SLIM JIM ANTENNA PROJECT

Several designs rolled into one

Edited and condensed from various designs

Page updated with new information and videos

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.

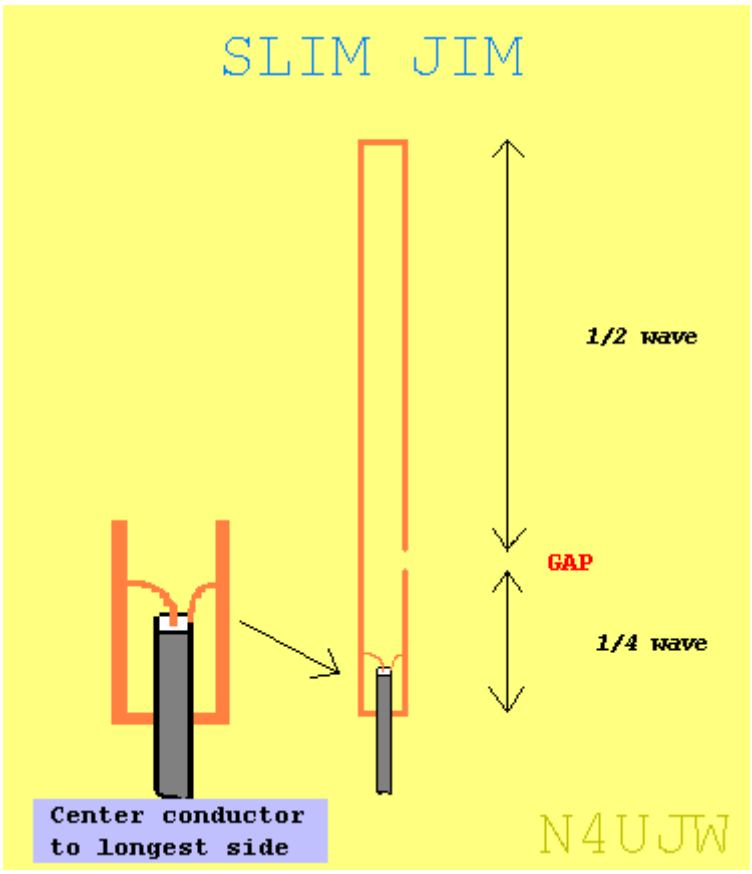
Some have even stated that, "In fact I found it outperformed a 1/2wave over 1/2wave over 1/2wave colinear!"

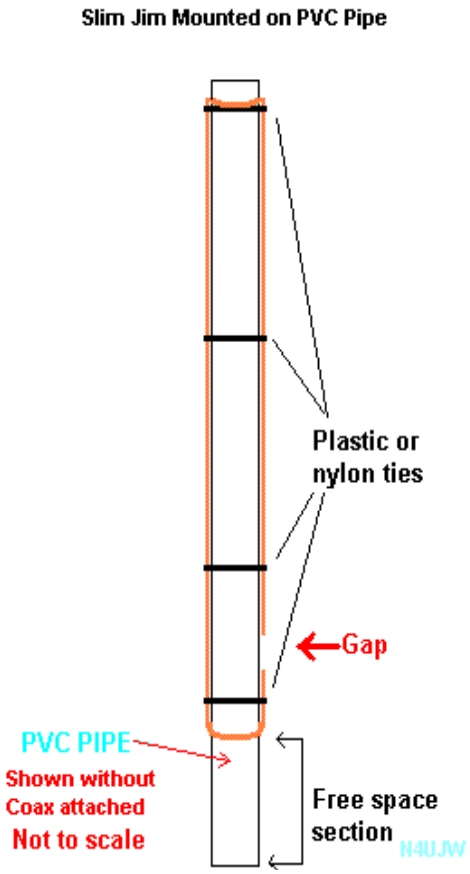
No matter what you call it, it seems to do an excellent job according to most reports. What have you got to loose?

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.

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

Updates by F4DYT, Dimitri of France
(EDITORS COMMENTS IN RED TYPE----HIS COMMENTS IN BLACK)

Just to report that yesterday I built the Slim Jim for 2m using the instructions I found in your site. Without any changes to your design, it made an increase of 4 S points (measured in my FT-857D screen) the reception of a repeater 60 km away.

4 S points in an FT-857D is to be taken with caution. It only shows a *qualitative* increase in reception. I am afraid, S points in my transceiver cannot be related to quantitative measures. (Note: Normal calibrated S meters yield about 6db per S unit.....there is NO way this antenna has 24db gain. Dimitri compared the Slim Jim to a 1/4 wave ground plane.) (See below for more).
It does seem to be a very good antenna for 2 meters or any other band where the physical size would not be a mounting problem.

I agree!

What were you using before the Slim Jim to compare it to and how high was the old antenna and how high is the new Slim Jim?

I used a home-built 1/4 lambda ground plane, built using the ARRL Antenna Handbook instructions. Photos can be seen in http://f4dyt.free.fr

Height is of relative value, since the Ground Plane had a... ground. And Slim Jim is very insensitive to height. Both antennas were installed as indoor VHF antennas at the attic of my house, both at around 3 meters above ground. It was an A/B test.

I did a QRP test with 5 watts using a repeater 24 km East from home. I don't have a clear view, so some diffraction may affect results (if I am in a reinforcement zone, for example). My correspondent gave me a 57 with very little noise, and a very good signal strength for a QRP station.

I would like to report that I modeled the antenna on MMANA (I also had to convert all units into metric ones). My simulations suggest that the theoretical height would have been 1.73 m, and that at 1.47 m the antenna should NOT work. Of course, reality won ;-)

I also want to report that the firing angle is very low. For example, before; I was able to listen to airplanes going to the Charles de Gaulle airport at 121.500 MHz (AM) which are flying over our heads (we are below an aerial corridor). Now I listen to them much weaker, while the airport tower enters at S9++ (again, FT-857D measures not to be trusted at all). The MMANA simulations also suggest a maximum gain between 3 and 4 degrees, with a secondary lobe at 60 degrees. (Dimitri's MMANA simulations confirm the very low angle of radiation that this antenna is noted for. Several months testing at the N4UJW QTH using this antenna to listen to 2 meter transmissions from the station aboard the International Space Station also comfirms the extreme low angle of the pattern. It has been noted that on all passes over this QTH, the 2 meter signals were MUCH stronger at and below 8 degrees above the horizon with the signal strength decreasing as the ISS approached overhead!.....N4UJW)

73
Dimitri F4DYT
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Dimitri Aguero - daguero@free.fr
F4DYT - Locator JN18bv
Saint-Germain-en-Laye, France

These comparisons will help others evaluate the antenna.....73 N4UJW

NEW Additional gap spacing information:
These air gap spacing measurements are believed to be accurate for the frequencies mentioned.
(Some experimentation may be needed for your particular frequency)
72mhz = 7.6cm
144mhz = 3.8cm (1.49 inches)
220mhz = 2.5cm (.98 inches)
440mhz = 1.25cm (.49 inches)

***Gregory Harris <wdx9khy@sbcglobal.net>* wrote:**

August 2006

Howdy OM

I perused your webpage - I'm a condo ham and can't have any outdoor antennas. Also don't like the thought of a G.P. (with it's radials) hanging from the ceiling. Went to the local hardware emporium and got some wire and a legnth of PVC double-wall pipe, and 1 bar stool "foot" for each end. Drilled a hole at the top....used number 16 wire for the elements , held it all together with electrical tape. Put it in the corner of the "shack" (a bedroom) fired 5W from my ancient IC228H rig....and it works like a champ. Getting good reports from 5W and an indoor slim jim. It is a great apartment antenna. Take care thanks
73

Greg WB9MII

MORE SLIM JIM ANTENNA PROJECTS:

2Meter 300 Ohm Twinlead Slim Jim Version.

Convert a J Pole to a Slim Jim!

2m Copper Tubing Slim Jim by KE5FXU

6 Meter 300 Ohm Slim Jim (From VK land)

MW3RUH SLIM JIM SPACER TIPS