A Long Hot Loopy Summer Day: (Another Antenna Project to Play With)

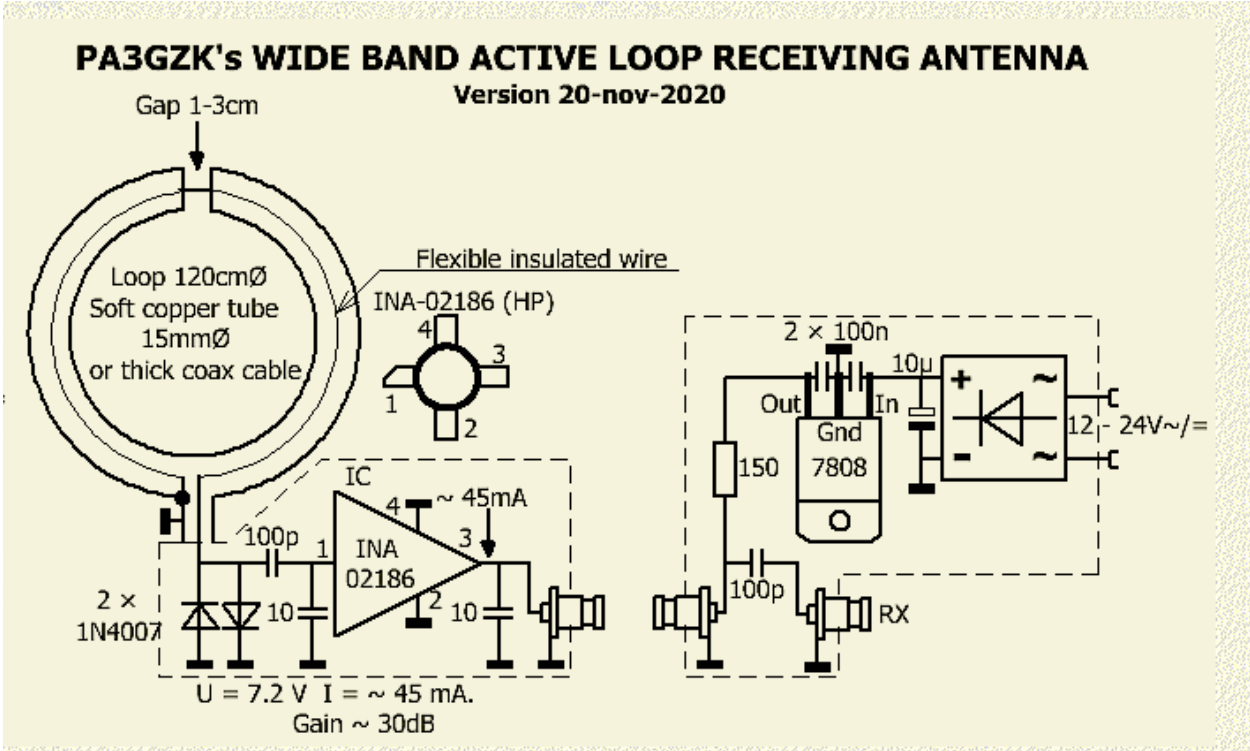
I stepped into the backyard early this past Monday and was greeted with the smell of flowers and the cool air so common in this part of the world in the early morning. (And probably in every other part of the world, I suspect.) Birds were singing and all was as if it was a new beginning. It seemed like all had been washed during the night and was fresh and ready to go again.

Yesterday was stifling hot; Too hot for even a BBQ because of the intense sun in our west facing backyard. I sat at the patio table and sipped a cup of delicious coffee and pondered the day. What was I going to explore today? Should I change the labels on the cables that had faded over the years or perhaps just tidy up the shack and watch a video from Dave Casler and gather inspiration that way? The slate was clean, so the possibilities were endless. Then it dawned on me that I had promised my oldest and best friend, Terry, on the coast that I would help him out by building a receiving loop antenna and ship it to him when done. Terry has been plagued with some serious health issues recently and was in recovery mode right now. His strength is not there quite yet and although the mind was strong the body was a bit weak, and he could use some help. Who better than his oldest friend to do whatever I could to help him get his receiving antenna working in a noisy environment? Seems like a simple thing to do and I set about putting the parts together for this new project.

So, the new antenna has to fulfill the following criteria:
1. It needs to be a loop because of its excellent ability to reject common mode noise by being directional
2. I want it to be only a metre across or less
3. It will need to be made with commonly available parts from a hardware store
4. It will need to be an active antenna using commonly available components
5. It will need to be powered using a Bias-T adaptor that can be powered with 12VDC
6. It will be fed with 50-ohm coaxial cable which will carry both the signal and the power
7. It will need to be mountable on a small rotator
8. And most importantly it needs to be able to be shipped via Canada Post in a small package

Now that sounds pretty simple, doesn't it? So I began the research part of the project. First, I started by seeing what other people had done and by learning from their experience. I found a few articles on the subject by simply typing into my browser, "Active Loop Antennas". The one that intrigued me the most was by Gag

Geurts PA3GZK. He had designed an interesting loop that met all my criteria, and it was simple and could be replicated using North American hardware. Here's the article: https://pa0fri.home.xs4all.nl/Ant/Active%20antenna/Active%20receiving%20%20loop%20antenna%20eng.htm



The most intriguing part of the design is the use of the electrostatic shielded loop design. This simply means that the antenna element is within a grounded loop of copper tubing that has a split at the top of about a centimetre and has the effect of deeper nulls off the broadsides of the antenna. I proved that it indeed worked when I connected a piece of coax to the antenna without a preamp and listened on the broadcast band to signals from Calgary radio stations. I could null the stations out nearly completely when turning the antenna broadside to the transmission It was weak, but it worked perfectly, so I was encouraged. Here is another article I found on the internet that explains the reasoning behind electrostatic loops quite well. https://www.qrz.ru/schemes/contribute/arrl/chap5.pdf

Oh I should mention that I have only just begun to work on this antenna and have a whole bunch of things to experiment with over the coming weeks before it's complete. So far, the results are promising to say the least. So, this is the first in a series on this fascinating project so stay tuned.

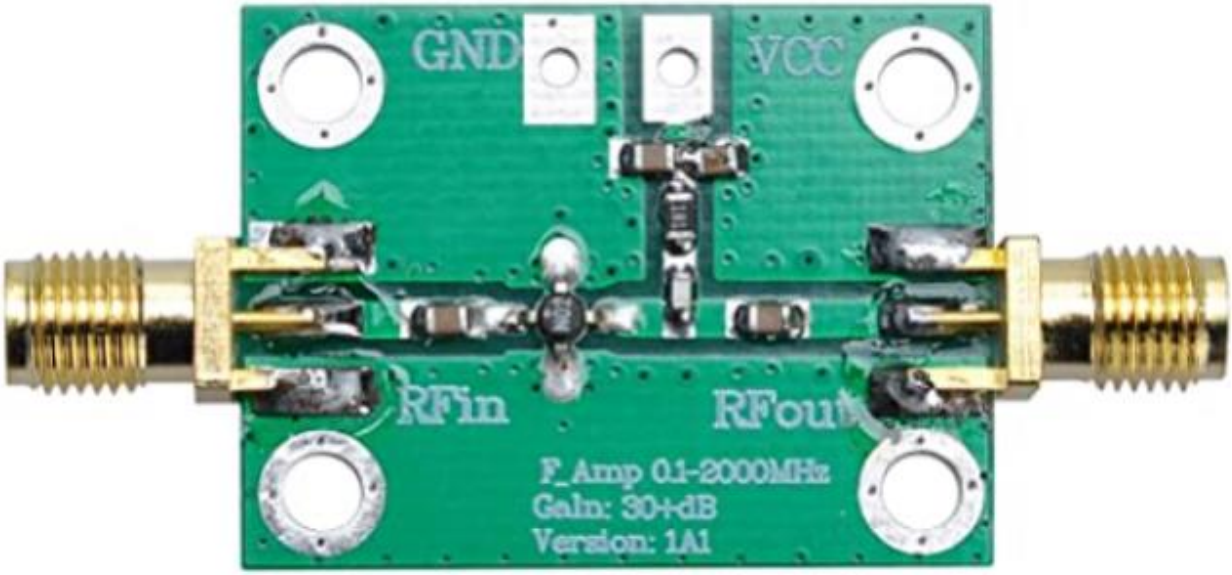
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Tom VE6ARG

A Long Hot Loopy Summer Day: (A short update)

Thanks to everyone that commented on my latest project. It is a work in progress that is easier said than done and tests my ability to do it right. Let's talk about it for a minute.

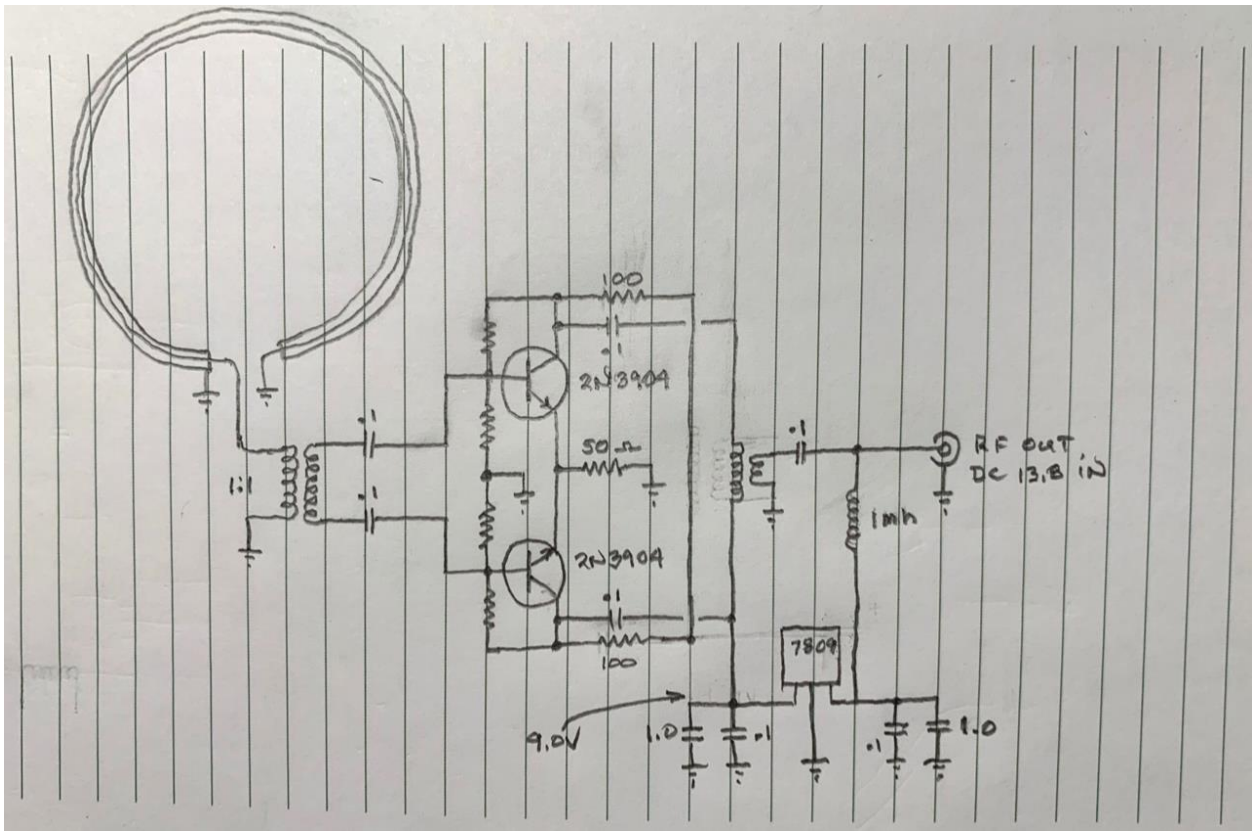
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So, I built the one below with a few mods and it sort of, kinda, worked but was unstable as hell and it created more birdies than a bird sanctuary on steroids. Holy crap it was terrible. It used one of those INA—02186 MMA's that you can buy from Amazon for $15 and they are supposed to work from DC to nano waves easily and provide you with 30db of gain. Yeah right. When I looked at it on the spectrum



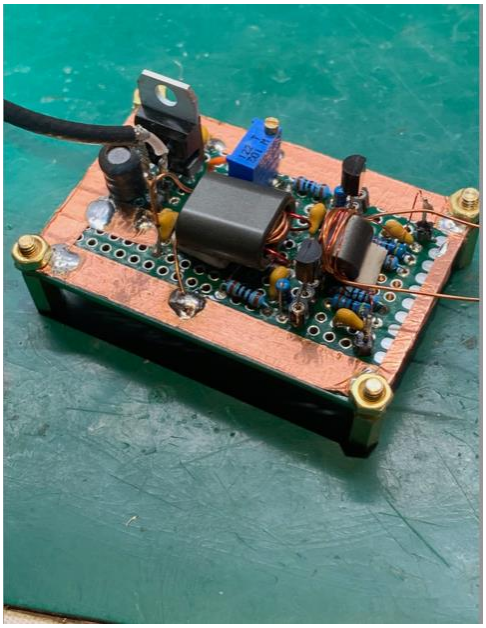
analyzer it looked like my grass in the front yard that needs to be mowed badly. It oscillated, it pumped the AGC, it scared the cats and made the dog bark. The only thing it didn't do was work. I tried varying the voltage to it and it just didn't work. Something desperately wrong with that so back to the drawing board. Here's a picture of it:

So, the next thing I tried was a balanced preamp made from two 2N3904's and it was stable and had about 20db of gain as well. I works well and I took the single ended output from the loop and fed it through a 1:1 transformer and voila it works



perfectly. Not as much gain as the INA-02186 but it's quiet and worked the way I expected it would. I have to experiment with it a bit to see if I can improve it, but I think I'm on the right track here now. Here's the schematic for that one:

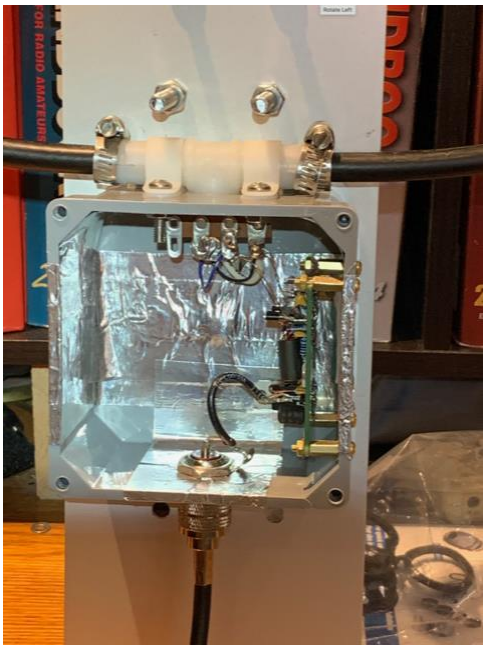
I also was struggling with using the copper tubing and decided to use a length of LMR-400 instead which just happens to be 3/8" on the outside as well, so that worked out well and it is able to be rolled up easily for shipping to my friend out on the coast. Of course, you have to use something to stabilize it at the top and I did that with a nylon Tee that worked perfectly. I also changed the antenna to an end fed loop



by only grounding the shield at the single feed end. I grounded the inner conductor at the far end but not the shield. It works as well as the other loop did so that was a plus and next, I will try some other configurations for the loop to see if I can improve it. I haven't settled on the component values for the base circuit but will show you the components after I have finished my experiments.

So, I tried it out on the pole in the backyard and it works OK. It isn't overwhelming but with conditions the way they are and have been over the last few days, I certainly didn't expect to hear much. However, I am able to hear WWV on 5, 10 ,15 and 20Mhz so that is encouraging. So, I'm back to the drawing board again and hopefully it will improve over time. Here's a couple of pictures to show what it looks like…. (Note: please don't mind the mess in the shack. I've been working and it tends to get a bit messy when that happens. I won't even show you the bench.)





Oh, I should mention again that I have only just begun to work on this antenna and have a whole bunch of things to experiment with over the coming weeks before it's complete. So far, the results are promising to say the least. So, this is the second in a series on this fascinating project so stay tuned.

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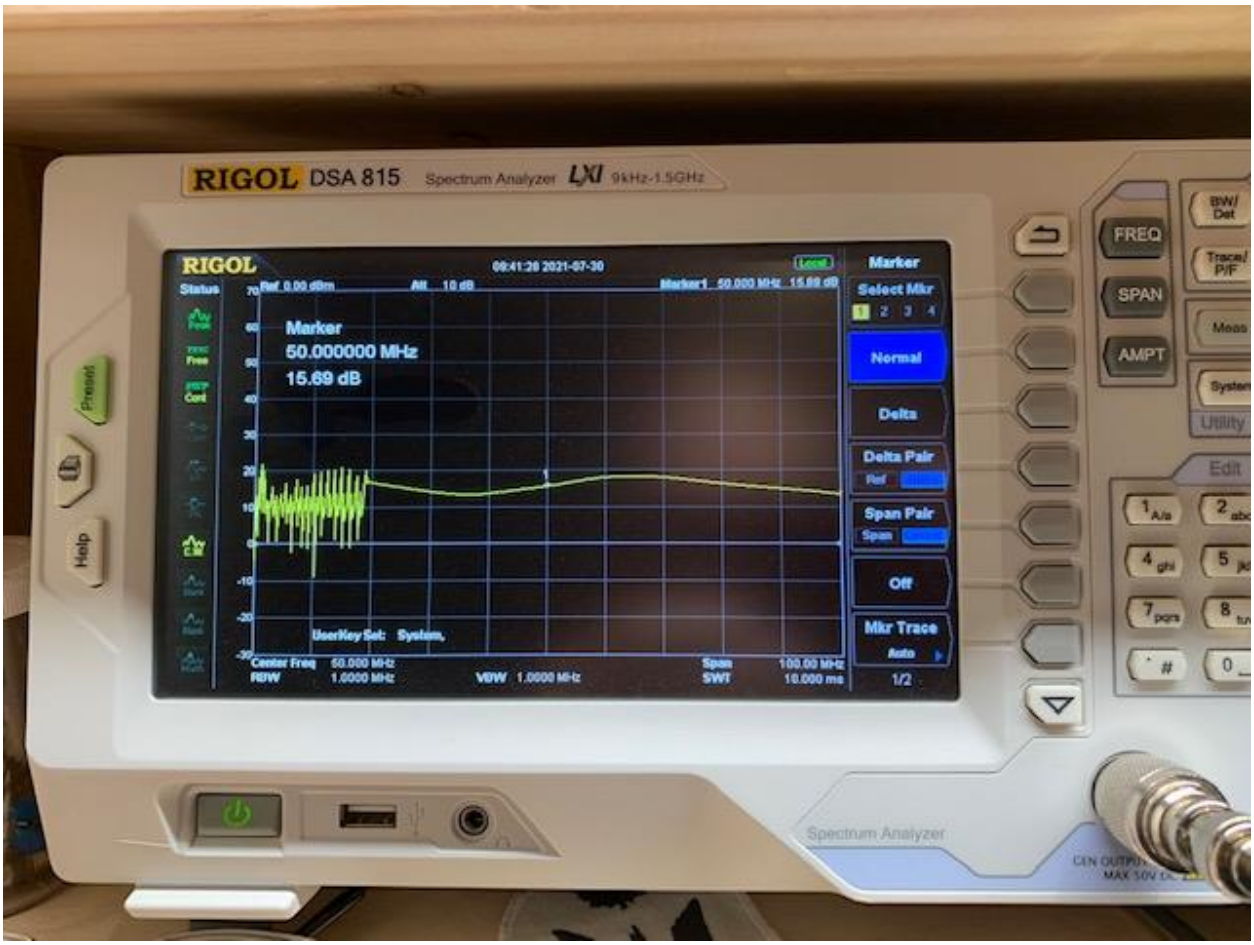
A RX Loop Antenna Project: (Another short update)

Keep those comments coming. I have received lots of mail regarding my loop antenna project and I appreciate them very much. Especially ones where your experience is included.

So, as you may remember, the new antenna has to fulfill the following criteria:
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I started testing some little amplifiers with some shielding around them and they went nuts. What the hell, I thought. I would have expected some shielding around the amplifier would be a good thing, but so much for thinking. Obviously, my thinking was faulty, and I needed to do some more sleuthing to get it figured out. Murphy was up to his old tricks again and got me fair and square on that one. I put it on my spectrum analyzer and looked at the response originally. It was a mess. However, when I reinstalled the SMA connectors and moved it away from any type of shielding it worked perfectly. It averaged 28dBm gain from 1 mHz to 100 mHz and I saw no birdies at all on the response. Now that's what I wanted to see, and it looks like I'll be able to use the INA02186 RF amps after all if I can figure out what causes them to be unstable. I tested 3 of them and they all showed the same response.

Then it dawned on me that I had built a stand-alone amplifier a few years ago that I had used one of those nifty little preamps in and it never seemed to work so I put it on the DSA 815 spectrum analyzer and this happened…

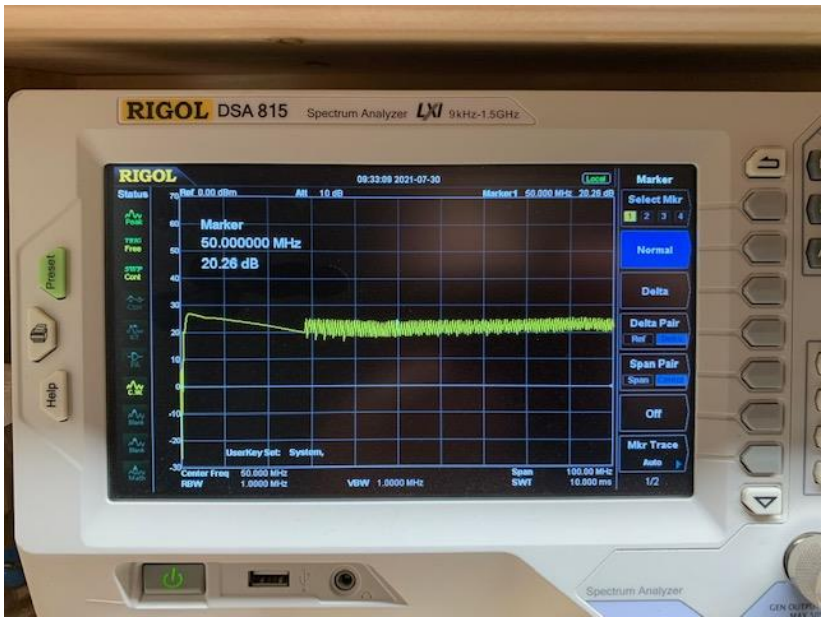




Yikes! That's a bit scary. No wonder the damn thing didn't want to work. Looks like major oscillation right down near the bottom of its response. I took the cover off and just held it above the case and it got even worse.

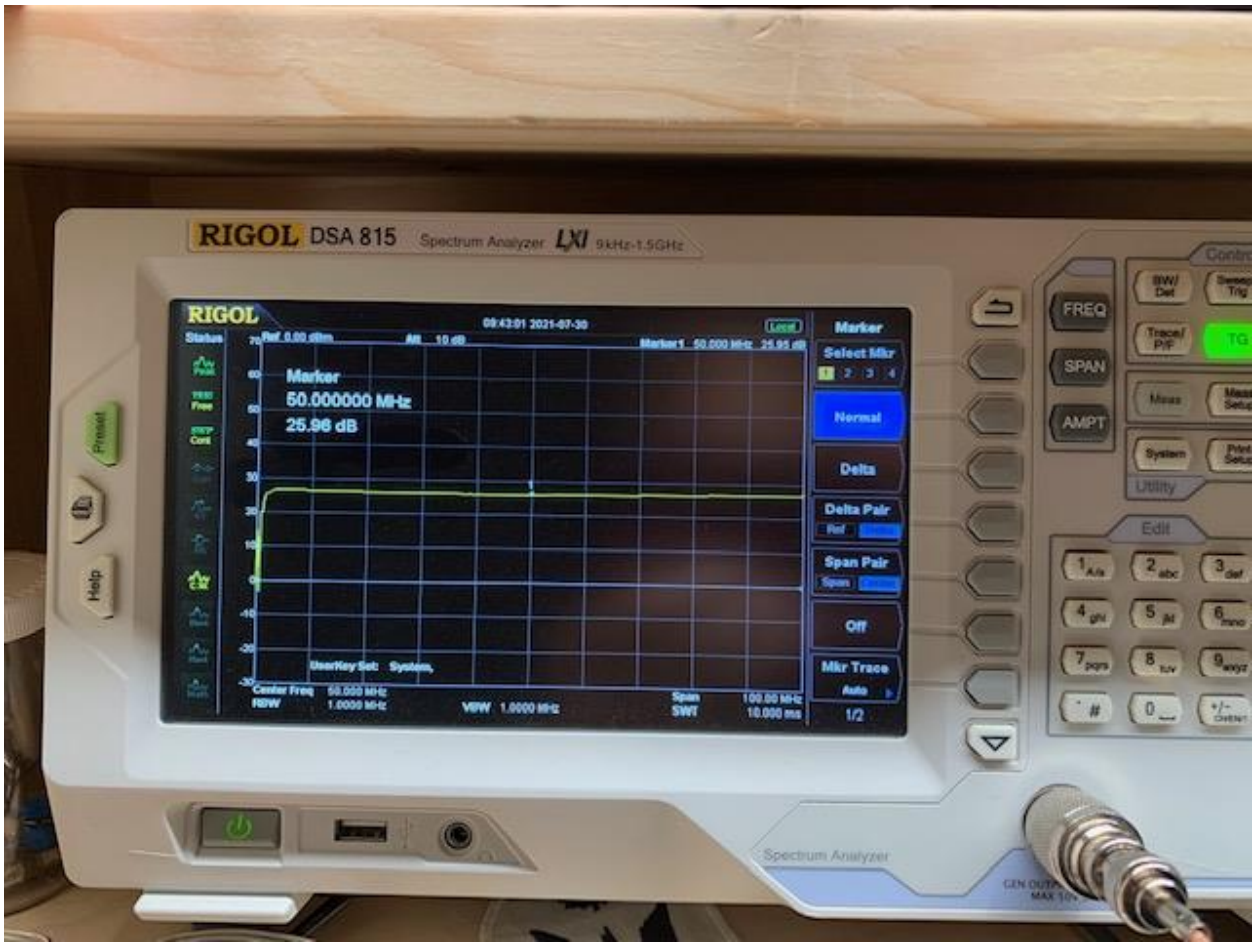


So then I took it off to see the response and this happened…. It stabilized nicely and I think I found the cause of the instability. The stupid Hammond case was the problem. It likely has to do with the distance the case cover is from the top of the board but more study needs to be done to confirm that and what the cause is. I moved some connections around and tried different configurations and it still worked like an oscillator instead of like an amplifier whenever I put the

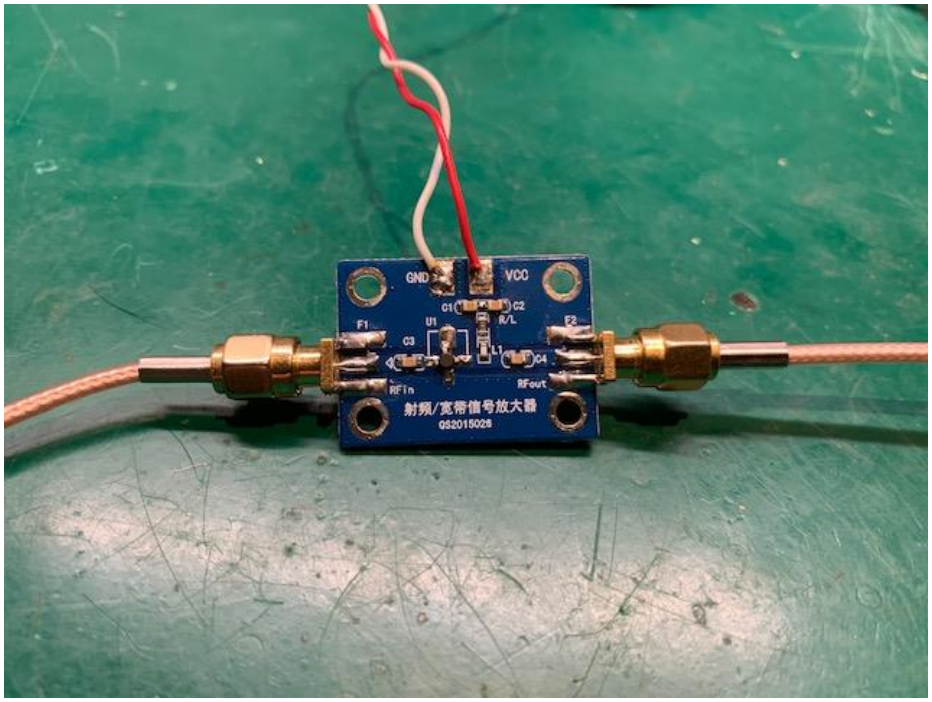


cover back on. I got tired of putting the screws in after awhile (I'm a slow learner) and just left the cover off and here's the results...

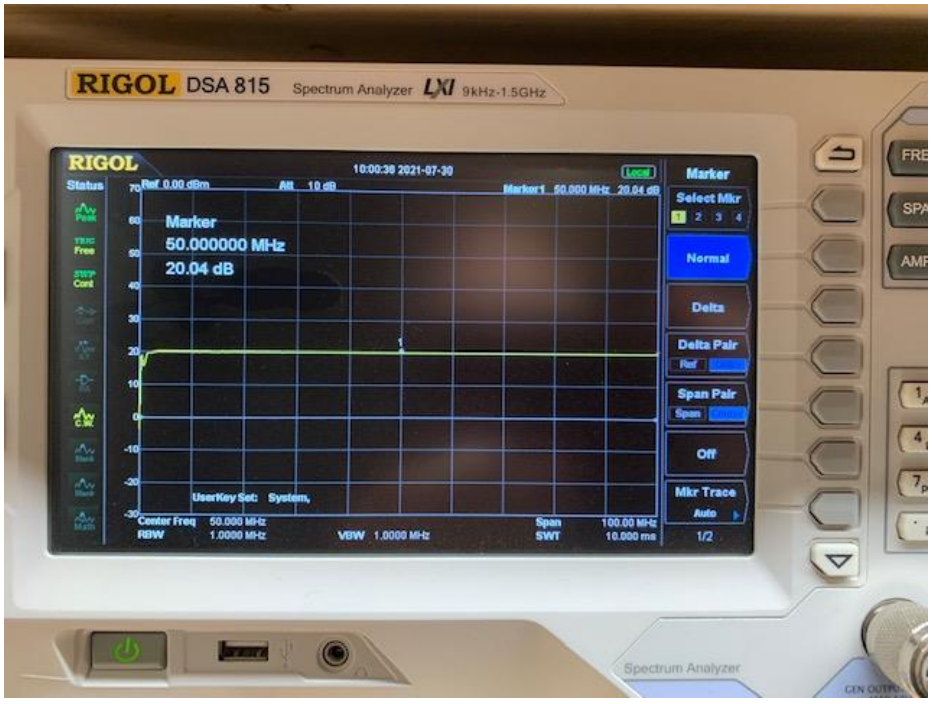
Now that looks a bit better doesn't it? You can see at the 50 mHz point where the marker is that the gain is 25.96 db. Not too shabby. Somehow the completely shielded case is interfering with the little amplifier and when you remove the cover it settles down.



Let's try one without shielding and see what happens, I thought, and here are the results. This is a completely new one running on 13.8 volts directly…



It was advertised that it was flat from 0 mHz to 2.0 gHz at 20 dBm and it certainly appears to be that. I tested it and it only dropped to 19.5 dBm at 1.5 gHz so that proved it was pretty close. I'm only interested in HF and by putting the centre frequency on the DSA 815 on 50 mHz it shows it is doing exactly what I wanted it to do. Now I just have to figure out what I need to do to get it tamed down when it's in a case. Not bad for $15 though I would say. We're on the right track as far as I'm concerned.



So why am I looking at changing from the balanced amplifier I had built? The damn thing seems to have a low level oscillation happening in it too and it shows up when you are looking at the broadcast band. It works pretty well on the HF bands and seems to have about 20 dBm gain right from 1 to 30 mHz but the anomaly shows up on the broadcast band which I know my friend will want to use it for too. Not only that it could also be a source of noise that I don't want to have

present when he is listening to HF. So that's the reasoning behind my continued search for the right solution.

I should mention again that I have only just begun to work on this antenna and have a whole bunch of things to experiment with over the coming weeks before it's complete. So far, the results are promising to say the least. So, this is the third in a series on this fascinating project so stay tuned.

73
Tom VE6ARG

Oh, I know, Working on the Loop Again?

Yup, sure am doing that alrighty. I decided that because of delays on another project that I couldn't let it get in the way of other things that need to be finished. So last night I pulled the loop antenna that I have been working on for my friend on the coast out of the pile of projects and had a hard look at it again. I connected it and it had dismal performance, so I pulled what little hair I have left out and let it coagulate on the floor with all the nuts, bolts, bits of wire, spent tie wraps, heat shrink toys for the cats, spider carcasses and other stuff that gathers there. While thinking about it I figured I'd better gather all that floor sweeping stuff up in a heap and try to stuff it into the already overflowing garbage can under my operating desk. What! Clean my shop, now wait a minute! Isn't that sacrilege or something? It only took me a few minutes so you can see how committed I was to that task. So back to the loop…

As mentioned, the performance was dismal. Why, I wondered? Then, just for fun, I took the whole thing apart and did some tests. Usually when you touch a screwdriver to an antenna input you will get some noise or at least a click. Nope - nothing there. I suppose something is amiss, I said to myself, and sure enough, what was amiss was my brain when I put the whole thing together with the RF choke, I chose. It seems the RF choke used to power the amplifier was sucking the life out of all my signals and spitting them onto the floor with all that other stuff I kept tripping over. It was either too small or wasn't passing any current. I measured it and it was definitely passing current, but something else was amiss. Just for the fun of it, because it was starting to become fun, I disconnected it from the Bias T supply and connected it directly powering it with the 12V station supply instead not using the offending choke. I jumped to life and beautiful tones came from the speaker of my rig of AM radio stations up and down the dial. Something was working and beautifully so.

As some of you might remember I am using a 10' piece of LMR-400 as the antenna element and I changed it to only use the outside braid and even better signals were

obtained. The thing simply came to life even sitting on my, now clean, floor in the shack. I tuned up to 3700 and could hear the comments of that quiet bunch of net runners and checker inner's doing their thing and once again the thing was alive and well, even while sitting on the floor in the shack. Something was working right finally, and I might be able to get it performing the way I want it to. After pasting the hair, I had pulled out back onto my skull with Gorilla glue, I put a 1:1 binocular wound transformer between the single ended input and the balanced antenna loop and it improved it even more. It also is very directional in the current configuration. This is a nice project instead of a POS as I was referring to it before.

So next week I will tell you all the other things I'm going to do to make this thing perfect in every way and I'll include some pictures too. Wish me luck.

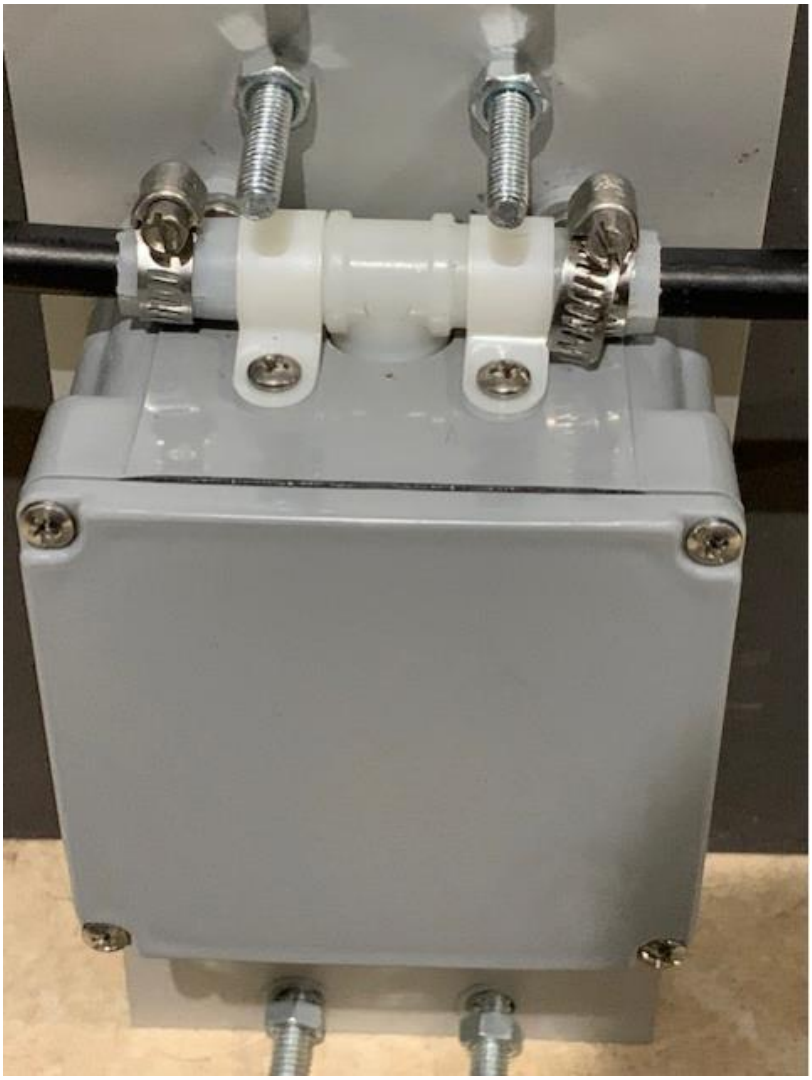
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Tom VE6ARG

The Loop is Finished at Last:



Finally, I can say the loop is ready for shipping to my friend, Terry, on the west coast. After solving all the problems with it over the last few months, I can safely say it works the way I want it to and it will serve him well from 500khz to above 30mhz. I should mention that Terry is my oldest friend (for over 55 years) is not a ham, so his interest lies with listening to shortwave and other things specifically designing and building high end receivers for HF. The fact that he is plagued with noise issues means that a conventional antenna is not something that would work well in this case. Up to this point he has no

way of being able to listen to much of anything because of that noise issue. Hence the natural ability of a small loop to reject noise and to focus reception in a particular direction by turning it is an ideal alternative. So, let's have a look at the loop…



The loop consists of a 10-foot loop of LMR-400 coax formed into a 36" loop. Because that stuff is a bit floppy it is supported at the top and bottom by a 1/2" nylon "T". The coax is simply threaded through the top "T". The bottom "T" serves as a way to feed the antenna into the 4x4x2 inch electrical box that is lined with 2" aluminum duct tape to provide shielding. The "T" is inserted into the top of the box through a hole drilled into it and it is then clamped into position with two 5/8" nylon cable clamps. In order to make a tight fit for the coax I sawed slits across the ends of the "T" so that it would tighten around the cable with small hose clamps. I then ran a 36" piece of 1/2" PVC pipe from the back plate to the top "T" and clamped it there after cutting some slits in top of the pipe so it would compress around the "T" and hold it firmly.

Everything is mounted to a pre-drilled piece of .080 anodized aluminum sheet that measures 12"x4.5". Holes were cut for 2 - 1.5" x 2.5" U-bolts that are used to hold the 1/2" PVC pipe and holes were cut for 2 - 1.75" x 3" U-bolts near the bottom of the plate to use for mounting the antenna. Not shown, and for shipping purposes, I will cut the PVC pipe in half before I ship it and put a nylon coupling in the middle and

clamp it with hose clamps. That way the whole device can be packaged in a box that doesn't encroach on the over size dimensions that Canada Post charges a LOT more for. The only connections that need weather sealing with silicon seal are the hole at the top of the box where the 1/2" fitting goes through and on the ends before putting the coax through the fitting. I simply put a coating of silicon seal around each end of the coax. Finally, the box is mounted to the back plate after drilling appropriate holes using 10-32 stainless bolts and nuts. The whole structure is light and very, very strong. It weighs 2.8 lbs in it's finished state.

Ok so let's talk about the guts of the thing. It is a single loop using the outside braid of the LMR-400 as the element. I didn't use the inside conductor in parallel because it would probably reduce the inductance by half and therefore wouldn't work well in my opinion. I don't actually know what effect that would have because I didn't try it. Anyone who builds this loop could experiment and let me know your results. I suppose it could be arranged to be two loops instead by putting them in series and that would be interesting and would double the inductance of the unit but that could reduce the maximum frequency the loop could hear so I didn't bother trying it.





The loop outside shield has some #20 insulated wire soldered to it and is fed through the nylon “T” to a 4 terminal strip that is attached at one end to the 8-32 bolt that is used to hold the cable clamp above it. The wires are fed through to a a small binocular balun with 5 turns of #26 wire on the input side and 4 turns of #26 wire on the output. That will maintain the balance of the loop without grounding one side. The balun is soldered to a terminal strip. The output side of the balun is soldered to a short piece of RG174 coax terminated in a male SMA connector and attached to the low noise amplifier (LNA) input. The LNA is mounted on a small piece of double sided Proto board that has a 7812 voltage regulator mounted on it with 1.0 mfd capacitors on the input and output and is fed through a 1.0 mH RF choke which at the other end connects to the output terminal on the board mounted SMA female connector. This effectively provides raw power to the LNA though the coax.. The output of the LNA is attached to a SO-239 via another short piece of RG174 coax through a SMA connector. The LNA is mounted to the same Proto board on small 5mm brass standoffs and the main board is mounted to the wall of the box using standoffs and bolted through the box with M3 x 5mm screws.

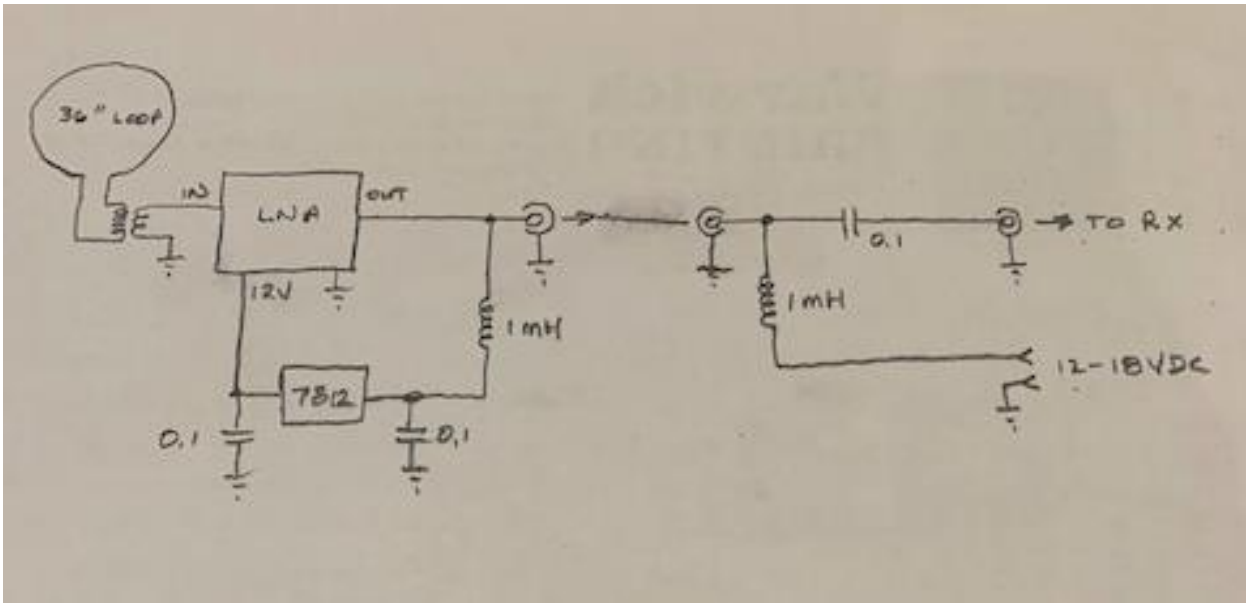
The final part of the project is the Bias “T” power that needs to be used to connect the power to the antenna through the coax feeding it. It is a simple isolated capacitively coupled connection with two bulkhead SO-239 connectors on each end and a bulkhead power connector on the RX end of the little box it all is enclosed in. The power is fed from the power socket connector to another 1.0 mH RF choke with the other end connected directly to the Antenna connector. I mounted all the parts to for the Bias T on a small cutoff of Protoboard and soldered it directly to the SO239 connectors. The transformer is a non-regulated 12V - 0.2A wall wart. It could be fed with any power source that is over 13V such as a station power supply with excellent results. Here is the parts list for those of you who want to build this amazing loop…



10’ - LMR-400 coax cable - GPS Central
1 - 4x4x2 inch electrical weather sealed box - Home Depot
1 - 4.5” x 12” .080 aluminum plate - try National Salvage or a flashing company
2 - 1/2” Nylon “T” - Home Hardware
1 - 1/2” Nylon coupling - Home Hardware
36” 1/2” PVC water pipe - Home Hardware
3 - SO-239 coax bulkhead connectors - Amazon
2 - 3/4” hose clamps - Home Hardware
3 - 1.5” hose clamps - Home Hardware
2 - 1.5” x 2.5” U-bolts - Home Hardware

2 - 2.5” x 3” U-bolts - Home Hardware
24” - Aluminum duct tape - Home Hardware
1 - 4 terminal insulated phenolic terminal strip - have no idea where it came from, but they are available through Mouser
4 - 10-32 x 1/2” SS bolts and nuts
2 - 8-32 x 1/2” SS bolts and nuts
1 - LNA 30db 0.1 to 2000MHz - Amazon
2 - SMA right angles - Amazon
2 - SMA male crimp connectors for RG174 - Amazon
10” - RG174 or RG316 coax cable - Amazon
1 - DC female 5.5 x 2.1mm bulkhead power jack - Amazon
1 - DC 12V x 0.2A power supply or equivalent with 2.1mm connector - Amazon
2 - 1mH RF chokes - Aliexpress
1 - LM7812 3 terminal regulator - Amazon
2 - 40 x 60mm proto boards - Amazon
3 - 1 mF ceramic capacitors - Amazon or Aliexpress
1 - 100 x 60 x 25mm plastic box - Amazon
12” Number 26 magnet wire - Amazon
8 - 3mm threaded brass standoffs - Amazon
Assorted insulated wire - pull some cable apart and get some hookup wire to work with

Here is the schematic for this simple project…



So that's it. It works perfectly and is sensitive and very directional. It should serve my old friend well and I look forward to hearing how he likes it. Is it as sensitive as a long wire antenna or dipole? Of course not, but for people who are stuck with extreme noise problems it solves a problem and allow you to listen to the whole HF band without having to fling things up into trees or put up towers and stuff. Put it on a simple TV antenna rotator at about 6 feet and you're away to the races. If you have any questions, just drop me a note and I will try to help.

73
Tom VE6ARG