

LTE700+CDMA/GSM850
Thrip-Band Series Repeater
17K-A01
User Manual

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Preface

This user's manual describes the installation, commissioning and maintenance of 17K-A01 wide band consumer repeaters of LTE700(A+B+C) +CDMA/GSM850three systems.

Please do read user manual carefully before installing and maintaining the repeaters.

The information in this manual is subject to change without prior notice.

Opinions are welcomed about the manual improvement.

1. Safety Warnings

Users must follow the below principles:

- Repeater should follow system requirement of communication equipment, assure good grounding and lightning protection.
- The power supply voltage of repeater should meet the standards of security requirement; any operation shall be carried out only after cutting off power in advance. Only the professional is authorized for the operation.
- Do not dismantle machine, maintain or displace accessories by yourself, because in this way, the equipment may be damaged and you may even get an electric shock.
- Do not open the repeater, touch the module of repeater, or open the cover of module to touch the electronic component. The components will be damaged due to electrostatic.
- Please keep away from heating-equipment, because the repeater will dissipate heat during working. And do not cover booster with anything that influences heat-dissipation.

2. Introduction

Our 17K-A01 full band repeater is the perfect solution for providing a wireless improvement in the cellular reception of a home, office, restaurant, VIP Room, apartment, building or shopping mall, in the quickest time possibly. One repeater covers 50 to 2000 square meters.

In order to maintain safe and specific output signal levels, this repeater has built-in signal oscillation detection circuit to adjust the gain automatically so as to avoid interference to the cellular network.

Below diagram shows how simple and fast the repeater system is installed and works effectively:

One Yagi antenna, as donor antenna, is installed at the top of the roof to pick up good mobile phone signals from outside, and send through 3D-FB cable to repeater to amplify the signals significantly, then the output signals are sent to the indoor whip antennas and finally transmitted into the covering area. Very clear phone call or high speed mobile data are immediately achieved within the area.



3. System Characteristics

3.1. Features

- Streamline shape.
- Wide band repeater to support signals of all operators.
- High-integration (One board to contain low-noise amplifier, frequency selection module, power amplifier module, both uplink and downlink one for all).
- Auto automatic gain control to stabilize the coverage and minimize the noises.
- Auto shut off function as final step to avoid severe interference with mobile network (not available for some models).

3.2. Appearance of the repeaters

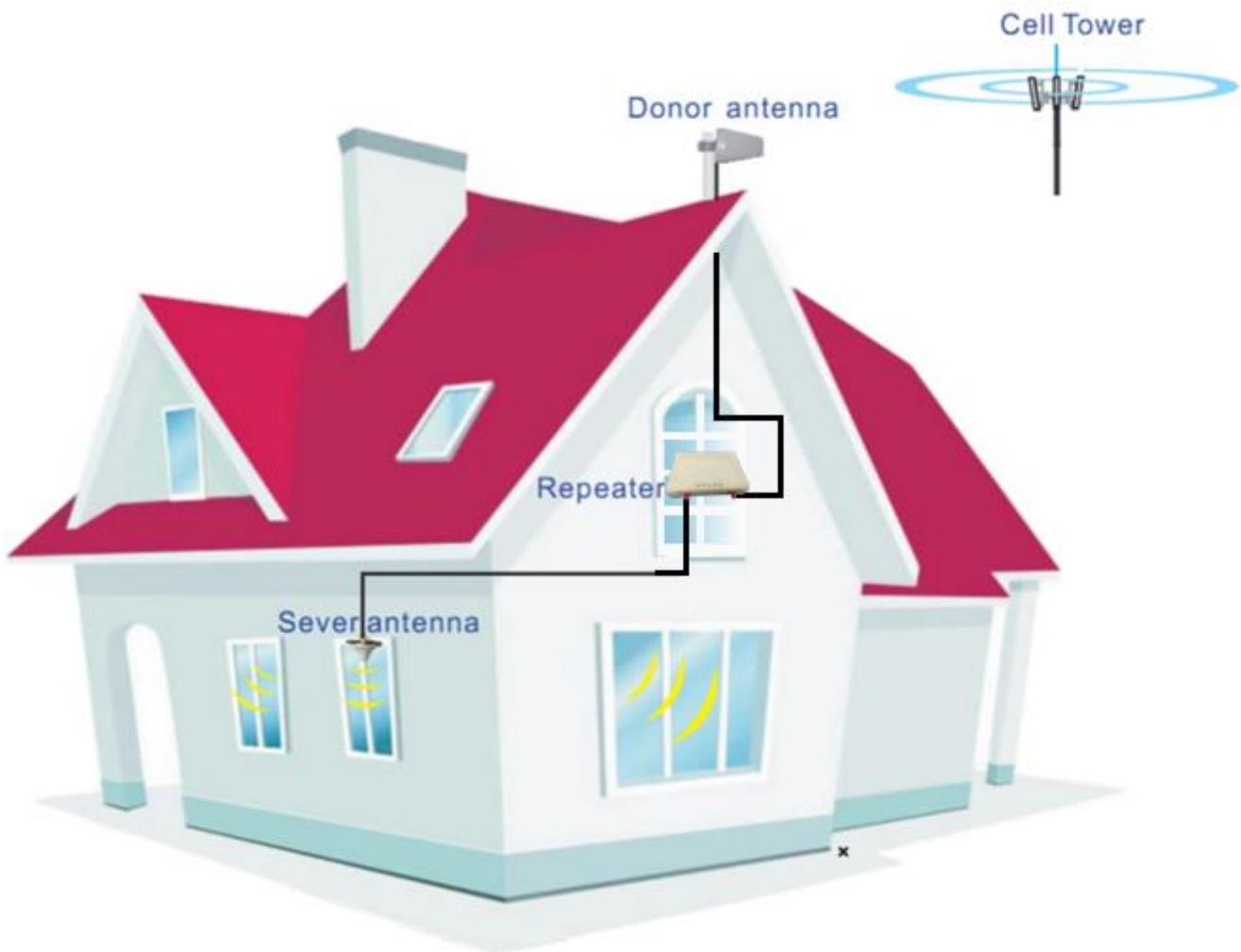


4. Block diagram and work principle

17K-A01 repeater is basically a bi-directional amplifier, the downlink signals are received by the repeater from cell tower by the donor antenna, filtered by its internal duplexers and FC unit, amplified by low noise amplifier (LNA) and downlink PA unit, and then sent via the server antenna to the area to improve mobile signals for mobile phones.

The uplink signal of mobile devices from the coverage area is input via the server antenna, then filtered by duplexers and FC unit, amplified by the uplink low noise amplifier (LNA) and the uplink PA unit and finally sent via the donor antenna to the cell tower.

5. Recommended booster antenna kitting



5.1. Recommended donor/outdoor antenna

Function: Pick up donor signals from the cell tower and send to the repeater by cable; the power level and quality of the received signals influence a lot on the coverage effect. Donor antenna also transmits the uplink signals from the repeater to cell tower.



Log Periodic Antenna

This is a wideband directional antenna with high gain. It's usually installed in the roof of the house and face to the BTS tower for better signal reception.

5.2. Recommended service/indoor antenna

Whip antenna, suitable to be installed in the center and radiate all direction; It is better to use a directional panel antenna or wide band Yagi when the coverage shape is long and narrow (corridors, long row of houses in two sides, tunnels or elevators or rural open space)



The whip antenna

The whip antenna is an omni directional antenna with a radiation of 360 degree. It's usually directly connect to the booster, and then put the repeater in the central of the covering area for signal distribution.

5.3. Optional booster kitting for fixed installation

5.3.1. The outdoor booster antenna kitting:

7dBi Log Periodic Antenna with 15 meters 3D-FB Coax Cable (SMA-Male Connectors)

5.3.2. The indoor booster antenna kitting:

1dBi Whip Antenna SMA-Male Connectors

6. Main technical specification

6.1. RF technical specification

Electrical specification		Uplink	Downlink
Frequency Range	LTE(A&B)	698~ 716 MHz	728 ~746 MHz
	LTE (C)	776~ 787MHz	746 ~757 MHz
	CDMA/GSM850	824~849 MHz	869~894MHz
Max .Gain		63dB	63dB
Max .Output Power		17~20dBm	≤17dBm
Band width		Wide Band	
Automatic Level Control		≥ 31dB	
Intermodulation Products	9KHz~1GHz	≤ -19dBm	≤-19dBm
	1GHz~12.75GHz	≤ -19dBm	≤ -19dBm
Spurious Emission	9KHz~1GHz	≤ -36dBm	

	1GHz~12.75GHz	≤ -30dBm
Gain Flatness		CDMA<E&AWS≤ 8dB;PCS≤12dB
Noise Figure		≤9dB
VSWR		≤3
Group Delay		≤ 1.0μs
Frequency stability		≤ 0.01ppm

LED		Standard	
Power LED		Power Indicator	
ALARM LED		ALARM Indicator	
Variable Gain		Downlink linkage the Uplink (When ALC is working, the downlink adjust several dB, the uplink will adjust the same.) But Uplink doesn't linkage the Downlink.	
Uplink Inactivity		295S≤Δt1≤300S, and shut off uplink, the noise level ≤-70dBm	
OSCILLATION DETECTION	Detection time Δt1	≤300mS	≤1000mS
	Restart time Δt2	≥60S	≥60S
	Restart times	≤5	≤5
ALC LED		Orange @ ALC 1~5dB, Red @ ALC15dB~20dB,	
Mechanical Specifications		Standard	
I/O Port		SMA-Female	
Impedance		50 ohm	
Operating Temperature		-25°C~+55°C	

6.2. Mechanical specification

SN	Item	specification
1	Environment Conditions	IP40
2	Cooling mode	Nature cooling

6.3. Environment Conditions

SN	Item	specification
1	Operating Temperature	-25°C to +55°C
2	Storage Temperature	-40°C to +80°C
3	Humidity	5% to 85%

6.4. Requirements for adapters

SN	Item	Minimum	Typical value	Maximum
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1	Input Voltage Range	90 V	220 V	264 V
2	Output Voltage Range	47 Hz	50Hz	63 Hz

7. Installation

The repeaters should be used to cover the indoor area. Humidity and temperature of working environment can affect the reliability of repeater. So, temperature, humidity, dust, interference, power, space requirements and other factors should be considered during installation of repeater.

7.1. Installation Location Requirement

- 1) It is appreciated that the repeater is installed in a cool, dry and ventilated room without erosive gas and smoke and without leakage on its proof.
- 2) Or a cool and ventilated wall of which sun-proof and waterproof is expected.
- 3) Besides above, common wall, tower or high pole is Ok too.
- 4) Installation height should be easy for RF cable wiring, heat dissipation, security and maintenance.
- 5) Have a set of independent and stable power supply.
- 6) Have lightning conductor in the building, tower or high pole with enough strength or stability.

7.2. Power requirement

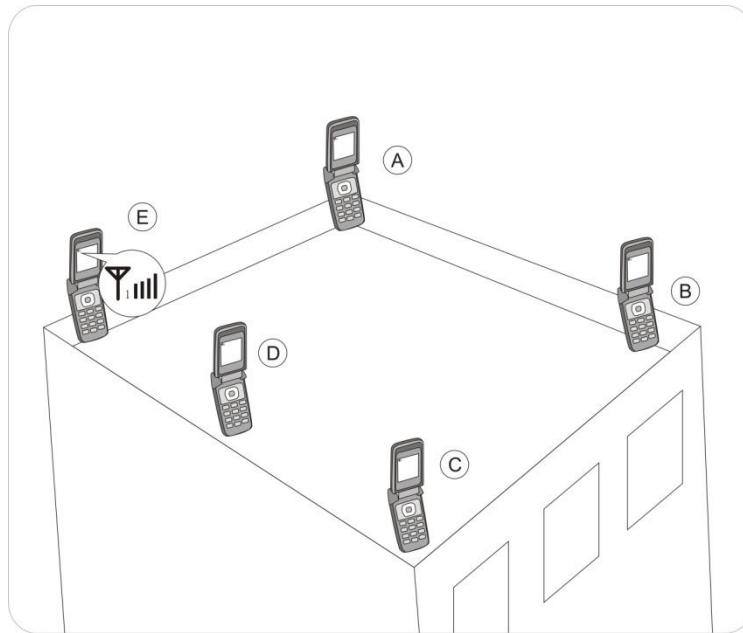
Generally it is AC power supply, and the requirement of AC is 90~264VAC / 50±5Hz

7.3. Installation tools and accessory

No.	Name	Specification	Quantity	Remark
1	Plastic Expansion Bolt	M5*24	6	Standard accessories
2	Tapping screw	M3*27	4	Standard accessories
3	Hanging folder		1	Standard accessories
4	reciprocating drill		1	Engineering-owned, punch the wall
5	Shot bit	M3	1	Engineering-owned, punch the wall

7.4. Installation of donor antenna

The repeater's main function is to improve weak RF signals of an area. A simple formula: Input power+ Gain= Output power. The signal strength from the outdoor antenna directly affects the efficiency of the indoor coverage. It is very important to choose the donor antenna location in order to get the best signals.



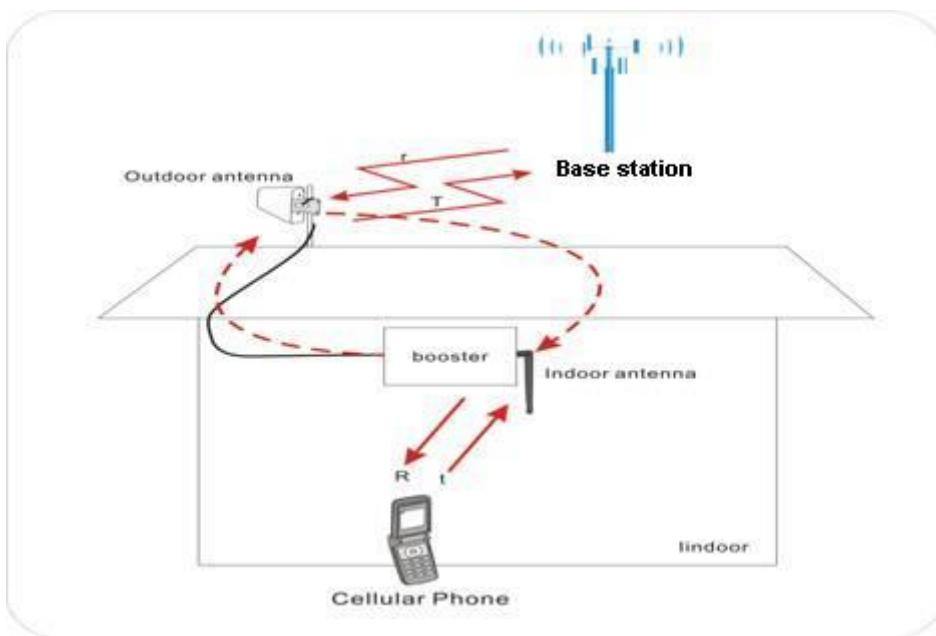
- Testing the signal strength received from donor antenna mounted in site by mobile phone:
 - Please select the top of building to install the donor antenna if total floors are less than 7 floors, and shall try your best to select places like balcony or platform lower than 7th floor for donor antenna if the buildings are over 7 floors, because the mobile signals are clean at less than 7th floor.
 - The mobile phone shall display full bar signals in location where the donor antenna is installed
 - The phone calls or data transmission shall be smooth and stable by 3 times testing in location where the donor antenna is to be installed
 - As shown from the above illustration, testing the signals from A to E, and select a best place that displays full bar signals to install the donor antenna.
- Selecting the installation direction of donor antenna.
 - The donor antenna shall point to the direction of the tower, and it would be much better to keep line of sight.
 - Please select the opposite directions for donor antenna and server antenna. If donor and server antennas have to be installed in the same direction, please install them only after the signal quality is tested and the self-oscillation is avoided. If the directional antenna is selected, the main directional angle should point to the tower antenna.
 - If the performance is poor due to weak signals or poor phone call quality, please adjust the direction of donor antenna or change its position in order to obtain the best calling effect.
 - The wide band repeater supports all mobile operators or different mobile systems, so please adjust the donor antenna direction to have balance between signals of different mobile operators

or various mobile systems.

■ Donor antenna installation ---Notes:

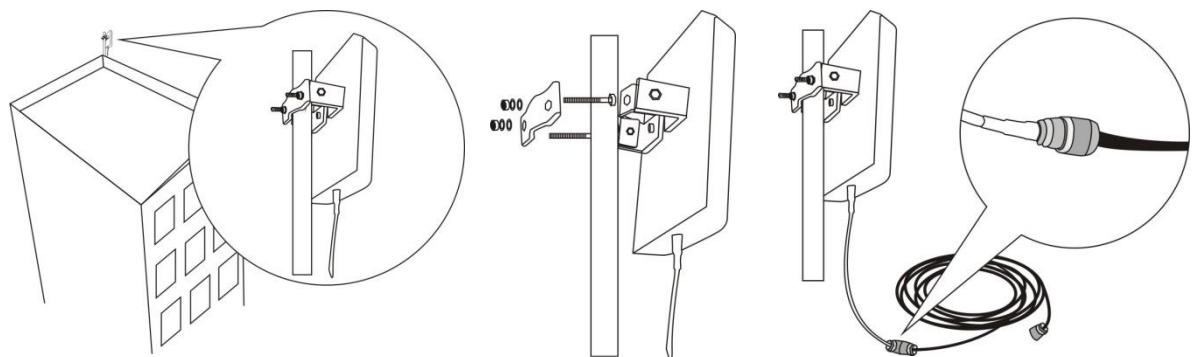
- Do not install the donor antenna during the rainy day with lightning.
- Please follow the instructions to install the donor antenna.
- It is a must that the waterproof shall be done to connectors of donor antenna and feeder lines.
- In order to avoid interference, please note that the donor antenna should be far away from the following objects of metal, high-voltage line, and RF antenna and high-voltage transformer.
- Repeater is a two-way signal amplifier. So proper isolation between donor antenna and server antenna is necessary in order to avoid self-oscillation. About the definition for self-oscillation, take MIC and loudspeaker for example; if it is too close for each other, it could make big noise. So the repeater can only run smoothly if alarm LED always remains GREEN color.
- The minimum distance between donor antenna and server antenna shall be more than 10 meters; again the direction of donor and server antennas shall be opposite.

As shown in the below illustration, the booster amplifies the downlink signal r from the tower and send to the indoor antenna hereafter. If the distance between outdoor antenna and indoor antenna is less than the required distance, the amplified signal R will go back from indoor antenna to outdoor antenna. So it will lead to self-oscillation and reduce the coverage area, also the bad calling quality could happen at the same time, and the worse is that the mobile network could be influenced badly and the operators will finally come to shut off the repeater system.

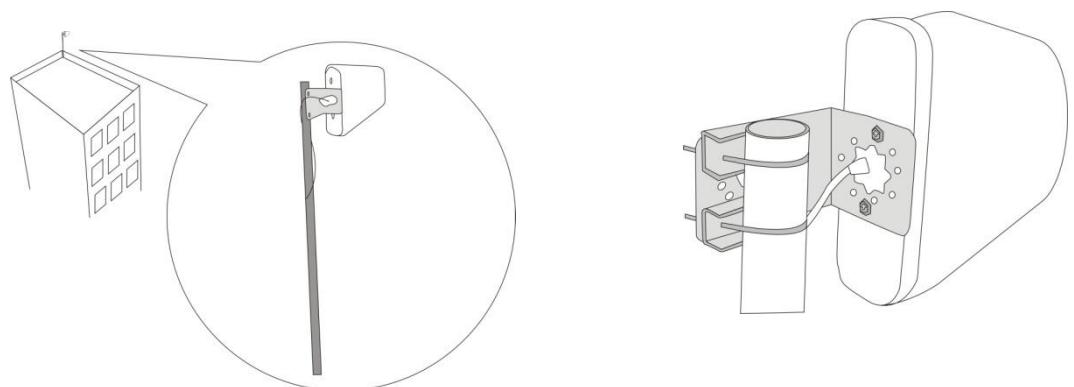


If isolation can't be achieved by the limited distance, the roof of the building or any other barriers can be used in between to increase isolation.

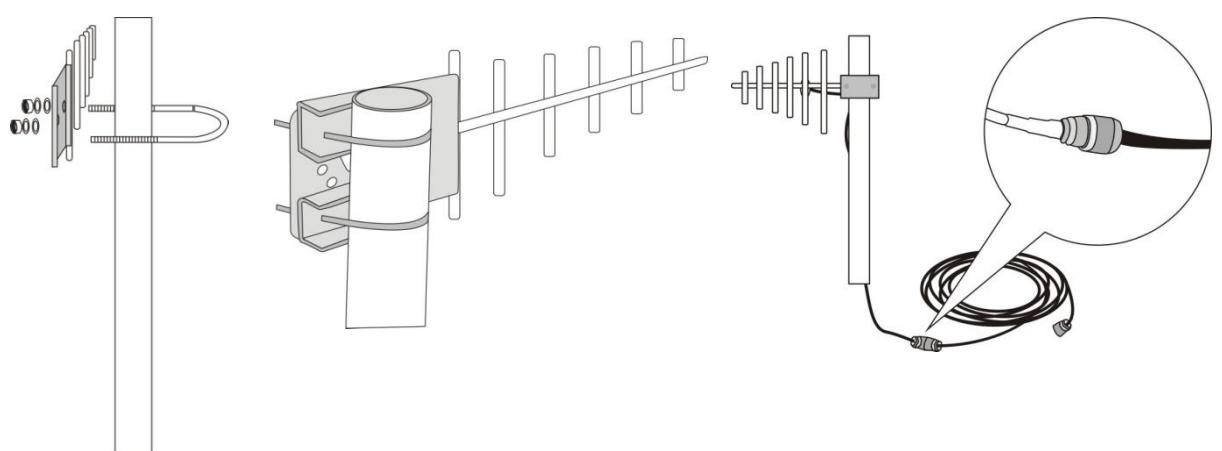
■ Installation of panel antenna as donor antenna



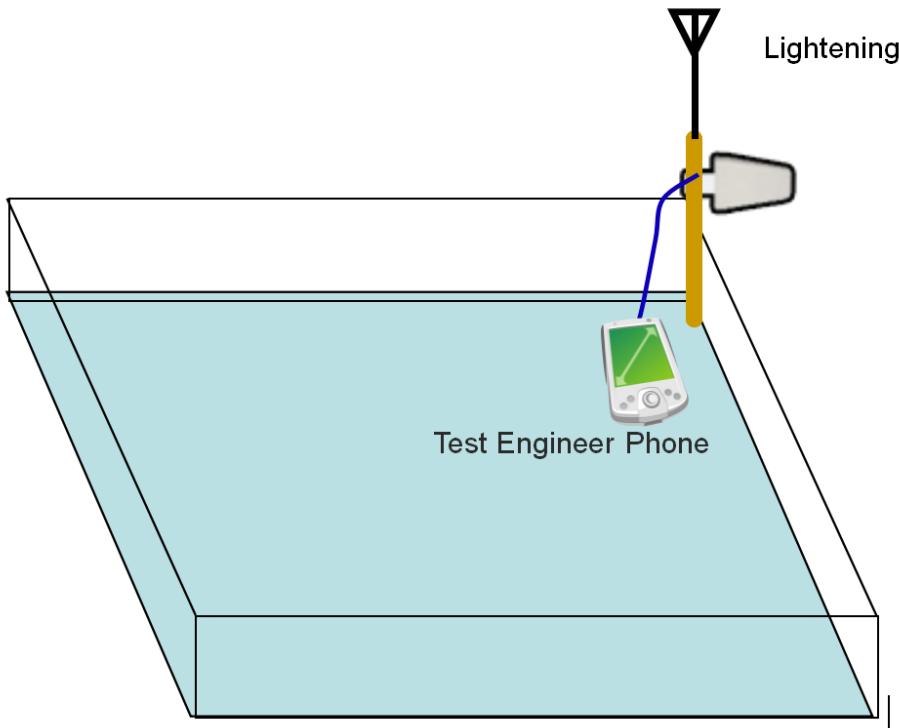
■ Installation of wide directional antenna as donor antenna



■ Installation of YAGI antenna as donor antenna



■ Test the call quality of donor antenna (for professional installation team only)



Fix the donor antenna after selecting the best position, and adjust slightly its height or angles in order to get the signals with suitable input power level and calling quality.

- **System Requirement of GSM or PCS**

- 1) The total input power level shall be around -50dBm, lowest shall be more than -80dBm
- 2) Test by mobile phone or data card by 3~5 times to make sure the calling quality is good at 95% of the time, and no handovers.
- 3) It is requested that the leading BCCH shall be 6dB higher than the second BCCH in order to avoid call drops (for professional engineering reference only).

- **System Requirement of CDMA or AWS**

- 1) The input power level shall be around -55 ~ -60dBm (it is less than GSM or DCS because of breathing effect), the lowest shall be more than -90dBm.
- 2) Test by mobile phone or data card by 3~5 times to make sure that E_c/I_o is more than -7dB, and no handovers.
- 3) E_c/I_o of adjacent carrier shall be 8dB less than that of donor carrier to avoid soft handover. The active PN shall be only 1.

7.5. Cable layout and connector assembly

- 1) Keep the type, specifications, routing direction, location, and curvature radius of cables in compliance with the design requirement. Place cables in good order, bend them smoothly, and protect the outer skin against any damage.
- 2) Bind cables in good order when laying them on cable racks. When leading cables in or out of troughs, use a hole-opener to open cable troughs and then install PVC lock-nuts to protect them.
- 3) Keep horizontal cables straight and fasten them stably with a fixing clip every 1 to 1.5 meters, with a proper stress.
- 4) Bind and fasten vertical cables every two to three meters to avoid damaging cables or connectors owing to their own heavy weight. Take back the cables and re-lay them when you have difficulty in pulling them, and avoid using a strong force to pull them.
- 5) Separate RF cables from power cables. Take proper isolation measures if they have to be placed on the same cable racks owing to the site condition restriction.
- 6) Correctly fasten all connection parts of the whole system, from the antenna to active interfaces to passive interfaces, and keep electrical interfaces well contacted. Give waterproof treatment to outdoor connection parts.
- 7) Take lightning protection measures for the antenna and feeder system in accordance with the design requirement. Avoid deforming the antenna feeder where grounding clips are placed, and give waterproof treatment to the feeder.
- 8) Keep exposed indoor cables in good order. Install PVC troughs or tubes if the exposed cables are more than 1 meter long. Place small passive RF parts such as power splitter in cable troughs.
- 9) Process both ends of RF coaxial cables as follows:
 - ✧ Keep the same redundant cable length and keep the length of stripped cables to agree with the corresponding connectors.
 - ✧ Use a proper force to cut the jacket layer or insulation layer and avoid damaging the braid shielded net and cores.
 - ✧ Weld cores firmly and smoothly with a proper amount of solder, without solder projections or nodules. Assemble coaxial cables strictly in accordance with the installation specifications.
 - ✧ Keep a moderate length of heat-shrinkable tubes and heat-shrink the tubes evenly when adding heat-shrinkable tubes to the end of cables.
 - ✧ Protect the ends of cables against water and dampness. Use waterproof tape to give waterproof treatment to exposed cable ends. Cut off the end if it is damped or water-soaked.

7.6. Indoor antenna installation

Proper antennas shall be selected according to the site conditions and the requirement. And more than one antenna can be used with the repeater, especially for repeaters equal with or over 20dBm, and 30dBm can be connected with up to 10 antennas in order to send the signals to larger areas or distribute the signals equally. Please consult our professional engineers about the solution if you want to connect more than one antenna.

- 1) Omni antenna (Indoor ceiling omni antenna or whip antenna), is suitable to be installed in the center and radiate all directions.



- 2) It is better to use a directional panel antenna or Yagi when the coverage shape is long and narrow (corridors, long row of houses in two sides, tunnels or elevators or rural open space).



7.7. Repeater Installation

7.7.1. Installation Steps

10dBm~30dBm shall be installed in indoor areas only

- 1) Connect the power supply and the cables properly to the repeater ports.
- 2) Check again to make sure the repeater is installed firmly and repeater alarm LED must stay green.

7.7.2. Repeater's ports description

- 1) Outdoor port: connected with the donor antenna by cable.
- 2) Indoor port: connected with server antenna directly or by cable.
- 3) DC IN: connected with power supply.

7.7.3. Accessories selection

Please pay attention to the two points of “frequency” and “impedance” during the selection of the accessories. All accessories shall support the repeater’s frequencies from feeder line, antenna and splitter to combiners etc. For example, the repeater’s frequency is GSM900, so all the accessories must support the GSM900 frequency. And the repeater’s impedance is 50ohm, so the accessories shall all be 50ohm. To use any other impedance of coax will put an extra load on your repeater, shorten its life span and decrease the system performance.

7.8. Repeater Settings

Please check very carefully all cable connections are correct and firm before running operation test and then carry out following tests.

7.8.1. Switch on power

After power is on, check first the POWER and ALARM LEDs.

- Status and definition of POWER indicator:

Status	Definition
Green	Normal

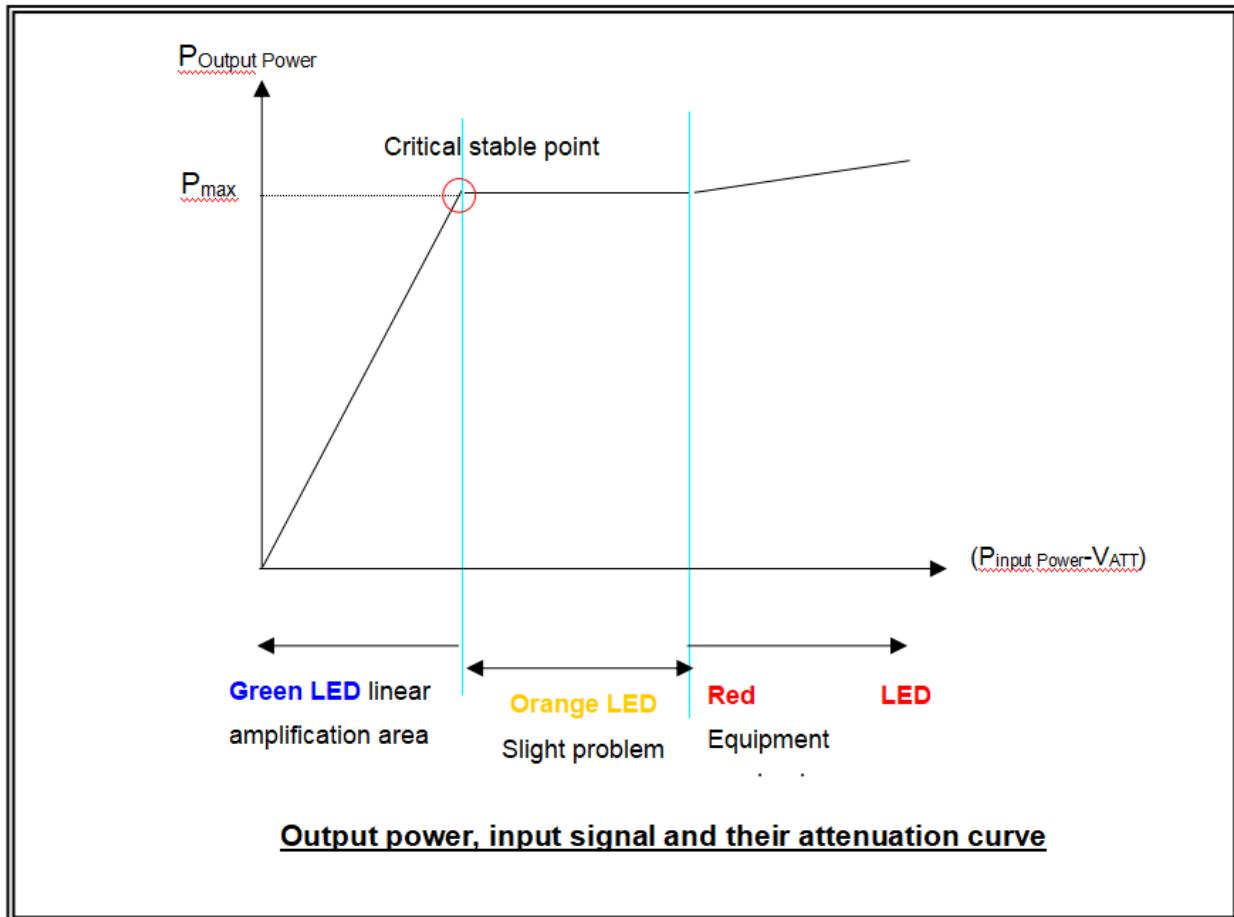
Off	DC power problem
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- Status and Definition of ALARM indicator:

Status	ALARM
Green	<p>It is working in linearity</p> <p>Note: Input signals may be not enough, please refer to the figures shown in the device. Do not do anything if it is good; otherwise please adjust the repeater system to get better source signal.</p>
Orange	<p>It is working with medium oscillation.</p> <p>AGC activate 1~15dB.</p>
Red	It is working with deep oscillation.
Flickering	AGC activate over 15dB, and it will shut off after 5 seconds of Red.

7.8.2. Repeater Commissioning

- The curve about device working status



$P_{\text{Output Power}}$: Output Power

$P_{\text{input Power}}$: Input Power

V_{ATT} : Attenuation value of attenuator

$P_{\text{input Power}} - V_{\text{ATT}}$: Input Power—Attenuation value of attenuator

P_{max} : Rate output power

7.9. System Test

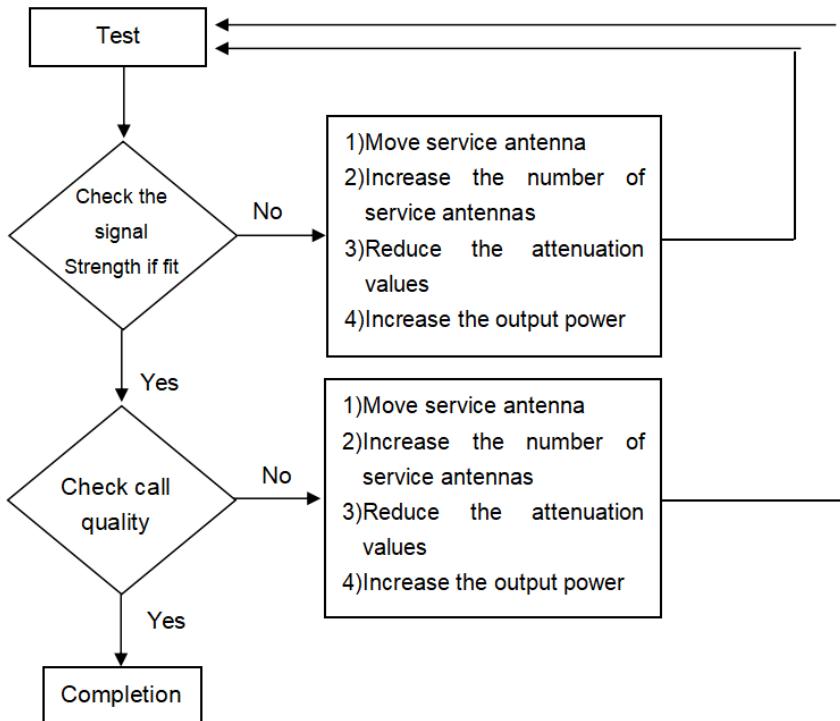
7.9.1. Check whether the coverage is good

- 1) Have a test with mobile phone or data card (engineering mobile phone is preferred). If the signals in most areas have not been improved, please check below again:
 - ◆ The weak input signal leads to the low output power. Change the direction of donor antenna or its installation position or replace donor antenna with higher gain antenna to increase input signal power level.

- ◆ Check whether it is necessary to add more server antennas since barriers block the signal penetration, also check whether the repeater's power is enough; please install more server antennas or replace with a repeater of higher power level.

2) If the signals in small part of the areas have not been improved, please check below:

- ◆ Check whether the service antenna is installed correctly or not, you may try to move the antenna location to improve coverage.
- ◆ Check if it is necessary to adjust the direction of the sever antenna.
- ◆ Check whether it is necessary to add one or more antenna to enhance the coverage of special areas.



- ◆ Remark:
 - ✧ **Reduce the attenuation values***---at the same time must ensure the isolation.
 - ✧ **Increase the output power*** ---recommended ways: adjust the donor antenna direction / location, or replace with higher gain antenna to increase input signal strength.

7.9.2. Repeater can not communicate in Power-ON status

- 1) The power is on but it has a signal fluctuation or a flash signal. The phone call can not be achieved.

It shall be caused by the insufficient isolation between donor antenna and serve antenna.

Please take below measures:

- Firstly check whether the alarm LED is orange. The orange light shows the insufficient isolation.
- Secondly adjust the antennas' directions or locations or enlarge the distance between them.
- Thirdly reduce the repeater's gain by ATT DIP if the above methods don't work.

The following measures can also be tried:

- Use the roof of the building to enlarge the isolation (Please try to place the donor antenna and server antenna in different floors).
- Use some obstacles (Such as wall).

2) The repeater's power is on but the phone is not connected into the network and still can not communicate.

- **Reason 1:** There are loose or wrong connections in the repeater system.
 - ✧ **Solution:** Please try to fasten the connections between the different parts of the system.
- **Reason 2:** The signals received by donor antenna of other operators nearby are too strong. (For example, the other operators' signals are 10 dB stronger than the needed signals.)
 - ✧ **Solution 1:** Change the direction of donor antenna or its installation position, so that the gap of signal strength is reduced between operators.
 - ✧ **Solution 2:** Use barriers (like buildings) to block signals of other operators.

3) The repeater has alarm OFF status

- **Reason:** the repeater breaks down.
 - ✧ **Solution:** Please check the power adaptor to see if it breaks down or not, then take off the plug and re-plug in, if alarm LED maintains off, the repeater break down is confirmed, then please consult local dealers for warranty.
- **Reason 2:** There is self oscillation if alarm LED turns red after re-plugging in.
 - ✧ **Solution 1:** Change the direction or location of donor or server antennas to enlarge the distance.
 - ✧ **Solution 2:** Use barriers (like buildings) to increase isolation.
 - ✧ **Solution 3:** Reduce the repeater gain by DIP switch.

8. FCC RF Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. End users must follow the specific operating instruction for satisfying RF exposure compliance. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this

equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

9. FCC Warning

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 antenna and cables as specified by the manufacturer. Antennas **MUST** be installed at least 20cm (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 the device.

This device may be operated **ONLY** in a fixed location for in-building use.

Warning: The Inside Antennas for fixed installations must have 6 feet of separation distance from all active users.

Warning: The Outdoor Antennas for fixed installations must be installed no higher than 10 meters above ground

10. ISEDC Warning

ISEDC Statement

The device has been tested and complies with SAR limits, users can obtain Canadian information on RF exposure and compliance

Après examen de ce matériel aux conformité aux limites DAS et/ou aux limites d'intensité de champ RF, les utilisateurs peuvent sur l'exposition aux radiofréquences et la conformité and compliance d'acquérir les informations correspondantes.

This device complies with Innovation, Science and Economic Development Canada Compliance license-exempt RSS standard(s). Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement

ISEDC Radiation Exposure Statement:

This equipment complies with ISEDC RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

ISEDC exposition aux radiations:

ce matériel est conforme aux limites d'exposition aux rayonnements rf isedc énoncée dans un autre environnement. ce matériel doit être installé et exploité avec distance minimale de 20 entre le radiateur et votre corps.

-----End -----

SZZJ Communication Technology Co., LTD

2208-A22, Block A, Union Square, 5022 Binhe Avenue, Fushan Community, Futian Street, Futian District, Shenzhen

Please note, BEFORE USE, you must meet all requirements set out in CPC-2-1-05

<https://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf08942.html>

This is a CONSUMER device.

BEFORE USE, you must meet all requirements set out in CPC-2-1-05.

This device MUST ONLY be operated with approved antennas and cables as specified by the manufacturer. Antennas must be installed in a way where the minimum separation distance between the antennas and a user (or bystander) specified by the manufacturer is ALWAYS maintained.

In order to reduce oscillations it is recommended that sufficient separation distance is maintained between the donor and server antennas of the zone enhancer system.

You MUST cease operation of this device immediately if requested by ISED 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.