EXPERIMENTAL BROADCASTER'S NEWSLETTER

December 1, 1985 Vol. 2, No 12

Only 25 days until Christmas. My how time flies when you're having fun. Your EBN editor for example is receiving part of his Christmas presents in the form of more computer goodies. We've just added a "Near Letter Quality" graphics printer, and in a week or two we'll have 20 Megabytes of storage. All this helps Panaxis give customers quicker and more specialized services. You'll see some evidence of this in following pages, one of which includes an FME exciter update.

Several things delayed completion of the EBN on time this month. Waiting for some pix and articles, and my wife in the hospital for a few days after Thanksgiving, to name a few. Next issue should be on time.

We still need more input from each EBN subscriber. Tell us about your format, equipment, how you got started, what ideas you may have on station improvements, etc. And....send pictures. If We run short of information each month I have no choice but to fill these pages with "mini-lessons".

On the subject of mini-lessons...your editor's background is mostly in electronics, broadcast engineering, and teaching of same. This means mini-lessons will usually be technical in nature. Each subject will be made as simple as possible in the few pages allowed, but now and then you may feel like your in a snow storm. If I get carried away to the point where you can't follow what I'm trying to say, **PLEASE** let me know. Teaching something, even in bits and pieces, requires feedback. I need to hear from you!

Also, if there is a subject you would like me to cover in the mini-lessons, let me know. The EBN was started to assist you in making a better station. To do that I need to know what information will do you the most good.

Published by PANAXIS PRODUCTIONS, Box 130, Paradise, CA 95969

STATION OF THE MONTH (Radio 1200 Network)

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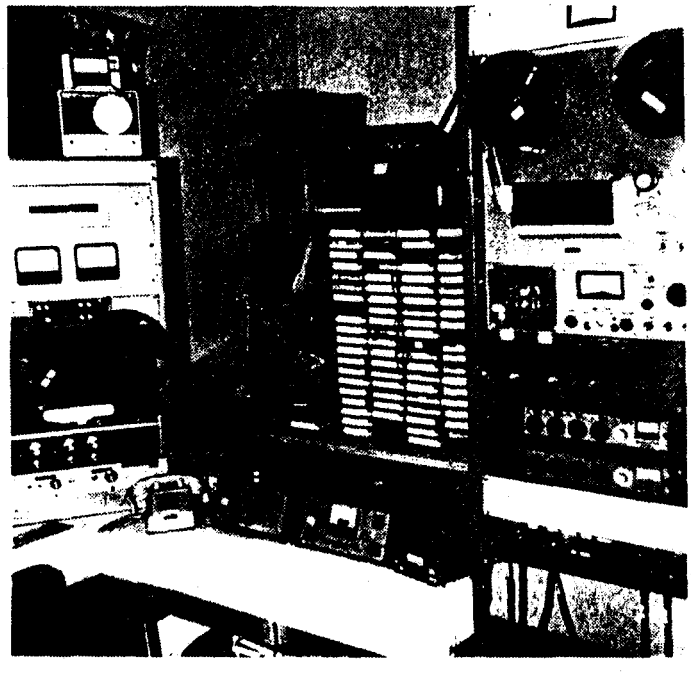
EV635AS mics
Fisher Reverb and Numark EQ



WHAT'S NEW AT THE FCC

The Commission apparently is still aggressively searching for "pirate" stations to shut down. It was reported to the EBN that at least 3 low power (2 watt and below) FM stations were closed in the Brooklyn area. Publications such as Popular Communications however only indicate shortwave station closures and fines. The FCC has been reported to be in areas where low power FM stations reside, and in some cases have shown that they knew the stations were there.....but seem to be ignoring them.

The poor FCC is loved by very few. It should be remembered that its just another job and somebody has to do it. The Commission however is now making broadcasters even more upset. They are now trying to raise the fees for construction permits. The "government" has from time-to-time tried to make various agencies self supporting..bringing home their own operating expenses. The FCC has not been very well budgeted the last few years. This then may be an attempt to gather more operating monies but at the expense of broadcasters..so says an editorial in BM/E (Broadcast Management & Engineering).

The Field Operations Bureau (FOB) in the past has been able to levy fines of up to $2000 directly to a broadcast station. Licensed station violations which would call for a larger fine had to be referred back to Washington,DC. Apparently that's not the case any longer. The Field office inspectors are being given the authority to levy fines up to the maximum allowable under current law..$10,000! Broadcasters are not too happy about that either.

The latest census from the FCC indicates there are 4,793 AM stations, 3,818 FM stations, and 1,202 Educational FM stations in the U.S. How come they don't give us a figure for Carrier-Current, low-power FM, and shortwave"pirate" stations?

The NAB (National Association of Broadcasters) is concerned about the FCC's deregulation of RF interference caused by certain types of appliances. With the proliferation of computerized driers, refrigerators, cook stoves, and washing machines, and a bunch of other stuff, the airwaves are being bombarded by millions of tiny transmitters. Ultrasonic pest control devices may operate just above the range of human hearing...but some also generate radio waves as part of the process. Interference has been reported from 20 MHz all the way up to 470 MHz (FM band included).

Although this computer doesn't seem to cause interference, my scope and frequency counter both plant a carrier in the middle of the FM band! I found this out the hard way while trying to repair an oscillator. I found the carrier on the test radio ok but no matter what I did to the circuit I couldn't get it to change frequency. I found the reason by accident when I switched off the 'scope before turning-off the radio..and the carrier disappeared!

MINI-LESSON (A passive notch filter)

A notch filter is a device for reducing (or nulling) the amplitude of a particular frequency. There are two types, the active filter which uses a controlled amplifier of some type, and the passive filter. The passive filter uses only resistive, capacitive, or inductive components. Generally the active filter provides a very deep null and fairly narrow bandwidth. That is it reduces the level of the desired frequency and only slightly reduces frequencies on either side of that. A passive filter offers simplicity however and is quite often sufficient for reducing the level of an undesirable frequency to an acceptable level.

The Panaxis FME 250 exciter circuit has a couple of quirks which can be annoying when they pop up. One of these is the 25 kHz PLL reference frequency not nulling completely at some selected FM frequencies. It becomes a problem only when modulating with a composite stereo signal. The 19 kHz pilot mixes "beats" with the 25 kHz and produces a difference frequency of 6 kHz. This 6 kHz is then a background tone in the audio.

The following circuit has been installed on at least one FME 250 with excellent results. The circuit is a "Bridged T" filter. It may be used on any frequency simply by calculating the values of the components. You can make a passive 19 kHz notch filter for example, or even a 60 Hz notch filter. The upper frequency limit is determined by wiring techniques and stray inductance and capacitance. This means it's usable up to perhaps 200 kHz to 500 kHz.

A simple computer program in "Basic" makes it easy to determine the correct values of all components for any frequency you wish to null. The smaller the value of R2 and/or the larger the value of C, the deeper the null. Remember however that a small R2 and/or a large value of C can "load" the signal source. To avoid any problems there you should put a resistor in series between the source and the filter. The value should be at least equal to your source impedance (600 to 10k ohms).

For the FME 250's 25 kHz notch filter the bottom of the null (suppression of unwanted frequency) is better than 40 dB (100 times less). Very close tolerance components will give a greater null. For example the calculation calls for a 3.45 ohm resistance for R2, however a standard 5% resistor is available at 3.3 ohms, so that's what's used. This makes the null center at about 26 kHz (at which the level was down 55dB!).

```
10  KEY OFF:SCREEN 0,0,0,0:CLS
20  INPUT "Null frequency desired"; F
30  INPUT "Value of C in uF       "; C
40  INPUT "Value of R1 in Ohms    "; R1
50  C = C/1000000!: Z = (6.28*F*C)*(6.28*F*C): R2 = 1/(R1*Z)
60  PRINT:PRINT:PRINT "For a null frequency of" F: PRINT:PRINT:PRINT
70  PRINT "C in uF      ="C*1000000!
80  PRINT "R1 in Ohms   ="R1: PRINT "R2 in Ohms   ="R2: PRINT:PRINT:
90  PRINT "Do you want to do another (Y/N)?"
100 Q$=INKEY$:IF Q$=""THEN 100:IF (Q$="Y") OR (Q$="y")THEN 20 ELSE END
```

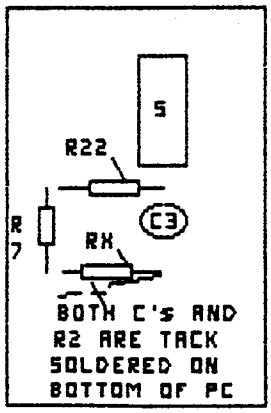
When you run the program it will look like this:

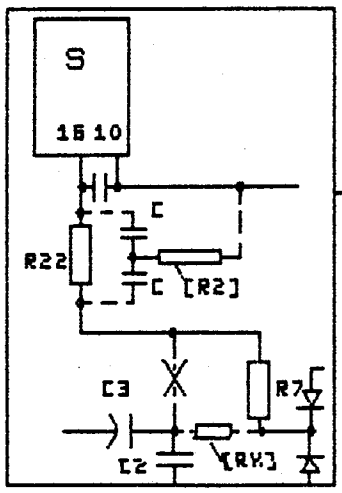
```
Null frequency desired?  25000
Value of C in uF?        .05
Value of R1 in Ohms?     4700
```

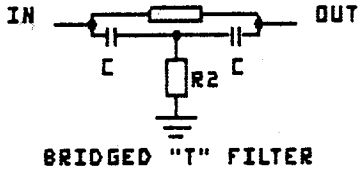
For a null frequency of 25000

```
C in uF      = .05
R1 in Ohms   = 4700
R2 in Ohms   = 3.452732
```

MODIFICATIONS TO FME 250







BRIDGED "T" FILTER

MODIFICATIONS FOR FME-250 EXCITER:

BRIDGED "T" FILTER INSTALLED AT DOTTED LINES USING EXISTING R22 AS THE R1 IN THE ABOVE CIRCUIT. THE VALUE OF C [BOTH OF THEM] IS .05 uF. [R2] IS 3.3 OHMS. RX MUST ALSO BE ADDED AND THE EXISTING JUMPER MUST BE REMOVED. VALUE OF RX IS 2.2K. THIS REDUCES THE 25 KHz REFERENCE FREQUENCY BY AN ADDITIONAL 40-50 dB.

. . . . . .

MINI-LESSON (When is a wire not a wire?)

Dealing with radio frequency energy is a little like working with "black Magic". There are certain rules you must follow to have everything work out the way you want...but often it takes a few choice words as well. What works for ordinary electricity is not always true for working with RF currents.

Suppose you've just assembled an FME 250 exciter. You mount it in a nice metal box so it is properly shielded. You use some plastic spacers and screws to secure the pc board to the inside bottom of your nice metal box. Your pc board ground consists of a 2" long piece of wire - one end soldered to the ground trace on the board, the other end bolted to the metal box. ....WRONG !!!!!

That piece of wire exhibits a characteristic called inductance. Inductance offers an opposition to a change in current flow. That opposition is measured in ohms just like resistance. In this case however the "resistance", called inductive reactance, increases with frequency.

The inductance of a straight piece of wire: $L = .0021[2.303 \log_{10} (4l/d)-1]uH$
Where wire length in cm = l and wire diameter in cm = d

This means a 2" piece of hook-up wire has an inductance of about 60 nanohenries. The reactance is $X_L = 6.28 \times F \times L$ Where F is 100 MHz and the inductance is 60 nanohenries (.00000006 Henry) the reactance is 37.68 Ohms.

In other words, what you might think is a good ground wire is in fact an "ac" resistance of almost 38 Ohms. Assume you have as little as 10 milliamps of RF current trying to get from the board to "ground". The voltage difference from one end of the wire to the other would be $i(X_L) = e$ or about .38 volt!

Now let's assume that you mount the same FME 250 assembly in the box using a metal spacer, 1/4" long, at each of the four corners. The spacer is about .4 cm in diameter and .6 cm long. From the previous formula we can calculate about 3 nanohenries of inductance for each spacer. All four spacers are connected from the common trace on the board to the "ground" of the box..they are all in parallel with each other..the total inductance is 3 nH divided by 4 = .75 nH. The reactance at 100 MHz of .75 nH is about .5 ohm.

Now, if we have 10 milliamps of RF currents seeking ground the situation has changed. The voltage difference between board and box would be .01 amps times .5 ohm = 5 millivolts. This is certainly a lot better than .38 volt (380 millivolts). Radio frequency circuits have a difficult time operating properly when their "ground" is floating at some voltage level above an actual "ground". The short metal spacers therefore provide a much better ground than does some random length of wire.

Another example illustrates why interconnecting wires should be kept short. Suppose you are connecting the output of an FM oscillator to the input of an amplifier (such as from the FME to the FMA 5000). If we use a wire about 3" long we'll find its reactance at 100 MHz is about 50 ohms. The input to the amplifier is also 50 ohms but is mostly resistive (not reactive like an inductor). The reactance of the wire is in series with the amplifier's input. This results in less drive voltage reaching the amplifier. Actual drive power could be reduced to 1/2!

To calculate actual losses you must consider several variables. Some of these include the impedances (vector sums of reactance and resistance), distributed capacitance, skin loss (RF currents travel on the surface or "skin" of a conductor), etc. Larger diameter wires reduce skin loss.

A similar problem exists between the output of the amplifier and the antenna connector. If the wire is too long the resulting inductive reactance can cause a loss of output power. Where interconnections have to be longer than an inch or two it is advisable to use coax cable instead of regular wire.

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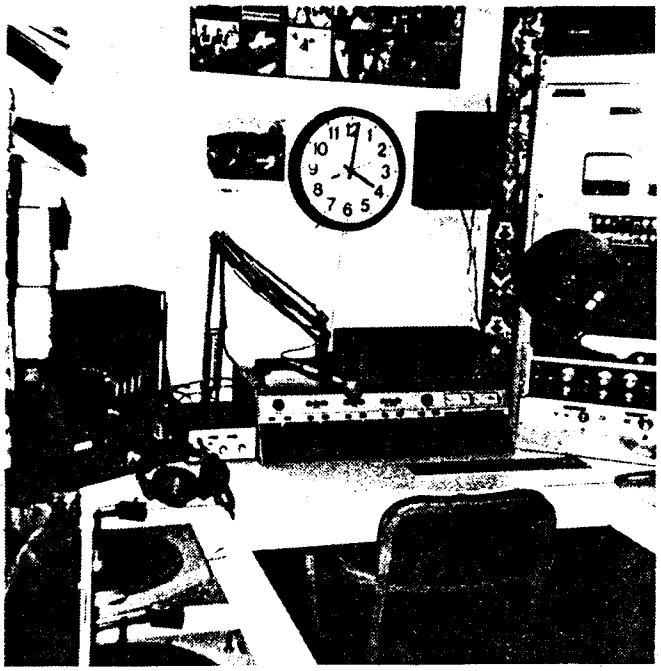

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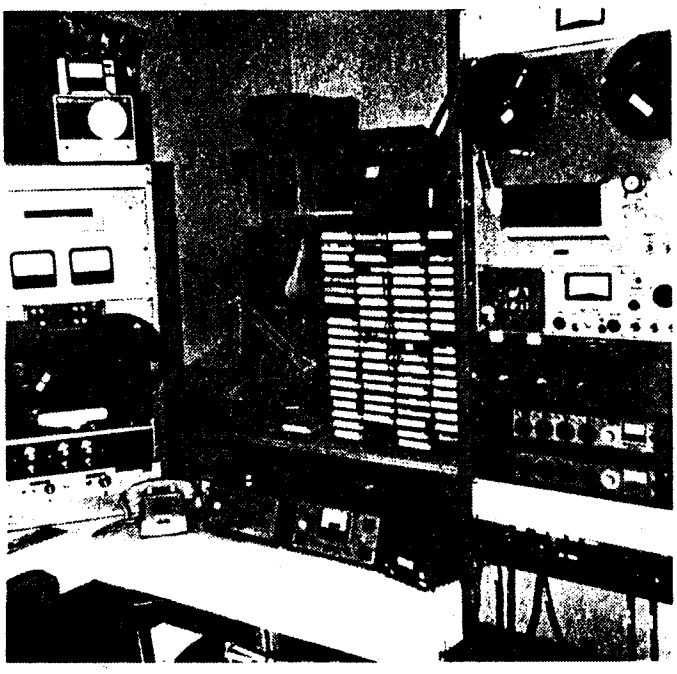

WANTED, FOR SALE, EXCHANGE, SWAP, BARTER

FOR SALE: FME 5000 stereo unit. Best offer. Going cable..Rich White, 518 E. Town St. Suite 621, Columbus, OH 43215

FOR SALE:(1) 10 Megabyte hard drive for PC. Presently in Panaxis' IBM compatible. Moving up to larger storage of 20 Megabytes. Unit purchased in May 85, still has 4 months of warranty left. (2) Heathkit 35 MHz, dual trace scope with delay line and all that good stuff. Cost $800.00 as new kit, assembled by "high quality technician". Excellent condition. (3) Four foot microwave "dish" (have two of them). Can be used for experimentation with satellite tv reception if you have a good LNA. Contact Ernie (Panaxis) at (916) 534-0417 with your best offer.

FOR SALE: FMS 200/2000, good condition, $100.00 or best offer. Sanyo DCA-411 Stereo Amplifier, $75.00 or best offer. Paul Kriegler, 423 N 47th St. Omaha, NE 68132 (402) 551-2124 evenings.

FOR SALE OR TRADE: Blonder-Tongue MCA-B AGC processor for cable use. Only $75.00 or equivalent trade. Rod Moyes, PO Box 278, Tranquility, CA 93668

JINGLE GIVE-A-WAY: I have quite a selection of "108 FM" jingles for an M.O.R./Easy listening/Adult Contemporary format. All I need is a cassette, return postage, and whether you want a standard, DBX, type II or Dolby B recording. I am also looking for generic or "K" frequency only jingles (second generation preferred) and used equipment to help a student-run school station. Contact Bill De Felice, 621 Bishop Ave. Bridgeport, CT 06610

BULLETIN BOARD (Messages)

Want to make contact with EBer's: Bill Coleman, 114 Circle Dr
Rockymount, NC 27801 (919) 443-7870

John Hart, 5157 Longston Rd
Virginia Bch, VA

Deadline for getting pix into Panaxis for inclusion in new book "Pleasures and Perils of Pirate Broadcasting" has been extended to February 1, 1986. We need pix, stories, information, etc., about low-power experimental, Free Radio, and "pirate" broadcasting. All input confidential. If you have already submitted pix to the EBN or Panaxis in the past then we need your WRITTEN permission to use them (no pix will be identified with names or locations). All persons submitting worthwhile materials will receive a free copy of the book when it is published. Send info to Ernie at Panaxis, PO Box 130, Paradise, CA 95969

Don't forget the LPBN needs your support. You'll benefit also with a source of pre-taped shows from other LPBN stations. No fees to pay, just postage. For more info contact John Dutton, Low Power Broadcasting Network, 514 Vincel, Moberly, MO 65270