

Build an All Band HF Air Core 1:1 Choke Balun THE "UGLY BALUN"

Introduction....

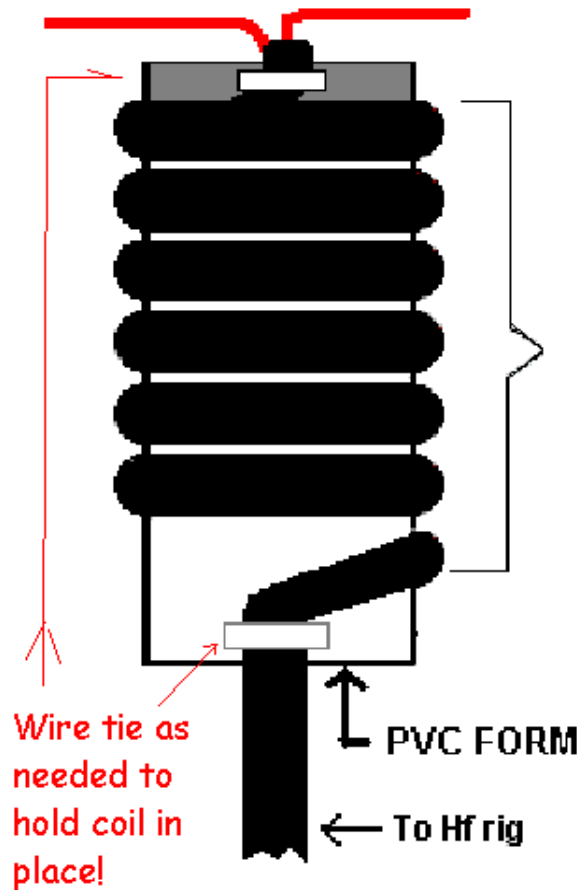
A balun's purpose is to allow connecting a balanced, (e.g., a dipole or driven element) to an unbalanced line such as coax which is not balanced, thus the name, Balun. **The 1:1 choke "balun" is not actually a balun.** It's function is to help eliminate rf currents from flowing on the outside of coaxial cable using the principle of choke action. Another "name" for it is the air choke.

In transmitting antennas, this is accomplished by presenting a high impedance (resistance), to RF currents flowing outside the coax shield. This forces currents in each side of a driven elements to be equal. This is especially important in beam antennas because it prevents distortion of the beam's pattern caused by unequal currents in the driver(s). In a simple dipole, the balun (choke), assures that the dipole, and not the feed line, is doing the radiating!

When you connect center fed antennas, like dipoles, V's, triangles, yagis, rhombics, loops and so on, to coaxial cable, unless care is taken, it is not difficult to end up with **feeder radiation**. Not only can the loss in power be quite significant, but the radiation characteristics of the antenna system will also be seriously compromised. In laymen's terms, it won't be what you are expecting from the pattern of your antenna. As the feedline becomes part of the antenna, currents can flow from the line into the mains and on TV cables, metal masts and yagi booms, causing a variety of EMI problems that can be very difficult to trace. Frequently these problems are simply due to unbalance - and the solution is the humble air choke.

If an antenna system is fed at center with a parallel conductor line (provided that correct installation procedures are followed) balance will be maintained, USING A BALUN, with currents in equal and opposite phase canceling each other out.

When the connection is to a coaxial cable, WITHOUT A BALUN, this cannot occur because currents flowing inside the cable from the connection to the inner conductor are separated from those flowing on the outside from the connection to the shield, and the result is unbalance causing feeder radiation. However, if the two electrical circuit elements (antenna and coaxial cable) are coupled using a balun, balance will be maintained. Enter.....The Ugly Balun!.....



This is the basic construction drawing for the 1:1 Choke Balun for 160 thru 10 meters using one continuous length to the rig starting at the antenna attachment points. Depending on your use, coax connectors can be added or other connectors can be made for different types of antennas. Balun should be located AT the feed point of the antenna or very close. Drawing is not to scale and is only showing one method of winding the coax on a PVC form. The important part of the drawing is the 18 to 21 feet of coax close wound on the form. The number of coils is not important....just the length! Don't wind your coax tight enough to crush the internal insulation.

N4UJW

An Inexpensive, High-Performance, Ugly 50 ohm Balun

"Building a no-grief 1.8MHz to 30MHz 50ohm-balun is easy.!"

"No costly ferrite-cores are needed, just a short length of 3 to 5 inch size plastic pipe, about 25 feet of 50ohm coax plus some nylon cable ties.

Solid-dielectric coax is best for this application because foam-dielectric has a tendency to allow a change in the conductor to conductor spacing over a period of time if it is bent into a tight circle. This can eventually result in voltage breakdown of the internal insulation.

The required length of the plastic pipe depends on the diameter and length of the coax used and the diameter of the pipe. For RG-213/U coax, about one foot of 5 inch size pipe is needed for a 1.8MHz to 30MHz balun. For 3.5MHz to 30MHz coverage, about 18 to 21 feet of coax is needed. This length of coax is also adequate for most applications on 1.8MHz.

18 to 21 feet **should** cover all of 160 through 10 meters.

The number of turns is not critical because the inductance depends more on the length of

the wire (coax) than on the number of turns, which will vary depending on the diameter of the plastic pipe that is used.

The coax is single-layer close-wound on the plastic pipe.

The first and last turns of the coax are secured to the plastic pipe with nylon cable ties passed through small holes drilled in the plastic pipe.

The coil winding must not be placed against a conductor.

The name of this simple but effective device is a choke balun.

NOTE: Some people build choke-baluns, without a plastic coil-form, by scramble-winding the coax into a coil and taping it together. The problem with scramble-winding is that the first and last turns of the coax may touch each other. This creates two complications. The distributed-capacitance of the balun is increased and the RF-lossy vinyl jacket of the coax is subjected to a high RF-voltage. The single-layer winding on the plastic coil-form construction method solves these problems since it divides the RF-voltage and capacitance evenly across each turn of the balun"....AG6K

Credit for this article goes to AG6K, Rick Measures and was edited from a Pre-copy version of another article titled "A BALANCED - BALANCED ANTENNA TUNER" published in QST, February, 1990.

Step by Step Sequence of building the "Ugly Balun" incorporated as a center insulator also using PVC by KC7AVA. (Sequence is from left to right and down page.)



4" PVC and RG213	Winding the 21' of coax	Securing coax with cable ties
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So239 installed

Preparing the coax

Adding a solder lug



**Connecting the coax to
the S0239**

Taping the leads

**Eye-bolt antenna
terminals installed**



Time to wire up the terminals	Unbraiding the dielectric took time!	All wired up
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The KC7AVA Ugly Balun – ready to go!
 See his entire construction article and his story of
["Getting Back on the Air" at the link here!](#)

Lots more "Ugly Balun" photos, ideas and installations sent in by users below!

Here are examples in the pictures below using cable ties on PVC pipe forms which work well also. Your choice!
(Imagine the coil form is removed). Pictures are showing how to secure the coils together. Do not let the first and last coils touch!



Picture above courtesy of VE7AVV



Picture above courtesy of KC2NXV (now N4NYY) shows using 2 pvc couplers joined and glued using about 2 inches of 4 inch PVC pipe, so the couplers would adhere and be stronger.

More "Ugly Balun" ideas from DAVE THOMAS, M3RUH BELOW:



The Dave Thomas, MW3RUH BOTTLE SPECIAL!



Dave uses a plastic drink bottle as a form. He installs an S0-239 in the bottle cap and antenna connectors on the other end!
NICE TIP DAVE!



**Photos courtesy Bill, KI4PCB, using 4 " PVC FORM
Notice the screw terminal block used for connections**



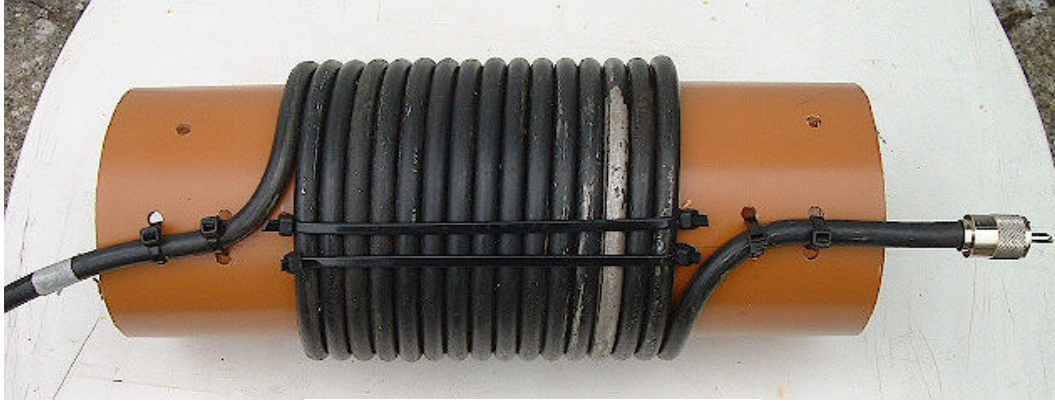
KI4PCB "Ugly Balun" on the air!



The N7ATA "Ugly Balun in Real Life"...thanks Dan!



Courtesy of G4APL (see info below)

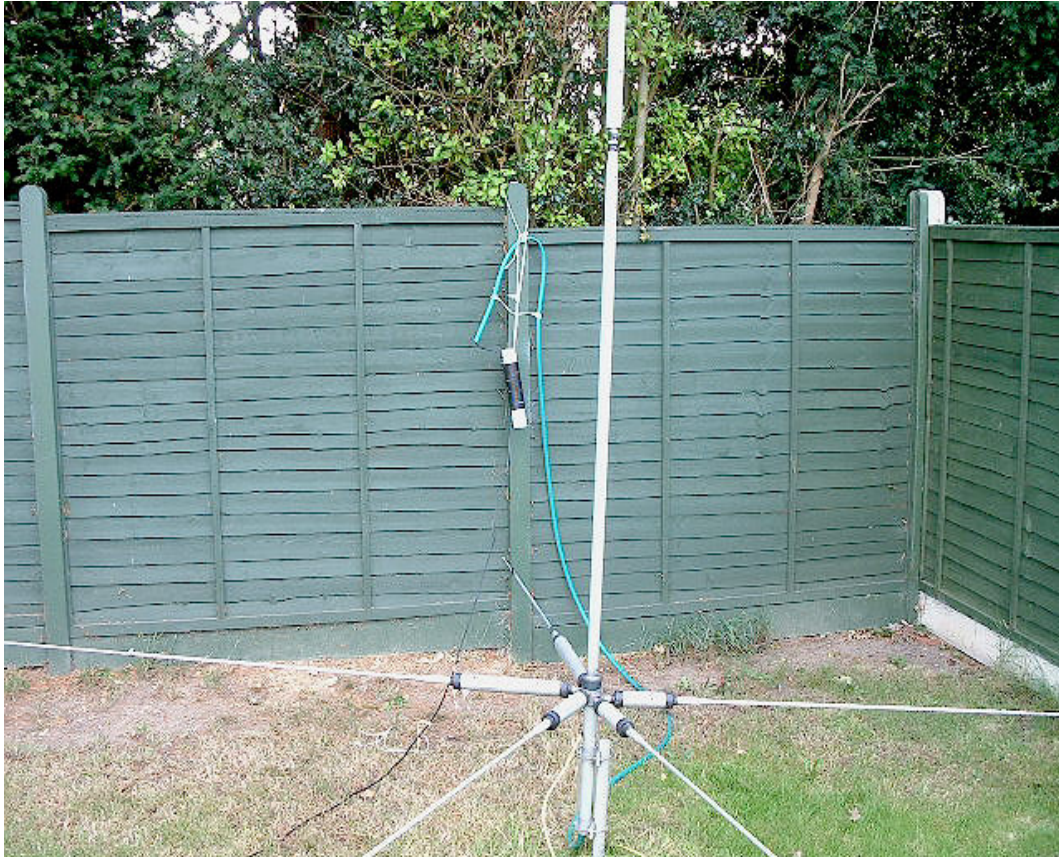


Courtesy of G4APL (See info below)



Courtesy of G4APL.

(Air choke used on Mosley Mustang Mark3 3 element 10,15, 20 metre trapped Yagi)



G4APL Ugly Choke Balun inline with the GB7CIP Pactor Trapped HF Ground Plane

Another Ugly Choke Balun by G4APL

Paul, G4APL, has brought together some excellent examples on how to construct and build Choke Balun in the pictures above and the information below to share with us:

Paul decided to build two or three of them, depending on what material could be found in the shed.

The idea was to add a balun to the HF beam, a Mosley Mustang Mark3 3 element 10,15, 20 metre trapped yagi. This is fed with co-ax and has the Mosley earth strapped at the feed point. The beam has been adjusted for the low end of the HF (High Frequency) bands.

Paul had used a commercial balun in the 1970's before and burnt this one out. It was supposed to be rated to 1 kilowatt pep. (peak envelope power).

Using the information material from the instructions for the "Ugly Balun" above, it was time to see what was in the shed.

A short length of 4 inch drain pipe was located that was left over from the 90 foot of drain pipe laid underground that carries the RF cables. Also found a 2 inch piece of down pipe.

Materials: HF Beam Balun

12 inches length of 4inch diameter PVC drain pile

cable ties

18 foot of RG58

two suitable cable plugs

Having got all the required tools out, it took Paul and hour to build the Ugly Choke Balun as pictured above.

The HF Balun is attached vertically to the Stub Mast at the Mosley Mustang Mark3 beam.

Paul was very surprised with the results. Testing the aerial and Balun with 250 Watts the standing wave was surprisingly good.

Never seen this beam produce these results before!

14.005MHz to 14.150MHz 1.1:1

14.200MHz 1.2:1

14.250MHz 1.4:1

14.300MHz 1.9:1

21.005MHz to 21.300 1.1:1

21.400MHz 1.2:1

28.005MHz – 28:400MHz 1.1:1

28.500MHz 1.2:1

**Now to do some dxing and see how the aerial performs.
Hope the above is of use to you.....73 Paul G4APL**

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**More from ZL1ALZ, JOHN from New Zealand!
"Ugly Balun" construction used on a 40 meter vertical!**



Closeup of the ZL1ALZ "Ugly Balun"



The VE2ITZ Balun with Sloper Antenna!

Excellent results!

Never had such an easy time at tuning the sloper antennas with the "Ugly Balun"!

By the way; the balun consists of 20 feet of coax wound around a 2 and a half inch diameter plastic bottle. I then proceeded to put gaffer tape to hold it in place.

Et Voila!

Cheers and 73 de VE2ITZ in Montreal, Canada

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"Ugly Balun" installed on the A3S 3 Element Beam at the KO4MAX QTH!

This update was compiled from various emails:

"Hey, we don't think it's so ugly!"

KO4MAX deserves the credit just for putting up with me.

I wanted to add (in this update), that 21 feet is the length of coax used in the construction.

We put the antenna up on a Sunday afternoon, and it was sketchy to say the least. The auto tuner in his Icom 746 Pro kept engaging automatically (even when it was turned off).

I knew it had to be coupling with the feed line.

So, I showed him your Ugly Balun page and then the Hy Gain manual I have, which calls for 12 turns 6 inches in diameter.

He read the Cushcraft A3S/40m manual which states 8 turns at 6 inches in diameter.

After much debate we went with your design. See photos below.

Monday, enter the Ugly Balun.

Now, the antenna works and it works well.

The second day on the air (Tuesday) he sent an email informing me that "it rocks" which is a quote.

He also says it's a big improvement over the dipoles he had on those bands.

75/80 meters and the warc bands is all that is left in his shack.

We'll rework those dipoles for those bands.

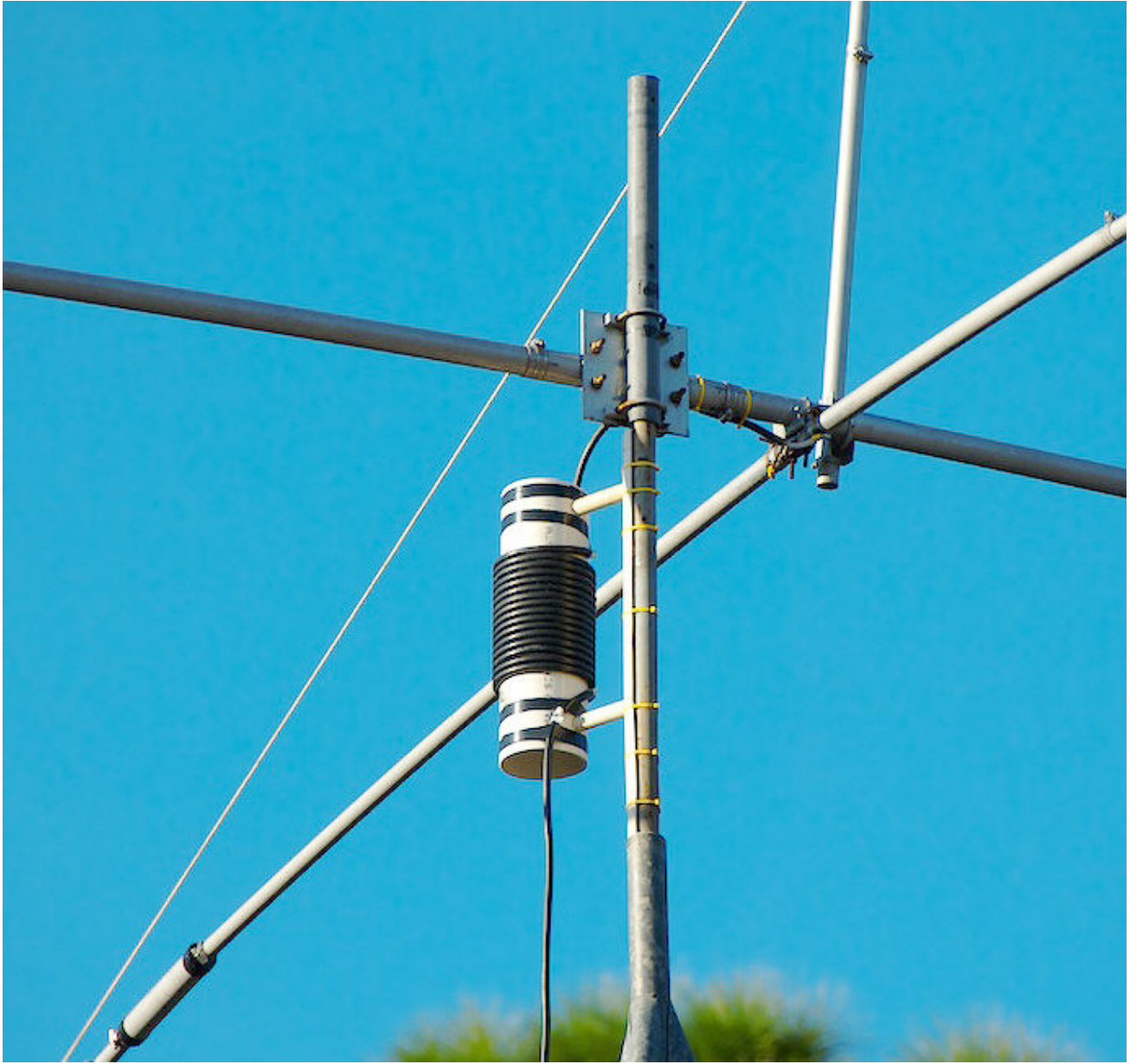
Thank you for your contribution and website!

We found the Ugly Balun to be a huge help when it came time to stop the feed line coupling.

We think it gives this big A3S/40m (10-15-20-40m 3 Element beam) "character".

We installed this at KO4MAX in South Florida. See photos below:







Update 04-2011....showing stainless steel clamps in final installation



We used 4.5 inch bolts through the half pipe (split in two vertically).
We inserted 4 inch stand-offs and bolted the 4.5 inch PVC to the half pipe.
We used tie wraps for a temporary installation (During testing).
Stainless steel clamps were used in final installation.
We plan to install U-bolts to permanently mount the assembly to the mast pipe.

No more coupling with the coax after installation.
Tested with the MFJ-269 Pro Antenna Analyzer
Nearly perfect on all 4 bands!

This thing, over 2 years later, still working like a champ.
This installation should provide many years of service

Came down off the tower and made our first contact with Italy IZ5ILF - Max

Thanks for the ugly balun concept!"
73'

TL7VE - DX8FW - Tim

Balun Pics below submitted by K8CPA. "Ugly Balun" mounted on base of tower.



The work, including the Balun winding was done by my friend Matt, AC8AC.
The Antenna is a homebrew G5RV, that actually works!
73 es gud dx
DE K8CPA



VU2UWZ Version



YV5GRB Version

"I want to thank you for the usefull information and different examples on your web page, I could understand and build two 1:1 chokes for my 5BTV phased verticals, I also helped other local hams with this project. They work!."
73 de Eduard (YV5GRB)

Below are some ideas from Kelvin, G4ZTD



Balun shown attached to vertical antenna



Antenna connector end shown



Balun shown mounted to gray pipe



SO-239 end

I used 21 feet of rg58 on 4 inch drain pipe, I used clear 3mm plastic sheet cut to fit in the ends, glued these in using hotmelt, then at one end I fitted an so239 connector and the other end has terminal posts to connect to the antenna and ground. You will notice the vertical slots cut into the brown tube. These are to allow any water to run out of it. The gray pipe was glued to it so I could attach it to the pole with cable ties.

Funny thing is it looks quite cool.

I have tested it on 20 mtrs 14.230 (SSTV) and the swr meter hardly moves.

Many thanks for the info you gave on the site. Best 73 Kelvin, G4ZTD

The WA6GUZ Installation!



Nice installation on a vertical by WA6GUZ!



**"I built the "ugly balun" for my TWIN LEAD, 80m MARCONI (by William Orr)
Balun and antenna operating excellent !" VK4JAO- Arno**



N5DRG
Greeting Fellow Hams,

After reading the article on the Pro's and Con's of the "Ugly Balun", I decided to make one and install it on my home brew 3 Element 17 Meter Yagi.... after all one home brew deserves another right?

Looks like it is going to work out just fine. I used 21 feet of 9913 Flex around a 3 inch schedule 40 PVC pipe.

The dipole has a split driven element so feeding it was just like feeding a wire dipole.

Tuned up ok but may have to adjust the DE for a little better standing wave ratio, but all in all its a thing of beauty.

Ugly is just a state of mind!

Catch ya on the air,

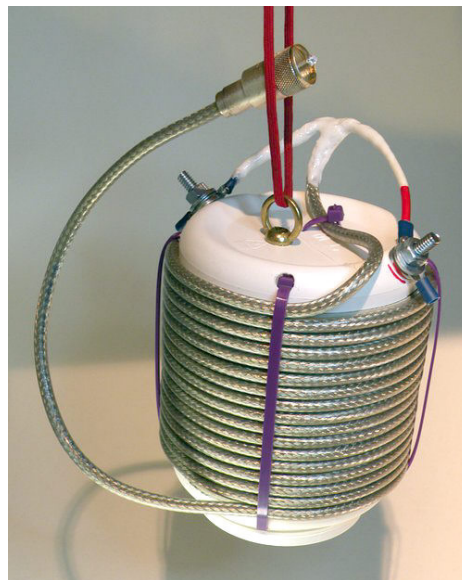
Danny

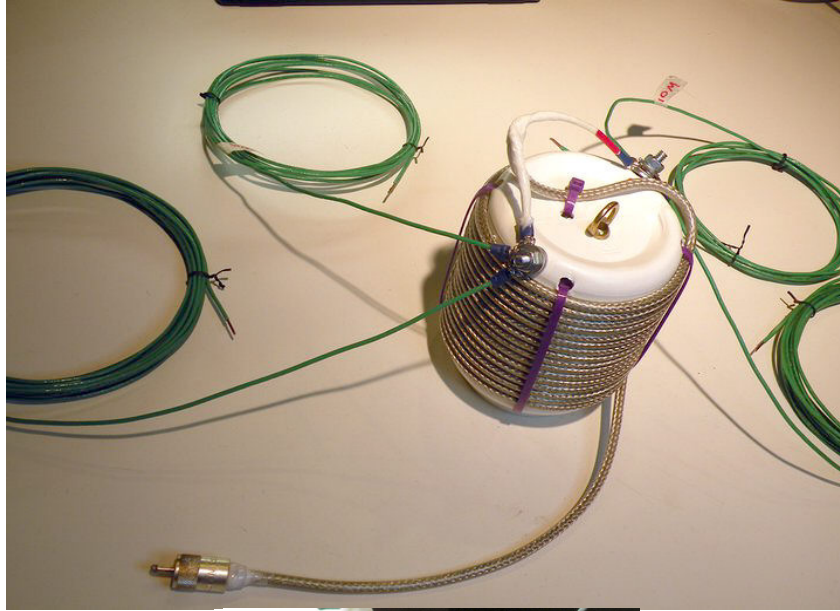
N5DRG

This just in from K2NCC!
Frank and his ham friends calls it his "bee-hive" balun!

I made my first home-brew 20M dipole late 2010, and quickly found myself faced with a challenge. Too much RFI into the shack. On a local technical net, I mentioned my woes and attempts to eliminate cooking myself without relocating. More than one ham recommended the "UGLY BALUN". My first thoughts showed my ignorance as I didn't take it as a serious solution. But glancing around the shack I saw I had enough to try it anyway, and the opportunity to make another antenna was appealing.

Boy, am I glad I did! A quick GOOGLE search led me to the Hamuniverse.com site and this Ugly Balun article. Adding the air-wound common-mode choke (Ugly Balun sounds so much better!) It reduced my field-strength meter swing from 10+ to barely 1 anywhere in the room. Now, I too recommend it to anyone using a dipole. Ugly doesn't mean stupid! In ham radio lingo, it means beautiful! See photos below.





How I built the "bee hive" ugly balun:

I used a large pump-type shampoo bottle, about 5" tall, 4" diameter, upside down. After measuring and tapping holes for my tie-wraps, I wound about 20' of RG8x around the plastic bottle, and used a PL-259 connector on one end to bridge with the feed-line. The other end of the coax was center conductor to one side, shielding to the other, making the dipole connection points. I used nuts-n-bolts and a couple of large washers on both sides of the bolts for stress-relief on the plastic and to secure the antenna legs. This assembly allows me to remove the balun from the system easily and add/remove bands with little effort. A threaded brass loop from an old table-lamp lets me use a simple double-ended snap hook to a eye-bolt screwed to the eve of the house. I finished off the project by applying a generous amount of liquid tape to anywhere that water could seep in.

Now I'm happy as a (uncooked!) clam. (I should'a said ham!!).
What a superb and simple solution. Thank you!

Frank, K2NCC
Hillsboro, Oregon

From 2E0RCR

This is made from 21 feet of RG213 Coax and a little bit extra to help connect the balun to the antenna.

I have decided to mount the choke on a wooden fence panel as illustrated in left picture below.

It was too fiddly getting up to the CP6 coaxial mounting so I just patched into the coax.





Balun mounted on fence below antenna.

Results:

I could never tune 80m but now I can. There is considerably less noise than before. I am so impressed I have made another one to take portable with me for when we attach large verticals to portable masts. Hopefully this will help some of the RF feedback issues I have been having.

Kind Regards

Robert 2E0RCR



Here is my new "choke balun" in the 2 images above for the Diamond CP-6.
I can now tune better. 80m came alive.
Less background noise all over the bands.
I feel happy to try the Ugly Balun.
73, Bert EA8AGF