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....Serving the Communications Industry Worldwide....

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NRBA proposes deregulation bill

Washington DC...The National Radio Broadcasters Association (NRBA) has announced it will immediately begin pressing for a *radio* deregulation bill now that H.R.-3333 is dead.

In the words of Senator Goldwater, the "deregulation of radio is no longer an issue. The only question is how and when."

NRBA believes that the time is now and will continue to press for legislation lifting the onerous and counterproductive regulatory burdens now borne by radio industry.

At this time it does not appear that the goal of the total deregulation of radio can be achieved through amendments to the Communications Act of 1934. If, however, the necessary changes are incorporated into the 1934 Act NRBA would in all likelihood be supportive.

"We are not so concerned with the *vehicle* for total radio deregulation as the achievement of our goal," NRBA Vice President Abe Voron commented. "We [illegible], however, support mere cosmetic alterations to the 1934 Act that will prove of little value in deregulating radio."

Points Made

Proposals were submitted to Congressmen Lionel Van Deerlin and James Broyhill following a meeting between NRBA representatives and the Congressmen to facilitate the development of radio deregulation legislation. The proposals will be shared with other members of the House Communications Subcommittee in the near future.

Highlights of the proposal include:

1. Radio licenses extended to 7 years.
2. Licensees will meet the public interest, convenience and necessity standard by broadcasting a certain percentage of non-entertainment programming. This percentage, to be determined by the FCC, shall not exceed 8% for AM stations or 6% for FM stations.
3. License revocation only in cases of willful and intentional reporting of false information to the FCC, willful and repeated failure to operate as set forth in the license, violations of lottery, fraud and/or obscenity laws as outlined in the United States Criminal Code.
4. The FCC shall be prohibited from evaluating program content, format, presentation or topics covered in non-entertainment programming in renewal proceedings.
5. Section 317 of the Communications Act of 1934, sponsorship identification rules, will be repealed.
6. In the event a renewal application is designated for hearing, competing applications will be be entertained.
7. Ownership bill be limited to 10 AM and 10 FM stations. No restrictions on cross-ownership of AM and FM stations.
8. FCC required to set standards for petitions to deny or revoke, and to establish sanctions for abuse of these processes. Parameters for standards and sanctions to be set by statute.
9. Establish fund to make monies available to minority applicants qualified to own and operate a radio station. Fund to be administered by the FCC.

Ampro buys Scully Recording

Newtown PA...Ampro Broadcasting, a manufacturer of broadcasting equipment, has purchased Scully Recording Instruments, formerly a division of Dictaphone Corporation. Scully manufactures recording instruments for the broadcast and recording industry.

"To reflect this new association, we have changed our name to Ampro/Scully", stated Tom Creighton, Vice President of Sales and Marketing. Ampro/Scully markets its products worldwide.

Ampro/Scully has added facilities in Newtown, Pa. for manufacturing and warehousing of Scully recorders. Executive offices have also been relocated to this new complex at 826 Newtown/Yardley Road, Newtown, Pa. 18940. Telephone: (215) 968-9000.

INDEX

Consultant's Corner:

The Howard AM sideband response method

by George P. Howard
Part I

Sarasota FL... (beaches, bikinis and a little engineering on cloudy days)...

In recent times there have been numerous articles on the importance of obtaining superior AM sideband response (bandwidth). This has become increasingly important due to the sideband response demands of AM stereo; and most are probably familiar with the articles of John H. Mullaney, Grant Bingeman, C.V. Clark, Harrison Klein, Harv Rees, and others.

Editor's Note: This month's Consultant's Corner features the Howard method for obtaining superior AM sideband response results.

George P. Howard is an R.F. network consultant (formerly vice president and director of the communications products division of Multronics, Inc.; from which he resigned in 1972 to engage in private consulting).

He is well-known for his designs of directional antenna phasing systems, bifilar filters, and his unique driving point impedance determination system. His most recent developments are the EOR impedance matching method (a constant phase network, requiring no R.F. bridging) and a special sideband rotation network.

This article takes issue with some of the things that have been written previously on this subject and it welcomes constructive criticism. The article would not have been possible without the helpful comments of such people as John Mullaney, Dr. Jerry Raines, Dr. Bob Hoover, Frank Colligan; and most especially the untiring computer programming efforts of Jack J. Mullaney and the field engineering assistance of Ed Osborne.

Point 1.

There are only two points in a broadcast system that are critical for obtaining good sideband response.
(a) The plate tube of the transmitter
(b) The antenna tuning unit

Point 2.

Sideband response is "generated" at the plate tube. If we do not start with a good condition there (by providing the optimum sideband loads) we will have nothing worthwhile to give to the antenna.

Point 3.

The antenna may be properly matched to the transmission line; but if the choice of the antenna network provides poor sideband response at that point, it will not be making full use of whatever superior response we may have generated at the plate.

Point 4.

An improperly selected antenna network can make it more difficult to ultimately provide a good plate situation.

Point 5.

A transmission line is a "network" and the selection of its length affects the ease or difficulty of providing a good plate situation. It, of course, has different electrical lengths (and consequently, different "networks") at the various frequencies across the bandwidth spectrum of interest.

Point 6.

There is an optimum length of transmission line that can be used (in conjunction with the optimum antenna network). However, this length may be impractical and we usually must work with the time honored method of line length selection which is; "how do we get from here to there."

Point 7.

Even with a transmission line of a "poor length" it can be compensated by a proper network at its input.

Point 8.

The ultimate goal for obtaining superior sideband response is to achieve *equal power* sidebands, with that power being such that it is close to the optimum of carrier power/4. For a 10,000 watt carrier, this would be 2,500 watts in each sideband; giving a total bandwidth spectrum power of 15,000 watts. The equal sideband powers can be greater than carrier/4; but this depends upon the modulator being capable of producing the extra power that it would be called upon to deliver.

Point 9.

Smith Chart rotation of sideband impedances to obtain essentially symmetrical sideband loads (where the resistances are equal; and the reactances are equal but opposite in sign) is *not* the optimum method for obtaining good sideband response. A computer program is required to determine the power networks for a system, and those networks are not necessarily the ones that result from Smith Chart rotation, but rather are those that produce *equal parallel resistances* at the sideband; thereby producing *equal power* sidebands. In the process of accomplishing this they incidentally produce essentially symmetrical sidebands with the preferred horseshoe up condition and low VSWR's.

Point 10.

A few comments about parallel resistances. A load is a series circuit of R jX. This can be the load that exists at the plate, the common point, the transmission line, the antenna; anywhere in the system. At any of these points the sideband frequencies have loads of different values, but still R jX.

All of these series impedances have an "equivalent" parallel circuit. The equivalent for a series load of 20 -j 200 is a parallel circuit which has a resistance of 2020 paralleled by a capacitive reactance of -j 202. We call these parallel values Rp and Xp and they are easily obtained from:

$$Rp = R + \frac{(X)^2}{R}$$

$$Xp = \frac{R\,(Rp)}{X}$$

When the Rp values at the two sidebands being compared (like plus or minus 10KHz) are identical, you will have achieved equal power sidebands. The computer program selection of the proper system networks assures that those equal powers will be very close to the optimum of carrier power/4.

Smith Chart rotation does not do this. By now you must have guessed that I prefer calculators and computers to Smith Charts. They are often a useful tool, but probably not favored by the society for the prevention of blindness!

Point 11.

I have stated that points other than the plate tube and the antenna tuning unit are not critical for the sideband response condition. If they were, we would be in big trouble. Take a transmission line as an example. We might measure its input and output and find good sideband response conditions, but these are purely arbitrary measurement points and have no real meaning. There will be numerous points along that line that have very poor sideband response conditions; in fact the response is continually changing as we move from the output to the input.

It is only at the carrier frequency that the line looks like Zo along its entire length (assuming a load of Zo).

Point 12.

The "equivalent" network for a transmission line with a pure resistance characteristic impedance of Zo and a length in electrical degrees of θ (assuming no attenuation) is a Tee network consisting of:

X1 (input arm) = $\left| Zo \tan\frac{\theta}{2} \right|$

X2 (output arm) = $\left| Zo \tan\frac{\theta}{2} \right|$

X3 (shunt leg) = $-\left| \frac{Zo}{\sin\theta} \right|$

(Continued on page 9)

Gold plating a tin ear

by John Price
Radio Arts
PART III

Pasadena CA...Once our tin ears have been gold-plated (see BEE June and July, 1979) you may have found that your complacency has been lost forever. The little flaws in your station's sound used to be ignored or reasoned away. Now they demand fixing.

That's good. Just as your pd is constantly questioning his choice of currents and gold, you should be questioning the technical quality of your finished product.

The gold-plated ear will soon find that *cartridge sound* remains the root of most sound problems on the air. True, they are much better than they used to be. But the various machines that go to make up your cartridge audio often seem to have the poorest overall performance. You may have even bought various new pieces of equipment, or the latest version of the basic endless loop cartridge with little improvement.

Hot damn, you say. Another piece on cart machines. Right. But I dare you to do all that follows and admit that your cart performance has not improved.

Darers go first, you say. I have—and have made carts sound better than reel-to-reel equipment at stations from Daytona to Boise. Now it's your turn.

Tools and Supplies

Strange as it may seem, the first thing you'll need is a full track *reel-to-reel* machine. It doesn't have to be the world's greatest, so that old rusty one in the back room may do. Don't worry about performance unless it is really kaput—we won't record anything above 1KHz on it.

You'll also need an audio generator that is reasonably well calibrated. Hang a frequency counter on it if you have one.

And finally, a good *full track* 7½ ips test tape, a small supply of lubricated cartridge tape on a reel (with a *large* hub) and some empty cartridge bodies. The carts should be of the same type as those you use on the air.

The recorder's bias should be close to optimum for your cartridge tape. This may need some adjusting if it has been set for a low-noise variety. Note where the "bias adjust" control is, feed 1KHz into the machine, and adjust the bias for maximum level on the *playback* meter. Close is good enough.

Now, thread the test tape and carefully set the *playback* meter for OVU while the 700Hz tone *at operating level* is heard. (Note: Now is a good time to "calibrate" the playback of your machine by marking the control setting. Tapes made on this machine should peak OVU at this playback level.)

Next, thread the cartridge tape and record three lengths of 1KHz test tone, each about one minute long, using your audio generator (and frequency counter, if available). Record the first to *play back* at OVU, the second at -3VU, the third at -6VU.

Repeat this process using 150Hz. But first, go back to your test tape and set the playback meter to read -6VU while the 700Hz tone at operating level is heard. Cut three lengths of tape as before, but note that these will actually be six db hotter than the 1KHz set. (This is because 150Hz, or secondary, or "aux" tones are recorded six db hot by NAB standard. Evidently the "standard" was set up when cart machines had very poor bass response.)

You now have six cuts on your reel of cartridge tape: 1KHz at 0, -3 and -6VU; 150Hz at +6, +3 and OVU, except that you have lowered the playback level by 6db so that they read 0, -3, and -6VU.

If you really trust your reel machine, you may also want to cut three more tracks: they can be useful in trouble-shooting and routine

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3M: Research of magnetic audio tape improvements

New York NY...Much of the improvement in the quality of magnetic tape recording in recent years results from basic research into the magnetic medium, generally oxides, that reproduce acoustical patterns. New magnetic particles developed by tape manufacturers have contributed greatly to improving the signal-to-noise ratios of tape recording systems.

The current generation of music mastering tapes exemplifies the contribution of this research to advances in sound reproduction. The oxide coating of 3M's "Scotch" 250 mastering tape, for example, increases its usable dynamic range by 4 dB over previous low noise, standard output tapes.

The significance of this improvement lies in the fact that it was achieved without trade-offs for undesirable print-through characteristics or a decline in high frequency sensitivity.

In explaining this achievement, 3M's engineers pointed out that improvements in signal-to-noise ratios can be accomplished in three ways:

- Lowering biased tape noise.
- Increasing the maximum undistorted output of the tape.
- A combination of these two.

An obvious method to obtain higher maximum undistorted output is to increase the amount of magnetic material in each unit of coating. However, the use of this method prior to the present generation of commercial oxides produced two undesirable side effects. First, it resulted in greater print-through—the transfer of acoustical patterns from one layer of tape to another through the seepage of the magnetic field. Second, the consequent need for increased bias lessened high frequency sensitivity and contributed to high frequency saturation. Thus, the easy solution to the problem limited the dynamic range of the tape.

The Best Way

It appeared that a viable solution might lie in developing a new magnetic oxide with improved noise properties and improved print-through characteristics. Clearly, these improvements would have to be achieved in a magnetic recording tape that would be compatible with current recording equipment.

The engineers went to work. They created a new oxide comprising harder particles that permitted a thicker oxide coating. In their terms, they developed a "higher coercivity" oxide that permits an improvement in "remanence." In fact, the new oxide permits a 33% increase in remanence with significantly less increase in print-through than could be obtained with previous oxides.

The result is a tape capable of delivering higher output, lower tape noise and less harmonic distortion. The increase achieved in remanence enables the tape to produce a 3 dB higher maximum output at peak bias than the best of its predecessors.

Tests show the new tape to be lower in noise across the audio spectrum than any of its forerunners. When measured through a NAB standard noise weighting network, the new tape's noise was found to be 1 dB lower at both short and long wave lengths.

The low frequency signal-to-noise ratio of the new tape improved by 4 dB; 1 dB attributable to noise improvement and 3 dB attributable to maximum signal increase over older standard output, low-noise products.

The new tape requires about 2 dB, or approximately 25%, more bias to reach its peak output. However, if the machine is equalized to accommodate the tape's most popular predecessors, no equalization readjustment is necessary when switching to the new tape.

In addition to an improved oxide, the new tape incorporates technical innovations in surface finishing and durability. Since short wave-length signals are predominantly recorded at the oxide coating's surface, a smooth surface is critical to high frequency sensitivity and saturation level.

Accelerated wear tests, as well as use under actual studio conditions, have shown the new tape to be equal to its predecessors in durability.

Set Up

When moving up from conventional recording tapes to the new music mastering series, a knowledge of machine adjustments is important. To obtain the best results, bias should be set for peak 15 mil output. No equalization adjustment is required for "Scotch" 250 tape if the machine has been set up for "Scotch" 206 or 207 recording tape.

After adjusting bias, three options are available:

- Improve signal-to-noise ratio by 4 dB, while maintaining the same overload margin (commonly called head room) as for "Scotch" 206 or 207. This is accomplished by decreasing the play meter calibrate or play level by 3 dB; increasing record drive by 2 dB and decreasing the record meter calibrate by 2 dB.
- Improve signal-to-noise ratio 1 dB, while increasing head room 3 dB across the audio spectrum. This is accomplished by reducing record drive 1 dB and increasing the record meter calibrate 1 dB.
- Improve signal-to-noise ratio 2 dB and head room 2 dB. This is accomplished by decreasing the play meter calibrate or play level by 1 dB.

What does the future hold? Most tape manufacturers are constantly working to improve the current state of the art. Digital recording tapes, metal particle pigments and new binder systems are some of the new advances the industry will see. All are designed to improve the quality of tape recording systems, whether for broadcast or recording studio use.

TIN EAR

continued from page 4

alignment work. Cut one minute of 700Hz at operating level (make the playback meter match the same tone on your test tape), plus 10KHz and 15KHz at -10VU, Cut the last two only if your machine is in *good* alignment. They will serve as rough-adjustment alignment tapes. The 700Hz gives you a good operating level reference.

Now, mark each cut's beginning and end with a grease pencil, and wind each onto a cartridge. When splicing, cut away enough tape so you are splicing audio to audio—this will give you continuous-tone carts.

When you are done, you should have either carts 1-6 or 1-9 on Table 1. Label them clearly, store them carefully, and never use them on a machine whose heads may be magnetized.

The same storage shelf should contain some "store-bought" items: A standard alignment cartridge, preferably *full-track*; a precision head-height guage; a head demagnetizer and all the common tapemachine cleaning stuff.

Playback Machines

Let's start our improvement program where the sound comes out and

(Continued on page 6)

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Report on July FCC developments

by B. Jay Baraff
Baraff, Koerner & Olender, P.C.

The FCC has denied two petitions seeking reconsideration of its fee refunds challenging the FCC's requirement that applicants accept the refund as full payment of any claim and waive their rights to further litigation. Petitioners felt that they should be allowed to receive the allowed refunds but not waive their rights to seeking further refunds in court. However, FCC felt that there should be some finality to the 10 year old fee refund issue.

Fairness Doctrine and Personal Attack Rule Changed

The FCC has amended its Rules to exampt from the personal attack rule all uses of a broadcast station's facilities by a legally-qualified condidate. This means if a candidate attacks a non-candidate, the personal attack rules do not apply. It also eliminates the applicability of the Fairness Doctrine to Section 315 uses which means that if a candidate speaks out in favor of a controversial issue, the licensee does not have to provide contrasting points of view.

FCC Has Revised Its Public Interest Notice

Section 73.1202 of the Commission's Rules pertaining to licensee public notice obligations has been simplified. The notice should include the date of the last renewal grant, expiration date and a statement that a list of problems and needs are available for public inspection. The notice suggests the public should send comments about the station's operation.

Format Changes To Be Considered By FCC

The U.S. Court of Appeals has ordered the FCC to hold hearings when a broadcast station changes a unique entertainment format. The Court feels that this affects diversity of programming. However, the Court held that no public interest question would be raised in the following areas if there is another station providing an adequate substitute for the lost programming; there is no public protest of the change in format; there are too few stations to provide the format to the small number of supporters of the lost format; and the station cannot make a profit under the existing format.

New EEO Policy.

In a major policy change concerning FCC's affirmative action EEO requirements, the Commission announced that upgrading in this area after a license term will not mitigate a deficient record during the license term. In short, if your EEO record is not good at the time that your renewal application is filed, later upgrading will not soften the blow of any sanctions.

Multiple Ownership Proposal.

The NAACP has requested that the FCC amend its Multiple Ownership Rules to require divestiture of existing AM/FM combinations and to prevent the common ownership of future acquisitions.

TIN EAR

continued from page 4

work backward.

First, *clean* each machine. More good equipment is replaced just because it is dirty than because it is worn out. Scrape and wipe and clean, then do it again. That blob of glup on the belt pulley will cause flutter no matter what fancy cartridge you shove into the deck. Cast your eye over the deck, and eliminate the dirt with swabs, a vacuum cleaner, alcohol and elbow grease.

Second, use your head height guage. This is intense territory, for most false-cuing problems are caused by playback heads that are too high—the cue track of the head is hearing audio as well as cue tones. If your decks have pieces of metal on the deckplate that support the underside of carts, DO NOT rest the guage on these. It should measure height from the deck plate *only*.

Table 1

RECOMMENDED TEST CARTRIDGES

Required		
#1	1 KHz at Odb	Primary tone record level
#2	1 KHz at -3db	Primary tone sensor set: cartridge recorder
#3	1KHz at -6db	Primary tone sensor set: cartridge playbacks
#4	150Hz at +6db	Secondary tone record level
#5	150Hz at +3db	Secondary tone sensor set: cartridge recorder
#6	150Hz at Odb	Secondary tone sensor set: cartridge playbacks
Optional		
#7	700Hz at OVU reference NAB operating level:	Operating level set
#8	10KHz at -10db	Rough azimuth adjust
#9	15KHz at -10db	Medium azimuth adjust

Each cartridge is fully described in text. #8 and #9 should never be used for final azimuth adjustments, but only as preliminary rough adjustments before a professional alignment cartridge is used.

Next comes the alignment cartridge. You may want to use the 10KHz and 15KHz carts as a rough guide before you wade through the whole alignment/frequency response run on that three-minute cartridge.

If you are working on stereo equipment, it is imperative that you listen to the summed mono signal from both left and right channels. In stereo, align for maximum *summed* highs—that is *minimum* summed phase shift, and that's the worst offender in stereo carts. An invaluable tool is a momentary A+B pushbutton next to the monitor control on every console. If your ears can hear alignment tones at 15KHz, you can ear-align any cart deck for perfect phasing in a matter of minutes while the button is depressed. Make sure it is installed behind enough isolation so that it can't destroy separation on the program busses while it is pressed. Make it momentary so it can't get left in the 'on' position.

Now, recheck head height. Your alignment work may have disturbed this.

With the audio section peaked, our new test cartridges go to work. Insert #3—1KHz at -6VU. Adjust the *primary* tone sensor so it will just *barely* catch this tone. You have just given yourself an honest 6db of headroom at playback. It may be the first time you knew just how sensitive that sensor was. If you can't get it to cue on a tone 6db low, you may be headed for trouble on that machine, and the circuit should be checked. Any deck should have that much headroom built into its electronics.

Repeat the procedure with cartridge #6—15KHz at 6db below normal 15KHz levels. This will give you that much forgiveness for secondary (or "aux") tones if you use them for automation or warning cues.

Once this procedure is applied to all of your playbacks, you will have established a group of calibrated machines—all with the same head height and alignment, all with six db of headroom for cue tones recorded at standard levels. *(Cont. on page 12)*

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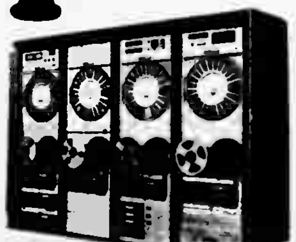

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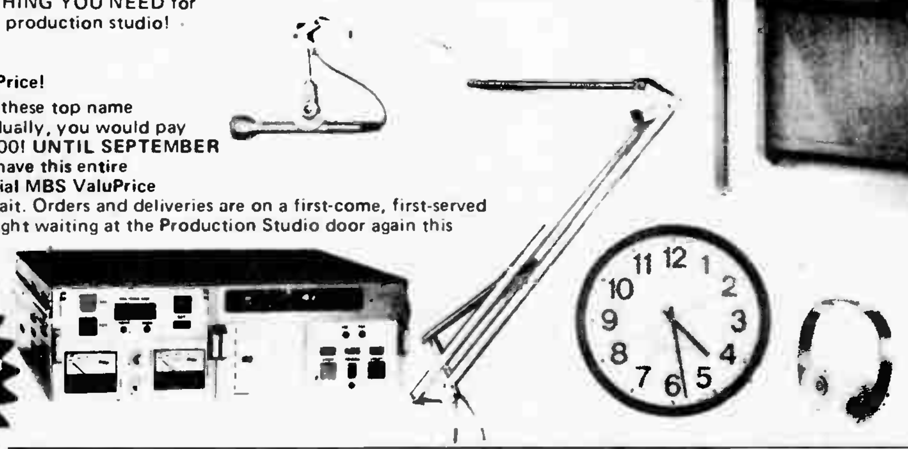

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Circle 110 on Action-gram

Clint Free on VTR's:

Some notes on the VR-2000

Fargo ND...Last month I worked on an interesting editing problem on an Ampex VR-2000. There was a "click" in the audio of approximately -5db from program level at the edit time. In this machine, the audio, cue erase and bias amplifier are turned on with either audio or cue record. Also, when editing, cue record is not separated from master record as audio is. Consequently, when record is activated at the beginning of an edit, the bias and erase amplifier is turned on immediately. Then, when audio is turned on by the editor, approximately 1/2 second later, erase and bias are at full amplitude. Applying this drive to the erase and record heads at full amplitude produces a "click," one of life's problems!

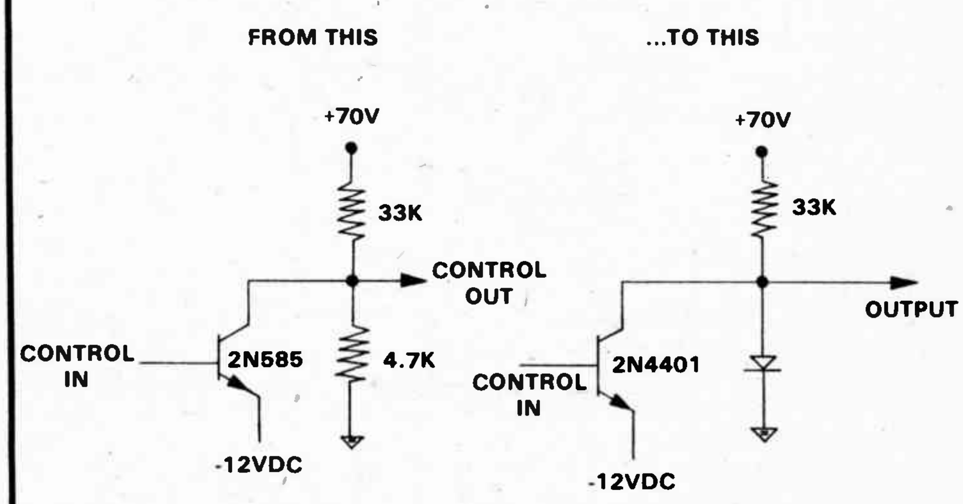
In this machine the cue channel was never used and everyone was happy just to remove the cue control connector to correct the problem. However, for machines where the cue channel is used, this would be a poor solution. For most VR-2000 machines using a relay to disconnect cue control of the bias and erase amplifier when the editor is on, and audio is not off, would be a suitable solution. Slightly more involved would be to edit the cue channel with audio edit record logic.

Headwheel problems

In another VR-1200 editing problem, I found that there was a lurch of headwheel at the edit time caused by temporary loading of the plus and minus 12 volt regulator by the record RF amplifiers. The regulated power is common to the servo and the phase of the headwheel changed by about 200 nanoseconds for a new head (more RF drive) and 1.5 microseconds for a worn head (less RF drive). The problem was corrected by installing a 1.8 amp plus and minus regulator for the RF record drive electronics, and removing the switched loading resistors on the RF chassis.

In RCA TR-4 machines there are some unlatch and inhibit stages in the control system which become unstable as temperatures rise. Germanium transistors (2N585) develop leakage causing modes to drop out, change, etc. I installed some 2N4401 transistors and changed the circuit as shown in Figure 1 to correct the problem.

FIGURE 1



These transistors are on the play, record and drive control modules.

HOWARD METHOD

continued from page 2

The equations above assume that the line is equal to or less than 180°. If it is greater than 180°, simply subtract increments of 180° until the answer is a phase less than 180°. That will be the proper θ value to use.

The Zo value is the same for all frequencies, but remember that the θ value is different for different frequencies.

$$\theta = \frac{(ft.)\ (MHz)}{2.734\ (VP)}$$

Where: VP = the velocity of propagation of the particular line (like .81 for 7/8" foam).

Once you have determined the "equivalent" networks you can find the resulting input impedances for any given load at a specific frequency (using of course the proper network for the frequency involved).

This can be done by letting:

Ra = load resistance
Xa = load reactance

Then for the resulting input impedance of Rs jXs.

$$A = Tan^{-1}\left(\frac{(Xa) + (X2) + (X3)}{Ra}\right)$$

$$Rs = \frac{(X3)^2\ (Cos\ A)^2}{Ra}$$

$$Xs = -\left(Rs\ Tan\ (A) - (X3) - (X1)\right)$$

The above applies to any R.F. network where the values of X1, X2 and X3 are known.

It does not have to be a so-called Tee network, because *all networks are essentially Tee networks.*

a. An L network is a Tee network where either X1 or X2 of the equivalent Tee is 0 reactance.

b. A shunt reactance is a Tee network where both the X1 and X2 of the equivalent Tee are 0 reactance.

c. A series reactance is a Tee network where X1 = 0 and X3 = infinity for the equivalent Tee.

d. A Pi network is 2 Tee networks in series, where the input Tee has X1 = 0; with the output Tee having X2 = 0 and X1 = the series arm of the Pi.

Often it is helpful to view all networks or strings of networks as being Tees in the manner described above. Your transmitter networks can be analyzed by this method.

Point 13.

To truly obtain superior sideband response it may be advisable or necessary to modify some of the transmitter networks by changing their settings or adding components. This is to be done without lessening the harmonic suppression quality of the signal.

Transmitters are designed to work into a non-reactive dummy load; and even for this condition the sideband response at the plate tube is not as good as it is capable of being.

For most transmitters to produce good sideband response at the plate tube, they *do not want to see* symmetrical sideband loads at the transmitter output point (common point)!

As an example, assume that your transmitter's plate is designed for wanting to see a load of 3200 jO.

Now, if you were to put a 3200 ohm resistor across the plate tube (disconnecting from that point all other circuitry except the R.F. output network/s; and at the same time being sure to leave the plate tube "in" as part of the total circuit) you could:

a. Use an R.F. bridge and signal generator/receiver at the transmitter output.

b. Carefully make a bridge measurement of the impedance existing at the carrier frequency (with all networks set to their factory specified reactances or actual tuned settings). You should find that impedance to be 50 jO. Like the dummy load that you normally tune your transmitter into.

c. Next put the generator on the sideband frequency that is 10KHz above carrier and make another bridge measurement to get an impedance for that sideband.

d. Do the same for 10KHz below carrier.

e. For all measurements use a frequency counter and correct the bridge dial X reading appropriately to get the actual reactance for the frequency involved.

f. These impedance measurements will be the values that the network/s *want to see* as a load at the different frequencies to *produce* the 3200 jO at the plate tube for each of those frequencies.

g. Those loads will not be symmetrical at the sidebands, nor will the sideband powers be equal at the transmitter output with those loads. Again, this is not one of the critical points for equal sideband powers; but providing loads of those or similar values at the transmitter output can be quite difficult, if not impossible.

Point 14.

The Howard sideband method produces equal sideband powers at the transmitter output; and then by transmitter network/s adjustment carries that equal power condition over to the plate tube.

Point 15.

The optimum situation would be to have a transmitter specifically designed for sideband response. An example of such a transmitter will be given.

Point 16.

There is a network that is especially

(Continued on page 10)

HOWARD METHOD

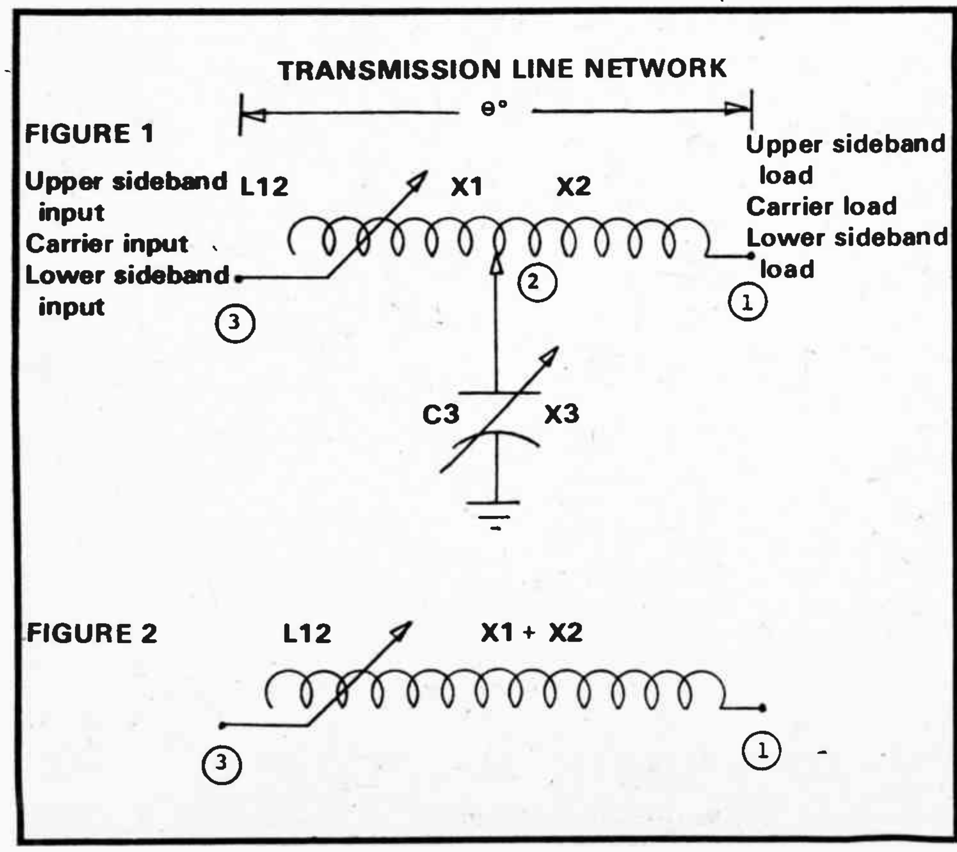
continued from page 9

useful for giving equal sideband powers at the input when the carrier load is R jO. It is not a cure-all, because it does not automatically produce powers of carrier/4 if the sideband loads presented to it are very badly "out of balance;" but in many instances it does a good job.

Most importantly its method for tuning is easy and logical. It is a "transmission line network" with values as previously described in Point 12 and as shown in Figures 1 and 2.

Using the computer value determined for θ degrees and the resulting X1, X2, X3 reactance values:

a. (Fig. 2) Tune L12 to give the total reactance required by X1 + X2. (This would be done by R.F. bridge measurement for the carrier frequency.)



b. (Fig. 2) Accurately count the total number of turns required.

c. (Fig. 2) Now locate the point on L12 that is exactly 1/2 that number of turns.

d. (Fig. 1) Clip the X3 shunt leg on at that point (which will be point 2).

e. (Fig. 1) Now there will be a position within the tuning range of C3 that produces that desired carrier pure resistance input, point 3, and gives equal power sidebands there. That will be the position that produces the pure resistance as the result of having the calculated X3 value.

f. Calling the load resistance Ra and the desired input resistance Rs: the resulting requirement for the X3 reactance value will never be *less than*, -[(Ra) (Rs)]1/2. This determines the *maximum* capacity requirement for C3.

g. L12 will have a wide range of inductance requirements, because the network is technically capable of going from 0 = 0° to 0 = -180°. The input portion of L12 will have a different amperage requirement than the output portion of L12 (if Rs = Ra). Consequently, the coil must be selected for the higher of the two amperage requirements.

h. Most often the total reactance requirement for L12, (X1 + X2), will be that which results from a 0 value of plus or minus 90° + 20°.

i. L12 does not have to be a variable type coil, but it is more convenient if it is.

j. C3 does not have to be a variable capacitor. It can be a coil and capacitor in series, but then the capacitor should be of only slightly *lesser capacity value* than the computer calculated value.

k. Sometimes computer values are not necessarily essential. The requirements for the network can be computed for the range of 0 shown in (h) above. Then following the tuning procedure a range of network conditions can be tried by simply starting with L12 at its full number of turns (with C3 attached at the mid-point); checking the input sideband results, then moving one turn towards the output simultaneously with *both* the coil roller (or tap) and the C3 clip position. Each time retuning C3 for a pure resistance input and then once again checking the sideband results. As those sideband Rp values approach equality you are approaching power equality.

This is a time consuming process in that it requires many measurements and frequency changes for the generator being used, but it will accomplish the job. Thank the "main man" for computers.

Point 17.

The equations for *sideband response conditions* will be given next month at the conclusion of this article with a suggested format for listing their results.

Point 18.

The antenna network was one of our two critical points for achieving good sideband response. Let's see what happens by our selection of different networks for a given load situation.

For the sideband response of the antenna we are told to take its impedances for the carrier; and upper and lower sidebands.

Like: 1010 Khz 70 +j 177
1000 Khz 67 +j 170
990 Khz 63 + j 162

Then we take the resonated condition of the carrier by cancelling out its reactance (in this case with a capacitor of -j 170). That capacitor looks like -j 168.317 at 1010 Khz and -j 171.717 at 99.0 Khz.

Therefore, for the resonated carrier condition we now have:

1010 Khz 70 +j 8.683
1000 Khz 67 j 0
990 Khz 63 -j 9.717

Then we are told to calculate the sideband response conditions based upon these new impedance values.

But wait a minute, this *assumes* that we have an antenna network, part of which is a capacitor of -j 170 (or greater) in series with the carrier load. I say "or greater;" because if it were, the resonated condition would still be obtained but it would occur at a point somewhere "along the capacitor" rather than at its input.

If we do this we would get the sideband response conditions listed for Example #1 (all examples will be shown next month at the conclusion of the article).

Now, what happens if our particular network does not have a series capacitor of that size in its output arm (because a different reactance is needed due to the requirements of the network that we have chosen to make the match to the transmission line)?

We then have simply given the generator "a new pure resistance load to look at" by now having produced *the pure resistance condition* at the input of the antenna network.

If we look at the sideband response conditions there, we will see that we have obtained equal power sidebands that are very close to the optimum of carrier/4 by having used the optimum network.

Point 19.

If you think that you may be having a problem with the sideband response of your system (and consequently the strength and quality of your audio), a computer analysis of your system might be advisable. This would let you know what could be done through changes of network settings and/or addition of components or networks to improve your situation.

Next month: Final discussion, equations and examples.

audiotechniques mixdown

652 Glenbrook Road, Stamford, CT 06906 Tel: (203) 359-2312 1619 Broadway, Suite 905, New York, NY 10019 Tel: (212) 586-5989

WINTER IS HELL!

AT's Ham Brosious and Manhattan's Howard Schwartz flank Mack Emerman, owner of Miami's famed Criteria Studios, during a Biscayne Bay sail on Mack's 52-foot ketch. Occasion was Howie's trip to MCI to finalize custom requirements for his new 56 input automated console, said to be MCI's most expensive ever. The large number of inputs on the new board, scheduled for delivery in April, is required to provide capability for the planned dual 24 and 32 track operation. Emerman's new Criteria West, another all-MCI twin 32 track operation, and the new Schwartz facility were both designed by Sugarloaf View, NYC.

```
THIS IS DAISY..
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AS MY MEMORY GETS
BETTER I HOPE TO
IMPROVE DELIVERY ON
ALL AUDIOTECHNIQUES
PRODUCTS.

.. LOVE.....DAISY
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How many bongos? Vibraslaps? Cry baby wah wahs?

Musical Instruments Required by Major Recording Studios . . .

When Nigeria America Tapes and Records, Ltd. (NATRL) asked Audiotechniques to supply a complete complement of musical instruments for their giant new recording complex in Lagos, Nigeria, we turned to A & R's Don Frey, a veteran New York recording executive for his recommendations. Calling on his own experience and conferences with major New York City recording studios and rental agencies, Frey developed a state-of-the-art package for world class studios, anticipating a broad spectrum of musical requirements. With Don's permission and with the feeling that it represents an important contribution for studio managers everywhere, we are reprinting the complete list. (Your comments welcome, of course.)

STUDIO INSTRUMENT LIST

Steinway Grand Piano
Hammond B-200 Organ
Oberheimer 4-Voice Synthesizer
Fender Rhodes 73
Fender Rhodes 88
Hohner Clavinet
Ludwig #989 Drum Set
Evans Hydrolic heads
Musser M-51 Xylophone
Musser M-30 Marimba
Musser M-55 Vibes
9180-CH Chimes
Deagan Orchestra Bells
Bell Tree w/stand
Ludwig #935 Timpani (29"- 26")
Ludwig #930 Timpani (26")
LP Conga
LP Tumba
LP Quinto
LP Timbales
2-Fender Super Twin
Ampeg B-15N
30-Manhasset music stands
1-pr. 14" Zildjian Hi-Hat
18" Zildjian Crash Cymbal
20" Zildjian Ride Cymbal
Tambourine w/head
Tambourine w/o head
Maracas
Claves
LP Bongos
Gourd & Scraper
Cowbell w/beater
Cabasa
Tubos Shaker
Triangle w/beater & clip
Castinettes
Woodblock
Ratchet
Police Whistle
Slide Whistle
Bird Whistle
Slapstick
Vibraslap
Finger Cymbals
Sleigh Bells
MXR 100
2-MXR Envelope Filters
2-Mutron Biphase
DeArmond Vol. Pedal
Cry Baby Wah Wah
Small Stone Phaser
2-Echoplex
MXR 90
Helpinstill 110

SHORT TAKES

24 track studio for the Tallyman

Perennial recording super star, Harry Belafonte, recently took delivery of MCI 24 track equipment for his new studio at Belafonte Productions in NYC. Audiotechniques' Mike Salafia took care of the arrangements.

New Studio for Ace Frehley

Kiss recording star, Ace Frehley, has contracted with Audiotechniques to supply and install all equipment for his new 24-track studio at his home in Connecticut. The all-MCI studio has been designed by Sugarloaf View.

New Recorders for Generation

Generation Sound Studios (NYC) took delivery of a new MCI 24-track recorder and the first of three new MCI two-track units with mono-stereo capability for advertising requirements. Owner Alan Mirchin also reports that his new John Storyk designed 24-track studio at Aura Recording will open this month.

Speaking of Storyk Designs

Audiotechniques' new demo room in Stamford is a John Storyk design, featuring the latest technology in control room acoustics. We'll have all the newest of outboard goodies on demo as well as consoles, recorders, monitors and mikes (Faulkner and Salafia, that is!).

Hottest Outboard Gear?

Last month's article on outboard brought plugs for favorites by users and many requests for demonstrations. Most requested . . . toss up between A & D's Compex Limiter and Lexicon's Prime Time. (Solution: try 'em both!)

New Studio Activity

Looks like another big year for studio expansions and new studios as our proposal writers turned out a record number of project presentations during January-February. Give us a call for an individually tailored, computerized proposal. If you're even thinking about a project, we should be talking.

More Automation

It's another MCI automation system for Manhattan as A & R Recording adds the JH-50 system to their 500 console at the A-2 studio on 7th Avenue.

Greg Hanks named Technical Services Manager

Audiotechniques is pleased to announce the appointment of Greg Hanks to the position of Technical Services Manager. Greg was formerly Chief Engineer for Heider-Filmways in Hollywood, CA. Other engineering positions included ABC and Western United Sound Labs, both Hollywood, and Longview Farm in MA. Welcome, Greg!

Check Audiotechniques first . . . for WEST PENN WIRE!

We recommend West Penn as the best studio wire made. Reason? We've sold nearly 5 million feet of #291 two conductor shielded to studios all over the world without one complaint! Always in stock, in a blinding array of colors!

Rumor Mill . . .

Digital 2 tracks to hit market with affordable prices? (Sooner than you think, reports our overseas spy!)

New "Super Tape" to dominate studio market within 2 years? (Don't ask us, ask our midwest secret agent,)

Caribbean 24 track studio on huge barge to be backed by industry's biggest stars as tax shelter? (Why not?)

Two offers on that Manhattan studio biggie, but has anyone come close to the asking price? (Not according to our N.Y.C. correspondent.)

NEW . . . FROM MCI!

JH-600 Series Automated Consoles

Response to MCI's new 600 console at the AES convention was overwhelming! In the month following the show, orders for 60 units with a sales value of over $2.6 million have been received by MCI! Recording engineers were impressed with the thoroughness of design considerations of multi-track recording, the simplicity of the automation system and the attractive price. We can safely say that the MCI 600 is the outstanding console value in the world today! We know that's pretty strong, but when you consider the features, we know you'll agree, too.

EXR . . .

The Automatic Equalizer!

Many of you heard EXR at the AES Show and marveled at its performance. We now have EXR's in stock and also available at AT Rentals in NYC. For EXR information, contact Bob Cavanaugh at (203) 359-2312.

CLASSIFIEDS

MCI JH 10-16 with remote and MCI 416-18 Console, pair $21,600

MCI JH 16 with locator, good condition $14,250

BERLINER'S CORNER

MCI continues to conduct an excellent training course on current production tape recorders and consoles. The next training sessions scheduled for March 5-10 and May 7-12 and July 9-14. If you wish to sign up for these, please contact me for details and a training school bulletin.

If you are an MCI user and are not receiving MCI's "News & Views" magazine on a regular basis, you should be. It not only reviews new MCI products, but also has good advice and update information as well. Contact me and you'll be on the mailing list.

Check Audiotechniques first . . . for ORBAN!

Your mixes can be improved . . . if you're not using Orban. Parametric Eq's, De-essers, Stereo Synthesizers, Reverbs . . . we've got 'em all in stock, at prices you'll like.

TIN EAR

continued from page 6

Cartridge Recorders

Now it's time to get at the machine that cuts all those cartridges. Precision here will be reflected all over the station, so make it good. Do all the things we've listed for playbacks, with particular emphasis on cleaning, since your recorder probably gets very heavy use.

The one major change is for the tone sensor levels: Set them to just *barely* detect tones from cartridges #2 and #5. Those have tones just 3db below standard level, while your playbacks are set for 6db of headroom. The purpose is to make your recorder the quality-control machine. A cart with a bad tone will fail to recue here, *before* it gets on the air. You will occasionally find a note that "carts won't recue in Production, but they're OK on the air." That's just your safety factor at work. You know that those carts have tones between 3 and 6db low, and you'd better start trouble-shooting the recorder.

It is no secret that the record section of your cart recorder is the most important of all. Before we go through the routine, let's pause to reflect on just why we use cartridges in broadcasting.

The original endless-loop cartridge was what we call a "C" size today—the great big ones. They were loaded full of double-coated tape, and ran at 3 3/4 ips. At the splice, the tape was twisted ½ turn, and two programs of background music were recorded on the tape—one on each side. Each time the splice passed by the heads, the alternate program was played.

Along came radio in 1958. We doubled the cartridge speed, shrunk it to "B" and "A" sizes, and put it in a start-stop-start-stop mode of operation, all the while requiring broadcast audio quality and, later, stereo broadcast quality. No wonder some problems developed.

The biggest problem remaining is the variations in the corner post at the left front corner of the cartridge. The different heights from cart to cart cause the tape to pass across the first opening of the cartridge at different angles. This was no problem when the carts were used only to play back tapes recorded on open-reel duplicators, then wound onto the cartridge turntables. It wasn't even a problem when combination record-play heads were used in the *second* opening.

Then came NAB standards, which put the separate record head out in that first hole. Much energy, time and money has been spent selling various forms of cartridges that propose better quality-control of the all-important corner post. My experience shows that the problem is still the cause of most bad cartridge sound.

But by following a few key steps, not stressed enough in most manuals and articles, we can minimize the "floating corner post syndrome" so that your carts will meet all but the very best reel-to-reel standards.

1. Adjust the *record* head height very carefully, using your guage, but don't take that as a final answer. Recording a continuous 1KHz tone on a cart, raise and lower the record head slightly until you obtain maximum playback level. This shows that the recorded tracks exactly match the sections of the playback head—and all other playback heads if you've been meticulous with your height guage.

2. Align the record head very carefully while looking at the playback of the machine—of the *summed* playback if it's a stereo one. Remember that this record section will cast the die for every playback in the place, so take your time. See how close OVU equals NAB operating level out. If it is more than 2db off in either direction, suspect the recording bias and adjust it for peak output level. See if the various types of lube tape in use require different bias settings. If so, peak the bias for the tape requiring the most, and let other types be somewhat over-biased.

Check the overall record-play frequency response, but remember that high frequencies get turned up inside the record amp, then turned down in playback (pre- and de-emphasis). Your machine, fed 15KHz at -10VU, is really putting it on tape at OVU, so keep all tones for a frequency run at -10VU. Boost playback so -10VU in equals OVU out for accurate meter readings.

So now you have perfect bias, frequency response, alignment and head height—for the one cartridge you've been playing all this time. Now comes the most important part!

Select as many cartridges as your patience will stand. One dozen is the minimum. Erase each one, and record 15KHz on it while watching the (summed) playback signals. Rock the *record* head azimuth adjustment back and forth until you get a perfect maximum reading. You will soon start to notice that the maximum occurs somewhere between a range of settings—usually about 90 degrees

(Continued on page 22)

BEE Employment Service

For Help Wanted

Any company or station can run technical Help Wanted ads at the flat rate of $12 per month, per insert (for each 50 word increment). Payment is preferred with insert, but if invoice is necessary, there will be an extra $1.00 charge. Blind box numbers can be provided at an extra charge of $10.00 per insert, and the responses will be forwarded to the listee, unopened, upon receipt.

For Positions Wanted

Any individual can run a Position Wanted ad, FREE of charge, at any time. Simply send in your listing, 50 words maximum, and it will appear in the following 3 issues of BEE. Contact information will be provided, but if a box number is required, there is a $10.00 fee which must be paid with the listing (there will be NO invoicing). Responses will be forwarded to the listee, unopened, upon receipt.

..................Clip out & mail to: BEE, Box 1238, Arlington VA 22210..................

Name ______________________________

Title ______________________________

Company ______________________________

Address ______________________________

City ______________________________

State ______________________ **Zip** ____________

Telephone ______________________________

(Verifiable number must be provided)

Signature ______________________________

Check as appropriate:

☐ Help Wanted ☐ Positions Wanted

☐ With Box Number ☐ Without Box Number

Text (50 words maximum): ______________________________

EMPLOYMENT CLASSIFIED

POSITIONS WANTED

Sales Manager, 5 years Industrial/Residential Video Sales, Rentals, and Industrial Production. Basic technical understanding all phases of Video Equipment willing to relocate. Resume available upon request. Kenneth Cheek, Personal, Southern Video Systems, Inc., 4019 W. Kennedy Blvd. Tampa, FL 33609. (813) 379-5094.

1st class, 3 yr's TV and Radio, currently chief at backwoods station, desires maintenance or Asst. Chief with quality-conscious AM-FM. Have gold-plated ear; will travel. Can jock. Send replies to Box PW 7-1.

AM, FM or combination owners. Thinking of selling? Upgrading? Experienced broadcast executive seeking first owner/operator venture in medium or small market. Let's talk. No brokers, please. J.U. Steele/Editor, NAB Code Authority, 477 Madison Avenue (#1405), New York, New York 10022, (212) 759-7020.

POSITIONS WANTED

1st Class. Experience includes: 2 years directional, 6 years with non-commercial stations, fund raising, management, programming, instruction, complete design, operation and installation of 2 stations, CCTV experience. Prefer school station position but will look at others and will re-locate. Box PW 6-1.

Chief Engineer at Midwest AM/FM (stereo) automation station looking for advancement from a small-market facility to medium or large-market station. Love the station/work but I have to eat. Send replies to Box PW 6-2 for mutual exchange of information.

For listings with Box numbers, reply to Box______, c/o BEE, PO Box 1238, Arlington VA 22210

TEST EQUIP...CONTD.

WANT TO BUY

***Distortion Meter**, B & W 410 or comparable make and age. Key Code 8-15.*

***GR 1330-A** oscillator, good condition with manual. Key Code 8-50.*

Leader LAS5500 audio systems analyzer or equivalent. Key Code 7-37.

Audio Oscillator, prefer HP-200CD. Key Code 6-61.

Oscilloscope, prefer solid state scope. Key Code 6-61.

TRANSMITTERS

WANT TO SELL

***Gates 1KW FM** transmitter FM-1-B rebuilt and modified two years ago with CCA exciter FM10E and Wilkinson stereo generator SGIE. Key Code 8-1.*

***Gates M-6095** Exciter. Good condition. Key Code 8-6.*

***SCA Generator**, Moseley SCG-4. Key Code 8-43.*

***Sparta-Bauer 705** transmitter. 5 KW with 1 KW cut-back. Currently on 620 KHz. Complete with all tubes, crystals, semiconductors, etc. Includes 5 spare 4CX-5000 tubes (used), many miscellaneous new and used small tubes, spare HV and LV silicon rectifiers. Excellent operating condition. Key Code 8-59.*

***Collins 208U-3** 3KW pep linear amplifier complete with 310V-1 RF exciter, 618Z-4 RF translator, 798T-1 IF translator (Collins URG series) widely used in military and commercial services. Continuous coverage 2-3 MHz in 100 HZ, SSB AM CW RTTY. Just completely checked Collins service facility. Offers invited. Key Code 8-64.*

***Gates M-6095** Exciter. Excellent condition. Key Code 8-6.*

***Collins FM 831D-2.** 2.5kw with exciter. Smoke and heat damaged in fire. Could be put back on Air. Key Code 8-7.*

***RCA 55011** arms (two pieces), two pieces 94030 capacitors, all used in RCA BTF10B transmitter. Accepting best offer. Key Code 8-10.*

***RCA BTA-1R** transmitter. 1 KW with 250 watt cutback. No crystals, otherwise complete. Can furnish output tank components for most frequencies. Wilkinson rectifiers in HV supply. Well maintained and in excellent operating condition. Key Code 8-59.*

***CCA AM 5,000D.** Smoke damaged in fire. All meters and parts good, or could be put on Air. Key Code 8-7.*

***RCA 55131** resistors (two pieces), RCA 55130 resistor (1 piece), RCA 55248 resistor (1 piece). Accepting best offer f/u/w BTF-10B. Key Code 8-10.*

Gates 250-GY, 250 watt transmitter. Excell. cond. $1500. Key Code 7-6.

Collins 786W-1 SCA generator card used in 310-Z series FM exciters. Excellent condition. $500. Key Code 7-24.

RCA TTU-2A tuned to ch. 14 taken out of service May 1979 exciter, harmonic filters, diplexer included. Key Code 7-29.

QEI Automatic Transmission service very good cond. currently in service. $2250. Key Code 6-18.

Gates BFE-10C, mono. 91.5 mhz; 10-watt. Now operating. Make offer. Key Code 6-65.

RCA BTX-1A, 67KHZ sub-carrier generator with manual. $300. Key Code 6-6.

Two high power FM isolation filters can be retuned. Key Code 6-43.

RCA UHF Filterplexers; CH. 31, 12.5 KW rated, 3-1/8" line; CH. 35, 12.5 KW rated, 3-1/8" line; CH. 40, 25-30 KW rated, 6-1/8" line. Key Code 6-16.

RCA BTA-5H 5000 watts AM on 1300kHz with extra cystal at 1240kHz. Beefed up solid state power supply. Very good cond. Key Code 6-51.

McMartin TBM 25000-C RF amplifier. Key Code 5-17.

Moseley Model ADP-220 Transmitter Auto Logger with IBM Typewriter Model 3604. Key Code 6-13.

Gates TE-1 exciter with stereo generator. Rebuilt by Gates in 1974. $1500. Key Code 6-29.

Gates M-6095 exciter, $350. Key Code 5-75.

Gates 3KW FM transmitter (2). Key Code 5-36.

Raytheon RA-1000. Excellent condition. $1100. Key Code 5-18.

FM 1000 broadcast transmitter $5800. Key Code 5-17.

RCA BTA-50H1S 50 kilowatt AM ampliphase. BTE-20A solid state exciter with 5KW cutback. Exc. cond. $35,000. Key Cond 5-20.

FM-10 solid state exciter. Key Code 5-17.

Westinghouse FM 10KW final and power supply. Key Code 5-36.

ITA-Wilkinson, 10-watt exciter less power supply, new tubes, $400. Key Code 5-49.

AM 1 KW Vanguard II, used on air until Sept. 78, spare parts and final tubes, 10 years old. Key Code 4-17.

Western Electric 1937, 50 KW AM transmitter, $11,000. Call (800) 336-3045.

WANT TO BUY

***CCA 10DS** or other direct FM exciter. Key Code 8-43.*

***Bauer Model 707** 1000 Watt AM transmitter. Key Code 8-18.*

***RCA BTA-5R** or 5-T 5 KW transmitter. Good condition only. Transmitter will be inspected before purchase. Key Code 8-59.*

Wanting 250, 500, 1,000 and 5,000 watt AM FM transmitters. Guarantee Radio Supply Corp., 1314 Iturbide Street, Laredo, TX 78040. Richard Reyes, 512-723-3331.

Properly working low voltage 350 Volt Power Transformer (T-6) used in Gates BC1-F transmitter. Key Code 7-44.

1KW AM transmitter. Key Code 7-11.

Gates Vanguard I or Vanguard II transmitter 1KW/250 or 1KW/500 (damaged but reconstructible). Looking for one that may have been fire damaged or cabinetry damaged. Key Code 7-35.

FM transmitter 250 watt. Key Code 6-16.

Gates BC1G, BC1H or BC1T transmitter 1000 w/250w, good cond. Key Code 6-23.

TT 1UB in operating condition. Key Code 6-33.

High School wishing to increase power, needs 250 watt transmitter. Key Code 6-50.

RCA BTA 10-F used transmitter. Key Code 6-44.

Harkins & Hershfield manual needed for model FME-50 FM exciter. Key Code 6-19.

TUBES

WANT TO SELL

***RCA 4-125A/4D21** tubes (6 pieces), RCA 673 tubes (14 pieces), RCA 836 tubes (6 pieces). Key Code 8-10.*

***G.E. tubes** (4 pieces) GL836, RCA 5762 tube (1 piece). Key Code 8-10.*

***Receiving types-surplus.** Older miniatures on hand, 6AU6, 6CB6, 6J6, etc. types, a few others also. Send for list. Key Code 8-5.*

3CX10000A3 and two 4CX3000A General Electric, save 25% on current price. Key Code 7-12.

Six 3X2500A3 Tubes. Removed from transmitter & spares. Condition unknown. Key Code 6-16.

Receiving tubes (190) in large tube caddy, all tubes good, used in communications equipment. 110 are in boxes, 80 are loose but all are good. Make offer. Key Code 6-59.

4-400A transmitting tubes (4), used but ok for spares. Make offer. Key Code 6-59.

JAN-CBXT 8161 Eimac tubes (4-new). Key Code 5-36.

4-1000A (new). Key Code 5-36.

891 (3-used). Key Code 5-36.

872A mercury vapor rectifier tubes, (three), new, never used, half price. Key Code 5-65.

Tubes: Two each 845 and 872-A probably used, condition unknown. Make offer. Key Code 4-24.

WANT TO BUY

Telefunken VF-14 for U47; U48 microphones. Telefunken AC-701. Key Code 7-2.

Tube 813 (four). Key Code 7-43.

125A tubes (4). Key Code 5-36.

GTE color slide studio tube for Model CSS-1. Key Code 5-14.

250A tubes (4). Key Code 5-36.

400A tubes (4). Key Code 5-36.

TURNTABLES & LATHES

WANT TO SELL

***Shure M64** Pre-amp. Best Offer. Key Code 8-40.*

***Technics SP-10** direct drive with wooden base and dust cover, Infinity Black Widow tonearm and Shure cartridge. Will sell pieces separately or together. Key Code 8-61.*

***Gates CB-210** turntables (two), complete with pre-amps and compensators, and cabinet furniture to house the turntables. Turntables equipped with Rek-O-Kut, S-260-16 tonearms. Key Code 8-11.*

***Fairchild Portable Lathes** (two), one excellent the other for parts, with Fairchild and Presto 1-C heads. Key Code 8-3.*

***Collins model TT-200-S** w/Bodine motor, Shure M232 arm. Thoroughly reconditioned & painted. Best offer. Key Code 8-40.*

***Sparta G-12** turntable. Drilled for Micro-trak 303 arm. Key Code 8-59.*

***Microtrak 306** tonearms 2 available, good condition. Key Code 8-42.*

Gates Model CB-77, 12 inch turntables. One with Gates tonearm, $100, one without arm $25. Key Code 7-57.

Gates Model CB-77, 12" turntables (two) with Microtrak 303 tonearms. Fair condition, $150 eac. plus shipping. Key Code 7-24.

Fairchild variable pitch disc cutting lathe, mono, 2 speed, complete with microscope, Grampian head, Gotham amplifier and not stylus. Make offer. Key Code 7-28.

Gray 33H single speed t.t. w/Ortophone arm and stereo cartridge on walnut base. $100. Key Code 7-27.

Pioneer PLA-35 turntable w/base, dustcover & cartridge. Like-new cond. $85. Key Code 6-19.

Micro-Track Rosewood 12 inch tonearms with Stanton D5107 cartridges and stylus, 2 sets available. $75 set. Key Code 6-79.

G.E. mode 47A12B2 transcription equalizer. Key Code 6-42.

Gray Research Tone Arms (older) 16 in. modified but good for parts. Less cartridges. Make offer. Key Code 6-55.

Sparta TEP-3M Monaural Turntable Preamplifier, excel. cond. Make offer. Key Code 6-59.

Rek-O-Kut B-12H 12 in TT w/320 arm will accept a trade of something. Key Code 6-35.

Gray model 208 16" viscuos-damped tone arm. Key Code 6-42.

QRK (older) tone ams 12 in. One in good condition, one poor. All metal. Make offer. Key Code 6-55.

Russco studio pro model B with Shure tone arm and cartridge. Key Code 6-66.

Mastering Room Package, includes: Scully lathe #50l, Scully 280-mastering tape recorder plus many other top brand items. Call or write for complete list. $25000. Key Code 6-70

Rek-O-Kut Disc Recording ;Lathe & l6in. turntable. w/spiral crank and 120 LPI and 210 LPI feed screws. exc. cond. $250. Key Code 6-2.

Technics direct drive. SP-100 and SP-15 in stock. Dependable, quiet, low maintenance, well engineered. Also cartridges and preamps. Write or call for complete list. Full Compass Systems, 55 N. Dickinson, Madison WI 53703. Tel. 608-257-7722 or TWX 910-286-2745.

G.E. Model 48A10A Pre-amplifier. Key Code 6-42.

Disc mastering mono Neumann lathe. $5000. Key Code 6-70.

QRK 12 (2 ea.) turntables w/QRK arms & Shure M-44-7 carts; 5 yrs old rebuilt 6 mos. ago. $150 each. Key Code 6-65.

Sparta 6T-12 turntables, 2 available at $100 each. Key Code 6-79.

Rek-O-Kut 16 in. turntable, 33-1/3 & 78 RPM idlers needs felt pad. $50. Key Code 6-2.

Rekocut Rondine turntable, fair cond. Key Code 5-27.

Microtrak 306 tonearms, two available, good cond. Key Code 5-27.

RCA BQ2B in cabinet with Shure M-236 arm. $50. Key Code 5-22.

Collins twelve inch turntable, fair cond. Key Code 5-27.

Gates CB-500 16" turntable with mounted Grey tonearm, $75. Key Code 5-23.

Rekocut A-60 tonearm, fair cond. Key Code 5-27.

Gray 208S tonearm, fair cond. Key Code 5-27.

CCA 12-72 turntables with Shure arms, 3 year old, 2 each, new motors. Best offer. Key Code 5-9.

Gates CB-500 turntables, four available, good cond. Key code 5-27.

Rekocut S-260 tonearm, two available, good cond. Key Code 5-27.

Russco turntable. Like new. Its a repo. $150. Key Code 4-85.

WANT TO BUY

***Gates phono** pre-amps M-6244 or M-5235. Also need 2 Gray 16" viscous arms or Gates GR-16. Key Code 8-12.*

***12-inch turntables** (two), 3 speed with or without tone arms. Must be in good condition, $200 tops for both. Key Code 8-24.*

Gray old style 16" tone arms, viscous damped or Gates GR-16 arms. Need two. Service manual for RCA BA-6A limiter. Key Code 6-56.

Gates GR-16 ftone arms or Gray equivelent, 2 each. Also need two or three Gates M-5235 pre-amps, tube type, reasonable. Key Code 6-22.

RCA Model BQ-1A turntable manual needed, or copy of same. Key Code 6-19.

Turntables, Russco & QRK 12", $150 for (2) tops. Key Code 5-43.

TV FILM EQUIPMENT

WANT TO SELL

***Auricon Camera**, 16mm with TV shutter, optical sound, half hour load, transfer direct to film from monitor. Key Code 8-3.*

16MM Edit Bench Kit: Moviola SZA synchronizer and winders, Muray viewer, Bolex splicer, Neumade applicator, and Spedrol cleaner. Excellent condition. $195. Autodyne, Box 13036, Orlando FL 32859. 305-855-6868.

RCA TK-27 color film chain. Numerous Updates. Key Code 7-13.

RCA film chain F(completed) with 16mm projectors and teleprojector (slide) w/remote control and mirrors. Working cond. Best offer. Key Code 7-64.

TP-16 Film Projector. Key Code 6-13.

Kodak TV M-100-A Super 8 projector for film chain or normal use. Like new, sealed bid to open June 20. Mark outside envelope "Super 8 Bid", minimum bid $750. Key Code 5-48.

Canon DS-8 Super 8mm camera with F1.4, 7.5-60mm, 1-8 zoom, automatic aperature, carrying case, 21 synchronized cassette reecorders, 3 filters, and extra NiCad power unit and charger. Cost over $1700 new excel. cond. $795. Autodyne, Box 13036, Orlando FL 32859. 305-855-6868.

See page 14 for International Contact Instructions

The Exchange The Exchange The Exchange

TV FILM...WTS...CONTD.

Cine Special w/case. Two sets special effects mats, three lenses, two magazines motor, assortment of filters. $350. Key Code 7-25.

Telecine island with Laird 5300,FP 1200 camera, Bell Howell 16mm projector, Spindler-Saupe 35mm. Key Code 5-42.

Bolex SM-8 Super 8mm projector-with sound, excellent cond. $225. Autodyne, Box 13036, Orlando FL 32859. 305-855-6868

WANT TO BUY

35mm Film projector with television three to two pulldown. Key Code 6-67.

Slide projector for film chain. Key Code 6-16.

VIDEO PRODUCTION EQUIP.

WANT TO SELL

Panasonic WV5311 *pulsecross rackmount. mon. w/Tek 528 mtg. space, new. Key Code 8-46.*

Microtime Image Plus *Proc. Amp/Video Enhancer/Corrector. Key Code 8-4.*

Houston Fearless pedestal*, PD-3, perfect condition, same as ITE pedestal P-4, $350 or best offer or trade. Key Code 8-31.*

Kanarc monitors (17" b&w), New HI-E transformer. Best offer. Key Code 7-64.

Telemation TSG-2000 SYNC generators. Two, both color, one with GEN-lock. Key Code 7-18.

Vital Proc Amp V1-750 in good condition. $1200. Key Code 7-43.

Ball Bros. special effects Mark IV generator. Best offer. Key Code 7-64.

H-P 335E TV frequency and modulation monitors for channel 73. Like new. 2 available at $300 each. Key Code 7-33.

Dynascience Model 468 Vertical Aperature Equalizer. Solid State. Working when removed from service. Key Code 7-18.

I.M.I. MK III large screen color projector, demo. $12,950. Key Code 7-18.

Gibralter, Quick-set cradle Heads (2) original price $520. Good condition. Make offer. Key Code 7-49.

Full tripod with elevator (2), Quick set 2 sec. legs ht. 42"-85". Very good condition original price $520. Make offer. Key Code 7-49.

Vital Processing Amps, V-500 (2 units); V-100 (2 units). Key Code 6-16.

RCA TA-9 Stab Amps, 2 units available. Key Code 6-16.

RCA TG-25 special effects generator complete with 6' rack. Sell of trade. Key Code 6-48.

Telemet RGB Color Keyer Model. Key Code 6-13.

Advent video beam 1000 A with screen. Best cash offer Key Code 6-57.

I.O. camera chains, 3 inch. RCA TK-14 with zoom lenses. Key Code 5-83.

Sony VTR system: 21" B/W monitor with tuner, 7" x ½" reel recorder, camera (B/W), tripod, microphone, cases, cables, $650 for package. Key Code 5-74.

RCA TG-2 sync generator. Key Code 5-83.

Concord MR750 Receiver-monitor, 9 inch solid state. $150. Key Code 5-91.

Davis & Sanford floating action tripod "B" & head, excel. cond. $175. Autodyne, Box 13036, Orlando FL 32859. 305-855-6868.

RCA TR-22 monochrome, worked fine when removed from service, $1000 or best offer over. Key Code 5-64.

RCA Waveform TO-2. Very clean. Like New. $300. Key Code 5-91.

Kodak AF-2 Ektagraphic Slide projector with auto-focus and timer, excel. cond. $195. Autodyne, Box 13036, Orlando FL 32859. 305-855-6868.

International Nuclear Corp. Model TVM-2 video modulator to feed TV receiver IF strip bypassing tuner, $50. Key Code 5-15.

Conrac CQF-14 monochrome monitors, 2 units, high resolution, with manual, 2 for $100 or best offer or trade. Key Code 5-68.

Ampex AC-116, SEG. $150. Key Code 5-85.

Reynolds/Leteron Mod LE-200 Titler machine with 3 alphabets. In carrying case, excel. cond. $225. Autodyne, Box 13036, Orlando FL 32859. 305-855-6868.

Chyron IIIB stand alone font create system. 1 yr. old in excellent condition. Call for list of components. Key Code 5-12.

Advent 7' projection TV/monitor, Videobeam 1000A. Retails approx. $4400, sell for $2600. Key Code 5-53.

WANT TO BUY

Sony/Admiral *color monitor/receiver with cord for AV5000 Sony video recorder. Can have bad pix tube, must be repairable. Key Code 8-12*

Equipment *for Religious Cable TV Station and Color Production Studio. Key Code 8-2.*

Studio Equip. *complete, either package or piece by piece, SS only. Key Code 8-17.*

Local Control panel for a Bell & Howell model 614EVMS 16mm projector. Key Code 7-56.

VIDEO TAPE RECORDERS

WANT TO SELL

Remote control *for Ampex VR-660 VTR, will pay cash. Key Code 8-31.*

Sony 2860 VCR *3/4 inch U-matic (three) modified for Convergence editing system. Like new condition. Will sell individually or all three. Key Code 8-45.*

IVC-960 *(one) with T.B.C., full editing and one IVC-960 alone. Key Code 8-3.*

JVC U-matic *3/4" video player mod CP5200, as new. Key Code 8-30.*

Sony VO-1600 *3/4" tape record/players with tuner, excellent condition. Several. Key Code 8-58.*

JVC CR6060U *3/4" VCR with frame advance, RF modulator, service manual. Excellent condition. Key Code 8-24.*

Sony 1000 VCR *3/4 inch U-matic player. Key Code 8-45.*

Sony VP-2000 *Videocassette Player. Key Code 8-4.*

VR2000-B *loaded, Ampex line D.O.C. Editec, RA4000 interface, 2 heads. Key Code 8-36.*

Sony 2600 *3/4 inch U-matic recorder players. Key Code 8-45.*

Sony 1200 VCR *3/4 inch U-matic player. Key Code 8-45.*

Sony TRI *editing system, 1 ea 2850, 1 ea 2800, 1 ea EA5 editor. Key Code 8-58.*

JVC/Ampex CR-4400-LU, 3/4" miniportable, Just reconditioned by Ampex, AC supply with charger and spare battery. $2500. Key Code 7-43.

IVC 960 video tape recorders, 2 each, with IVC4102 TBCs, 2 each. $5000 for the lot. Key Code 7-33.

VPR-1 with AST. (machine is in tabletop case). Good condition. $2300. Key Code 7-17.

Sony 2860 3/4" VTR, with new warranty. A good deal. Key Code 7-25.

JVC 6300 3/4", excellent condition. $1500 and freight. Key Code 7-67.

JVC. CR6000U 3/4", needs some work. $400. Key Code 7-48.

Panasonic NV 3110, ½" video tape player with RF adapter. $100. Key Code 7-33.

Panasonic ¾" editing system. two 9500's, one 9200, NUA950 controller. Key Code 6-9.

JVC-U—matic ¾" full editing system, one RM-83U, 2 pc CR300U, mint cond. in original cartons. $9000 firm. Key Code 6-21.

IVC-870 Video Tape machines, 2 each, one working and one needs repair. Key Code 6-13.

Ampex VR-7500 VTRs. 1", 3 units available. Key Code 6-16.

GE (Sony CV2000) 4TD182 ½" B&W VTR. Pre-EIAJ, compatible w/Videorover 1, etc., Used less than 10 hours. Good cond. $150 plus shipping. Key Code 6-60.

Sony 1" 320F VTR. Key Code 6-9.

Panasonic Model NV-3085. Battery operated, AC adapter. B/W with camera, Zoom lens, tripod, extra tape reels, 12" B/W TV set (with off-the-air recording capability), 16ft. camera extender cable, extra batteries. Plays through any TV set. Perfect cond. Original cost over $2000. Sacrifice at $1175. Key Code 6-15.

Sony 2860 VCR ¾" U-matic modified for Convergence editing system, 3 each. Like new cond. Will sell individually or all three. Key Code 6-71.

Panasonic Tape-A-Vision Portable Video Tape Recorder-Model NV-8100. Just removed from service. Exc. cond. Complete w/B&W camera, monitor, mic and all wire and cables. Complete instruction books, factory repair manuals and extra reels of video recording tape. Key Code 6-55.

Ampex VR-5100, $245; VR-7500, $295; IVC 800 AS/M, $495. Autodyne, Box 13036, Orlando FL 32859. 305-855-6868.

JVC videotape CR-6300U, new, w/warranty, remote control unit, Bretford rolling-base production cabinet, $1500. Key Code 5-53.

AKAI, ¼" VTR, B/W R-R Portable with camera tuner & monitor like new. $500. Key Code 5-80.

Ampex 5100, one inch VTR-needs head. Best offer. Key Code 5-85.

Sony 1000 VCR ¾" U-matic player. Key Code 5-32.

AKAI 700 Deck complete electronics, ¼" VTR like new. $375. Key Code 5-80.

WANT TO BUY

Sony 2800 in good condition. Will consider good 2850A. Key Code 7-43.

Service/Operational manual for the IVC 760 or photocopy of same. Key Code 6-60.

Panasonic NV8000 or equiv, (have old tapes that need dubbing to cassette). Key Code 6-24.

Norelco Video Head for model EL3401/54 1 inch recorder, also need original type T.V. connector cable for same. Head Part No. EL 1953. Key Code 6-22.

RCA TR-3, TR-4 or **TR-22** quad machines, low band or high band, will pay cash or trade. Key Code 5-68.

In the U.S. call 800-336-3045
For any Key Code Names and Addresses.

800-336-3045

New Listings are in *Italics.*

TIN EAR

continued from page 12

rotation of the azimuth screw head. You may well find one or two carts that are wildcatters, and require settings way out of this range. Discard these from your test.

When you have gone through all your samples, set the azimuth screw for the *center point* of your spread. HERE'S THE KEY TO THE WHOLE PROBLEM. You want the minimum possible deviation of azimuth, and you will only know that if you have found the *range*, and set the *center point*. The smaller the spread, the better (more uniform) your cartridges are, and the less deviation from perfect phasing you will have on the air.

You can see the wisdom of using a large number of carts to find the range of perfect azimuth settings: By using only one, you might have locked the azimuth at one *end* of the range. Carts at the other end would sound like a special-effects machine.

(Continued on page 23)

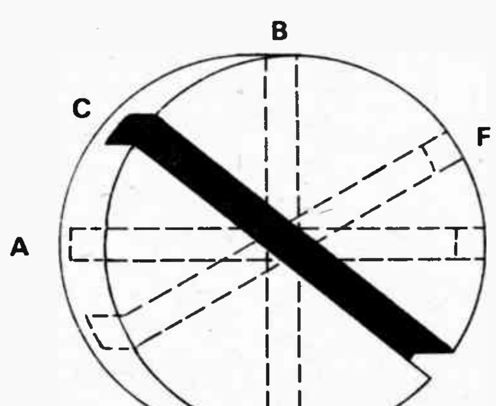

FIGURE 1

Magnified head of azimuth-adjusting screw on cartridge recorder illustrates method of "averaging" azimuth to obtain best response and least phasing from all cartridges. Large number of test cartridges show best performance with screw slot somewhere in the 90-degree range from point A to point B. Mid-point, C, is final resting place. One cartridge which has best highs and minimum phase shift at point F is discarded as obviously defective.

TIN EAR

continued from page 22

Now we're recording perfect cartridge audio, but we're not quite through. You also need perfect cue tones.

Arrange some way for the *cue* section of the playback head to drive a *program* playback channel. On machines with pin plugs behind the head, simply transpose two plugs behind the head. Insert cartridge #1, and set the level on any convenient meter. If you have one, hang the frequency counter on the output, too. (If not, just hum along with the 1KHz tone. You may want to do this late at night when you're alone in the place to protect your reputation.)

Now insert a blank cartridge and tone. Is it the same frequency? NAB specs allow a plus or minus 10% tolerance, so anywhere between 900-1100Hz is OK, but the closer the better. Now, how about the level? If it is more than plus or minus 1db from your standard cart's level, better adjust it. Remember, those playback sensors on your quality-control machine have only 3db of forgiveness.

Now do the same thing with cartridge #4 and the 150 Hz secondary or "aux" tone. Remember, it should be 6db "hot" compared to the primary tone. For some reason, cart recorders have a tendency to let their secondary tones drift off-frequency. I've seen more than one automation system bravely trying to figure out what to do with 120Hz secondary tones. Often, its decision was the wrong one. While specs allow it to range from 135-165Hz, keep it as close as possible, and check it once in a while. There's nothing worse than having to re-dub ~~dozens~~ of carts because the aux tones are bad.

Admire Your Results

You now have a cartridge record-play chain with minimum phase shift, maximum tone reliability and the best durn sound you've ever heard off of carts. If there are still problems, it has to be external to this chain.

Which it well could be: hundreds of pieces of equipment are replaced with "a better model" each year, only to connected up with the same bad wiring, to the same cheap mikes feeding distorted mixers, thereby improving nothing.

As a final step, make sure anyone recording carts can easily "A-B" what's going in against what's coming out. First, lock the input level control on the recorder so that OVU on your console equals OVU during *playback* of the cartridged 700Hz tone, when compared to a known standard (cartridge #7, for example). If the recorder's VU reads other than zero in the *record* position at this point, it could mean a) the VU is out of calibration (adjust the "record calibration" control); b) the bias setting is not correct for the tape you are using (adjust the bias as above); or c) it was just never set right, and you have been recording carts at the wrong level all these years. In any case, correct it, but leave the meter switch on playback. Instruct your staff to read the console VU to see what's going in, and the recorder's VU to see what's coming out a split-second later. Now they can A-B input versus output levels.

Go one step farther: A-B audio checks. Balance the program and audition levels in your console, and keep the recorder's output on the audition buss. Now, by switching the monitor from program to audition during cart dubbing, you can easily hear the difference between input and output. Activate the A+B pushbutton, and you add a check for stereo-mono phasing as you dub each cartridge.

If you possess a dual-channel console, you may even try a version of the above with identical speakers for each channel, so you can constantly hear both input and the recorded output, if you can stand the delay between the two. (It tends to offset one ear about six inches to the rear of your head).

Carts Can Sound Good

The final result of all this will be cartridge sound that will amaze you. You have the tools with which to keep the sound that way, and the checkpoints for cart-by-cart monitoring as you dub the lifeblood of your station's sound.

Of course, good cart sound can be self-defeating. You may find yourself carting music, which formerly had to come from discs to sound decent. Your pleas for new equipment may be for naught, since the old stuff sounds so great (ask for a raise instead). Other stations may attempt to spy on your new gear, which doesn't exist.

The real secret will be your gold-plated ears, which can hear the difference between the good, the bad and the ugly.