



SK Telesys

*User Manual of TRI-band RF Repeater
For Sprint*




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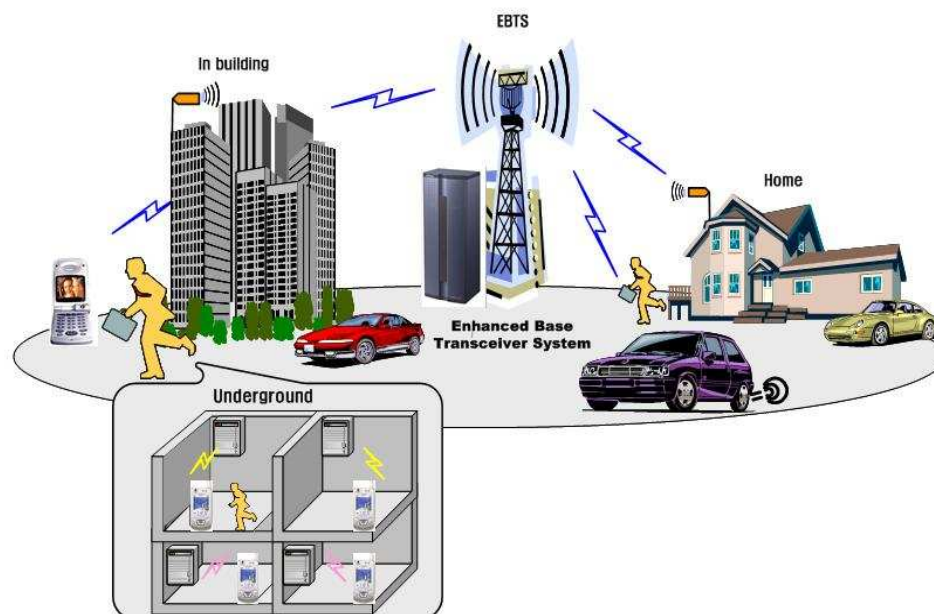
Section 1. Overview

TRI-band RF Repeater is designed for increasing coverage and capacity in Sprint's CDMA & iDEN systems. The repeater can provide coverage for all troubled areas such as suburban, shadow areas, backside of mountains, urban and metropolitan locations. The SKTS Products also provides easy installation, remote status monitoring and control function (NMS System) through the wired line and wireless modems. SKTS' RF Repeater is designed to help support existing legacy equipment and help Sprint provide nationwide service.

SK telesys improved Repeater System for Sprint CDMA band to meet the requirements for coverage in the contiguous and non-contiguous spectrum in North America. The digital filter manipulates discrete samples of an input signal to produce a filtered output signal. This brand new repeater system utilizes the digital filter technology. This removes the noise and passes the extract spectrum needed in digital signal processing systems (DSP). The digital filter carries the filtering of sampled-data, or discrete-time, signals, which are typically digital representations of analog signals which have been generated by way of analog-to-digital conversion. Digital signal processing has an advantage over analog processing in that it enables an exact reproduction of the signals and the processing operations without any degradation in the signal.

The Tri-Band RF repeater is designed to be elastically applied to any frequency of iDEN band, and the frequency selection level of the frequency bandwidth to service of the Down Link and Up Link through 1 Up/Down converter module is excellent and minimizes interference in other signals. Besides, this is designed to enable users to select their desired band(a maximum of 20MHz) in the CDMA 65MHz band.

The basic structure of a Tri-Band RF repeater is such that 1 output port is supported to 1 input port. The inside of a repeater is divided into a block for iDEN and a block for CDMA, and the DL(Down Link) Converter and UL(Up Link) Converter for iDEN and CDMA are composed as one module respectively for optimum size and high efficiency. Besides, this is composed of PSU(Power Supply Unit), Filter and PAU(Power Amplifier Unit).



<Fig. 1 > Configuration of Tri-Band Network

Section 2. Components

2.1 Packing List

No	Description	Quantity	Remark
1	Tri-Band Digital Repeater	1	
2	AC Power Cable	1	
3	Ground Cable	1	
4	Anchor Bolts	4	
5	Key	2	
6	CD	1	Manual
7	Bracket	1	
8	Installation Guide Sheet	1	

<Table 1 > Packing List



<Fig. 2 > Components of Tri-Band Digital Repeater

2.2 System, Exterior



<Fig. 3 > View of Tri-Band Digital Repeater

2.3 Warning and Hazards



WARNING! ELECTRIC SHOCK POSSIBLE.

Danger of electric shock!

Switch off while(it is) maintained and inspected!



WARNING! EXPOSURE TO RF

Working with the repeater while in operation, may expose the

Technician to RF electromagnetic fields that exceed FCC rules for

human exposure. Visit the FCC website at www.fcc.gov/oet/rfsafety to learn more about the effects of exposure to RF electromagnetic fields.

RF EXPOSURE & ANTENNA PLACEMENT

Actual separation distance is determined upon gain of antenna used.

Please maintain a minimum safe distance of at least 20 cm while operating near the donor and the service antennas. Also, the donor antenna needs to be mounted outdoors on a permanent structure.

FCC STATEMENT

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at own expense.

Warning!

This equipment generates or uses radio frequency energy.

Changes or modifications to this equipment may cause harmful interference unless the modifications are expressly approved in the instruction manual. The user could lose the authority to operate this equipment if an unauthorized change or modification is made.

****RECOMMENDATION:**

The Manufacturer recommends TURNING OFF the POWER AMPS - Prior to any Modifications to the Repeater. This is done through the GUI.

Turning off the power amps during modifications will help to extend the life of the Repeater.

Section 3. Feature and Specifications

3.1 RF Specification

Item		Specification	Remark
Frequency Range	800 MHz	Downlink : 851~869 MHz Uplink : 806~824 MHz	25kHz Step
	900 MHz	Downlink : 935~940 MHz Uplink : 896~901 MHz	25kHz Step
	1900 MHz	Downlink : 1930~1995 MHz Uplink : 1850~1915 MHz	Total : 65MHz
Amplifier Gain / Output Power per Band		65dB / 25dBm	iDEN
		80dB / 24dBm	CDMA
Input Level		-15 ~ -40dBm / Total	iDEN
		-16 ~ -56dBm / Total	CDMA
Ripple		± 1.25 dB	iDEN
		± 1.5 dB	CDMA
Gain Control Range		40 ~ 65dB(1dB/Step ± 0.5 dB or less)	iDEN
		40 ~ 80dB(1dB/Step ± 0.5 dB or less)	CDMA
Frequency Response		$\geq \Delta 65$ dBc	@Edge ± 500 KHz (iDEN)
		$\geq \Delta 50$ dBc	@Edge ± 1 MHz (CDMA)
Downlink Adjacent Power	1 carrier	25KHz : ≥ 50 dBc 50KHz : ≥ 55 dBc 500KHz : 55dBc 1MHz, 2MHz : 55dBc	iDEN
	8carriers	25KHz : 47dBc 50KHz : 52dBc 500KHz : 52dBc	

		1MHz, 2MHz : 52dBc	
900MHz Intermodulation		1870~1880MHz/-105dBm	900MHz only
Spurious RF Emission		≤ -13dBm	
Propagation Delay		≤ 8us	iDEN
		≤ 13us	CDMA
Up Link Noise Figure		≤ 5dB @ Max. Gain	
		≤ 12dB @ Min. Gain	
VSWR		1.5 : 1	

<Table 2 > RF Specifications

3.2 Mechanical Specification

Item	Specification
Cabinet	Indoor Type
RF Connector Type(IN/OUT)	N-Type Female
Dimension(H*W*D)	580*420*291 mm
Weight	31.2 kg

<Table 3 > Mechanical Specifications

3.3 Environmental Specification

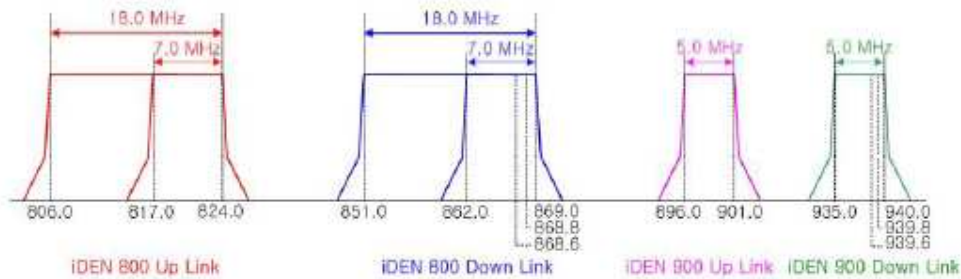
Item	Specification	Remark
Working temperature/ humidity	-10℃ ~ 50℃ / 5 % ~ 95%	Tem. / Humi. around cabinet
Power	108 ~ 127 VAC, 60Hz	※ Option -40 to -60VDC 20 to 30 VDC

<Table 4 > Environmental Specifications

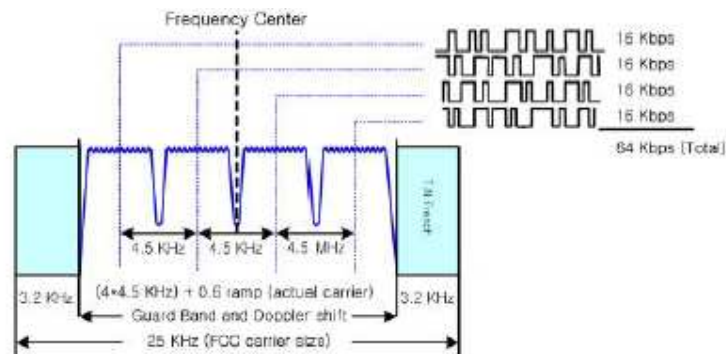
3.4 Operation Frequencies

Item		Frequency	Remark
Down Link	800 MHz	851 ~ 869 MHz	25kHz Step
		862 ~ 869 MHz	25kHz Step
	900 MHz	935 ~ 940 MHz	25kHz Step
Up Link	800 MHz	806 ~ 824 MHz	25kHz Step
		817 ~ 824 MHz	25kHz Step
	900 MHz	896 ~ 901 MHz	25kHz Step

<Table 5 > iDEN Frequency



<Figure 4 > iDEN Frequency

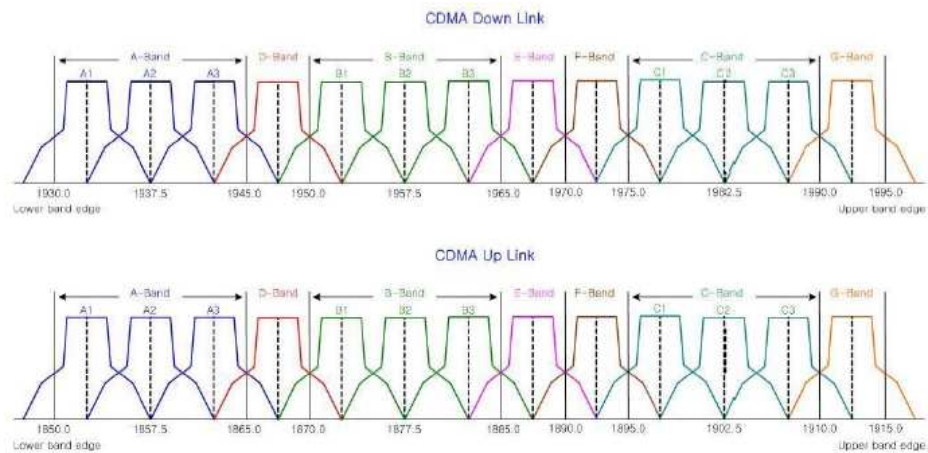


<Figure 5 > Features of iDEN Carrier

Item		Frequency	BW
Downlink	A	1930.625 ~ 1944.375 MHz	13.75 MHz

	D	1945.625 ~ 1949.375 MHz	3.75 MHz
	B	1950.625 ~ 1964.375 MHz	13.75 MHz
	E	1965.625 ~ 1969.375 MHz	3.75 MHz
	F	1970.625 ~ 1974.375 MHz	3.75 MHz
	C	1975.625 ~ 1989.375 MHz	13.75 MHz
	G	1990.625 ~ 1994.375 MHz	3.75 MHz
Uplink	A	1850.625 ~ 1864.375 MHz	13.75 MHz
	D	1865.625 ~ 1869.375 MHz	3.75 MHz
	B	1870.625 ~ 1884.375 MHz	13.75 MHz
	E	1885.625 ~ 1889.375 MHz	3.75 MHz
	F	1890.625 ~ 1894.375 MHz	3.75 MHz
	C	1895.625 ~ 1909.375 MHz	13.75 MHz
	G	1910.625 ~ 1914.375 MHz	3.75 MHz

<Table 6 > CDMA Frequency

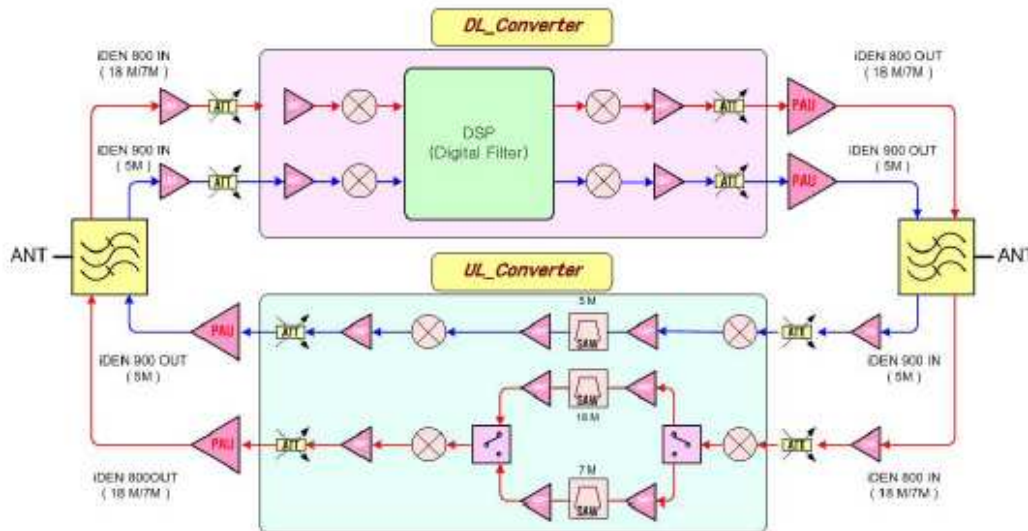


<Fig. 6> CDMA Frequency

Section 4. System Block Diagram

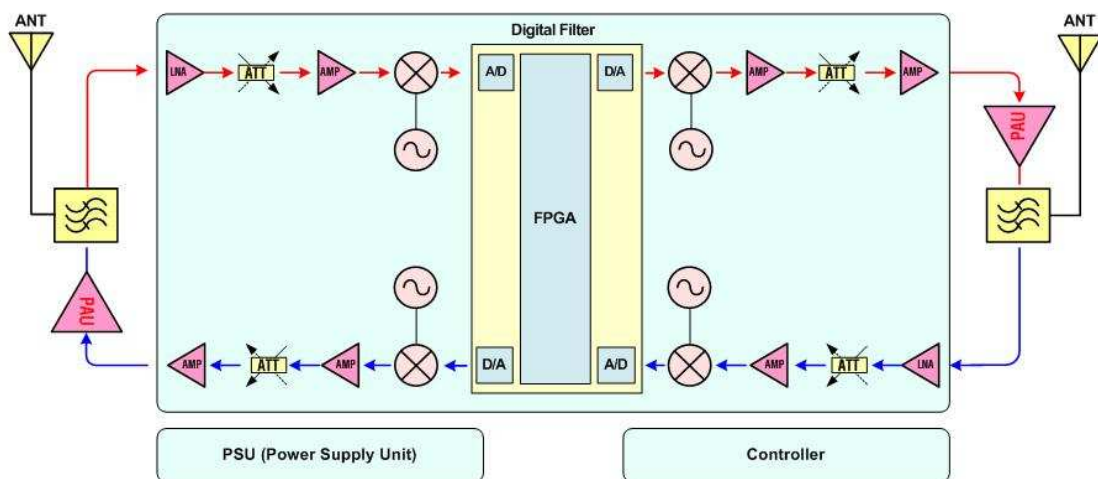
4.1 Block Diagram

4.1.1 iDEN Block Diagram



<Fig. 7> iDEN Block Diagram

4.1.2 CDMA Digital Block Diagram



<Fig. 8> CDMA Digital Block Diagram

4.2 About Block Diagram

This was realized in one body type available in both of an iDEN frequency band and a CDMA frequency band with a filter of cavity type and has only the iDEN frequency band and CDMA frequency band to service pass selectively after securing isolation between the Down Link and UP Link enough while other bands are removed because, of the base station(EBTS) signals of the iDEN and CDMA received through antenna, only the desired bands are made to pass selectively since it is connected to the donor ANT of repeaters.

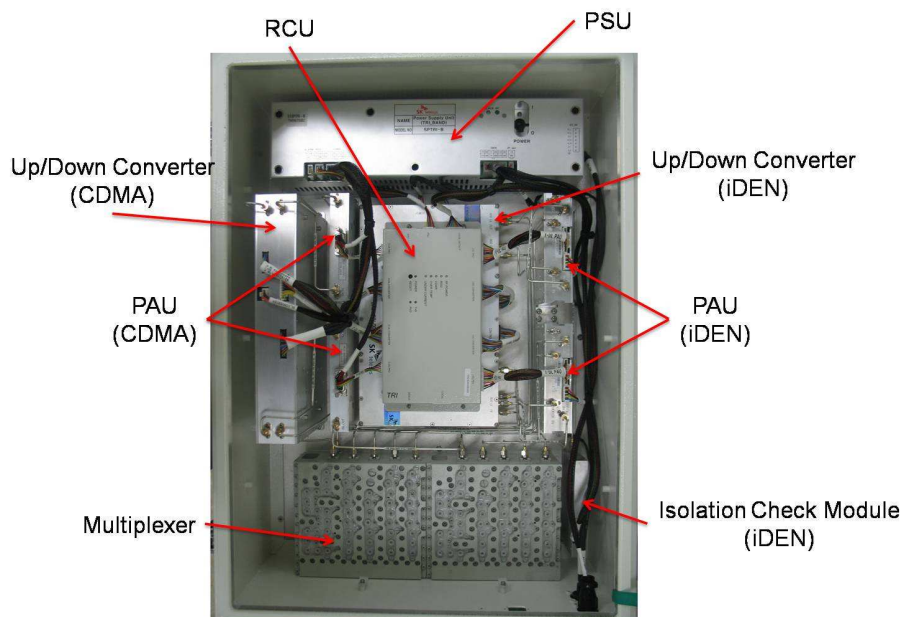
The up/down converter modules of the Tri-Band RF repeater were realized for iDEN and CDMA respectively. The Up/Down Converter Module for iDEN is composed of a down converter and up converter from the filter to the PAU input in the down link and up link of repeaters and a digital filter of the variable bandwidth. Besides, the same structure is composed in a pair in order to handle two bands such as a 900M band and a 800M band. The Up/Down converter of the down link was realized as a digital filter through a conversion and A/D conversion from the base station(EBTS) signals inputted through the LNA part to the IF frequency. The up/down converter of the Up Link was made to take a Roll Off characteristic using a SAW filter by converting the RF signal of the terminal inputted through the LNA into the IF frequency(70MHz), differently from the down link. And, Digital filter of the up/down converter module for CDMA converts the analog to digital and transmits it to the FPGA in order to filter out the signal. FPGA has a logic algorithm that can filter out each possible Bandwidth in FA, 1.25MHz, minimum value and it selects when CPU send a command to select the pass band. Digitalized signal goes through the DA converter after filtering the signal in any 65MHz PCS band by digital section. Digital filter guaranties a uniform RF division output and an accurate filtering service band in any Sprint PCS spectrum. Also it provides less spatial limitation when designing the HW for the most complicated pass band combinations.

The signals passing through the Up/Down Converter are inputted as a PAU module for iDEN and CDMA respectively, so as to amplify the iDEN signals and CDMA signals to a proper output level, pass through a filter realized with an iDEN frequency band and a CDMA frequency band in one body type, and then be discharged through ANT.

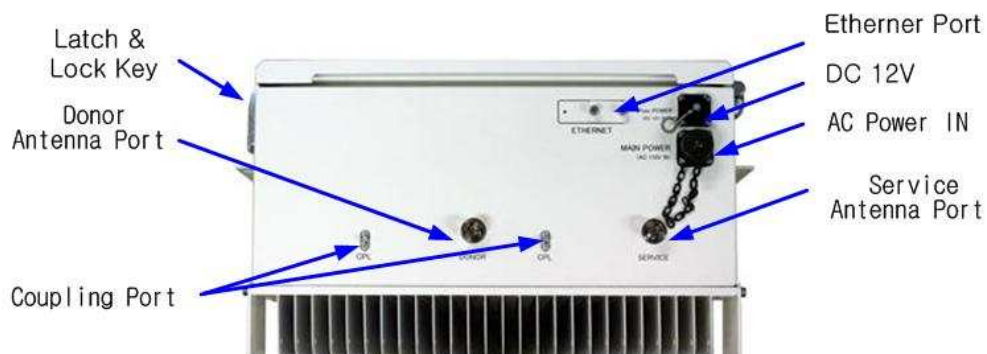
Section 5. System Overview

5.1 Configuration and Features

Modules comprising TRI-Band Repeater are arranged for operators and technicians to utilize them effectively. The Repeater is basically a wall-mounted structure, and if required it is constructed to be installed on 19 inch Rack. At the bottom of repeater, there are 1 donor port, 1 service port, 1 Donor signal monitoring port, 1 Service signal monitoring port, and AC power outlet. The internal structure of TRI-Band repeater is composed of the following Modules.



<Fig. 9> Internal Configuration of Tri-Band Repeater



<Fig. 10> Tri-Band Repeater Connector

5.1.1 PSU (Power Supply Unit)

The AC power source is converted through A/D and D/D to feed stable current to each active device. The Repeater adopts industrial equivalent level or above components. It is highly robust physical structure and meets all required electrical specification. Operating power ranges from AC 108- to 127V input and it converts to DC 3.5V, 3.8V, DC 7V, DC 12V and DC 27V for use.

5.1.2 Controller

RCU consists of RF Control Part and Network Control Part to monitor and control the state of each module of CDMA repeater. RF Control Part is linked to GUI through DEBUG port to collect status information and control modules.

Network Control Part enables high-level NMS (Ethernet) communication through RJ-45 port to monitor and control the status. The LEDs display the status in the front panel of RCU that easily identifies any malfunctions of the Modules. Since the controller is powered by batteries, when the batteries are not properly installed, it may cause damage to the equipment and possibly explode. Please safely dispose of the used batteries.

**※ Caution: Improper replacement of batteries can cause risk of explosion.
Dispose of used batteries according to State and local laws.**



(1) LED

- a. RF POWER: Red light = Alarm / Green light = Normal
- b. RSSI: Red light = Alarm / Green Light = Normal
- c. VSWR: Red light = Alarm / Green Light = Normal
- d. OVER TEMP: Red light = Alarm / Green = Normal

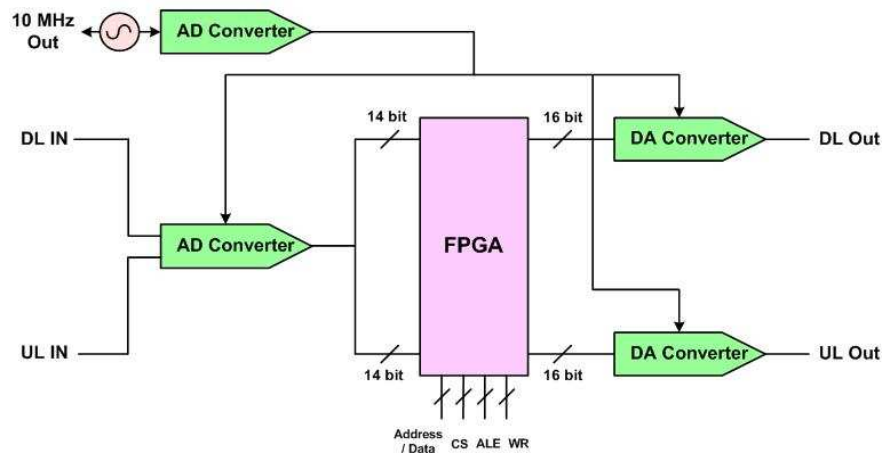
- e. UNDER CURRENT: Red light = Alarm / Green = Normal
- f. POWER: Solid Green = Power On / Blinking Green = Normal
- h. RESET: Controller Reset Button
- i. TXD: On = Data transmitting with Web GUI connected Green blinking
- j. RXD: On = Data receiving with Web GUI connected Green blinking

5.1.3 UP/DOWN Converter

Up/Down Converter modules of the Tri-Band RF repeater were realized for iDEN and CDMA respectively. The Up/Down Converter Module for iDEN is composed of a down converter and up converter from the filter to the PAU input in the down link and up link of repeaters and a digital filter of the variable bandwidth. Besides, the same structure is composed in a pair in order to handle two bands such as a 900M band and a 800M band. Up/Down Converter of Down Link converts EBTS signal input through LNA part to IF frequency(62.5MHz) and embodies Digital Filter as A/D conversion. It takes Roll off nature with digital filter, minimized the impact of other signal by stopping nearby other band and other signal, removes spurious and improves degree of separation.

In addition, Up link unlike Down link converts Terminal's RF signal input through LNA to IF frequency(70MHz) to take roll off nature of SAW Filter, minimizes the impact of other signals by restraining them to remove spurious and to improve degree of separation.

And, IF signal at the Digital filter of up/down converter module for CDMA is converted to Digital Domain Signal by A/D Converter and sent to the FPGA. The Signal at the FPGA will be filtered out and sent to the D/A Converter. All process of ADC, DAC and FPGA synchronizes in the 10MHz Reference Clock TCXO in order to promise an accurate. All process synchronizes in the 10MHz Reference Clock TCXO in order to promise an accurate converting. All possible bandwidth combinations are 1.25, 2.50, 3.75, 5.00, 6.25, 7.00, 8.75, 10.00, 13.75, & 18.75 MHz contiguously or non-contiguously.



<Fig. 11> Block Diagram for CDMA Digital Filter

Up/Down Converter module for iDEN and CDMA suppresses leakage of local signals into the input terminal by inserting a band path filter on the front side of a mixer. The mixer minimizes IMD components of the system by applying elements having characteristics of high IP3 and minimizes influence on the next step by maintaining linearity. The base station(EBTS) signals converted into the IF frequency are recovered into the original frequency through the up converter. Local stage for IF conversion is designed to minimize phase noises in order not to reduce quality(p value) of waveform that can take place during the conversion process of signals. RF Block of Down Link Up/Down Converter as Down Link Gain Control Block phase performs AGC and ALC functions to protect devices on over-input of iDEN RF Repeater, and with the need of user it may turn On/Off the functions with automatic compensation function for gains on temperature of system.

5.1.4 Multiplexer

This was realized in one body type available in both of an iDEN frequency band and a CDMA frequency band with a filter of cavity type and has only the iDEN frequency band and CDMA frequency band to service inputted to the LNA part after securing isolation between the Down Link and UP Link enough while other bands are removed because, of the base station(EBTS) signals of the iDEN and CDMA received through antenna, only the desired bands are made to pass selectively since it is connected to the donor ANT of repeaters. Beside, the backward direction(Up Link) minimizes the power of spurious wave discharge generated from PAU.

5.1.5 PAU

PAU considers Spurious features to apply degauss with credibility, endurance and high P1dB and inspects at all times output by linking to system's control part. So when main problem happens, it can be reported to upper level and if required by the user PAU move can be On/Off. The PAU of the Tri-Band repeater is divided into ones for iDEN and CDMA, but the PAU for iDEN service is composed of the integrated modules of iDEN 800/900, and the PAU for CDMA service is composed of a single module. Down Link PAU amplifies iDEN signal and CDMA signal to proper output level and supply Controller with VSWR information of output port and Repeater's output level. Also detect its own temperature and supply Controller with Device failure to check normal operation state of Module.

5.1.6 Isolation Check Module

For the isolation check module for CDMA, the Down Link converter of the UP/DOWN converter module is coupled to become an input of the isolation check module. Such signals find the maximum value and minimum value by measuring a oscillation detection value while moving by 50KHz from -250KHz to +250KHz of oscillation check frequency within the module. When the difference between the maximum value and minimum value is 2dB greater than the setting value, the gain is compensated as much as the difference, and when it is -2dB less than the setting value, the gain is compensated as much as -0.5dB. Isolation is monitored and controlled through such action.

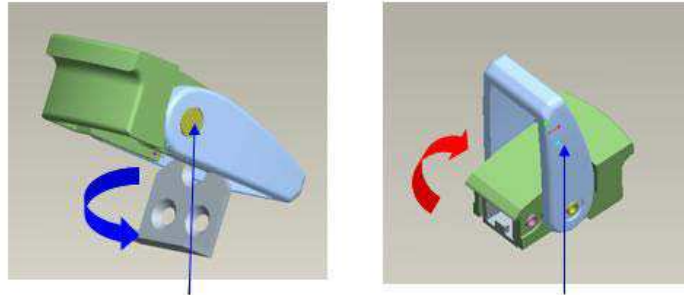
The isolation check module for iDEN find the maximum value and minimum value by measuring the oscillation detection value while moving by 30KHz up to 798 ~ 799MHz of oscillation check frequency through channel scanning within a module. When the difference between the maximum value and minimum value is 2dB greater than the setting value, the gain is compensated as much as the difference, and when it is -2dB less than the setting value, the gain is compensated as much as -0.5dB. Isolation is monitored and controlled through such action.

5.1.7 Cabinet

Cabinet of Repeater has die-casting structure enabling modules to be installed inside of door panel to enhance implementation efficiency and minimize the size of cabinet. Heat fin size of repeater is calculated upon the output level to show an excellent heat radiation effect.

(1) Latch

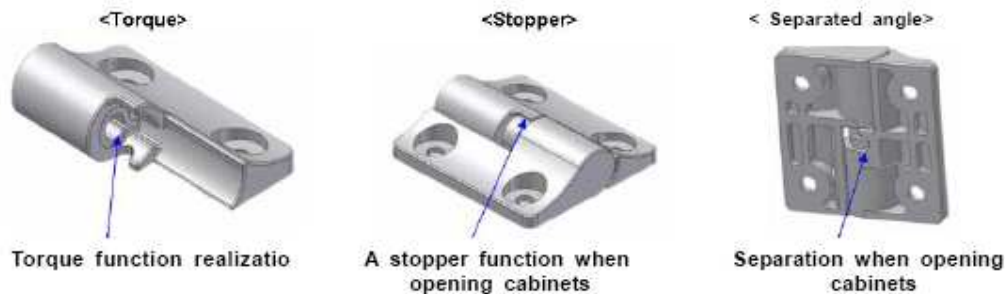
Latch is well sealed and locked to secure safety in which it can play a major role in preventing moisture and vibration. With automatic lift function of Head, door is easy open and closed. Minimized Shaft's recess of Latch prevents shaking.



<Fig. 12> Latch Structure

(2) Hinge

On assembling and maintaining cabinet the hinge is designed to provide convenience and quick access for its opening and closing, and it has 3 merits such as Torque, Stopper and Separation Angle function.



<Fig. 13> Hinge Functions

A. Torque Function

It prevents sudden door opening or closing considering the operator's safety when assembling and operating.

B. Stopper Function

It keeps sudden door opening from damaging cabinet on maintaining after assembling and set up. The additional design for opening has double safety structure for stopping function.

C. Separation Angle Function

Attached Notch to the center bottom of Hinge keeps separation on closing, and as

opening in a certain angle (about 20-30 degree) Door and Body part of Cabinet may be separated.

5.2 Additional Functions

5.2.1 ALC Function

The function is designed for stable operation of the repeater and base station to constantly maintain the same repeater output selected by the installer and prevent it from exceeding the pre set limit.

A. Procedure

- a. Switch ON/OFF ALC function set up through GUI.
- b. When the down link output value is greater than the set level or 1.5dB less than that in case of CDMA or 1dB less than that in case of i-DEN, the difference shall be compensated.
- c. When the up link output value is greater than the set level or 1.5dB less than that in case of CDMA or 1dB less than that in case of i-DEN, the difference shall be compensated.
- d. Monitor output value of Down Link and Up Link every second.

B. Notes

- a. Down Link and Up link are operates independently.
- b. On isolation check it does not operate.

****RECOMMENDATION:**

The Manufacturer recommends **TURNING OFF the POWER AMPS – Prior to any Modifications to the Repeater. This is done through the GUI. Turning off the power amps during modifications will help to extend the life of the Repeater.**

5.2.2 Shutdown Function

When output of repeater exceeds set up limit, it is to function Shutdown for stable protection.

(1) Procedure

- a. Operate when output value of Down Link and Up Link is 3dB(iDEN Shutdown Level) over ALC set up limit.
- b. Inspect output for 5 seconds to find that 5 second output is operation condition. Then do PAU OFF to perform the first Shutdown move.
- c. Perform PAU ON move 5 seconds after Shutdown move.

- d. Inspect output for 4 seconds again after waiting for stable output for 1 second.
- e. Perform c, d and e move for 3 times.
- f. After 3rd move the PAU ON waiting time is 30 minutes. With Shutdown condition afterward, proceed complete Shutdown state.
- g. On complete Shutdown state the user should directly switch the repeater OFF or ON, or set up PAU ON to come out of complete Shutdown state.

(2) Notes

- a. Will not function when ALC Operation set up is OFF.
- b. Down Link and Up Link operate independently of each other.

5.2.3 Oscillation Check Function

(1) Procedure

- a. Switch ON/OFF oscillation check function with GUI.
- b. Inspect the -250KHz ~ +250KHz section based on frequency in case of CDMA through channel scanning. Inspect the 798 ~ 799MHz section in case of i-DEN.
- c. The isolation check module for CDMA measures the oscillation detection value while moving by 500KHz from -250KHz. In case of i-DEN, inspect the oscillation detection value while moving by 30KHz in the 798 ~ 799MHz frequency section.
- d. Find the minimum and maximum value from values measured from c.
- e. When the difference between the maximum value and minimum value is 2dB(iDEN 0dB) greater than the setting value, the gain is compensated as much as the difference.
- f. When the difference between the maximum value and minimum value is -2dB(iDEN -1dB) less than the setting value, the gain is compensated as much as -0.5dB.

(2) Notes

- a. Do not operate while channel scan is in operation.
- b. When ALC is operating, gain correction value should not exceed ALC set up level.
- c. When Up Link ALC operation is OFF, link Down Link Gain to operate.

5.2.4 Oscillation Shutdown Function

(1) Procedure

- a. Operate when oscillation attenuation is over 30dB.
- b. Switch all PAU OFF and start alarming.

- c. Return PAU to original state after 10 seconds to perform oscillation check function.
 - d. On continuous Shutdown condition, try 3 times to enter complete Shutdown state afterward.
 - e. On complete Shutdown state the user should directly switch the repeater OFF or ON, or set up PAU ON to come out of complete Shutdown state.
- (2) Notes
- a. Operate when oscillation check function is ON only.

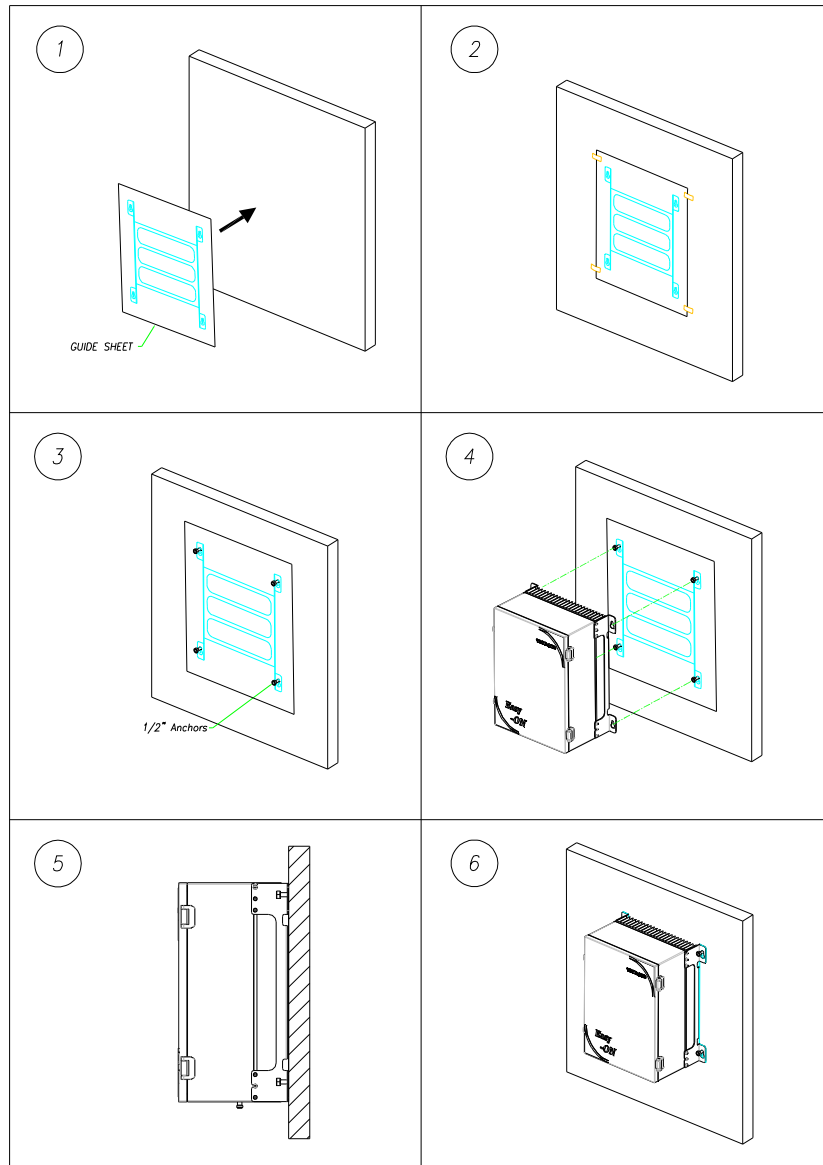
Section 6. System Installation Guide

The Cabinet of the Repeater is a die-casting structure, which supports wall-mount installation and if required it can be installed in a 19 inch Rack.

The Repeater has 4 Wall Mount Holes, which need to be installed properly to sustain the weight of repeater on a wall-mounted installation.

The procedure for wall-mounting installation are as follows;

- (1) Remove Repeater from package.
- (2) Check the components of repeater. Next remove 8 screws that hold the bracket to the repeater. (4 per side) **Leave the guide screws attached to the repeater.
- (3) Use 4 anchor bolts to attach the bracket to the wall. (Optional)
- (4) Confirm the bracket is safely mounted to the wall.
- (5) Hang the repeater on the Wall-mounted Bracket using the Guide screws. Now attach the remaining screws. Make sure the bracket and repeater are securely mounted to the wall.
- (6) Check to determine if it is installed properly and is attached firmly to the wall.



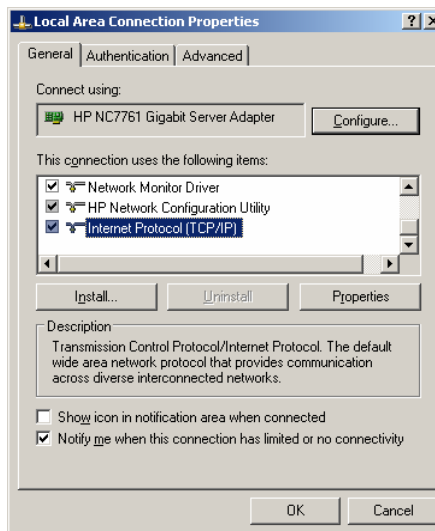
<Fig. 14> Mounting Sequence of the Tri-Band Repeater

※ Ethernet Instructions: This equipment is indoor used and all the communication wiring are limited to inside of the building.

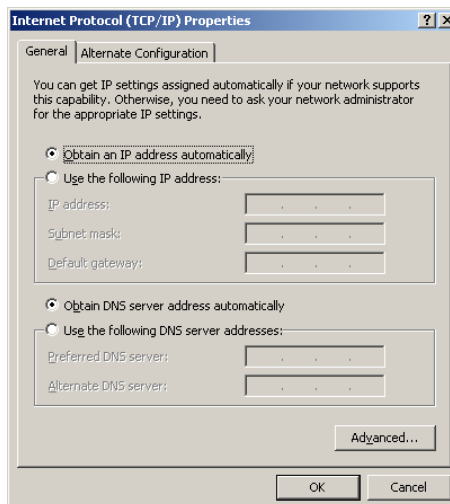
Section 7. WEB GUI

7.1 Program setup

- (1) The Ethernet Port of Repeater and Laptop are linked through LAN Cable.
- (2) A Cross-Connect Cable is used for LAN Cable.
- (3) When selecting the following picture, IP is automatically assigned to Laptop computer from the repeater.

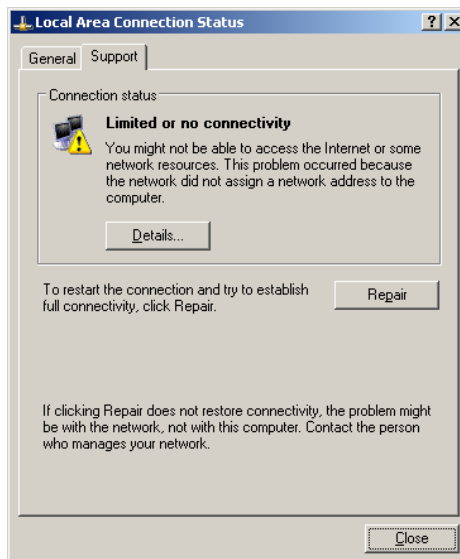


<Fig. 15> Local Area Connection Properties

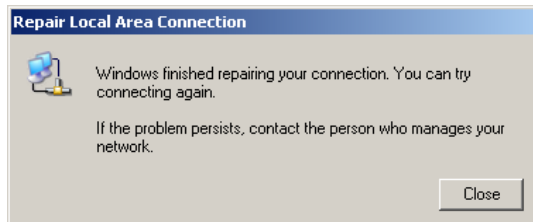


<Fig. 16> Internet Protocol (TCP/IP) Properties

(4) When network is not linked in a certain time, select Repair on Support window to recover IP.



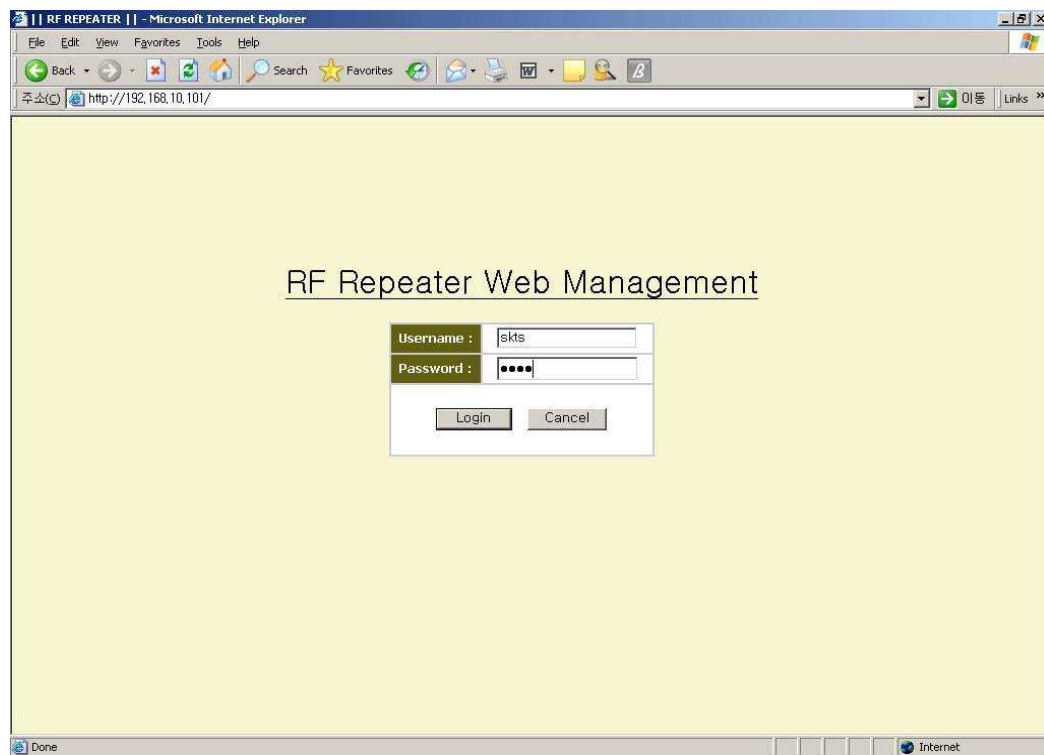
<Fig. 17> Local Area Connection Status-1



<Fig. 18> Local Area Connection Status-2

7.2 WEB GUI Connection

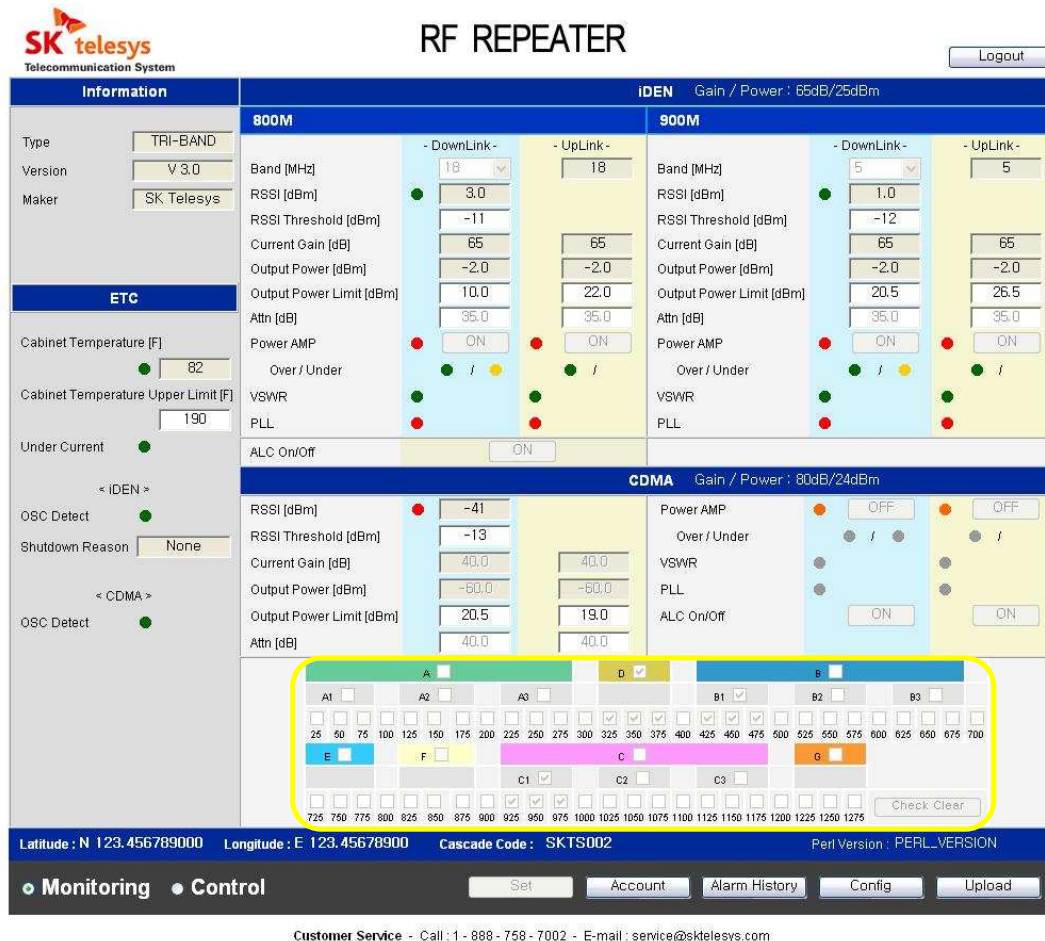
(1) Input connection address on address window of Internet Explorer to access
 (2) The Connection address set up as the repeater is released is as follows;
<http://192.168.10.101/>When linked to the repeater, input Username and Password on Login screen as follows to click [Login].



<Fig. 19> Web GUI Initial Screen

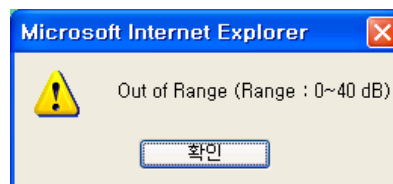
(3) Default Username & Password set up as the repeater is released are skts & skts.

(4) As linked to Web GUI, the following screen appears.



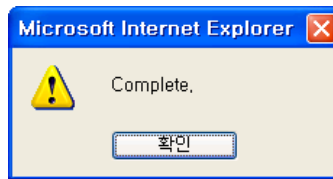
<Fig. 20> Tri-Band Digital Repeater Web GUI (Band selection for CDMA in yellow box)

- (5) After connecting, check the status of repeater; it updates every 4 seconds on the screen.
- (6) When Control is selected at bottom of the screen, it stops Polling and activates the “Set” Button giving the user the ability to change values and alter the configuration.
- (7) After changing the set up values, if the input range is exceeded a warning window appears and it returns to the previous value.



<Fig. 21> Input Range Excess Message

- (8) After changing the set up values, select the Set button to transmit the changed data. When set up is complete, a windows message appears – press enter or click “OK”.



<Fig. 22> Set Up Completion Message

7.3 Monitoring and Control

Common menu displayed in bottom line description is as below;

Latitude : N 123.456789000 Longitude : E -123.4567890 Cascade Code : SKTS Perl Version : PERL_VERSION

Latitude: latitude of repeater location

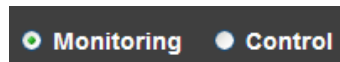
Longitude: longitude of repeater location

Cascade Code: Cascade Code of repeater

The above 3 items (Latitude, Longitude, Cascade Code) are configurable on 'Config' page.

If any item is skipped, the PAU (Power AMP) will shut down and the Control mode in GUI does not work.

Perl Script Version: the version of Perl Script (Application file) installed in operator's Proxy Server.

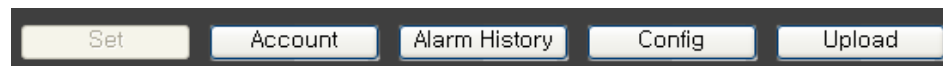


<Fig. 23> Mode Select

(1) When selecting Monitoring Mode, it monitors the present state of repeater system.

(2) When selection Control Mode, it stops Updating of repeater system and changes into controllable Mode.

(3) The basic Mode after connecting is Monitoring Mode, and after controlling repeater on Control Mode it automatically changes into Monitoring Mode.



<Fig. 24> Function Button

Set: It activates on Control Mode. After changing set up value take down the control on system to change state.

Account: Manages User's information.

Alarm History: May show Alarm History Data on system.

Config: Reads and changes the parameter value affecting system connection.

Upload: Upload system program.

Logout

<Fig. 25> Logout

End the present connection.

Monitoring/Control items on the display are below;

Title	Item	Monitoring	Remark
Information	Type	Monitoring	Repeater Type
	Version	Monitoring	Repeater Version
	Maker	Monitoring	SK telesys
	Gain/Power	Monitoring	value
ETC	Cabinet temp	Monitoring	Cabinet Temp Alarm
			Current cabinet temp in [F]
	Conv Temp	Monitoring	Converter Temp Alarm
			Current Conv Temp Alarm
	Under Current	Monitoring	PSU under current
	OSC Detect	Monitoring	Oscillation Alarm
CDMA	DL	RSSI	M / C
		RSSI	RSSI value in dBm
		Converter PLL	Monitoring
		Converter PLL	Converter PLL Lock Alarm
		Power AMP	M / C
		Power AMP	AMP ON/OFF
		Output	Monitoring
	UL	Output	AMP Output PWR
		Over PWR	Monitoring
		Over PWR	Alarm when output is 3dB higher than setting output
		Under PWR	Monitoring
		Under PWR	Alarm when output is 3dB lower than setting output
		VSWR	Monitoring
		VSWR	AMP self diagnostics
		Converter PLL	Monitoring
		Converter PLL	Converter PLL Lock
		Power AMP	M / C
		Power AMP	AMP ON/OFF
		Over PWR	Monitoring
		Over PWR	Alarm when output is 3dB higher than setting output
		Under PWR	Monitoring
		Under PWR	Alarm when output is 3dB lower than setting output
		VSWR	Monitoring
		VSWR	AMP self diagnostics
	Band	A ~ G PCS	Control
			- Select using Channel number

				<ul style="list-style-type: none"> - Do not select more than 20MHz combination as a serving band - Select by Band, Sub, and FA or combination.
--	--	--	--	--

<Table 7 > Monitoring/Control items on the display

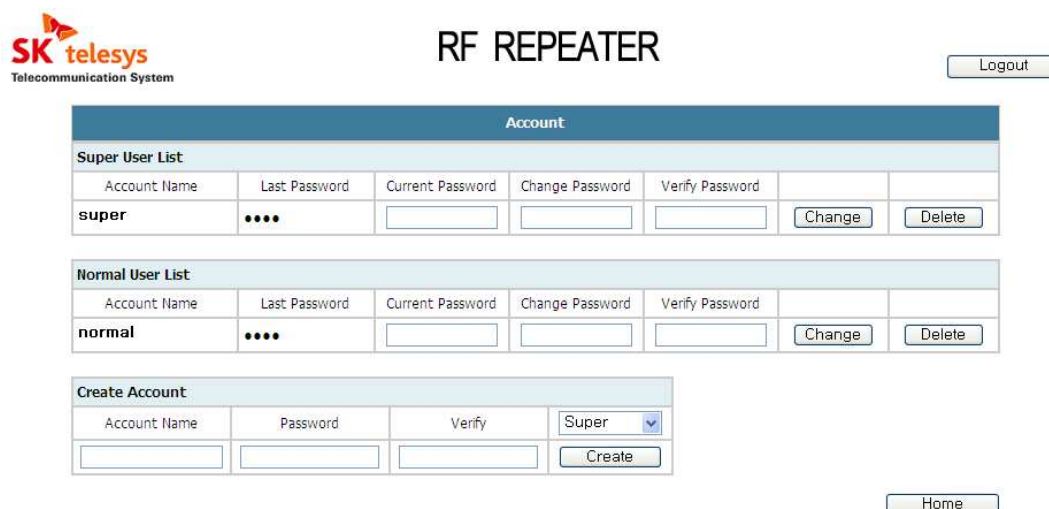
7.3.1 Account

It can register or delete the users accessible to Use Management page, and the grade of user is divided into Super user and Normal user.

The total maximum number of users available for registration is 4 for super user category and 25 for normal user category.

On shipment the Default Super User name & Password of repeater are **skts & skts**.

As pressing Home button it returns to the main screen.



<Fig. 26> Account Page

7.3.2 User Registration

Select the right of User to register on Create Account Block at the bottom of Page, input User Name and Password to be registered as new and press Create Button to register.



<Fig. 27> User Registration

7.3.3 Delete and Change of User

Deletion of a User is the Super User's unique right. Click the Delete button on the right hand side of the User List Block to delete. Deletion of a Super User Name is possible only with the

input of the Current Super User Password. Deletion of a Normal User is possible simply by clicking on the Delete Button.

To Change a Password please click the Change button once the new Password has been inputted.

Create Account	Password	Verify	Super ▼
Super1	••••	••••	Create

<Fig. 28> Deletion and Change of User

7.3.4 Alarm History

Alarm details stored in system can be seen, which shows the occurrence time of alarm, its occurrence and release.

Alarm History can be seen up to 50 Indexes.

RF REPEATER

Logout

Alarm History			
Index	Time	Alarm Name	Alarm Status
1	2007/6/4 15:27:34	iDEN 900M DownLink VSWR	Normal
2	2007/6/4 15:27:31	iDEN 900M DownLink VSWR	Fail
3	2007/6/1 9:33:12	CDMA UpLink PLL Lock	Normal
3	2007/6/1 9:33:12	CDMA OSC PLL	Fail
3	2007/6/1 9:33:12	iDEN OSC PLL	Fail
4	2007/5/31 20:25:18	CDMA UpLink PLL Lock	Fail
4	2007/5/31 20:25:18	CDMA OSC PLL	Normal
4	2007/5/31 20:25:18	iDEN OSC PLL	Normal

Delete

Home

<Fig. 29> Alarm History

Press Delete button at the bottom to delete alarm details stored, and the deleted alarm details can not be restored.

Press Home button to return to the main screen.

7.3.5 Configuration

It shows basic connection information required to connection and system configuration, and the initial set up value on shipment is as follows;

RF REPEATER

Logout

NCB Ver. 3.0

Ethernet Configuration	
IP Address	192 . 168 . 10 . 101
Subnet Mask	255 . 255 . 255 . 0
Default Gateway	192 . 168 . 10 . 1
Primary DNS Server	0 . 0 . 0 . 0
Secondary DNS Server	0 . 0 . 0 . 0
DHCP Server Configuration	
Enable Server	<input checked="" type="checkbox"/>
Lease Area	192 . 168 . 10 . 10 - 192 . 168 . 10 . 50
SNMP Configuration	
Site ID (Cascade Code)	SKTS
Sprint Server IP Address	. . .
Latitude	
Longitude	
Trap/Inform Community	public
Heartbeat duration time [min]	30
RTC Configuration	
Date [month/day/year]	06 / 05 / 2009
Time [hour:min:sec]	16 . 12 . 46
Alarm	
The Alarm duration [min]	0
<div>Set Cancel</div> <div>Home</div>	

Customer Service - Call : 1 - 888 - 758 - 7002 - E-mail : service@sktelesys.com

<Fig. 30> Configuration Information of System

7.3.6 Upload

Upload Page is necessary to upgrade the system program.

RF REPEATER

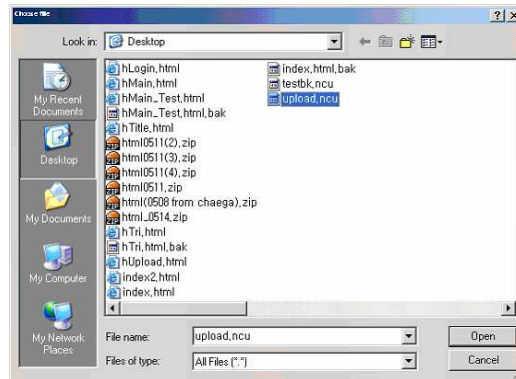
Logout

UPLOAD	
Upload File Name	<input type="text"/> <div>Browse... Upload</div>
Key Value	<input type="text"/>
Status	Select the appropriate file and press the Upload button.
<div>Home</div>	

<Fig. 31> Upload Page

Click [Search] button to select the file for Uploading on Popup window.

Controller of repeater comprises Network Control Board and Repeater Control Board, and each Board's Upload file is divided into SKTSNCB_vxx.ncu and SKTSRCB_x_vx.x.xx.rcu.



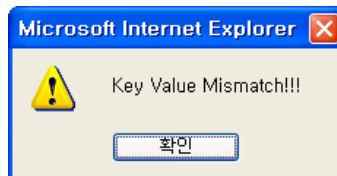
<Fig. 32> File Selection

UPLOAD	
Upload File Name	C:\WProject\Web\WTSEX1100\WHTML\Wupload.ncu <input type="button" value="Browse..."/> <input type="button" value="Upload"/>
Key Value	4E4F
Status	Select the appropriate file and press the Upload button

<Fig. 33> Upload Arrangement

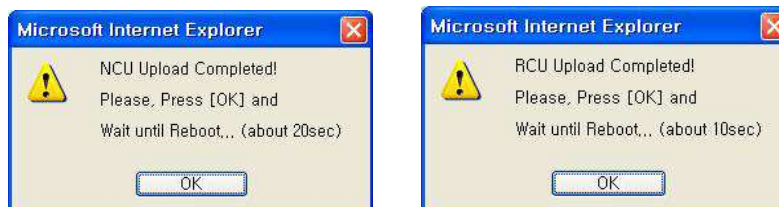
As the selected file path is seen, input Key Value provided and press Upload button to upgrade system.

If Key Value is different by files and inaccurate, Upload is impossible.



<Fig. 34> Key Value Error

On completion of Upload, the following message appears and system is automatically rebooted. On rebuttoning connection is not available, after rebooted normal connection is available.



<Fig. 35> Upload Completion

Section 8. Maintenance Guide

8.1 Confirmation of System Components

For normal operation of equipment the following should be confirmed on installation.

A. Confirm whether the repeater's exterior would be deformed by damaged package of repeater on delivery.

B. Confirm that the components of equipment as in the packing list and that the location for installation satisfies temperature and humidity for operation of equipment defined in the product specification.

C. Confirm the input signal condition of equipment defined in the product's specification.

D. Confirm that the state of cable and connector is good.

E. Confirm that the state of bracket of repeater is good.

8.2 Cautions regarding System Installation

In order for dangerous events not to occur on installation of repeater, the provided guidance should be followed.

Especially power cords are permanent connection typed so that easily accessible power switch on/off device should be equipped at indoor service wires with outlets easily accessible to repeater.

※ Non-detachable Power supply Code: for PLUGGABLE EQUIPMENT, the socket-outlet shall be installed near the equipment and shall be easily accessible.

Order	Description	Cautions
1	Donor ANT welding and feeder installation. Service ANT or LCX equipped	-Cable should be installed w/o exterior damage -Protect connection parts -Install feeder to min environment influence
2	Installation of ANT of Donor	-Fixed firm for local wind
3	Power cable and RF cable arrangement	-Prevent cable

<Table 8> Caution on System Installation

Section 9. System setup and inspection

9.1 Items to be checked for Opening

A. Confirm AC 108 ~ 127 VAC common use power and power cable.

B. Check if Donor RF input signal from exterior is at normal level.

Caution※

When system operates without input signal confirmed, over-input may cause serious damage on amplifying devices because of saturation of output. Therefore, after checking input signal level by equipment and ALC ON status (default from factory ALC ON) to operate equipment.

C. Put 108 ~ 127 VAC into power connector of equipment to switch ON.

D. Check Alarm LED blinking state of GUI or Repeater's front board through laptop.

E. When it is determined that the Down Link RF input signal from exterior is normal, switch OFF the Repeater and connect ANT feed and Service ANT to Input/Output Port of Repeater and switch the repeater ON again.

Caution ※

Conclude carefully lest Down Link and Up Link Port be reversed.

9.2 Items to be check after opening

A. Confirm existence of abnormality by checking the alarm LED lighting status of repeaters.

B. Confirm whether the RF input/output values are normal or not by using GUI.

C. Confirm the normal operation status of repeater by measuring spurious feature of the repeater's down link and up link output using a spectrum analyzer through coupling

ports beside each input/output port of the repeater after about 10 minutes turning on the power of repeaters.

- D. After normal operation of repeater, measure calling quality of service area by terminal or optimize radio environment if shadow areas or calling inability areas are present.

9.3 Failure and Inspection

9.3.1 Inspection of Repeater

On routine or emergency service of repeater the following orders should be taken to check its failure.

- A. Check RF input/output level and LED of repeater using Web GUI. On routine service check calling quality with terminal or measurement equipment or on emergency service the following should be taken even if RF input/out level of repeater on Web GUI is normal.
- B. Connect link spectrum analyzer to test terminal of repeater to confirm output state.
- C. Use Coupling port to check output value.
- D. Check if the output value of repeater obtained by spectrum analyzer equal to actual output value of repeater.
- E. Check input level of repeater when the output value of repeater obtained by spectrum analyzer is not equal to actual output value of repeater.
- F. When input level is different, check antenna connection and feeder cable.
- G. If the output value of repeater is abnormal as comparing input level to the gain of repeater, turn off and on the repeater and then recheck the output state with spectrum analyzer. On severe failure immediately replace with spare parts.

Symptom	Troubleshooting
---------	-----------------

No Power	Check the Power Cord
	Check the input voltage
Low or No output Power	Check Alarm History
	Check the ANT and its connector
	Check the Input level
	Check the Gain
	Check the Cable
	Adjust the ALC level
OSC Alarm	Check the ANT and Cable Connector
	Check the Input Level
	Check and replace the cable

<Table 9> Symptoms & Troubleshooting

9.3.2 Facility Inspection

On routine Inspection and service failure the following parts and items are needed to be inspected.

Inspection Parts	Inspection Items	Remark
Feeder, Leakage Coaxial	Feeder or leakage coaxial cable	
Donor & Service ANT	Inspect the malfunction of Antenna's welding	
Connector	Adaptor, cable	
PWR Incoming source	Check the voltage 108 ~127 VAC	

<Table 10> Inspection Parts and Items

Section 10. Warranty and Repair

10.1 General Warranty

This product carries a Standard Warranty period of five (5) years unless indicated otherwise on the package or in the acknowledgment of the purchase order.

10.2 Limitations of Warranty

Your exclusive remedy for any defective product is limited to the repair or replacement of the defective product. SK Telesys Corp. may elect the remedy or combination of remedies to provide by its sole discretion. SK Telesys Corp. shall have a reasonable time after determining that a defective product exists to repair or replace the problem unit. SK Telesys Corp. warranty applies to repaired or replaced products for the balance of the applicable period of the original warranty or ninety days from the date of shipment of a repaired or replaced product, whichever is longer.

10.3 Limitation of Damages

The liability for any defective product shall in no event exceed the purchase price for the defective product.

10.4 No Consequential Damages

SK Telesys Corp. has no liability for general, consequential, incidental or special damages.

10.5 Additional Limitation on Warranty

SK Telesys Corp. standard warranty does not cover products which have been received improperly packaged, altered, or physically damaged. For example, broken warranty seal, labels exhibiting tampering, physically abused equipment. SK Telesys Corp. Proprietary Document Page 27 of 31 CDMA RF Repeater User Manual enclosure, broken pins on

connectors, any modifications made without SK Telesys Corp. authorization, will void all warranties.

10.6 Return Material Authorization (RMA)

No product may be returned directly to SK Telesys Corp. without first getting an approval from SK Telesys Corp. If it is determined that the product may be defective, you will be given an RMA number and instructions in how to return the product. An unauthorized return, i.e., one for which an RMA number has not been issued, will be returned to you at your expense. Authorized returns are to be shipped to the address on the RMA in an approved shipping container. You will be given our courier information. It is suggested that the original box and packaging materials should be kept if an occasion arises where a defective product needs to be shipped back to SK Telesys Corp. To request an RMA, please call 888-758-7002 or send an email to service@sktelesys.com.

Section 11. . Contact Information

Maker	
Korea Office Address	SK Telesys Co., Ltd 12-13F, Naewei Bldg.6, Eulgiro-2Ga, Jung-Gu, Seoul 100-844, Korea Homepage: www.sktelesys.com
US Office Address	SK Telesys Corp. 12750 center court drive suite #400, Cerritos, CA 90703
Staff in charge of sales	Kap Soo, Park, Director Phone: 562-207-1924, Fax: 562-207-1925 Email: kapsark@sktelesys.com
Service contact in US	Email : service@sktelesys.com Phone: 888-758-7002
Staff in charge of R&D	Jae-Hyung Kim, Manager Phone: 82-31-786-5625, Email: kjhyung@sktelesys.com