



CR500 Bi-Directional Repeater Installation & User Manual



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Introduction

In-building repeaters provide enhanced coverage of cellular telephone signals for areas that are confined or enclosed such as tunnels, underground parking garages, and within buildings. Many buildings are constructed of materials like metal, brick and concrete that attenuate cellular telephone signals. Symptoms such as dropped calls, broken audio and static indicate the need for an in-building repeater.

The SignalReach™ CR500 Small Office Home Office (SOHO) Cellular Repeater extends cellular services into buildings, parking garages, tunnels and other poor coverage areas. The CR500 is designed for use with 1900MHz cellular handsets and offers a cost-effective solution for small business and residential applications.

The SignalReach™ CR500 is a stationary device that automatically reradiates signals from cellular base stations without channel translation, for the purpose of improving coverage of existing service by increasing the signal strength in dead spots. The repeater is a network-compatible device that amplifies cellular signals in both the uplink and downlink directions. The repeater is simple to install, and contains circuitry to ensure proper operating power levels, and as well, includes an automatic feedback and detection circuitry that detects poor isolation between the subscriber and donor antennas. In this condition the repeater will adjust its gain to compensate for the abnormality, and warn the user through a visual indicator LED. The CR500 will enhance the cellular telephone user's experience while complying with cellular network specifications. Linear operation is guaranteed under all conditions.

The CR500 allows up to two indoor antennas to be used without the need of external components. Its auxiliary indoor antenna port allows a second indoor zone to be easily covered.

This product is designed for installations where cellular coverage is available outside the building, and indoor coverage is inadequate.

CR500 Features:

- Easy Installation – No calibration required
- Automatic feedback detection and warning circuitry
- Auxiliary in-building antenna port provides enhanced coverage
- Up to 20,000 ft² of free space coverage with only one interior antenna
- Network-compatible operation
- Auto levelling circuitry ensures linear operation
- IC, FCC approved
- External fault output signal

Functional Description

The repeater works on the principle of receiving the handset signal through a subscriber (indoor) antenna, amplifying or 'boosting' its signal level, and then passing it on to the donor (outdoor) antenna located outside the building. Signals from the cellular tower (downlink) are also amplified and passed to the subscriber antenna.

The SignalReach™ CR500 in-building repeater is a Class B Broadband device, and processes the cellular 1850-1910/1930-1990 MHz band. Input and output duplexers and band pass filters in the downlink and uplink path provide the repeater's filtering and isolation. The maximum gain in each of the downlink and uplink path is 60dB. Both the downlink and uplink paths incorporate automatic gain control, to ensure that downlink and uplink power amplifiers operate free of distortion. The CR500 has primary and secondary subscriber ports, allowing the repeater to expand the in-building coverage area without degrading repeater performance.

The SignalReach™ CR500 in-building repeater is compatible with all technologies in the 1900 MHz band, including GSM, TDMA and CDMA.

Installation Procedure

Warning; Equipment Installation

❖ Proper Grounding

- Follow the local building codes for installation of antennas on buildings.
- Ensure that the exterior mounted donor antenna is properly mounted and grounded for lightning protection.

❖ RF exposure Guidelines

- During transmitter operation, in order to meet RF Maximum Permissible Exposure Safety Guidelines, a minimum distance of 50 cm (20 in.) shall be maintained between the outdoor (uplink) antenna and personnel.
- During transmitter operation, in order to meet RF Maximum Permissible Exposure Safety Guidelines, a minimum distance of 20 cm (8 in.) shall be maintained between the indoor antenna and personnel.
- The maximum cellular outdoor (uplink) antenna gain authorized shall be limited to 18 dBi or less in order to meet RF exposure (MPE) limit as per FCC guidelines.
- The maximum cellular indoor (downlink) antenna gain authorized shall be limited to 9 dBi or less in order to meet RF exposure (MPE) limit as per FCC guidelines.

❖ Servicing

- When servicing or installing outdoor transmitting elements (i.e. antennas), all transmitting signal sources should be turned off in order to meet RF exposure (MPE) limit as per FCC guidelines.

The repeater unit should be installed in a sheltered area, as it is not sealed to prevent water (rain) ingress. The repeater unit should not be installed in an area where the ambient temperature is expected to exceed +60°C.

The SignalReach™ CR500 is not supplied with cabling or antennas. The indoor and outdoor antenna types and locations must be chosen carefully to avoid re-generative feedback. Re-generative feedback occurs when the subscriber antenna picks up the donor antenna transmit signal. A general rule of thumb is to locate the antennas where the isolation is at least 10 dB greater than the operating

repeater gain. The SignalReach™ repeater has a maximum gain of 60dB, as a result, the isolation required between the subscriber and the donor antenna is in a range of 70dB. The line of sight separation between the subscriber (indoor) and donor (outdoor) antennas represented by a free space loss of 70dB within a building is 17 meters (55 feet). The separation distance can be reduced if the donor antenna is mounted on the building exterior (i.e. on a roof), or using a directional donor antenna (narrow beam width). For example, if a metal roof separates the indoor and outdoor antennas, the physical separation may be substantially reduced.

The following table indicates antenna separation distances for different installation configurations:

	Line of Sight in- building	Exterior Donor Antenna, with 20dB Attenuation ¹	Exterior mounted Directional Antenna ²
Separation Distance meters (ft)	17 (55)	8 (26)	4 (13)

¹ The attenuation is indicative of the construction material that a signal has to penetrate through

² As in ¹, but using a directional antenna with a typical front to back ratio of 20dB

It is not recommended that the donor (outdoor) and subscriber (indoor) antennas be installed within sight of each other. Do not install the unit where a skylight or other low loss RF path exists between the donor or subscriber antenna. Arrista recommends that the donor (outdoor) antenna be installed on the roof or on an outside wall of a building. A cell phone can be used to determine if an adequate signal is present at the chosen location. Run a length of 50-ohm cable between chosen location and the repeater unit.

Cable Length	Recommended Cable
< 50 ft	Andrew CNT-100, CNT-200 Times Microwave LMR-240, or equiv.
50 – 100 ft	Andrew CNT-400 Times Microwave LMR-400, or equiv.
> 150 ft	Andrew CNT-600 or equivalent

Select a suitable location for the subscriber (indoor) antenna, and connect it to the *Ant 1* port of the repeater.

If only one subscriber (indoor) antenna is to be used, flip the switch to

the left to disable the second subscriber port.

If a second subscriber (indoor) antenna is to be used, select a location that is at least 16 meters (55ft) away from both the first subscriber (indoor) antenna and the donor (outdoor) antenna. Once the antenna is connected, adjust the sliding switch to enable the secondary subscriber port (*Ant 2*).

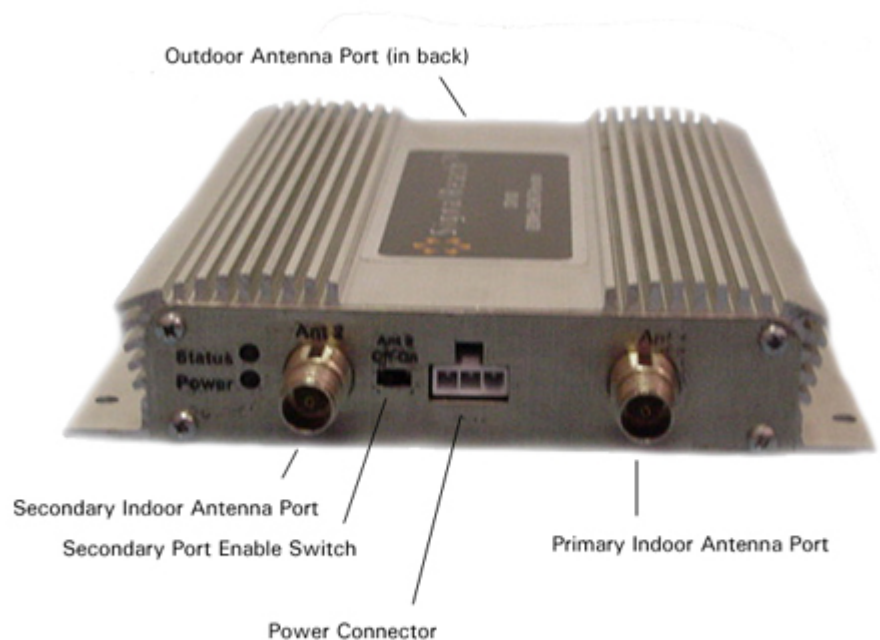


Figure 1. CR500 Connections

Verify all cables are connected properly and connect the provided AC to DC adapter to the unit. The power LED will illuminate, and the status LED should briefly flash and then extinguish. The normal operating condition is a green power LED with an extinguished status LED.

If the status LED is amber and flashing, either an isolation problem exists or too much signal is being received at the outdoor antenna. To solve this problem, try relocating the antenna or rotate the antenna (for directional antennas) until the amber LED extinguishes.

If the status LED is green and flashing, either an isolation problem exists (try relocating the antenna) or a handset is operating too close to the indoor antenna. If it was caused by a handset operating too close, the status LED should extinguish when the handset is moved further away from the antenna.

Fault Reporting

The unit has an open collector output than can relay any fault condition to an external device. This uses the third pin in the power connector. This pin is rated at 12V, 200mA and is at ground potential when a fault condition exists.

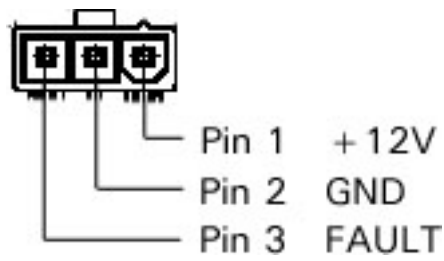


Figure 2 Power Connector Pinout

Operation

The in-building repeater operates automatically and does not require user intervention. There are no user controls, except for a sliding switch to allow a user to connect additional subscriber antenna on the repeaters secondary port to increase coverage area.

The front panel has two LEDs. A green ‘Power’ LED indicates that the repeater is operating. The ‘Status’ LED indicates several conditions; consult the troubleshooting section for details.

Product Maintenance

The CR500 does not require maintenance, as long as it is properly installed following the guidelines stated in this manual. It is recommended that all RF connectors be periodically checked for corrosion, strain relief. Also periodically check the integrity of power connections

Troubleshooting

The repeater unit contains no user serviceable parts and should not require maintenance. Two LEDs on the unit will indicate its current operating state.

Indication	Cause	Action
Power LED is off, status LED is off	The repeater does not have power applied to it	Check the power supply connection.
Power LED is on, status LED is off	The repeater is operating normally	None.
Power LED is on, status LED is amber and flashing	The repeater has reduced its downlink gain to maintain network compatibility. The signal received at the outdoor antenna may be too strong, or there is feedback between the indoor and outdoor antenna.	Try relocating the outdoor antenna, or rotating it (if a directional antenna was used). A RF pad may need to be installed at the outdoor antenna to reduce gain.
Power LED is on, status LED is green and flashing	The repeater has reduced its uplink gain to maintain network compatibility. This is usually caused by a handset being used too close to the interior antenna.	None. The repeater will automatically return to full gain when conditions permit. If the condition persists when no handset is nearby, relocate the indoor and/or outdoor antennas to get more isolation.
Power LED is off, status LED is red and flashing	The repeater is off-line due to a high temperature fault. The repeater will restart automatically when the unit cools down	Determine the cause of the overheating (e.g., hot environment, inadequate airflow). Possibly re-locate the amplifier to a cooler location.
Power LED is flashing, status LED is red	The repeater has detected an internal fault and is off-line.	Interrupt power to the unit to see if it returns to normal operation, otherwise service is required.

RF Specifications

	Uplink	Downlink
Frequency Range	1850-1910 MHz	1930-1990 MHz
Typical Output Power ¹	+ 23dBm	+15dBm
Typical Gain	60 dB	60 dB
Maximum Allowable Antenna Gain	18 dBi	9 dBi
Poor Isolation Detection & Warning Indicator	If re-generative feedback between indoor and outdoor antennas is detected, condition will be indicated with an amber LED indicator	
Maximum Possible Exposure (MPE)	Human exposure to non-ionizing radiation meets or exceeds the permissible FCC mandated MPE specification	

¹ The RF output power specification is for a multi-carrier environment of up to 3 simultaneous TDMA carriers or 1 CDMA Carrier

General Specifications

Power Requirements	12V DC, 0.5 Amp typical, 1.0 Amp max
Remote Alarm Output	An open collector output, third pin in the power connector. Contact rating: 12V, 200mA. Pin is at ground potential on fault condition.
Operating Temperature Range	-40 to +60°C (-40 to 128°F), indoor use only
Dimensions	161mm L x 152mm W x 33mm H (6.38" L x 5.98" W x 1.30" H) without RF connectors
Net Weight	1.5 kg (3.2 lbs)
RF Connectors	TNC Female
Subscriber Antenna	Customer Supplied
Donor Antenna	Customer Supplied
Included Accessories	120V AC adapter, the adapter complies to UL and CSA safety standards

