Mt. AIRY V.H.F. RADIO CLUB, INC.

CHEESE BITS

W3CCX
CLUB MEMORIAL CALL

ARRL Affiliated Club

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PREZ SEZ:

May is now upon us and it's time for the 62nd Dayton Hamvention, a great way to see what's going on with Ham radio and see friends from around the country. It's also time for great weather and planning those antenna projects. We've had such a hard winter that antenna work has been far from our minds, and rightly so; but now the weather makes one start to think about new antennas and towers. What new projects are stirring around in your mind?

We had a great April ARRL night with Ed Hare, W1RFI coming to talk about what goes on in the Laboratory at the League. We so appreciate that the League provides us with top notch presentations. Ed will be sending their interference gear along with a presenter to our September Conference.
Last month was conference month for me, with two conferences two weeks apart. First the NEWS conference was attended by 8 packrats comprising 10 percent of the conference attendees, nice showing. The theme was SSPA's and all that goes into their care and feeding; they even had a special Friday afternoon session dedicated to this topic. It's always nice to meet with our Northeastern neighbors.

Then it was nice to meet with our Southern neighbors at the Southeastern VHF Society Conference which was held this year in Atlanta. It was a convenient stopping point on the way to our vacation in Myrtle Beach. Nice to see an antenna range going again, seems we don't do this up North any more and I'm not sure why. They also had the usual high tech gear for checking equipment. It was provided by Agilent.

One of the more interesting discussions was talk about how to attract more hams, and especially to our slice of the hobby. We've been going to local clubs on our own initiative, but what came out of this conference was an initiative to create some new (hopefully dynamic) presentation materials that show the fun surrounding our sphere of the hobby: weak signal contacts.

Promoting our Weak Signal message is also the theme of the booth that we will be sponsoring during the upcoming ARRL Centennial celebration Conference that is being held in July. I encourage many of you to take time between Thursday the 17th and Saturday the 19th of July to come to Hartford and celebrate 100 years of the National organization that represents our interests to the rest of the country and the world. There will be many opportunities to visit headquarters and W1AW. When have you visited the League? While there, help us man the Weak Signal booth that we are jointly sponsoring along with many other groups around the country. I already know of five members joining in the celebration, lets double that number.

When you get back from Dayton you have one month to prepare for June. The ARRL June VHF Contest is held at Big Pocono State Park for our club. This is a great opportunity to experience VHF/

Pack Rats **CHEESE BITS** is a monthly publication of the **Mt. AIRY VHF RADIO CLUB, INC. –**Abington, PA.

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50.080 144.284 222.064 432.286 903.072 1296.245 MHz
2304.043 3456.207 5763.196 10,368.062 MHz (as of 1/08)

MONDAY NIGHT NETS

TIME	FREQUENCY	NET CONTROL
7:30 PM	50.145 MHz	K3EOD FM29ll WA3QPX FM29di
8:00 PM	144.150 MHz	N3ITT FN20kl
8:30 PM	222.125 MHz	KB1JEY FN20je
8:30 PM	224.58R MHz	W3GXB FN20jm
9:00 PM	432.110 MHz	WB2RVX FM29mt
9:30 PM	1296.100 MHz	K3TUF FN10we
10:00 PM	903.100 MHz	WA3SRU FN20le

Visit the Mt Airy VHF Radio Club at: www.packratvhf.com or www.w3ccx.com

UHF/uW weak signal work from one of the best locations in our area. It's only a short drive (you would go there to ski) and you can be a real asset to the club. We set up on Friday arriving at noon in Tannersville. Then we will set up five towers and put all our gear in two large trucks used as operating positions. We operate the contest from 2 PM on Saturday until 11 PM on Sunday. Monday morning we get up and tear down ending up at our starting location to unload. **Here is where we can use help even if you don't attend at the mountain.** Let us know you will help.

The May meeting is going to be all about the DVB-T Dongle for VHF/UHF listening. For those of you not attending Dayton, this will be an interesting presentation.

Also, it's not too early to prepare for our Mid Atlantic VHF Conference in September, make sure you are clear for the 26th through the 28th and; lets work on lots of bands.

Phil K3TUF

PA DESIGN PRIMER + 2 METER EXAMPLE

PART 1

de: KB3XG

Introduction:
Push pull amplifiers have been around almost since the dawn of radio. I have been in the push pull solid state power amplifier business for over 30 years and learned just about everything I know from my 1st boss and one of the original Pack Rat founding Fathers Al, W3RZU. The electrical design on paper is relatively simple. The schematic of one power amplifier looks the same as another. On the other hand there are other issues that require close attention or the result will be a bright flash of light and a small pile of melted silicon. If you understand the "important" design issues that are not made clear in textbooks, magazine articles, and application notes, the average ham can homebrew a PA for basically the cost of the devices.

Push Pull Advantages:
The advantages of a push pull circuit over a single ended circuit are 2nd harmonic cancellation, increased efficiency, reduction in cap values needed for the impedance transformation, and improved thermal performance.

1) In theory the 2nd harmonic will be cancelled completely since the devices are operating differentially. In practice -30 dBc of 2nd harmonic cancellation can be expected. This puts less stress on the high power low pass filter. i.e. It's easier to filter out the 3rd harmonic.

2) A push pull circuit increases the efficiency since only one device is being driven at a time. This gives the device that is not being driven a chance to cool off. This is most noticeable in a class-B amplifier. For communications, the amplifier will be operated in class-AB so a 10 to 15% increase in efficiency can be expected.

3) Because the transistors are being operated differentially the voltage across the drains will be 2V compared to a single ended circuit. 2V means that the value of the caps across the lines will be half the value of a cap in an equivalent single ended PA. Half the cap value means that the cap will pass half the current and dissipate half the power.

4) The thermal load of a push pull circuit on a heat sink is half what an equivalent single ended circuit would be since the same amount of heat is shared between two devices.

Load Line Calculations:
My initial design starting point is calculating what balanced impedance is required at the drains for a desired output power. It's a simple algebraic equation that I call W3RZU's (Ohms) law for push pull PA's.

$$Pout = \frac{2 \times \text{drain volts}^2}{\text{Drain-Drain impedance}}$$

A few calculations for a 50 volt device are shown in Table 1. Subtract about 10% of the power supply voltage for this calculation since the FET's can never drive down to zero volts. Line 4 of Table 1 says that you need a balanced impedance of 4 Ohms across the 2 drains or 2 Ohms for each FET. You could arrive at an impedance matching circuit using a combination of lumped caps, inductors, and microstrip lines but the impedance is low making the "Q" of the matching circuit high. This will result in a hard to tune and most probably an unstable circuit.

Vdd	ratio x:1	drain-drain	each side	Pout
45	1	50.0	25.00	81
45	4	12.5	6.25	324
45	9	5.56	2.78	729
45	12.4	4.03	2.02	1004
45	16	3.13	1.56	1296

Table 1: Load Line Calculations:

Transformer Match Advantages:
I prefer using transformers in any form whenever possible. A transmission line transformer is distributed in nature so a single transformer can replace a handful of caps and inductors. Every time you add a component to a circuit you add loss so in general it's best to use less parts. A high power output match using lumped components puts stress on the parts near the drains. By stress I mean the drain impedance is low making the current and the power dissipation of the parts near the drains high. A transformer relieves the stress since the heat is distributed over the length of coax used to wind the transformer. A transformer also had the advantage of bandwidth. A lumped component network including the DC feed will have several resonance points. A transformer has no resonance points over a broad frequency range. (see Figure 1) Transistors always seem to be looking for a hidden resonance for an excuse to oscillate and blow up.

Figures 2 and 3 show two electrically identical output match circuits for a 2 meter 700 Watt load line. The data for the lumped element match is calculated and the data for the transformer match is measured. Each circuit has about 50 MHz of usable bandwidth. Figure 1 shows that the lumped match has VSWR dips at 130 and 155 MHz similar to what you would see on a low pass filter. Each dip represents a resonance point where an oscillation could occur. The lumped element match requires careful and accurate placement of the caps across the differential lines. If the 25 to 50 Ohm transition (node between microstrip lines 2 & 3) is not at the exact spot, a small piece of copper tape will be required to tune the length of the lines while at the same time moving the caps around to find the optimum match. This can result in hours of frustration and most probably a device failure due to operator error. If the transformer coax is cut close to the calculated length it will work with no tuning.

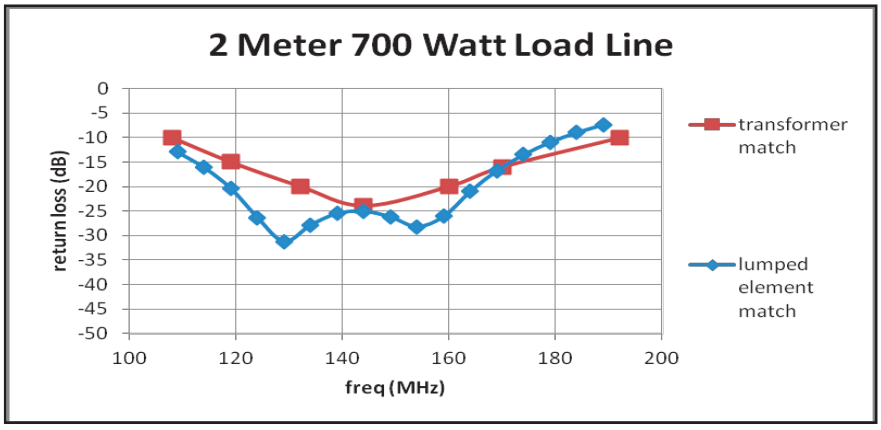


Figure 1: Lumped vs. Transformer Output Load Line

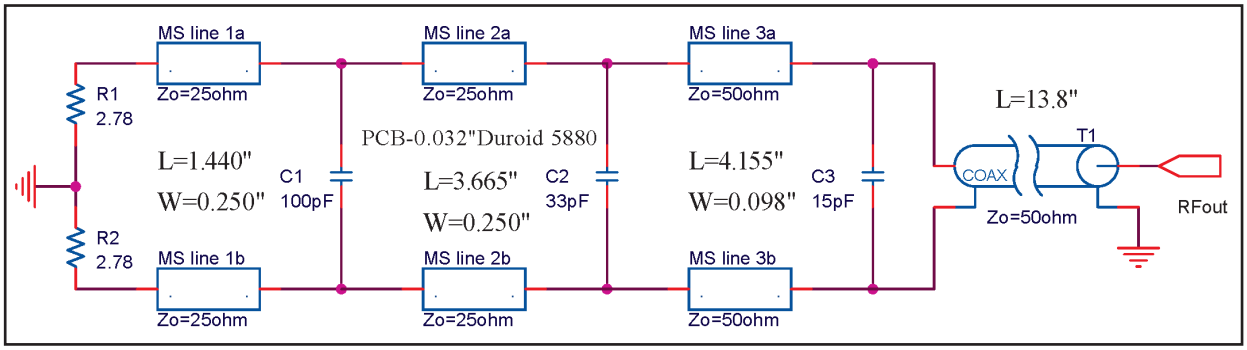


Figure 2: Lumped element 2 Meter 700 Watt Load Line

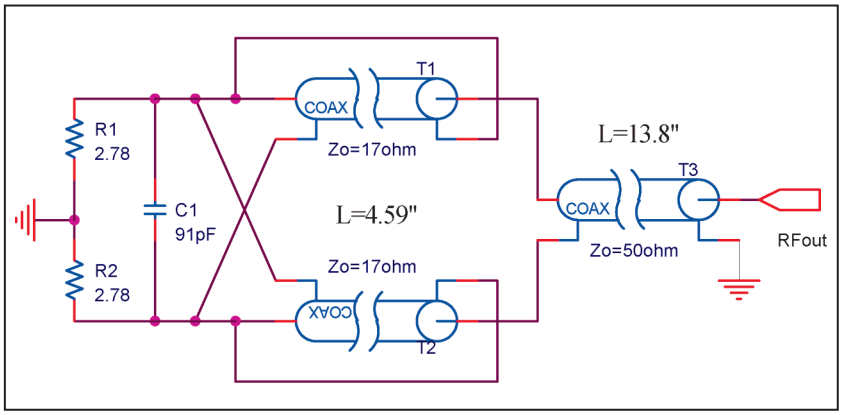


Figure 3: Transmission Line Transformer 700 W Load Line

Note: A small amount of stray inductance is introduced when the coax shield is removed to expose the center conductor. A shunt cap (C1) is connected across the low impedance side of the transformer to cancel the stray series L making the impedance look real (R+j0) across the frequency band of interest.

As seen from the data in Table 1, the transmission line transformer can only transform impedances with a turns squared ratio. (1:1, 1:4, 1:9, 4:9, 1:16) If the desired output power is 1 KW a lumped element matching L-section will be required to make the final impedance tweak.

Figure 4 shows the addition of a short piece of microstrip line and an increase in value of C1. 91 pF compensates the series L of the transformer plus another 92 pF for the high Z side of the L-section. The components used to make up this L-section will be the only tuning point necessary to fine tune for best efficiency, best power, best gain, etc.

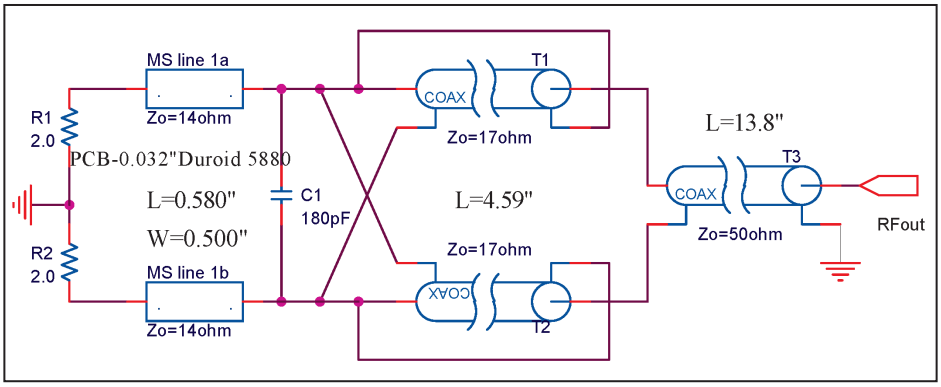


Figure 4: Transmission Line Transformer 1000 W Load Line

The physical length of a transformer is frequency and turns ratio dependent. Calculations may show that the desired length of coax is too short to wind it into a transformer. The center frequency coax length is determined by the quarter wave length and the impedance of the coax is determined by the square root of the product of the two impedances.

A 4:1 transmission line transformer is a good example to examine. Figures 5 and 6 show the same 4:1 transformer with two different schematic representations. It is apparent why the length of the 1:1 balun (T3) must be a quarter wavelength long. The shield is shorted at one end so it looks like an open circuit at the other end of the shield. The center frequency of the balun is 2 Meters based on a length of 13.8" and the useful bandwidth of this transformer will be a little less than one octave. At two times 2 Meters (288 MHz) the balun will look like a short circuit.

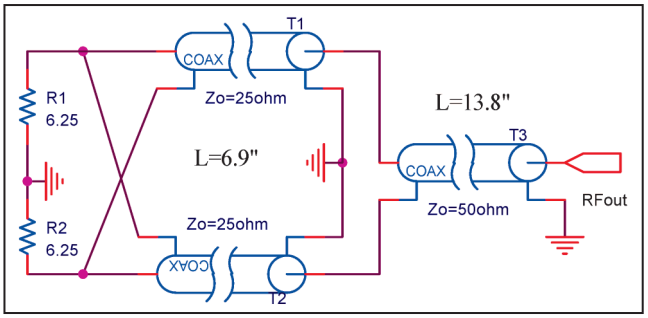


Figure 5: Balanced 4:1 Coax Schematic

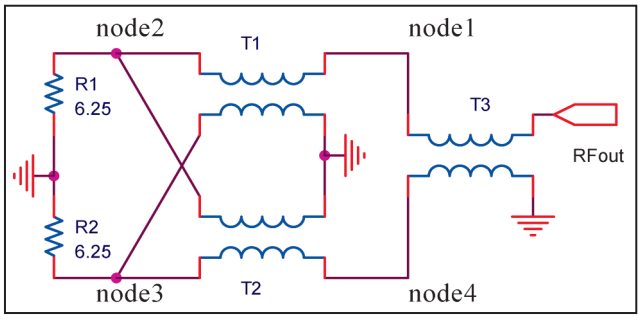


Figure 6: Balanced 4:1 Equivalent Schematic

The electrical length of the balanced 4:1 is a little more difficult to understand unless you re-draw the schematic as shown in Figure 7. The 4:1 has a zero impedance point (ground node) where the shields of T1 and T2 are connected together. The electrical length between the ground node and node #1 must be 1/4 wave so the length of each piece of coax must be 1/8 wave. (6.9" for 2 Meters) As with the 1:1 balun, the 4:1 will look like a short circuit at 288 MHz.

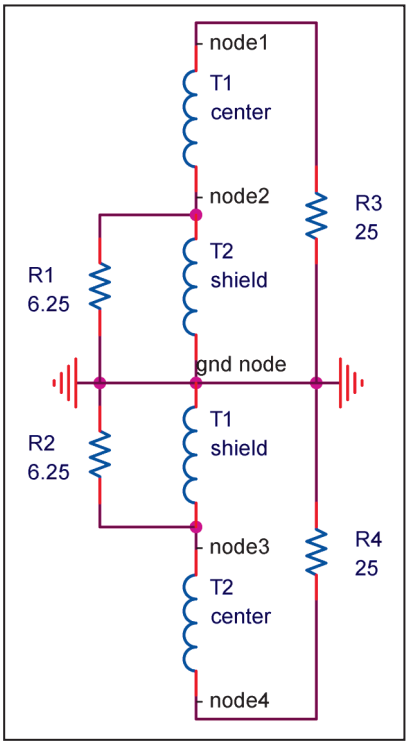


Figure 7:
Balanced
4:1 Equivalent

Figures 8 through 11 show other transmission line transformers that the interested ham may find useful on a future project. All example lengths are cut for 2 Meters. Table 2 shows the electrical length in wavelengths.

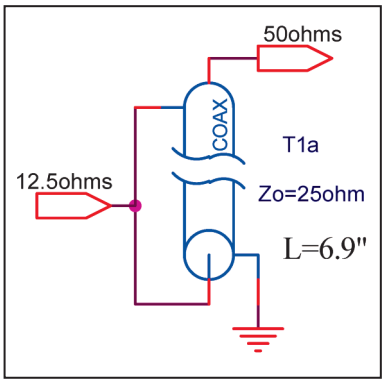


Figure 8: Un-Balanced
4:1

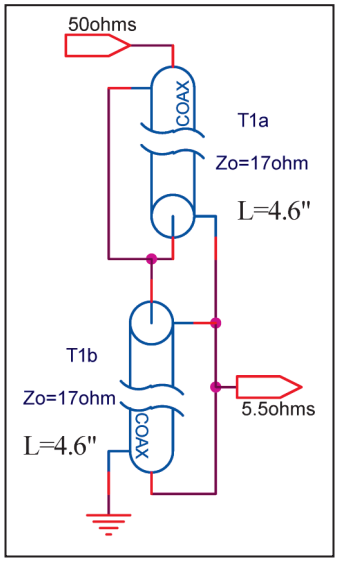


Figure 9:
Un-Balanced 9:1

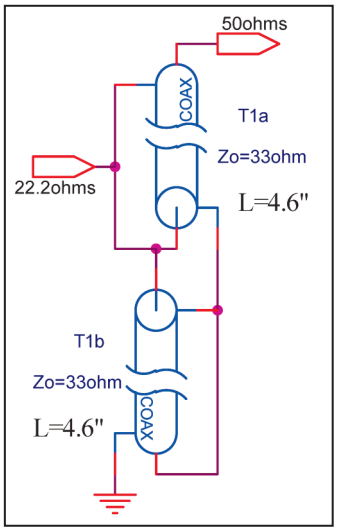
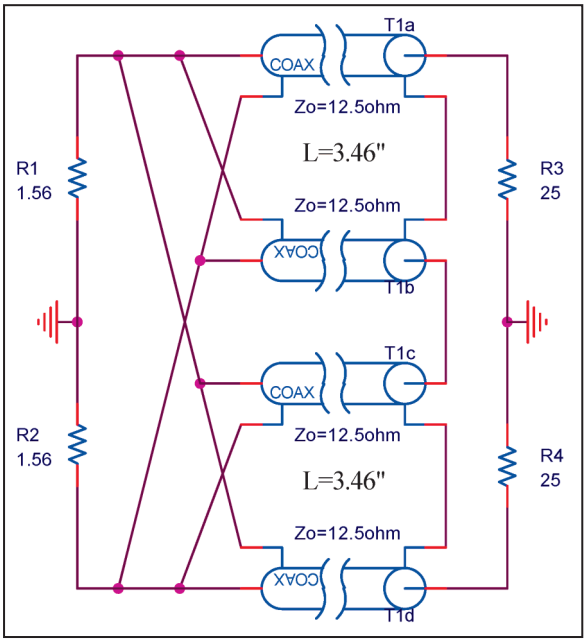


Figure 10:
Un-Balanced 4:9

Figure 11: Balanced 16:1 Coax Schematic



Transformer Coax Impedance Calculation:
The ideal impedance of the coax used to wind transformers is determined by the equation:

Coax Zo = square root (Z1 x Z2) = square root (12.5ohms x 50ohms) = 25 Ohms for a 4:1

If you don't have the correct impedance coax in your junk box you can parallel 50 Ohm coax to get the desired impedance. Use 2 equal lengths of 50 Ohm coax for a 4:1 transformer. Solder the center conductors together and both shields together. Use 3 equal lengths of paralleled 50 Ohm coax for a 9:1 transformer. There are also vendors like Weico that make shielded Teflon cable that has impedances close to what is required. The only disadvantage of using non-impedance controlled cable is the impedance may be different from one lot of cable to another.

freq (MHz)	Z ratio	wavelength (lambda)	length inch	coax Zo (Ohm)
144	1:1	0.250	13.8	50.0
144	1:4	0.125	6.9	25.0
144	1:9	0.083	4.6	16.7
144	4:9	0.083	4.6	33.3
144	1:16	0.063	3.5	12.5

Table 2:Transmission Line Transformer Summary

Capacitors and Inductors:
Most hams (myself included) are tempted to run to our junk boxes and use whatever we find for our project du jour. Please take a little time to think before you solder an unknown component into your homebrew circuit. You may have a great design but a bad component selection may falsely lead you to believe that your design has a deficiency.

Inductors:
It is common knowledge that RF travels on the outside skin of a wire conductor. It is surprising how this skin effect reduces the performance of a wire inductor. For a 110 VAC application a #12 wire is rated for 20 Amps but the same gauge wire will get hot with 10 Amps of RF applied. Table 3 shows the depth of penetration of the wire OD vs. frequency. At 2 Meters, you could bore the center of a #12 copper wire and leave all but a 3 tenths of a mil of copper and the conductor would behave the same as a solid piece of wire. (Figure 12) This drastically decreases the cross sectional area of the wire and in turn drastically increases the copper loss. 10 Amps through a #12 wire at 2 Meters is equivalent to using #30 wire which will dissipate 10 Watts per foot. The numbers are negative at 60 Hz since the skin depth exceeds the wire diameter.

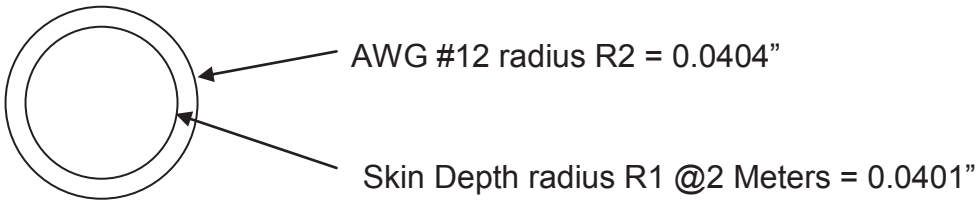


Figure 12: Reduction of Cross Sectional Area due to Skin Effect

freq	R1 inch	R2 inch	area1 sq inch	area2 sq inch	area2-area1	equiv AWG	AWG Ohms/ft	Watts/ft at 10A
60 Hz	-0.4202	0.0404	0.5548	0.0051	-0.5497	#12	0.0016	0.16
1900kHz	0.0378	0.0404	0.0045	0.0051	0.00064	#21	0.0102	1.02
14 MHz	0.0395	0.0404	0.0049	0.0051	0.00024	#25	0.0324	3.24
144 MHz	0.0401	0.0404	0.0051	0.0051	0.00008	#30	0.1032	10.3
1296MHz	0.0403	0.0404	0.0051	0.0051	0.00003	#35	0.3290	32.9

Table 3: Skin Depth and Wire Pdiss Calculations vs Frequency:

Capacitors:
Other than the active devices, selecting the correct capacitor for a high power RF circuit is probably the most critical consideration. As previously stated, the device impedances are low, the current through the caps is high, and the power dissipated by the cap is high. An inductor only has copper loss to worry about. A cap has both copper and dielectric loss. A typical ceramic cap is constructed with several layers of conductor metal separated with layers of ceramic material. The layers of ceramic act as a thermal insulator which makes removing the heat from the cap very difficult.
Most capacitor vendors specify value with a tolerance and maximum working voltage. (WVDC) This is

not enough information to determine if the capacitor will survive in your PA circuit. It is important to know the equivalent series resistance (ESR), the capacitor "Q", the series resonant frequency of the cap, and the current rating. Capacitor Pdiss can be calculated using this data if the circuit impedance is known. The 180 pF ATC "C" size capacitor (C1) shown in the 9:1 transformer match in Figure 4 will be used as an example.

Effective Capacitance:
This is a variable that I did not give much thought to until recently. All caps have some unwanted series inductance due to the metal plates. At some frequency the reactance of the cap will equal the reactance of the stray inductance. (Series Resonance, Figure 13) As the frequency approaches the resonant frequency the value of the cap approaches infinity. This explains why using the correct value cap, as per your design, can produce non optimum performance in a RF circuit. The engineer or ham eventually substitutes a cap that works and the experience is explained away as RF magic.

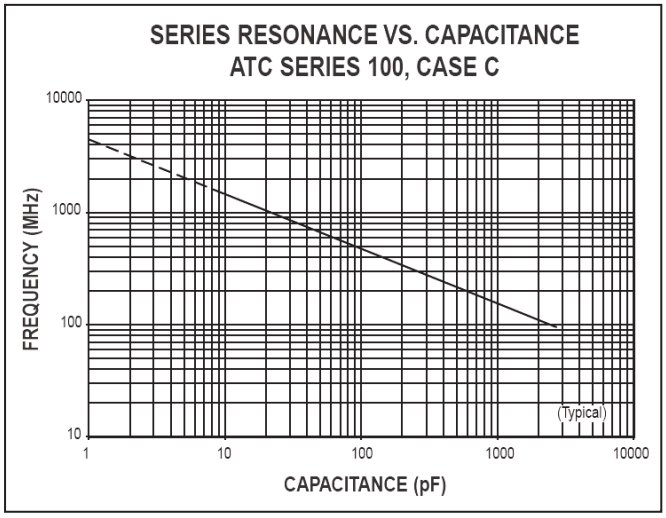


Figure 13: Resonance vs. Capacitance

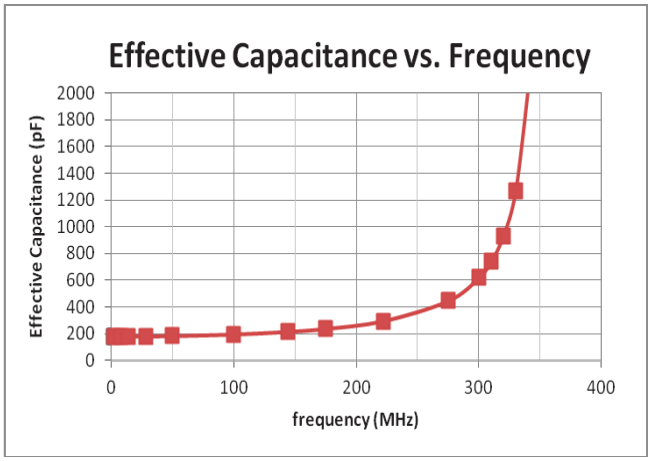


Figure 14: Effective Capacitance vs. Frequency

A plot of Effective Capacitance vs. Frequency is shown in Figure 14. At low frequencies the cap value is close to the value laser marked on the ceramic body. At 2 Meters the effective value increases from 180 pF to 215 pF. At 356 MHz the 180 pF cap looks like 0.01 uF. The cap starts to look like an inductor above the resonant frequency. It is important to note that additional stray inductance will be introduced when you solder the cap to the PC board. This will reduce the resonant frequency and further increase the effective value of the cap.

If the effective capacitance is well understood you can add series inductance to your circuit as a method of tuning a high power capacitor. Select a standard value cap slightly less than what the design calls for. Experiment with adding a short length of copper tape in series with the cap leads until you get to the desired performance. I don't recommend using this tuning method in commercial products but I highly recommend it for a high power ham application.

Capacitor ESR and Power Dissipation:
The Equivalent Series Resistance (ESR) is a measure of the resistance of the metal plates and the dielectric material that make up the capacitor. Higher value caps have more plates in parallel so the ESR is lower. If the cap is used at lower frequencies the dielectric loss will be less so the ESR is lower. (see Figure 15). If the power and circuit impedance is known, the ESR can be used to calculate how much power the cap will dissipate.

The 180 pF ATC “C” size will again be used as an example. At 2 Meters a 180 pF cap has an ESR of 0.044 Ohms. The balanced impedance at the point where C1 is soldered to the circuit shown in Figure 4 is 5.56 Ohms. The average power at this point in the circuit is 1000 Watts. Table 4 shows that the current through the cap is 12 Amps and the power dissipation of the cap is over 6 Watts. 6 Watts does not sound like much but the ceramic material is a poor thermal conductor so most of the heat transfer is through the metal end plates and into the traces of the PC Board. The dimension of the metal end plates is 0.040” x 0.250”. Your ham intuition should tell you that this small amount of surface area will not be enough to dissipate 6 or 7 Watts.

Freq	Cap	power	Zo	volts	Xc	ESR	Current	Pdiss
(MHz)	(pF)	(avg)	(Ohms)	(avg)	(Ohm)	(Ohm)	(Amps)	(Watts)
144	180	1000	5.56	74.6	6.14	0.044	12.1	6.5

Table 4: 180 pF ATC “C” size Current and Pdiss Calculations

The ATC data sheet shows that the cap is only rated for 9 Amps and the circuit requires 12 Amps. (see Figure 16) The note on the current rating graph says the temperature will rise by 100 degC. (15 degC/W x 6.5W) The ambient temperature of the PA in an enclosure will probably be in the 50 degC range so the temperature will be high enough (50+100 degC) to unsolder the cap from the circuit. You could try using two half value caps in parallel to distribute the heat, reduce the amplifier output power, or figure out a way to extract the heat from the cap. (There will be more discussion regarding this problem in part 2.)

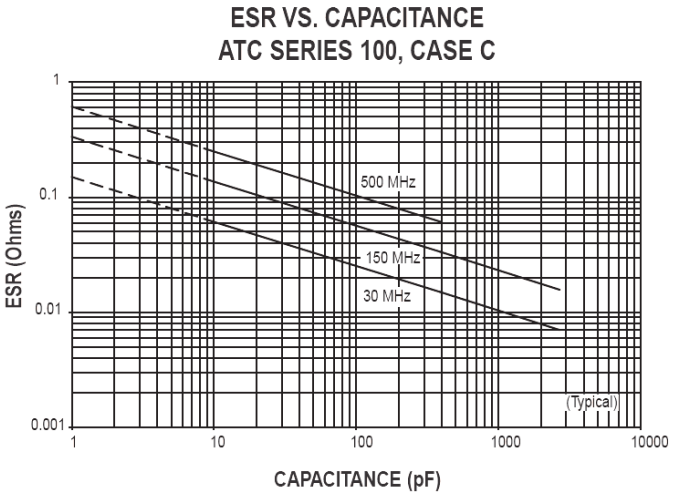


Figure 15: ESR vs. Capacitance

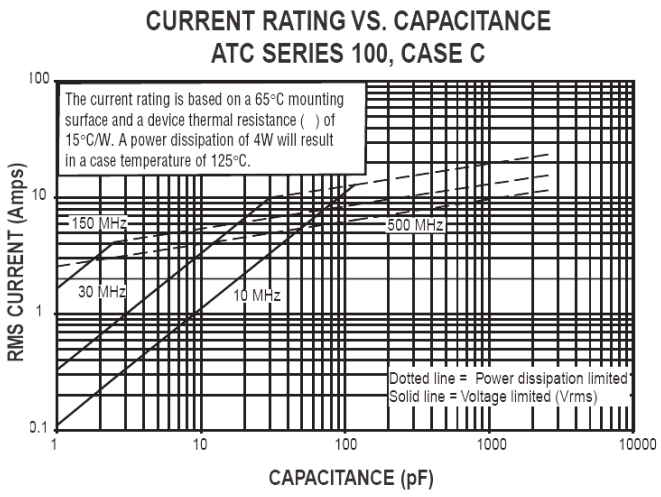


Figure 16: Max Current vs. Capacitance

Conclusion:
Part 1 of this series is basically Electronics 101 so many of the Packrats may be already familiar with what has been presented. Part 2 will show photos of practical transformers mounted in working VHF/UHF power amplifier circuits. Possible solutions to some of the inherent shortcomings of components such as caps, inductors, and the active devices will also be discussed. **73xg**

Footnotes:

Alternate High Power Capacitor Footnote:
I remember being asked a question by Dick, WA2AAU when I gave a talk on this topic at the Packrat Conference last fall. Dick wanted to know why I didn't use Unelco silver mica caps since this type of cap is known to be capable of dissipating many watts of heat. It looks like at some point in time Semco bought Unelco and Cornell Dubilier bough Semco. CDE still offers this type of silver mica cap. (type MCM-MIN) The data sheet is complete with ESR, series resonance, and max current data. It looks like this type of cap would work well in a high power RF circuit. I work at a place in south Jersey that makes extremely high power RF plasma generators and the customers will not accept a product that uses this type of capacitor. Some of the customers operate high power RF in a "not so clean" environment. The MCM-MIN caps are mounted in an open frame which invites unknown contaminants which would eventually cause a failure.

Design Software Footnotes:
When I don't have access to expensive design software at work I use something that Al, K2UYH gave me back in the mid 1980's. It's a very simple but effective linear analysis tool written by Chris Trask, N7ZWY. ALMOND.EXE has R, L, and C models as well as ideal transmission line and transformer models. I used ALMOND to generate all of the data presented in this Cheese Bits article. The software is so old I had to download DOSBOX to run it on my WIN7 machine. It may seem a bit cumbersome to use based on today's standards but the math is the same and it still gives correct answers. I'm not sure if ALMOND is still available online. I remember that the program, manual, and several dozen design examples fit on a single 5.25" 360kb floppy disc.

ALMOND calculates transmission line lengths in electrical degrees. I use another free application that can be used to convert electrical degrees into physical microstrip widths and lengths. HP (now Aglient) makes a great little tool called AppCAD. I think it is still available for download at a strange sounding website. (www.hp.woodshot.com) In addition to transmission line models it has other engineering tools for noise calculations, mixer spurs, S-parameters, bias circuits, etc.

All of the data sheets for the ATC's porcelain multilayer ceramic caps are available online but ATC also has a nice little calculator that gives all the detailed capacitor specifications at any frequency of interest. I used Tech-Select to arrive at accurate values for ESR, Xc, and max current as opposed to pulling the numbers off of a graph. "ATC Tech-Select" (tselect.exe) is available for free on the ATC website. (www.atceramics.com)

Some Quotes from Presentations At the Eastern VHF Conference

—gathered by K1DS

- If it doesn't have a keyboard and a screen, the new guys don't know how to use it.
- As you go up in distance, aircraft scatter is better than tropo---not because it's better, but because tropo stinks!
- No sense in trying aircraft scatter with the B2 bomber.
- So what's going on here? It's magic. Not just any magic, but physics magic, the best kind.
- You can do the math, but the physics guy will tell you it's just a bunch of mumbo-jumbo.
- Vermont maple syrup. Liquid gold! Not the inferior New Hampshire kind. (the prize table)
- I doubled my age (since I started VHF). I have enough energy to take down one more thing or climb down but not both.

- The lenses for my home-made telescope were from ACE Hardware. "Look, daddy. The moon has a rain-bow!"

…more on p.14

K1JT Re-dedicates Dwingeloo Dish

Nice article in this weeks (4/20) ARRL newsletter. Describes our own K1JT helping to get the 25 meter Radio Telescope in the Netherlands back on the air. Joe was the guest of honor and pressed the ceremonial button to start the operation in April

—Bert K3IUV

Fay?, K1JT & PA3FXB in Control Room

"Marietta and I had a great time in Holland! "

-- Joe, K1JT

EME SSTV —- Yikes!!

The telescope tips from zenith down toward horizon, and dumps a few hundred "Earth Balls" (inflated images of Earth) which are caught and taken home by kids:

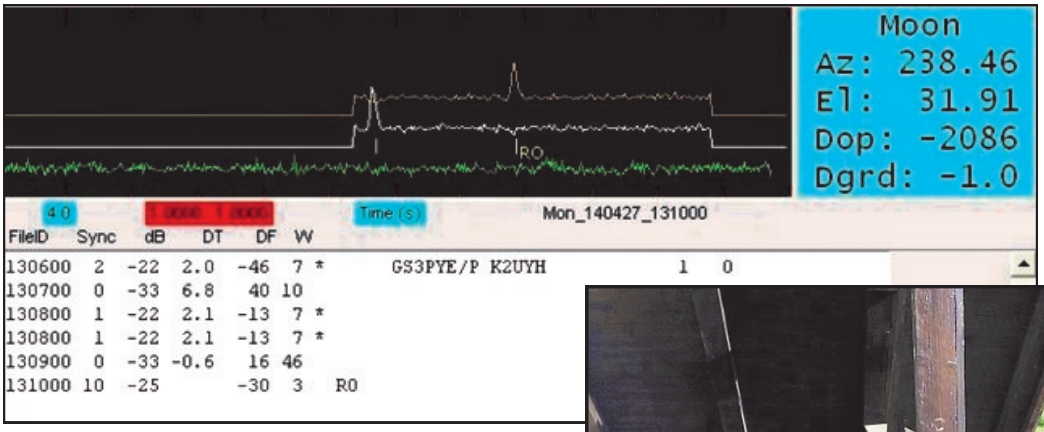
Cheap & Cheerful 23 cm EME (simplex)

Here is an example of what can be accomplished on 23cm with modest gear (well receiving, at least)

Hi Al.....GA.
Sunday afternoon (4/27/14) I got a copy of your signal at 23cm. Just using my test-setup, consisting of a 12 el Yagi on the balcony....hi!

I am working hard on my 3,2 m dish to be ready soon.... PWR will be 800 Watts.....

best 73 de **Hermann alias Pit DC9UP ex F5VKQ** Pse see the pics below.



...more quotes from VHF conf

- He saved money. He wrote his own Software Defined Radio program.
- Researchers in Cognitive Radio find an open piece of spectrum and then poop all over it.
- For the 10GHz Contest, the signal was awful, but if they heard anything they were so excited that no-one said anything.
- Do a cycle. It doesn't Hertz at all.
- There is no such thing as a perfect mixer, so you see those little blips on the left side of the DC line.
- How many GEEKS do we have here?
- ETTUS Radio: 80% of a radio for 20% of the price.
- I got a grant, so I am building 80% of a radio for 10% of the price.

April Meeting Pix

Ed Hare, W1RFI, ARRL "Lab Dad" came down from CT and did a lively, entertaining and informative presentation. AND he presented the Packrat Awards and Certificates for 2013/2014. **THANKS ED!!**

Packrat of the Year!

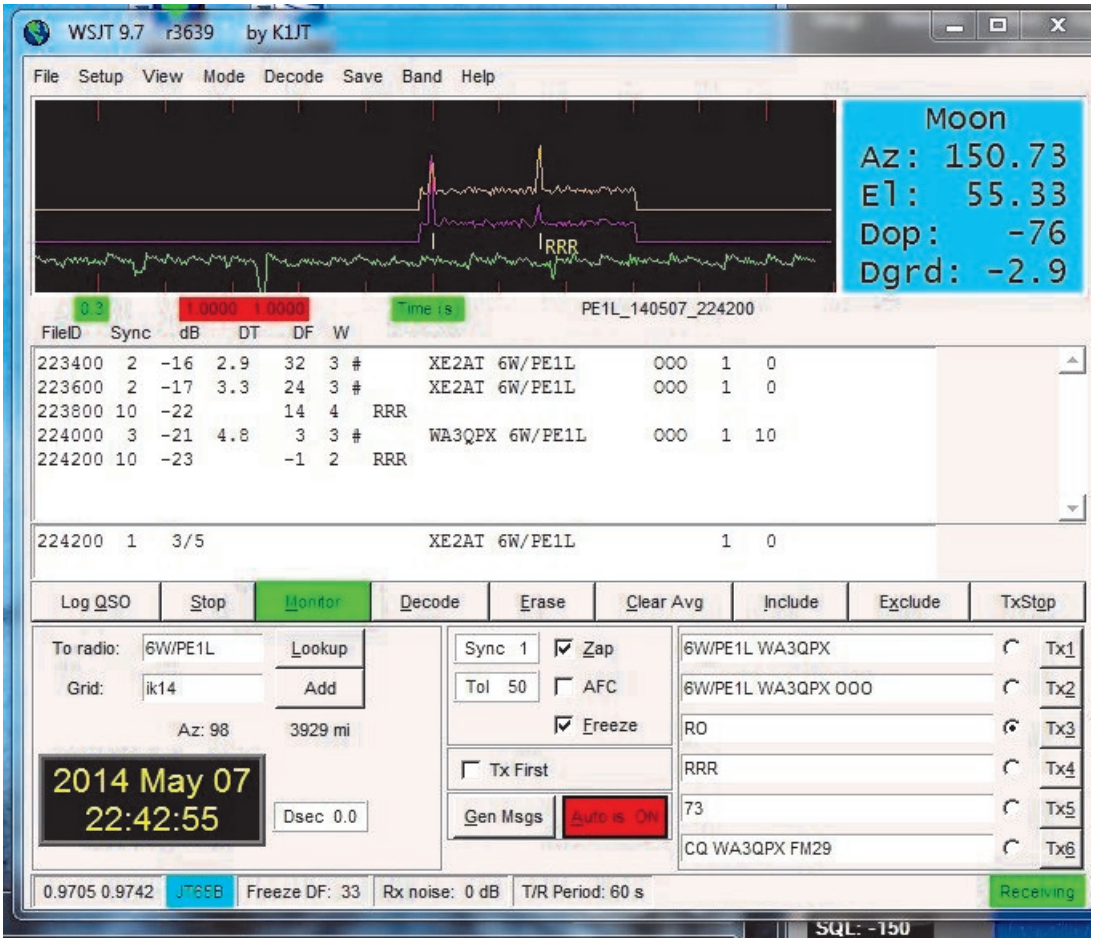
Rover Recognition

Many more pix available, but we're out of room this month. Congratulations to ALL THE WINNERS!!!

Tnx K3JJZ for taking the pix

2M EME Senegal

Congrats to Paul: MM EME QSO with 6W/PE1L on May 7, 2014!!



USB Dongle Spectrum Analyzer

Passed on to Cheese Bits by Al, K2UYH:

You might be interested in this - a low cost, entry level spectrum analyzer that uses a dongle with proprietary software at a cheap price ($79). I see lots of applications for this depending, of course **if the seller's claims are substantiated.**

The company is:
http://usbspectrumanalyzer.com/touchstone/
I took the plunge and bought one of these ($79 version) to see how they work, and if of use to the hobbyist will be a good article to write about.

By the way, a magazine out of Germany, Tele-Audiovision asked if I could write an article about the dongle. This is a great, free, on-line magazine and includes satellite TV too, check it out.

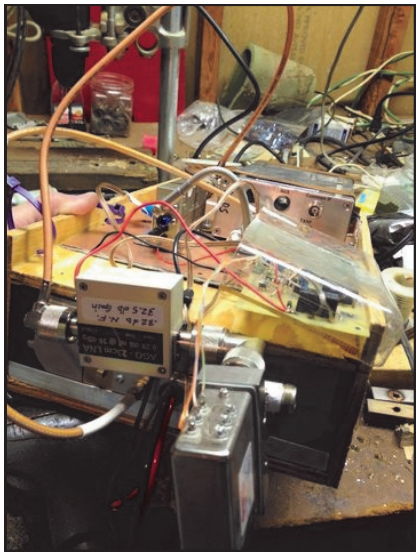
http://www.tele-audiovision.com/eng/TELE-audiovision-1405/

73's, Mario Filippi

Ps—late news see http://www.k3tuf.com/packrat/Artl.pdf

902MHz QSOs with Texas and VE6

Yes, it's possible to make QSOs on 33cm over long distances—almost 500,000 miles to be sure--**Using EME!** Al, K2UYH, asked me if we could use my 902 gear on his dish to try a few QSOs with others who had EME gear for this frequency. My 902 MHz transverter and amplifier, along with the preamp, filter and sequencer are packaged in a home-made plywood box of sorts and was ideal for the job. **But getting things right for these QSOs** took a bit of patience and experimentation.



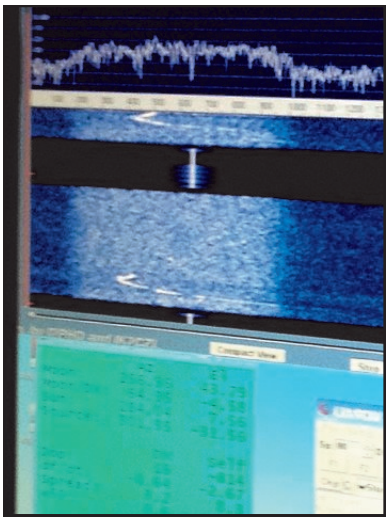
I have always enjoyed visiting with Al and assisting or working his EME station. With a 28' Kennedy dish, (and now with auto-tracking added, thanks to Russ, K2TXB and the W2DRZ tracker), signals are most often excellent off the moon. The retro feel of Al's shack is not lost on me either—with stretches of tools, meters, racks, switches, computers and radios—I feel right at home. We started with some modifications of my 902 set-up, adding another 25 dB, 0.3Nf preamp in front of the existing 25 dB preamp, and removing the low pass filter. Al had been concerned about the characteristics of the filter, having it checked in his lab, and found that it started to degrade signals at 900 MHz, with almost a **3 dB loss at 902 MHz.** I explained to him that this filter enabled me to hear weak signals on 902/3, but he was firm in his desire to start without it. Once the reconfiguration was done with a few changes of the coax cables and connector adaptors, it was mounted to the feed point on the dish with two sturdy clamps. The 1296 dish feed was replaced with a 902 feed that had been made several years ago, but recently checked in the lab for return loss. The antenna cable was attached from the TR relay to the feed, the 12 VDC connector was mated to the rig, but the power indicating LED wasn't lit. Oops, ground was missing. An alligator clip fixed that. Next a 26 V power supply was clamped to the feed to bring power to the amplifier and the AC was connected to that. We checked out the receive noise on the TS2000x IF rig and there was plenty. The shack TR switch and sequencer were both working. Next move was checking the transmit power with a 10 dB pad in the 2m IF line. The smallest Bird slug available was 50 watts and the lowest power out from the TS2000x was 5 watts. The Bird showed about 2.5 watts at the end of a piece of RG58 cable in the shack, before the attenuator. Adding the relay and

of

attenuator in the chain, we were probably down to 0.2 watts, and at the feed we were measuring about 65 watts at 902 MHz. We dropped the attenuation to 7 dB and the **amp power appeared to max out close to 100 watts**. Now it was time to do some echo testing.

VNA LPF show s –1.78 dB at 902.179 MHz

The dish was pointed at the Moon, the TR switch was flipped to transmit, and after a few seconds we listened; nothing but noise. After several trials, we asked Al, W5LUA, in Texas to put up a signal. Nothing heard, and nothing seen on the Spectroview display from Al's SDR-IQ display. W5LUA asked us to send a signal. He reported that he was copying us and that our signal had a big chirp. Now it's time to do a little head-scratching and see what we need to do. Step 1: Remove the second preamp — easily accomplished with an SMA double-female adapter. Noise reduced, but no signal. Step 2: Look for Sun noise. We could not find the sun. Step 3: Try to hear the Packrat 903.073 beacon. Turned the dish to about 200 degrees, but nothing was heard. Step 4: Add back the low-pass filter after the first preamp. *Look! There's the trace of the beacon on Spectroview.* Step 5: More carefully calibrate the dish azimuth to the beacon (the feed was slightly offset from center to make room for the 902 equipment). Step 6: Try to hear our own echoes again. They were still not there, but, W5LUA's signal was there and easily copied.



Echo of 902 chirp!

Now we proceed to make our first 902 CW QSO with Al, W5LUA, and exchanging OOO reports. We also saw and heard our echoes! The echoes were moving so much due to the chirp that they were not where we expected them to be. They sounded more like a toy *ray gun* than an EME echo. Al and I think that this is likely caused by some sag in the 12 VDC supply, which is sitting in the shack. Almost **100 feet of cable supplies the transverter through a series of small gauge wires** and connectors.

On to our second QSO with Grant, VE6TA. Grant's signal is easily spotted in the waterfall, and tuned in for best listening. We respond to his CQ a few times, and he finally returns with a TTT report. That means that he hears our signal but cannot decode the CW. We try repositioning the dish a few fractions of a degree, and on the second try we are able to exchange OOO reports. By this time, the third potential contact, Barry, VE4MA has his moon window gone, and the last possible contact, Tony, WA8RJF is experiencing too much noise and also needs a filter**. We declared the outing a success, having completed two CW QSOs and learned a lot in the process.**

Now it's time to change feeds again and get the station on the air for the 9 cm (EME is on 3400 not 3456) EME weekend event. Up the ladder goes Al, disconnects the feed, transverter and amplifier, and power supply. Up goes the one-piece 9 cm package of transverter, amplifier and power supply in its place. Back to the shack to check TR switching, receive noise and dish position. With a fine touch, Al nudges his dish to measure a little more than a dB of moon noise, checks for his nice echoes, which are excellent. Sadly, his first VK sked is not available due to high winds at his end. It's getting late and time to head home and savor the memory of those 902 QSOs. (Al stayed on for another hour and QSO'd both W5LUA and VE6TA on 9 cm along with K5GW and another VK, VK3NX at 5 degrees elevation).

73, Rick, K1DS

The Wayback Machine

Gleaned from the pages of Cheese Bits, March 1964 (Vol. VII Nr. 2) (Authors comments in *italics)*

- The cover story congratulated the club on its 8th anniversary, and featured an article titled "The story of W3CCX", which detailed the life and times of Matt Gelardi, W3CCX. Matt joined the club in 1957, and was a strong contributor during his short time with us. He guided the construction of 6 and 2 meter converters and other equipment by the members. He died in 1958, and the club honored him by adopting his call as the Club Call. He was an "Electronics Scientist" and spent a good part of his career at the NADC in Johnsville (*along with such other Packrats as W3CL Harry; W3ZD, Dave; and W3UJD, Mario. More details on his career, in the full article on the Packrat web site*).
- Editor's Corner. Helen gave a brief history of the Packrat growth from it's beginnings in 1956. The original group of 11 members grew to 90 full members, 16 retirees and 1 student member in 1964. The 1st picnic was held in 1956. In 1964, attendance was 500! (C*ontinuing to the present, but with a lot fewer in attendance*! *Of course, then we had a small flea market in conjunction with the picnic. Lots more details in the full article*).
- March 27, 1964 saw a major earthquake in Alaska. Ham radio played a major role in communication to the damaged areas. Numerous newspaper articles reported details of this assistance and provided a good deal of favorable publicity. Club members W3ELI, K3WEU and K3ESL were mentioned by name and call in the Philadelphia Inquirer article. Helen included 3-½ pages of newspaper extracts describing the amateur role in this disaster. (*Read it all on the web site*).
- AREC (Amateur Radio Emergency Corps.). Details of the AREC, what it is, what it does and how to participate were described, to encourage greater member participation in emergency support. Club member W3ELI, George Van Dyke is the EC (Emergency Coordinator) for the Philadelphia area. (*Club members were encouraged to join and participate in the AREC*).
- Red Cross disaster drill, followed by "the real thing". On 3/17/64, several club members had been attending emergency training at the Red Cross building, 22nd and Montgomery Ave. Leaving the meeting they heard an "ear shattering" noise. Looking down the street they saw a car rolling side over side, down the street toward them. Behind the car, a bus was careening out of control and hit 4 other cars. Club members K3ESL and W3NSM contacted the police and assisted in crowd control. 49 people were injured. The accident was caused by a "young girl, driving without a license"!
- W3HKZ listed several exhibits in the 1964 NY Worlds Fair, of interest to Hams. Among them was a microwave horn demonstration by AT&T. Also, Amateur station K2US operated in the Coca-Cola pavilion.

- Club treasurer reported the calls of members delinquent in dues (*figured embarrassment would encourage payment?*).
- Two Meter Activity report, by Dave, W3ZD (nee W3LHF). Dave notes the slowly increasing percentage of contacts being made on SSB. He reports a nightly SSB sked between W2VLQ in NNJ and W1PBT, a distance over 300 miles. He commented "The new double ended **Nuvistor** looks like a good bet for the cascode circuit. How about a new converter using these, Bert?" (*Sad to say, I don't remember this Nuvistor, or Dave's friendly jab!*).
- New Products, by W3NSI, Lyn. Littlefuse announced a new line of miniature fuses, 7/32" long. (*That's a little less than ¼", in case you want a more familiar reference*). Available with ratings of 1/8 to 5 amps, they supported the trend toward miniaturization.
- Transmitter hunt announced for May 9, conducted by the Mobile Sixers and the Packrats. Hidden rigs on both 6 and 2 meters will operate with the call of W3HFY, Hal, a Packrat. (*Hal was an avid "hunter", and had a wood boom cubical quad that he mounted on his car for transmitter hunts*)! (*I've mentioned before that this was a popular activity.* ***Why can't we do it again, perhaps using the ubiquitous FM rigs?****).*
- June QSO party announcement. Team captains K3ACR (6), W3SAO (2) and W2EIF (220 and 432). To be held in Hilltown. We have two 40' towers and one 30' tower for use.
- April meeting speaker was W3SAO, Frankie. An extract / summary of his talk was included in the 'Bits. He described the architecture, operation and application of D'Arsonval, Iron Vane and Electrodynamometer meter movements. (*Frankie was the meter repair technician at the NADC. We always enjoyed watching him demonstrate the* ***art of straightening meter pointers.*** *You had to be there to appreciate it*!).
- Helen apologized for the late C'Bits delivery, offering the following causes: Her typewriter was in the repair shop (*what's a typewriter*?), she fell down the steps and was badly bruised, and she had the German measles on April 21! (*Only thing missing was "the dog ate the stencils'*).
- Ladies night report. 100 people attended the Roast Beef Dinner at the Southwark AC. Superb music for dancing. The MC goofed in presenting awards, and called K3 one PM, and K3 one UV! K3IPM, Stan received top score in the club, and top score on 6-meters. K3IUV, Bert received top score on 220.
- ARRL Bulletin Nr 942. The "Staib" expedition will soon be crossing the Arctic Sea and North Pole on skis. Communication was to be maintained through the Norwegian Amateur Radio League, using 20m and 40 Mc (MHz). All are advised to keep frequencies clear. Calls used were LI2C, LI2C/2, LIC2.3 and LIC2.4.
- Old Timers night banquet, May 2nd, 1964. Trenton NJ. Speaker was Clarence C. Tuska, Co-founder of ARRL and 1st editor of QST. Author's note: (*Cleaning the basement, I found my copy of the*

reprint of the book "Two Hundred Meters and Down" by Clinton B. Desoto, as described last month. Available for loan).

(*As in previous editions, many "folksy" comments about members, their families, and activities were included in this edition of Cheese Bits. If interested, or for more details, visit www.W3CCX.COM and read the full issue posted there by our Webmaster, Ron, W3RJW*).

***thirty*, de K3IUV**

Save the Date!

Mid-Atlantic States VHF Conference

September 26-27-28

InnPlace Hotel, Bensalem, PA

Hosted by the Packrats

NOW REQUESTING PAPERS and PRESENTATIONS

Please forward your topic, summary of file to:

rick1ds@hotmail.com

CSVHFS

The Central States VHF Society, Inc. is soliciting papers, presentations, and Poster displays for the 48th Annual CSVHFS Conference on 25–27 July, 2014. Papers, presentations, and Posters on all aspects of weak-signal VHF and above amateur radio are requested. You do not need to attend the conference, nor present your paper, to have it published in the Proceedings. Posters will be displayed during the two days of the Conference. More information can be found at: http://www.csvhfs.org/2014conference/2014callforpapers.html

Tom / K5TRA csvhfs2014@gmail.com

Spring Sprints

CSVHFS is pleased to announce the following dates for the 2014 Central States VHF Society sponsored Spring Sprints:

1. **144 MHz**: Monday, 4/7/14 from 7 - 11 PM local.
2. **222 MHz**: Tuesday, 4/15/14 from 7 - 11 PM local.
3. **432 MHz**: Wednesday, 4/23/14 from 7 - 11 PM local.
4. **Microwave**, 902 MHz and up: Saturday, 5/3/14 from 6 AM - 1 PM local.

All but 6M Sprint are DONE. If you haven't yet, please post your results by going to http://www.3830scores.com/index.php and clicking on "144MHz Spring Sprint" in the yellow column on the left of the web page

5. **50 MHz**: Saturday, 5/10/14 from 2300z until 0300z Sunday, 5/11/14.

Rules for the 2014 Spring Sprints are on https://sites.google.com/site/springvhfupsprints/

Please let me know if you have any further questions.

The Spring and Fall Sprints are a great way to interest new hams in the world of VHF and above operating!

73, Kent O'Dell
KA2KQM
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Events

For inclusion, please direct event notices to the editor.

Spring Sprints—Contest Early April to early May 2014. See information on page 15 of this issue for details. **6M still to go!**

ARRL June VHF QSO Party - Contest June 14-16, 2014. The annual Camelback trek. Details to follow.

CSVHFS Conference— 48th Annual Conference July 25-27, 2014 in Austin,Texas. See http://www.csvhfs.org/2014conference/index.html for details

ARRL August UHF Contest - August 2-3, 2013. Details to follow.

10 GHz and Up (round 1) Contest - August 16-17, 2014. Details to follow.

September VHF QSO Party - Contest September 13-15, 2014. Details to follow.

10 GHz and Up (round 2) Contest - September 20-21, 2014. Details to follow.

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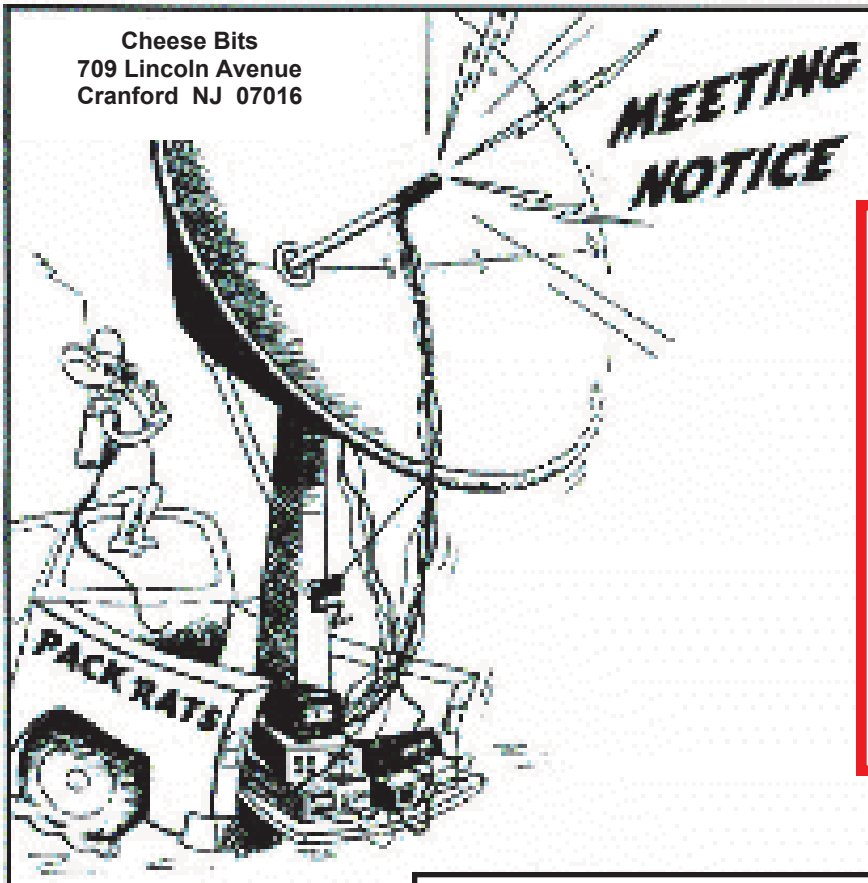

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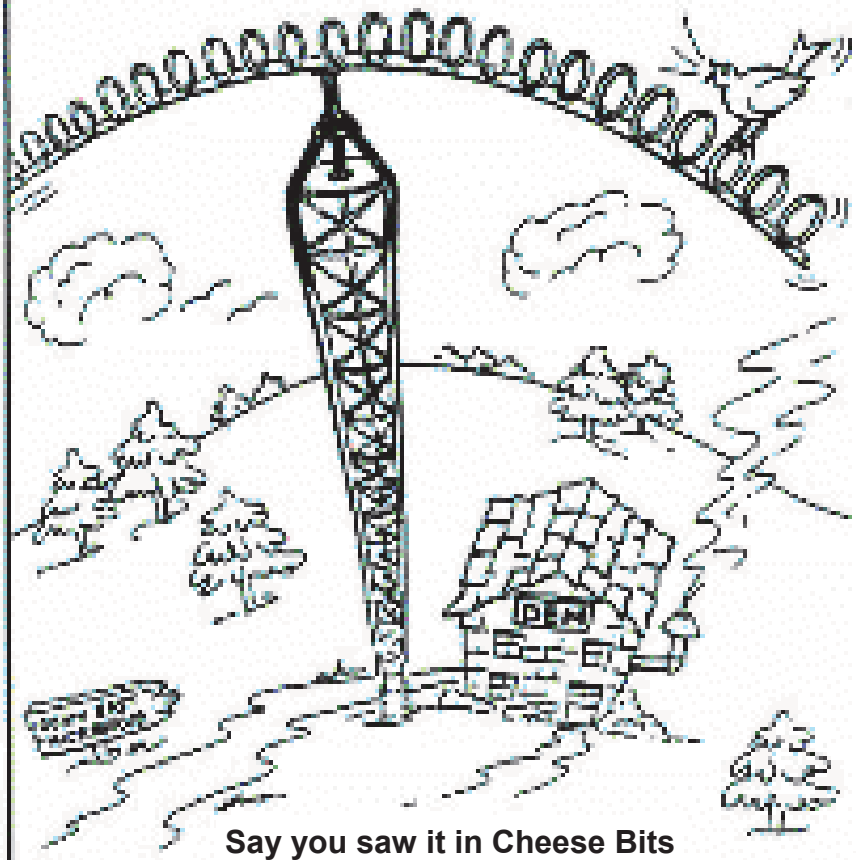

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