
FR-RLRL45US

Operating Manual



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Author Manager:	Jun-Hyun Lee

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- Address : FRTek Tower, 11-25, Simin-daero 327beon-gil, Dongan-gu, Anyang-si, Gyeonggi-do, Korea
- Zip Code : 14055
- Homepage : <http://www.frttek.co.kr>

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Used Abbreviations

ACLR	A djacent C hannel L eakage P ower R atio
ALC	A uto L evel C ontrol
EVM	E rror V ector M agnitude
GUI	G raphical U ser I nterface
HPA	H igh P ower A mp
HAAT	H eight A bove A verage T errain
ICS	I nterference C ancellation S ystem
PSU	P ower S upply U nit
SISO	S ingle I nput S ingle O utput
VSWR	V oltage S tanding W ave R atio
USB	U niversal S erial B us
3GPP	3 rd G eneration P artnership P roject
EMS	E nterprise M anagement S ystems
RET	R emote E lectric T ilt

Chapter 1 Safety & Certification Notice

1.1 Health and Safety Warnings

Safety & Certification Notice

1.1 FCC Warning Statements

1.1.1 FCC Part 15.105 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 his own expense.

1.1.2 FCC Part 15.21 statement

- Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment



Obey all general and regional installation and safety regulations relating to work on high voltage installations, as well as regulations covering correct use of tools and personal protective equipment.



Home/ personal use are prohibited.



Please be informed that the temperature of the surface is too high. Please be careful. The label is attached to the front of the equipment and the PSU(Power Supply Unit).



Please be informed that there is a risk of injury caused by hazardous voltage and energy. Please be careful. The label is attached to the front of the PSU(Power Supply Unit).

Booster Warning Label

WARNING. This is **NOT** a **CONSUMER** device. It is designed for installation by **FCC LICENSEES** and **QUALIFIED INSTALLERS**. You **MUST** have an **FCC LICENSE** or express consent of an FCC License to operate this device. Unauthorized use may result in significant forfeiture penalties, including penalties in excess of \$100,000 for each continuing violation.

***Chapter 2* System Overview**

2.1 System Overview

System Overview

2.1 System Overview

FRtek's repeater is the most economical and effective solution for outdoor coverage with high RF efficiency and robust feedback cancellation. ICS repeater receives 1900MHz CDMA and LTE RF signal from BTS and transmits them to service user after amplifying to expand CDMA/LTE service coverage and cover shadow regions with black spot where BTS installation is not available.

ICS repeater supports CDMA(forward/reverse direction) service with 5MHz, 10MHz and 15MHz bandwidth and 5MHz bandwidth for LTE service at the same time supporting forward direction gain control and ALC(Automatic Level Control) function for controlling tilt each donor & server antenna.

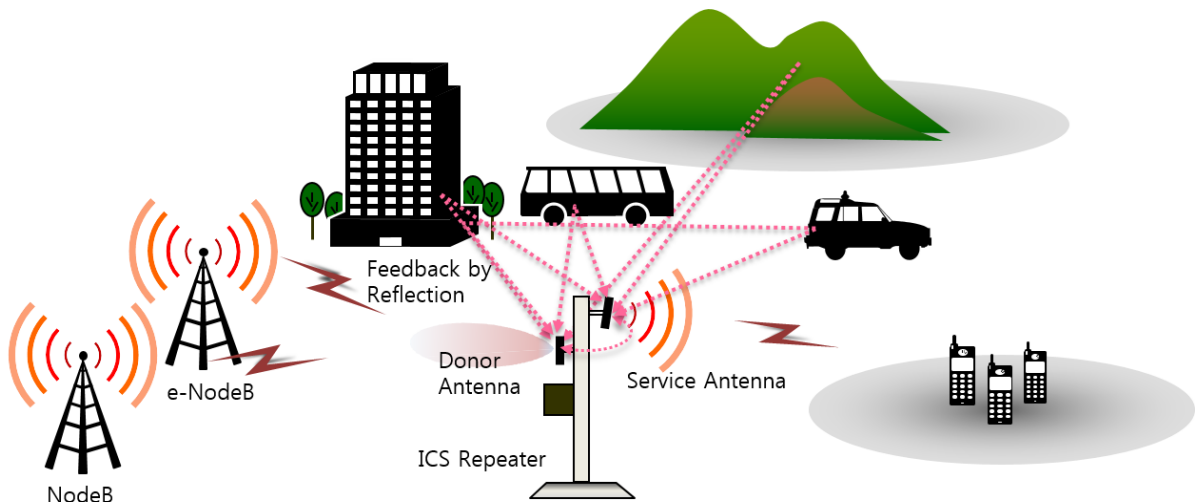


Figure 1. ICS Repeater Service Application Network

2.1.1 ICS Repeater Installation Location

- Outdoor/Indoor in urban and countryside.

2.1.2 ICS Repeater General Information

Items		Specification	Remark
Service Frequency		LTE, CDMA2000/EV-DO	LTE 5M / 10M
Frequency band	DL	1930 ~ 1995 MHz	

	UL	1850 ~ 1915 MHz	
System Output	DL	30Watt/Total (44.77dBm /Total)	
	UL	2Watt/Total (33dBm /Total)	
AC Power		AC 110V ~ 240V	
Enclosure Size		Below 24" x 19" x 15"	
Weight		Below 35kg	Excluding mounting bracket

※ Maximum DL output power is 30Watt/Total

- In case of 3 blocks : 10Watt (40dBm) per block
- In case of 2 blocks : 15Watt (41.76dBm) per block
- In case of 1 block : 20Watt (43.01dBm) per block

※ Maximum UL output power is 2Watt/Total

- In case of 3 blocks : 0.67Watt. (28.26dBm) per block
- In case of 2 blocks : 1Watt (30dBm) per block
- In case of 1 block : 1.33Watt (31.23dBm) per block

Chapter 3 System Configuration

-
- 3.1 Configuration**
 - 3.2 System Module Configuration**
 - 3.3 System Port Configuration**
 - 3.4 AC Power Cable**
 - 3.5 Antenna**

System Configuration

3.1 System Figuration

This equipment is designed with consideration the following items:

- Enclosure of the equipment is designed for outdoor environments and for handling such as rainfall, snowfall and temperature change.
- This equipment is designed to carry, assemble, install easily.
- Enclosure of this equipment is designed to protect breaking into dust, pollutants and insect.
- Enclosure of the equipment is designed to avoid the occurrence of vibration or malfunction due to external environmental conditions (earthquake Zone4), mechanical damage.
- All parts this equipment is made smoothly.
- The system is composed of sufficient shielding considering the effect on electromagnetic wave of each connection.



Figure 2. Repeater Figuration

3.2 System Module Configuration

Module Name	Q'ty	Description
Duplexer	2	There are 2 types for donor and server and it support to divide DL/UL signal.
DL HPA	1	It amplifies output of DL Signal from ICS Module.
UL HPA	1	It amplifies output of UL Signal from ICS Module.
ICS Module	1	It performs ICS signal processing after receiving main signal and feedback signal to and also embedded MCU and performs MCU function.
PSU	1	It supplies power to each module after converting from AC to DC
EMS Board	1	It has a function to control and monitor of repeater and to provide software upgrade.
RET Interface Board	1	Surge protection circuit of AISG 2.0 Port(RET)

3.3 System Port Configuration

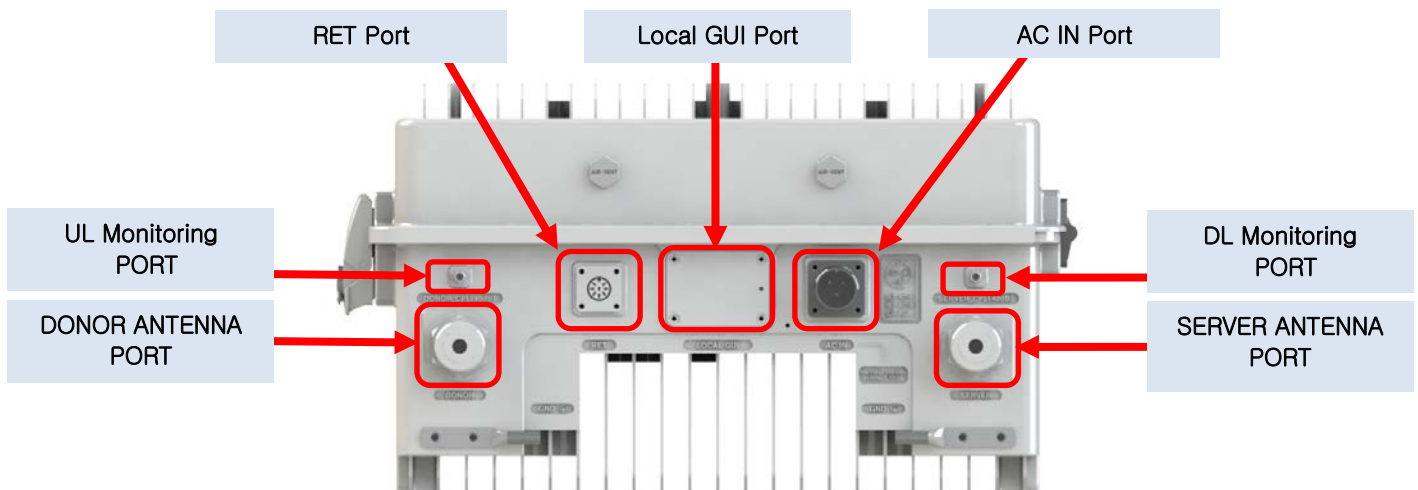
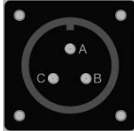


Figure 3. ICS Repeater External Port Configuration

Port Type	Description	Location of port
AC IN Port (For supplying AC PORT)	AC(110~204V) is provided from external power cabinet. Spec : MS3106A-16-10S(Female)	At the bottom of enclosure
Donor Antenna	Connection port with link antenna, it receives and transmit BTS(BS) signal through this port. Spec : 7/16 DIN-Female	At the bottom of enclosure
Server Antenna	Connection port with server antenna, it receives and transmit Mobile(MS) signal through this port. Spec : 7/16 DIN-Female	At the bottom of enclosure
DL MON	It controls systems and monitor system status. Connector Spec : SMA-Type Female	At the bottom of enclosure
UL MON	It controls systems and monitor system status. Connector Spec : SMA-Type Female	At the bottom of enclosure
RET (AISG 2.0)	Control tilting function by cascading donor/server antenna remotely Connector Spec : SU-20SPR-8S	At the bottom of enclosure
Local GUI	Control and check status of repeater with connection between PC and communication cable by GUI. Connector Spec : RJ-45	At the bottom of enclosure

3.4 AC Power Cable

FR-RLRL45US Repeater is using an AC 110V~240V as a main power. User should check the polarity of each pin in case of connecting power.

MS Connector	Pin Name	Name	Description	Length(mm)
	A	AC_H	AC Hot	1800
	B	AC-N	AC Neutral	1800
	C	F.G	Frame Ground	1800

Power cable of is as following and turn on the switch after connecting equipment.

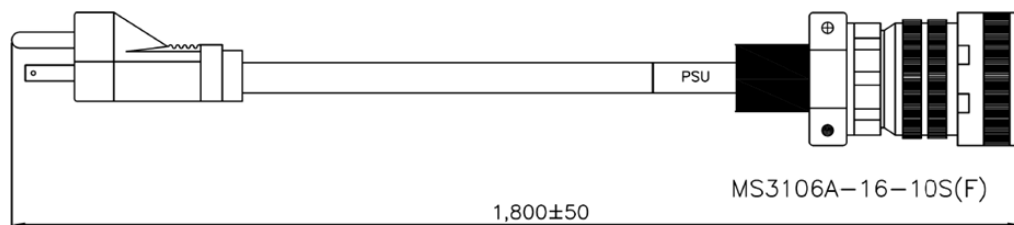


Figure 4. AC Power Cable

3.5 Antenna

One of the important system optimizations task is to adjust antenna tilts, or the inclination of the antenna in relation to an axis. By doing tilt adjustment, we are able to control the received RF power to concentrate the energy into the new desired direction. FR-RLRL45US Repeater has RET function to adjust antenna tile.

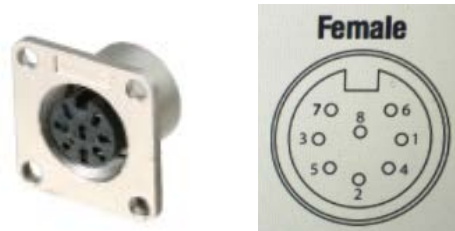


Figure 5. RET Port Connector(SU-20SPR-8S) Pin Map



Part 27.50

Antennas must be installed in accordance with FCC 27.50. Over 17dBi gain antennas the height of the antenna above average terrain (HAAT) must not exceed **xxxm**. For different gain antennas refer to the relevant rules.



Part 90.635 requirement

Antennas must be installed in accordance with FCC 90.635. Over 17dBi gain antennas the height of the antenna above average terrain (HAAT) must not exceed **XXXX m**. For different gain antennas refer to the relevant rules.



Use of unauthorized antennas, cables, and /or coupling devices not conforming with ERP/EIRP and /or indoor- only restrictions is prohibited.

***Chapter 4* System Specification**

-
- 4.1 RF Specification**
 - 4.2 Power Specification**
 - 4.3 Environment Specification**

System Specification

4.1 RF Specification

Items		Specification	Remark
Service Frequency		LTE, CDMA2000/EV-DO	LTE 5M / 10M
Frequency band	DL	CDMA	1930 ~ 1995 MHz
	UL	CDMA	1850 ~ 1915 MHz
Occupied Bandwidth		25 MHz configurable (3 channels contiguous and or non-contiguous) in 5MHz increments.	
Band Flatness		$\leq 3\text{dB p-p}$	In case of 6 cascading
Frequency Stability		$\leq \pm 0.05\text{ppm}$	
Waveform Quality	CDMA	$\text{Rho} \geq 0.99$	
	LTE (5M / 10M)	$\text{EVM} \leq 3.2\%$	E-TM3.1(64QAM)
		$\text{EVM} \leq 5.1\%$	E-TM3.2(16QAM)
		$\text{EVM} \leq 7.1\%$	E-TM3.3(QPSK)
	CDMA	$\text{Rho} \geq 0.96$	In case of 6 cascading
	LTE (5M / 10M)	$\text{EVM} \leq 15\%$	E-TM3.1(64QAM) (In case of 6 cascading)
		$\text{EVM} \leq 15\%$	E-TM3.2(16QAM) (In case of 6 cascading)
$\text{EVM} \leq 15\%$		E-TM3.3(QPSK) (In case of 6 cascading)	

This system complies with prescribed gain control and input/output function specification.

Items		Specification	Remark
Gain control range		65 ~ 105 dB	DL / UL
Gain control gap		0.5 dB /Step	
Gain control error		Below ± 0.5 dB /Step	
Input Range	DL	-60.3dBm/Total	
	UL	-72dBm/Total	
Output Level	DL	30Watt/Total (44.7dBm /Total)	
	UL	2Watt/Total (33dBm /Total)	
Shut-down Function	DL	Over 45.7dBm / Total	Can configure shut-down level
	UL	34dBm / Total	
System Noise Figure		Within 4dB	
System Delay Period	CDMA	≤ 4.0 usec	DL / UL
	LTE (5M / 10M)	≤ 4.0 usec	DL / UL
Standing wave ratio (VSWR)		$\leq 1.5:1$	DL / UL
ALC Range		≥ 30 dB	DL / UL
Feedback signal remove function		G=I+15dB	

※ Maximum DL output power is 30Watt/Total

- In case of 3 blocks : 10Watt (40dBm) per block
- In case of 2 blocks : 15Watt (41.76dBm) per block
- In case of 1 block : 20Watt (43.01dBm) per block

※ Maximum UL output power is 2Watt/Total

- In case of 3 blocks : 0.67Watt. (28.26dBm) per block
- In case of 2 blocks : 1Watt (30dBm) per block
- In case of 1 block : 1.33Watt (31.23dBm) per block

4.2 Power Specification

Items	Specification
Power	AC110 ~ 240V, 60Hz

4.3 Environment Specification

4.3.1 This system operates in operating temperature between -40°C ~ +55°C without problem.

4.3.2 After testing the temperature/humidity test, there is no condensation inside of the system. 4.3.3 In terms of not operating system, there is not condensation and function degradation due to difference of temperature.

4.3.4 When testing prescribed vibration, there is no system and mechanical damage.

4.3.5 When testing prescribed rainfall, there is no water penetration.

4.3.6 Without external fan, it maintains proper temperature in enclosure.

4.3.7 Complied with Telcordia GR63-CORE(Dust).

4.3.8 This system is designed with compatible component for FCC & UL Certificate.

4.3.9 Major environment test condition is same as following table.

Items	Condition of application	Requirements
Storage Environment Condition	<ul style="list-style-type: none"> • Temperature: -40 ~ +85°C • Humidity: 5 ~ 95% 	No change of system function
Operation Environment	<ul style="list-style-type: none"> • Temperature: -40 ~ +55°C • Humidity: 5 ~ 100% 	No change of system function
Vibration	<ul style="list-style-type: none"> • Vibration Range: 10 ~ 150Hz • 0.1 Octaves/min • Earthquake test : Zone 4 	No change of system function No change inside/outside of enclosure
Altitude/Barometer	<ul style="list-style-type: none"> • 10000.ft AMSL.(Estimated 3,000M) 	No change of system function
Waterproof	<ul style="list-style-type: none"> • NEMA Specification 4 	No penetration of water inside
Anti-Dust		No change internal/external enclosure

Chapter 5 FR-RLRL45US Installation

5.1 Installation

FR-RLRL45US Installation

5.1 Installation

5.1.1 Grounding Connection

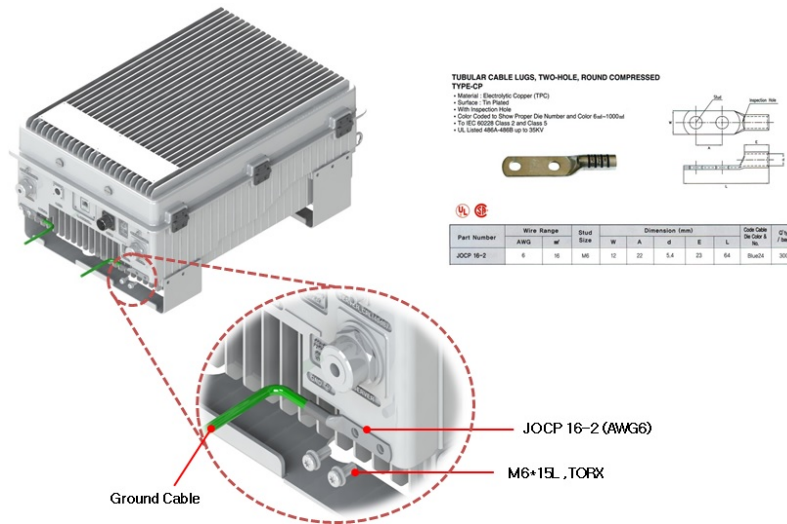


Figure 6. Connection of grounding cable

This system connects with enclosure grounding and building ground to avoid electrical hazard and protect system operator.

5.1.2 Antenna Connection

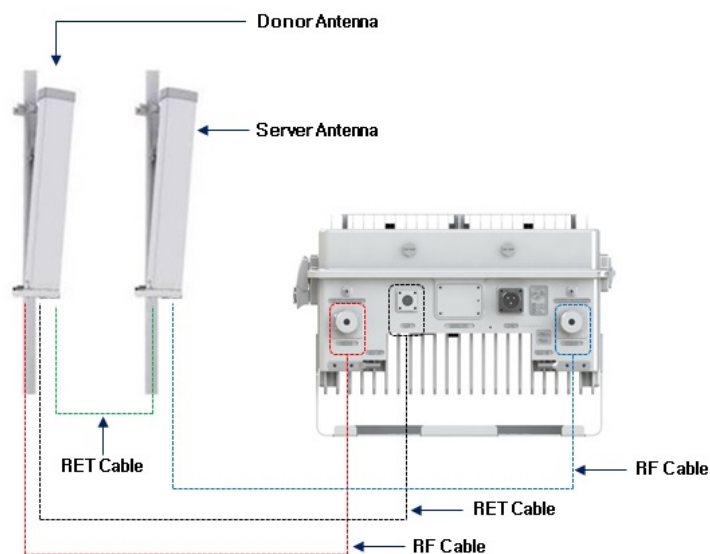


Figure 7. ICS Antenna Cable Connection.

Donor and Server Antenna have RF and RET ports, and these ports are connected to ICS repeater. The brief drawing which connectors to the antenna of ICS repeater is as follows.

Antenna being used for ICS repeater should be approved by service provider or officially approved and proper antenna type can be selective depending on the installation environment.

This system is composed of 2 antenna port (Donor and server antenna) it is DIN-Type Connector.

 **Warning**

Antenna should be installed according the regulation - FCC 27.50, for different gain antennas refer to the relevant rules.

5.1.3 AC Power Connection

ICS repeater uses AC110V~240V as a main power. Power cable includes a plug, following information is pin specification of AC power cable, User should check the polarity of each pin in case of connecting power.

 **Warning**

Do not use unauthorized antenna, cable and coupling device.

FR-RLRL45US
Operating Manual

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