

Amplifier Installation Guide



In-Building
Wireless
Amplifier

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Warning: This manual contains important safety and operating information. Please read and follow the instructions in this manual. Failure to do so could be hazardous and result in damage to your amplifier.

30-Day Money-Back Guarantee

All Wilson Electronics products are protected by Wilson's 30-day money-back guarantee. If for any reason the performance of any product is not acceptable, simply return the product directly to the reseller with a dated proof of purchase.

1-Year Warranty

Wilson Electronics amplifiers are warranted for one (1) year against defects in workmanship and / or materials. Warranty cases may be resolved by returning the product directly to the reseller with a dated proof of purchase.

Amplifiers may also be returned directly to the manufacturer at the consumer's expense, with a dated proof of purchase and a Returned Material Authorization (RMA) number supplied by Wilson Electronics. Wilson shall, at its option, either repair or replace the product. Wilson Electronics will pay for delivery of the repaired or replaced product back to the original consumer.

This warranty does not apply to any amplifiers determined by Wilson Electronics to have been subjected to misuse, abuse, neglect, or mishandling that alters or damages physical or electronic properties.

RMA numbers may be obtained by phoning Technical Support at 866-294-1660.

The Manufacturer's rated output power of this equipment is for single carrier operation. For situations when multiple carrier signals are present, the rating would have to be reduced by 3.5 dB, especially where the output signal is re-radiated and can cause interference to adjacent band users. This power reduction is to be by means of input power or gain reduction and not by an attenuator at the output of the device.

Operation is subject to the following two conditions: (1) This device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of this device.

Disclaimer: The information provided by Wilson Electronics, Inc. is believed to be complete and accurate. However, no responsibility is assumed by Wilson Electronics, Inc. for any business or personal losses arising from its use, or for any infringements of patents or other rights of third parties that may result from its use.

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For additional Technical Support visit

www.wilsonelectronics.com

Phone: 866-294-1660

Fax: 435-656-2432

Installation Instructions for the Following Wilson Amplifier:

In-Building Wireless iDEN Smart Technology™ 60 dB 900 MHz Amplifier

Model # 274106, Part # 804106

FCC ID: PWO274106SB IC: 4726A-274106SB

The term "IC" before the radio certification number only signifies that Industry Canada technical specifications were met.

Antenna Options & Accessories



- A 880-965 MHz Yagi Antenna (301142)
- B Dual-Band Panel Antenna (301135)
- C Dual-Polarity Dome Antenna (301123)
- D Dual-Band Dome Antenna (301121)
- E Low Profile Cellular Antenna (301106)
- F Amplifier Soft Cases
- G Amplifier Hard Kit Cases

Before Getting Started

This guide will help you properly install Wilson's In-Building Wireless Smart Technology™ Amplifier. **It is important to read through all of the installation steps for your particular application prior to installing any equipment.** Read through the instructions, visualize where all the equipment will need to be installed and do a soft installation before mounting any equipment. If you do not understand the instructions in full, seek professional help, or contact Wilson Technical Support at 866-294-1660.

Inside this Package

- In-building wireless amplifier
- AC/DC 110 volt power supply



In-building wireless amplifier



AC/DC plug-in power supply

Additional Required Equipment (sold separately)

- Outside Yagi antenna
- Inside dome, panel or low-profile antenna
- Antenna coax cable

How it Works

Wilson amplifiers are small, portable, bi-directional devices that deliver service levels consistent with what would be expected in areas of high cell network coverage. They amplify a weak or shadowed signal in mobile, marine and in-building applications.

When using a Wilson amplifier in conjunction with Wilson antennas, the outside antenna will collect the cell tower signal and send it through the cable to the amplifier. The signal is then amplified and broadcast from the inside antenna to the surrounding area. Cell phones and cellular data cards in that area then communicate with the improved signal. When a cell phone or cellular device transmits, the signal is received by the inside antenna, amplified by the amplifier and broadcast back to the cell tower through the outside antenna.

Installation Overview

The following steps provide a summary of the amplifier/antenna installation process. However, they are **not** a substitute for the complete installation instructions on the following pages, which you should read thoroughly. Contact Wilson's Technical Support Department with any questions at 866-294-1660.

STEP 1 Install the Outside Antenna

Mount the Yagi antenna so that it points toward the cell site and away from where the inside antenna will be located. The two antennas will need 75 feet of separation. (See illustrations on pages 5 and 7.)

STEP 2 Install the Inside Antenna

Select a location in the center of where the signal needs to be amplified. Refer to the instructions included with the inside antenna. (See illustration on page 6 to determine the inside antenna model that best meets your specific needs.)

STEP 3 Install the Amplifier

Position the amplifier in a well-ventilated location near a power outlet. Attach the outside and inside antennas to the amplifier using 9913 or equivalent coax cable (available from Wilson Electronics).

STEP 4 Power up the Amplifier

IMPORTANT! Before connecting the power supply, ensure that both the inside and outside antenna cables are connected. Also ensure that all cell phones and cellular data cards within 50 feet of the inside antenna are turned off. Plug in the supplied 6-volt power supply into the amplifier and then into a wall outlet.

STEP 5 Check the Amplifier Lights

The PWR light should be green, indicating that the amplifier has power. If all other lights are also green, the amplifier is operating properly; however, if you do not have the desired signal coverage area, refer to pages 5, 6, 9 and 10. (Note: if you are using an outdoor Yagi antenna, it must be adjusted for maximum signal.)

STEP 6 If All Lights are Green Except Light D...

This indicates the combination of outside signals is too strong. Turn the outside antenna slightly away from the cell site until all lights are green.

STEP 7 If Light A is Amber...

An amber light in the A position indicates the amplifier is working but at reduced gain due to oscillation. If you are satisfied with the signal coverage, no action is necessary. If not, increase the separation between the inside and outside antennas, then unplug the power supply and plug it back in to reset the amplifier. If you still have an amber light, repeat the procedure. (See "Troubleshooting" on page 10.)

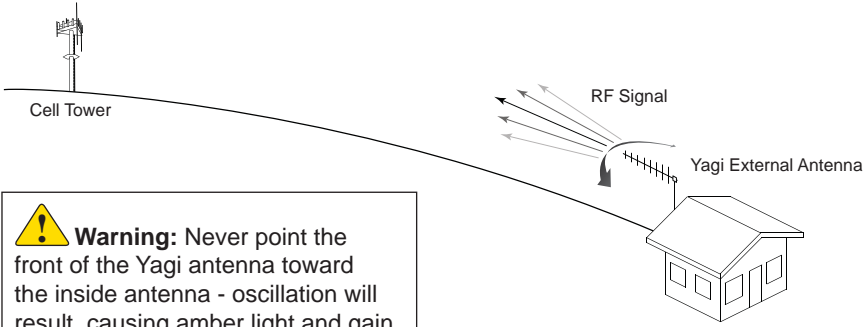
STEP 8 If Light A is Red...

A red light in the A position indicates the amplifier has shut down, due either to oscillation or to cell phone overload. (See "Troubleshooting" and "Cell Phone Overload Protection" on pages 10 and 11.)

Installing a Wilson Outside Antenna

Select a location on the roof of the building to install the outside antenna, using a cell phone in test mode to find the strongest signal from the cell tower.

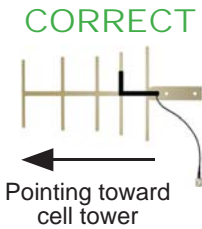
For test mode help, visit www.wilsonelectronics.com or call Technical Support at 866-294-1660.



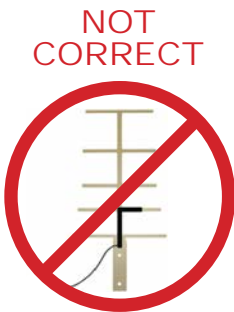
Warning: Never point the front of the Yagi antenna toward the inside antenna - oscillation will result, causing amber light and gain reduction.

Follow the specific antenna installation instructions included with the outside antenna.

Lightning protection is recommended for all in-building installations. Take extreme care to ensure neither you nor the antenna come in contact with any electrical power lines.



A Yagi antenna must be installed horizontally with the elements vertical and the drip hole on the bottom. Ensure there are three feet of clearance in all directions surrounding the antenna.



Warning: The outside antenna must be installed on an outdoor permanent structure with a separation of at least 14 inches from all persons during normal operation.

Installing a Wilson Inside Antenna

Select a suitable location for the inside antenna, preferably in the center of where the signal needs to be amplified. To determine signal strength and coverage distance, refer to page 11 of this installation guide.

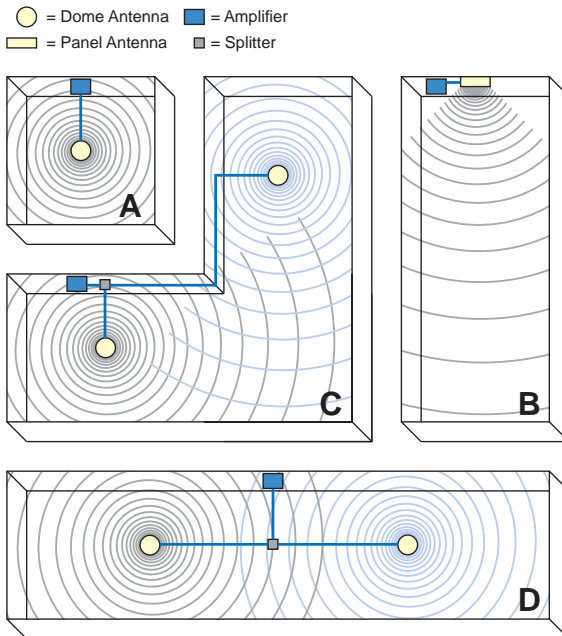
Follow the specific antenna installation instructions included with the inside antenna.

Wilson has several inside antenna options. The dome and panel antennas are the most popular for in-building applications.

For a square room, a dome antenna will provide better coverage. (A)

For a rectangular room, a panel antenna will provide better coverage. (B)

In some cases, multiple inside antennas may be required (C & D). A signal may be "split" by using a splitter. If using more than one inside antenna, a separation of at least 20 feet is necessary between inside antennas.



Connect the coax cable from the amplifier to the inside antenna. For distances of 20 feet or more, use 9913 coax cable or equivalent to prevent significant signal loss.



Warning: An inside antenna must have a separation distance from all persons that is at least 8 inches from either the dome antenna, panel antenna or other antenna with gain not to exceed 7 dBi.

Installing a Wilson Amplifier

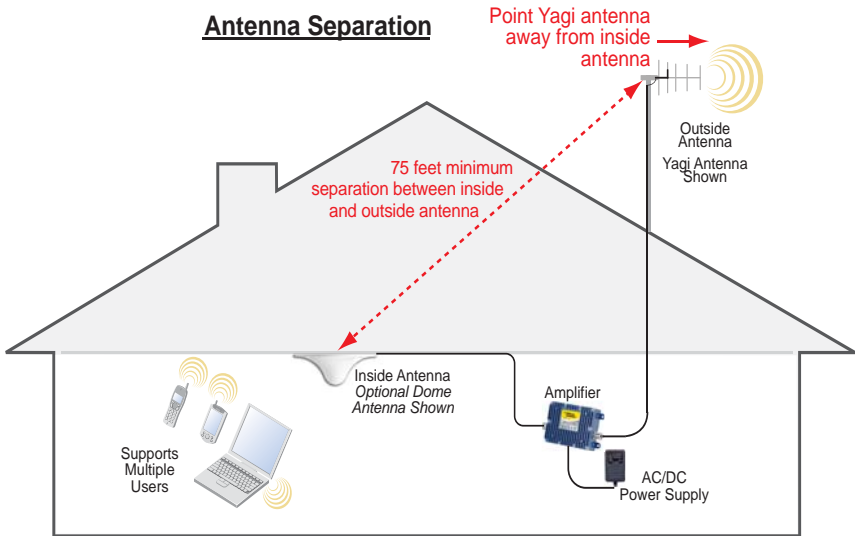
Select a location to install the amplifier that is away from excessive heat, direct sunlight, moisture and that has proper ventilation. Do not place the amplifier in an air-tight enclosure.

Recommended installation locations for in-building amplifiers are:

- On a wall
- On the ceiling
- Near a power outlet

Run the outside antenna cable to the amplifier and attach it to the N-Female connector labeled “outside antenna” on the amplifier. Run the inside antenna cable to the amplifier and attach it to the N-Female connector labeled “inside antenna” on the amplifier.

Note: Be careful when plugging the connector in so as not to damage the center pins on the connectors.



Connect the outside antenna to the amplifier with 9913 or equivalent coax cable (available from Wilson Electronics). Place the inside antenna in the center of the area needing the amplified signal. It is important to have at least 75 feet of separation between the inside and outside antennas.



Warning: Connecting the amplifier directly to the cell phone with use of an adapter will damage the cell phone.

Powering up a Wilson Amplifier

1. **IMPORTANT!** Ensure that all cell phones and cellular data cards within 50 feet of the inside antenna are turned off.
2. To verify proper installation of the amplifier and antennas, make sure that the distance between the inside and outside antennas is a minimum of 75 feet.
3. If you are using an outside Yagi antenna, never point the front of the Yagi toward the inside antenna.
4. Ensure that both the outside antenna coax cable and the inside antenna coax cable are connected to the amplifier before powering up the amplifier.
5. Plug the 6-volt power supply into the amplifier input marked "power" (carefully, to avoid damaging the center pin) and then into a wall outlet.



Warning: Use only the power supply provided in this package. Use of a non-Wilson product may damage your equipment.



Warning: Verify that both the outside antenna and the inside antenna are connected to the amplifier before powering up the amplifier.

NOTE: The aluminum casing of a Wilson amplifier will adjust very quickly to the ambient temperature of its environment. For example, in the summer, when the attic of a house can easily exceed 100 degrees Fahrenheit, the amplifier temperature may be 10 or more degrees higher. The casing will be hot to the touch. Such high temperatures will not damage the amplifier, nor do they pose a fire risk. As recommended in these instructions, install the amplifier in a location with adequate ventilation. Keep the area free of items that could block air flow to the amplifier.

Understanding the Amplifier Lights

The amplifier is equipped with sensitive electronics designed to detect amplifier oscillation or cell phone overload, both of which can hamper amplifier performance. The amplifier is designed to automatically reduce gain or, if necessary, shut down to prevent or compensate for these conditions. Oscillation or overload can be caused by improper equipment installation -- understanding the amplifier lights will help you identify and solve potential problems.



The power light will turn green when the amplifier is initially powered on.



When all lights are green, the amplifier is working at proper gain level (peak performance).



If lights A, B and C are green but D is out, the combination of outside signals is too strong and the amplifier is powering down. To remedy this, turn the outside antenna slightly away from the cell site until all lights are green.



If light A is amber, lights B and C are green, and light D is off, the amplifier has reduced its gain by 10 dB due to oscillation. Similar to placing a microphone next to a speaker with an audio amplifier, placing the inside and outside antennas too close to each other will cause oscillation. In such a case, although the amplifier is still working at reduced gain, the antennas need more separation for optimal amplifier performance. See "Troubleshooting" on page 10.



If light A is amber, light B is green, and lights C and D are off, the amplifier has reduced its gain by 20 dB due to oscillation. As above, the amplifier is still working at reduced gain, but the inside and outside antennas need more separation for optimal performance. See "Troubleshooting" on page 10.



If light A is red, the amplifier has shut down, due either to oscillation or to cell phone overload. See "Troubleshooting" on page 10.

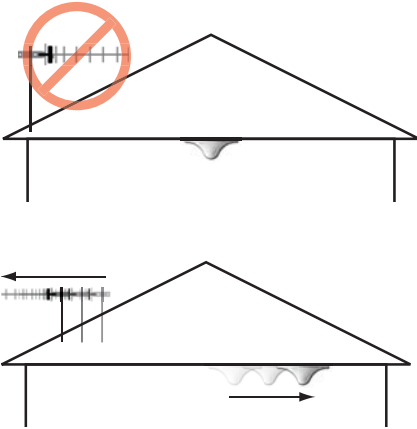
Troubleshooting



If light A is amber, this indicates the amplifier is working, but at reduced performance (gain level). Increase the separation distance between the inside and outside antennas, reset the amplifier by disconnecting and reconnecting the power supply, then check to ensure that light A is green. If it is not, repeat this procedure. (Note: an amber light could also be caused by a loose connector or bad cable.)



If light A is red, verify that the outside Yagi antenna is pointed away from the inside antenna and not across the roof of the building. If need be, redirect the Yagi antenna so that it is pointing away from the inside antenna. Then, reset the amplifier by disconnecting and reconnecting the power supply. See "Cell Phone Overload Protection" on page 11.



If light A is still red, increase the separation distance between the inside and outside antennas. Then, reset the amplifier by disconnecting and reconnecting the power supply. If light A is now green, there is sufficient antenna separation. If not, repeat this procedure.

Note: in all cases in which greater antenna separation is needed, this separation increase can be horizontal, vertical or both.



If all lights are green but you do not have the desired signal coverage area:

- You may not be using the proper antennas (see pages 5 and 6)
- The outside antenna may not be pointed toward the strongest signal
- The inside antenna may not be connected
- One or more coax cable connections may be loose
- You may have a bad connector or cable

If you are unable to achieve the desired signal coverage with any of the above troubleshooting steps, please contact Wilson Technical Support at 866-294-1660.

Cell Phone Overload Protection



If the cell phone is too close to the inside antenna when making a call, it can overload the amplifier. To prevent such overload, the amplifier is equipped with Automatic Gain Control, which reduces gain. (Gain is indicated by green lights in the B, C and D positions.) One or more of these lights may go out, indicating gain cutback. For example, if light D is out but lights B and C are green, this indicates minimum gain reduction.



Maximum gain reduction is indicated if lights B, C and D are all out.





If lights B, C and D go out and light A shows red, the amplifier has automatically shut down due to overload. Remove the power cable and plug it back in to reset the amplifier, then move the cell phone farther from the inside antenna while making a call.








If light A again shows red after moving the cell phone farther from the inside antenna and resetting the amplifier power, repeat the resetting procedure and move the cell phone farther from the inside antenna. If the red light once again activates while making a call, contact Wilson's Technical Support Department at 866-294-1660.

Warnings and Recommendations

 **Warning:** The Yagi antenna must always be located so the back or side points to the inside antenna. Never point the front of the Yagi antenna toward the inside antenna – oscillation protection will result, causing red light and amplifier shut-down.

 **Warning:** **RF Safety:** The outside antenna must be installed on an outdoor permanent structure with a separation of at least 14 inches from all persons during normal operation.

-  Warning: Connecting the amplifier directly to the cell phone with use of an adapter will damage the cell phone.
-  Warning: Connect both the outside and inside antenna cables to the amplifier before powering up the amplifier.
-  Warning: Use only the power supply provided in this package. Use of a non-Wilson product may damage your equipment.
-  Warning: **RF Safety:** An inside antenna must have a separation distance from all persons that is at least 8 inches from either the dome antenna, panel antenna or other antenna with gain not to exceed 7 dBi.
-  Warning: **NOTE:** Use of this amplifier with an inside antenna gain higher than 7 dBi is in violation of FCC regulations. All Wilson mobile and inside antennas have gains of 7 dBi or less for frequencies applicable to this amplifier. Use of this amplifier with an outside building antenna gain exceeding 13 dBi is in violation of FCC regulations. All Wilson Yagi antennas have gains of 13 dBi or less for frequencies applicable to this amplifier. Use of antennas with higher than the above maximum allowable gains is in violation of FCC regulations for which the offender is fully liable.

Finding Signal Strength and Calculating Coverage Distance

Signal strength and the corresponding coverage distance you can expect to achieve with your amplifier/antenna system are based on a combination of several factors: the received signal strength of your cell phone alone, the signal gain achieved by your amplifier and antennas, and the signal loss from cables, taps and splitters you may be using.

To calculate your approximate signal coverage distance, you can enter this information into our Coverage Area Calculator on the Technical Support page on our website (www.wilsonelectronics.com). If you prefer, you can manually calculate your approximate signal coverage distance using the instructions on this and the following two pages.

First, measure the Outside Signal Level (OSL) at the intended outside antenna location using a cell phone in test mode. (For assistance, visit the Phone Test Modes section on the Technical Support page on our website or call 866-294-1660.) The OSL will always be a negative number. (Even if the cell phone shows a positive number, you will need to change it to a negative for this calculation.) Maximum signal strength is usually about -50. When the signal weakens to about -100 or worse, the call may be dropped.

Depending on the model, your amplifier gain (AG) will be 50 or 60 dB (see the label on your amplifier). Your inside and outside antennas will also add signal gain, again depending on the antenna models you are using (see the table on page 13).

You will also experience some signal loss from cables, splitters and taps used to connect your system (see the table on page 13).

Factor Conversions

Using the table below, find and circle the appropriate decibel (dB) numbers that correspond to the equipment in your particular system. Be sure to choose your numbers from the appropriate frequency column, based on the service you receive (iDEN, Cellular or PCS).

	Frequency		
	iDEN 851 / 901	Cellular 869	PCS 1930
Antenna Factor (AF)			
Low Profile (inside)	+3 dB	+3 dB	+3 dB
Dual-Band Panel (inside)	+7 dB	+7 dB	+7 dB
Dual-Band Dome (inside)	+2 dB	+2 dB	+2 dB
Dual-Polarity Dome (inside)	+5 dB	+5 dB	+5 dB
Yagi 806-939 MHz Cellular (outside)	+13 dB	+13 dB	+13 dB
Yagi 800-900 MHz Cellular (outside)	+10 dB	+10 dB	+10 dB
Yagi 880-965 MHz (outside)	+10 dB	+10 dB	+10 dB
Yagi 1800-1900 MHz PCS (outside)	+13 dB	+13 dB	+13 dB
Cable Factor (CF)			
20' RG 58	-4 dB	-4 dB	-7 dB
20' 9913	-3 dB	-3 dB	-4 dB
30' 9913	-3 dB	-3 dB	-5 dB
50' 9913	-4 dB	-4 dB	-7 dB
100' 9913	-7 dB	-7 dB	-10 dB
Splitter Factor (SF)			
	-3 dB	-3 dB	-3 dB
Tap Factor (TF) (depends on model - refer to tap label)			
	-6/-10 dB	-6/-10 dB	-6/-10 dB

Use the following formula to calculate your Signal Strength (S). Write in your numbers as appropriate. Be sure to account for the length of **all** cable, inside and out. Add up the numbers for **all** taps and/or splitters (if you are not using any, enter 0). Remember, AG and AF will be positive numbers; OSL, CF, TF, SF and S will be negative.

$$\text{OSL} + \text{AG} + \text{AF} + \text{CF} + \text{SF} + \text{TF} = \text{S}$$

Once you have calculated your signal strength, use the graph on the following page to determine approximate coverage distance. See below for a sample calculation.

Sample Signal Strength and Coverage Calculation

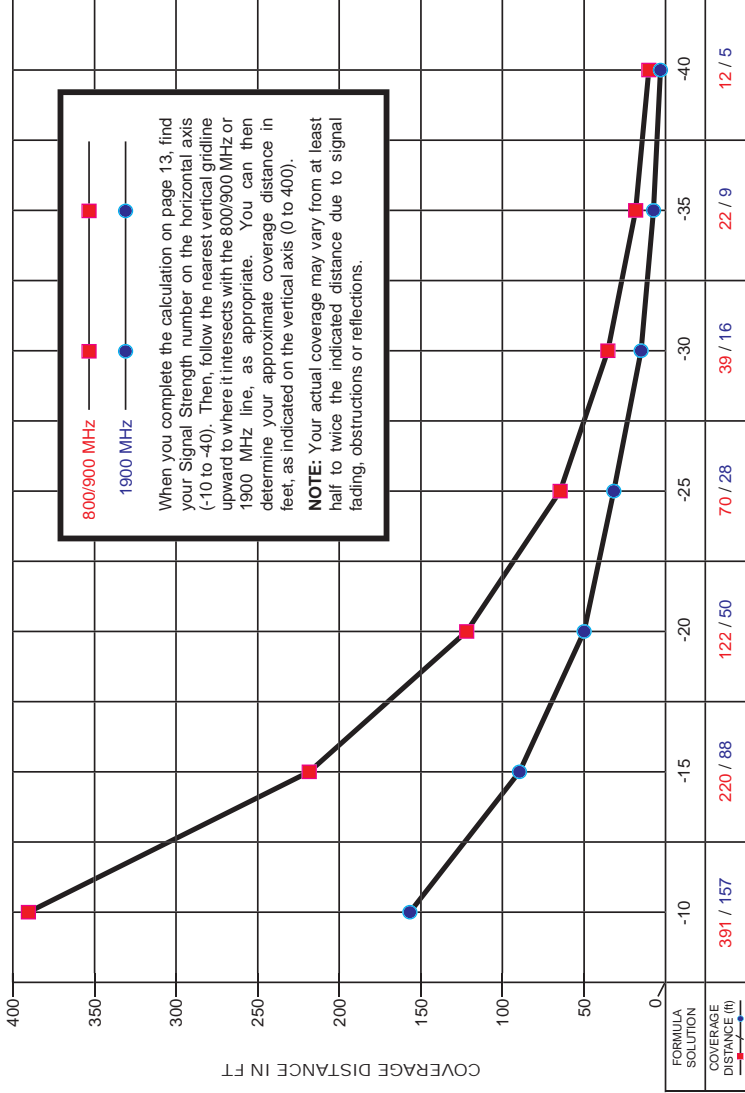
This example assumes an OSL of -90, use of a 60 dB cellular amplifier, an 806-939 MHz Yagi antenna and a low profile inside antenna with 100 total feet of inside and outside 9913 cable with no splitters or taps.

- OSL -90 (always a negative number) found on cell phone in test mode
- AG +60 gain
- AF +16 dB gain (+13 dB for the Yagi antenna and +3 dB for the low-profile antenna)
- CF -7 dB loss
- SF 0 (none used)
- TF 0 (none used)

$$\text{Formula: } -90 + 60 + 16 + -7 + 0 + 0 = -21$$

With a signal strength of -21, coverage distance would be approximately 120 feet from the inside antenna.

INSIDE BUILDING COVERAGE DISTANCE



SIGNAL STRENGTH

Amplifier Specifications

Model Number	274106	
Connectors	N-Female 50 ohms	
Impedance (input/output)	50 Ohms	
Dimensions	4.5 x 3.5 x 1.25 inch (11.4 x 8.9 x 3.2 cm)	
Weight	1.5 lbs (0.7 kg)	
Frequency	896-940 MHz	
¹Passband Gain (nominal)	70 dB Maximum	
²20 dB Bandwidth (nominal)	Uplink/Downlink	45 MHz / 46 MHz Maximum
Power output for single cell phone (uplink)		
	iDEN	+20.9 dBm
³Power output (uplink for multiple cell phones:	Number of cell phones	⁴Maximum Power
	2	+22.1 dBm
	3	+18.6 dBm
	4	+16.1 dBm
	5	+14.1 dBm
	6	+12.6 dBm
Power output for single received channel (downlink)		
	iDEN	+19.8 dBm
³Power output for multiple received channels (downlink)		
The maximum power is reduced by the number of channels:	Number of cell phones	⁴Maximum Power
	2	+22.9 dBm
	3	+19.4 dBm
	4	+16.9 dBm
	5	+14.9 dBm
	6	+13.4 dBm
Noise Figure (typical)	3 - 4 dB	
Isolation (uplink/downlink)	>90 dB	
Power Requirements	120 V AC, 0.2 A	
FCC ID:	PWO274106SB	
IC:	4726A-274106SB	

- Notes:
1. Nominal gain is the maximum gain at any frequency in the passband.
 2. Nominal bandwidth is the difference between two frequencies that are adjacent to the passband where the amplification is 20 dB lower than the passband amplification. One of the frequencies is lower than the passband and the other is higher.
 3. The Manufacturer's rated output power of this equipment is for single carrier operation. For situations when multiple carrier signals are present, the rating would have to be reduced by 3.5 dB, especially where the output signal is re-radiated and can cause interference to adjacent band users. This power reduction is to be by means of input power or gain reduction and not by an attenuator at the output of the device.
 4. The maximum power for 2 or more simultaneous signals will be reduced by 6 dB every time the number of signals is doubled.



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