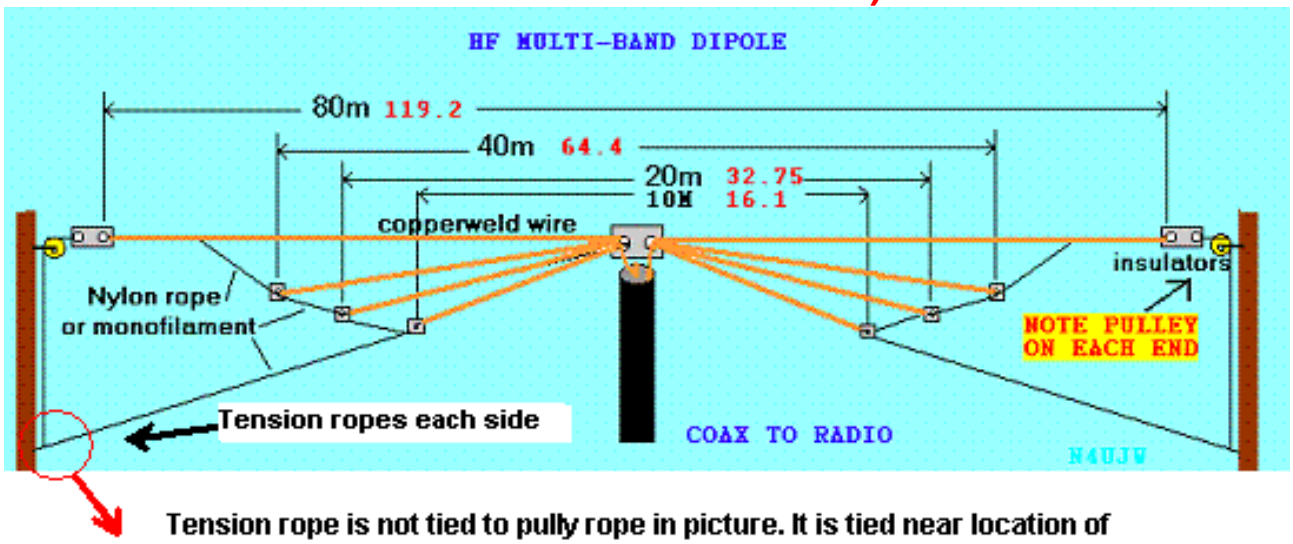
BUILD THIS MULTIBAND FAN DIPOLE FOR ALL BAND HF ANTENNA EXCITEMENT

(NEW UPDATED CONSTRUCTION TIPS FOR FASTER TUNING---SEE BELOW)



Tension rope is not tied to pully rope in picture. It is tied near location of pully rope down on supports within easy reach. It is tied last after final SWR adjustment and the antenna is in it's final position.

Suggested total lengths:
80 meters - 120 feet
40 meters - 65 to 66 feet
20 meters - 34 feet
10 meters - 17 feet
These lengths are not exact. Some tuning may be required. Use the standard formula 468 / freqmhz for total feet for each band (freq) of interest. Adjust each length longer or shorter as needed.

CONSTRUCTION UPDATES FOR EASIER TUNING WITH ADDITIONAL BUILDER FEEDBACK

Based on research done by the Stanford Research Institute (SRI) to construct a three-frequency multi-band dipole that would work without any need for cut and try techniques, we pass on this information in the hope that it will help you more easily get this type of antenna on the air quicker.

What they came up with was much improved method over the old cut and prune technique seen at the bottom of this page.

They found that the wires at the center feed point had to be separated by at least 5 1/2 inches vertically and the ends separated by 38 inches in the 2 to 18 MHz range. As in any fan dipole construction, all of the dipoles are connected in parallel but in the SRI method, the separation between them at the feed point must be maintained.

By this simple change they found that you could accurately cut the antenna element lengths for given frequencies and eliminate the need for pruning.

***In the drawing above*, the lowest frequency antenna is on top and is cut 4% short of the standard 1/2 wave length. (Length in feet= 0.96 times 468 divided by the operating frequency in MHz).**

The middle frequency antenna (lower in frequency), is cut for an exact 1/2 wave length. (length in feet= 468 divided by the frequency in MHz)

The highest frequency antenna is at the bottom and cut for 1% longer than the 1/2 wavelength (length in feet= 1.01 times 468 divided by the frequency in MHz)

Compared to the construction effort of a standard multi-band dipole the only difference is the fabrication of a feed block or center insulator that is about 12 inches vertically by 3 inches wide, so make sure this is made

of a good insulating material such as Lucite, Bakelite, fiberglass, or PVC.

The end 38 inches of separation can be maintained by separate halyards on each element or a spreader bar with a common halyard.
The bandwidth will be at least plus or minus 2% for a 1.5 to 1 SWR according to Stanford Research Institute.

Editors note: It is assumed that this method will only work as described if you are working with a "3 band" multiband dipole. We do not have information for use with over 3 bands using the SRI method.
If you arrive at a better method, let us know! See feedback below.
You can chose whichever method of constructing the multiband dipole using either the method above or use the old cut and try method below.....your choice.
We would appreciate any feedback if you use the newer method ABOVE!

Email n4ujw at hamuniverse.com with your comments to be added to feedback.

Feedback!

See how others have built the multiband fan dipole using the new easy SRI technique:

From N9FIY - Marty: 07-24-2013 (pictures in photos above and description - left shows center support and "Ugly Balun" near bottom of PVC tubing. Picture on right shows finished installation. Note spreader bars hanging down to keep dipoles separated.

I used the materials described below along with how I built it as follows:

4" PVC tubing (smallest size I could get my hand in) 24" long with caps for both ends, for the center support and insulator.

Two pieces 16 ga copper 1/2 wide 13" long, (used on inside of PVC tubing center support/insulator)
7 small #10 eyebolts,
2 ea 10 ft lengths of 1/2 inch pvc for the spreaders,
21 ft of rg8u mini for the "ugly balun", and a chassis mount pl259.
Top wire, for 40 meters, was 12 ga. thnn wire.
Middle wire for 20 meters and bottom wire for 10 meters was 14 ga thnn.
I drilled 3 holes in the copper strips 1/2 inches from the end and spaced them 6 inches apart.
Then starting 2 inches down on the 4 inch pvc tube I drilled 3 holes down each side 6 inches apart using the copper as a guide.

They are 180 degrees apart from each other and another hole 1/2 inche to the side of each hole to feed the wire into the pipe.
Cut top wire (the 40 meter dipole) into 2 pieces 33 ft long,
Cut second wire (the 20 meter dipole) into 2 pieces 18 ft long,
Then cut the third (for 10 meters) into 2 pieces 10 ft long.
Anchor each wire to eyebolt,
Feed eyebolt thru pvc pipe and copper strip and land wire on inside to copper strip.
On bottom wire, drill a 1/4 inch diameter hole 2 inches below bottom hole and feed coax in and land this with the bottom 10 meter, wires.
Wrap the coax for the ugly balun around the pvc pipe at the bottom end, making a tight wrap and secure with wire ties, feed coax back in.

Now mount the pl259 chasis mount connector to the bottom end cap,
Solder center conductor of coax to center pin of the pl259 and coax shield to mounting screw.
Place both end caps on using the last eyebolt in top cap.
Use sheetmetal screws to hold on end caps,
Seal off all holes and end caps with silicone.
Top wire is finished to 62' 10" using dogbones (4%short) for 40 meters,
Second wire is 33' 3/16" (exact length) for 20 meters also using dogbones,

Third wire 16' 3/4" (1% short) for 10 meters.
Use the 1/2 inch pvc to space the 20 and 40 meter wires 36" apart and drill the holes in another piece to go between all three wires at the 10 meter end 16" spacing from 20 meter wire.
Run poly rope from 10 meter wire to dogbone on 20 meter wire. The rest of the installation is to hang it as high as you can with 2 pcs of poly rope for each end.

Added note - I used a nut and fender washer on outside of PVC tubing, and a nut and star washer on inside for better contact. I also feel this makes it stronger.
Feel free to contact me for any more info 73 Marty N9FIY..... email cdianne78 AThotmail.com
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09/2010."I wanted to provide some additional information about fan dipoles.
The SRI figures that you have posted are quite correct (I

believe that Donald Lee did the research for the US Army that created those findings.) I do know from personal experience that the US Army validated SRI's research findings with extensive field testing years ago. I believe that for some unknown reason the Army always recommended 1 meter (39.37") for end separation in fan dipoles."

"My own fan dipole (80/40/20) built to the SRI specs needed no additional pruning in order to achieve the appropriate resonant frequencies. Mine is an inverted V with the feed point at 45' and the ends at 20'." Source - anonymous.

Feedback from another builder

"I constructed it as per the stanford example. spaced the dipole elements 38 inches apart using pvc pipe.

The measurements I came up with were different than the ones mentioned in the article.

I built a 160/80/40.

The 160 was cut 4% shorter with target freq at 1.9mhz,

The 80 and 40 both ended up being 4% longer than the 468/freq formula.

Conclusion to achieve target freq these are the formulas that worked for me.

Lowest freq antenna 468/freq X .96

Middle antenna 468/freq X 1.04

Lowest antenna

(highest freq antenna) 468/freq X 1.04

Hope this helps anyone experimenting with the fan dipole.

Details are as follows.

1:1 current balun at feed point.
Dipoles fed as per Stanford instructions.
Spacing as per Stanford instructions.
Gauge of wire is 10 gauge stranded."
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Latest feed back and builds 04-2014 from:
KL3JM MODIFIED "SRI" MULTIBAND FAN DIPOLE FOR 80 - 40 - 20 Meters

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Older cut and try method below:

CONSTRUCTING THE MULTIBAND DIPOLE: (Older cut and try method)

Here is a fairly simple and easy to build multi band horizontal fan type dipole that can be constructed for all band operation from 160 meters up thru 6 meters or even higher.
In the drawing above, it is shown for just four bands, 80 thru 10. One separate dipole for each band needed. However you can build it to suit your own preferences by using the standard formula for a dipole:
468/freq mhz = total length for each band. Use the formula for your desired center frequency.

Each dipole length above in**RED**is in feet and tenths of a foot for the center of the General portion of each bandand is derived from the above formula and should be cut longer for swr trimming. USE #12 TO #14 GAUGE COPPERWELD WIRE IF POSSIBLE or use what you have on hand. The top most dipole must support the entire weight of the antenna.
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Start with your lowest (in frequency) band of operation as the main (top) support for the entire setup. Cut it per the formula but add a couple of feet on each end for tuning. Try to use a wire size that will support the other dipoles.

This is the main support for all the other dipoles and must carry their weight.

Cut a dipole for each band of operation. (SEE EDITORS NOTE AT BOTTOM OF ARTICLE)

Cut each full length in half....example: for the 10 meter length from the formula you get 16.1 feet for the total length. Cut it in half at about 8 feet per side. Make sure you cut each length about a foot or more longer for swr trimming and attaching to center and end insulators!

If you are building the four band dipole above, you should have 8 lengths of wire scattered all over your work area.

WARNING! DON'T DO IT IN YOUR LIVING ROOM, THE XYL WILL NOT BE VERY HAPPY WITH YOU AND AFTER SHE GETS FINISHED WITH THE QRM,,,, ALL YOUR ANTENNA BUILDING WILL HAVE TO BE DONE FROM THE DOG'S HAM SHACK!

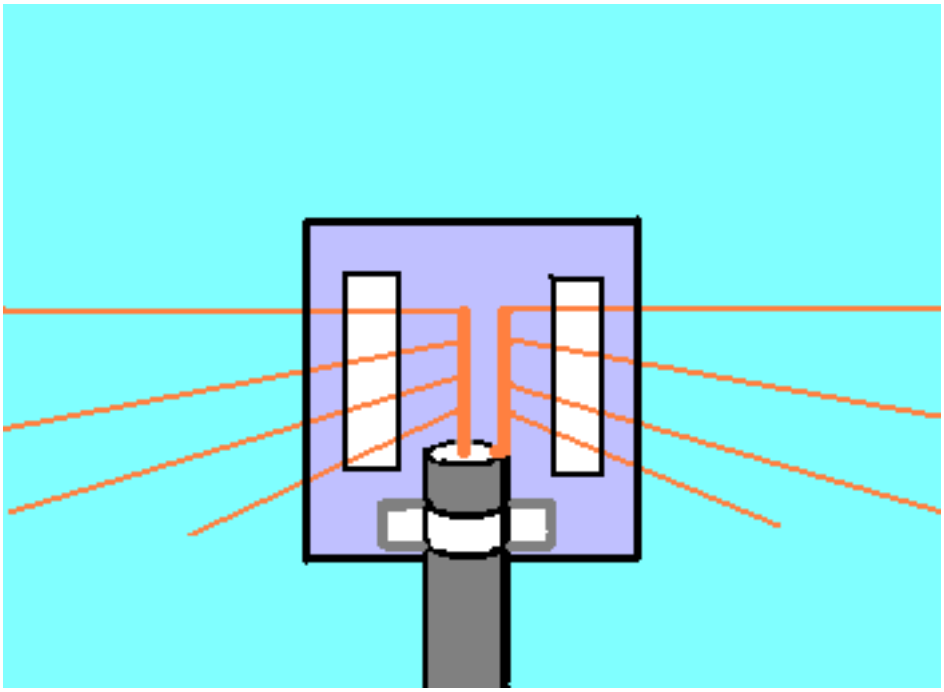
It is assumed that you have your end support poles, trees, center and end insulators, pulleys all ready to go before you start working on the actual dipoles.

A very important part of this design is the installation of the pulleys (in yellow on drawing) on each end attached to each side support.

They are added to this design due to the swr trimming process and make it very easy to pull the entire antenna up and down while making the swr adjustments. Mount a suitable size pulley on each end attached to your pole, trees, etc for the diameter of cord or rope used to support the system.

Start your antenna trimming with the top dipole.... attach your coax to the center insulator leaving several inches of the center conductor and shield exposed. Each half of each dipole will be connected to the coax center pigtail and the shield separately. In other words, connect one side of the dipole to the center conductor and the other side to the shield.
Attach the other end of each half of the longest wire to the support cord and run thru the pulley on each end and pull the dipole up into the air between the end supports. Check swr.
Trim as needed with low power for lowest swr possible, lower with pulleys, attach the next highest band dipole electrically to the same point as the first dipole, raise it to operating height, check swr, lower for trimming, up and down, up and down.....due the same for all other dipoles for each higher band of operation.
When you are finished with the highest band of operation, pull the entire system up with the pulleys and tie of at the bottom securely.
Make certain that the coax center conductor is attached to one half of each dipole and the shield to the other half. All dipole ends at center insulator are connected together.

This may not be very clear to the new antenna builder so please see the drawing below for the center insulator arrangement.



**(NOTE: IF USING THE NEWER CONSTRUCTION METHOD MENTIONED ABOVE,
INSURE PROPER SPACING OF ANTENNA LEGS AT THIS CENTER INSULATOR!)**

The white areas in the center support drawing above are mechanical supports, clamps, wire ties or whatever your genius can come up with to support the main (top wire) and the weight of the coax.

Remember, all the weight of this antenna system is supported by the top wire.

The connections should be soldered and all should be sealed including coax end from water, ice, snow etc.

Use a 1:1 balun like the "Ugly Balun" project page on Hamuniverse.com close to the center before coax goes to your rig.

For best performance get it as high as possible and remember that since this is a dipole arrangement, it will

be somewhat bi-directional towards and away from you as viewed in the drawing. (BROADSIDE)

Remember that all elements will interact with each other in the tuning process and the final setup must be secured so the angle or distance between each dipole does not change when blowing in the wind, etc.

The angle or distance between each dipole is not critical but the final spacing must be maintained!

It will take lots of work (trial and error) in getting each dipole to the lowest SWR. Just keep TRYING.

It should also be noted that the antenna can be used in an inverted v fashion but remember the spacing should be secure in the final operating position. Tune it as in all the above instructions. You may use a tuner with this antenna un-trimmed to save a lot of work but doing it correctly for best swr without a tuner is always better!

EXPERIMENT! EXPERIMENT! EXPERIMENT!

Editors note:

The multiband fan dipole can be very difficult to tune for lowest swr in some installations. There are many variables that will make tuning difficult. Height above ground, sometimes the angle of each dipole relative to the other dipoles, surroundings , etc. If you can get the swr to around 2 to 1 or lower for each band....don't worry too much about it. **(see the newer construction method above)**

You might also consider using a good antenna tuner if you are having major tuning problems. A 2:1 SWR or lower can be handled by most builtin tuners in radios.

You might also consider removing HF combinations such as 40/15 meters and 80/30 meters.
For these cases, cut the element for the lower frequency and let it serve **double duty at the odd harmonic**. In other words, cut the 40 meter element and let it serve also as the 15 meter element which eliminates the 15 meter section.
Make sure that the distance between all dipole elements does not change when tuning.
They must be in a fixed position always with some sort of spacer. In theory, we could fashion a four-wire antenna for the 80, 40, 30, 20, 15 and 10-meter bands.

In practice, it may be difficult to obtain a good match on all bands.
Since the resonant length of a given element in the presence of the others is not the same as a dipole by itself, tuning can be a tedious and difficult procedure.
Adjust elements for resonance in order from lowest frequency to the highest such as in an 80 40 20 10 combo.....start with 80 first.....then go to next higher frequency dipole.
Always cut each dipole a lot longer than required for each band to make tuning easier.
Trim as needed for your operating frequency.
All of these bandwidth, adjustment and matching problems are easily solved with an antenna tuner at the transmitter, feeding the antenna through 100 feet or less of RG-8 coax.
Please remember to send us feedback if you are using the newer construction method or if you have any tips you would like to pass along to others that make the

multiband dipole easier or faster to get set up! 73! Email to N4UJW at Hamuniverse.com

Back to antenna projects