Users Guide
&
Installation Manual

USHR-700L

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This is a CONSUMER device.

BEFORE USE, you MUST REGISTER THIS DEVICE with your wireless provider and have your provider's consent. Most wireless providers consent to the use of signal boosters. Some providers may not consent to the use of this device on their network. If you are unsure, contact your provider.

You MUST operate this device with approved antennas and cables as specified by the manufacturer. Antennas MUST be installed at least 20 cm (8 inches) from any person.

You MUST cease operating this device immediately if requested by the FCC or a licensed wireless service provider.

WARNING. E911 location information may not be provided or may be inaccurate for calls served by using this device.

1. General Information

1.1. Precautions

Reference : Direction/Information for the proper operation

Cautions : Information for users to avoid malfunctions

Warning : Instruction for users to avoid unexpected hazard

1.1.1 Do not drop the device
- It may damage the product and its function

1.1.2 Do not place near magnetic material
- It may cause of possible malfunction

1.1.3 Product is recommended to be used with original AC/DC adapter

1.1.4 Install the product where it is recommended
- It may not properly operate if it is not recommended location

1.1.5 Do not disassemble/ repair the product
- Warranty may void once you disassemble the product.

1.1.6 Turn off the device immediately if a smog or any strange odor is detected from the product.

1.1.7 Use contained bolt to install on the wall. Make sure it is safely installed before operation

1.2 . Features

1.2.1. Summary

This device may be installed on residential area, office, warehouse etc. .
Following is advantage of using in-building repeater system.

I. Decrease dropped call rate
II. Increase signal strength
III. Improve Data / Voice quality
IV. Prolong hand phone battery life
V. Improve data Communication Rate

This is RF type amplifier for 700 MHz LTE of Band 12 and Band 13 signal enhancement.
(Please see page 13 for Operating Frequency in details)

1.2.2 . Features

I. Wider Coverage area
- Band 12 Gain DL 61dB /UL 60dB, Band 13 Gain DL 61dB/ UL 60dB.

II. ALC(Automatic output Level Control)
- Stabilize operation in any radio environment

III. Fulfill 3GPP spurious specification at +22dBm output power (category A)
- Provide high Data Communication Rate

IV. Easy gain control by dip switch located on the front side of product

V. Support dual band
- enable to connect service from multiple currier simultaneously
- LTE Band 12/13 service simultaneously
- LTE Band 12/13 adopt independent operation algorithm

VI. Check status of product by LED indicator

VII. Manage and control product by GUI(Graphic User Interface)
- Please ask professional installer about GUI Program

VIII. Enable to stay connected in homes and offices
- Please ask professional installer for installation on homes & offices

IX. LTE ready

X. Automatically isolation detection and gain setting
- Power ON/OFF when oscillation occurs.

XI. UP Link Sleep Mode
- If no signal detected for 5 minutes, UP Link Path Shuts Off

XII. UL/DL gain Interlocking Mode

1.2.3. Function

I. S/D (Auto Shut Down Mode)

Built-In Automatic Self-Monitoring Features for Anti-Oscillation:

Automatic Shut Down Mode operates when oscillation in the uplink and downlinks bands are detected, thus terminates potential harmful interference to wireless networks.

- **1 MINUTE Non-Operative Mode** on the first initial oscillation detection.
- **Default Algorithm Re-Set Mode** when Auto S/D Mode is cleared
- **Complete Shut Off Mode** on the 5th repetition of Auto S/D Mode status.

BAND 12 & BAND 13 PATH are independently monitored and operated.

II. Intermodulation Gain & Power Limit Control

Uplink & Downlink PATH formulate consistent link balance to regulate its input and output gain & power limits.

max UL gain < − 34dB − RSSI + MSCL (" FCC 13-21,(i), 78p")

RSSI : the downlink composite received signal power at the donor port (calculation value : DL Output − DL Gain)

MSCL : Mobile Station and repeater service port minimum Coupling Loss (setting value)

BAND 12 & BAND 13 PATH gain limits are independently controlled

III. ALC (Automatic Level Control)

ALC is implemented due to the higher rate of signal changes and wide dynamic range in LTE Bands, the Automatic Gain Power Control (AGC) may experience off set time synchronization error.

- **Optimal Window Size** (frequency range) sets the optimal level to increase faster response to LTE Frequency changes on the basis of gain power control via signal input/output differential calculation

BAND 12 & BAND 13 PATH gain limits are independently controlled

IV. UL PATH Automatic Sleep Mode

If coverage is non-existent (Zero Area Zone), Uplink PATH shuts off as *A Harmful Interference Avoidance* protocol and minimizes its power consumption.

1.2.3. Function

IV. UL PATH Automatic Sleep Mode (continue)

- **Automatic Turn OFF / if UL PATH < -92dBm**
- **Automatic Turn ON / if UL PATH > -90dBm**

****BAND 12 & BAND 13 PATH** gain limits are independently controlled

V. Oscillation Auto Prevention

- **Degradation Protection:** Detects potential performance degradation due to the overload LTE feedback (over-heating) signals by Isolation Check & Gain Configuration.
- **Feedback Limits**: Sets the operating range to exceeding high level Signals from Donor Antenna (external antenna) of a signal booster to Service Antenna (internal antenna)

BDA Gain < Antenna to Antenna Isolation – 15dB

If optimal isolation gain is not attained, PATH OFF shuts off automatically

****BAND 12 & BAND 13 Uplink PATH** are independently controlled

2. System components

① Dual Band Repeater

② AC/DC Adapter

③ User Manual

④ Installation bolts

① Dual band Repeater : BTS and mobile phone signal booster

② AC/DC Adaptor : 110VAC power supply

③ User Manual : Operation manual

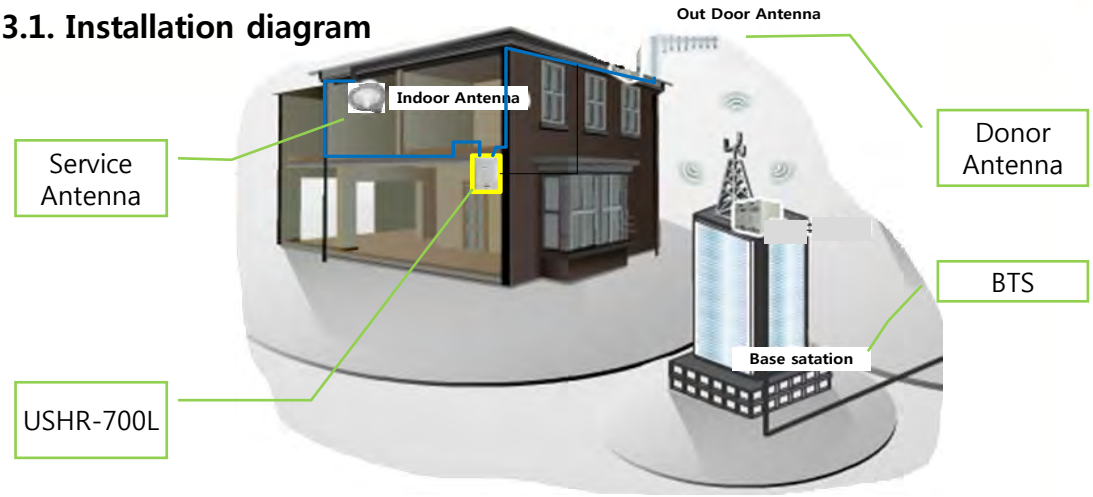
④ Installation Bolts : Holds repeater on the vertical wall

● List of approved antennas & cables

Antenna			RF Cable	
Item	Model	Gain	Model	Cable type
Service Antenna (Indoor Antenna)	PAT-CPWI-L	+4dBi	AC200000	LMR200
	TS260771	+8dBi	TS320000	RF240
	TS250374	+5dBi	TS340000	RF400
Donor Antenna (Outdoor Antenna)	ALP-17QD-L	+6dBi	TS350000	½"
	TS210471	+4.5dBi	TS360000	½"
	TS220971	+9dBi	-	-

3. Installation

3.1. Installation diagram



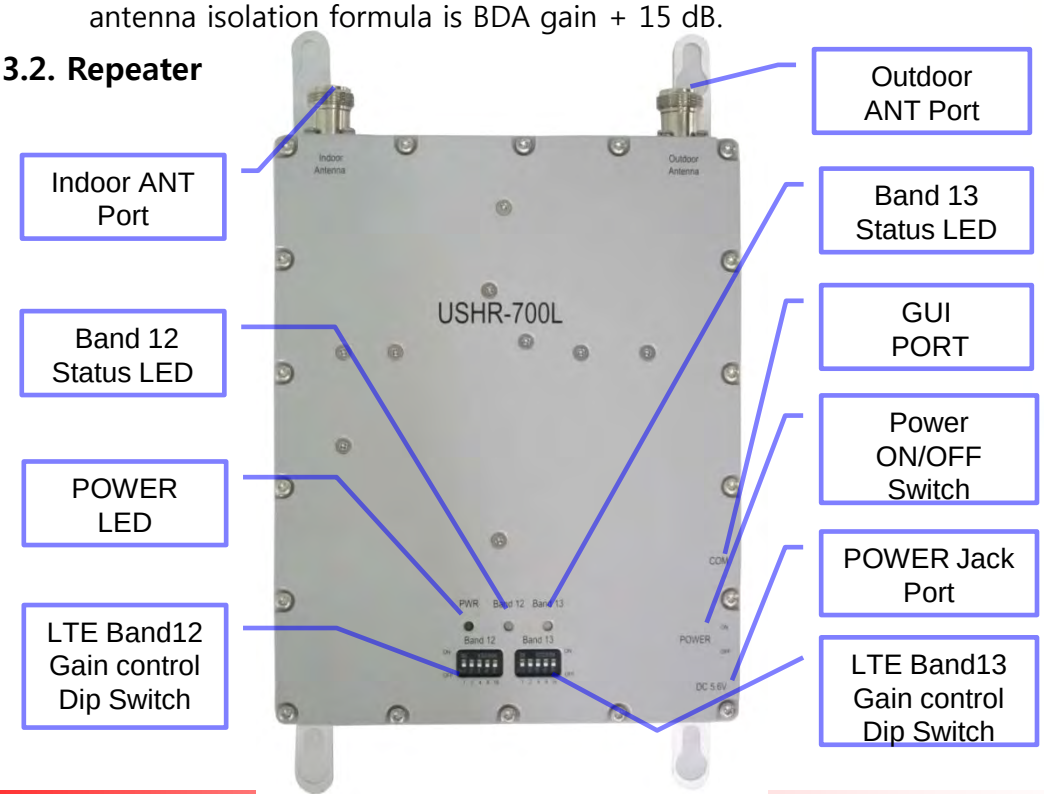
3.1.1. Install Donor Antenna on higher location to avoid any signal interference. Mount towards to the BTS where a clear line-of-sight path exists for optimal signal level.

3.1.2. Install service antenna at appropriate location such as wall or roof ceiling. Make sure service antenna is not blocked by furniture or hope appliance.

3.1.3. Use enclosed bolt to fix repeater on the wall and plug in power adaptor.

3.1.4. For best optimal operation, antenna isolation (oscillation level) should be set above minimum 15 dB gain. The industry standard for antenna to antenna isolation formula is BDA gain + 15 dB.

3.2. Repeater



3.3. Repeater and Antenna connection

3.3.1. Connect donor antenna cable to outdoor antenna port as shown below.

3.3.2. Connect Service antenna to indoor antenna port as shown below.

3.3.3. Plug in power adaptor to power outlet.

3.3.4. Plug in AD/DC adaptor to connector listed as DC5.6V

3.3.5. Once power is on, it will show 3 green LED light on the front of product as shown below.

LTE Band12
Gain manual control
Dip Switch (0~25dB)

LTE Band13
Gain manual control
Dip Switch (0~25dB)

3.3.6 The factory default set-up has both Automatic Attenuator Control (AAC) & Automatic Level Control (ALC) pre-activated by USHR-700L Internal CPU. All Isolation Check features can be manually adjusted via Dip switch using GUI program (Repeater Control & Monitoring Software).

4. Trouble Shooting

4.1. LED Status

Item	GREEN LED	RED LED	Reference
PWR	ON	×	See 4.1.1
	OFF	×	See 4.1.1
LTE Band 12	ON	-	See 4.1.2
	-	ON	See 4.1.3
	Green Blinking per 1 sec cycle	-	See 4.1.4
	Green Blinking per 5 sec cycle	-	See 4.1.5
	-	RED Blinking per 1 sec cycle	See 4.1.6
		RED Blinking per 5 sec cycle	See 4.1.7
LTE Band 13	ON	-	See 4.1.8
	-	ON	See 4.1.9
	Green Blinking per 1 sec cycle	-	See 4.1.10
	Green Blinking per 5 sec cycle	-	See 4.1.11
	-	RED Blinking per 1 sec cycle	See 4.1.12
		RED Blinking per 5 sec cycle	See 4.1.13

4.1.1. Power on /off status.

4.1.2. Band 12 normal operation condition.

4.1.3. Band 12 detects excessive input signal and shut down.

4.1.4 Shut Down Algorithm status on BAND 12 Signal Input.

4.1.5. PATH OFF indicator during Uplink Sleep Mode for BAND 12.

4.1.6. Isolation SD Algorithm status on Band 12

4.1.7. Band 12 detects Insufficient Isolation between donor & service antenna and shut down.

4.1.8. Band 13 normal operation condition.

4.1.9. Band 13 detects excessive input signal and shut down.

4.1.10 Shut Down Algorithm status on BAND 13 Signal Input.

4.1.11. PATH OFF indicator during Uplink Sleep Mode for BAND 13.

4.1.12. PATH OFF indicator during Uplink Sleep Mode for BAND 12.

4.1.13. Band 12 detects Insufficient Isolation between donor & service antenna and shut down.

5. Specification

5.1. Electrical Specification

Item		Specifications	Note
Frequency Range	Down Link	728 ~ 746 MHz	BAND12
	Up Link	698 ~ 716 MHz	
	Down Link	746 ~ 757 MHz	BAND13
	Up Link	776 ~ 787 MHz	
Modulation Type	GSM. EDGE, CDMA, EVDO, HSPA, LTE		
Input Power limit	Down Link	-45dBm max	BAND12
	Up Link	-13dBm max	
	Down Link	-45dBm max	BAND13
	Up Link	-13dBm max	
Output Power	Down Link	+2dBm @ booster output port	LTE DL 5MHz 25RB
	Up Link	+22dBm @ booster output port	LTE UL 5MHz 25RB
	Down Link	+2dBm @ booster output port	LTE DL 5MHz 25RB
	Up Link	+22dBm @ booster output port	LTE UL 5MHz 25RB
Gain	Down Link	47dB ~ 61dB (±1.0dB)	BAND12
	Up Link	35dB ~ 60dB (±1.0dB)	
	Down Link	47dB ~ 61dB (±1.0dB)	BAND13
	Up Link	35dB ~ 60dB (±1.0dB)	
Ripple	Down / Up Link	< 4dB	BAND12
	Down / Up Link	< 4dB	BAND13
Noise Figure	Down / Up Link	< 6.0dB / < 6.0dB	BAND12 Max Gain
	Down / Up Link	< 6.0dB / < 6.0dB	BAND13 Max Gain
Noise Power Limit	Down Link	< -70dBm/MHz	On shutdown
	Up Link	< -70dBm/MHz	On shutdown & sleep mode
	Down / Up Link	FCC	BAND12
	Down / Up Link	FCC	BAND13
Propagation Delay		< 3us	
VSWR		≤ 1.8 : 1	
ALC Setting Level	Down Link(Upper Value)	+2dBm±1.0dB	- ALC, SD, OSC functional operation is completely separate BAND12 and BAND13.
	Window Size(Lower Offset)	0 ~ 10dB	
	Up Link (Upper Value)	+22dBm±1.0dB	
	Window Size(Lower Offset)	0 ~ 10dB	
ALC Range	Down Link	≤ 14dB	
	Up Link	≤ 25dB	
Uplink Gain limit	DL starting input level for Uplink Gain Interlocking	-68 dBm	
Shutdown Level	Down Link	> -45dBm/Total	
	Up Link	> -13dBm/Total	
OSC Level	Down Link	DL detects OSC under 1 sec.	
	Up Link	UL detects OSC under 0.3 sec.	
Uplink In-activity	Up link	On@ > -90dBm, OFF@ < -92dBm	- No uplink signal for 5 minutes

Gain Control Range	ALC	Down Link	0dB ~ 14dB / 1dB step @ Band12	- be controlled GUI or Dip Switch - Total Atten control Range : 0dB ~ 25dB / 1dB Step (Both DL and UL are the same)
		Up Link	0dB ~ 25dB / 1dB step @ Band13	
	Dip Switch	Down link	0dB ~ 25dB / 1dB Step	
		Up link	0dB ~ 25dB / 1dB Step	
Gain Control Deviation			< ± 1dB	
EVM			< 7%	No Feedback
ACLR (± 10MHz)		Down Link	≥ 38dB	LTE DL 5MHz 25RB
		Up Link	≥ 32dB	LTE UL 5MHz 25RB
Isolation checking Range			47dB ~ 75dB / BAND12	Detecting deviation: < ±2.0dB
			47dB ~ 75dB / BAND13	
In band Spurious (Operating band unwanted emissions)			Category A	3GPP TS 36.106
Out Band Spurious			< -13dBm/1kHz RBW	9kHz ~ 150kHz
			< -13dBm/10kHz RBW	150kHz ~ 30MHz
			< -13dBm/100kHz RBW	30MHz ~ 1GHz
			< -13dBm/1MHz RBW	1GHz ~ 12.75GHz
3rd IMD			< -19dBm	
Frequency Stability			≤ ±0.01ppm	
GUI Interface			RS-232C	
Power Consumption			< 15 W	
Operating Power			AC/DC Adapter(AC110V or AC220V)	
RF Connector			N-type Female	

● Additional Information:

This repeater is a bi-directional amplifier for the boosting of cellular phone signals and data communication devices.
The following frequency bands and emission types are utilized.

Frequency Band		
Uplink	698 ~ 716 MHz	776 ~ 787 MHz
Downlink	728 ~ 746 MHz	746 ~ 757 MHz

Emission Designators					
CDMA	HSPA	LTE	EVDO	EDGE	GSM
F9W	F9W	G7D	F9W	G7W	GXW

5.2. Mechanical Specification

Item	Specifications	Note
Dimensions (L × W × H)	151mm x 191mm x 35mm (5.95 x 7.5 x 1.38 inch)	
Weight	< 2Kg	

5.3. Environment Specification

Item	Specifications	Note
Temperature	-30 ~ 55℃(-22 ~ 131℉)	
Humidity	10 ~ 95%	

5.4. AC/DC Adaptor Specification

Items	Specifications	Note
AC input power	90VAC ~ 264VAC, 47Hz ~ 63Hz	
Output rated Voltage	+5.5VDC/1.3A	
Voltage Current range	2.5A ~ 0.0 A	
Operation Temperature	-30℃ ~ +55℃	
Operation humidity	10% ~ 90%	

6. Certificates

6.1 FCC Certification

Model : USHR-700L

- **Certificate Data :**
- **Certificate Number:**