Channel Selective Repeater

User Manual

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1 General

1.1 Overview

In GSM mobile communication system, limited by the coverage of base station or by geographic environment, the transmission of signals may be influenced in shadow or semi-shadow in some areas, generally referred to as blind area or semi-blind area, bringing serious impact on voice quality or even causing failure to normal communication. To solve this problem, apart from adding more base stations, the deployment of mobile communication repeater, characterized by quick expansion of coverage and reduction of cost, shall be an ideal cost-effective choice of high efficiency.

Wireless transmission repeater of GSM mobile communications is an important tool to expand network coverage, enhance network capacity, reduce network cost and realize network optimization. Wireless transmission repeater of GSM mobile communications is meant to amplify communication signal, extend network coverage, to improve communication quality by amplifying some weak received signal and expanding the signal coverage and to distribute traffic load in various base stations with efficiency.

In the course of GSM network optimization, wireless transmission repeater of GSM mobile communications offers a wide variety of application, and has become an indispensable part of network system. In some areas, such as satellite cities of some large cities, remote residential areas, countries and towns or other blind areas or shadow areas formed due to the natural or human obstacles (such as high mountains, large buildings, tunnels or underground stores), optical fiber transmission repeater of GSM mobile communications shall be the most economical and reasonable solution to the effective coverage of these

networks since these areas are demanding a greater coverage rather than capacity.

Wireless transmission repeater of GSM mobile communications is cheap with easy installation. It will greatly reduce the investment in equipment and running cost to expand the network by optical fiber transmission repeater. The outdoor cabinet design enables the equipment to work under severe conditions in the open air and saves a lot of operating cost by working without establishment of machine room, air conditioner or large-scale power supply.

PULSE GX** wireless transmission repeater integrated with wireless communication technology and excellent performance, provides operators with multiple solutions that can save the investment in equipment and running maintenance cost without lowering the network quality. As a supplement to base stations, the system can be easily expanded to the blind areas that need covering to solve the problem of coverage. By using GX** GSM repeater of GSM mobile communications, the surplus capacity of networks can be re-planned or re-arranged so that the resources of networks will be used to their maximum. The application of repeater shall attract more traffic load with its short cycles, immediate returned profits, easy installation and savings of network resources and expand the network coverage with low cost to make up for the insufficient coverage of system base station. It is a good solution to optimize network with wireless transmission repeater in networks.

1.2 Scope of Application of the Equipment

Applicable to airport, stations, highway, railway lines, subway, light rail, tourist areas, large-scale industry and mining enterprises, satellite cities of large cities, remote residential areas, countryside and blind areas and shadow areas of GSM mobile communications.

GX** repeater of GSM mobile communications mainly serves the operators of GSM900MHz mobile communication.

1.3 Features

(1) Use filter with high selectivity and low insertion-loss and multi-grade filter technology to enhance the isolation between uplink and downlink.

(2) No interference to the base station and other radio equipments with low noise for the system, proper linearity and high power.

(3) Ensure normal working of the repeater under tough environment with automatic level control (ALC) function.

(4) Modularized design facilitates assembly and maintenance.

(5) With local LCD or local PC, technicians can monitor, set, modify the parameters of all the modules of repeaters and easily collect equipment information.

(6) With wireless digital transmission and remote monitoring system, operator can monitor and maintenance for network more easily.

(7) Equipped with perfect network management system (NMS) and friendly operation interface, provide highly reliable operation and failure treatment capability.

(8) With Hwatel NMS software, technicians can control repeaters in the monitoring center or optimize parameters and upgrade software according to the actual situation of network. It will

facilitate the monitoring of wireless transmission repeater of mobile communications.

When monitoring center has not been established, technicians can monitor, set, modify the parameters of all the modules of repeaters and easily collect equipment warning information via local PC. Once the repeater fails, monitoring system can immediately send warning information to designated mobile phone or cable phones at will.

When a monitoring center has been established, technicians can control repeaters by OMT software in the monitoring center or optimize parameters and upgrade software according to the actual situation of network. It will facilitate the monitoring of wireless transmission repeater of mobile communications.

1.4 Technical standard

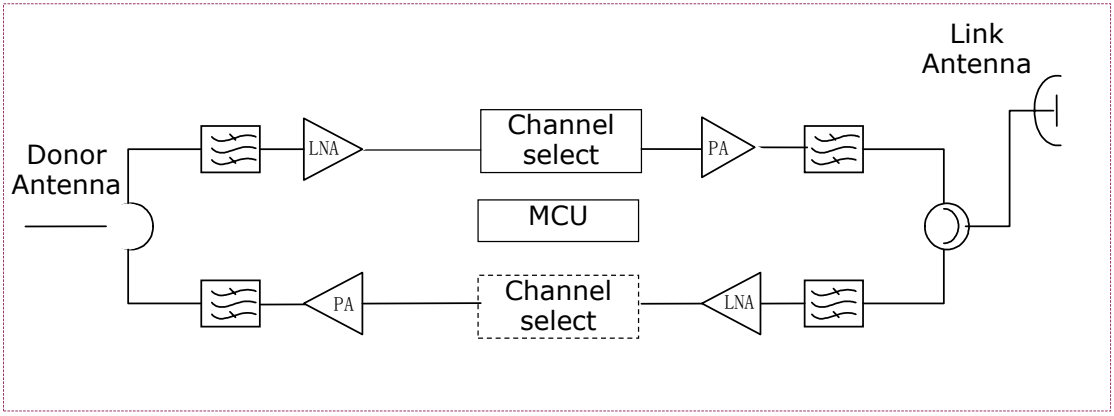
1. GSM 05.05 "Wireless transmission and reception
2. GSM 03.30 "Wireless network planning"
3. GSM 11.20 "GSM base station (BBS) equipment specifications"
4. Requirements for repeater by National Radio Administration Bureau
5. YD/T952-1998 " Technical Requirements for 900M Repeater"

2 Technical specification

2.1 Theory of operation

2.1.1 Block diagram

Components of repeater



The equipment consists of duplexers, uplink filters, downlink filters, uplink channel selective amplifying module, downlink channel selective module (optional), Power amplifying module, monitoring elements and power elements.

2.1.2 Operation Theory of the Equipment

The downlink signal received by the donor antenna of the base station shall be sent to a channel selective filter via duplexer to be filtered and to be amplified by the downlink band selective amplifier to a proper level. The coverage antenna via a duplexer shall emit the downlink signal. Similarly, for uplink, the signal received by the re-transmission antenna shall have its level adjusted to a regulated level by a uplink band selective amplifier after it is filtered. The donor antenna will emit it after it is filtered and sent to the duplexer.

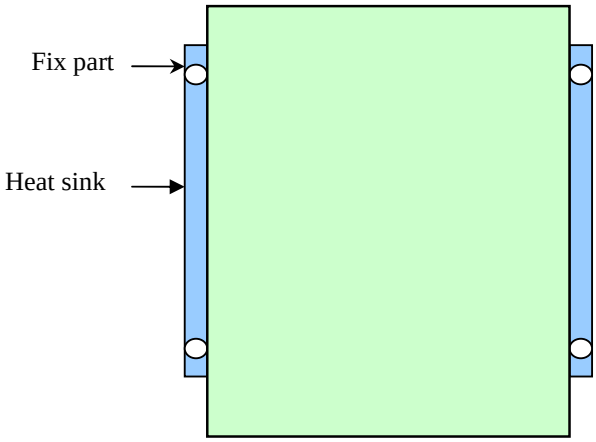
2.2 Major Technical Performances

Item		Up Link	Down Link
Frequency range		890-915MHz	935-960MHz
Max. Output Power		33/35/37dBm	33/37/40/43 dBm
Max. Gain		90±3 dB	95±3 dB
Gain step		1 db	
Gain adjust scope		31 dB	
Channel select		0/2/4/6/8	2/4/6/8
ALC		$\triangle f_0$<=2 dB	△f0<=2 dB
Passband Ripple		No bigger 3 dB	No bigger 3 dB
Frequency Error		±5X10^{-8}	±5X10^{-8}
Gain Adjustment Range		No less 30dB	No less 30dB
Gain Adjustment Error	-10 dB	±1.0dB	
	-20 dB	±1.0dB	
	-30 dB	±1.5dB	
Gain Adjustment Step		1 dB / Step	1 dB / Step
Noise Figure		<=4 dB	<=4 dB
Spurious emission		9KHz-1GHz: <=-36dBm/30KHz	
		1GHz-12.75GHz: <=-30dBm/30KHz	
Third-order inter-modulation distortion	In Work band	<=-45dBc/30KHz	<=-50dBc/30KHz
	Out band (offset from work band edge 1MHZ)	9KHz-1GHz: <=-36dBm/30KHz	
		1-12.75GHz: <=-30dBm/30KHz	
System Time Delay		< 5 us	
VSWR		< 1.4:1	
In/Output Impedance (Ω)		50W	
In/Output Connector		N-F	
Working Voltage		DC -48V DC or 220V AC	
Requirement for technical safety		In accordance with relevant regulations in the standard of GB4793-84	
Requirement for		In accordance with relevant regulations in the	

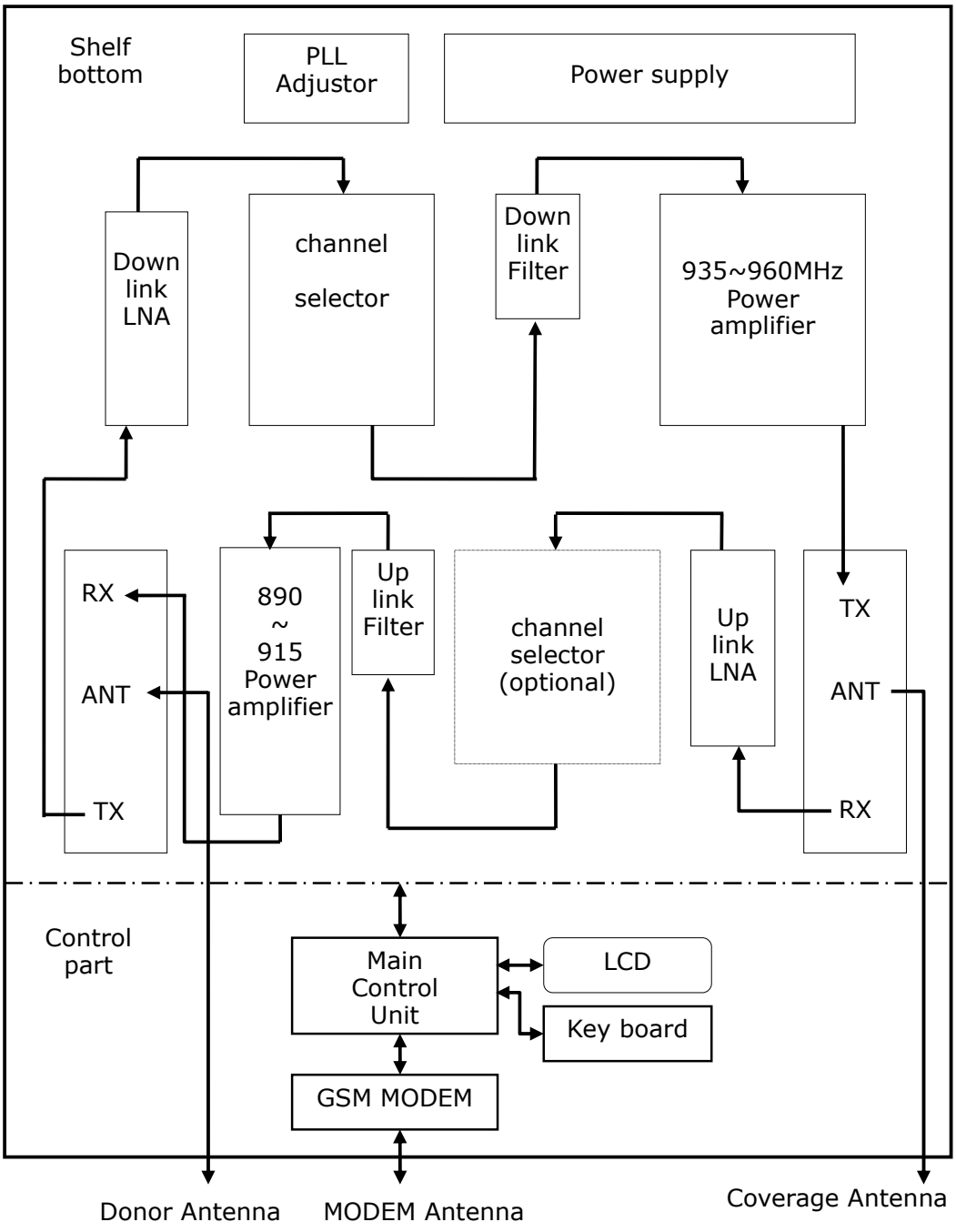
electromagnetic compatibility	standard of GB6833-87
Environmental Conditions	Temperature: -25℃ ~ +55℃ Humidity: ≤ 95% Air pressure: 70～106kPa
Dimension(W x D x H)	360 x 168 x 420mm
Management and control	LCD and keyboard on Front panel Local computer through RS232 Remote management via GSM SMS channel
* detail tech parameter should reference to Test Report accomplished with its repeater	

3 Installation

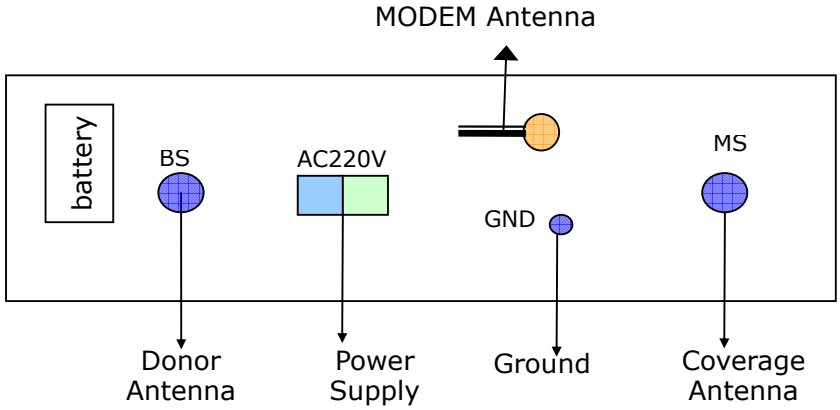
3.1 System description



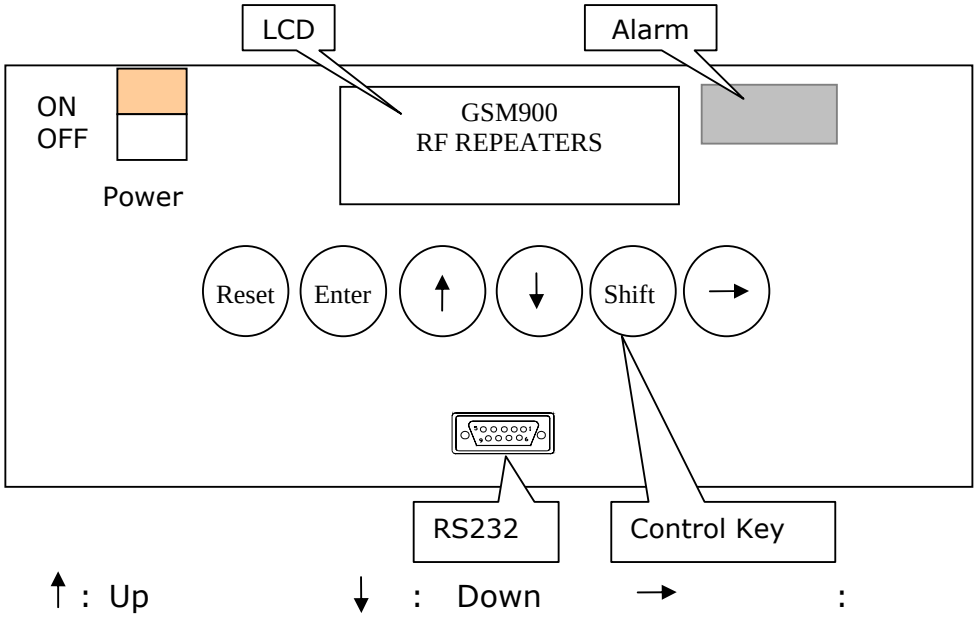
3.1.1 Major Block Diagram



3.1.2 Bottom panel



3.1.3 Front panel



3.2 LCD setting

LCD	Explain
Power On display	
GSM900 RF Repeaters	Power On Welcome
Test A/D1.. OK	Self test: A/D1 ----- passed
Test MODEM .. OK	Self test: Modem ---- passed, if failure will show "Fail"
LOOK P1.0 ->DV_27.0V UPP_28dBm DNP_37dBm	Show status: DV_27.0V:DC power voltage is 27V UPP_28dBm: Uplink Power now is 28 dBm, (range : 0dBm---33dBm) DNP_37dBm: Downlink Power now is 37 dBm,: (range : 0dBm---43dBm) If there alarm , will display at below, such as "DV WRONG" etc …
Press "Down" keyboard will show below	
LOOK P1.1 ->AC_220V I_02.0A UPGP_090dB DNGP_095dB	Item 1.1:Show status: AC_220V: current AC power voltage is 220 Volt I_02.0A: current AC power current is 2.0 ampere UPGP_090dB: current uplink gain is 90 dB DNGP _090dB: current downlink gain is 90 dB
Press "Down" keyboard will show below menu	
<- SETUP P0 ->SETUP ->LOOKVER	MENU: SETUP: setup device parameter LOOK: display device parameter VER: display device version
When cursor on "VER", press "Return" button, will show software version as below	

GSM900 VER1.0	Version information: GSM900 VER1.0
When cursor on "SETUP", press "Return" button, will enter setting page and show below When cursor on "LOOK", press "Return" button, will enter looking page, looking page is same with setting page, only different is can just look and can nor modify any parameter	
KEY_ 0000	Password setting: operator can edit password through "right" and "shift" button; when finished edit press "return" to confirm KEY_0000: password now is 0000, Default factory password is 0000
<- SETUP P2.1 -> VER_2 FAC_ 0000 FIX_41 COM_2 VER_2	Item 2.1:Parameter setting: operator can edit through "right" and "shift" button; when finished edit press "return" to confirm VER_2: setting Version FAC_0000: setting manufactory ID FIX_41: setting device type ID COM_2: setting management mode; Remote mode: "2";Local mode: "5"
<- SETUP P2.2 -> ID _ 00000000 SN _ FF	Item 2.2:Parameter setting: operator can edit through "right" and "shift" button; when finished edit press "return" to confirm ID_00000000: Setting repeater ID , 8 character SN_FF: setting device serial ID
<- SETUP P2.3 -> CTel _ _ _ _ _ _ _ _ _ _ _ _ JTel _ _ _ _ _ _ _ _ _ _ _ _	Item 2.3:Parameter setting: operator can edit through "right" and "shift" button; when finished edit press "return" to confirm CTel_____: Setting NMS center Mobile phone number JTel_____: Setting Alarm report Mobile phone number
<- SETUP P2.4 -> CH1 _ ON CH2 _ ON CH3 _ OFF CH4 _ OFF CH5 _ OFF CH6 _ OFF	Item 2.4: work channel enable setting: operator can edit through "right" and "shift" button; when finished edit press "return" to confirm CH1_ON: 1st work channel open CH2_ON: 2nd work channel open CH5~CH8: no use for 2 channel selective repeater. (if for 4 channel or 8 channel selective repeater, they are should be on enable)

<- SETUP P2.5 -> DVL_ON L1G_OFF LNA1 _ ON LNA2_OFF GL _ ON DOOR_ON	Item 2.5: Alarm Enable setting: operator can edit through "right" and "shift" button; when finished edit press "return" to confirm DVL_ON: Loss power alarm Enable L1G_OFF: Fiber Optical alarm Enable (for HG900-OW family) LNA1_ON: uplink LNA failure Enable LNA2_ON: downlink LNA failure Enable GL_ON: self active alarm Enable DOOR_ON: door open alarm Enable
<- SETUP P2.6 -> UPP_ON DNP_ON TCH_ON DLP_ON	Item 2.6: Indicator Enable setting: operator can edit through "right" and "shift" button; when finished edit press "return" to confirm UPP_ON: uplink power overload Indicator enable DNP_ON: downlink power overload enable TCH_ON: temperature alarm Enable DLP-ON: downlink input power threshold enable
<- SETUP P2.7 UPSW _OFF DNSW_ON CS_OFF POWER_ON	Item 2.7: Alarm Enable setting: operator can edit through "right" and "shift" button; when finished edit press "return" to confirm UPSW_ON: uplink stationary wave alarm enable DNSW_ON: downlink stationary wave alarm enable POWER_ON: power modular failure alarm enable
<- SETUP P2.8 -> UHPA_ 0 DHPA-1 UATT_ 00dB DATT_ 00dB UPH--+05dBm DPH--+36dBm	Item 2.8: Alarm Enable setting: operator can edit through "right" and "shift" button; when finished edit press "return" to confirm UHPA_0: uplink PA enable(0 close/1 open) DHPA_1: downlink PA enable(0 close/1 open) UATT_00dB: setting uplink attenuation ATT(0 ～ 31dB) DATT_99dB: setting downlink attenuation ATT(0～ 31dB) UPH_+05dBm: uplink power upper threshold DPH_+36dBm: downlink power upper threshold
<- SETUP P2.9 -> CH1_ 055 CH2_ 050 CH3_ 000 CH4_ 000	Item 2.9: channel selective setting: operator can edit through "right" and "shift" button; when finished edit press "return" to confirm CH1_050: 1st work channel ID setting. (scope 1~125, reference to appendix) CH2_055: 2nd work channel ID setting. (scope 1~125, reference to appendix). CH3_060: No use for 2 channel selective CH4_065: No use for 2 channel selective

<- SETUP P2.10 -> CH5_ 000 CH6_ 000 CH7_ 000 CH8_ 000	Item 2.10: Work channel setting: operator can edit through "right" and "shift" button; when finished edit press "return" to confirm CH5_000: No use for 2 channel selective CH6_000: No use for 2 channel selective CH7_000: No use for 2 channel selective CH8_000: No use for 2 channel selective
<- SETUP P2.11 -> UPALC_ 00dB DNALC-00dB ATTU_ 00dB ATTD_ 00dB UGP_090dB DGP_095dB	Item 2.11: parameter setting: operator can edit through "right" and "shift" button; when finished edit press "return" to confirm UPALC_00dB: uplink ALC value (no use for ABS) DNALC_00dB: downlink ALC value (no use for ABS) ATTU_00dB: setting uplink attenuation (0～31dB) (no use for ABS) ATTD_00dB: setting downlink attenuation (0 ～ 31dB) (no use for ABS) UGP_90dB: setting uplink MAX gain DGP_95dB: setting downlink MAX gain
<- SETUP P2.12 -> KEY _ 0000	Item 2.12: password setting: operator can edit through "right" and "shift" button; when finished edit press "return" to confirm KEY_0000: setting pass word, Default factory pass word: 0000

3.3 Preparations before Installation of the Equipment

Following jobs should be done before installation of equipment:

- Site reconnaissance and test of electromagnetic environment
- Selection of plan for coverage, determination of construction plan

The site reconnaissance and test of electromagnetic environment shall be basis for design and installation of the constructions. The contents include the position of the donor antenna and its field intensity, areas under coverage and landform, determination of the fixing position of the antenna and plan for cable laying, and the design and installation of grounding system.

(1) Installation of antenna

1) Donor antenna must be carefully adjusted so that it will face the base station in an exact way.

2) Coverage antenna must keep a proper isolation degree with

donor antenna while its coverage must be ensured. For isolation degree, the greater, the better.

(2) Selection of band

Set to corresponding frequencies by using the monitoring and control software of the repeater.

(3) Field intensity test and level adjustment.

Level adjustment is important in the opening of wireless transmission repeater construction, especially for downlink passage. First, test field intensity of the signal of the base by donor antenna and then adjust the uplink and downlink gains according to the field intensity of the signal so that the downlink output shall meet the requirements of coverage. Meanwhile, adjust corresponding uplink and downlink gains.

(4) Sealing of joints of feed lines:

it is suggested that it should be powered up first and test the level to see if it is normal before the sealing of joints of feed line of antenna. Clean the joint's inner part before installation of it, check and see if the length of cable core and their left or right position are correct and then fix them. Check if the joint is fastened before sealing.

(5) Lightning protections

The location of wireless transmission repeater is usually in high buildings or at the top of mountain and is connected to the antenna by feed line. Thus it should have reliable lightning protection. The lightning protections of wireless transmission repeater include the followings:

- Cases, antenna bases and cables must be reliably grounded.
- Inlet power cables must be protected against lightning.
- The lightning protection of antenna.

(6) Grounding of Equipment

Peel off the plastic skin of the feed line with special tools according to the requirements of the process and leave a 6 to 7cm cut. Do not

hurt the inner ripple copper tube. Fasten it with copper braided tape to ensure that it is closely fastened with ripple copper sheet. Seal it with tape or clay and fasten the other end firmly to ground. Fixing screws or nuts must receive anti-rust treatment.

3.4 Installation and Opening of Equipment

Open the package and check the merchandise according to packing list. Consult with construction units and determine the position and height of the antenna pole, ways of feed line laying and fixing, position for installation of the equipment and burying of 220V power and ground cables according to the position for installation determined in the report and field intensity tested on site. Then install and debug in accordance with the following steps:

1. Before installation of the equipment, set up the donor antenna in the selected position for donor antenna, check if the signal received by donor antenna and the signal amplitude agree with design plan. Adjust the direction and angle of the antenna to achieve a maximum value of amplitude of the signal from base station. Then, fix the donor antenna.

2. Determine the brief direction of the coverage antenna according to the plan and install the antenna. The way of polarization is usually vertical. The gains of vertical polarization is superior to 2-3dB, however, the vertical polarization has a small angle and is too much exposed so the antenna must be fixed. In addition, the way of installation of the dipole antenna and reflector under various polarizations shall be determined in accordance with installation instructions for the antenna.

3. After fixing of the equipment, open it and test the mobile signal with a mobile phone and adjust the position of the antenna to achieve best coverage.

4. After the adjustment of antenna, fasten the antenna to avoid impact of external force. Pay attention to grounding of the equipment.

5. Description of indicators: When the equipment is powered up, red light will be on indicating that the equipment is in the status of initialization. The yellow light will blink in regular intervals to indicate that the system is working normally. After a while, the red light will be off, indicating that initialization is completed and the system is in working status. It usually takes 10 seconds when it is under the condition without modem. If it is connected to wireless modem, it takes one minute to initialize. Users can operate the equipment with supplied software after the system has entered normal working condition. Green light will blink irregularly, indicating that it is working normally.

6. Installation of monitoring and control system (wireless modem)

4 Maintenance

It is unnecessary to shut down the equipment without special need once the equipment is put to use. Therefore, the equipment must be used in ventilated and clean environment, avoiding dust from entering the equipment, consequently causing damage. The equipment can work soundly on the condition of temperature of -5C～+55C and humidity of 95%.The equipment must be shut down immediately for maintenance once abnormities occur (such as noise from module increases or odor appears). Check if the antenna fails to receive signals due to the change of angle when the signals cannot be received or received poorly while the equipment is found to work with normality. Adjust antenna and re-fix it when it is found with changed angle.

When the equipments are working normally, do not touch the joints between equipment if not necessary so as to prevent joints from getting loosened or improperly contacted. When the equipment fails, user must turn it off and notify our company. It is not allowed to take apart the joints between the equipment or to turn on the equipment, to avoid

accident.

5 Cautions

The products of our company have been tested and aged before delivery so as to ensure quality.

The products are sealed upon delivery and no units or individuals are allowed to unseal them without the authorization of our company. Our company shall not be liable for any consequences caused due to the unauthorized start of the product.

Check all the attached accessories by packing list upon reception of the equipment of our company. Contact the supplier in time for any shortage.

Our company owns the property right of our products which is protected by State law. No units or individuals are allowed to copy them. Our company shall investigate any of these actions for their legal responsibilities and reserves the right to claim for economic losses duly suffered.

Appendix

(1) Power Watt to dBm exchange table

DBm	watt	dBm	watt	dBm	watt	dBm	watt
0	0.001	16	0.04	31	1.28	46	40
1	0.00125	17	0.048	32	1.6	47	51.2
3	0.002	18	0.064	33	2	48	64
4	0.0025	19	0.08	34	2.56	49	80
5	0.003	20	0.1	35	3.2	50	100

6	0.004	21	0.128	36	4	51	128
7	0.005	22	0.16	37	5.12	52	160
8	0.006	23	0.2	38	6.4	53	200
9	0.008	24	0.256	39	8	54	256
10	0.01	25	0.32	40	10	55	320
11	0.012	26	0.4	41	12.8	56	400
12	0.016	27	0.512	42	16	57	512
13	0.02	28	0.64	43	20	58	640
14	0.024	29	0.8	44	25.6	59	800
15	0.032	30	1	45	32	60	1000

dBm=10logmW

Channel ID define

- Channel ID scope : 1 to 125
- Step between two channel is : 200K Hz
- Uplink channel define:

  Channel N = 890.000HZ + N * 0.2 M Hz
- Downlink channel define:

  Channel M = 935.000HZ + M * 0.2 M Hz
- example:

  Channel 1 (uplink) is : 890+1*0.2=890.2 MHz

  Channel 55 (uplink) is : 890+55*0.2=901 MHz

  Channel 125 (uplink) is : 890+125*0.2=915 MHz

  Channel 1 (downlink) is: 935+1*0.2=935.2 MHz

  Channel 65 (downlink) is: 935+65*0.2=948 MHz

  Channel 125 (downlink) is: 935+125*0.2=960.000MHz