INSTALLATION & OPERATION MANUAL FOR THE BETA MODELS OF THE PCS SSR

Contents:

1.0 Description

WARNING: This device complies with CFR 47, Part 24 of the FCC rules. Any modification not expressed approved by the manufacturer could invalidate the user's authority to operate the device.

1.1 Physical Configuration

Figure 1 is an illustration of the 18" PCS Side to Side Repeater (SSR) indicating important features; Figure 2 is an illustration of the 12" SSR. As shown in the illustrations both SSRs have a square shape with rounded corners; both units have the same physical thickness (approximately 2"). The 18" unit weighs approximately 14.5 pounds; the 12" unit approximately 8 pounds. The 2" wide edge of both units contain 4 deep grooves separated by fins; this structure is an important electrical feature and must be keep free of extraneous material. Likewise, the central 8" square area on each face is electrically active and must be kept free of contaminating materials. Take special note that each face of the SSR has a unique electrical function and must properly oriented in operation (see section 2.0). The illustrations show the SSR without the radomes normally attached to each face. When attached the radome with the Andrew flash indicates which side should be facing the handset (mobile unit).

1.2 Electronic Description & Block Diagram

The 1900 series PCS repeaters operate in the 1900 MHz PCS band. They were developed to provide more reliable coverage and/or range extension of PCS systems within sheltered structures. Specific models for each of the major US PCS sub-bands

(A, B, C, D, E & F) are offered. Pre-aligned antennas on each side of the repeaters make them easy to install and simple to operate. Designed for indoor environments, they only require a standard US 110VAC outlet for operating power. All three popular PCS systems (TDMA, CDMA & GSM) are supported.

Figure 3 is an electronic block diagram of SSR internal and external circuitry. Separate antennas provide receive and transmit functions for the complementary uplink and downlink bands. In operation, the appropriate receive antenna feeds its' signal to a band pass filter that functions to reject undesired signals and isolate the complementary band's signal. The signal from the band pass filter feeds an amplifier with an AGC loop that limits maximum output power to approximately 100 milliwatts. The amplifier output feeds a second band pass filter functioning to limit spurious amplifier output signals and further isolate the complementary band's signal. The complementary band's signal path is identical to that previously described, except in the reverse direction. Both amplifiers include crude RSSI circuitry and over-current protection circuitry.

1.3 Operational Environment

The SSR has been designed to operate properly in a temperature and humidity controlled indoor environment. Operation in environments where the ambient temperature is outside the 50^{o}-85^{o} F range or the relative humidity is greater than 50% may result in unsatisfactory performance. Exposure to temperatures outside the 10^{o}-120^{o} F range or relative humidity greater than 80% may result in permanent damage to the unit.

2.0 Installation Guide Lines

2.1 Location

CAUTION: In order to comply with FCC rules for rf exposure, the following must be observed:

The antenna must be installed such that a minimum separation distance of 20 cm. is maintained between the antenna and any persons.

Proper operation of the SSR cannot be achieved if the following installation location guide lines are not followed.

The prevention of signal feedback from the transmit antenna on one side of the SSR to the same path's receive antenna on the opposite side of the SSR is paramount to proper operation of the SSR. Any matter in the surrounding environment of the SSR will produce undesirable feedback signals. Any object with any physical dimension that is greater than 2 inches may cause undesirable signal reflections and/or refractions severe enough to cause unstable operation of the SSR. Metal objects normally cause worse reflections and/or refraction than non-metallic objects. The level of undesired reflected and/or refracted signals is directly proportional to the size of the object and inversely proportional to the distance between the SSR and the

reflecting/refracting object. Obviously, a perfect "free space" environment for the SSR is the ideal location, but not practical. However, a major goal of the operating location selection process is to find a place that approximates a "free space" environment as closely as possible.

A location that provides a "clear" communication link with a suitable base station signal using a typical handset is also required for proper operation of the SSR. Base station signal level at various candidate locations should be measured using the RSSI on a handset or more precise instrumentation. Experience indicates that a location with the highest base station signal level that is free of any object within a 15-20 feet radius hemisphere centered on one side of the SSR should provide suitable SSR operation.

2.2 Mounting Considerations

Mounting should be accomplished with due consideration of the minimization of undesirable feedback signal discussed in section 2.1. Early product development testing used 50 lb. braided nylon cord and small "S" hooks to hang the SSR four or more feet below a convenient overhead structural member (see Figure 4). Mounting devices made of non-conductive, low dielectric constant and/or high loss tangent materials attached to any edge that minimally blocks the grooves between the fins on the edges may be used to mount the SSR.

2.3 Power Supply Location & Connections

The power supply furnished with the SSR requires a standard US 110 VAC outlet. It connects to the SSR via a permanently attached two-conductor cable with a special polarized connector and RF absorbing material on approximately 18" of length adjacent to the SSR. The location of the power supply also requires special attention to the minimization of undesirable feedback signals. The recommended location is as near the plane that bisects the SSR around the finned edge as possible and as far away from the SSR as possible.

3.0 Operation Guide Lines

3.1 Power / Interface Circuit Board

All controls and indicators for the SSR are mounted on the power / interface circuit board (PWR I/F); which is mounted in one of grooves between the edge fins (see Figures 1 & 2). The four small LEDs mounted on the PWR I/F provide the following information:

Green LED at edge of PWR I/F most distant from power connector.	On state indicates that SSR is receiving power from the power supply and the internal circuitry has not exceeded the maximum safe current demand.
	Off state (concurrent with an off state for the adjacent Red LED) indicates that the SSR is not receiving power from the power supply.

Red LED adjacent to Green Power LED described above.	On state indicates an internal over current event has occurred. Power to the SSR must be interrupted for 10 or more seconds to reset this "circuit breaker" function. Repeated resets (more than 3 times in 30 minutes) may cause permanent damage to SSR.
	Off state (with concurrent on state of power LED) indicates normal SSR operation
Green LED nearest power connector.	RSSI for the down link (signal received from the base station and re-transmitted to the handset). On state indicates reception of a useable signal from the base station.
Green LED next in line away from power connector.	RSSI for the up link (signal received from the handset and re-transmitted to the base station). On state indicates reception of a useable signal from the handset.

3.2 Stability

After mounting the SSR in a location selected using the guidelines of section 2.0 and connecting the power supply stable operation must be confirmed. If stable operation in the selected location cannot be achieved, either another stable location must be found or the gain of the SSR must be reduced (see Appendix C).

A good way to confirm stable operation is by use of a spectrum analyzer and a suitable pick-up antenna. Locate the spectrum analyzer and pick-up antenna outside the 15-20 feet clear field hemisphere of the SSR, adjust the analyzer controls to display signals in a 150 MHz band centered on the operating band of the SSR (see appendix A), and set the analyzer bandwidth, attenuation, and sweep parameters to provide –90 to –100 dBm measurement sensitivity. Turn off the SSR by removing its' power cable; while viewing the analyzer display, turn the SSR back on and watch for spurious signals that change amplitude and frequency in a random manner. The presence of such randomly changing signals is a strong indication of an unstable SSR. With a normally operating SSR you should be able to see the base station down link signal and this signal should increase in amplitude when the SSR is turned on (See Figure 5).

If a spectrum analyzer is not available, a less certain but useful way to confirm satisfactory operation is to make a phone call using a hand set that operates in the same band as the SSR. The audio quality is usually badly garbled and distorted when the SSR is operating in an unstable manner.

Figure 1. 18” Side to Side Repeater

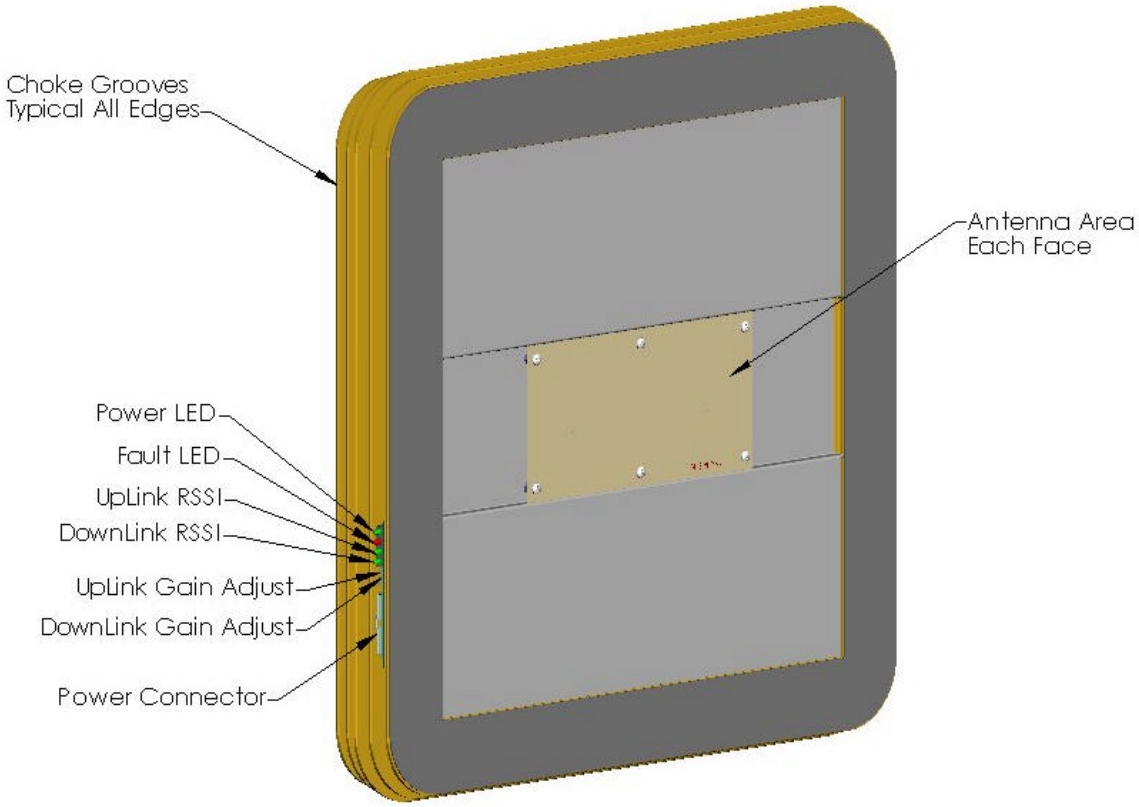


Figure 2. 12” Side to Side Repeater

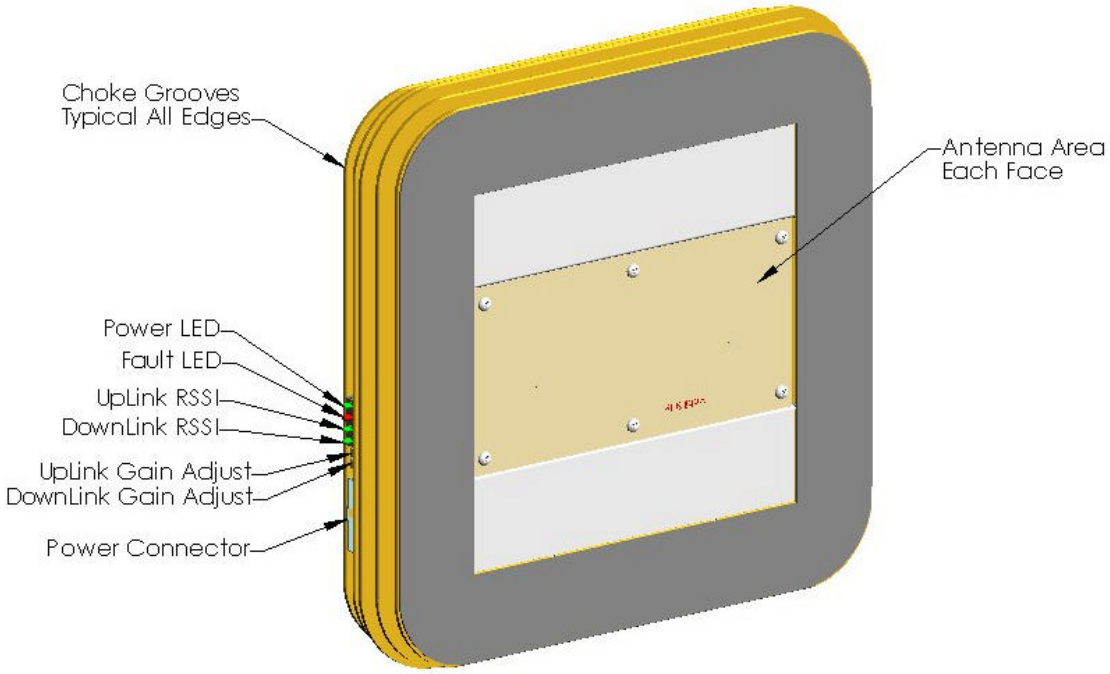


Figure 3. Side to Side Repeater Block Diagram

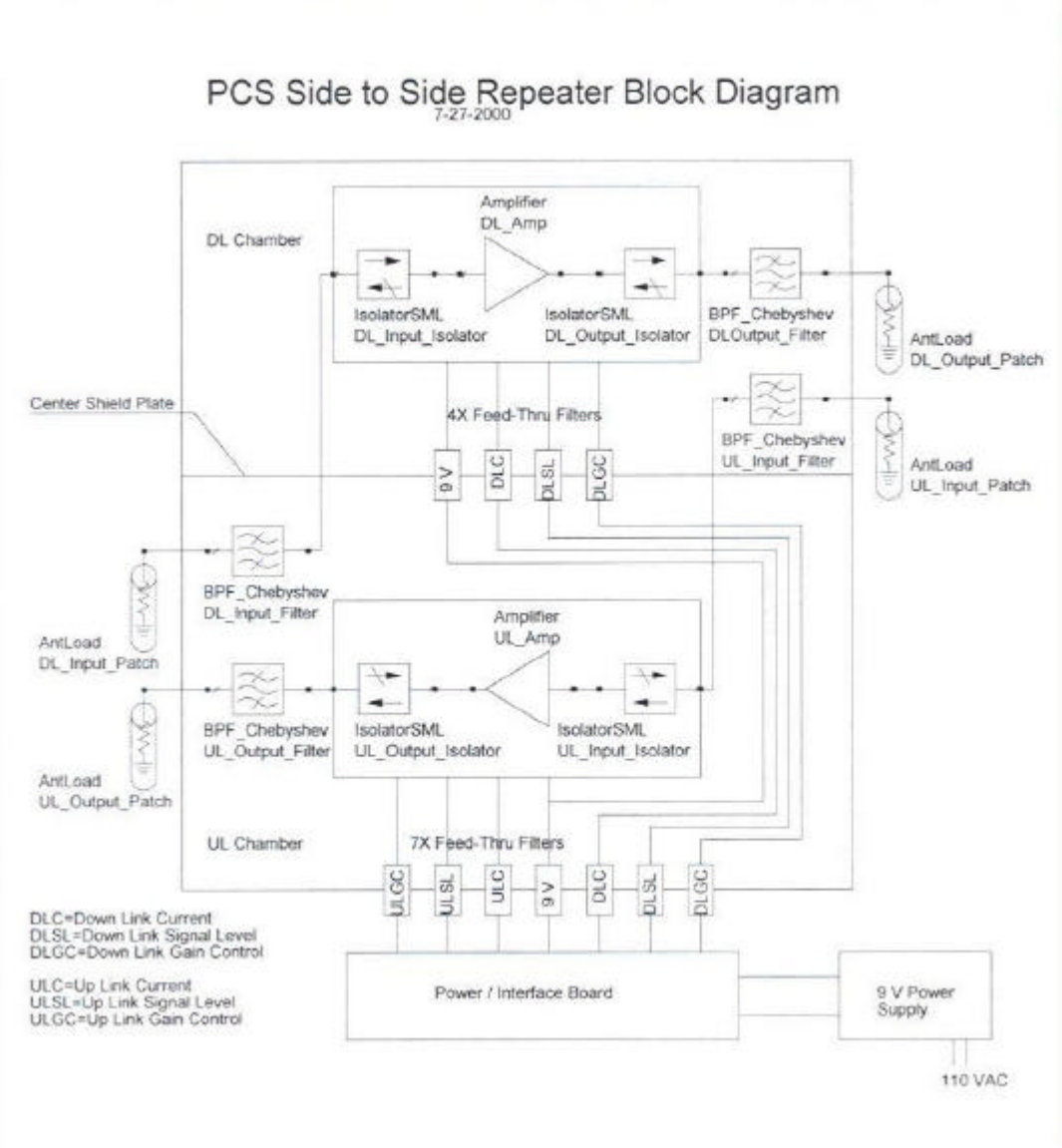


Figure 4. Typical SSR Installation Mounting

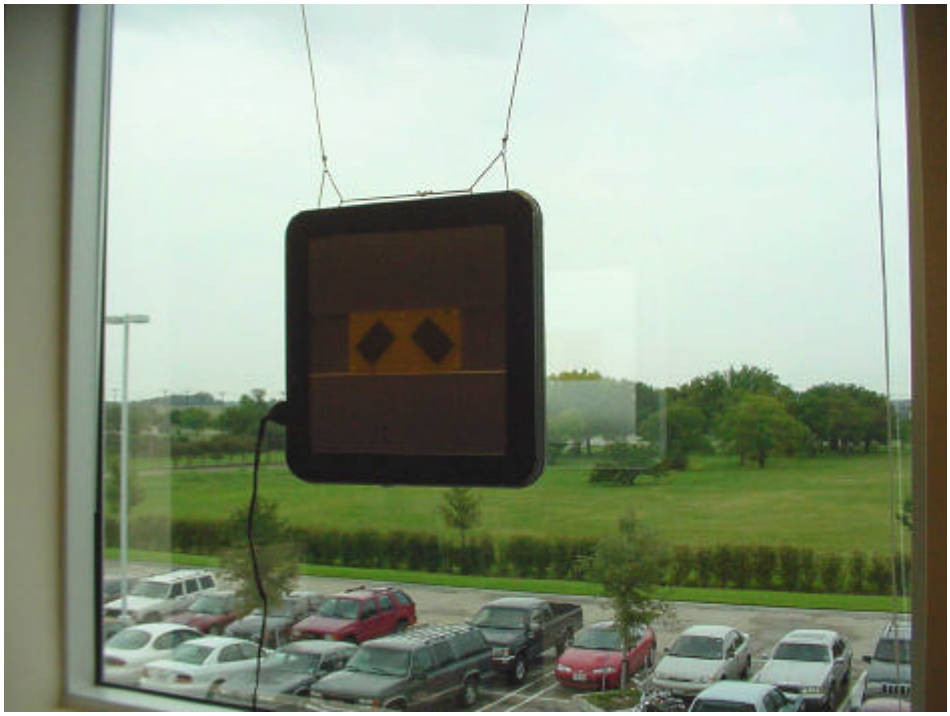
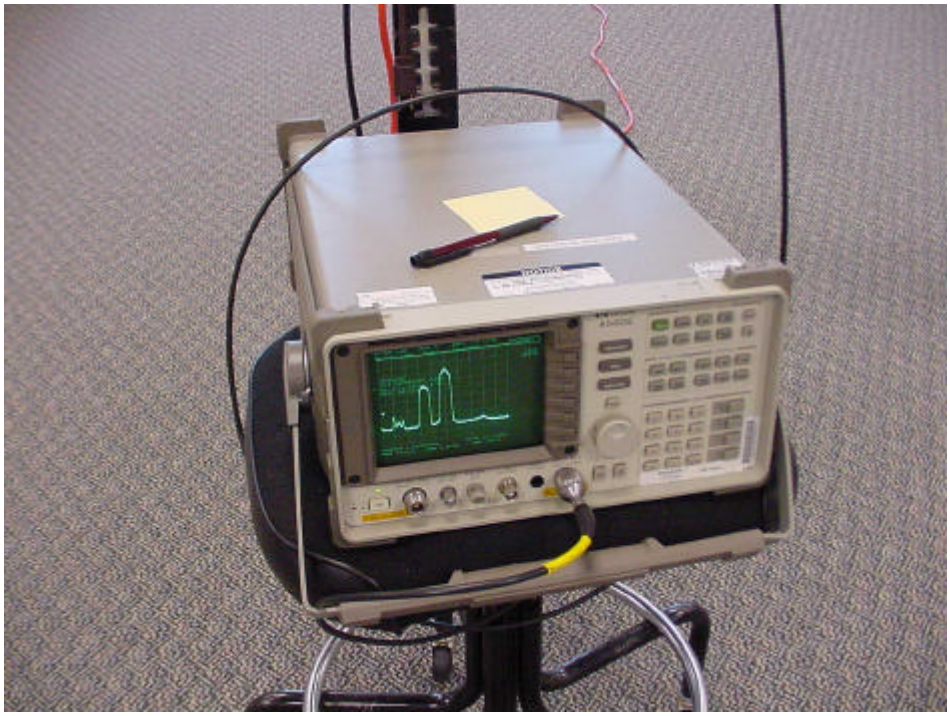


Figure 5. Example of Spectrum Analyzer Display of Base Station Signals for Stable Operation of the SSR



APPENDIX A. PCS Frequency Band and Blocks

Band/Block	Channel Numbers	Mobil Station Transmit Frequency (MHz)	Base Station Transmit Frequency (MHz)
A	0-299	1850-1865	1930-1945
D	300-399	1865-1870	1945-1950
B	400-699	1870-1885	1950-1965
E	700-799	1885-1890	1965-1970
F	800-899	1890-1895	1970-1975
C	900-1199	1895-1910	1975-1990

APPENDIX B: Specifications

	Common to all Models:					
Model 1900-xxx	**-12A & -18A**	**-12B & -18B**	**-12C & -18C**	**-12D & -18D**	**-12E & -18E**	**-12F & -18F**
Rx Freq (MHz)	1850-1865	1870-1885	1895-1910	1865-1870	1885-1890	1890-1895
Rx NF	5.5 dB Max					
Tx Freq (MHz)	1930-1945	1950-1965	1975-1990	1945-1950	1965-1970	1970-1975
Tx Pwr	+20 dBm typical; +21 dBm Max					
ACPR	-50 dB Min @ ±885 kHz					
Power @110VAC	20 watts Max					
Temp Range	50 to 85 ^{o}F					
	Common to all 12” Square Models:					
Rx/Tx Active Gain	45 dB min					
Size	12” X 12” X 2” less Power Supply					
Weight	8-1/2 lbs less Power Supply					
	Common to all 18” Square Models:					
Rx/Tx Active Gain	50 dB min					
Size	18” X 18” X 2” less Power Supply					
Weight	14-1/2 lbs less Power Supply					

APPENDIX C: Gain Adjustment

The small multi-turn potentiometers (pot) visible on the edge of PWR I/F board between the power connector and the row of LEDs may be adjusted to reduce the electronic gain of the SSR (see illustration below). Keep in mind that proper location of the SSR is the best way stabilize the SSR. Gain reduction will drastically reduce the range over which the SSR can provide signal improvement. Rotation of the adjustment screw clockwise will reduce the gain of the SSR. Adjustment sensitivity is approximately 1 dB per turn in the mid range of the pot. The pots have a slip-clutch action at each end of their range to preclude accidental damage during adjustment to the desired setting.