Installing a Cell phone Amplifier and External Antenna on a Born Free

The following will show how I installed a Wilson Mobile Wireless Cellular/PCS Dual-Band 800/1900MHz Amplifier (801231) in our 2005 24RB coach.

We needed to extend our talk/data range while traveling. Our current Verizon phones only have about 250mw of power and this is not enough when traveling off the main highways. In the USA the maximum transmit power for an analog cell phone is 3.6 watts and the peak power for a GSM or a CDMA (digital) handset is just 2 watts. CDMA2000 or TDMA typically uses less than 1 watt; Verizon uses CDMA!

The amplifier we chose has an output of 1.5 watts.

Specifications

Part Number	801231
Frequency	824-894 MHz / 1850-1990 MHz
Gain	40 dB / 45 dB
Max Output Power	1.5 watts
Max RF	31.7 dBm
Noise Figure	3.5 dB nominal

Flatness	± 3.5 dB / ± 4 dB
Isolation	> 90 dB
Power Requirements	6V, 0.6A - 2A (subject to uplink power)
Connectors	SMA Female
Dimensions	3.25 x 3.25 x 1 (inches) or 9.6 x 8.1 x 3.8 (cm)
Weight	4 oz or 0.11 kg

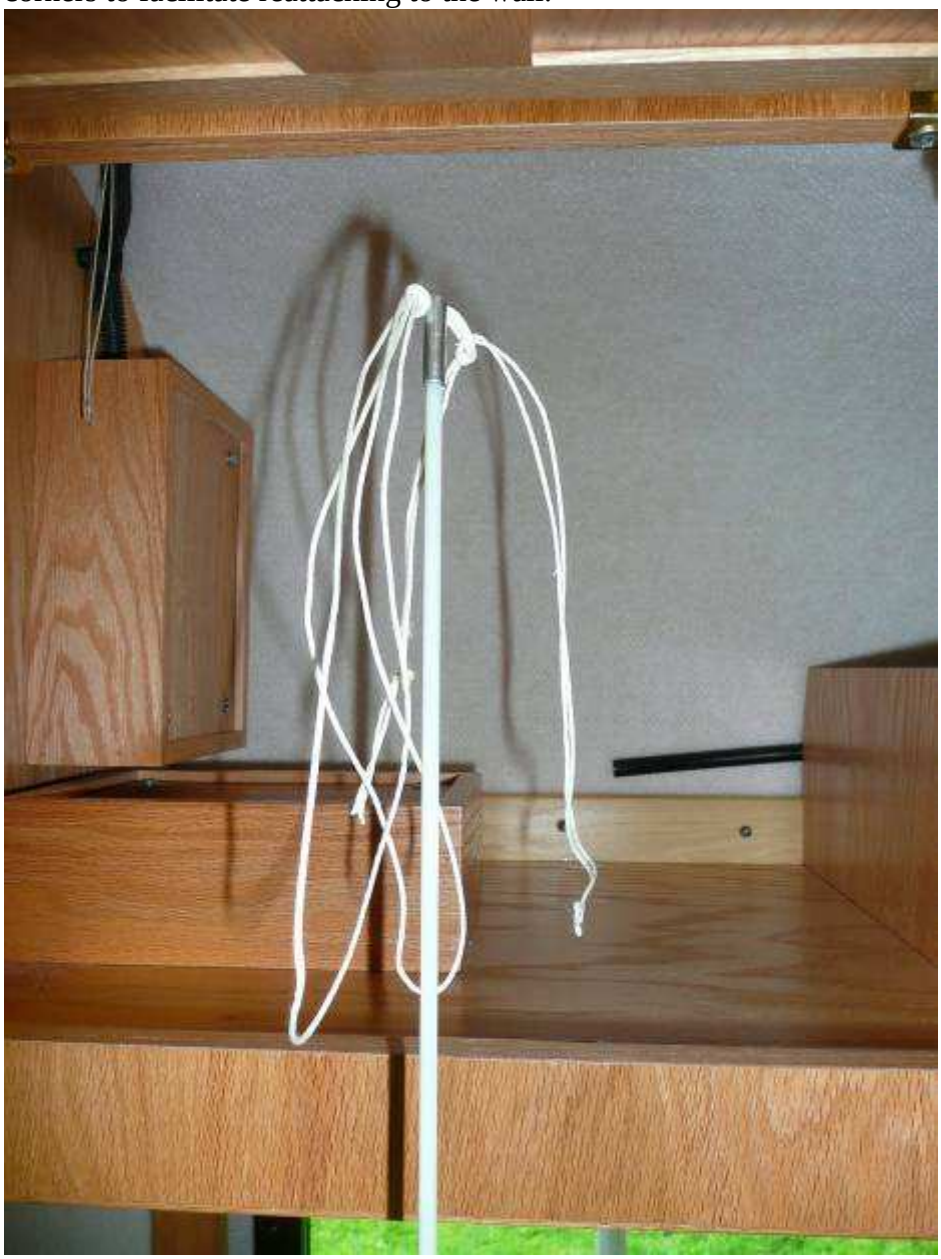
I mounted the external magnetic mount antenna on the refrigerator vent, as even cell antennas require a ground plane. I used a thin steel plate measuring 8”L x 4”W for the ground plane and added an additional steel stiffener using rivets. Wilson Electronics recommends at least a 3 ½” diameter plate if mounting on fiberglass or any non-metallic surface. I used stainless steel 10-24 x ½” screws, washers and locking nuts (nylocks) with Dicor (brand) lap sealant #501.
Note: you do not need to run an actual ground to the ground plane.
The following pictures will explain how I wired and mounted the control unit (amplifier). I used the supplied coax cables only; so as to reduce losses in additional connectors and longer cables. I won’t be going into great detail on pulling cables as I’ve done that in previous posts.
All cable runs use rubber grommets where there is penetration of plastic or metal.

Here I removed the refrigerator vent cover to run my coax.

Here are three pictures showing the ground plane plate (bottom), then a 3”x4” stiffener plate (riveted), and finally a small steel box (riveted) to mount the antenna inside. I cut a slot in the back to let water drain.

Plate attached to bottom of vent cover for added stiffness.

I needed to pull my coax for the internal antenna about 3 feet across the headliner, so I used a 6 foot fiberglass rod ¼" diameter and tied loops of waxed twine on the end in order to grab it with a piece of stiff wire on the other end. This picture also shows the oak cover over the electrical box for 110VAC that I later modified. Notice the 4 screw locations; I relocated them to the corners to facilitate reattaching to the wall.



Next, I drilled a hole underneath the storage area/entertainment center for the wiring (coax) to feed through, then up and across the ceiling. The coax was only 5 feet long so I had to minimize my cable run.

Coax pushed thru the hole I drilled; you can see the string I pulled across from the overhead passenger side cabinet.

Here is a picture of the fiberglass rod and some of the wiring for the lighting; this is the backside of the entertainment center.

I pushed the fiberglass pole thru the headliner from the forward cabinet using an existing cut in the headliner for the AC power cable.

Here I’m showing the oak cover removed. I installed the 12VDC outlet and a switch; you can clearly see the new screw holes drilled thru the corners. I re-used the top holes for the switch and an LED (to be on the left) trying to minimize the number of holes drilled. The half moon cutout is existing and is for the 110VAC cable.

This is the inside view of the oak cover. The electronics pkg. is entirely optional. I used parts on hand rather than purchasing new items. The switch is a 6A/125VAC rather than a DC rated switch, so I added the snubber network consisting of a capacitor and a resistor across the contacts (much like a condenser on a set of points on older cars). I will give details later.

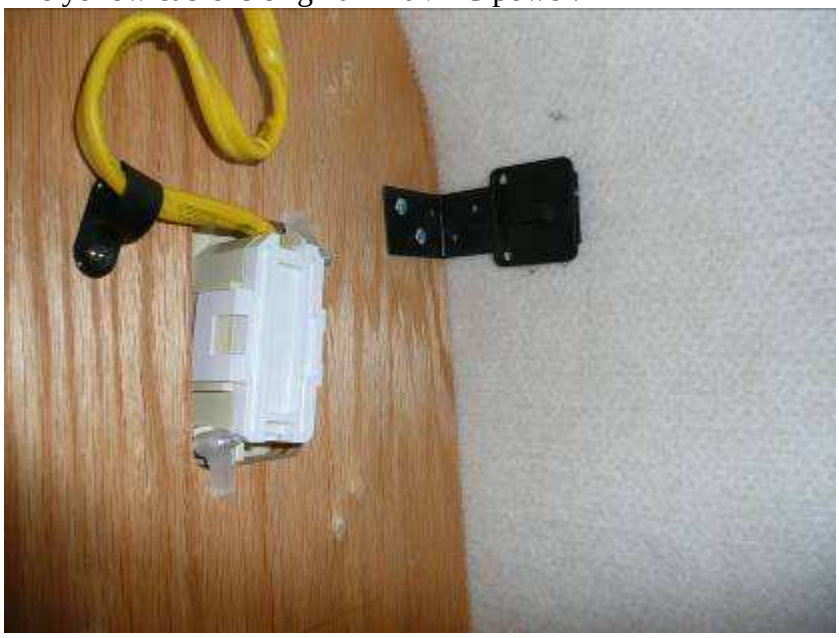
I had to fashion a mounting plate to hold the amplifier control unit to the inside of the cabinet. I bent a piece of flat steel, drilled some holes, and filed out the metal to make these slots for the plastic mounting plate supplied with the kit.

This is the plastic adapter plate that will fit to the mounting bracket above.

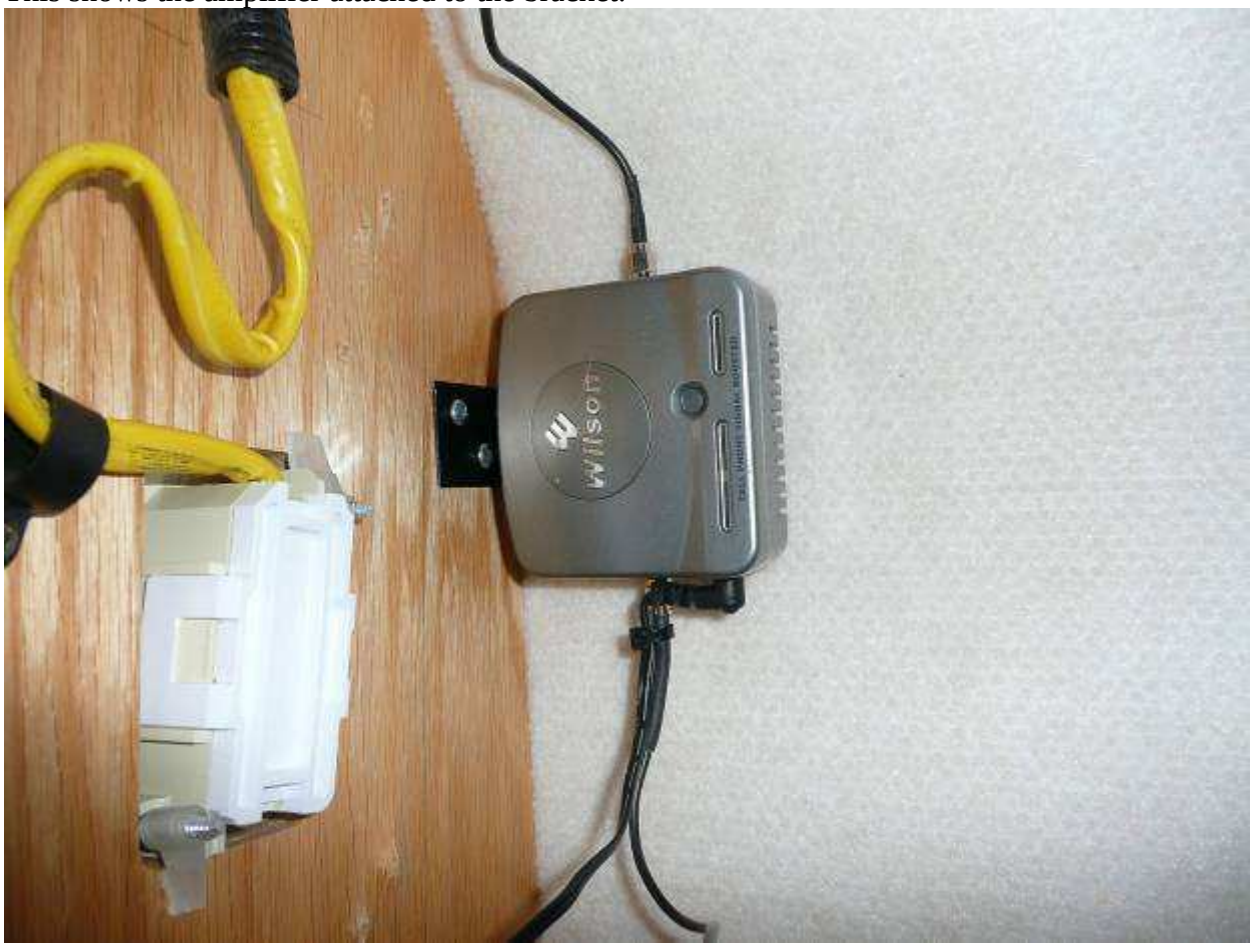
I used cotter pins to attach the plastic adapter to the steel mounting plate.

This shows how the bracket attaches to the amplifier using the slot.

Bracket for amplifier attached to wall of cabinet.
The yellow cable is original 110VAC power.



This shows the amplifier attached to the bracket.



This is how I ran the coax and power cable behind the cabinet bins using ½" PVC.
The coax runs down the refrigerator vent then thru an existing hole I drilled for another project and continues on the passenger side to this picture.

Oak cover installed, amplifier mounted, and unit powered up.

Side view as seen when cabinet door is open.

This is where I mounted the cell phone cradle; the cradle is also the internal antenna.

Magnetic mount external antenna.

This is a close up of the external antenna.

Project finished.
U shaped cable magnet is optional.

Additional Notes:
I wired the 12VDC outlet with #14 gauge wire and connected it to the original TV/12VDC outlet that is fused at 10A in the original fuse panel. The amplifier only draws 2A maximum.

I built a snubber network for the power switch and a simple surge suppressor for the amplifier. The snubber consists of a 100 ohm/1W resistor in series with a .1mfd/100VDC capacitor placed across the switch terminals. When the switch is opened, current continues to flow for a few milli-seconds thru the snubber saving the contacts on the switch. Refer to Wikipedia for more info: http://en.wikipedia.org/wiki/Snubber

The surge suppressor circuit consists of a .001mfd/4Kv capacitor, an 18VDC rated MOV (metal oxide varistor) and a 220mfd capacitor rated at 50VDC. These are wired in parallel to the 12VDC outlet. The other resistor on the board is a dropping resistor for the green power LED on the front of the oak cover. I picked a resistor (560 ohms/10%) that would give me 2VDC/20ma. to the LED.
I chose all these values as this is what I had in my "collection" of parts.
All exposed (on roof) cables are wrapped with 3M T88 type black electrical tape:
http://www.3m.com/product/information/Scotch-Super-Vinyl-Electrical-Tape-88.html
This is for UV protection.

The internal cell phone cradle has a built in antenna that has a range of approximately 18" or a bit further if the outside signal is good.
http://www.wilsonelectronics.com//ViewProduct.php?ID=131
Wilson Electronics is located in St.George, Utah 800-204-4104 (toll-free) and Made in the USA.

Coax cables: RG174 Low-Loss Coaxial Cable
Antenna Gain: 5.12 dBi 806-894MHz / 6.12 dBi 1850-1990 MHz

The small square steel box I used was actually the cover from a 30's vintage telephone jack (I didn't have the jack just the cover).

We use our cell phone with our Garmin Nuvi GPS in Bluetooth mode (hands free) or our bluetooth headsets. We use our Verizon Mobile Office Kit with our LG 8350 cell and a 10' USB cable to our laptop.

Materials:
Mobile Wireless Cellular/PCS Dual-Band 800/1900MHz Amplifier (801231)
$300.00
$3.00 for flashing from Home Depot for our refrigerator vent cover.
$2.00 for (6) 10-24 x1/2" stainless steel panhead screws, washer and nuts.
Total: $305.00

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