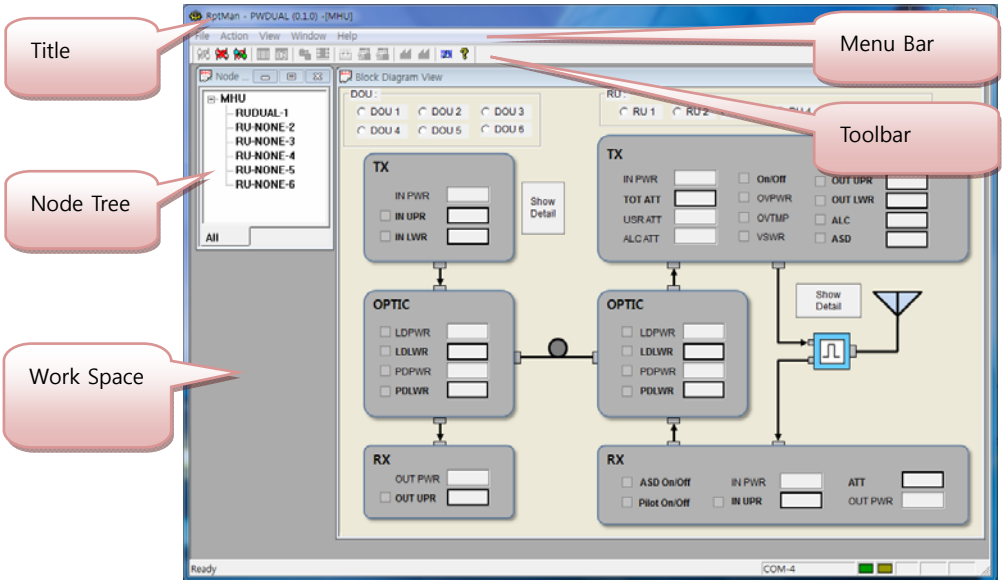
The cable connection between repeater and PC (GUI program) is illustrated below.

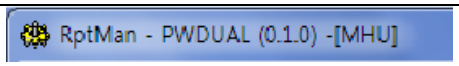


The NMS port of MHU provides two ports; one is a D-sub port for local GUI. The other is an Ethernet port for NOC (Network Operating Center).



6.3. Screen



Section	Description
Window Title	 Displays the name of management program(GUI), i.e. RptMan-PWDUAL. Displays the type of equipment currently connected to the program (MHU or RU).
Menu Bar	 Presents working menu for operators. It is associated with tool icons, which can activate the tool bar menus.
Toolbar	 Presents icons (button type) for frequently used commands. User-friendly icons are used. Icons are activated or disabled as to the status of repeater.
Work Space	Status information and control functions are provided with a block diagram view of MHU and RU. Provides the working space for windows or dialogs.

6.4. Status Display

Status of repeater is displayed by LED's and values.

⇨ LED

- Alarm: ■/■ blinking indicates ALARM, ■ indicates NORMAL
- On/Off: ■ ON, ■ OFF
  Exception) for HPA, ■ is ON, ■ is OFF

⇨ Value

- Units are not displayed.
- Value displayed in box (0.0)

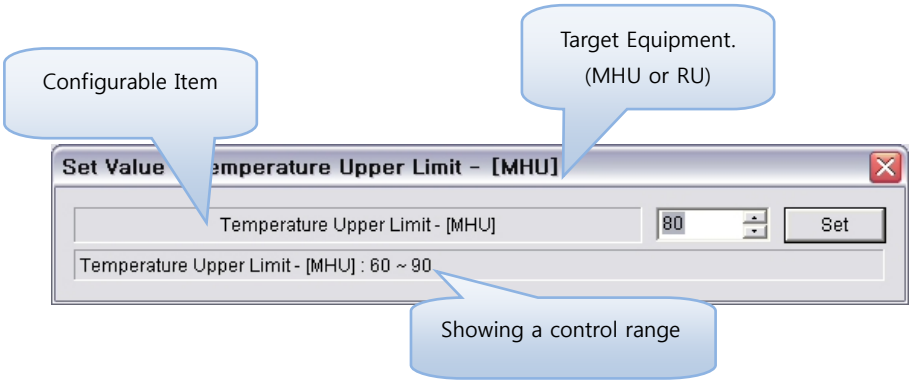
⇨ Control

- The shape of mouse cursor is changed to on controllable parameters.
- The texts of controllable LED or values are displayed in BOLD font.

6.5. Control Policy

⇨ System parameter can only be controlled one at a time.

⇨ Click a control item (button) to bring up a control popup dialog window.



⇨ Once a dialog popup window is opened, it stays there for repeated control until user closes the window.

6.6. Menu

Menu	Sub Menu	Function
File	Connect	Establishes connection between PC(GUI) and repeater
	Disconnect	Disconnects connection between PC(GUI) and repeater
	Exit	Finishes admin program.
Action	Power Table	Presents RF/Optic power table
	TC Table	Presents temperature compensation table
	Image Compression	Compress the firmware file (executable file of repeater) for download
	MHU image download	Downloads compressed firmware file to MHU equipment
	RU image download	Downloads compressed firmware file to RU equipment

	Factory Setting	Restores all parameter values to initial factory settings
	System action	Not available
	Gain Setting	Tx: set ATT to have 35dBm on the remote ANT output. Rx: set ATT to have 40dB of Rx total gain from RU to MHU including optical loss.
	Polling period	Controls the polling period between PC and repeater
View	Block window	Presents system window including MHU and RU
	MHU Window	Presents MHU status window in work space
	RU Remote Window	Presents RU status window in work space
Window	Cascade	Cascade or tile horizon arrangement of repeater status windows in work space
	Tile Horizon	
	Arrange icons	Arrange all icons under many window is opened
	Close all	Close all window
	Packet Debug	Presents debug window in workspace displaying packets between repeater and GUI program
Help	About RptMan.Dual	Displays the version information of GUI program, RptMan (Repeater Manager)

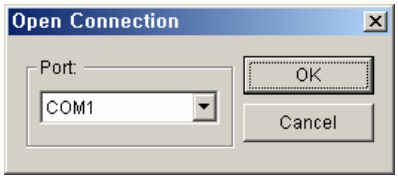
6.7. Toolbar

ITEM	ICON	Function
Communication Establishment		Establishes RS-232C connection to the repeater, then GUI starts to communicate and status of repeater are polled and displayed.
Communication Disconnection		Disconnects communication with connected repeater. Repeater status is not updated.
Polling Stop/Resume		Stops or resumes polling action of GUI program. (activated in toggling way)
Power Table		Presents RF/Optic power table
T/C table		Presents temperature compensation table
Debug Packet		Displays packet data between GUI and repeater like protocol analyzer and it may help debugging of software
Compression of image file		Compresses image file of repeater
Gain Setting		TX: set ATT to have 35dBm of output at the RU ANT Port RX: set ATT to have 40dB gain of Rx path → Tx/Rx Gain setting function carry out Tx/Rx gain setting including optical loss compensation automatically.
MHU Download		Download MHU firmware files to MHU equipment.
RU Download		Download RU firmware files to RU equipment.

MHU Factory Setting		Initialize MHU parameters to factory setting values.
RU Factory Setting		Restores RU parameters back to original factory setting values.
Help		Shows version information

6.8. Program operation

6.8.1. Initiating communication

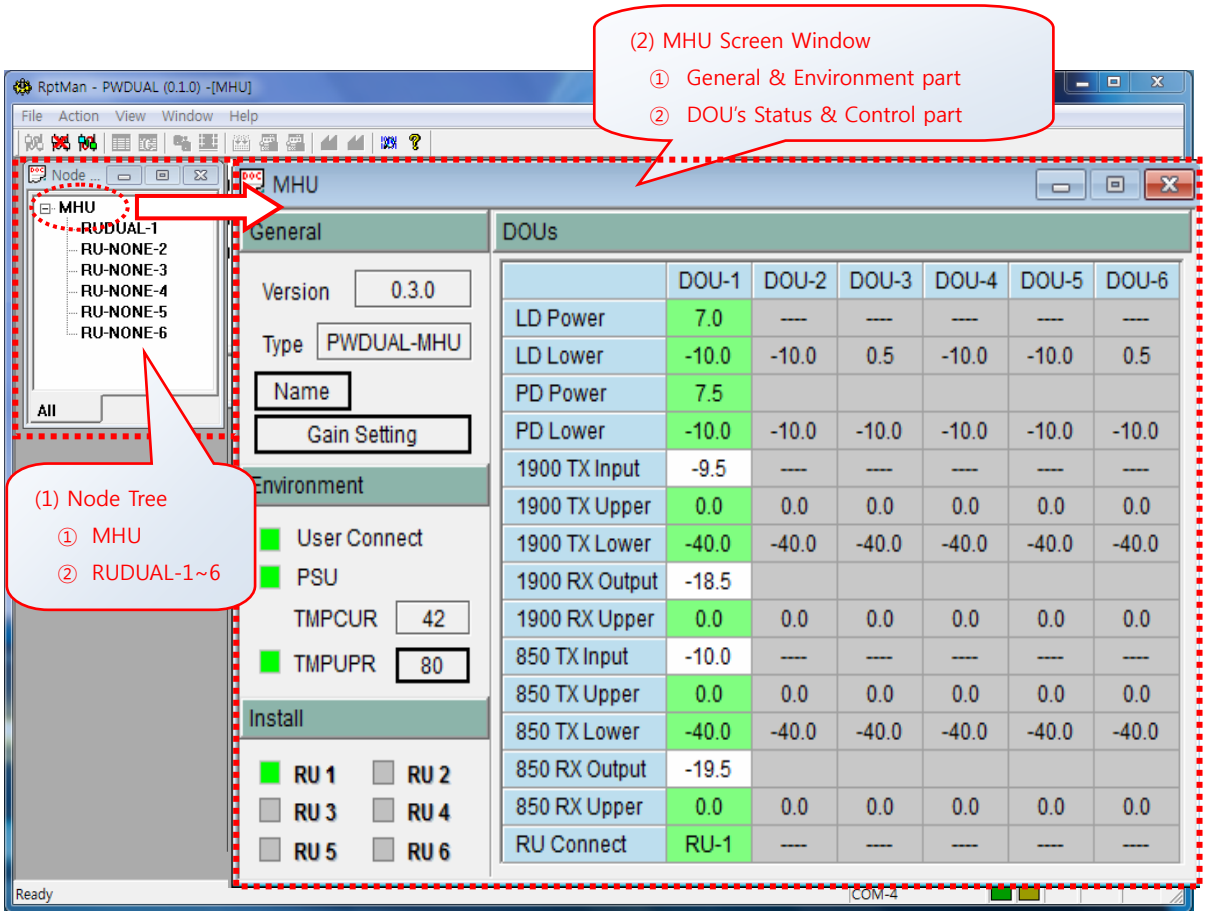


Function	Establishing communication between GUI and repeater	
Method	Click  button in toolbar of GUI program	
Description	Port	Combo box to set the com port (COM1, COM2, …)
	OK Button	Initiates communication between GUI and repeater, then closes this popup window("Open Connection") When communication port is established correctly, you can see the communication status by blinking icons.  (right-bottom side of the main screen)
	Cancel Button	Cancels and closes the popup window

6.8.2. Disconnect

Function	Disconnecting GUI from repeater
Method	Click  button in toolbar of GUI program
Description	The communication between GUI on PC and repeater becomes disconnected.

6.8.3. CM200D01 MHU Status Retrieval and Control

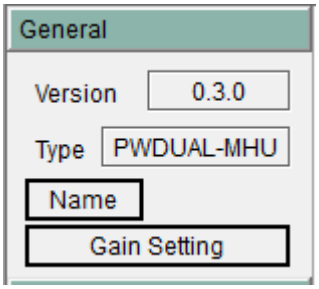
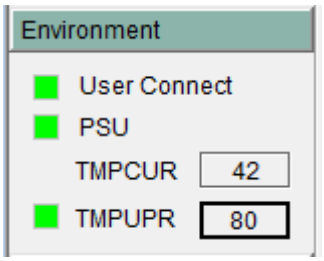
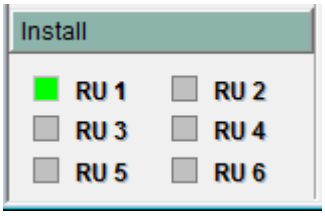
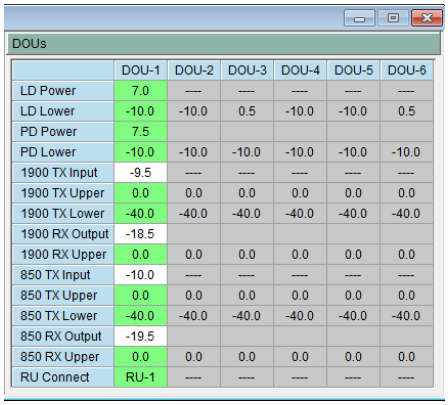


(1) Node Tree: This window displays the tree configuration of RUs connected with MHU

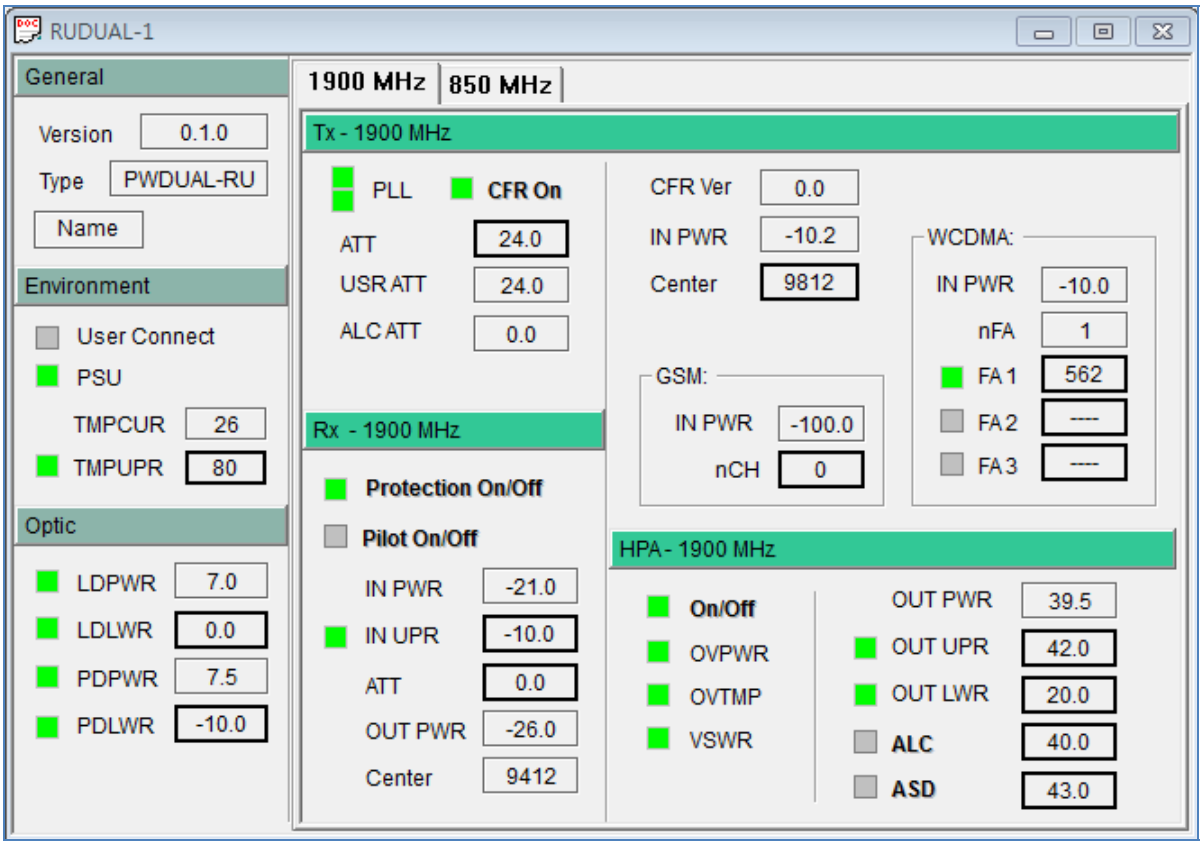
(1) Nose Tree	**① MHU**	**Press MHU to open the MHU screen**
	② RUDUAL-1 ~ 6	**Press RUDUAL-# to open each RU screen**

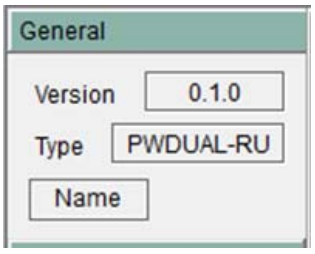
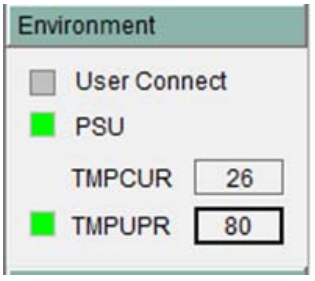
(2) MHU Screen window

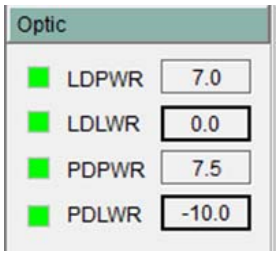
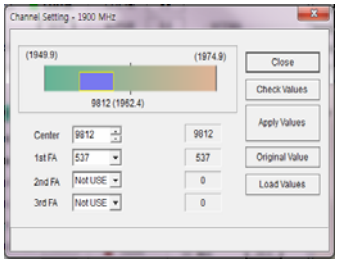
(2) MHU Screen	**① General & Environment**	**This part includes common parameter of MHU like system information or environments**
	② DOU Status/Control	**This screen provides information on 6DOUs** **➔ LD Power & Lower limit value** **➔ PD Power & Lower limit value** **➔ Tx Input, Rx Output Power & Limit value** **➔ RU Install information**

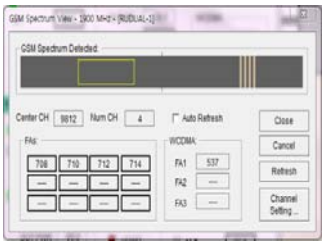
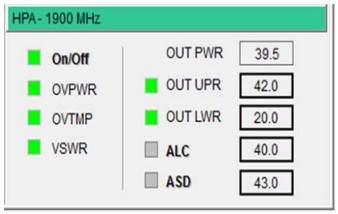
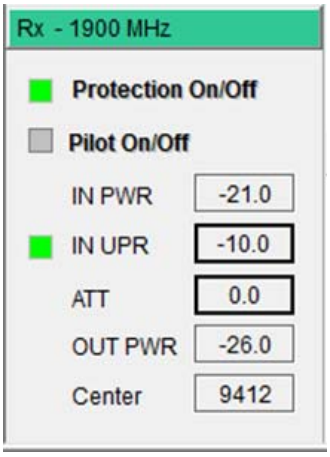
Group	Description
	⇨ Version: Firmware Versoin ⇨ Type: Repeater unit type ⇨ Name: ID of MHU for the communication ⇨ Gain Setting ■ TX: sets ATT to have 35dBm of output at the RU ANT Port ■ RX: sets ATT to have 40dB gain of Rx path ■ Tx/Rx Gain setting function carries out Tx/Rx gain setting including automatic optical loss compensation.
	⇨ User Connect: Connection status of COM port of repeater ⇨ PSU: Status of PSU ⇨ TMPCUR: Current temperature of the equipment ⇨ TMPUPR: set the upper threshold value of temperature (button) and alarm status (LED)
	⇨ Install: This sets up the RU to communicate with MHU. Even when an RU is connected to MHU physically by optic cable, the RU cannot communicate with MHU if RU is not installed logically by GUI.
	⇨ LD Power: Transmitted optical power level to RU ⇨ LD Lower: Lower limit level of the LD power ⇨ PD Power: Received optical power level from RU ⇨ PD Lower: Lower limit level of the PD power ⇨ 1900 Tx Input: Tx level input from 1900MHz BTS ⇨ 1900 Tx Upper: Upper limit of Tx input level ⇨ 1900 Tx Lower: Lower limit of Tx input level ⇨ 1900 Rx output: Rx level output to 1900MHz BTS ⇨ 1900 Rx Upper: Upper limit of Rx output level ⇨ 850 Tx Input: Tx level input from 850MHz BTS ⇨ 850 Tx Upper: Upper limit of Tx input level ⇨ 850 Tx Lower: Lower limit of Tx input level ⇨ 850 Rx output: Rx level output to 850MHz BTS ⇨ 850 Rx Upper: Upper limit of Rx output level ⇨ RU install: display the RU installation status

6.8.4. CM200D01 RU Status Retrieval and Control



Group	Description
	⇨ **Version: Firmware version** ⇨ **Type: Type of repeater** ⇨ **Name: Set the Name, ID, Serial No. of repeater RU**
	⇨ **User Connect: Connection status of COM port of repeater** ⇨ **PSU: Status of PSU** ⇨ **TMPCUR: Current temperature in repeater RU** ⇨ **TMPUPR: Value/control of upper threshold of temperature (button) and alarm status (LED)**

	⇨ LDPWR: Value of LD power (box) and status of LD (LED) ⇨ LDLWR: Value/control of lower threshold of LD power (button) and lower alarm status of LD power (LED) ⇨ PDPWR: Value of PD power (box) and status of PD (LED) ⇨ PDLWR: Value/control of lower threshold of PD power (button) and lower alarm status (LED)
	⇨ RU parameters for 1900MHz/850MHz band are displayed by the tab selection. Each band has the identical items which can be monocored and controlled.
	⇨ PLL: Alarm LED for 2 PLL's ⇨ CFR On: On/Off status of Crest Factor Reduction function ⇨ ATT: Sets ATT to control FWD gain, and shows its value. Displayed ATT value = USR ATT + ALC ATT ⇨ USR ATT: This is the main FWD Gain setting point. It is used for FWD auto gain setting or gain fine tuning ⇨ ALC ATT: When HPA output level is higher than ALC level it automatically controls FWD gain to maintain output level below HPA ALC level. ⇨ CFR On: On/Off control the Crest factor reduction function ⇨ INPWR: Input total power level on CFR board ⇨ Center: Set the center frequency of FWD band by GSM CH No. ⇨ GSM INPWR: This indicates signal power of GSM ⇨ GSM nCH: Indicates the current no. of GSM CH. When pressed, more information about GSM CHs can be viewed. ⇨ WCDMA INPWR: Indicates signal power of WCDMA ⇨ WCDMA nFA: Indicates the current no. of WCDMA FA ⇨ WCDMA FA1/FA2/FA3: This is to set the WCDMA CH to apply the CFR function to WCDMA FA's.
	⇨ Channel Setting Window for WCDMA CH and band center ⇨ Center: 25MHz operating band center frequency setting ⇨ 1st~3rd FA: WCDMA FA setting for WCDMA CFR function ⇨ Apply Values: setting action for Center and WCDMA CH ⇨ Load Values: verification action for set valuses after setting the Center and WCDMA CH

	⇨ GSM Spectrum View Window ⇨ Center CH: GSM CH for center freq. of 25MHz band ⇨ Num CH: Number of GSM CH currently dectected ⇨ FAs: GSM CH of spectrum displayed “GSM spectrum detected” window ⇨ WCDMA FA1~FA3: Currently set WCDMA FA CH.
	⇨ On/Off: Status/control the operation state of HPA ⇨ OVTMP: Alarm status of HPA Over-temperature ⇨ OVPWR: Alarm status of HPA Over-Power ⇨ VSWR: Alarm status of HPA VSWR ⇨ OUT PWR: Output power level of HPA(box) ⇨ OUT UPR: Display/control of upper threshold of HPA output power(button), alarm status(LED) ⇨ OUT LWR: Value/control of lower threshold of HPA output power(button), alarm status(LED) ⇨ ALC: Set ALC level for HPA output, and shows ALC on/off status of function(LED). ⇨ ASD(Auto Shutdown): ASD level(button), and shows ASD on/off status of function(LED).
	⇨ Protection On/Off: In order to protect RU from over input RVS(Rx) signal power. In case that input signal is more than IN UPR level, RU shuts down and LED is changed to RED. ⇨ Pilot On/Off: Sets CW signal generation, and shows its status. It is used for RVS gain setting. ⇨ IN PWR: RVS power value at the LNA output point ⇨ IN UPR: Sets RVS input upper threshold, and shows the alarm status of input upper threshold. ⇨ OUTPWR: RVS RF output power of RRBS(RRCHS) ⇨ ATT: Sets ATT to control RVS gain, and shows it’s value. ⇨ Center Freq: It indicates pilot signal frequency value. This value changes with FWD(Tx) center frequency automatically.

6.8.5. Firmware download

Firmware download is performed when system needs to be updated.

Downloading improper images (executable file of repeater CPU) may cause harmful damages to equipment.

The following steps should be taken for firmware download.

① Convert firmware source file (*.bin) to a downloadable file format.

Main menu: Action → Image Compression, toolbar: 

② Open a pop-up window showing the status of the target equipment for firmware download.

Step 1) Main menu View ¡æ Select Donor Windows or Remote Windows

Step 2) In Block View Dialog window, select Donor Windows or Remote Windows

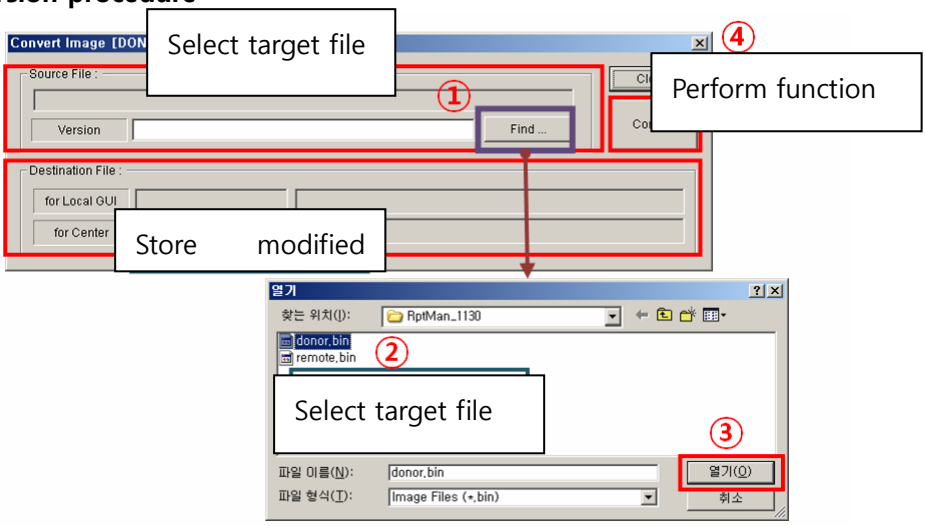
③ Download firmware to the target equipment.

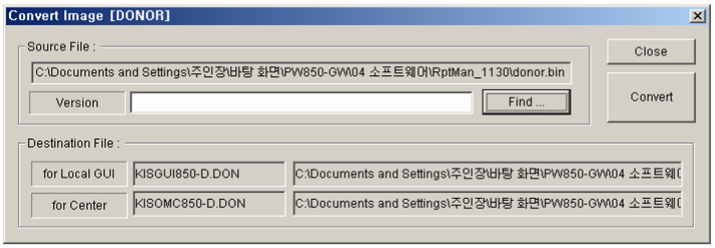
Step 1) Main menu Action ¡æ select Image Download menu

Step 2) In toolbar, select  **for MHU, and select**  **for RU**

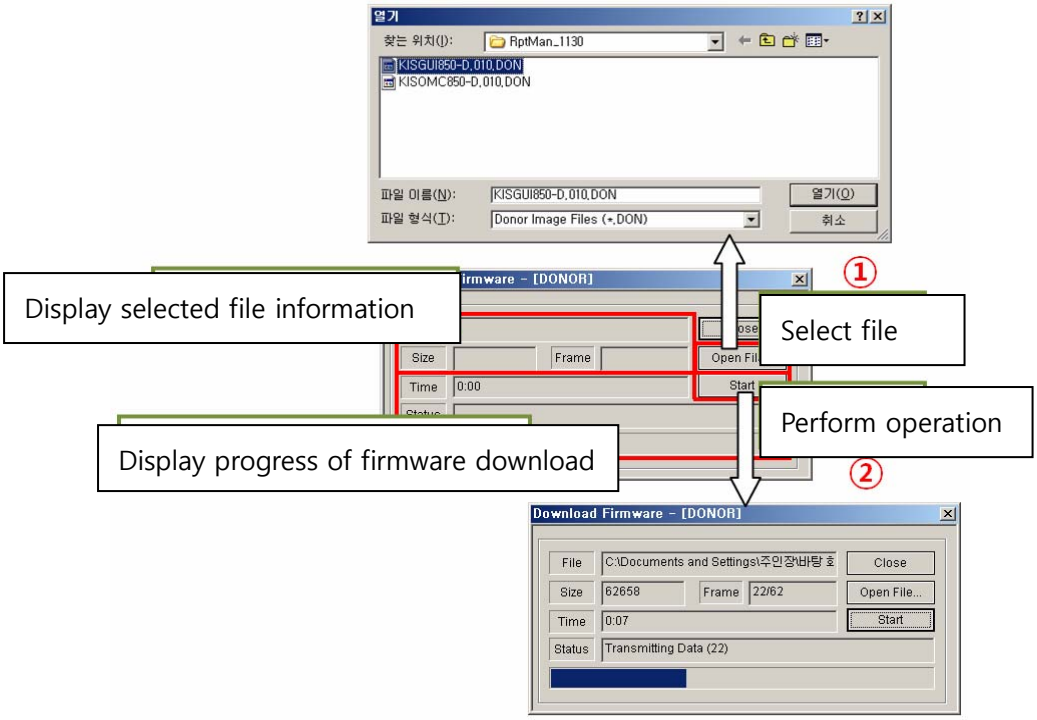
Download firmware after selecting the firmware file for the target equipment.

File conversion procedure





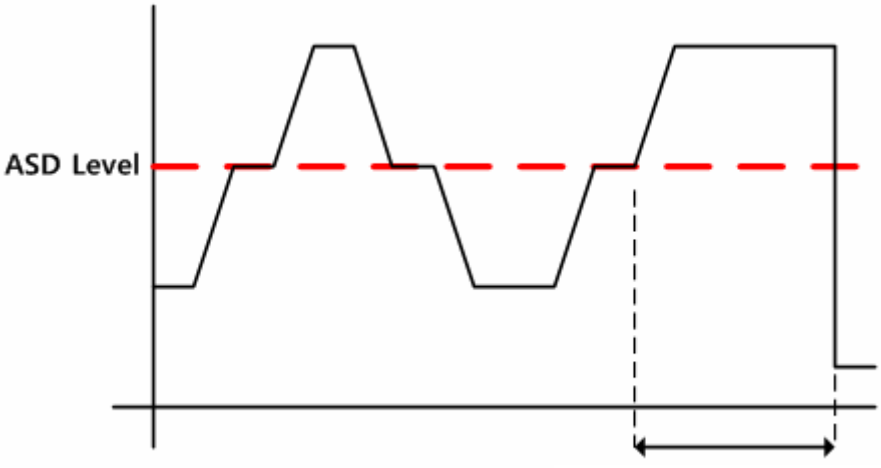
Download procedure



6.9. Additional features

6.9.1. ASD (Auto Shutdown) Function

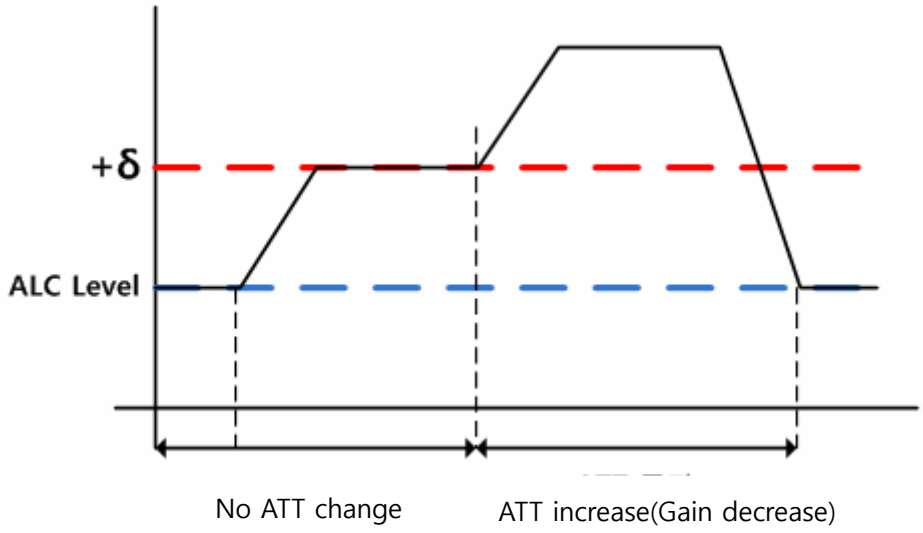
1. **If the power level is above the shut down level for longer than 1 second, turn off HPA.**
2. **During shutdown state, monitor RU input power. If the level is below 5dB from shut down level, turn on HPA automatically.**
3. **Monitor HPA output power in normal operation, and monitor RU input power during shut down.**



Longer than 1 sec, HPA off

6.9.2. ALC (Auto Level Control) Function

1. **If the power level reaches the ALC level, prevent from transmitting higher than ALC level by using ATT control.**
2. **By storing the existing ATT value, the ATT value before ALC can be reused even when the power is reduced.**



Appendix A Factory setting value for each equipment

MHU		RU	
Item	Value	Item	Value
MHU TEMP UPR	80	RU TEMP UPR	80
1900/850MHz Tx IN UPR	0	RFBS, RFCHS ATT	30
1900/850MHz Tx IN LWR	-10	Hidden ATT	N.A
1900/850MHz Rx OUT UPR	0	PLL	N.A
Optic LD LWR	0	-	N.A
Optic PD LWR	-10	HPA-850, HPA-1900 On/off	Off
		HPA-850, HPA-1900 OUT UPR	42
		HPA-850, HPA-1900 OUT LWR	20
		HPA-850, HPA-1900 ALC Level	40
		HPA-850, HPA-1900 ALC On/Off	ON
		HPA-850, HPA-1900 ASD Level	43
		HPA-850, HPA-1900 ASD On/Off	ON
		RRBS, RRCHS ASD	ON
		RRBS, RRCHS IN UPR	-50
		RRBS, RRCHS ATT	30
		RRBS, RRCHS PLL	N.A
		Optic LD LWR	0
		Optic PD LWR	-10

Appendix B 1900MHz GSM & WCDMA Frequency Map

✧ **Gray Channels are not used**

GSM		WCDMA		WCDMA	
Channel	Center freq.(MHz)	Channel	Center freq.(MHz)	Channel	Center freq.(MHz)
511	1930.0	9650	1930.0	400	1930.1
512	1930.2	9651	1930.2	401	1930.3
513	1930.4	9652	1930.4	402	1930.5
514	1930.6	9653	1930.6	403	1930.7
515	1930.8	9654	1930.8	404	1930.9
516	1931.0	9655	1931.0	405	1931.1
517	1931.2	9656	1931.2	406	1931.3
518	1931.4	9657	1931.4	407	1931.5
519	1931.6	9658	1931.6	408	1931.7
520	1931.8	9659	1931.8	409	1931.9
521	1932.0	9660	1932.0	410	1932.1
522	1932.2	9661	1932.2	411	1932.3
523	1932.4	9662	1932.4	412	1932.5
524	1932.6	9663	1932.6	413	1932.7
525	1932.8	9664	1932.8	414	1932.9
526	1933.0	9665	1933.0	415	1933.1
527	1933.2	9666	1933.2	416	1933.3
528	1933.4	9667	1933.4	417	1933.5
529	1933.6	9668	1933.6	418	1933.7
530	1933.8	9669	1933.8	419	1933.9
531	1934.0	9670	1934.0	420	1934.1
532	1934.2	9671	1934.2	421	1934.3
533	1934.4	9672	1934.4	422	1934.5
534	1934.6	9673	1934.6	423	1934.7
535	1934.8	9674	1934.8	424	1934.9
536	1935.0	9675	1935.0	425	1935.1
537	1935.2	9676	1935.2	426	1935.3
538	1935.4	9677	1935.4	427	1935.5
539	1935.6	9678	1935.6	428	1935.7
540	1935.8	9679	1935.8	429	1935.9
541	1936.0	9680	1936.0	430	1936.1
542	1936.2	9681	1936.2	431	1936.3
543	1936.4	9682	1936.4	432	1936.5
544	1936.6	9683	1936.6	433	1936.7
545	1936.8	9684	1936.8	434	1936.9

546	1937.0		9685	1937.0	435	1937.1
547	1937.2		9686	1937.2	436	1937.3
548	1937.4		9687	1937.4	437	1937.5
549	1937.6		9688	1937.6	438	1937.7
550	1937.8		9689	1937.8	439	1937.9
551	1938.0		9690	1938.0	440	1938.1
552	1938.2		9691	1938.2	441	1938.3
553	1938.4		9692	1938.4	442	1938.5
554	1938.6		9693	1938.6	443	1938.7
555	1938.8		9694	1938.8	444	1938.9
556	1939.0		9695	1939.0	445	1939.1
557	1939.2		9696	1939.2	446	1939.3
558	1939.4		9697	1939.4	447	1939.5
559	1939.6		9698	1939.6	448	1939.7
560	1939.8		9699	1939.8	449	1939.9
561	1940.0		9700	1940.0	450	1940.1
562	1940.2		9701	1940.2	451	1940.3
563	1940.4		9702	1940.4	452	1940.5
564	1940.6		9703	1940.6	453	1940.7
565	1940.8		9704	1940.8	454	1940.9
566	1941.0		9705	1941.0	455	1941.1
567	1941.2		9706	1941.2	456	1941.3
568	1941.4		9707	1941.4	457	1941.5
569	1941.6		9708	1941.6	458	1941.7
570	1941.8		9709	1941.8	459	1941.9
571	1942.0		9710	1942.0	460	1942.1
572	1942.2		9711	1942.2	461	1942.3
573	1942.4		9712	1942.4	462	1942.5
574	1942.6		9713	1942.6	463	1942.7
575	1942.8		9714	1942.8	464	1942.9
576	1943.0		9715	1943.0	465	1943.1
577	1943.2		9716	1943.2	466	1943.3
578	1943.4		9717	1943.4	467	1943.5
579	1943.6		9718	1943.6	468	1943.7
580	1943.8		9719	1943.8	469	1943.9
581	1944.0		9720	1944.0	470	1944.1
582	1944.2		9721	1944.2	471	1944.3
583	1944.4		9722	1944.4	472	1944.5
584	1944.6		9723	1944.6	473	1944.7
585	1944.8		9724	1944.8	474	1944.9
586	1945.0		9725	1945.0	475	1945.1

587	1945.2		9726	1945.2		476	1945.3
588	1945.4		9727	1945.4		477	1945.5
589	1945.6		9728	1945.6		478	1945.7
590	1945.8		9729	1945.8		479	1945.9
591	1946.0		9730	1946.0		480	1946.1
592	1946.2		9731	1946.2		481	1946.3
593	1946.4		9732	1946.4		482	1946.5
594	1946.6		9733	1946.6		483	1946.7
595	1946.8		9734	1946.8		484	1946.9
596	1947.0		9735	1947.0		485	1947.1
597	1947.2		9736	1947.2		486	1947.3
598	1947.4		9737	1947.4		487	1947.5
599	1947.6		9738	1947.6		488	1947.7
600	1947.8		9739	1947.8		489	1947.9
601	1948.0		9740	1948.0		490	1948.1
602	1948.2		9741	1948.2		491	1948.3
603	1948.4		9742	1948.4		492	1948.5
604	1948.6		9743	1948.6		493	1948.7
605	1948.8		9744	1948.8		494	1948.9
606	1949.0		9745	1949.0		495	1949.1
607	1949.2		9746	1949.2		496	1949.3
608	1949.4		9747	1949.4		497	1949.5
609	1949.6		9748	1949.6		498	1949.7
610	1949.8		9749	1949.8		499	1949.9
611	1950.0		9750	1950.0		500	1950.1
612	1950.2		9751	1950.2		501	1950.3
613	1950.4		9752	1950.4		502	1950.5
614	1950.6		9753	1950.6		503	1950.7
615	1950.8		9754	1950.8		504	1950.9
616	1951.0		9755	1951.0		505	1951.1
617	1951.2		9756	1951.2		506	1951.3
618	1951.4		9757	1951.4		507	1951.5
619	1951.6		9758	1951.6		508	1951.7
620	1951.8		9759	1951.8		509	1951.9
621	1952.0		9760	1952.0		510	1952.1
622	1952.2		9761	1952.2		511	1952.3
623	1952.4		9762	1952.4		512	1952.5
624	1952.6		9763	1952.6		513	1952.7
625	1952.8		9764	1952.8		514	1952.9
626	1953.0		9765	1953.0		515	1953.1
627	1953.2		9766	1953.2		516	1953.3

628	1953.4		9767	1953.4		517	1953.5
629	1953.6		9768	1953.6		518	1953.7
630	1953.8		9769	1953.8		519	1953.9
631	1954.0		9770	1954.0		520	1954.1
632	1954.2		9771	1954.2		521	1954.3
633	1954.4		9772	1954.4		522	1954.5
634	1954.6		9773	1954.6		523	1954.7
635	1954.8		9774	1954.8		524	1954.9
636	1955.0		9775	1955.0		525	1955.1
637	1955.2		9776	1955.2		526	1955.3
638	1955.4		9777	1955.4		527	1955.5
639	1955.6		9778	1955.6		528	1955.7
640	1955.8		9779	1955.8		529	1955.9
641	1956.0		9780	1956.0		530	1956.1
642	1956.2		9781	1956.2		531	1956.3
643	1956.4		9782	1956.4		532	1956.5
644	1956.6		9783	1956.6		533	1956.7
645	1956.8		9784	1956.8		534	1956.9
646	1957.0		9785	1957.0		535	1957.1
647	1957.2		9786	1957.2		536	1957.3
648	1957.4		9787	1957.4		537	1957.5
649	1957.6		9788	1957.6		538	1957.7
650	1957.8		9789	1957.8		539	1957.9
651	1958.0		9790	1958.0		540	1958.1
652	1958.2		9791	1958.2		541	1958.3
653	1958.4		9792	1958.4		542	1958.5
654	1958.6		9793	1958.6		543	1958.7
655	1958.8		9794	1958.8		544	1958.9
656	1959.0		9795	1959.0		545	1959.1
657	1959.2		9796	1959.2		546	1959.3
658	1959.4		9797	1959.4		547	1959.5
659	1959.6		9798	1959.6		548	1959.7
660	1959.8		9799	1959.8		549	1959.9
661	1960.0		9800	1960.0		550	1960.1
662	1960.2		9801	1960.2		551	1960.3
663	1960.4		9802	1960.4		552	1960.5
664	1960.6		9803	1960.6		553	1960.7
665	1960.8		9804	1960.8		554	1960.9
666	1961.0		9805	1961.0		555	1961.1
667	1961.2		9806	1961.2		556	1961.3
668	1961.4		9807	1961.4		557	1961.5

669	1961.6		9808	1961.6		558	1961.7
670	1961.8		9809	1961.8		559	1961.9
671	1962.0		9810	1962.0		560	1962.1
672	1962.2		9811	1962.2		561	1962.3
673	1962.4		9812	1962.4		562	1962.5
674	1962.6		9813	1962.6		563	1962.7
675	1962.8		9814	1962.8		564	1962.9
676	1963.0		9815	1963.0		565	1963.1
677	1963.2		9816	1963.2		566	1963.3
678	1963.4		9817	1963.4		567	1963.5
679	1963.6		9818	1963.6		568	1963.7
680	1963.8		9819	1963.8		569	1963.9
681	1964.0		9820	1964.0		570	1964.1
682	1964.2		9821	1964.2		571	1964.3
683	1964.4		9822	1964.4		572	1964.5
684	1964.6		9823	1964.6		573	1964.7
685	1964.8		9824	1964.8		574	1964.9
686	1965.0		9825	1965.0		575	1965.1
687	1965.2		9826	1965.2		576	1965.3
688	1965.4		9827	1965.4		577	1965.5
689	1965.6		9828	1965.6		578	1965.7
690	1965.8		9829	1965.8		579	1965.9
691	1966.0		9830	1966.0		580	1966.1
692	1966.2		9831	1966.2		581	1966.3
693	1966.4		9832	1966.4		582	1966.5
694	1966.6		9833	1966.6		583	1966.7
695	1966.8		9834	1966.8		584	1966.9
696	1967.0		9835	1967.0		585	1967.1
697	1967.2		9836	1967.2		586	1967.3
698	1967.4		9837	1967.4		587	1967.5
699	1967.6		9838	1967.6		588	1967.7
700	1967.8		9839	1967.8		589	1967.9
701	1968.0		9840	1968.0		590	1968.1
702	1968.2		9841	1968.2		591	1968.3
703	1968.4		9842	1968.4		592	1968.5
704	1968.6		9843	1968.6		593	1968.7
705	1968.8		9844	1968.8		594	1968.9
706	1969.0		9845	1969.0		595	1969.1
707	1969.2		9846	1969.2		596	1969.3
708	1969.4		9847	1969.4		597	1969.5
709	1969.6		9848	1969.6		598	1969.7

710	1969.8		9849	1969.8	599	1969.9
711	1970.0		9850	1970.0	600	1970.1
712	1970.2		9851	1970.2	601	1970.3
713	1970.4		9852	1970.4	602	1970.5
714	1970.6		9853	1970.6	603	1970.7
715	1970.8		9854	1970.8	604	1970.9
716	1971.0		9855	1971.0	605	1971.1
717	1971.2		9856	1971.2	606	1971.3
718	1971.4		9857	1971.4	607	1971.5
719	1971.6		9858	1971.6	608	1971.7
720	1971.8		9859	1971.8	609	1971.9
721	1972.0		9860	1972.0	610	1972.1
722	1972.2		9861	1972.2	611	1972.3
723	1972.4		9862	1972.4	612	1972.5
724	1972.6		9863	1972.6	613	1972.7
725	1972.8		9864	1972.8	614	1972.9
726	1973.0		9865	1973.0	615	1973.1
727	1973.2		9866	1973.2	616	1973.3
728	1973.4		9867	1973.4	617	1973.5
729	1973.6		9868	1973.6	618	1973.7
730	1973.8		9869	1973.8	619	1973.9
731	1974.0		9870	1974.0	620	1974.1
732	1974.2		9871	1974.2	621	1974.3
733	1974.4		9872	1974.4	622	1974.5
734	1974.6		9873	1974.6	623	1974.7
735	1974.8		9874	1974.8	624	1974.9
736	1975.0		9875	1975.0	625	1975.1
737	1975.2		9876	1975.2	626	1975.3
738	1975.4		9877	1975.4	627	1975.5
739	1975.6		9878	1975.6	628	1975.7
740	1975.8		9879	1975.8	629	1975.9
741	1976.0		9880	1976.0	630	1976.1
742	1976.2		9881	1976.2	631	1976.3
743	1976.4		9882	1976.4	632	1976.5
744	1976.6		9883	1976.6	633	1976.7
745	1976.8		9884	1976.8	634	1976.9
746	1977.0		9885	1977.0	635	1977.1
747	1977.2		9886	1977.2	636	1977.3
748	1977.4		9887	1977.4	637	1977.5
749	1977.6		9888	1977.6	638	1977.7
750	1977.8		9889	1977.8	639	1977.9

751	1978.0		9890	1978.0	640	1978.1
752	1978.2		9891	1978.2	641	1978.3
753	1978.4		9892	1978.4	642	1978.5
754	1978.6		9893	1978.6	643	1978.7
755	1978.8		9894	1978.8	644	1978.9
756	1979.0		9895	1979.0	645	1979.1
757	1979.2		9896	1979.2	646	1979.3
758	1979.4		9897	1979.4	647	1979.5
759	1979.6		9898	1979.6	648	1979.7
760	1979.8		9899	1979.8	649	1979.9
761	1980.0		9900	1980.0	650	1980.1
762	1980.2		9901	1980.2	651	1980.3
763	1980.4		9902	1980.4	652	1980.5
764	1980.6		9903	1980.6	653	1980.7
765	1980.8		9904	1980.8	654	1980.9
766	1981.0		9905	1981.0	655	1981.1
767	1981.2		9906	1981.2	656	1981.3
768	1981.4		9907	1981.4	657	1981.5
769	1981.6		9908	1981.6	658	1981.7
770	1981.8		9909	1981.8	659	1981.9
771	1982.0		9910	1982.0	660	1982.1
772	1982.2		9911	1982.2	661	1982.3
773	1982.4		9912	1982.4	662	1982.5
774	1982.6		9913	1982.6	663	1982.7
775	1982.8		9914	1982.8	664	1982.9
776	1983.0		9915	1983.0	665	1983.1
777	1983.2		9916	1983.2	666	1983.3
778	1983.4		9917	1983.4	667	1983.5
779	1983.6		9918	1983.6	668	1983.7
780	1983.8		9919	1983.8	669	1983.9
781	1984.0		9920	1984.0	670	1984.1
782	1984.2		9921	1984.2	671	1984.3
783	1984.4		9922	1984.4	672	1984.5
784	1984.6		9923	1984.6	673	1984.7
785	1984.8		9924	1984.8	674	1984.9
786	1985.0		9925	1985.0	675	1985.1
787	1985.2		9926	1985.2	676	1985.3
788	1985.4		9927	1985.4	677	1985.5
789	1985.6		9928	1985.6	678	1985.7
790	1985.8		9929	1985.8	679	1985.9
791	1986.0		9930	1986.0	680	1986.1

792	1986.2		9931	1986.2	681	1986.3
793	1986.4		9932	1986.4	682	1986.5
794	1986.6		9933	1986.6	683	1986.7
795	1986.8		9934	1986.8	684	1986.9
796	1987.0		9935	1987.0	685	1987.1
797	1987.2		9936	1987.2	686	1987.3
798	1987.4		9937	1987.4	687	1987.5
799	1987.6		9938	1987.6	688	1987.7
800	1987.8		9939	1987.8	689	1987.9
801	1988.0		9940	1988.0	690	1988.1
802	1988.2		9941	1988.2	691	1988.3
803	1988.4		9942	1988.4	692	1988.5
804	1988.6		9943	1988.6	693	1988.7
805	1988.8		9944	1988.8	694	1988.9
806	1989.0		9945	1989.0	695	1989.1
807	1989.2		9946	1989.2	696	1989.3
808	1989.4		9947	1989.4	697	1989.5
809	1989.6		9948	1989.6	698	1989.7
810	1989.8		9949	1989.8	699	1989.9
811	1990.0		9950	1990.0	700	1990.1

Appendix C 850MHz GSM & WCDMA Frequency Map

✧ **Gray Channels are not used**

GSM		WCDMA		WCDMA	
Channel	Center freq.(MHz)	Channel	Center freq.(MHz)	Channel	Center freq.(MHz)
127	869.0	4345	869.0	995	869.1
128	869.2	4346	869.2	996	869.3
129	869.4	4347	869.4	997	869.5
130	869.6	4348	869.6	998	869.7
131	869.8	4349	869.8	999	869.9
132	870.0	4350	870.0	1000	870.1
133	870.2	4351	870.2	1001	870.3
134	870.4	4352	870.4	1002	870.5
135	870.6	4353	870.6	1003	870.7
136	870.8	4354	870.8	1004	870.9
137	871.0	4355	871.0	1005	871.1
138	871.2	4356	871.2	1006	871.3
139	871.4	4357	871.4	1007	871.5
140	871.6	4358	871.6	1008	871.7
141	871.8	4359	871.8	1009	871.9
142	872.0	4360	872.0	1010	872.1
143	872.2	4361	872.2	1011	872.3
144	872.4	4362	872.4	1012	872.5
145	872.6	4363	872.6	1013	872.7
146	872.8	4364	872.8	1014	872.9
147	873.0	4365	873.0	1015	873.1
148	873.2	4366	873.2	1016	873.3
149	873.4	4367	873.4	1017	873.5
150	873.6	4368	873.6	1018	873.7
151	873.8	4369	873.8	1019	873.9
152	874.0	4370	874.0	1020	874.1
153	874.2	4371	874.2	1021	874.3
154	874.4	4372	874.4	1022	874.5
155	874.6	4373	874.6	1023	874.7
156	874.8	4374	874.8	1024	874.9
157	875.0	4375	875.0	1025	875.1
158	875.2	4376	875.2	1026	875.3
159	875.4	4377	875.4	1027	875.5
160	875.6	4378	875.6	1028	875.7
161	875.8	4379	875.8	1029	875.9

162	876.0		4380	876.0		1030	876.1
163	876.2		4381	876.2		1031	876.3
164	876.4		4382	876.4		1032	876.5
165	876.6		4383	876.6		1033	876.7
166	876.8		4384	876.8		1034	876.9
167	877.0		4385	877.0		1035	877.1
168	877.2		4386	877.2		1036	877.3
169	877.4		4387	877.4		1037	877.5
170	877.6		4388	877.6		1038	877.7
171	877.8		4389	877.8		1039	877.9
172	878.0		4390	878.0		1040	878.1
173	878.2		4391	878.2		1041	878.3
174	878.4		4392	878.4		1042	878.5
175	878.6		4393	878.6		1043	878.7
176	878.8		4394	878.8		1044	878.9
177	879.0		4395	879.0		1045	879.1
178	879.2		4396	879.2		1046	879.3
179	879.4		4397	879.4		1047	879.5
180	879.6		4398	879.6		1048	879.7
181	879.8		4399	879.8		1049	879.9
182	880.0		4400	880.0		1050	880.1
183	880.2		4401	880.2		1051	880.3
184	880.4		4402	880.4		1052	880.5
185	880.6		4403	880.6		1053	880.7
186	880.8		4404	880.8		1054	880.9
187	881.0		4405	881.0		1055	881.1
188	881.2		4406	881.2		1056	881.3
189	881.4		4407	881.4		1057	881.5
190	881.6		4408	881.6		1058	881.7
191	881.8		4409	881.8		1059	881.9
192	882.0		4410	882.0		1060	882.1
193	882.2		4411	882.2		1061	882.3
194	882.4		4412	882.4		1062	882.5
195	882.6		4413	882.6		1063	882.7
196	882.8		4414	882.8		1064	882.9
197	883.0		4415	883.0		1065	883.1
198	883.2		4416	883.2		1066	883.3
199	883.4		4417	883.4		1067	883.5
200	883.6		4418	883.6		1068	883.7
201	883.8		4419	883.8		1069	883.9
202	884.0		4420	884.0		1070	884.1

203	884.2		4421	884.2		1071	884.3
204	884.4		4422	884.4		1072	884.5
205	884.6		4423	884.6		1073	884.7
206	884.8		4424	884.8		1074	884.9
207	885.0		4425	885.0		1075	885.1
208	885.2		4426	885.2		1076	885.3
209	885.4		4427	885.4		1077	885.5
210	885.6		4428	885.6		1078	885.7
211	885.8		4429	885.8		1079	885.9
212	886.0		4430	886.0		1080	886.1
213	886.2		4431	886.2		1081	886.3
214	886.4		4432	886.4		1082	886.5
215	886.6		4433	886.6		1083	886.7
216	886.8		4434	886.8		1084	886.9
217	887.0		4435	887.0		1085	887.1
218	887.2		4436	887.2		1086	887.3
219	887.4		4437	887.4		1087	887.5
220	887.6		4438	887.6		1088	887.7
221	887.8		4439	887.8		1089	887.9
222	888.0		4440	888.0		1090	888.1
223	888.2		4441	888.2		1091	888.3
224	888.4		4442	888.4		1092	888.5
225	888.6		4443	888.6		1093	888.7
226	888.8		4444	888.8		1094	888.9
227	889.0		4445	889.0		1095	889.1
228	889.2		4446	889.2		1096	889.3
229	889.4		4447	889.4		1097	889.5
230	889.6		4448	889.6		1098	889.7
231	889.8		4449	889.8		1099	889.9
232	890.0		4450	890.0		1100	890.1
233	890.2		4451	890.2		1101	890.3
234	890.4		4452	890.4		1102	890.5
235	890.6		4453	890.6		1103	890.7
236	890.8		4454	890.8		1104	890.9
237	891.0		4455	891.0		1105	891.1
238	891.2		4456	891.2		1106	891.3
239	891.4		4457	891.4		1107	891.5
240	891.6		4458	891.6		1108	891.7
241	891.8		4459	891.8		1109	891.9
242	892.0		4460	892.0		1110	892.1
243	892.2		4461	892.2		1111	892.3

244	892.4		4462	892.4		1112	892.5
245	892.6		4463	892.6		1113	892.7
246	892.8		4464	892.8		1114	892.9
247	893.0		4465	893.0		1115	893.1
248	893.2		4466	893.2		1116	893.3
249	893.4		4467	893.4		1117	893.5
250	893.6		4468	893.6		1118	893.7
251	893.8		4469	893.8		1119	893.9
252	894.0		4470	894.0		1120	894.1