

Vol. 19 No. 8

www.mvus.org

October, 2005

Club Memorial Call W8KSE 10 GHZ Beacon, presently off the air.

Meeting at the Old Country Buffet !

near SR 725 and Yankee Rd. in Centerville

Oct Meeting on **Fri 28 Oct.** 7:30 PM Topic: **Microwave Update 2006**

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Upcoming Events!

2005 Microwave Update, 27-30 October, 2005

Sheraton Cerritos Hotel

12725 Center Court Dr Cerritos, Ca 90703

Sponsored by the San Bernadino Microwave Society

And cohosted by the Western States Weak Signal Society

Fort Wayne Indiana Hamfest & Computer Expo

19-29 Nov-2005

De N8ZM

It appears that the challenge I issued last month concerning MVUS hosting the Microwave Update Conference in 2006 was effective, especially when combined with Gerd's powers of persuasion at the meeting. MVUS will indeed be hosting MUD 2006. At this writing, we are trying to confirm the date and location, but are pushing very hard for October 20 – 22 at a location close to the I-70/75 interchange. Mike Schulsinger is feverishly trying to nail this down for us as I write this so that Al Ward can make an announcement at this year's MUD, which is coming up at the end of this month. Mike, by the way, deserves the credit for the original suggestion, made several years ago, for MVUS to host MUD in Dayton.

So, now we have our work cut out for us, and I have a list from Gerd of things that folks from our own ranks might contribute in terms of presentations of some sort. So we are on our way. We need to have some organizational and planning discussions early on, then get into the habit of a monthly coordination meeting, hopefully during the regular MVUS meeting. This would help reduce the problem of finding time for another meeting for us to fit into our schedules.

I'll have more on this at the meeting on the 28th, which is, by the way, the same weekend as MUD '06. Gerd is planning to be in CA then, and told me he would try to swing by the conference to see what he can learn that would be helpful to us.

As I am writing this a bit earlier than usual to try to get Anom Prop published a little further in advance of the meeting, I haven't had a chance to check on the status of the beacon or the repeater projects, but with the wonderful weather we have been having so far this fall, I suspect that the tower painting and inspection is moving along, and we should expect a call very soon to deliver both antennas and other tower mounted hardware for installation (hint, hint!). I am excited about both projects, because any time you can have antennas at 900 feet HAAT, there will be wonderful coverage and DX opportunities.

The ARRL September VHF contest proved a good one for the N8ZM team this year, with one of the best scores ever from our Urbana site. This was largely due to a terrific opening on 6m into FL and TX. Surprising as it may seem, but we felt like DX for a lot of TX stations, as quite a pileup occurred. Signals were so strong out of the South that we worked many of them with the beam pointed NE. There was even a station on from the New Orleans/Biloxi area that had been hit by Katrina just a few days before.

Well, that's all for now. I hope to see many of you on the 28th!

Tom, N8ZM.

Achtung! We have experienced some errors in our database as far as the dates are concerned. Please check the date on your label and if it doesn't seem right, please let me know by e-mail or by postcard so I can look into it and make corrections. We have a complete record on paper of all money transactions and can always double check!

73, Gerd, WB8IFM

This and That 10-05

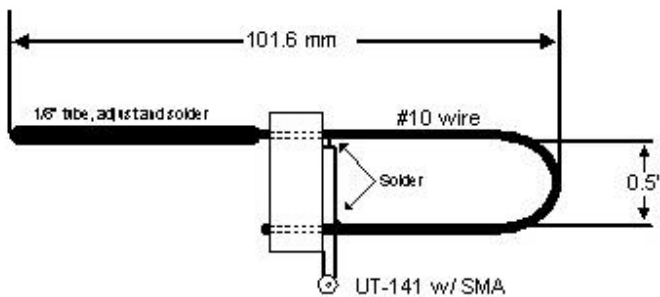
- **To tell the Truth.** “It is always best to tell the truth, unless, of course, you are an exceptionally good liar.”
[Playright Jeromy K Jerome]
- **Buying a Computer.** “Each time I shop for a computer, I am pulled between an insane lust for power and the desire to save money.”
[Bill Husted, KQ4YA]
- **First Law of Computing.** Here’s the law according to Husted: If the computer you own now can do everything you want it to do in a timely manner, you don’t need a new computer. [Bill Husted, KQ4YA]
- **Traveling Rock Band.** “ It is one of the great ironies of this generation. In a century when the entire knowledge of mankind can be compressed into a computer chip the size of a contact lens, it takes four huge trucks to transport enough stuff for a two hour show!”
[D.L. Stewart]
- **WW2 Band.** “Based on movies I’ve seen that were made in the ‘40s, the entire Tommy Dorsey band – and its instruments – traveled from engagement to engagement in a Model T Ford.[D.L. Stewart]
- **Driving fast.** “We have this strange fixation that fast movement always equals progress, and going slow is stagnation. But I think we are all wanting a little better balance between our need to move and our need to feel comfortable and at home where we live.
[David Engwicht]
- **Freedom.** “People say cars represent freedom ... but how free are you when you have to drive everywhere?
[Steven Logan]
- **Mechanic’s New Tool.** ... Using a tiny camera and a long fiber optic cable connected to a handheld screen, the mechanic can inspect the inside of a cylinder, or any other hard to see area. The image can be enlarged for more detail, and it carries its own light source. No large inspection holes needed. Great advances for anyone who is handy with money.
[Stu Faber]
- **The Older Generation:** Young man: “Today we have television, jet planes, space travel, man has walked on the moon, our spaceships have visited Mars, we even have nuclear energy, electric and hydrogen cars, computers with light speed processing...and uh...” taking advantage of a pause in the student’s litany, the old guy said: “You’re right. We didn’t have those things when we were young so we invented them, you little twit! What are you doing for the next generation?”
[Inventors’ Digest, July/August/September, 2005]
- **Minimalistic Music.** In an earlier technological age, I’d have said “ when you think the record player needle is stuck”, but to many folks don’t remember record players anymore! No matter what you think (or fear), the piece will always move on and will eventually end.
[Neal Gittleman]
- **First DX?** In 1916 Amateur Station 2IB worked 8AEZ, Lima Ohio- 750 miles across the US.
[AC6V Amateur History and Licensing]
- **1910, Oct 5.** B.F.Miessner invented and received a patent for the “Cat’s Whisker Detector”. He subsequently sold the patent for the sum of \$ 200 to John Firth.
[On the Early History of Radio Guidance]
- **Lightning Protection System (LPS).** A LPS can be defined as a "preferential path for lightning from intercept location to ground destination." And lightning can be defined as "arbitrary, capricious, random and unpredictable." When combining the aforementioned definitions, we should not be surprised to achieve less than 100% efficiency in our attempts to control lightning’s agenda.
[Internet]

10-Element 23cm Yagi By Mike, WB8GXB

All dimensions measured from reflector in millimeters. This antenna was tuned for 1258-MHz

All elements except the driven element are made from 1/8" aluminum tubing obtained from a hobby store. The driven el is a #10 copper wire with an 1/8" brass tube sliding over the #10 as a means of tuning. Connected to the driven element is UT-141 with an SMA connector. Elements are mounted in an 1/2" x 3/4" oak wood boom. Make the boom long enough so the antenna can be mounted to a 1-1/4" mast behind the reflector. For outside use coat the wood with a protective finish. Mount the elements through the 1/2" thickness of the boom. Elements can be held in place with a small amount of epoxy glue placed in the center of the element before inserting into boom.

Element Length (mm)	Spacing (mm)	Dir3	95.5	160.0
Refl	109.2	0.0		
Driven	101.6	43.8		
Dir1	99.3	71.0		
Dir2	96.6	101.5		
		Dir3	95.5	160.0
		Dir4	96.6	221.0
		Dir5	92.8	310.0
		Dir6	91.7	396.0
		Dir7	91.7	491.0
		Dir8	88.9	585.0



Driven Element

The driven element is a "J" design, i.e one side is like a folded dipole and the other a single length of wire. The brass tubing is on the single side and used to adjust for best return loss, then soldered into place. Adjust in 1/2mm increments as measured from the side of boom. Make a jig to hold tube at that spacing to ensure it does not slip when soldering in place. Spacing between the folded section is 1/2" measured inside to inside. I bent it using the shaft of a 1/2" drill. Attach the center of the UT-141 to the upper section as indicated in the drawing. For ease of assembly attach the UT-141 just to the side of the boom. Short section of driven element can extend into boom. Mine is flush with the other side.

1296 Dipole with Corner Reflector By Mike, WB8GXB

The reflector is made from 1/4" hardware cloth attached to a wooden frame. The size of each corner is 27" x 27". They are at 90-degrees with a straight dipole as the feed. The dipole is made from telescoping sections of brass hobby tubing. This allows the length of the dipole to be adjusted. The tubing is attached to UT-141 semi rigid line. Solder an electrical eyelet to the tube that will be connected to the shield side of the line. The eyelet is sized for a close fit to the UT-141. Solder in place. Drill a small hole in the other tube and insert over the center conductor. A 1/4-wave sleeve made from hobby brass tubing and attached below the elements as a 1:1 balun. Use a brass washer at the bottom and solder that to the UT-141 and tubing. Tape around the UT-141 can serve to center the top of the brass tube. Half a grommet was used as a spacer to keep the dipole from touching the open end of the balun. The dipole was adjusted for best return loss prior to inserting into reflector.

Space the dipole 65-mm from the back corner of the reflector. This spacing will set the impedance. Adjust for 50-ohms; the spacing will be approximately 0.3 wavelength.

A folded dipole may be a better feed with this antenna as it may provide more bandwidth. Adjust spacing for 50-ohms.

Silver Plating

By Mike, WB8GXB

I was making a pipe-cap cavity for 1296-MHz using copper water pipe fittings and hobby brass. Documentation on cavities states that for best results the cavity should be silver-plated. I intended to make a few of these and maybe for other bands as well. I wanted to silver plate mine if possible. I found a simple system from Caswell Plating to accomplish the task. They have some expensive systems but they also have a product called "Plug-N-Plate". This process consists of a wall transformer (1.7-volts for silver), a plating wand, gauze to hold the plating solution, and 4-oz of plating solution. The process is done as follows: 1. wrap the gauze around the wand, 2. plug in the transformer and connect one side to the part being plated (alligator clip) and the other side (banana jack) to the wand, 3. soak the gauze in plating solution, 4. brush the gauze wand on the part being plated. A plated finish will result. Coat the entire surface refreshing the gauze with solution as needed. Buff finish as desired. That is all there is to it. The plating coated the copper and brass evenly. The part must be

cleaned with a copper/brass cleaner for best results. Failure to do so may prevent any plating. The company also provides kits for other plating like nickel, tin, gold, etc. The silver kit costs \$38.00. 4-oz solution will plate a large area assuming it does not get contaminated. Never place the gauze-coated wand directly into the bottle. Always pour a little into a small cup and never pour that back into the bottle. Some silver plate solutions contain cyanide but this product does not. The silver solution is not considered hazardous so it does not require any hazardous shipping fees or restrictions. MSDS health rating is 1(low) for the silver solution but I would wear protective gloves. It will stain your cloths if you get any on you, as I found out. I also had to re-attach the alligator clip and banana jack. They had a very light crimp and into insulation as well. This URL takes you directly to the Plug-n-Plate page:
<http://www.caswellplating.com/kits/pluginplate.htm>

Quite a Bit of Activity in Michigan.

By Lloyd, Ne8i

Quite a bit of activity, Saturday October 1, 2005, Microwave Activity Day. Here in Michigan found, K8MD, K8EB, WW8M, WA8VPD, WB8TGY and myself, active on 1296 through 24 GHz. Quite a bit of 10 GHz. Saturday early morning, caught what was left of some Lake Erie tropo conditions. Reports of the WW8M beacons were way up. That disappeared about an hour after sunrise. So the rest of the day we had "dead band" conditions. The last few nights, lake effect tropo has been occurring. Conditions start picking up around 10 PM, and last to around 8 AM. So, night owls take notice! Keep an eye on the propagation reflectors. Turn that radio on, listen and call CQ. Second weekend of 10 GHz+ cumulative, had fall nighttime tropo on Lake Michigan. Saturday night around 11PM, W9ZIH EN52, heard K2YAZ's EN74 1296 beacon, then his 10 GHz beacon. They had 20 over signals on 10 GHz. By sunrise, the opening was gone. This fall nighttime lake effect tropo is common this time of year. WA8VPD, WB8TGY and I were rover stations. Mostly to GP Hill, EN82em. Mostly 10 and 24 GHz. Then we had a late lunch meeting to discuss things. The current and anticipated price of gasoline on future rover projects was an important topic. Next we talked about improvements to be made on the microwave stations. As to the beacons: they really help to determine propagation conditions. Not to mention the check whether the rig is receiving. The weather was fantastic, sunny, and warm, with just some wind. Just a nice day to be outside doing things.

Next Microwave Activity Day, **Sat Nov 5, 2005.**

Lloyd Ellsworth Ne8i
POBox 0338, Birmingham,
Michigan 48012-0338

QTH Grid EN82jm Beverly Hills Mi
Rover 160M - 47GHz

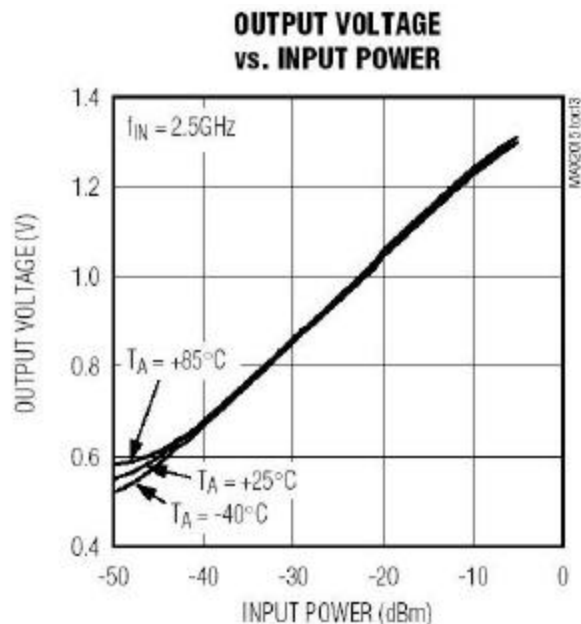
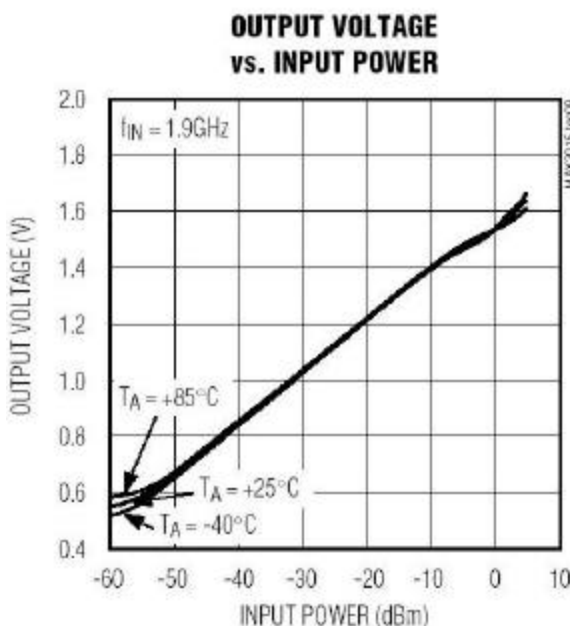
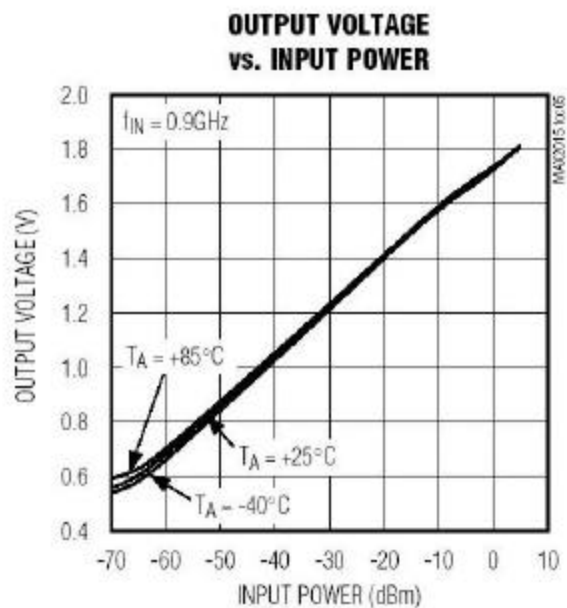
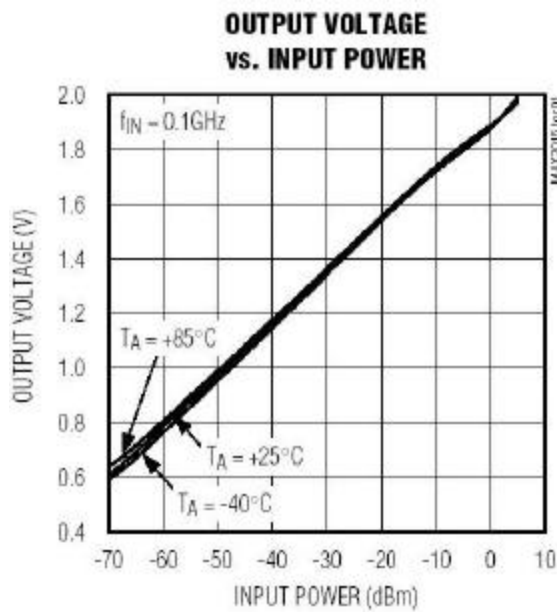
E-mail: ne8i@arrl.net

MAX2015 (RF Detector)

The MAX2015 complete **multistage logarithmic amplifier (detector)** is designed to accurately convert radio-frequency (RF) **signal power** in the **0.1GHz to 2.5GHz** frequency range to an equivalent **DC voltage**. The outstanding dynamic range and precision over temperature of this log amplifier make it particularly useful for a variety of base station and other wireless applications, including automatic gain control (AGC), transmitter power measurements, and **received signal strength indication (RSSI)** for terminal devices.

The MAX2015 can also be operated in a controller mode where it measures, compares, and controls the output power of a variable-gain amplifier as part of a fully integrated AGC loop.

This logarithmic amplifier provides much wider measurement range and superior accuracy compared to controllers based on diode detectors, while achieving excellent temperature stability over the full -40°C to $+85^{\circ}\text{C}$ operating range.



Range Calculations

By Adam MacDonald, N1GX

Introduction

I had a great time at the MVUS Antenna Measurement Party/Picnic thrown by Daun Yeagley last month. It's good to see others with a similar affinity for transducers of invisible RF waves and their documentation. Gerd thought it might be good to share a handy little application that I wrote last year for the purpose of visualizing the field perturbations that occur in an open antenna range due to ground reflections. Although I don't have space here to describe all of the background on this interesting and useful topic, I invite you to peruse some PDF documents that I uploaded to my FTP server at http://home.earthlink.net/~calvinf15a/Antenna_meas. Several useful articles in full text format describe basic theory of antenna measurements in an open air range, while others detail the construction of standard antennas and associated equipment. A seminal article is the 1974 QST article by Dick Turrin, W2IMU (Antenna_Performance_Measurements_QST_74.pdf), followed by a nice article by Richard Knadle, Jr. K2RIW (UHF_Antenna_Radiometry_76.pdf). A great pair of follow-up articles was done several years later by Fred Brown W6HPH, but I could only locate the PDF of the first part (Antenna_Gain_Measurements_QST_82.pdf). Paul Wade, whom many of you are familiar with regarding his microwave work, published a nice article in QST regarding the use of a noise figure ratiometer to accurately compare antennas to a known reference (Antenna_range_meas_Paul_Wade.pdf). I've even included the ANSI standard in case you wish to design your own backyard antenna range like Daun (ANSI_Std_C63_7-1988_Open_area_ant_test_range_construction.pdf). Many of these files I obtained at my university, so you may only use them for research and non-commercial benefit. That's enough on the literature search. These articles should satisfy your bedside reading habit for a while. There are a couple of other articles on the FTP site which I didn't mention here, so be sure to have a look at those as well.

Our Application

Back to the application I mentioned above. I like to use Labview to do quick and useful graphical applications (sorry Daun/Tom). The application I built, "Range-Calc", is primarily designed to give the user an understanding of the general electromagnetic field conditions that will be present in a well designed open air antenna range (ground range). The basic understanding of a ground range is that since it is difficult to minimize reflections from the ground, you might as well live with them, quantify them, and understand what they are doing to your measurements. The Turrin, Knadle and Brown articles describe equations that allow one to find the location of the main amplitude lobe that is present as a function of height above ground for any given distance from the source antenna. In general, the range designer wants to place the receiving antenna at the peak of this amplitude lobe, as the amplitude variation is much gentler at the peak, compared to the nulls, which are characterized by very sharp amplitude roll-off. Based on the image theory of EM radiators above a conducting plane, the

EM fields constructively and destructively interact to form a lobing pattern in space at any given distance from the source antenna. Range-Calc simply sums the EM fields emanating from the source antenna subject to the Helmholtz wave equation, and presents a display of the amplitude field at a given "window" described by the range from the source, as well as the operating frequency, ground reflectivity, and other parameters.

More Discussion

It is important to note that most measurements are considered valid in the far-field, that is, at a distance far enough from the source antenna that the characteristically spherical wave can be well represented by a plane wave (negligible phase distortion). Most have agreed that this point is where the phase of the spherical wave deviates no more than one Radian (about 57 degrees) across the aperture of the antenna (although some use 30 degrees). What this means is that if you have a very large aperture antenna (10 foot parabolic dish), the

far field might be quite far for you! In fact, this requirement increases as the square of the antenna aperture diameter. A popular misconception about the far-field range is that it decreases as a function of frequency; that is, very compact ranges can be built at the higher microwave frequencies. On the contrary, since the minimum far-field range is inversely proportional to wavelength, it *increases linearly with frequency*. In my current research with laser radars, the far-field doesn't start for many miles at optical frequencies! Although compact antenna ranges can be built with the aid of collimating RF lenses, that is certainly beyond the scope of this article. Range-Calc illuminates a small green LED when you select a range length that is satisfied by the 1-radian far-field criterion, so you can vary the range slider and experiment with this parameters as you see fit.

Download Software

To use the application, you can download just the application that I have uploaded to my ftp site Range_Calc.exe, or you can get the entire 13 MB installer from the MVUS site courtesy of K8UD. If you have the National Instruments Labview RunTime software installed for your OS (<http://digital.ni.com/softlib.nsf/>), you only need the small application Range_Calc.exe. Otherwise, you should download the windows 32-bit installer from the MVUS site. Run the application. You really need 1024x768 or finer screen resolution to see the whole application without scrolling.

Example

Let's start with an example. Set the ground reflectivity slider to 1.0 and the polarization switch to Horizontal. Set the units switch to feet. Set the Source Antenna Height to 2 feet. Enter 2 feet into the Aperture Diameter input box. Set the operating frequency to 1200 MHz. Slide the Range Length slider back and forth and note that the far-field Green LED comes on as you increase past about 106 feet. Set the Range Length to 150 feet. Note that you can either use the slider or type numerically into the corresponding text entry/display boxes. Now set the Source Antenna Height slider to 2 feet. At this point, you can immediately see that the predicted first lobe height at 150 feet down-range is 15.38 feet (in the Predicted First Peak Lobe indicator

box). If you were to physically probe the field vertically at 150 feet from the source, you would find a nice peak at approximately 15.4 feet. Next, set the Observation Window Aperture to 2 and Observation Window Width sliders to 20. These sliders set the extent of the intensity graph – you are setting up a 2 foot vertical by 20 foot horizontal slice of sky to map the intensity at a range of 150 feet from the source. It is best to match the Observation Window Aperture to the Aperture Diameter of your antenna. This will give a direct plot of the field across the aperture of your test antenna. Otherwise, if you just want to get a feel for the general field in this location, set the Observation Window Aperture size to whatever you desire.

If you now move the Test Antenna Height slider (far right side) to approximately 15.4 feet, you should see an oval intensity pattern in the Field Intensity Graph, together with an inverted parabola in the Field Amplitude Rolloff graph. This indicates that you have adjusted the height of the test antenna to such a point in the vertical that the field is at a maximum, and that the field rolls off as indicated in the Field Amplitude Rolloff graph. Although the roll-off looks severe, you should notice that the amplitude excursion across the 2 foot antenna aperture in this case is very minor, on the order of 0.05 dB or so! At this point it is interesting to start moving sliders around to explore the interaction of the parameters. Note that when the Ground Reflectivity slider is changed, the magnitude of the pattern changes, but not the general shape. As the reflectivity is reduced, the amplitude variation becomes less severe. When set to zero (no ground reflection), you can simply adjust the Test Antenna Height to match the Source Antenna Height and get a nice flat field (save for spherical wave effects).

Finally

So that's about it for the program. I'm almost positive you will find bugs. I'd like to hear from you for bug fixes or improvements. It was never meant to be a commercial application, but rather an exploratory tool for those of you who have an interest in testing antennas on an open air ground reflection range. Have fun with it. Your comments are certainly welcome!

Adam, N1GX.

HF-Balun Problem

By Gerd, WB8IFM

Gradually an “open” had developed in my feed line to the big short-wave beam and I suspected immediately the Hygain BN86 ferrite core balun. Lightning had hit the antenna several years ago and at that time also created an “open” that made me take the balun out and replace it with a hastily assembled $2\frac{1}{2}$ turn open air coax balun. However, this did not solve my problem. The “open” from the lightning turned out to be a burned up connector from the hard-line to a jumper cable which lead to the antenna switch. The switch, btw, was a complete loss and was replaced. The new balun worked nicely, if less than optimal, for a few years. Then, last year, I put the BN86 back in and all was as in the “old” days.

Anyway, I assume the balun at the time was somehow weakened but still useable and had now finally given out! Checking the Internet, I found other hams had problems with the balun and there were even pictures revealing the innards, never before seen, as the balun comes in a completely sealed plastic shell.

So I decided to again use a few turns of the coax as a balun. Only this time I was going to do a real good job. The open air coil starting directly at the symmetrical feed point of the beam and formed by a few turns of the coaxial jumper cable acts as a choke to the current that attempts to flow on the outside of the coax and messes up the radiation pattern. To look at the problem more in detail: this coil with its inherent self capacity forms a wideband resonant circuit and it works best with the resonance in the middle of its range. In my case the balun was to work on three bands: 10, 15 & 20 Meters. The resonance then ought to be somewhere close to 20 MHz. This is not very critical since the circuit, with its very small capacitance, is fairly broadband. The impedance at 14 MHz is inductive and should be circa 500-Ohm minimum and the impedance at 29 MHz is capacitive and also ought to be 500 Ohm capacitive. At 21 Mhz, close to resonance, the impedance might be several kilo Ohms.

I got some help from Klaus, DL7DU, who likes to dabble in such intricacies. When I sent him some data I had gleaned from the Internet, he completed

them giving me inductance data for some coils, e.g. .435 micro Henry. When I asked him how he had gotten this number he said: I estimated it! (hi) Anyway, a very important rule to calculate the self-capacitance of a single layer coil is: to multiply the diameter in cm by .9 to get the capacitance in pico Farad.

When one calculates the inductance of the coil, however, the Internet provides a smorgasbord of misinformation. In many instances it is impossible to tell what assumptions are being made and, of course, then you cannot fathom what is going on, what makes sense and what not. This is an unfortunate trend for “calculating software” and I feel there ought to be a “truth in software calculating” law, where the designer has to explain and document his approach! Other than that, my advice is: stay away from the Internet and rather do it the “old fashioned way” with formulas from the textbooks!

Our final choice was a $2\frac{1}{2}$ turn coil, 9” in diameter. Klaus measured a 3 turn and a 2 turn coil with resonant frequencies of 15.64 and 28.45 MHz respectively. The $2\frac{1}{2}$ turn coil resonates on 19.98 MHz and yields 471 Ohm inductive on 20 and 570 Ohm capacitive on 10 meters.



*I DECIDED NOT TO BECOME AN ASTRONAUT,
MY MOM TOLD ME THERE'S NO MUD IN SPACE.*

PS. At a small ham fest (Milford, OH) I spotted 2 m dipoles fed with a coil balun. The cable was RG58 type and the coil circa 3 turns at 2” in diameter! According to the builder, N8HHT, he varied the coil observing the SWR and when it was stable (no influence by moving or touching the downlink) he knew it was working!