

**Cellular Specialties, Inc.**

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# **Model 510<sub>pcs</sub> In-Building Amplifier**

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Installation and Users Manual



The serial number may be found on the label on the rear panel of the unit. For your convenience, note this number below, and retain this manual, along with proof of purchase, to serve as a permanent record of your purchase in the event of a theft, or for future reference.

MODEL NUMBER

**510**

DATE OF PURCHASE

SERIAL NUMBER

NAME OF COMPANY



**F C C I D N V R C S I 5 1 0 - 0 3**

This device complies with part 24 of the  
F C C Rules.

DISCLAIMER

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The general safety information in this guideline applies to both operating and service personnel. Specific warnings and cautions will be found in other parts of this manual where they apply, but may not appear in this summary. Failure to comply with these precautions or specific warnings elsewhere in the manual violates safety standards of design, manufacture, and intended use of equipment. Cellular Specialties, Inc. assumes no liability for the customer's failure to comply with these requirements.

## ➤ **GROUNDING**

This amplifier system is designed to operate from single-phase 120VAC power and should always be operated with both the neutral and ground wires properly connected. Do not remove or otherwise alter the grounding lug on the power cord.

## ➤ **EXPLOSIVE ATMOSPHERES**

This product has an integral circuit breaker, which may cause an electrical flash if the breaker should reset. To avoid explosion or fire, do not operate this product in the presence of flammable gases or fumes.

## ➤ **LIGHTNING DANGER**

Do not install or make adjustments to this unit during an electrical storm.

## ➤ **NO USER SERVICEABLE PARTS INSIDE**

HAZARDOUS VOLTAGES ARE PRESENT WHEN THE COVER IS REMOVED. Opening the chassis will void your warranty. If you suspect a malfunction with this product, call your dealer or the Cellular Specialties Support Line at (603) 626-6677.

Cellular Specialties, Inc. developed the Model 510<sub>pcs</sub> In-Building Amplifier (IBA) for use in enclosed structures where sufficient signal from local cell sites to operate cell phones was unavailable within the building. It is necessary that sufficient signal be available on the roof of the structure. The IBA is connected to an external antenna, usually on the roof, and to one or more internal antennas placed strategically throughout the area where phone service is desired.

The external antenna is to be an omni-directional antenna. Internal antennas are usually omni-directional although various other types may be used for certain installations. The IBA amplifies both the "uplink" (phone to tower) and "downlink" (tower to phone) signals thus facilitating communications to and from the local cell site

There are four amplification stages on the downlink and four on the uplink for a total of +65dB nominal gain for each link. (see Figure 2.1) Both links have manual gain control settings accessed through DIP switches on the back panel plus an AGC control for both the uplink and downlink. There are LED indicators on the front panel for power on, transmitter on, uplink overload and downlink overload.

An automatic amplifier safety shutdown circuit is also present which will disable the transmitters for ten seconds should the uplink or downlink overloads be reached to prevent excessive intermodulation and oscillation.

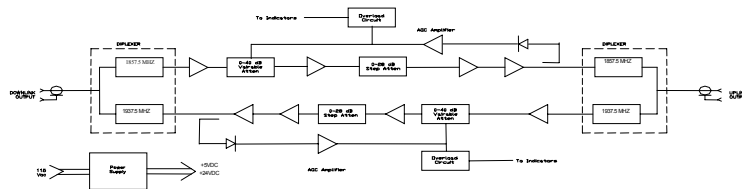
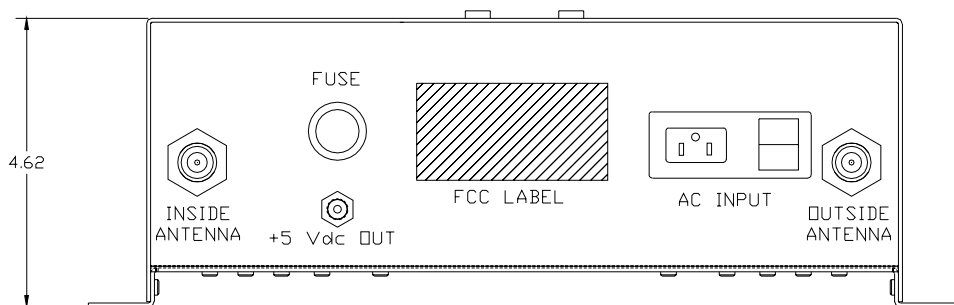
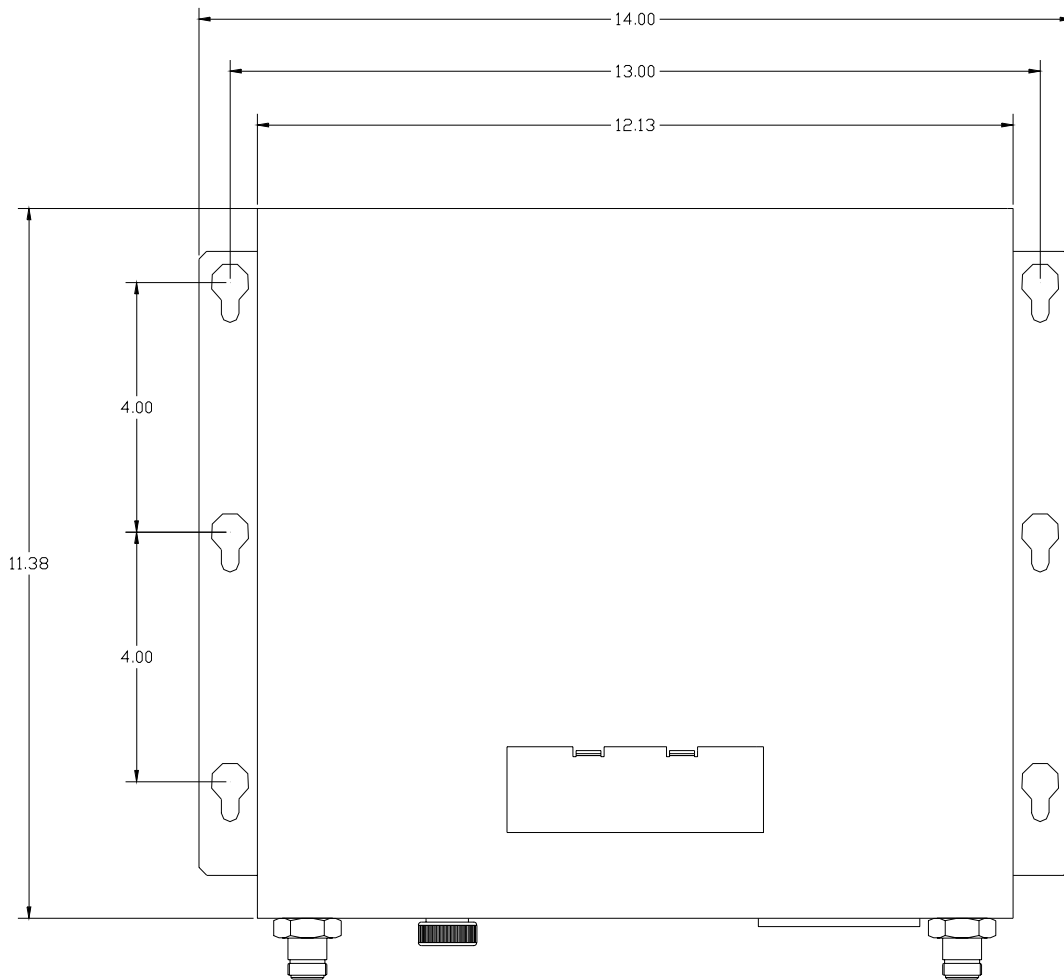


FIGURE 2.1 Functional Block Diagram



# 3.0

## GENERAL SPECIFICATIONS

All specifications stated as typical unless otherwise noted. Cellular Specialties, Inc. reserves the right to change these specifications at any time without notice.

	<b>Uplink (Phone to Tower)</b>	<b>Downlink (Tower to Phone)</b>
<b>Frequency</b>	1850-1865 MHz	1930-1945MHz
<b>Pass Band Ripple</b>	±1.5db	±1.5db
<b>Gain @ Zero Attenuation</b>	+65dB+3db	+65dB+3db
<b>Gain Adjustment Range</b>	-28db	-28db
<b>Power Output, Linear</b>	+23 dbm	+23 dbm
<b>Noise Figure, Typ.</b>	4.5db	4.5db
<b>3<sup>rd</sup> Order Intercept Point, IP3</b>	+36.5dbm	+36.5dbm
<b>Maximum Input Power</b>	-10dbm	-10dbm
<b>VSWR</b>	2.0:1 Max	
<b>Propagation Delay</b>	<1.0 microsecond	
<b>Impedance</b>	50 Ohms	
<b>Connectors</b>	‘N’ Female	
<b>Power Requirements</b>	120 VAC @ 500mA	
<b>Size</b>	15” x 13.5” x 4”	
<b>Weight</b>	6¾ Lbs., 3 kg	
<b>Operating Temperature</b>	-22 to +118°F, -30 to +48°C	
<b>Indicator LEDs</b>	Power, Transmitter On, Uplink Overload, Downlink Overload	
<b>Controls</b>	Power switch with fuse, AGC override switch, switches for Uplink and Downlink attenuation from 0-28dB in four dB steps.	

### Pre-installation Survey

**Note:**

The Installer should refer to the **Safety Precautions**, in the following section, for proper antenna selection and installation

A pre-installation survey should be performed prior to commitment to installation. Measurement of Received Signal Strength Indication (RSSI) should be recorded throughout the building in all areas where cell phone coverage is desired. RSSI levels around the exterior of the building as well as on the rooftop or as close to the point where the exterior antenna will be installed should also be recorded. RSSI readings at the position where the outside antenna will be installed should be greater than  $-90$  dBm. (E.g.  $-85$ dBm) Successful installations may be made with lower readings in some cases.



**WARNING!**

AMPLIFIER DAMAGE **WILL** OCCUR IF A HANDSET IS CONNECTED DIRECTLY TO THE IBA OR THE COAX THAT LEADS TO THE IBA.

The exact location of the proposed outside antenna should be measured with a GPS unit and the coordinates of the cell sites closest to the building in which the system is being installed should be obtained. With these coordinates the distance and bearing to each of the local cell sites can be computed and made available to the installation team. The first choice should be the closest site unless there is blockage in the form of buildings or terrain between the building and this cell site. If blockage exists an alternate site may be available.

If GPS coordinates are not available there is an alternative method of locating the dominant site: connect a handset via SMA female to N male adapter to the directional donor antenna. Rotate the antenna until maximum RSSI and SQE readings are obtained and secure it.

The location of the IBA and the interior antennas should be determined through the use of floor plans of the building in which the system is to be installed. It is important to locate the IBA at a central location and try to keep the coax runs from the amplifier to the antennas as short as possible. A maximum length of 150 feet is suggested although longer runs might be accommodated. This assumes that a coax with loss at



1900 MHz of approximately 3.5 dB per 100 feet is used. The coax used should be a nominal RG-8 type with a flame retardant rating except when installed in space where moving air (heating and/or cooling) exists. In which case the coax must be “plenum” rated. For long runs that exceed 150 feet, the use of low loss 1/2” coax is desirable. Of primary concern is the isolation between the outside antenna and the inside antennas.

**Important note:** A high degree of isolation must be afforded in order to prevent any re-generative feedback in the system. Feedback of this nature causes the amplifier to emit a continuous signal of maximum amplitude and could, in some cases, interfere with normal operation of the cell site. This isolation should be in the order of 70 dB and is usually obtained by mounting the outside antenna away from the edges of the roof. The use of window mounts or other non-rooftop mountings should be avoided.

## SAFETY PRECAUTIONS



For INDOOR use, an Omni-Directional Antenna with a maximum gain of 8dBi is authorized for use with this unit.

Inside antennas must be positioned to observe minimum separation of 20 cm. (~ 8 in.) from all users and bystanders. For the protection of personnel working in the vicinity of inside (downlink) antennas, the following guidelines for minimum distances between the human body and the antenna must be observed.

The installation of an INDOOR antenna must be such that, under normal conditions, all personnel cannot come within 20 cm. (~ 8.0 in.) from any inside antenna. Exceeding this minimum separation will ensure that the employee or bystander does not receive RF-exposure beyond the Maximum Permissible Exposure according to section 1.1310 i.e. limits for General Population/Uncontrolled Exposure.



For OUTDOOR use, an Omni-Directional Antenna with a maximum gain of 8dBi is authorized for use with this unit.

Outside antennas must be positioned to observe minimum separation of 20 cm. (~ 8 in.) from all users and bystanders. For the protection of personnel working in the vicinity of outside (uplink) antennas, the following guidelines for minimum distances between the human body and the antenna must be observed.

The installation of an OUTDOOR antenna must be such that, under normal conditions, all personnel cannot come within 20 cm. (~ 8 in.) from the outside antenna. Exceeding this minimum separation will ensure that the worker or bystander does not receive RF-exposure beyond the Maximum Permissible Exposure according to section 1.1310 i.e. limits for General Population/Uncontrolled Exposure.

### **Physical Installation**

The coaxial cable discussed above should be pulled from the rooftop location to the space designated for the amplifier installation. Additional coax should be pulled from the amplifier to where power splitters are located and thus to the position designated for the Omni-directional antennas. Usually this is accomplished by using existing cableways and running the cable above suspended ceilings. In many cases the Omni-directional antennas can be located above the suspended ceilings however, when this is not possible, alternatives such as ceiling or wall mounted antennas may be used.

When mounting the amplifier, take care to avoid areas of high heat or extreme cold. In general, do not place the unit on or near the top of high ceilings, by heaters or in cold storage areas.

In most cases the IBA will need very little adjustment. After connecting the coax and powering up the IBA, the signal levels within the previously surveyed areas should be checked for adequate RSSI and Signal Quality Equivalent (SQE) levels. Measurements should be made at the perimeter of the building both inside and outside. It is important that the RSSI levels measured outside the building remain close to those measured prior to installation of the IBA.

Both the uplink and downlink overload indicators should remain off. If either indicator is illuminated, the gain of the appropriate link should be reduced.

If the gain of the amplifier needs adjustment the uplink and the downlink may be adjusted by means of the step attenuators on the top of the unit. Attenuation from 0 dB to 28 dB in steps of 4 dB may be inserted by proper selection of the 4, 8 and 16 dB attenuators. If satisfactory phone performance is not obtained when the phone is in close proximity to the interior antenna it may be necessary to decrease the gain of one or both of the links.

# 6.0

## TROUBLESHOOTING

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All external cables should be carefully checked for “shorts” and “opens”.

The rooftop antenna, if directional, should be checked for proper alignment along the calculated compass heading. Typically, the directional antenna should be aimed at the same sight that your handset uses in the area where the outside antenna is to be placed.