The 2 Meter 146mhz Slim Jim Antenna Using Aluminum Tubing!

By N4UJW Hamuniverse.com

http://www.hamuniverse.com/slimjimaluminum.html

Further Experimentation With The 2 Meter (146mhz) Slim Jim Antenna Using Aluminum Tubing!
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Well, here I go again! Not wanting to be out done by myself and after having the temporary J Pole To Slim Jim Conversion project lay down on the ground due to some high winds we had, I decided to get with it on this 81 degree day in January, 2006 (yes, 81 degrees in Texas in January! Won't last long!)... and rebuild the old Slim Jim antenna conversion with aluminum tubing using half inch diameter "junk" tubing that I found hiding from me.

THE PARTS LIST

The following instructions may help you if you decide to try the Slim Jim antenna with aluminum tubing. Refer to the Slim Jim Antenna Project for more details if needed.
I used half inch OD "junk" aluminum tubing cut to these final lengths:
NOTE: THE TOTAL LENGTH FROM TOP TO BOTTOM IS 57 1/2 INCHES.
You should end up with with a very, very elongated rectangle with a space (air gap) between the shortest section and the one above it of about 1 inch.

Cut tubing as follows:
one section 57 1/2 inches
one section 37 1/4 inches
one section 19 1/4 inches (actually a bit shorter than this) 19.2 inches was used in the original Slim Jim antenna project on the site using copper tubing from the formulas on that page, but I rounded as close as possible.

2 sections of aluminum stock around 1/8 inch thick and about 1/2 inch wide by about 2 1/2 inches long used as top and bottom spacers "crossovers" to provide 2 inches between elements. I did not have a good method for bending the tubing for "one piece contruction" so I used the "crossovers" instead.

assorted screws, nuts, lock washers and bolts. No I did not use stainless steel....did not have!

one non-conductive spacer from an old piece of plastic, PVC, etc. This is used for support between short section and longest section about 5 inches down from the air gap. (See pictures below....it is a shade of green/blue in the picture)
This spacer and the bottom crossover of the Slim Jim antenna is used to mount the antenna to a 10 foot piece of PVC pipe at final installation by attaching self tapping screws thru each one....see pictures.

one section of non-conductive material between shortest section and the top half. (dark color in picture) . This came from another antenna "junk" pile. It is used only for support and an insulator, also to keep the bottom and upper sections in line.

THE CONSTRUCTION

I drilled holes suitable for the small bolts I had near both ends of the longest section (57 1/2 inches), and one end of the shortest section (19 1/4 inches) and one end of the section above the shortest section. (37 1/4 inches)
Then I attached the "2 1/2 inch "crossover" sections used as spacers and crossovers at bottom and top of Slim Jim using the bolts, lock washers and nuts.
Then I attached the air gap insulator/support between the lower and upper sections.

The construction of the Aluminum Slim Jim antenna was now finished except for mounting to the 10 foot PVC pipe, checking and adjusting swr and having some fun with it. Remember...this project was built from just scraps of this and that found laying around my pile of "junk"....(junk is defined by the XYL...it is gold to you and I)!

FINAL ADJUSTMENT WITH A SURPRISE!

I attached the Slim Jim antenna to the PVC pipe using the bottom crossover section and the green/blue spacer on the shortest section with self tapping screws. You may want to use a different arrangement such as nylon ties along with the screws or put bolts all the way thru the PVC for extra support. The antenna ends up mounted against the upper most part of the PVC pipe with the pipe in the center of both vertical elements.

To attach the coax to the antenna feed points, I used standard adjustable hose clamps that would tighten down on the shield and center conductor of the rg58 coax that I used. I suggest you use stainless steel clamps....again....I did not

have any.
The center conductor is attached to the LONGEST side of the antenna under the hose clamp.
The shield is attached to the SHORTEST section under the hose clamp. DO NOT tighten so as to cruch the coax. (My feedpoint connections were just a temporary measure so I could easily slide them up and down for swr tuning.)
They can be attached after tuning with screws, nuts, bolts, etc.
I trimmed off enough of the black outer coax covering exposing the shield about one inch and the center conductor extended so they could be attached to the feedpoints.
I did not measure. Cut coax so the shield and center conductor can be attached underneath the clamps. I connected the coax center conductor first and brought the rest at a 90 degree angle over to the shortest side for it's attachment.
Tighten the clamps at around 4 1/2 inches up from the bottom of the antenna. (This measurement was derived at by my experimentation during tune up). Yours may be different.
The clamps at the feed point connections may have to be adjusted up or down for the best match, hence, the reason for the hose clamps. (The first attempt I made was with the feed at about 3 inches from the bottom.... and the antenna resonant point was way out of the 2 meter band....about 138 mhz with an swr of around 3 to 1). This told me that the Slim Jim was way too long.....after adjusting the feed point closer to the air gap at 4 1/2 inches from the bottom, I was in business!
These are the final swr readings with the antenna up in it's final position....all of 10 feet above the ground beside the house:

144mhz 1.2
145mhz 1.1 Mfj 259b read x = 0 52 ohms
146mhz 1.1 x = 0 52 ohms
147mhz 1.1 x = 0 54 ohms
148mhz 1.3

All with a 98 percent match according to the Mfj 259b
All lengths of the Slim Jim may be changed slightly either way depending on your construction for better swr. You may not get that perfect 1:1 reading.

THE SURPRISE!

After I stood back and marveled at my "new" Slim Jim, it dawned on me that the bottom of the antenna was only about 8 inches from the metal roof flashing under the shingles!
This was a NO NO according to all of the Slim Jim articles I had researched on the Web.
The "freespace" distance should be no less than about 20 inches (1/4 wave) from

ANY metal in ANY direction!
THE HORROR!
I rechecked the swr, resonant points, etc over the entire 2 meter band using the MFJ 259B, in case I had made an error, (not a mistake), but the numbers were the same as before.
Now my curiosity came out showing it's ugly face, so I managed to get the 10 foot piece of PVC pipe up higher so the bottom of the antenna was at least 36 inches from ANY metal.....
Re-checked the readings using the Mfj 259b and to my wonder.....
NO CHANGE AT ALL!
I suspect that the freespace distance of 20 inches or more quoted in previous articles and research on this antenna is used so the pattern will not distort up or down from the "8 degree" angle of radiation from the ground. I have not done further research or testing on the air to confirm this but hope to in the future. If any of you out there wish to "model" this antenna using different distances from surrounding metal....I am open to your input.
An air wound choke may be used at the base of the antenna to help prevent rf on the feedline, creating difficulty with SWR readings, and help prevent distorting the low angle pattern.. For 2 meters, the air choke coil is about 4 turns of coax at 5 inches in diameter. Some builders use it....some don't...I have not added one at this time but plan to in the future to see if there is any effect on the pattern.

One note of further information for you should you decide to build the Slim Jim. During the period of time between this version and the dismantling of the old Slim Jim, I decided to put it back up as a Slim Jim antenna....take some S meter readings of area repeaters for a reference and then re-convert the same antenna back to the old standard J Pole.....take some readings of the same repeaters and compare them.

I found that the Slim Jim could bring up several of the same repeaters that the J Pole could not! No changes were made between the two comparisons except the antennas!
This tells me that the Slim Jim antenna has something going for it.....try one and get something going for you.....HAVE FUN! EXPERIMENT, EXPERIMENT, EXPERIMENT...
73 N4UJW HAMUNIVERSE.COM

Notice the hollow insulator covering the air gap
at the top of picture.

Original Slim Jim Project

http://www.hamuniverse.com/slimjim.html

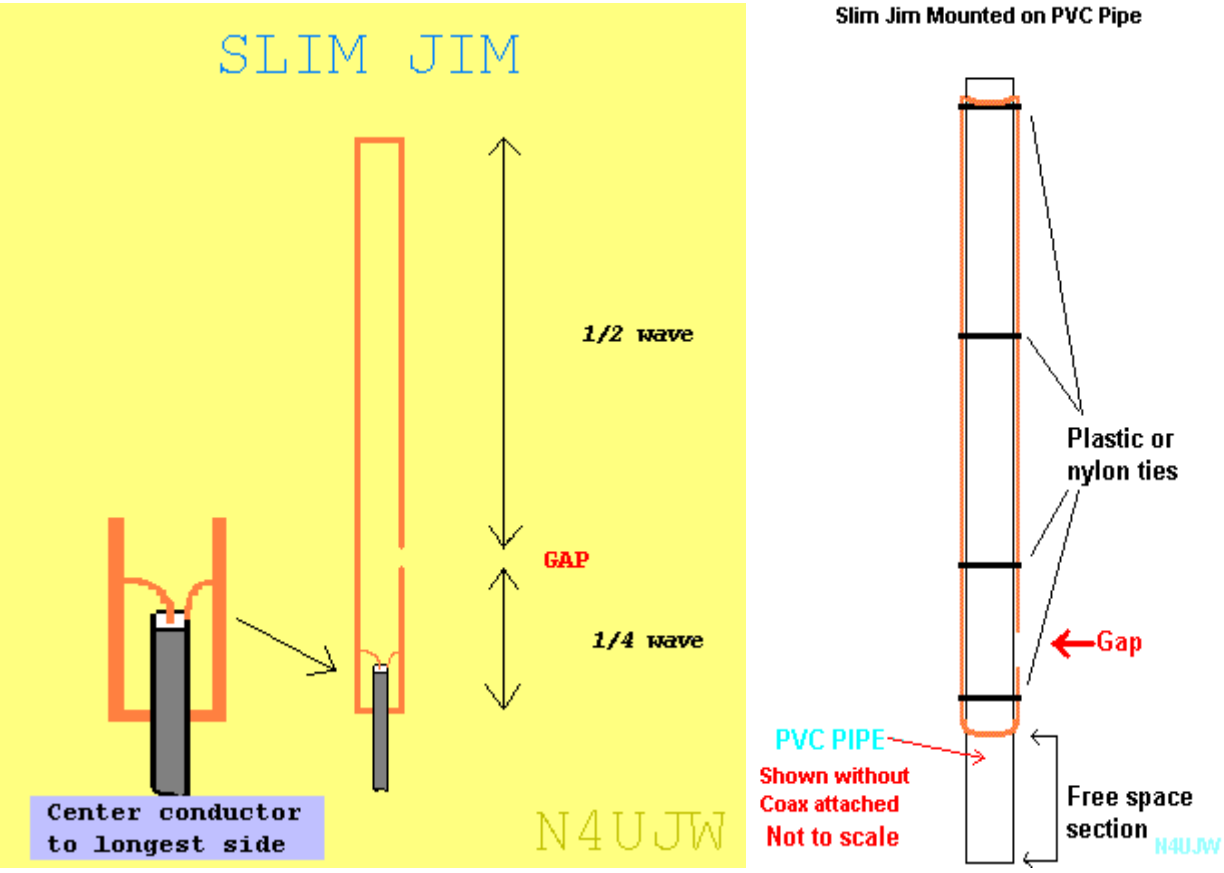
SLIM JIM ANTENNA PROJECT

Several designs rolled into one
Edited and condensed from various designs
Page updated with new information

The Slim Jim Antenna

The Slim Jim is a vertically polarized omnidirectional end-fed antenna having considerable "gain" and this is concentrated almost parallel to ground toward the horizon rather than skyward making it more efficient than a ground plane type antenna by about 50 percent better. It can be built for almost any frequency!
(Below 10 meters it gets VERY tall)
Due to it's SLIM design, there is very little wind loading.
It is fed with 50 ohm coax.

It uses a 'J ' type matching stub (J Integrated Matching = JIM), hense the name SLIM JIM. Credit for the original design goes to F.C. Judd, G2BCX. Since the vertical angle of radiation is so narrow, about 8 degrees toward the horizon, it usually out performs 5/8 wave or groundplane type construction due to their much higher angle of radiation. It is estimated that the Slim Jim appears to have about 6dB gain over a 5/8 wave antenna due to the extreme low angle of radiation.
(Most of the radiation is directed toward the horizion making the "gain" appear much greater than other vertical type antennas it has been compared to with A/B testing)
Editor's note: There are many gain figures quoted for this antenna and also various descriptions of the actual type of antenna on various websites. Some have even stated that, "In fact I found it outperformed a 1/2wave over 1/2wave over 1/2wave colinear!"
No matter what you call it, it seems to do an excellent job according to most reports. What have you got to loose?
Please let us know your results.....email us!
n4ujw AT hamuniverse.com
Using heavy duty construction would make this a good omni repeater antenna. When correctly matched for lowest swr, it has wide bandwidth.



Drawing on right shown with antenna mounted on PVC pipe

Construction details:
NOTE: NO PART OF THIS ANTENNA SHOULD BE GROUNDED!
It should be totally insulated from it's mount, mast, tower, etc with at least 1/4 wavelength of "freespace" distance. Formulas are provided below for all the measurements including the freespace distance.
The Slim Jim should be constructed from 1/2" copper pipe. Also old tv antenna elements or aluminum tubing could be used with some ingenuity and would be lighter. Experimentation with heavy guage wire supported inside PVC tubing or attached to insulated material such as wood could also be tried and would probally be successful with some ingenuity. 300 ohm twinlead versions also work great!

Using copper pipe, bends are made with soldered 90 degree copper elbows. An adjustable slip sleave made from copper can be added to the element on top above the gap for tuning purposes or possibly some sort of nut, bolt arrangement soldered into the upper end to adjust spacing if needed. (See the 2 meter SSB loop project on this site for better details and pictures of the nut, bolt arrangement.)
Depending on the frequency or band, the average length of the gap and

spacing between the elements is 3" at 72MHz and 1" at 220MHz. (See updates below) For 2 meter work this would be around 1 1/2 to 2 inches. Some experimenters report about 1 inch or less works well. Experiment with the adjustment for best results. The recommended mount is the use of PVC pipe and PVC pipe "T's."

Testing and tuneup:
Support the antenna as high as possible from the ground and other nearby objects especially metal, and fit the coaxial cable to the antenna with some crocodile (alligator) clips. It is suggested that the center conductor be attached to the longest element, shield to the shortest. See diagram above. Attach about 2 to 4 inches up from the bottom and check the VSWR at the design frequency.
USE LOW POWER!
Adjust the clips up or down to get the best match, mark where they are to be finally installed, remove the clips, and solder the coax directly or use clamps, screws, etc. Waterproof or seal all connections and the end of the coax. Use the copper sleeve or nut bolt arrangement, if added, for any necessary tuning.

FORMULAS
(For results in inches)

NOTE: Air gap and element spacing may have to be determined by some experimentation for various frequencies.
See new info about gap spacing below.

(Divide results by 12 for feet)
3/4 wave (longest section = 8415 / fMHz = inches
1/2 wave section = 5610 / fMHz = inches
1/4 wave section = 2805 / fMHz = inches
*** 1/4 wave freespace = 2953 / fMHz = inches**
*** This is the distance that antenna should be from mounting boom, mast or tower.**
Note: These formulas are believed to be accurate.
Some trimming or tweaking of lengths may be needed with YOUR construction!

Slim Jim Metric Formulas:
(For results in meters)
Updated June, 2006
(For results in Centimeters, multiply results by 100)

213.74 / fmhz = 3/4 wave overall length
142.496 / fmhz = 1/2 wave length
71.248 / fmhz = 1/4 wave length
Feed point = About 10 to 20% of 1/4 wavelength (+ - tuning)
75 / fmhz = 1/4 wave "freespace" in Meters
Note: These formulas are believed to be accurate. Some trimming or tweaking of lengths may be needed with YOUR construction!

Some Examples
2 Meters 146.00mhz
3/4 wave section 8415 divided by 146 = 57.63 inches
1/2 wave section 5610 divided by 146.00 = 38.42 inches
1/4 wave section 2805 divided by 146.00 = 19.21 inches
1/4 wave freespace 2953 divided by 146.00 = 20.22 inches
Feed point about 10 to 20% of 1/4 wave = 1.9 to 3.84 inches (+ - tuning)
The gap would be a guestimate at about 1 1/2 to 2 inches (+ - tuning)
Remember, the 1/4 wave freespace is the distance from the mount as a minumum.

6 Meters 50.150mhz
8415 / 50.150mhz = 167.79 inches
5610 / 50.150mhz = 111.8 inches
2805 / 50.150 = 55.93 inches
Gap spacing 10 to 20% of 1/4 wave = 8 inches (15%)
Freespace mounting distance 58.8 inches

10 Meters 28.400mhz
8415 / 28.4mhz = 296.30 inches (24.69 feet)
5610 / 28.4 = 197.5 inches (16.45 feet)
2805 / 28.4 = 98.76 inches (8.23 feet)
Freespace mounting distance 103.97 inches (8.66 feet)

17 Meters!
A 52 foot vertical including minimun distance from ground!
Hay don't laugh! It might be worth a try for about 6 db more!
Please send us your input if you have suggestions for any band using this antenna!
The lengths will have to be adjusted slightly for the addition of the top and bottom connection points.

See Construction and Testing tips below.

CONSTRUCTION and TESTING TIPS

CONSTRUCTION:

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The Slim Jim should be constructed from 1/2" copper pipe OR near this size of any conductive material but this is not an absolute! The bends are made with soldered 90 degree copper elbows if your using copper tubing. A slip sleave or other arrangement can be added to the upper or lower part of the gap made from copper, brass or aluminum for adjustment of the gap measurement for swr tuning, although the average length of the gap and spacing between the elements is 3" at 72MHz and 1" at 220MHz. Some experimentation may be needed for gap distance.

For 2 meters, this would be about 1 1/2 to 2 inches. Here again, this measurement is not extremly critical and the gap, element spacing and element length all interact.
The total distance from the top of the gap around the entire length and back to the bottom of the gap should equal about 1.5 wavelengths or in the case of the 2 meter example above about 115.26 inches.
No part of the antenna should be grounded to the tower or mast. The recommended mount is the use of PVC pipe and PVC pipe "T's."
Make sure the space between the tower or mast and the antenna is one "freespace" 1/4 wavelength.

TESTING:

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Stand upright (on a railing or non-conductive object, clear of metal surfaces,
drain pipes, etc.) and fit the coaxial cable to the antenna with some crocodile (alligator) clips. Attach about 2 to 4 inches up from the bottom (at 2 meters). It is suggested that the center conductor be attached to the longest element, shield to the shortest and using just enough power to get an swr reading, check the VSWR. Adjust the clips up or down to get the best match, mark where they are attached, remove the clips, and solder the coax directly. Seal connections and end of coax!
Use the copper sleeve, or other spacing adjustment if added, for any necessary tuning. You may not get that perfect 1:1! The air gap, total length and element spacing all interact.

RECENT INPUT FROM SOME BUILDERS:

12 - 03 - 06
Dear Om

Recently I returned back to this City of Visakhapatanm, AP,INDIA.

I was looking for a simple omni-directional antenna. Then happend to see ur slimjim design and tech details.

Immediately brewed one as follows:

Freq: 145 Mhz (being our center freq. in VHF)

PVC Pipe support: 32 MM Dia.

Ant. Eliment : 15 SWG Copper Enamilled.

Gaps and spacings used : 152, 98.3 , 49.2 CM

Gaps: 1.1/2" Feed Point: 2" Gr . Clearance: 50 CM.

Performance: Excellent (The stations which were very feeble , with GP now are very strong , and even 0.5 W is enough for me .
(we have no repeater)

I have No SWR meter, and simply depended on your design.

So many thanks to u for the support to ham community.

The following hams (brewed along with me) conveyed their thanks to u VU2DFB, VU3KVF, VU2NDJ .

73es

(RAMU)

VU2RMU.

03.12.06