

# Model 100-AS

## SMR Band RF Repeater

## User's Guide



ExCell RF, Inc.  
6400 Windcrest Drive  
Suite 1614  
Plano, TX 75024  
972-473-9988

[www.excell-rf.com](http://www.excell-rf.com)

© 2003 ExCell RF, Inc., all rights reserved

## Notice

The information contained in this document is subject to change without notice. We make no warranty of any kind with regard to this material, including but not limited to, the implied warranties of merchantability and fitness for a particular purpose. We shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

## Safety Information

The following safety symbols are used throughout this manual. Familiarize yourself with the symbols and their meaning before operating this instrument.

**Warning:** **Warning** denotes a hazard. It calls attention to a procedure, which if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a warning note until the indicated conditions are fully understood and met.

**Caution:** **Caution** denotes a hazard. It calls attention to a procedure that, if not correctly performed or adheres to, could result in damage to or destruction of the instrument. Do not proceed beyond a caution sign until the indicated conditions are fully understood and met.

**Note:** **Note** calls out special information for the user's attention. It provides operational information or additional instructions of which the user should be aware.

**Warning:** **No operator serviceable parts inside. Refer servicing to qualified personnel.**

**Caution:** Always use the three-prong AC power cord supplied with this product. Failure to ensure adequate grounding may cause product damage.

## **Warranty**

This product is warranted against defects in material and workmanship for period of one year from date of shipment. During the warranty period, we will, at our option, either repair or replace products that prove to be defective.

For warranty service or repair, this product must be returned to our designated service facility. Buyer shall prepay shipping charges for products returned to us and we shall pay shipping charges to return the repaired product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for replacement of products in another country. We warrant this product when properly installed. We do not warrant that the operation of this product will be uninterrupted or error-free.

## **Limitation of Warranty**

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer. Unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance is also not covered by this warranty.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. WE SPECIFICALLY DISCLAIM THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

***THIS EQUIPMENT COMPLIES WITH APPLICABLE FCC RULES. ANY CHANGES OR MODIFICATIONS NOT EXPRESSLY APPROVED BY THE MANUFACTURER COULD VOID THE USER'S AUTHORITY TO OPERATE THE EQUIPMENT.***

### ***Caution:***

***A minimum separation distance of 20cm between the transmit antenna and nearby persons must be maintained. If this separation distance is not maintained, this device may not be in compliance with FCC Exposure Rules.***

---

## Contents

1.	<b>Overview</b>	5
2.	<b>Preparation for Use</b>	6
2.1.	<b>Initial Inspection</b>	6
2.2.	<b>Power Requirements</b>	6
2.3.	<b>Turning On the Repeater</b>	7
2.4	<b>Front View</b>	7
3.	<b>Testing</b>	8
3.1	<b>Specifications</b>	8
3.2	<b>Appearance Inspection</b>	8
3.3	<b>MGC, Output Power &amp; OIP3 Test</b>	9
3.3.1	<b>Equipment</b>	9
3.3.2	<b>Criterion</b>	9
3.3.3	<b>Equipment Setting</b>	9
3.3.4	<b>Test Procedures</b>	9
3.4	<b>Flatness, Time Delay, Isolation and VSWR Measurements</b>	11
3.4.1	<b>Equipment</b>	11
3.4.2	<b>Criterion</b>	11
3.4.3	<b>Equipment Setting</b>	11
3.4.4	<b>Test Procedures</b>	11
3.5	<b>AGC Test</b>	12
3.5.1	<b>Equipment</b>	12
3.5.2	<b>Criterion</b>	12
3.5.3	<b>Equipment Setting</b>	13
3.5.4	<b>Test Procedures</b>	13
4.	<b>Trouble Shooting</b>	14

## 1. Overview

The Model 100-AS repeater is a compact, high-gain bi-directional amplifier that can be used to amplify RF signals in the 800 MHz SMR band. The Model 100-AS repeater can solve wireless coverage problems for most indoor and outdoor applications.

Typical applications for the Model 100-AS repeater are:

- Office Buildings
- Shopping Malls
- High Rise Buildings
- Hospitals
- Residential Properties
- Hotels
- Parking Garages
- University Campuses
- Airports
- Tunnels

**Note:** It is strongly recommended that the user obtain approval from the Wireless Service Provider prior to installing and powering up the repeater.

## 2. Preparation for Use

This section provides information on how to inspect your repeater when it arrives and what to expect when it is first powered on. It also includes the repeater power requirements.

### 2.1. Initial Inspection

Verify that the contents are complete. Table 2-1 lists shipping list. If the contents are incomplete, or the repeater does not pass the performance tests, notify us immediately. If the shipping container is damaged or the cushioning material shows signs of stress, also notify the carrier. Keep the shipping materials for the carrier's inspection.

**Warning: Do not attempt to clean internally.**

Table 2-1      Shipping List

Description
Repeater
Test Data Sheet

### 2.2. Power Requirements

The repeater requires no assembly other than connection to a power source. The power source must be 110VAC line voltage.

Table 2-2      AC Power Requirements

Voltage	90~132 Vrms(47 to 63Hz)
Power Consumption	Less than 40W

The repeater is supplied with a three-wire power cable, in accordance with international safety standards. When connected to an appropriate power line outlet, this cable grounds the repeater chassis.

---

**Warning: Failure to ground the repeater properly can result in personal injury. Before turning on the repeater, you must connect its protective earth terminals to the protective conductor of the main power cable. Insert the main power cable plug only into a socket outlet that has a protective earth contact. DO NOT defeat the earth-grounding protection.**

### 2.3. Turning On the Repeater

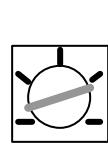
Plug the power cord into the line socket. Whenever you plug the cord, if the repeater is operating normally, you will see 2 green LEDs.

**Warning: Use a 3-wire AC Line and check the line voltage.**

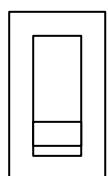
### 2.4 Front View



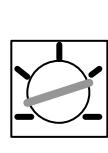
Control Board



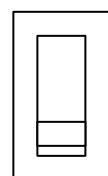
AGC



MGC



AGC



MGC

Forward Gain Control

- Clockwise : Gain (+)
- Counterclockwise : Gain (-)

Reverse Gain Control

- Clockwise : Gain (+)
- Counterclockwise : Gain (-)

### 3. Testing

This section describes the testing procedure that may be used to confirm that the repeater conforms to the specifications shown in Table 3.1.

#### 3.1 Specifications

Parameters		Conditions	Remarks
Frequency	Downlink	851 ~ 866MHz	
	Uplink	806 ~ 821MHz	
Input Power		-40dBm	Maximum
Output Power		+27dBm±1.0dB	Nominal 0.5W
OIP3		+45dBm	@14dBm/Tone
Gain		70dB	Maximum
Flatness		2dB	Peak to Peak
Noise Figure		3dB	Typical
Isolation		90dB	Minimum
VSWR		1.5 : 1	
Time Delay		0.2 uSec	Maximum
AGC Range		30dB	
MGC Range		20dB	Minimum
In/Out Impedance		50	
In/Out Connector		N-Type	Female
Operating Temperature		-20 ~ 50	Indoor Type
Power Supply		110V, 60Hz	America Only
Size		5.98" x 6.80" x 2.26"	W*H*D

#### 3.2 Appearance Inspection

- Procedures
  - 1) Check the connector, link cord.
  - 2) Connect the power cord of the repeater to the AC line.
  - 3) Check the LEDs. Two green LEDs means that the unit is operating normally.
  - 4) One is DC power is ok and the other means there is no alarm.

### 3.3 MGC, Output Power & OIP3 Test

#### 3.3.1 Equipment

Equipment Name	Number	Remarks
Spectrum Analyzer	1	Agilent 8595E or the equivalent
Signal Generator	2	Agilent E4432B or the equivalent
2-Way Combiner	1	General Purpose
Power Attenuator	1	Over 30dB (For protection of measurer)
Band Pass Filter (BPF)	1	For protection of measurer

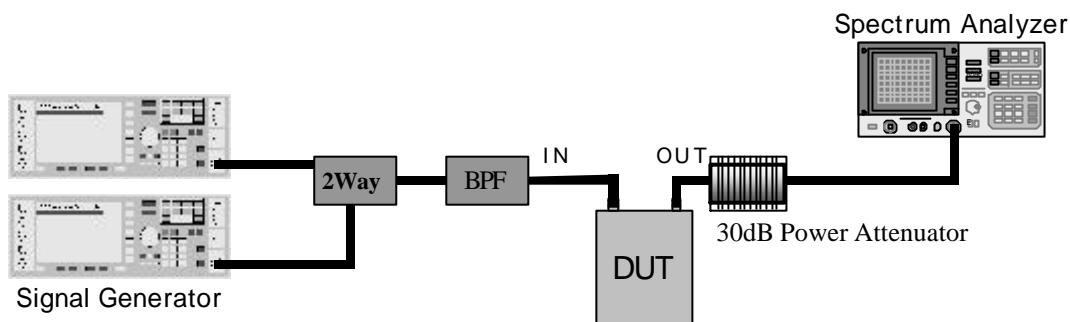
#### 3.3.2 Criterion

MGC Range : 20dB

Output Power : +27dBm  $\pm 0.5$ dB

OIP3 : +45dBm(@14dBm/Tone)

#### 3.3.3 Equipment Setting



#### 3.3.4 Test Procedures

- Common Measurement

- Measures the path loss from the Signal Generator output to the Repeater input. ( $IN_{loss}$ )
- Measures the path loss from the Repeater output to the Spectrum Analyzer input. ( $OUT_{loss}$ )
- Set the apparatus as drawings above.

**Warning: The BPF is used to protect the Signal Generator and the 30dB Power Attenuator is used to protect the Spectrum Analyzer.**

- Set the Signal Generator output as  $(-46+IN_{loss})$ dBm, and frequency as

860 MHz(@ Down link Case, 815MHz @ Uplink Case).

- 5) Set the Spectrum Analyzer as follows.  
 [ RBW : 30KHz, VBW : 300Hz, SWP : AUTO, SPAN : 2MHz,  
 CF : 860MHz Amplitude Offset : ( 30 + OUT<sub>loss</sub> ) dB ]

- MGC and Output Power Measurement
  - 1) Check the selection switch as MGC mode.
  - 2) Turn off one of signal generators.
  - 3) Connect the power cord of the repeater to the AC line.

**Warning: Use a 3-wire AC Line and check the line voltage.**

- 4) Measure and confirm that the output power is 27dBm  $\pm$ 0.5dB.
- 5) Turning the variable resistor and measure gain variation.
- 6) Disconnect the power cord of the repeater to the AC line.
- 7) Repeat the same test to the Uplink frequency.

MGC Gain Reference Table(Check 9 Pin D-Sub Pin 7 & 9)

Gain	Voltage	Attenuation
70 dB - 3 dB	3.09 V	0 dB
65 dB $\pm$ 3 dB	1.31 V	5 dB
60 dB $\pm$ 3 dB	0.99 V	10 dB
55 dB $\pm$ 3 dB	0.83 V	15 dB
50 dB $\pm$ 3 dB	0.75 V	20 dB
40 dB $\pm$ 3 dB	0.63 V	30 dB

Pin 7 is for Down Link, Pin 9 is for Up Link

- OIP3 Measurement
  - 1) Connect the power cord of the repeater to the AC line.
  - 2) Set 2 Tone Spacing as 250KHz.
  - 3) Set output power to +14dBm each tone.
  - 4) Measure 3<sup>rd</sup> harmonics value.
  - 5) Calculate OIP3 using the following formula.  

$$\text{OIP3} = \text{Pout} + \text{IMD}/2$$
  - 6) Repeat the same test to the Uplink frequency.

### 3.4 Flatness, Time Delay, Isolation and VSWR Measurements

#### 3.4.1 Equipment

Equipment Name	Number	Remarks
Network Analyzer	1	Agilent 8753D or the equivalent
Power Attenuator	1	Over 30dB (For protection of measurer)

#### 3.4.2 Criterion

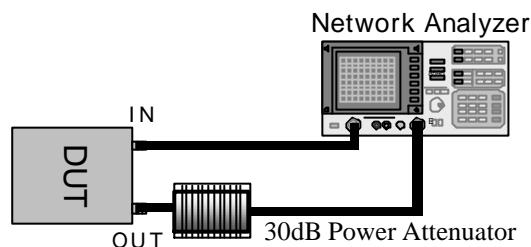
Flatness : 2dB(Peak-to-Peak)

Time Delay : 0.2uS(Maximum)

VSWR : 1.5 : 1

Isolation : 90 dB(Minimum)

#### 3.4.3 Equipment Setting



#### 3.4.4 Test Procedures

- Flatness & Time-Delay Measurement
  - Calibrate the Network Analyzer(NA) as 2 port calibration mode  
[ Fc : 860.00 MHz, SPAN : 20 MHz, Pin : Power of NA("IN" port of NA)]
  - Set the NA output power as -45dBm.
  - Set the apparatus as drawings above.

**Warning: The 30dB Attenuator is used to protect the Network Analyzer.**

- Set the apparatus maximum gain, 70dB.
- Measure the Flatness from the display
- Change display format to time delay.
- Measure the Time-Delay from the display
- Repeat the same test to the Uplink frequency.

- Isolation Measurement
  - 1) Calibrate the Network Analyzer(NA) as 2 port calibration mode [ Fc : 860.00 MHz, SPAN : 100 MHz, Pin : Power of NA("IN" port of NA)]
  - 2) Set the NA output power as -45dBm.
  - 3) Set the apparatus as drawings above.

**Warning: The 30dB Attenuator is used to protect the Network Analyzer.**

- 4) Set the apparatus maximum gain, 70dB.
- 5) Measure the Isolation from the Up-Link Frequency Band.
- 6) Repeat the same test to the Uplink frequency

- VSWR Measurement
  - 1) Calibrate the Network Analyzer as 1 port calibration mode.
  - 2) Set the apparatus as drawings above but terminate output port and set network analyzer's output power to -30dBm.
  - 3) Set the apparatus gain to maximum, 70 dB.
  - 4) Measure the VSWR.
  - 5) Repeat the same test to the Uplink frequency

### 3.5 AGC Test

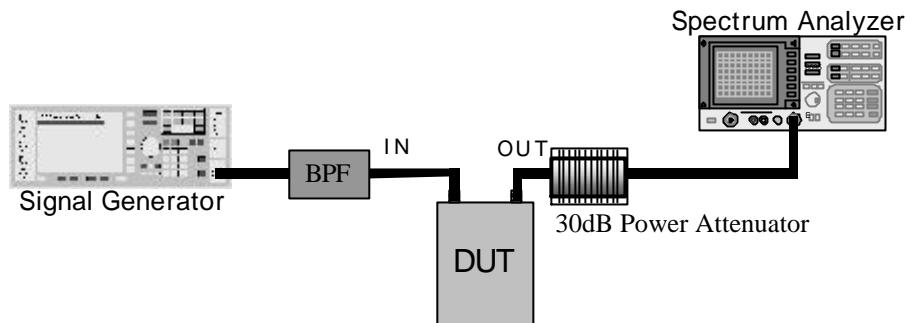
#### 3.5.1 Equipment

Equipment Name	Number	Remarks
Spectrum Analyzer	1	Agilent 8595E or the equivalent
Signal Generator	1	Agilent E4432B or the equivalent
Power Attenuator	1	Over 30dB (For protection of measurer)
Band Pass Filter (BPF)	1	For protection of measurer

#### 3.5.2 Criterion

AGC Range : 30dB

### 3.5.3 Equipment Setting



### 3.5.4 Test Procedures

- 1) Measures the path loss from the Signal Generator to the DUT input. (  $IN_{loss}$  )
- 2) Measures the path loss from the DUT output to the S.A. input. (  $OUT_{loss}$  )
- 3) Set the apparatus as drawings above.
- 4) Set the Signal Generator output as  $(-43+IN_{loss})\text{dBm}$ , and frequency as 860 MHz(@ Down link Case).
- 5) Set the Spectrum Analyzer as follows.  
 [ RBW : 30KHz, VBW : 300Hz, SWP : AUTO, SPAN : 2MHz,  
 CF : 860MHz Amplitude Offset :  $(30 + OUT_{loss})\text{dB}$  ]
- 6) Connect the power cord of the repeater to the AC line.
- 7) Check the selection switch as AGC mode.
- 8) Turn on the signal generators.
- 9) Measure the output power is  $27\text{dBm} \pm 1.5\text{dB}$  (Factory setting)
- 10) Increase the signal generator's output power to  $-13\text{dBm}$  and measure the spectrum analyzer's power is same.
- 11) Repeat the same test to the Uplink frequency

---

#### 4. Trouble Shooting

Conditions	Troubleshooting Procedure
No Output or Output is too low	<ul style="list-style-type: none"><li>● Check line cord is properly connected.</li><li>● Check input connector is properly connected.</li><li>● Check the MGC gain is minimum.</li><li>● Check Connector is OK.</li><li>● Check spectrum analyzer's offset setting is ok.</li><li>● Check Power LED is green.</li></ul>
Output power is not changing	<ul style="list-style-type: none"><li>● Check AGC is ON.</li><li>● Check output power detector.</li><li>● Check measuring frequency.</li></ul>