EXPERIMENTAL BROADCASTER'S NEWSLETTER

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We're getting a computer. Perhaps it will save some time in keeping office matters, inventory, mailing lists, etc. straight. It will also allow calling up names and addresses of customers and what they have purchased in the past. My brain box has been become overloaded and is about to crash.

Don't worry, we're not planning on getting a Modem right away, but when we do you computer hacks out there will only be privy to what we want you to have (ref April Issue).

We still need pix. I get promises, but still no pix.

We also need letters. Give us some feed-back and let us pass along to other EBer's what you are doing.

LETTERS

Dear EBN,

We began receiving your newsletter last year but were a little reluctant to send much information about our operation. We can tell you something about us though. Thereare four of us at the station. Fortunately we have two that work as electronic techs at a local company and keep our equipment going. We put a lot on tape but do some live announcing to.

We got a old Gates 1 kW AM transmitter and fixed it up. We built a little block building to put it and our audio stuff in. Our antenna is only 50 feet high but we have it loaded o.k. We are only on 4 to 5 hours a nite. We are close to the Mexican border so we get coverage into Mexico as well. We use Mexican call letters so the FCC doesn't know where we are. We'll let you guess what the call letters are. Listen for us at 1420.

Juan

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MINI-LESSON: Conversion of Amateur and Military surplus transmitters for Experimental broadcasting

Now and then one comes across an Amateur or Military transmitter for what may be a very reasonable cost. These can sometimes be found in flea markets, Ham radio shops, classified ads, surplus houses, etc. The transmitter may be rated at anything from a few watts to a hundred watts or so, and they come in AM and FM models!

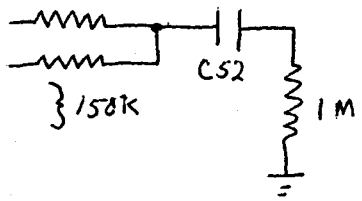
The first thing to consider of course is whether the radio can operate on the frequency you want. A 160 Meter transmitter (1.8 MHz) can be brought down into the AM band by changing crystals and adding some capacitors across the oscillator, buffer amplifier and final amplifier coils. Another example is 6 Meter and 2 M Amateur FM transmitters. By modifying the output stage of a 6 Meter unit so that it will double the frequency you can get it on the FM band. By eliminating a doubler stage on an older 2 Meter unit you can convert it to 72 MHz...a little more modification and it comes up to the FM band.

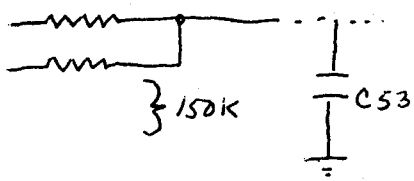
These kinds of modifications however requires someone who is well versed in RF (radio frequency) circuitry. Although all this looks like it may be an answer to some EB'ers dreams there are other limits to contend with. The audio sections are not designed for MUSIC! They are designed for VOICE frequencies. The audio bandwidth is usually shaped to roll-off below 300 Hz and above 3000 Hz. Not only that but Ham and Military FM transmitters are designed for NARROWBAND FM, and therefore can never sound as LOUD as a broadcast transmitter. NBFM is limited to + and - 5 KHz, while broadcast FM is + and - 75 KHz.

Usually you can modify the audio section of the transmitter to widen the response. The following is a schematic of the audio section of an Amateur transmitter. It was designed to give roll-off characteristics keeping the audio response limited to the voice frequencies.

Let's analyze the circuit a bit. First of all the input impedance is set by R16 and R17 at about 1 Megohm. This indicates a high impedance crystal or ceramic mic type input. If you were to connect this input to a mixer output without some kind of attenuation you would most certainly overdrive the first or second amplifier, but we'll get into that a little later.

If we redraw the tube impedance and R19 in parallel to indicate the driving impedance and show C52, C53, and R21 as portions of the load, we can analyze the frequency response.





A rule is that when the capacitive reactance is equal to the circuit resistance in a series circuit, the audio response is down 3 dB at the frequency at which this happens. The formula is: $\frac{.159}{C \times R}$ = Freq. $\frac{.159}{.0000000005 \times 1{,}150{,}000}$ =300 Hz

This says the bass response is -3 dB at 300 Hz, about -6 dB at 150 Hz and about -9 dB at 75 Hz.

The second drawing shows how C53 tends to "short out" the higher audio frequencies.

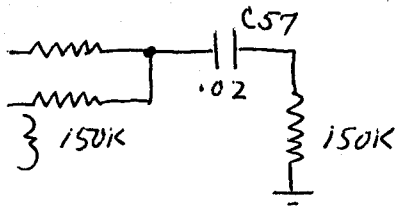
$\frac{.159}{.0000000002 \times 150{,}000}$ = 5300 Hz -3 dB at 5.3 KHz

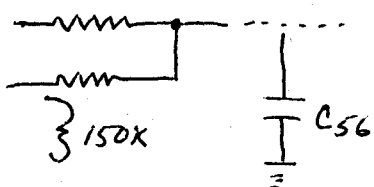
Redrawing the second stage shows C57 with the total series resistance, and the shunt effect of C56 with the drive impedance.

$\frac{.159}{.00000002 \times 300{,}000}$ = 26.5 Hz $\frac{.159}{.000000000 \times 150{,}000}$ = 2120 Hz

-3 dB at 26.5 Hz we can live with. But -3 dB at 2120 is about -6 dB at 4240 Hz and a -9 dB at 8.4 KHz.

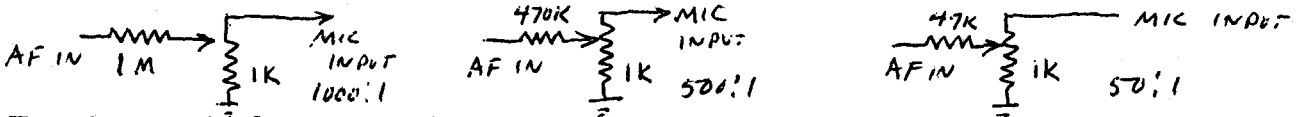
In conclusion then: The audio is down to -9 dB at 75 Hz and about - 9dB (-3 dB at 5.3 KHz + a - 6 dB at 4.2 KHz) at about 5 KHz.



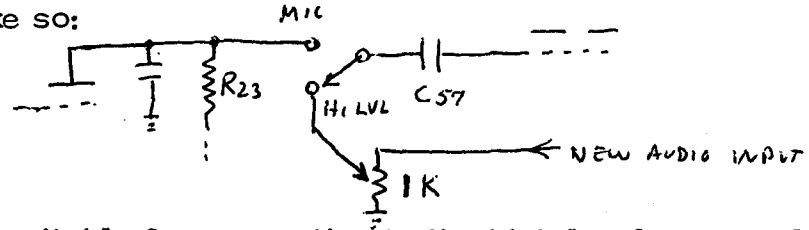


To improve the low frequency response C52 should be made larger, at least a .01 uF cap. To improve the high frequency response C53 and C56 should be made much smaller or be removed entirely.

As mentioned earlier feeding the mic input with line-level audio from a mixer would overdrive the first and second stages. An attenuator "pad" should be inserted between the mixer and the mic input. Mic inputs usually require only about 1 to 10 millivolts. The output from a mixer is between .5 (500 millivolts) and 1 volt (1000 millivolts). This means a reduction in audio level of 50 to 1000 times! A simple resistive divider will do the trick, like so:



For the particular transmitter shown here however it might be wise not to use the mic amplifier at all, but to simply go direct to the audio driver from the mixer. An added advantage is you have two less amplifier stages and therefore a good possibility to reduce tube noise. A suitable input circuit would simply switch the mic amp out of the circuit and connect instead to a line-level and volume control input, like so:



The above would also be suitable for connecting to the high level output of a compressor / limiter.

Other factors which may make an Amateur or Military transmitter difficult to modify for experimental broadcasting are: RF bandwidth, lack of broadcast preemphasis in FM's, and power supply. These can be corrected but are topics to be discussed at some later date.

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While we are somewhat on the subject of frequency response , let's clear up some of the myths about it. Consumer hi-fi gear is great for advertising response and distortion characteristics that would make any dog happy. Amplifiers that are flat from dc to 50 KHz, distortion less than .05%, etc. What humans can hear, and what the FCC has set for broadcast standards, are far below those specs.

As a general rule humans can hear from about 16 Hz to about 16 KHz. Below 16 Hz the sound becomes more of a rapid pulse rather than a tone. Above 16 KHz you don't hear the tone any longer but may experience a "pressure" on your ears.

You can barely pick out .1 % distortion when listenting to a single tone on a test record. On some tones you may even pick out as low as .01%. But with music it is almost impossible for anyone to detect less than 1%. Most listeners would not even be aware of 3% distortion.

The FCC has been aware of all this of course for many years. It has been documented over and over by audio engineers, the broadcast industry, etc. A distortion level of up to 3% is acceptable, and a frequency response of 30 Hz thru 15 KHz is acceptable.

The FCC specs for broadcast service for example follows the above criteria. They have allowed 2.5% of distortion at one end of the spectrum and 3.5% at the other. They also have allowed a -3 dB roll-off at any point along the frequency response. Most stations easily exceed these specs, but unfortunately some don't even come close.

Perhaps what is more important, at least in FM, is that the response is not rising in level as it does in frequency. FM of course does this on purpose with pre-emphasis, which is corrected at the receiver with de-emphasis. It is actually beneficial to start a roll-off of frequencies above 15 KHz right at the transmitter. The further reduction by de-emphasis at the receiver gives some extra noise and distortion reduction.

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There seems to be a renewed interest in hi-fi AM. I've been asked several times this past month about it. In the old days, the 30's AM was capable of broadcasting hi-fi but was limited by the audio equipment available. AM is still capable of hi-fi transmission but is now limited by regulation and convention. AM stations are allowed up to 8 KHz of audio. With AM that generates two sidebands for a total bandwidth of 16 KHz. AM receiver IF's (intermediate frequency amplifier stages) are designed for a 10 KHz bandwidth. Bandwidth is defined as the point where the signal level drops 3 dB. In this case then the receiver itself limits the audio response...its down 3 dB at 5 KHz audio.

This condition worsens with AM stereo. Since the stereo encoding utilizes phase shifts in the sidebands, any sideband degradation messes up the stereo. The side bands consist of the carrier frequency minus the audio frequency (lower sideband) and the carrier frequency plus the audio frequency (upper sideband). It is possible for the two sidebands to travel to a distant receiver by slightly different paths. This is something like "multipath" experienced with FM stereo. With AM stereo however the "center" of the music seems to move around the room.

If you operate on AM you might want to boost 5 KHz 3 to 5 dB, and 8 KHz 5 to 7 dB to make up for the receiver's deficiency. Not too much however as this could produce interference with adjacent channel stations.

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We've talked about SCA in previous issues, and that the FCC has made some new rules about it. The old SCA frequencies were 41 KHz and 67 KHz. A new one at 92 KHz is now permitted. AND, at least one major broadcast equipment manufacturer has a 5 - channel SCA modulator available!

SCA (Subsidiary Communications Authorization) is a channel that can "piggy-back" on a regular FM carrier. The 41 KHz channel can't be used with a stereo transmission because the two interfere, but the other channels can be utilized for various purposes.

For example: In addition to regular FM stereo programming, a background music or announcment channel can be transmitted at the same time. With yet another SCA channel a second back ground music, or even computer data can be transmitted - 3 different programs!

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MINI-LESSON The care and feeding of records and tapes.

There are a lot of record cleaners, tape cleaners, head cleaners, etc. for the very serious audiophile (and broadcaster). The truth of the matter is that some of them can actually be detramental to sounding good.

Some so-called record cleaners will actually leave "a waxy buildup" in your grooves! Cloth of any type can leave lint, and if it picks up abrasive material, can cause bad scratches in the vinyl. One classical station in San Francisco has a method they swear by...they wash their records once a week in room temperature water and a good brand of detergent! They give them a final rinse in clear water (room temp) and then air dry. The drying can be speeded up by blow drying with a fan or a blowdrier without heat.

They go to great lengths also to protect the record from warping. Vinyl should never be subjected to long term stress. Stress in this case means heavy weight upon it, or that it be allowed to rest on top of something, or against something at an angle. A single record may be laid flat, but should never have other records stacked on top..this is additional weight. Records should be stored perfectly vertical, not slanted one way or another. When a number of records are stored together they should not be tightly packed. Always keep the record in the jacket when its not actually on a turntable.

A good tape head cleaner is plain old alcohol. You apply it to the tape head with a cotton swab (Q-tip) with a little rubbing motion. Inspect the head to be sure all the dirt and scum have been removed. Always use a good brand of tape. Once a week cleaning is usually ample. Inspect the head at the same time for pits or grooves - a sign that it needs replacing.

When you're in a hurry it is often easy to just lay your tape down somewhere shile you cue up the next record, or change tapes. Be very careful of the place you put it down. If it is within 6" to a foot of electric motors, transformers, or current carrying wires, you could be in trouble. Tapes are erased by alternating magnetic fields.

A tape set down on top of a vertically mounted (setting on a table) reel-reel unit for just a moment while you put on and start a new tape can be damaged! It may not erase the whole tape, but may leave lower volume areas at one point on the reel. This comes out as a wooosh in the music level every time the reel goes around once. You see, even though it is hidden the tape motor is inside that case and probably close to the inside of that case (close to the outside).

Heat of course is bad for both records and tapes. With records it tends to warp them. With tapes it tends to erase them, and with older tapes makes them brittle. Always keep your materials in a cool, dry place, a good rule being no warmer than you can be comfortable with yourself!

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WHAT'S NEW AT THE FCC

Title 47 of the code of federal regulations now available at the Government Printing Office. These are four volumes of the FCC's Regulations as revised as of October 1, 1984.

		stock #	
Parts 0-19	$13.00	022-003-95441-4	Contains part 15 covering low power radiation devices - carrier current, wireless mics etc.
Parts 20 - 69	$14.00	022-003-95442-2	Not much interest to EBer's
Parts 70 - 79	$13.00	022-003-95443-1	Contains parts 73 (am,fm,tv, broadcasting, 74 auxiliary bdcs table of frequency allocations, and part 76, cable
Parts 80 - end	$14.00	022-003-95444-9	Part 95 on Personal radio and General mobile, Part 97 on Amateur radio

Also ask for "Rules in Print" - these are latest amendments to the Rules. Part 73,74 is $6.50 stock # 004-000-00411-6, and parts 2,5,15,18 is under stock # 004-000-00410-8 and goes for $5.50

Order from: US Government printing Office, Superintendent of Documents, Washington, D.C. 20402. OR Order by phone on Mastercharge or VISA, at (202) 783-3238

WANTED, FOR SALE, EXCHANGE, SWAP, BARTER

For Sale: Five watt FM, Make decent offer, Contact Rich White, Mt Vernon Plaza, 1058 Mt. Vernon Ave. Columbus, OH 43203

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

Wanted: Seeking correspondence/ideas from other EB/Pirate types. Formerly a local musician, I now work as a weekend D.J. announcer at a 1 kW commercial AM. I also operate a mobile recording studio. Want a low power station for the purpose of promoting local musical talent. Mailing address: Underground Sound, PO Box 143, Sunbury, PA 17801-0143

For Sale: Two AM 5000 units upgraded for more power and frequency control. Both are in one cabinet with two power supplies, 5 watt amps, and two exciters. $350.00 or best offer. ALSO, FM transmitting antennas cut to your frequency. QUARTERWAVE type gives effective power gain of 2 on metal mast; $100.00. HALFWAVE type gives effective power gain of 4 on metal mast; $135.00. ALSO, FM transmitter in deluxe cabinet with latest revised circuitry, upgraded to 1/2 watt, with 1/4 wave antenna (covers 7 miles with antenna at 15 feet off ground), $425.00. Contact Steve Webb, KKTO inc, 816 Woodlawn Dr., Thousand Oaks, CA 91360 or phone (no collect calls) (805) 495-0262

For Sale: NUMARK DM 1000 Mixer. 2 phono, 2 tape, 2 mic, cue, master fader and talk-over switch. $40.00. Contact Paul Kriegler, 423 N 47th ST, Omaha, NE 68132

Wanted: Rock programs for my LP station on trade basis. Will produce free rock shows for you if you supply tape and $1.00 for postage. Send for listing and free ROCK promo to: Music Data Base/KAOR-FM, PO Box 1625, Silver Springs, FL 32688-1625

For Sale: 4 books: Modern Radio Broadcasting - Management & Operation in Small-to-Medium Markets, How to Write News for Broadcast & Print Media, Modern Radio Programming, Radio Advertising - How to Sell and Write it. The Original cost about $40.00, sell for $15.00 (includes shipping). Write: Ernie, 3460 Skycrest Drive, Oroville, CA 95965

For Sale: A pair of very nice API 4 " VU meters (for building your own console). Original cost $40.00 each, will sell for $20.00 each. Call PANAXIS, (196) 534-0417