

HIGH PERFORMANCE BULLET2HP WIFI ANTENNA  
Revised 20 April 2013

INTRODUCTION

The basic design is taken from <http://www.mikestechblog.com> and I thank Mike for inspiring me to build this antenna. Commonly available electrical and plumbing parts make this antenna economical to build and rugged to survive. The Bullet2HP operating temperature is specified as -4F to +158F (-20C to +70C).

The Ubiquity Bullet2HP high-power wireless adapter connects directly to the antenna for absolute minimum radio-frequency (RF) losses. The "lead in" is up to 300-feet (91-meters) of CAT-5 Ethernet cable that connects directly to the computer. Power for the adapter is sent up the Ethernet cable from a Power Over Ethernet (POE) injector located indoors near the computer.

This antenna provides me a "five bar" 54-megabit (802.11g) connection to one commercial WiFi provider 1,000 feet (300 meters) distant, a "five bar" 11-megabit (802.11b) connection to a second provider one-half mile (800 meters) distant and a "four to five bar" 11-megabit (802.11b) connection to a third provider 2.4 unobstructed miles (3.8 km) distant. These are not just "signals seen" but accounts used operationally by me.



## CONSTRUCTION DETAILS

Start with a length of 4-inch (102 mm.) diameter galvanized steel dryer vent from a local plumbing shop. Cut off 13.5 inches (343 mm.) for the antenna. A metal abrasive blade in a 10-inch chop saw may be used to provide square cuts.

Some of the leftover duct can be opened up and flattened for making the end cap. Set one end of the duct down on the flat piece and draw around the duct with a marking pen to indicate the duct size. Draw another circle on the flat piece about one-inch outside the first circle. Cut along the larger circle. Then make lots of radial cuts (about 3/8" or 9 mm. apart) from the outside to the inner circle and bend up the resulting tabs to form a cap that will fit snugly over the end of the duct nearest the coax connector. Holding the cap snugly against the end of the duct, wrap black electrical tape over the tabs to hold them down. Then secure the cap with one of the 4" clamps (discussed below) over the tape.

Two 4-inch (102 mm.) duct or hose clamps are used to attach the flare at the front end and the cap at the rear end, and to help keep the duct round. One 3-inch (76 mm.) single-hole electrical conduit hanger (Minerallac #7) is used to secure the duct. It was put in a vise to spread out the base so it will reach around most of the 4-inch duct. A 2 1/2-inch (64 mm.) long 1/4-20 bolt and nylon stopnut secure the hanger to the duct. Two 1-inch (25 mm.) single-hole conduit hangers (Minerallac #2B) are used to attach the antenna to the pole, a 10-foot length of 1-inch EMT or PVC pipe. All three conduit hangers are attached to a 1-inch by 5-inch (25 mm. by 125 mm.) framer's tie plate (Simpson TP15) which has a quarter-inch (6 mm.) of the long edges bent up to form a channel or cradle to keep the 3-inch hanger from rotating. The hangers are attached to the tie plate using two 1/2" long (12 mm.) 1/4"-20 bolts and nylon stopnuts. This mounting design puts the entire antenna to one side of the pole so the antenna may be mounted anywhere along an existing pole as well as at the top.

A 4" to 6" (102 to 152 mm.) long tapered flare adapter (a heating duct part by Wellmade) is used for the front extension but this may be left off if it is too hard to find. A round piece of polyethylene is fitted into the groove of the flare to discourage birds from nesting in the antenna. It happened to me!

The dipole radiator inside the duct is made from a Type-N female bulkhead connector and 1.25" (32 mm.) of #14 solid copper wire soldered to the center pin of the N-connector. The N-connector is a single-hole bulkhead connector that inserts from the outside of the duct and secures with a 19 mm. (wrench size) nut on the inside of the duct. As needed, use some 1/2" washers over the N-connector on the outside of the duct to ensure the connector only protrudes inside the duct just enough to secure its mounting nut. The dipole radiator is located 1.75" (44 mm.) from the rear wall of the duct and stands 1.25" (32 mm.) high from the inside wall of the duct.

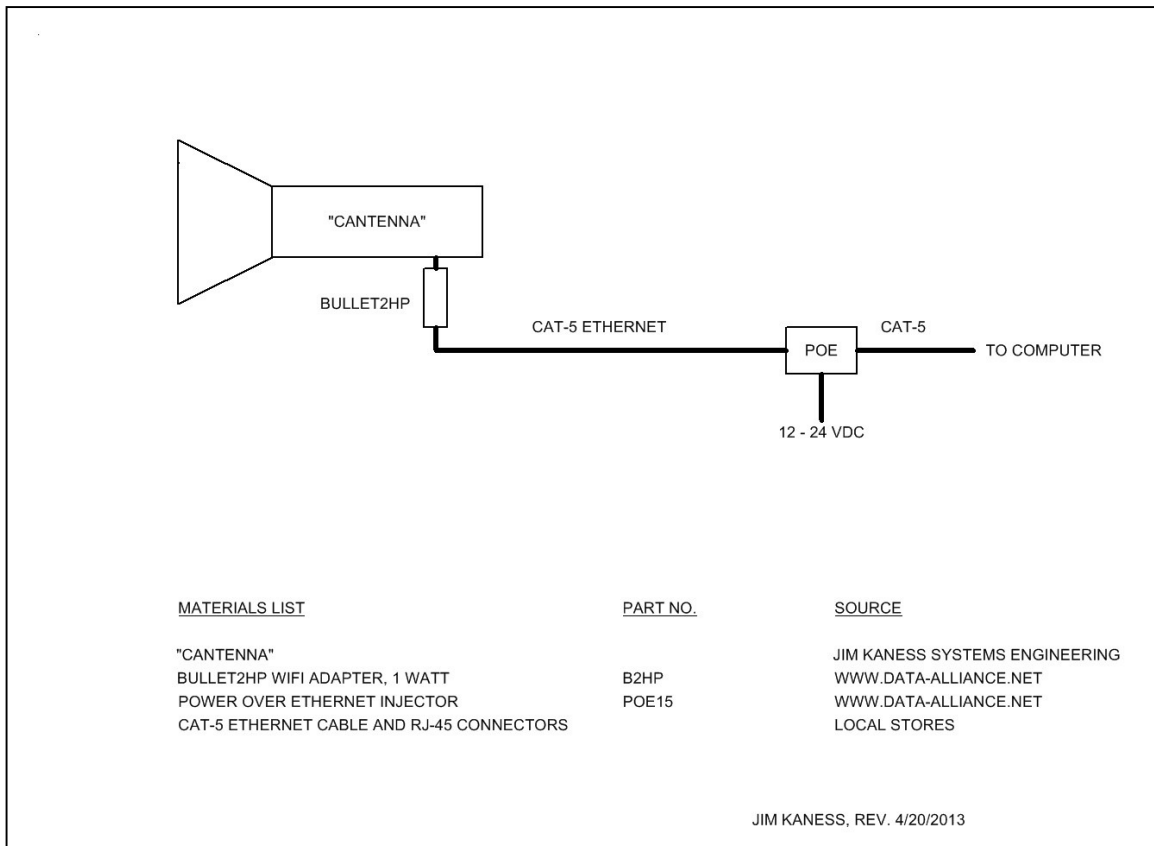
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### ELECTRONICS CONNECTIONS

The Bullet2HP male N-connector screws directly onto the antenna female N-connector. The Ethernet and RF connections at the Bullet are flooded with silicone grease before connecting to waterproof them. Indoors the POE injector provides the necessary POSITIVE 15 volts DC onto the Ethernet pins 4 & 5 (blue and blue-white) and NEGATIVE volts DC onto the Ethernet pins 7 & 8 (brown-white and brown) going toward the antenna.

### DRAWINGS AND DIMENSIONS

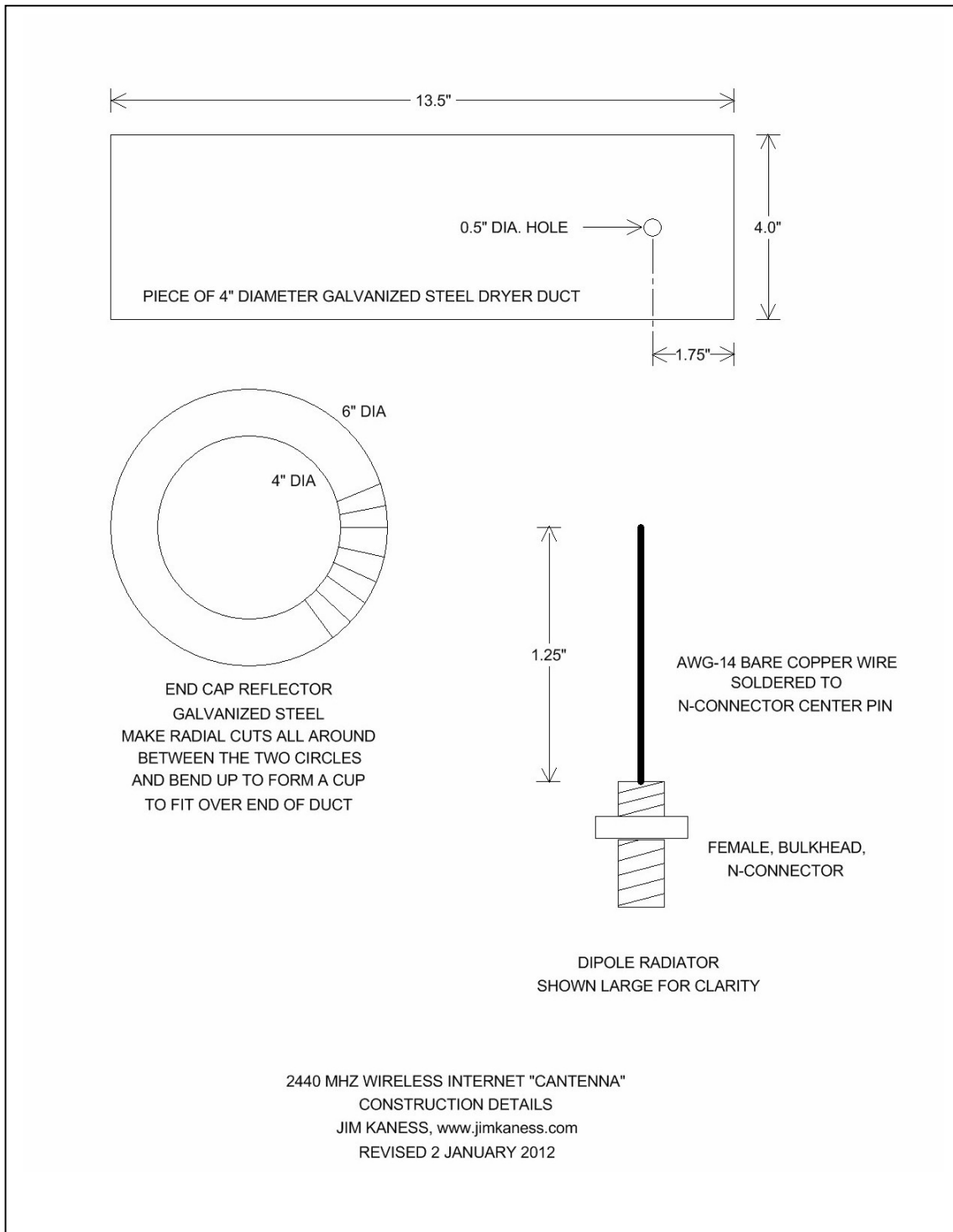


The finished antenna measures about 19 inches (483 mm.) long, 8 inches (203 mm.) high, and 8 inches (203 mm.) wide, and weighs about 3 pounds (1.4 kg.) without the Ethernet cable.

The Bullet2HP operating temperature is specified as -4F to +158F (-20C to +70C).

The gain of this antenna has not been measured. Experience shows that, when using your laptop built-in wifi, if you can barely see the signal you want to use, and have trouble connecting to it, using this antenna will give you 5 bars and a solid connection.

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**UBIQUITY BULLET-2-HP SETUP**  
**Revised 11 April 2013**

**INTRODUCTION**

The Bullet 2 HP comes with a default configuration of **Bridge** mode and a fixed IP of **192.168.1.20**. The default username and password are both **ubnt**.

To configure the Bullet 2 HP for use as a wifi adapter (infrastructure mode) it will be necessary to reconfigure it to **Router** mode and to obtain a **DHCP** IP automatically.

Follow these instructions patiently and carefully. If anything goes wrong with setting the Bullet 2 HP, you will get to appreciate the little **RESET** button located on the Ethernet end of the Bullet- while the Bullet is powered, depress the reset button for a few seconds with a ballpoint pen and the Bullet's configuration will revert to the factory defaults and you can start all over. It happened to me.

**SETUP AND CONFIGURATION**

The Bullet requires a DC voltage between 12 and 24 volts at up to 1 ampere for operation. This voltage is applied via "Power Over Ethernet (POE)" with positive applied to pins 4 and 5 (blue and blue-white) and negative applied to pins 7 and 8 (brown-white and brown).

1. For best results, connect some sort of antenna to the Bullet while configuring. I used a 1.25 inch of wire on the center pin.
2. Connect an Ethernet cable from the Bullet to the POE port on your POE injector. Connect a second Ethernet cable from the POE injector LAN port to your computer's LAN port.
3. Download and follow the instructions given at <http://www.svgrainne.com/SupportFiles/Bullet2012.pdf> to configure the Bullet. Make sure the **DHCP Fallback** is set to **192.168.1.20** as this is not implicitly called out in the referenced setup instructions.
4. Remember that if anything goes wrong to use the **RESET** button on the Bullet and start over!

**POE INJECTOR**

I made a POE injector cable as shown below. My power supply was from the junk box but anything from 12 to 24 VDC at 1 ampere or more will work.

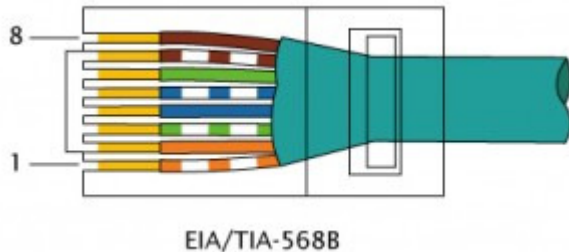
Start with a length of Ethernet cable, say between 6 and 12 feet. About a foot from one end, carefully cut and pull off the outer sheath and save it. Bend back the brown/brown-white and the blue/blue-white twisted pairs from the others. Slide the outer sheath you removed back over the remaining pairs, leaving the brown and blue twisted pairs sticking out. Terminate both ends of the Ethernet cable with RJ-45 connectors. Connect the brown/brown-white pair to NEGATIVE 12 to 24 VDC and connect the blue/blue-white pair to POSITIVE. Mark the end with ALL 8 wires with some red tape to indicate that end has power applied. That end goes to the Bullet. The other end, with only 4 wires, goes to your computer.

FROM <http://rj45pinout.net/>

## RJ45 pin out for 10BASE-T

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10BASE-T and 100BASE-TX only 4 wires are in use (2 pairs, orange and green pair), remaining 4 are free to use for any other purpose like PoE or telephone etc. For straight through LAN cable both ends are same, for crossover cable see [Crossover Cable section](#).



CONNECTOR SHOWN DIMPLE SIDE or PIN SIDE

POE SHOWN FOR BULLET 2 HP

Pin No.	Name	Description
Pin 1 Orange-White	TX_D1+	Transmit +
Pin 2 Orange	TX_D1-	Transmit -
Pin 3 Green-White	RX_D2+	Receive +
Pin 4 Blue	POE	POSITIVE 12 – 24 VDC
Pin 5 Blue-White	POE	POSITIVE 12 – 24 VDC
Pin 6 Green	RX_D2-	Receive -
Pin 7 Brown-White	POE	NEGATIVE 12 – 24 VDC
Pin 8 Brown	POE	NEGATIVE 12 – 24 VDC