EXPERIMENTAL BROADCASTER'S NEWSLETTER

July 1, 1985 Vol. 2, No. 7

Happy Hot July. Keep the fans going on your transmitter, especially if you have it hidden in some out-of-the-way place like the attic. We had one report of a garage attic that hits 140 in the summer and -15 in the winter. Great environment for a transmitter. Reminds me of a hill-top transmitter site where I once worked. Out in the open field, tin shed, and a one-room home-type A/C stuck in the door. That location is mentioned later in this newsletter. As I recall I spent many a night, all night, at that location. Some of those times included Christmas, New Years, Thanksgiving, my Birthday, the WIFE's Birthday, etc. The nerve of some people - they ask me if I own a station. Bah, Humbug!

Its been great fun. A lot of fun experiences, like bouncing around inside of equipment racks, dropping peanut butter sandwiches on the turntable,and milkshakes in the cart machines....but I told those stories already (if you weren't a subscriber then, remember, we sell back issues). Now, in business for myself, I have lots of free time. Why, only last week I found an hour just to look at the Sunset.

I guess I'm getting a little punchy. Its 2:00 am and I'm still at the computer. This is the first page, but its being typed last. I've simply run out of ideas. How about some input from subscribers. What mini-lessons would you like to see? How about more station pix and some comments about yourselves?

Are you subscribing to Radio World Newspaper yet? If not, you are missing out on some good stuff. Contact them at PO Box 1214, Falls Church, VA 22041.

What brought that to mind was remembering one of the articles in a recent issue of Radio World. An engineer just discovered heavy duty cartridges and styli with an elliptical point! KVHS, Clayton Valley High School, 410 watts FM stereo (antenna height 680 feet) has been using them for 15 years.. And that reminds me of another story....My Grandmother had an old Victrola when I was a kid. The tone arm had a large "floating head" attached to an elbow. The head consisted of a diaphram activated by a push-rod which was attached to the stylus holder. Vibrations at the stylus were transferred to the diaphram which in turn vibrated air. The vibrating air was pushed through the hollow tone arm to the acoustical matching device, a horn. It gave surprisingly good performance.

All of that I understood quite well, being both mechanically and electrically precocious at the age of 7. What REALLY fascinated me was the stylus. It was made from bamboo. . . . It was shaped into a long triangular stick. There was a tool that came with the Victrola for sharpening the stylus. When it got dull you slipped the stick into the tool.. push-pull, click-click, and a new diagonal cut was made across the triangular section. A new, and sharp tip was created. The stylus was then ready for another 25 plays or so.

So, if the diamond, sapphire, or osmium tip breaks off your stylus sometime just remember the above. Just sharpen a toothpick to a .7 mil elliptical point and glue it to your old stylus. . . . just kidding. But, its funny, I do remember some high fidelity salesman in a department store a few years ago. He was playing a disc with a ball-point pen.

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LETTERS

Dear EBN,

Here are the specifications for the SF530A antenna. This antenna is a real space saver, and its easy to put up anywhere. It's a 25 foot big stick looking very much like a C.B. antenna with the exception of being a little longer and having a bigger loading coil.

This antenna is made by MORAD whose reputation has been mainly in the building of marine transmitters and antennas. You can buy the SF530A antenna from MORAD ELECTRONICS CO., 1125 Northwest 46th St., Seattle, WA, 98107. The phone number is (206) 789-2525.

The SF530A is designed for 530 KHz and costs about $230.00. A similar antenna for 1610 KHz would be shorter and cost about $116.00

If you live in a dry (poorly conductive ground) area you will have to put in a ground system o'f about 300 to 400 feet of #8 wire buried 6 inches in the ground. In wetter areas you can probably get by with just a ground stake.

I get the near field signal at about 500 feet and the far field at about 3 miles with 20 watts. Sometimes on a clear day it can transmit as far as 6 miles away.

SF530A 530KHZ Specs

Base Pipe: 6'x 1.5"OD
Upper Pipe:10'xl.5"OD
Loading Coil: 40"
Covering: White Vinyl
Tip: adj. stainless
Hdw: Nickel Plated

Sorry, antenna pix did not reproduce well.

. . . . . -PIX

J.H. of QFM standing

Cpt. Midnight sitting

Promise of more pix next month!

Dear EBN,

Enclosed please find a photo of our transmitter set-up (studio not shown). We use this set-up for just about all broadcasts because it is portable. We broadcast from various remote sites and portability is a big concern. When we go on live or add a mic, turntable, etc., additional equipment is needed. Mainly we broadcast taped programs which is hassle free for our mobile set-up.

Equipment shown in photo:

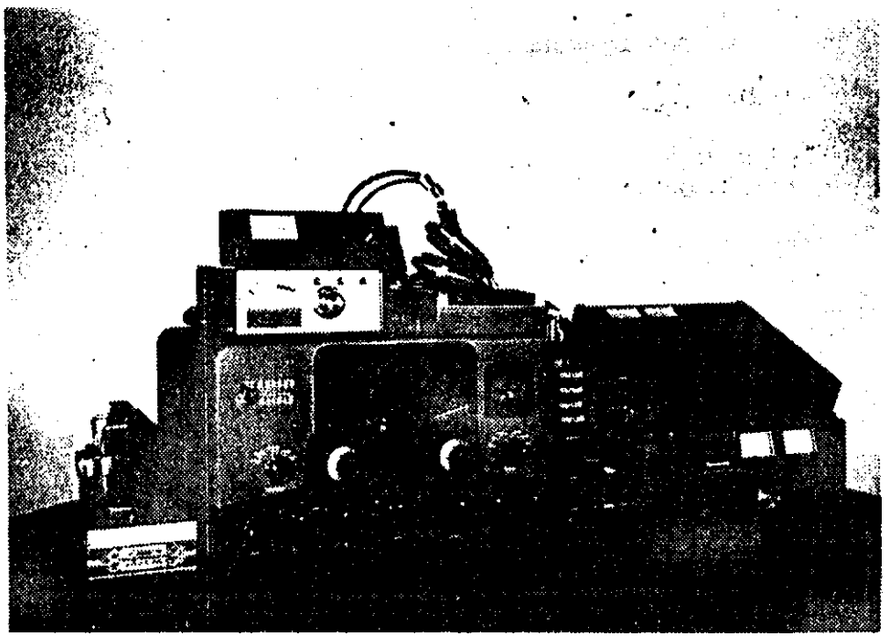
Johnson Viking Ranger I with audio section modified as shown in EBN.

Panaxis MMC custom compressor

Panasonic RS612US & Radio Shack CTR-70 Decks

Radio Shack Mixer
" " SWR Meter
" " Muffin Fan

Akai ASE-24 phones



Our antennas are 1/2 wave dipoles for 41 Meters (7400-7450 KHz). We have crystals for 41 Meters and 19 Meters (15050-15060) KHz. Currently we operate on 41 Meters, but may use 19 Meters later this summer.

Our station has been heard from Hawaii to Virginia, and Canada to Alabama. Anyone interested should give us a listen. We send out QSL's. We also hope that some EBN subscribers may become interested in the "Pirate" scene.

You can contact us by sending 3 First Class stamps (for return postage) to Union City Radio, PO Box 5074, Hilo, Hawaii, 96720.

Mark Taylor, Union City Radio

Editor's Note: Just received a report that Union City Radio was heard in the Channel Islands, Finland, and Belgium. They had some help of course by way of "Climax Relay Service". C. R. S. was transmitting on 6290 KHz on May 19th at about 10:15 GMT, using 20 watts and a 1/2 wave dipole.

WHAT'S NEW AT THE FCC

The frequencies just above the broadcast band, 1605 to 1705 KHz, have been assigned various uses over the years. From the 30's into the 50's a portion was used by mobile law enforcement (hi-way patrols). Broadcast stations were assigned specific frequencies for remote pick-ups, etc. With advances in technology mobile and remote broadcast pickup have progressively moved up in frequency. Many are operating in the 400 MHz range and some in the 900 MHz range. This leaves the abandoned lower frequencies available for reassignment. What the FCC has in mind is extending the AM broadcast band up to 1705 KHz!

The immediate problem of course is most of today's AM radios don't tune up that high. It will take a few years for radio manufacturers to get substantial quantities on the market and sold. The new assignment is scheduled for about 1990, that's only 5 years away!

There seems to be a great deal of support to permit current "day-time only" stations first crack at the new channels. Either/or giving preference to minority groups not currently having a broadcast voice in their communities.

NICE TO KNOW STUFF

We've received word from a few EBer's which have been shut down due to thunder storms. Lightening doesn't have to strike your antenna to cause very large voltages and currents. The static charges present during a thunderstorm can often be seen as small sparks when touching metal objects. Sharp pointed objects may even produce a corona discharge (a kind of fuzzy continuous spark) at its tip. This phenomenon was witnessed and feared by early sailors who saw sparks dancing on the tall masts of their sailing ships. They called it St Elmo's fire.

Your antenna may produce just such a corona during a storm. The voltages can be quite high, perhaps up to 50,000 volts. These high potentials can do funny things to the output stages of a transmitter. So far the damages reported have been to MOSFET power transistors.

There isn't much you can do about a direct hit, but you can reduce the danger from static buildup. Simply place a radio frequency choke between the center conductor of your coax and around (coax shield). This, can be at the antenna, or be permanently installed within the transmitter. The choke must have an inductance value where its reactance is several times the line impedance. A value of 3 uH or more for FM transmitters, and 300 uH or more for AM transmitters should do it. The radio frequencies see the inductance as a high impedance, almost not there. The static charges leak through the choke to ground since DC sees it as a piece of wire.

Your editor repaired a station that had a direct hit. Awesome is the word! It evaporated a foot of the center conductor of 7/8" Heliax. The center conductor was 1/4" copper pipe. We removed the coax connector, looked inside, (like looking into a garden hose) and saw nothing! Two feet were sawed off before we found a point where the center conductor was still o.k. Other damage included transmitter interlocks and doors fused together, transmitter power plug completely missing, and power sockets blown out of the wall. AND, the tower was properly GROUNDED!

Mini-Lesson: The good ol' low-pass filter

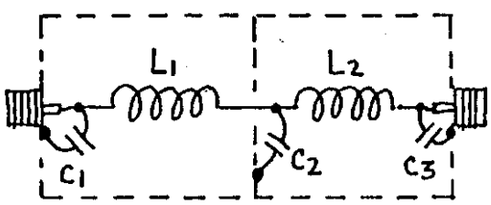
One of your primary concerns as a broadcaster should be to avoid interference to other radio services, this includes tv service. Operation on the FM band can cause interference to TV, Aeronautical channels, etc. Harmonics from operation on the AM band can cause interference on the shortwave bands, even though you, the operator, may not know it.

Interference comes in several forms. (1) Harmonics...these are multiples of your operating frequency. If you are operating at 1000 KHz, you may have harmonics at 2000 KHz, 3000 KHz, 4000 Khz, etc. On the FM band at 100 MHz you could easily have harmonics at 200 MHz, 300 MHz, 400 MHz, etc. (2) Spurious frequency generation....This is where internal problems of the transmitter produces other frequencies in addition to your desired frequency. These "spurs" may not have any relationship to your desired frequency. For example, you might be at 100 MHz, but have spurs at 89.5, 106.25, or whatever. Of course you may also have harmonics (multiples) of all your spurs as well as your fundamental. (3) Splatter...This is usually caused by overmodulation. It produces odd-order harmonics of both the fundamental (carrier) and your sidebands (carrier +/- your audio).

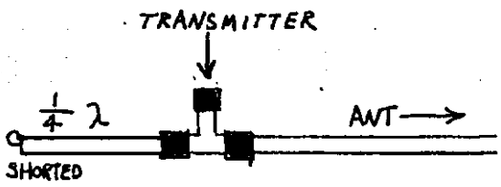
There are several types of filters, the easiest to construct is made from a length of coax. It suppresses your even harmonics (x2, x4, etc.) A 1/4 wavelength of coax is connected to your feed line through a "T" connector. The end of the 1/4 wavelength coax is shorted. A 1/4 wavelength of shorted coax appears resonant (high impedance) at your carrier frequency but is almost a dead short at twice that frequency. Fine tuning is done by making the coax a little long to start with and then jamming a pin into it at intervals coming back from the end. This way you are shorting the end and changing its length until you have it tuned exactly where you want it. You then cut the coax at that point and make the short permanent. You can also use a 1/2 wavelength coax but the end is left open instead of being shorted. Both of these are good only for one frequency, the one you tune it for. These work well for the FM band as they are only a few feet long. On AM however 1/4 wavelength is 100 times longer!

A low-pass filter attenuates all frequencies above your carrier frequency. This covers both even and odd harmonics, but has no effect on spurs which might appear below your carrier. A simple and inexpensive low-pass filter can be made from 2 coils, 3 capacitors, a metal box, and a couple of coax connectors. The biggest difficulty with this filter is calculating the coil turns. The schematic on the following page is a "PI Configured, 5-element, Chebyshev Low-Pass Filter". Either end can be the "in" or the "out".

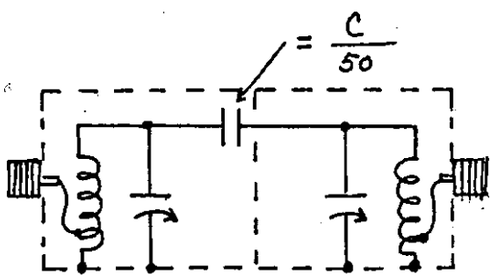
Cases (2) & (3) require a band-pass filter because you have frequencies not related to your carrier frequency. This is a circuit that tunes sharply to your desired frequency allowing it, and only it, to pass on to the antenna. All other frequencies, both above and below your carrier are attenuated. The following page shows the schematic of such a filter. It uses 2 parallel tuned "tank" circuits which are very loosely coupled together. The coupling may be either "capacitive" or "inductive". This one uses capacitive coupling. As in the low-pass filter the difficult part is determining the coil turns. In addition you must also determine the tuning capacitors and the "taps" on the coil.



LOW-PASS FILTER: C1=C3=C/f, C2=(2)C1, C=2400 pF, L1=L2=L/F, L=10.38 uH, f=MHz. This circuit is designed for 50 ohms in and out. Two coils are placed in a long box with a shield between them. The capacitors are soldered to the inductors and to the box as shown. Find values of components by dividing C and L by your frequency in MHz. Values shown are for 1 MHz.



QUARTER WAVE SHORTED STUB': Length in feet = 246 VF/f Where f is your freq. in MHz and VF is the velocity factor of the cable. The velocity factor of "poly" cable is .66, "foam" cable is .80. Start a little long and shorten cable to tune it to your frequency.



BAND-PASS FILTER: L=79.62(f)(10^{6}),C=.0003(f)(10^{112}), Where L is in uH, C is in pF, The formulae are more complicated than this. Above were worked out including a "Q" of 10 for this circuit. All you need to do is plug in your frequency and punch it up on your calculator. Use twice the calculated value for selecting your variable (trimmer) capacitors. That way your tuning adjustment will be about center of their range.

COIL WINDING DATA:

There are optimum sizes for winding coils. For the above examples the coil length should be no less than 1/2 nor more than 3 times its diameter. To find the number of turns use:.

Turns = $\sqrt{L(18d + 40i)/d}$

Where L is in uH
d=coil diameter in inches
i=coil length in inches

Example: 1.5 MHz, low-pass, L=10.38uH/1.5=6.92uH

Coil diameter is 2", length is 4"

$\sqrt{6.92\ (36 + 160)/2}$ =17.6 turns

Unfortunately this formula can not be used with accuracy at VHF frequencies so we have to resort to an empirical table, a portion of which is shown here:

d=l/2" wound 8 turns per inch

1 turn	=	.045 uH
2 turns	=	.08 uH
3 turns	=	.12 uH
4 turns	=	.18 uH

Example: 108 MHz. low-pass, L=10.38uH/108=.096uH

The coil would be a little over 2 turns and 1/4" long.

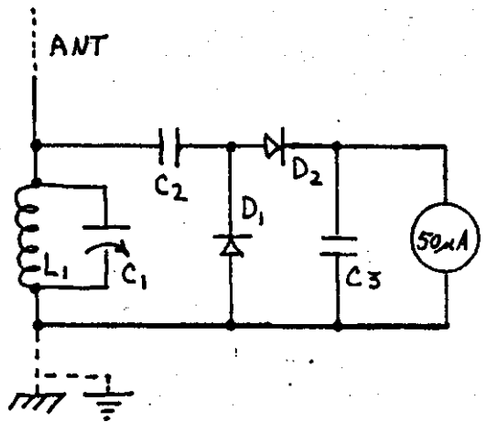
Mini-lesson: Measurement of Field, Strength

Some radios have signal strength meters. Just look at that meter and tune up your transmitter for maximum reading, right? Well, almost right. The meter in the radio is driven by the AGC (automatic gain control) circuit. Its function is to lower gain as the signal gets stronger. The result is the meter reading increases only a small amount compared to the actual field strength.

A field strength meter, made for that purpose, shows a change in field strength in greater detail. You can make one easily, for less than $10 if you shop around. Most of, if not all, the parts can be purchased at Radio Shack.

It can be built on a perf board, installed in a plastic box with a tuning knob, and requires no batteries. It is easy to use too. Just connect any length of wire to it, place it some distance from the antenna-but where you can see it, and tune up! If the meter pegs to the right just make the antenna shorter by folding back the end of the wire. When measuring broadcast band (AM) signals you may have to connect it to a "ground" as well.

PARTS LIST - Field Strength Meter,
L, 4 turns, 1/4" diameter, 1/4 long (for FM band) or
L, "slug tuned coil" for AM band
C7 50 pF trimmer (for FM) or 100 pF for AM
C2 100 pF ceramic disc cap
C3 .001 uF ceramic disc cap
D1, D2 IN34 diodes or equiv.
Meter 50 uA (Radio Shack 270-1750)



LOOPS

I received a bit of interesting information the other day concerning loops. The information was followed up with a copy of an article run in Popular Communications, August of 1983;

Apparently Telco (Bell telephone system) has test trunk lines in every one of its toll offices. These are used by the repairmen, and testers, to check out different lines in the system. There are several toll (exchange) offices in any one area code. This makes for a lot of these test loops.

The last 4 digits are always similar, consisting mostly of 9's. There are usually two of these lines to an exchange. Typical numbers would be 877-9990 and 877-9993. The 877 denotes the exchange, the 999- denotes the test line.

If you dial the higher number of the pair you hear silence, the lower number you get a 1000 Hz tone. In either case you will not hear it "ring". If you dial one of these "loops" you will be billed as if you made any other local call. If you dial a loop in another area code you will be billed for the long distance charges as well. Continued on page -8

WANTED, FOR SALE, EXCHANGE, SWAP, BARTER

Wanted: Shortwave transmitter for 7400 KHz. Must work great. Write Wizzard, c/o Debbie Nyburg. PO Rox 475. Cambridge, NE 69022

Wanted: Contact with phone phreaks, info on-excitersand various "boxes", and pirate operators Write: Union City Radio, PO Box 5074, Hilo, HI 96720

Wanted: Public Domain and/or other computer programs for IBM compatible. Areas of interest are graphs, word processing, records, data management, satellite location, general and communications electronics. Can work trade (for programs or Panaxis products) or cash for the right stuff. Write "Ernie" c/o EBN, PO Box 130, Paradise, CA 95969

Wanted: Contact with other EBer's, especially those living in my state. Contact: John Hart, 5157 Langston Rd. Virginia Beach, VA 23464

Wanted: Information, stories, etc., about short wave and broadcasting "PIRATES". Names do not have to be given. Material to be used in preparation of a new Panaxis "Broadcaster's Library" book on "How to get into Pirate Broadcasting". A copy of the book will be sent to all those that have contributed substantial and worthwhile materials. Write: Panaxis Productions, "Book Division", Box 130, Paradise, CA 95969

Loops.....continued.

So what, you say! Well here is the glory of it all. Apparently "pirates" along with many other "groups" use these loops for conversation or whatever. If you dial either number, and someone else has dialed the other number, you'll be connected and can talk to each other. You have complete anonymity, no one knows who you are, unless you tell them of course. You can have conversations with complete strangers, talk about anything, or make scheduled calls to friends or "pirates".

Most users of loops do their calling late at night when Telco tech's are not working, just to avoid any hassle. Most of the time however Telco doesn't seem to mind. Occasionally Telco will have their computer check billing to see if a loop has been called - if it finds someone then a notice is sent explaining that Telco loops and are not to be used by the general public.....

When loops are accessed in other area codes, like halfway across the country, it is almost impossible to trace the callers. A technician would have to be on duty at the time, and even then it would take time to trace. Most users therefore change loops periodically, and keep conversations down to a few minutes, just to be safe.

We don't have a list of active loops, you'll have to experiment and find them on your own. It has been reported however that a pair in the 713 area code are 664-1799 and 664-1499. If you have any information on loop numbers and wish to pass it on, just write us a note here at EBN. We'll keep them handy for anyone who wants them.