

CDMA1900 Dual Band Selective Repeater 0.5W

User Manual



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0.5W

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1 Preface

Manual Instruction

CDMA1900 Dual Band Selective Repeater 0.5W is an important part of the CDMA network system. It mainly receives processes and amplifies RF signal to extend the BTS coverage area.

This manual introduces the working principle, function, structure and commissioning of the Dual Band Selective Repeater.

Content Introduction

This user manual mainly introduces four chapters including working principle, function, structure, commission.

Chapter 2: System brief introduction mainly introduces the basic working principle, product characteristics and interfaces etc...

Chapter 3: System structure introduces the use of every unit in the Band selective repeater such as main modules, monitoring units and PA units... which will make the user have a good knowledge of the Band selective repeater structure.

Chapter 4: System instruction for antenna selection, The equipment does meet the exemption requirements in respect of RF Exposure... Applicable MPE Limits, FCC Formulas and Calculations, Selection for Service Antennas.

Chapter 5: System commissioning mainly introduces the general testing procedures of the system, testing tool, apparatus, system testing content, testing methods that will help user to run the Band selective repeater in the optimal condition.

Annex A is Outlet Configuration.

NOTE:

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/her own expense.

2 System Summary

2.1 Overview

This chapter gives a brief introduction of the Dual Band Selective Repeater, including the application, basic working principle, product characteristics and main technical indexes. In this way, user can have a rough idea about the repeater.

2.2 Brief Introduction

Repeater is the equipment for the wireless network optimization that can enlarge the BTS coverage area. It is widely used in the blind area, high traffic load area and the pilot pollution area etc...

2.3 Basic Working Principle

The repeater receives the downlink (DL) signal from BTS via the donor antenna, the signal will be filtered by duplexer and amplified by low noise amplifier (LNA), and then DL band selective unit will select operation band, and finally it will be amplified by DL power amplifier (PA) unit and filtered by duplexer, sent via the service antenna to the coverage area. There is a dual SAW filter in the DL band selective unit, and it makes the band selectivity of the repeater viable.

The service antenna receives the uplink (UL) signal from mobile terminal; the signal will be filtered by duplexer, amplified by the UL low noise amplifier (LNA) and filtered by the UL band selective unit, and then amplified by the UL PA unit and filtered by UL duplexer, sent via the donor antenna to the BTS. Certainly there is a dual SAW filter in the UL band selective unit.

The main control unit will control the modules. User can inquire and modify the parameters by LOC (local) interface, and we also can do it in the NMS (Net Management System) by ways of SMS or data fax.

The PS (Power Supply) unit supplies power to all the active units.

Please refer to the following fig 2-1

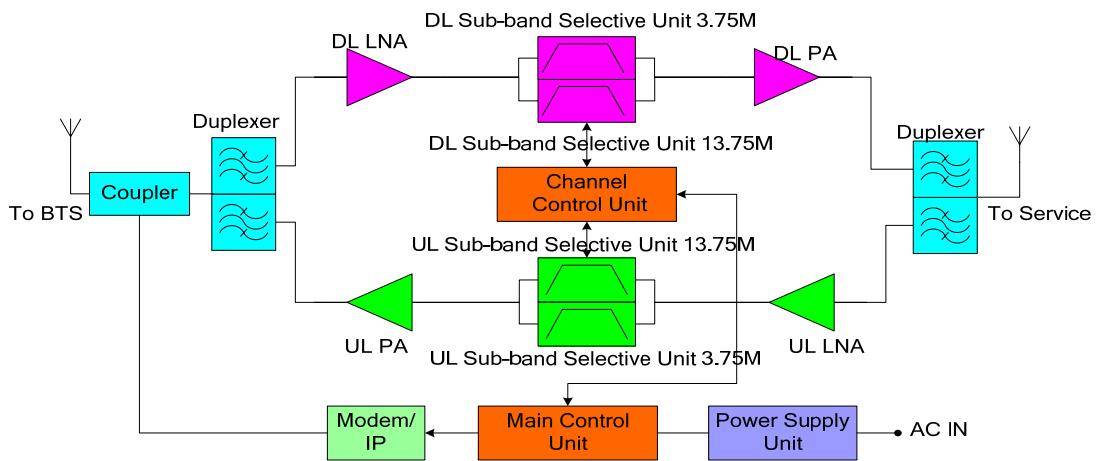


Fig. 2-1 Configuration of CDMA1900 Dual Band Selective Repeater.

2.4 Product Features

- Good performance & good technical parameters.
- Modular structure, high reliable and easy to upgrade and maintain.
- With spontaneous heat dissipation.
- Local and remote monitoring function which access to the NMS.
- With a perfect protection function.
- Dual band for work, Sub-band 3.75MHz&13.75MHz.

2.5 Case Variants

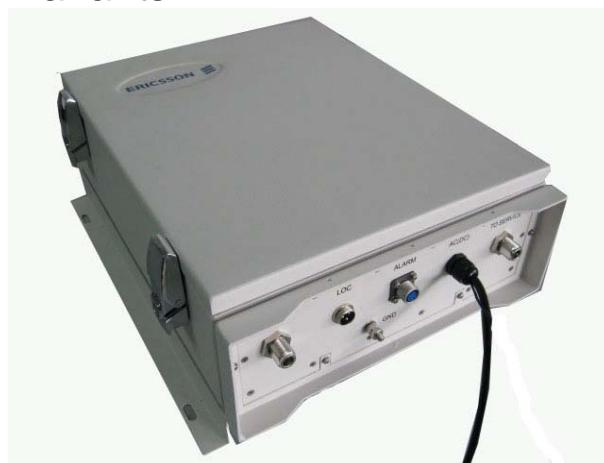


Fig.2-2 Outlook of CDMA1900 Dual Band Selective Repeater

2.6 Interface

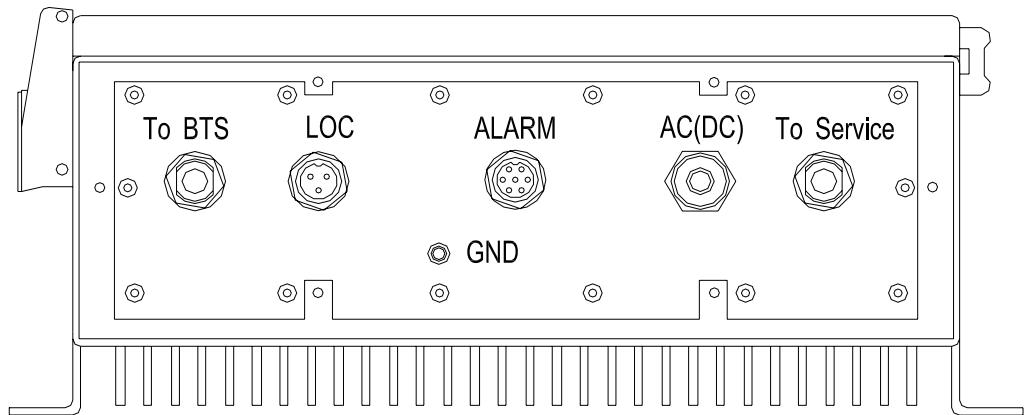


Fig. 2-3 Interface of CDMA1900 Dual Band Selective Repeater

- TO SERVICE: Port of service antenna, N/F.
- TO BTS: Port of donor antenna, N/F.
- LOC: Port of local monitoring, RS232, 3-core waterproof socket PLT-163.
PIN1: RX; PIN2: TX; PIN3: GND.
- AC(DC): Port of AC or DC power supply.
- ALARM: External alarm, socket PLT-167
- GND: Grounding

3 System Structure

Abstract

This chapter introduces the interior structure of CDMA1900 Dual Band Selective Repeater 0.5W, which can help us to know the whole repeater by the introduction of modules.

3.1 System Constitution

CDMA1900 Dual Band Selective Repeater 0.5W is composed of DL/UL LNA, DL/UL Band Selective unit, DL/UL PA, modem, coupler for the modem, main control unit, PS module and duplexer, etc.

3.2 DL/UL LNA

LNA is behind the duplexer, as the first amplifier, LNA is required to have good performance such as very low noise factor and matched resistance. At the mean while, there is a digital attenuator in the LNA, so we can get a gain adjustment from 0-30dB.

3.3 DL/UL Band Selective Unit

Signal is filtered by a narrow band SAW filter in the Band Selective Unit, so we can well deal with the disturbance.

3.4 DL/UL PA

PA unit can amplify the RF signal to a high power level to meet the requirement of coverage.

3.5 Coupler for Modem

Coupler for the modem provides necessary RF signal to the modem.

3.6 Modem

Modem is the ideal tool by which we can query and control the repeater from the NMS.

3.7 Control Unit

Control unit controls the whole operation and provides the various functions such as the alarm detection, local control, remote control and etc.

3.8 Duplexer

Duplexer separates or combines the UL and DL RF signal.

3.9 Power Supply

According to the different requirements, power supply can support AC 90~270V

4

Instruction for antenna selection

The equipment does meet the exemption requirements in respect of RF Exposure.

The following assessment is provided of compliance with the FCC limits for maximum permissible exposure (MPE) to RF fields.

Based on the mathematical analyses described herein, the potential RF exposure levels in all areas of possible interest should compliance with the applicable FCC limit for controlled or occupational exposure. The proposed operation is therefore in compliance with the FCC regulations and exposure limits.

The sections that follow provide the analysis and conclusions regarding compliance

Operational Data

Frequency Band:	1.9GHz
Antenna Dimension:	< 0.5 meters height
Suggestion Antenna gain:	3~11dBi
Max Input power for antenna:	8~15dBm
Antenna Height AGL:	3 meters

Limits for Occupational/Controlled Exposure

Frequency Range(MHz)	Power Density(S) (mW/sqcm)	Averaging Time (minutes)
0.3-3.0	100	6
3.0-30	900/f*f	6
30-300	1	6
300-1500	f/300	6
1500-100000	5	6

Limits for General Population/Uncontrolled Exposure

Frequency Range(MHz)	Power Density(S) (mW/sqcm)	Averaging Time (minutes)
0.3-1.34	100	30
1.34-30	180/f*f	30
30-300	0.2	30
300-1500	f/1500	30
1500-100000	1	30

4.1 Applicable MPE Limits

The MPE limits are described in the FCC Rules and Regulations. For the frequency range of interest here, the applicable limit for acceptable, continuous exposure of the general population is 1.0 milliwatt per square centimeter (mW/ sq.cm), for "controlled" occupational exposure, it is 5.0 mW/sq.cm.

4.2 FCC Formulas and Calculations

Based on the requirement of 47 CFR 2.1033, the device should operate and installation support FCC RF exposure compliance.

FCC Bulletin OET 65 provides standardized formulas for calculating the power density in both of the areas of interest here:

Equations for Predicting RF Fields Calculations can be made to predict RF field strength and power density levels around typical RF sources. For example, in the case of a single radiating antenna, a prediction for power density in the far-field of the antenna can be made by use of the general Equations below. These equations are generally accurate in the far-field of an antenna but will over-predict power density in the near field, where they could be used for making a "worst case" or conservative prediction.

$$S = \frac{PG}{4\pi R^2}$$

Where:

S = power density (in appropriate units, e.g. mW/sq.cm)

P = power input to the antenna (in appropriate units, e.g., mW)

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

Or:

$$S = \frac{EIRP}{4\pi R^2}$$

Where:

EIRP = equivalent (or effective) isotropically radiated power

When using these and other equations care must be taken to use the **correct units** for all variables. For example, in the Equation, if power density in units of mW/sq.cm is desired then power should be expressed in milliwatts and distance in cm. Other units may be used, but care must be taken to use correct conversion factors when necessary.

Also, it is important to note that the power gain factor, G , in the Equation is normally **numeric** gain. Therefore, when power gain is expressed in logarithmic terms, i.e., dB, a conversion is required using the relation:

$$G_{\text{num}} = 10^{\frac{G_{\text{dB}}}{10}}$$

For example, a logarithmic power gain of 14 dB is equal to a numeric gain of 25.12.

For acceptable, continuous exposure of the general population is 1.0 mW/sq.cm

For "controlled" occupational exposure, it is 5.0 mW/sq.cm.

Express the equation in when we know P G and S

$$D = R = \sqrt[2]{PG/4\pi S}$$

In this case:

$$P=500\text{mW}$$

$$G=14\text{dBi}$$

Then the general population safety distance to antenna should be:

$$D > 31.63\text{cm}$$

For "controlled" occupational exposure

$$D > 14.14\text{cm}$$

Each area of interest should be addressed and consider the results of the calculations.

4.3 Selection for Service Antennas

Panel Indoor Antenna 6/9/10dBi

If the equipment intended to deployed in the indoor use, the suggestion service antenna can be select like this:

Frequency	(MHz)	824-960 /1700-2200/2400-2500
Mechanical Specifications		
Dimension (L x W x H)	(mm)	210 x 180 x 44
Weight	(kg)	0.9
Radiating element material		copper & aluminum
Radome Material		ABS
Operating Temperature (°)		-30 - +60
Connector Type:		N - F



<i>Installation:</i>	wall mounting		
Electrical Specifications	806 - 960	1700 - 2200	2400 - 2500
Polarization	vertical	vertical	vertical
Gain (dBi)	6	9	10
Horizontal-3dB Beamwidth (°)	95	65	40
Vertical-3dB Beamwidth (°)	80	55	50
VSWR	<1.4:1	<1.4:1	<1.4:1
Impedance (Ohms)	50	50	50
Max Input Protection (W)	50	50	50
<i>Lightning Protection</i>	direct ground	direct	direct grounding

Logarithm Cycle Antenna 8dBi

Frequency	(MHz)	824 - 960/1710 - 2500
Mechanical Specifications		
Dimension	L x W x H (mm)	280 x 220 x 60
Weight	(kg)	2
Radiating element material		copper & aluminum
Diameter Of Installation Pole (mm)		φ 40 - 70
Operating Temperature (°)		-30 - +60
Max Wind Speed (Km/h)		201
Connector Type:		N - F
<i>Installation:</i>	pole mounting	
Electrical Specifications	824 - 960	1710 - 2500
Polarization	vertical	vertical
Gain (dBi)	8 ± 1	8 ± 1
Horizontal-3dB Beamwidth (°)	95	100
Vertical-3dB Beamwidth (°)	55	80
Front-to-Back Ratio (dB)	≥ 10	≥ 10
VSWR	<1.4:1	<1.4:1
Impedance (Ohms)	50	50
Max Input Protection (W)	50	50
<i>Lightning Protection</i>	direct ground	direct grounding



5 System Commissioning

This chapter describes the testing steps of fiber repeater system, the tools and instruments needed for the repeater commissioning, as well as the general commissioning test procedures.

5.1 Testing Tools and Instruments

Needed Instruments for the booster commissioning test are,

Spectrum Analyzer

Laptop

Test Mobile Phone

VSWR Tester

Multi-meter

Compass

Spanner

Local Control Serial Connection Cable (RS232)

5.2 VSWR Test of Antenna and Feeder System

To ensure the booster normal operation, we use VSWR tester to measure the VSWR value of donor and service antenna. An engineering record is necessary. The VSWR of the antenna and feeder system should be no higher than 1.5.

If not ok, check the connector again.

5.3 Voltage Test of Power Supply System

If with AC supply, there is an unstable voltage and a big fluctuation in the wide countryside area, we should use the multi-meter to test AC voltage and make sure the value range is from 85V to 132V with a good engineering record.

If with other power supply, we should testing the PS system value and have a good engineering too.

5.4 Parameter Test

- 1 Connect the laptop with the repeater LOC interface via RS232, which is the local control dedicated serial interface.

- 2 Ensure the donor antenna and the service antenna are not connected to the repeater, switch on the repeater.
- 3 Run the local software on the laptop.
- 4 Confirm the DL PA and the UL PA is turnoff.
- 5 Calculate the DL gain as follows, and set it by local software.

According to the DL signal power P_{in} received by the donor antenna, the wanted output power of the repeater P_{out} , calculate the DL gain, and set it by local software.

- 6 Connect the donor antenna and the service antenna to the repeater.
- 7 Switch on the DL PA by the local software, inquiry the DL output power. If the output power is not less than the rating power, reduce the repeater gain until the output power is 2dB smaller than the rating power, thus the repeater can work in a good dynamic range.
- 8 According to the DL gain, estimate the UL gain and set it by the local software, calculate the UL output noise level and slightly adjust the UL gain until the output noise level meet the system requirement. Generally, UL gain is 3-10dB smaller than DL gain.
- 9 Make calling test in the coverage area, make sure the calling quality and the coverage range meet the requirement of the system.
- 10 If the wanted signal interrupts with the neighboring signal which is outside of the wanted frequency range, we can filter it by setting a proper value to the UL or DL frequency offset by the local software.

5.5

Remote Control Test

- 1 Shut down the PS of the repeater.
- 2 Place the SIM card to the socket on the Modem.
- 3 Turn on the repeater.
- 4 The power light on the Modem will light in 3 seconds. It shows the power supply to the Modem is ok.
- 5 The communication light on the Modem will flash in 15 seconds and this may last for 5 seconds. This shows that the Modem has registered successfully, or you need to check the SIM card and the RF cable.
- 6 Set your telephone number to the WARN PHONE (phone number for alarm) by the software.
- 7 Make an alarm, and check whether you will receive an alarm message. If you receive, the Modem is ok.

- 8 Set the final phone numbers to the repeater, such as REP PHONE (repeater's phone number), WARN PHONE, CHECK PHONE1 (phone number for inquiry) to CHECK PHONE5 of the OMC.
- 9 Set the REP ID (repeater's ID) assigned from the OMC to the repeater.
- 10 Inform the OMC have a remote control test to the repeater

Note:

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

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

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

Appendix A: OUTLET CONFIGURATION

1	Repeater(Remote Unit)	1	
2	CD *	1	
3	Swelled screw	4	

Mark: CD includes the files:

- 1 User Manual;
- 2 O&M Manual;
- 3 Installation Direction Manual;
- 4 Specification;
- 5 Local Control Software.