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Ozark QRP BANNER

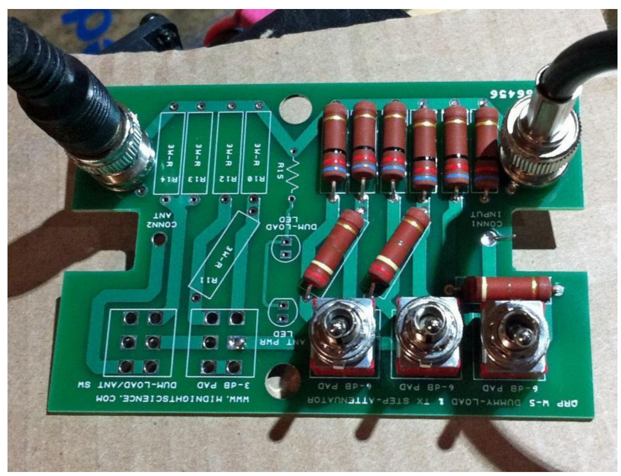
Index

Noise Reduction in the Shack, Part I

By Phil, WØXI

I recently worked MDØCCE (Isle of Man, UK) and JW7QIA (Svalvard on the Arctic Circle) on 17 meters. Both stations were weak but readable.

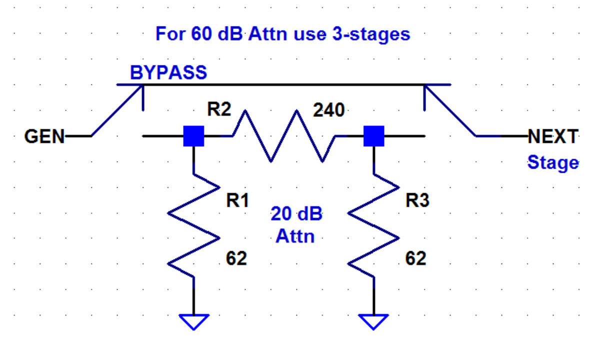
That got me to thinking – along with the usual increase in summer noise on the bands – that I need to try to reduce the noise level at my station on 40 through 10 meters as much as possible. And after reading an article on S-meters (1), I decided to check the calibration and operation of the meter on my Yeasu FT450D. This Part I covers the meter check.



As you may recall, the International Amateur Radio Union (IARU), in 1981, redefined an S9 reading to be 50 micro-volts. In addition each S unit below that should indicate a reduction in signal strength of 6 dB (half the signal voltage). Above S9 most meters mark off increases of +20 dB in signal strength. Common on many rigs and my Yeasu FT450D as well, in order to view S readings one must turn the RF gain fully clockwise, i.e. give the receiver its full gain. A casual check with my FT450D and vertical SteppIR antenna on each band, indicated noise levels of between S1 and S6 or so from 15 through 40 meters respectively. This increase of noise level with a decrease in frequency is expected, in part due to the fact that galactic (space) noise diminishes with frequency. The variable in the mix is noise due to storms in the troposphere (atmosphere). I expect that the averages above will decrease as our winter season returns. An aside, I ran across an interesting fact in surfing the internet on radio noise: there are 8 million lightning strikes to the ground on earth per day! Noise level averages vary by area too: industrial, urban, country side.

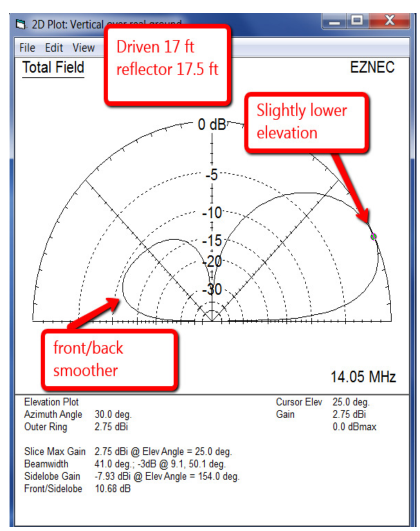
Does that mean I'll have to operate with remote antennas out in the county? Hm.

In order to check how close my FT450D S-meter was to the standard, I decided to use my BK-4017B signal generator and partial step attenuator PCB, shown in pictures 1 and 2. I needed the attenuator because my generator has a limited range at its output jack, 10V down to 10 mV. To reach the 50 uV range I needed three 20 dB attenuators in series. Picture 3 displays the schematic for one section. Each stage presents a 50 ohm input and output plus a voltage reduction of ten to 1. The 50 uV signal mentioned above for S9 is, of course, an RMS value. Hence, I needed a peak-to-peak sine wave from the generator of 141 mv followed by three 20 dB attenuators to produce 50 uV RMS at the input to my FT450D antenna jack.



Once the signal was applied, I was happy to see that the S-meter reported just under S9, as noted in Picture 4 at upper left. Since my generator is limited to a max frequency of 10 MHz, I only checked how the meter did on 3.550, 7.050 and 10.0 MHz. I was happy to find that the readings were right at S9 for these bands. In order to reach the S9 level, it was necessary to tune the RX to the frequency of the generator. The meter reading peaks about the same was when I tune in a CW signal. Although there might be a pot somewhere inside the FT450D that allows for adjustment of the S-Meter, I didn't see anything about that in the manual.

My final check was to flip each section of the step attenuator off, one at a time, to see what the meter reported. It turned out that each step added a bit more than the 20 dB anticipated. In turning off one switch, the S-meter reported a bit more than 25 dB; switching off another and the meter indicated about 45 dB; and finally, with all switches off, the meter reported a level just above 60 dB. So it seems that the scale between S9 and S9 + 20 dB is not quite linear. However, I was pleased with the meter reports overall. One last note. Most S-meters are connected at the IF strip of your radio. For this configuration, your S-meter should not move



on a given band when you vary your audio volume.

Next Steps? Even though I live on a relatively small city lot, I am thinking about adding a movable antenna reflector element from one ground stand to another around the yard. If I stick a pole in the west stand, my SteppIR vertical should give me gain to the east and reduce noise from the west. If I stick the pole southeast, then I'll be able to hear more from ND and SD and hear less from FL. Hm. I've got the pole so it's just a matter of trying it and comparing the S-meter readings. Picture 5 displays my EZNEC simulation of the vertical antenna pattern with the added reflector. Noise and signals from the back side should be reduced. The pattern from the front has a beam width of about 60 degrees with a 30 degree Azimuth launch. So, there should be a slight reduction in noise and an increase in signal gain.

72, WØXI

References:

(1) S-meters: g4fkh.co.uk/wp-content/uploads/**2012**/07/**August**-**2012**-**RadCom**.pdf

Second Sunday Sprint

SSS

July 13th ..watch the 4sqrp reflector

A Simple Code Speedometer

Bill Dekle – KV6Z

The device described here was developed primarily as an aid for code practice. I'm currently trying to improve my straight key speed and use it to monitor my progress. It could also be used to calibrate the speed control knob on rigs that have them, and to monitor the speed of other CW stations.

Code speed is an elusive parameter to measure. What, exactly, constitutes a 'word', and what should the timing relationship be for dits, dahs, intra- and inter- character spaces, and for word spacing? If everyone used 'standard' timing, and "PARIS" was the only word they ever sent, it would be an easy matter to divide 1200 by the time (in milliseconds) of a 'dit' or an intracharacter space in order to determine the speed in words-per-minute. Neither of those conditions are likely to occur and, as a result, a wide variety of timing variations exist.

I'm not going to attempt to describe all the code timing schemes in current use. Footnote 1 is a great primer on the subject and it describes one of the more common timing deviations. In addition to the type of timing scheme exemplified in the footnote, there are other sources of timing variations. Many electronic keyers allow variable 'weight' settings that alter the timing, and there are the timing variations that can occur with bugs and straight keying. With all the opportunities for timing variations, a scheme that uses a measurement of 'dit' time to indicate code speed did not seem like a reasonable approach.

It occurred to me, however, that no matter how badly distorted the character and word spacing can get, there was one parameter that all code timing schemes had in common: if a given sample of text is sent in a specified amount of time, <u>any</u> timing scheme will produce the same number of rf pulses in that amount of time. The circuit described here takes advantage of that fact to measure and display code speed. The block diagram is shown below and the schematic is shown in Figure 2.

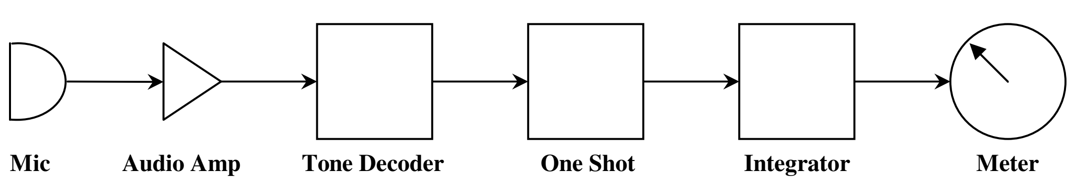


Figure 1. Code Speedometer Block Diagram.

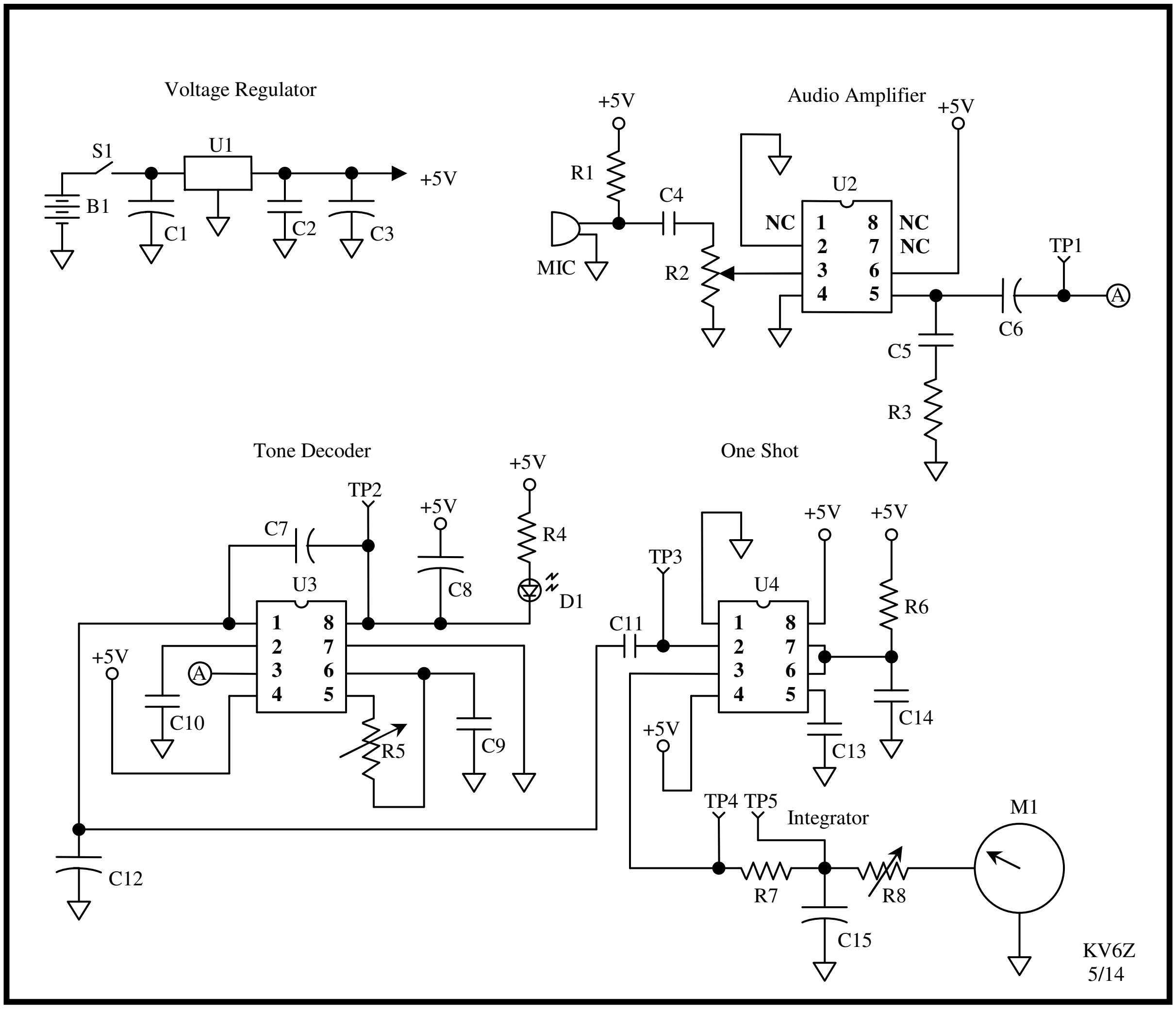
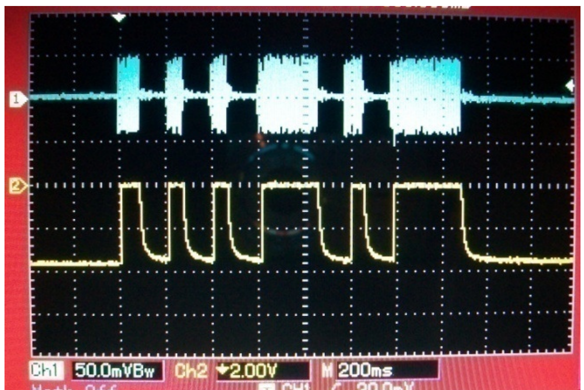


Figure 2. Code Speedometer Schematic.

S1	SPST Toggle	C1	1 µf electrolytic	C12	0.4 µf
B1	9V	C2	0.01 µf	C13	0.01 µf
D1	LED	C3	33 µf electrolytic	C14	0.1 µf
R1	10 kΩ	C4	0.1 µf	C15	1000 µf electrolytic
R2	10 kΩ pot	C5	0.047 µf	MIC	electret
R3	10 Ω	C6	10 µf electrolytic	M1	50 µa panel meter
R4	1.2 kΩ	C7	1 µf electrolytic	U1	78L05
R5	20 kΩ pot	C8	6.8 µf electrolytic	U2	LM386
R6	270 kΩ	C9	0.2 µf	U3	LM567
R7	10 kΩ	C10	0.2 µf	U4	NE555
R8*	20 kΩ pc trim pot	C11	0.01 µf		* - See Text

Figure 3. Parts List.

At low to moderate listening levels, the microphone output by itself isn't quite enough to satisfy the audio input requirement of the tone decoder. A 386 audio amp set for a gain of 20 easily provided the required audio. The tone decoder produces a negative-going pulse at pin 8 for the duration of the audio as long as the amplitude and frequency input requirements are met. Figure 4 shows the audio input for my hand keyed "SK" on channel 1 and the pulse output of the tone decoder on Channel 2 (inverted for clarity). In order to provide the integrator with a fixed-width pulse for every negative edge of the tone decoder, I used a 555 timer in the monostable mode. I wanted the 555 output pulse as long as possible but not so long as to overrun the next code element at fast speeds so I set the 555 output to 40 ms. Since the 555 trigger must be shorter than the output pulse, I used the output from pin 1 of the tone decoder as a trigger. The 555 trigger is shown in channel 2 of Figure 5 along with the tone decoder output for reference.



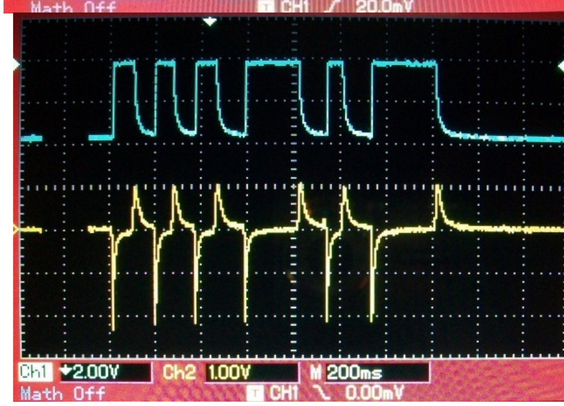


Figure 4. "SK" at TP1 and TP2.

Figure 5. "SK" at TP2 and TP3.

Figure 6 shows the constant amplitude/constant width output pulses of the 555 on channel 2 and the trigger is shown again on channel 1. The integrator charges when it receives a pulse from the one-shot and discharges when no pulse is present. Since the meter indicates the level of charge on the integrator, its deflection is an indicator of the frequency of cw pulses and, hence, code speed. Figure 7 shows my hand keying in channel 1 at TP2 of the word "Paris" (sent twice), and channel 2 shows the charge on the integrator at TP5. Note that for the RC values chosen, the integrator charge is reasonably level after only 5 characters are sent.

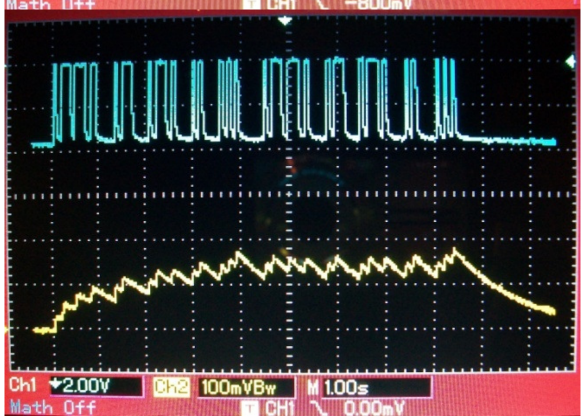


Figure 6. "SK" at TP3 and TP4.

Figure 7. Integrator voltage at TP5.

I used a Hydrogen Peroxide/Muriatic Acid solution to etch the circuit board shown in Figures 8 and 9. The finished project is shown in Figure 10.

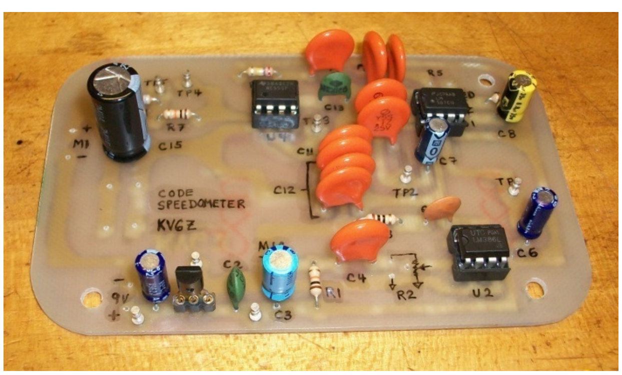


Figure 8. Circuit Board Top

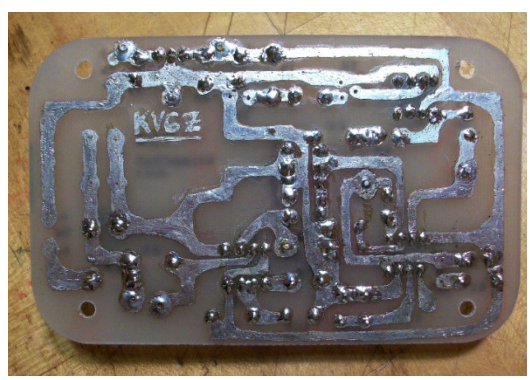


Figure 9. Circuit Board Bottom.

Using the Code Speedometer is straightforward. Place the microphone near the speaker and adjust the "SYNC LOCK" control R5 so that the PLL portion of the tone decoder achieves phase lock and the LED pulses in step with the code audio. Tuning is not difficult but it is important that the LED is exactly in step with the audio with no drop out, so watch it closely. Set the "AUDIO GAIN" control R2 just high enough for reliable triggering but not so high as to cause noise-induced false triggering.

Calibration is accomplished by setting the pc trim pot R8 for the desired meter deflection at a known code speed. I used W1AW code practice transmissions and set the meter for about 50% deflection at 18 WPM. At this point, I measured the resistance of R8 and replaced it with a fixed resistor of the same value (8.2 kΩ in my case) before I returned to the code practice audio and noted the meter Figure 10. Final Assembly readings at other speeds so I could make a custom meter scale marked in WPM. Although the inertia of the meter movement contributes toward a steady reading, you'll have to compromise between response time and a rock-steady needle. Experiment with the values of R7 and C15 until you are satisfied with the meter response.

The Code Speedometer draws about 15 ma with no signal and about 21 ma when the LED is lit so the battery should last a reasonable amount of time with intermittent use. Modifications that could be considered include adding an external dc power source or adding an auxiliary audio input jack for use when headphones are used.

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1. Bloom, Jon. "A Standard for Morse Timing Using the Farnsworth Technique." *QEX* Apr 1990: 8-9.

Thursday mornings ~ 8 to 8:30am
A gathering of CW ops are having fun on
7.122 MHz
....and you are invited!

Field Day, by David Cripe – NMØS

This year, Field Day happened to coincide with a Cub Scout Overnight program at our local scout camp, which presented a perfect opportunity to demonstrate and promote Ham Radio to the next generation of operators. Using some good old Boy Scout skills, we used a bow fishing rig to loft a line over some convenient trees, and pulled the 40M dipole to treetop level. Rig used was an ancient TenTec Triton IV operating from a car battery, with a solar panel to supplement. We operated SSB primarily in 40M and 20M, but also brought a laptop with Fldigi to run CW and display the received text.

To help promote the hobby, we also had a table set up with literature, 4SQRP kits and other projects. We included a bug and straight key connected to a CPO for a hands-on activity.

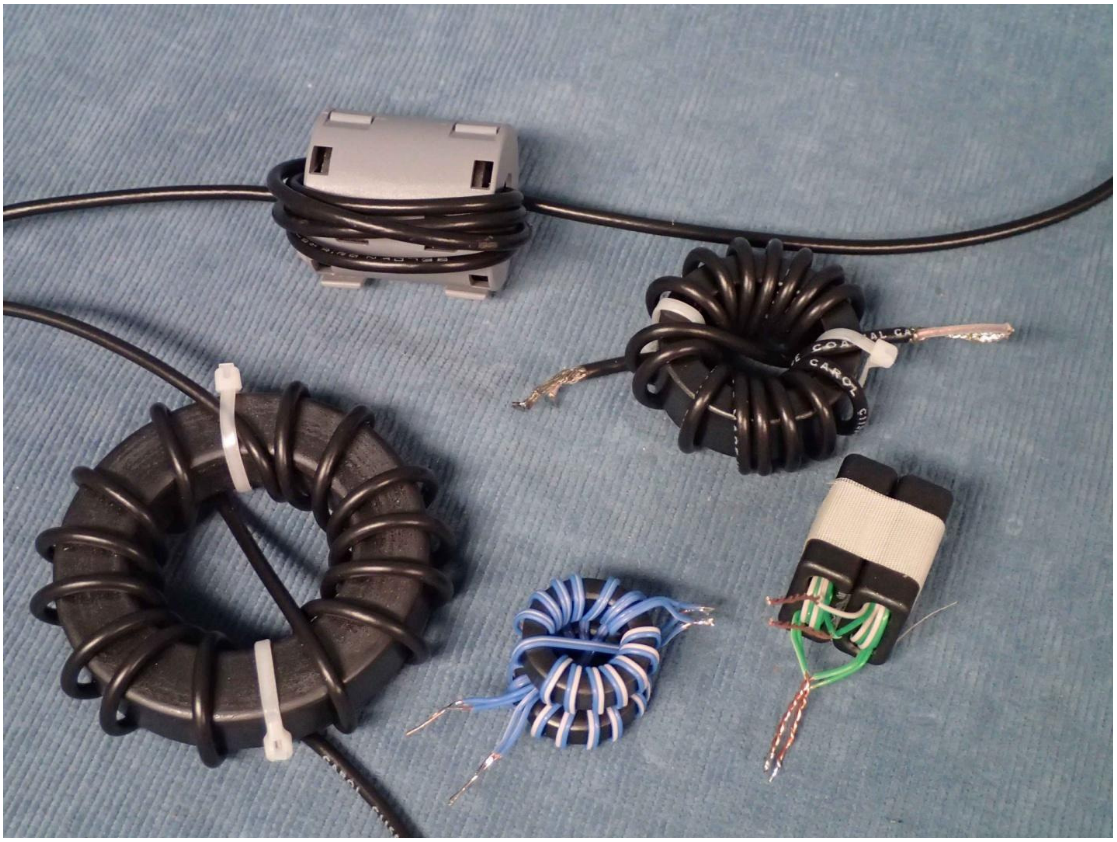
A steady stream of elementary and middle-school-aged boys and their parents kept us busy answering questions most of the afternoon. The kids were pretty interested in the radio kits and projects, and thought it was cool that archery had another use besides shooting at targets.

All in all it was a brief operation, tearing down after 5:00 PM for other obligations, but it was a great opportunity to promote the hobby.

73 Dave NM0S

A TEST SUMMARY OF FIVE CHOKE BALUNS

Larry Naumann - NØSA



I like to use 1:1 choke baluns on most of my antennas to cut down on feed line radiation which is caused by induced currents on the outside of the coax shield. If you do a web search for baluns designed for Ham radio use you will find tons of drawings and ideas. May of which are not very good designs. After reading a lot on the subject I decided to do a little testing for myself. I stuck with the designs that I thought would yield the best results. I used a scalar network analyzer to determine the insertion losses involved with each design and I used my Sark110 antenna analyzer to determine the SWR and Zmag for a match situation. Then I used the Sark110 to test for choking Zmag. Some of the results were a bit surprising.

Here are the five designs that I tested.

#1; FT225-43 ferrite core with 14 turns of RG174 coax

#2;   FT130-43 ferrite core with 14 turns of RG174 coax

#3;   Snap on ferrite core with 6 turns of RG174 coax. This is your standard large ferrite snap on and is   probably a #43 mix.

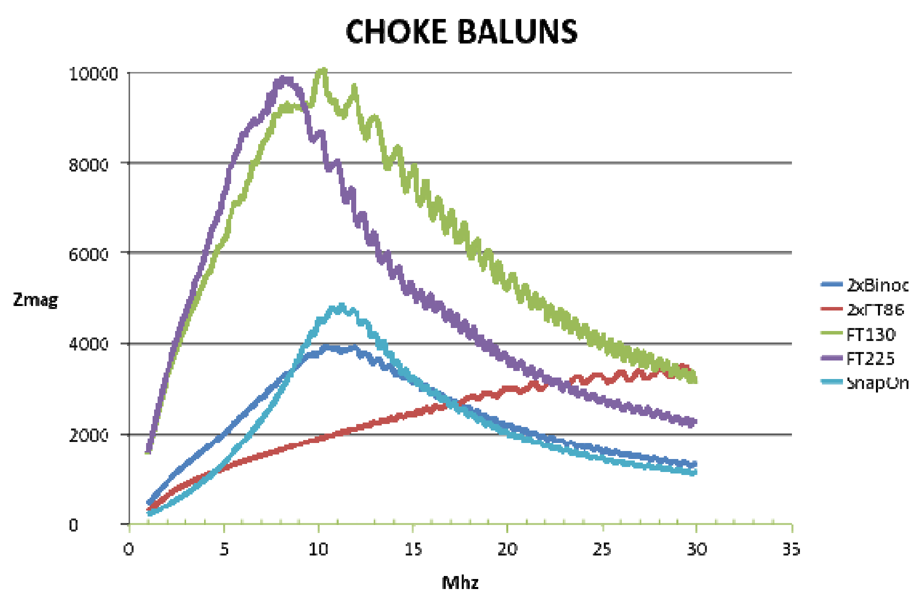
#4;   2x FT86-43 ferrite cores with 14 turns in each core using a molded CAT5 pair. This differs from most CAT5 cable in the fact that the two wires are molded together like a tiny zip cord. The two sets of windings are connected in parallel because CAT5 pairs have a 100 ohm impedance, so connected in parallel they give a good match to 50 ohms.

#5;   Two 43 mix binocular cores with 5 turns of CAT5 on each core. Wired in parallel for the same reason as design #4.

I tested all 5 for matched insertion loss and they all did very well in this category, all were under .3 dB for losses from 1 to 30 Mhz.

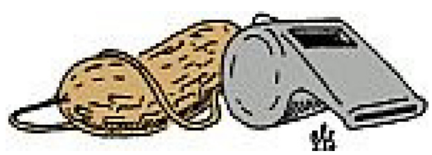
I then tested for SWR from 1 to 30 Mhz with a 50 ohm load connected. They all did well in this category with a worse case match at 30 Mhz of no more than 1.4:1.

Now I tested each design for choking impedance from 1 to 30 mhz. The higher this number the better it will choke off or cut down on induced currents on the outside of the shield. Years ago a lot of literature stated that 500 ohms was a good benchmark but lately the literature is leaning towards 5000 ohms as a good benchmark for choking impedance. Below is a chart of the five chokes that shows the actual choking impedance called Zmag.



From the graph it is easy to see which ones work best. The two large ferrites with the RG174 do a very good job. I expected better from the 2xFT86 design but it came in last in the testing. The surprise for me was the snap on ferrite with only six turns of RG174. It does a decent job for the 40, 30 and 20 meter bands. Not quite 5000 ohms but still a very nice choke, if you try hard you may be able to get 2 to 3 more turns in one for even better performance. The binocular cores do a pretty good job and they make a small package. If size was a concern I would go with the two binocular core design. The FT130 design is a good performer and not real big.
I hope this information will help you make your next choke decision a bit more informed. I found it very interesting and it answered a lot of questions I have had for awhile.

....a very special thanks to Larry – NØSA and Keith – KCØPP editor of the St. Louis QRP Society, "Peanut Whistle" for allowing the Ozark QRP Banner to re-print this excellent article.



Four State QRP Group

is meeting at the Country Cupboard Restaurant in downtown Seneca, Mo. This is one of the locations that 4SQRP folks gather.

The Country Cupboard has a nice menu and they have a separate meeting room we can use.

The Country Cupboard restaurant is located in the first block north of the blinker light in downtown Seneca. From Barney's, head north on Cherokee Street (that's the main street of town). Go across the railroad tracks and keep going past the blinker light stop.
The restaurant is located at 1038 Cherokee street, on the west side of the street.

Caution: If you are headed north, do not make a left "J turn" into a parking spot. "J turns" are illegal in the downtown area. Keep going north past the restaurant till you reach the residential area north of downtown where a "U turn" is permitted. Make a U turn there (it's a wide street) and come back to the parking in front of the restaurant.

Our group is an informal organization with no officers, no rules, no dues or any other things to get in the way of having fun with QRP. **We get-together monthly for lunch and the sharing of ideas and information, parts swapping and just plain fun on our normal third Saturday of a month.**

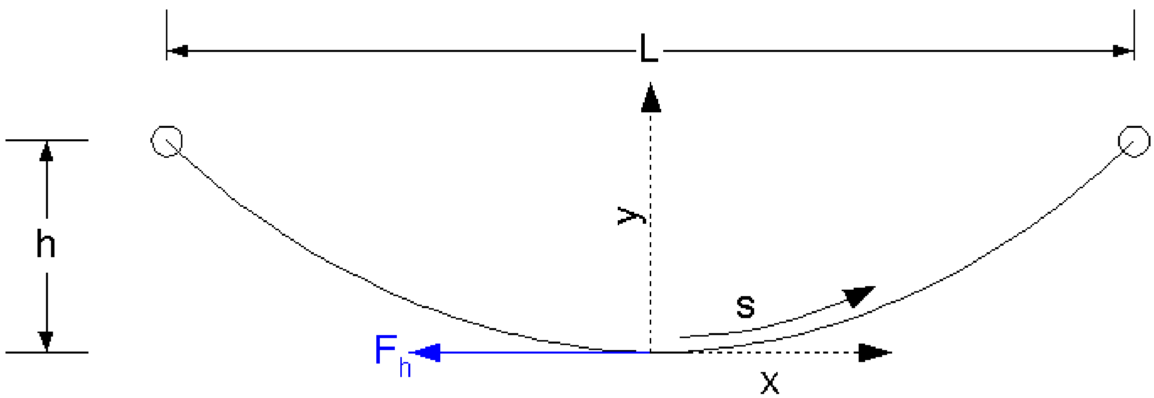
All ham radio amateurs (or prospective hams) are invited to participate.

Catenary Curves

By Jim – W6RMK

The catenary is the shape that a free hanging flexible cable or wire assumes. The following gives equations for the case where the wire is of uniform mass per unit length, and the supporting points are at the same height. Cases where the ends are not at the same height, or where there are point loads (i.e. dipole antennas supported at ends with a feedline hanging in the middle), can also be calculated, but these equations won't do it. (They are "left as an exercise for the reader"...<grin>)

The picture below defines some terminology and the reference points.



We assume that the origin is at the center of the span.

Total span = L
Sag in the cable = h
So, the coordinates of the endpoints are (+/- L/2,h).

The weight per unit length = w

Total length of wire/cable = S

Length along the cable from the origin = s

Fh is the horizontal force component everywhere, and is equal to half the tension at the center.

Equations

The horizontal force, in terms of total cable length and sag is

$Fh = w / (8*h) * (S^2 - 4*h^2)$

The y coordinate (height) of any point in terms of the horizontal force

$y= Fh / w * (\cosh(w * x / Fh) - 1)$

(Change suggested by Stephen Argles, 24 Nov 2003)

The span, given horizontal force, weight, and length of cable

$L = (2 * Fh / w) * \text{arcsinh}(S * w / (2 * Fh))$

The total cable length, given span and horizontal force (useful for computing how long a span can be supported)

$S = (2 * Fh / w) * \sinh(w * L / (2 * Fh))$

The arc length from origin (center):

$s = Fh / w * \sinh(w * x / Fh)$

Tension

It's also useful to know the peak tension in the cable, which occurs at the end points. The Vertical force at support is

$Fv = w * S / 2$,

i.e. the total weight of the cable divided by two. And, the Horizontal force, computed above, is Fh. So the tension is simply the combination of the two:

$T^2 = Fh^2 + (w * S / 2)^2$

The minimum tension is, of course, Fh, at the center point where the cable doesn't support any of it's own weight. If you need the tension in between, you just need to compute the vertical force at a given point, which is equal to the weight of the cable from that point to the center (*i.e.* s*w).

Unequal supports (approximate)

Some equations assuming that the cable forms a parabola (generally a good approximation if the sag is not too great) taken from the Reference Data for Radio Engineers book:

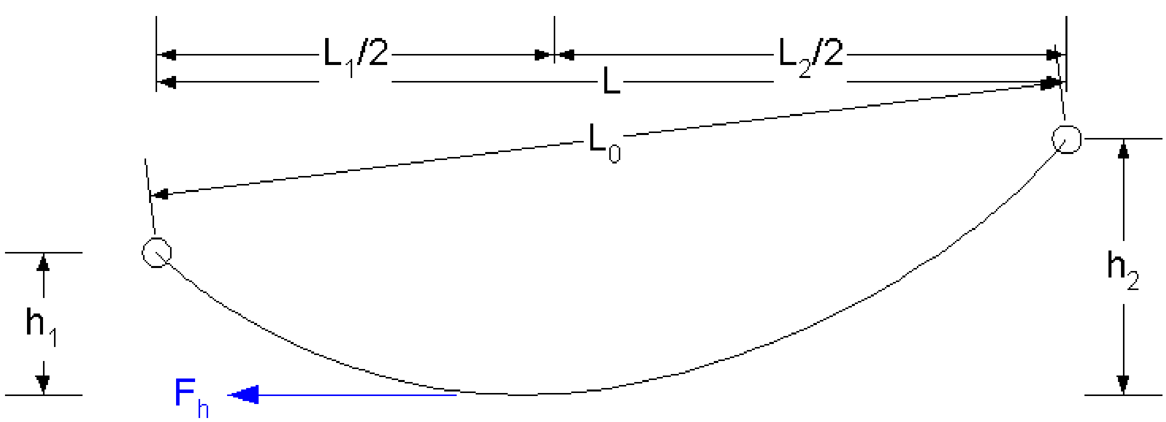
Two supports, 1 and 2, at heights h1 and h2, respectively
The low point is L1/2 from the lower support and L2/2 from the higher support.
L0 is the distance between the supports in a straight line
L is the distance between the supports in a horizontal distance
S is the total cable length
w is the weight per unit length
T is the tension in a straight line parallel to the line between supports
Fh is the horizontal component of the tension
alpha is the angle above the horizontal from support 1 to support 2

h = h0 = w*L0^2*cos(alpha)/(8*T)

h1 = w*L1^2/(8*Fh)
h2 = w*L2^2/(8*Fh)

L1/2 = L/2 - ((h2-h1)*Fh*cos(alpha)/(w*L))
L2/2 = L/2 + ((h2-h1)*Fh*cos(alpha)/(w*L))

S = L + 4/3 *(h1^2/L1 + h2^2/L2)



Some worked examples

Assume a 40 meter dipole, supported in three points, center and the two ends, made of AWG#12 copper wire. The actual "leg length" is only 10 meters nominally, and we want to allow no more than 10 cm (4") of sag. Will the wire fail?

Looking up copper wire in the tables: AWG 12 is 2.05 mm in diameter, and weighs 29.4 kg/km, with an area of 3.309 sq mm. The breaking strength of the wire is 337 pounds for hard drawn (65.7 kips), Medium hard drawn 51kips, 261.6lb, soft 38.5kips, 197.5lb. Copper clad steel is much stronger at 711 or 770 pounds for 40% and 30% copper respectively.

Calculating: Fh = 36 N; The span will be 9.997 meters; The tension is 37.03N, for a stress of 10.9 MPa. This is well below the failure loads for copper wire, even soft annealed.

Excel spreadsheet

An excel spreadsheet with the equations for the equal support height case and adding in wind forces can be found here.

Wind loads are added to the gravity load; worst case.. normally, they'd act at right angles, so you could take the square root of the sum of the squares. The load is calculated by assuming a Cd of 1.2 (typical for round cylinders at these Reynolds numbers)

References:

http://www.du.edu/~jcalvert/math/catenary.htm

radio/math/catenary.htm - 24 Nov 2003 - Jim Lux
(changed to update formula for y coordinate, based on email from Stephen Argles)
(math home page) (radio home page) (Jim's home page)

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Dan - KB6NU's Column

New hams are different

By Dan Romanchik, KB6NU

This is going to be a bit of a ramble, but I need to get some thoughts down about new hams, and maybe get some feedback on these ideas from both new hams and guys that have been around for a while.

Recently, I visited the All Hands Active (AHA) makerspace here in Ann Arbor. Several of the "makers" that use this space have recently gotten their ham licenses—-most of them in one of my one-day Tech classes. I was down there trying to get them interested in attending Field Day, and in particular, in operating the GOTA station.

There were four of us sitting around, talking about amateur radio, the projects they were working on, Field Day, and other stuff. In the past, they had also expressed an interest in doing something with WA2HOM, our station at the Ann Arbor Hands-On Museum. While it was a great discussion, it was apparent to me that it was going to be difficult to get them out for Field.

It dawned on me that these new radio amateurs were just not interested in the “old” amateur radio. Sitting in front of shortwave radios and exchanging fake signal reports with other guys sitting in front of shortwave radios is just not their idea of a good time. I think that if you take a step back and try to look at it through their eyes, you’ll see where they’re coming from.

What are they interested in? Well, one guy is having a blast playing around with RTL SDR dongles. He’s also trying to figure out a way to rig up wireless link to light a light at bus stops around his house when a bus is approaching. Another is working on a Hinternet-type project. I helped him out a little bit last summer setting up a wireless node at his house.

This is perhaps one reason why there are so many more licensed radio amateurs these days, but yet there seems to be less activity on the HF bands these days. HF is just not where it’s at for these new guys.

One consequence of this is that the old amateur radio clubs don’t have much to offer the new guys. In fact, one of them told me that the one time that he attended the local club meeting, he got such a hostile response that he decided not to return.

I’m finding this all quite interesting. I do intend to pursue some kind of joint activities between the All Hands Active maker group and WA2HOM and see where that goes. They may not be interested in working DX on 20m, but they do seem to be interested in the IRLP node that we’re in the process of installing there.

I’m not sure where this is all headed, but what I do know is that these folks have a lot of energy and creativity. If we can couple that with our knowledge and experience, then I think that we’ll be a good fit for one another. It’s going to take open minds all around, though.

I'm really interested in hearing from all of you about this. Have your clubs made contact with the

"makers" in your area? Do any of them have ham radio licenses? Are there any interesting ham radio/maker projects going on in your area?
===
When he's not thinking about the future of amateur radio, Dan, KB6NU enjoys working CW on the HF bands, teaching amateur radio classes, and building kits. For more information about his operating activities and his "No-Nonsense" series of amateur radio license study guides, go to KB6NU.Com or e-mail cwgeek@kb6nu.com.

Can't Be DONE !?! ......heh...heh,

(oh yeah, it CAN!!!!!!!!)

The 4SQRP Group will reach **1000** members on March 13, 2015.
What's your guess? ...... via Bill – KV6Z

I'm up for a good challenge to get me going.
Lets use this a new club goal to invite all the new members we can between now and next March and Beat this number!
Why not be optimistic?
I'm In, any one else?
Lets roll , via Johnny ACØBQ

Wow wouldn't that be great!! I think it will take an effort by all to invite folks to join. Just an email will do it, there's an example email in the Groups files sections, and it's also reproduced below. Lets all invite prospective members and watch the growth skyrocket. , via Terry - WAØITP

Hello xxxx, tnx for the QSO,
or "good to see you in the Fox Hunt, net, on the air " etc.

We're growing the Four State QRP Group, and this is an invitation to join. We are a group of nearly 800 QRP minded hams who are active in QRP operating and building (and designing!), our web home is here:

http://www.4sqrp.com/index.php

There are no costs of any kind associated with membership. All that's required to join is to sign up for our email reflector:

http://www.4sqrp.com/reflsub.php

The reflector is mannerly and not as busy as some, so it won't clog your inbox. We're happy to report that the organization is healthy and growing steadily.

We provide kits to the QRP community in order to finance an annual conference, OzarkCon,

http://www.ozarkcon.com/index.php.

I like to say that it's the premier QRP conference in the Central time zone.

We have "comfortable" nets each Wednesday night, all are welcome so please feel free to check in, we'd like to hear from you. In our case "comfortable" means not high speed but your speed, and no strict net protocol. Just check in and say hello. Net reminders are posted on the reflector each Wednesday, and after the nets, a list of check-ins is posted on the reflector.

Please check us out, we hope to see you on the membership list and meet you on the nets soon.

Thank you for your consideration.

Sincerely,

The Four State QRP Comfortable nets meet each Wednesday night beginning at 7:30 PM CDT, 0030z.

Note: on Nov 6 we'll be on CST.

If we have to QSY, I like to move up, Wayne likes to move down, and Dick doesn't have to move much at all.

Add anything to the exchange that you wish, temp rig, ant, etc. Checking into all sessions is encouraged.

7:30 CDT 0030z ... 40M CW Net on 7122, KCØPMH NCS
8:00 CDT 0100z ... 80M CW Net on 3564, WAØITP NCS.
8:30 CDT 0130z ... 40M CW Net on 7122, KCØPMH NCS
9:00 CDT 0200z ... 80M PSK Net on 3580.5, NØTGR

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