Published in three sections

Radio World

A-Editorial
B-Buyers Guide
C-BEE

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NRBA/Miami Draws Mixed Review

Exhibitors Unhappy

Miami Beach FL . . . The National Radio Broadcasters Association's (NRBA) 8th Annual Convention and Exposition was held in Miami Beach, from September 13-16, at the Fontainebleau Hilton Hotel. As in previous years, the show, while strong in some areas, suffered from a lack of "floor traffic." And, even though the traffic was better than that seen at the NAB's recent Radio Programmer's Conference held in Chicago, many exhibitors felt the show really wasn't worth their expense in time or money.

On the other hand, the lack of union problems experienced in Chicago coupled with the good service and facilities at the hotel was a welcome relief. From the attendee's point of view, while there weren't many exciting new products on display, the workshops and sessions made the show.

The technical sessions

While there were some last minute changes in panelists and topics, all of the technical sessions were informative. The first workshop on Monday morning was entitled, "Audio Processing for High Fidelity," and it was the audio processing session of the show. It started off with Ed Buterbaugh's (of CKLW/Windsor) very interesting discussion of listener fatigue (see his complete presentation elsewhere in this issue).

It ended with Bob Orban of Orban Associates and Nigel Branwell of A&DR discussing the relative merits of highly adjustable versus preset audio processing equipment. Orban's point was that with a preset system the CE cannot inadvertently hurt his station's sound with an improper setting, and Branwell's counterpoint was that with an adjustable system the knowledgable CE can set the equipment to best suit his situation. Since this reflects a basic difference in the philosophy of how these two companies approach the market, the discussion ended as it began, with two divergent views.

Monday afternoon's session, "Engineer/Manager Co-Existence, The Impossible Dream," drew the smallest audience, perhaps 25 people, but in the opinion of some, it was a very important session (see Mark Durenberger's column for a discussion of what the future may bring). Tuesday morning there was a session on digital audio and another session on satellite technology. The digital audio presentation were interesting, but the satellite workshop packed the room and generated a great deal of interest.

The session began with Gary Worth (President, Wold Comm) introducing the panelists, Tom Keenzie of United Video, Richard Langhans of RCA, Gary Landemark of California Microwave, and Chuck Kelly of KIUP/KRSI. The presentations ranged from a technical review of diplexing techniques to Chuck Kelly's review from the CE's position (see his column elsewhere in this issue as well).

Tuesday's luncheon featured FCC Chairman Mark Fowler as the guest speaker. His presentation was well received, particularly when he called for the elimination of the "fairness doctrine" and Section 315 of the Communications Act. He also touched on the AM stereo situation when he promised a decision by the end of the first quarter of 1982. It may be remembered that the last time the Commission had an AM stereo decision ready for an NAB show (that was in 1980), the result was something less than satisfactory to most broadcasters. It will be interesting to see if Chairman Fowler's continued talk about letting marketplace forces predominate as much as possible will also be applied in the AM stereo docket.

Tuesday afternoon, and continuing Wednesday morning, *Radio World*'s own factotum, Mark Durenberger, along with Steve Church, John Higdon, Harrison Klein, and Harv Rees, put on the best nuts-and-bolts sessions of the show, "The Things Ma Bell Never Taught You, 1981 Edition." To full rooms each day, Mr. Durenberger and friends outlined the do's and don'ts of interfacing with Ma Bell (both figuratively and literally). Needless to say there was a great deal of audience participation and questions, and everyone got a lot out of both sessions.

Finally, rounding out the sessions

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Tips for Prospective DA Owners

by Grant W. Bingeman
Continental Elec/Dallas

Dallas TX . . . When a station is in the market for a phaser, it expects and deserves a cost-effective product which has been designed for good bandwidth and good adjustability. However, the station must know the right questions to ask to ensure that it gets what it wants. Some of the more difficult questions will be addressed here.

First, some background. Impedance bandwidth is optimized by juggling phaser components and array parameters for minimum sideband VSWR at the common-point. If the +/- 10 kHz sideband VSWR is below 1.2, the impedance bandwidth can be considered excellent; below 1.5, good; below 1.9, treatable with external broadbanding circuits; but above 2.0 there may be some permanent impairment of audio quality, or a monster of a broadbanding circuit.

Pattern bandwidth

Pattern bandwidth is measured by sideband field strength and phase. The ideals are constant magnitude and linear phase. You are not likely to get these in the null areas of the pattern, so do not even bother trying, unless you are worried about your sidebands interfering with your co- and adjacent-channel neighbors.

The best you can usually hope for is optimization over the 3 dB beamwidth of the major lobe(s) of your pattern. Be sure to ask for a tabulation or plot of the far-field magnitude and phase at the sidebands as well as at the carrier. Remember that pattern and impedance bandwidth are two different animals, and some compromise may be required between them.

Optimization can begin before the phaser is even considered, that is, when the pattern is designed. A specific directional pattern can be produced by many different combinations of tower height, orientation, and current. Each of these combinations will have unique bandwidth and adjustment characteristics. To ensure that the designer has selected the optimum combination, ask to see the driving-point impedances for each case.

In general, the best choice will have operating base resistances closest to positive 50 ohms. For example, negative 20 ohms is often preferable to negative 60 ohms, all other things being equal. There are exceptions of course, but the only way to find them is to perform a full network analysis of the phaser and towers, as a whole, for each case.

That can be expensive, so it pays to make a prediction based solely on driving-point impedances, which are easily obtained. Later, if the first network analysis yields bitter fruit, try a second combination.

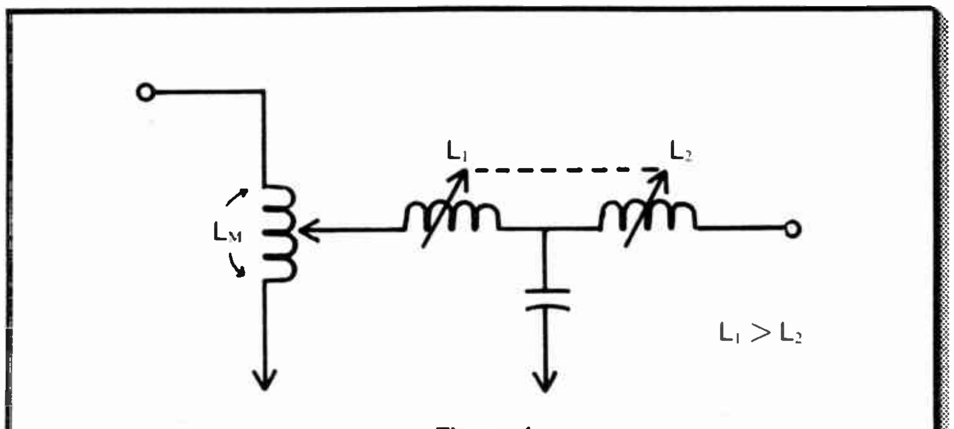

Figure 1

Driving points

To avoid building a house on quicksand, one needs to know that the theoretical driving-point impedances are a good reflection of reality. If the impedance calculations are to be valid, they must be based on the following. A: The electro-magnetic velocity of propagation on a tower is less than the speed of light. B: The pattern field ratios are not equal to the tower loop-current ratios, except when all towers are the same height. C: The loop ratios and phases are not equal to the base ratios and phases of tall towers (height greater than about 120 degrees). D: Common sense tells us that we do not want to build a DA next to a shipyard, and yet it happens. Re-radiation or scattering can usually be compensated for if the parasitic elements are fixed, but not when they are mobile!

The presence of undesired scatterers will force the original field ratios and phases to change, thus affecting the driving-point impedances. However, if the dimensions and locations of the scatterers are known in advance, they can be made part of the analysis.

Regarding bandwidth and adjustability optimization, one vitally important question needs to be answered. Did the analysis fully model the coupling between towers? Ask to see the network representing the tower self and mutual impedances.

There should be connections from each individual tower to each other tower in the array. These connections are in addition to the connections to the phaser. If the coupling was not modelled, then the results of the analysis are probably meaningless.

I know that some phaser designers feel that they do not have the time or the computer resources to produce a rigorous analysis. If so, they have no business referring to their design as "wideband." Sometimes you will hear a defense for not broadbanding based on receiver bandwidth. "What good is a wideband phaser when the receiver passband stops at 3 kHz?" The response to this legitimate question is three-fold.

First, the transmitter performs better into a wideband load. Next, the inter-modulation distortion components do fall within the passband of even the poorest receivers. And finally, find someone who has broadbanded their 2.0 VSWR to 1.2, and ask them if they experienced a perceptible difference in audio quality.

We all know what a phaser does. It provides the correct current magnitudes and phases to a set of towers in order to produce a specific directional radiation pattern. Thus the phase shift across each network and transmission line affects the outcome.

Did you know that the phase shift across a transmission line is affected by the VSWR on that line? Be sure that the final adjustment of the phaser leaves a reasonable match on the transmission lines; otherwise, the phaser may not perform as desired.

Did you know that the phase shift across many types of power dividers can be quite high? To ensure that this phase shift was accounted for, ask. And while you have the designer's attention, ask if the negative towers have been returned to the common-point in phase, and if the phase shifts from the tower loops to the bases have been accounted for.

Did you know that the mutual inductance between coil sections appears as a negative reactance at the junction of those two sections? In the case of a low-Q shunt power divider, this means that ganged coils in a phase shifter connected to that power divider must have unequal reactances (Figure 1).

The coil connected to the power divider junction must (in addition to its normal function) tune out the capaci-

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Canadian Content

Hi Power Transmitter Review

by Rob Meuser/Tech Dir
CJJD/Hamilton

Hamilton Ont . . . This month we will look at transmitters commonly used at stations in Canada (see Table 1). Since most Canadian stations use at least a 10 kW transmitter, our list includes 10 and 50 kW units. This list is not a re-write of specification sheets, rather it is a guide that was compiled by Gus Sondermeyer of Stan Davis Broadcast Technical Services in Vancouver. The list was originally intended for the exclusive use of their customers.

Generally useful

The points covered here could be used for other power levels and even FM. Many of the seemingly mechanical features could prove to be important to the prolonged operation of the chosen transmitter. I have removed some subjective evaluations relative to the overall on-air sound and there is a section that will allow you to provide your own data table according to your requirements.

Unfortunately the cost figures in the tables are based on December, 1980 prices, and some of them may have changed. Each of the manufacturers and the tube suppliers should be contacted to update prices. Also, it is important to remember that these figures are in Canadian funds including exchange fees.

Missing from this tabulation is a new all-Canadian solid state transmitter. This revolutionary unit scores well on most of the enclosed criteria and will be the subject of a separate column.

Table 2 gives a brief look at some 50 kW units. I know there are several advertised, but only three models are generally available at present.

Now that the mundane points are covered, let's look at actual performance. I have deleted these categories from the tables as they were not verifiable by standard measurement techniques. We can, however, discuss them one by one.

Square wave performance, 20 Hz to 7.5 kHz. Look at both ends of the spectrum, as the HF square wave will give clues as to how heavy processing will survive, especially with pre-emphasis. Phase linearity, which overlaps square wave performance somewhat, should be checked across the spectrum. A dual trace scope and a high quality demod unit will probably suffice. If there is phase shift, you will not have perfect square wave response.

Depth of modulation linearity. Most special design transmitters employ some kind of trick to achieve 100% negative modulation. Check for 100% mod at all frequencies!

SMPTE intermodulation distortion; what is guaranteed? What would you find if you walked into a running plant with your IM meter, and were allowed to measure the transmitter (not a bad idea if you have friends with the right power and model transmitter). How much maintenance is required to keep the IM low. Sometimes you are at the mercy of the PA tubes with respect to IM. It pays to research certain brands of PA's to ascertain the consistency of performance. If you look at the two 50

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Reader's Forum

Got something to say about *Radio World*? Any comments on articles? Get it off your chest! Call us at 800-336-3045 or send a letter to Reader's Forum (*Radio World* Box 1238, Arlington VA 22210) for a reply.

From El Salvador

Dear RW:

I want to thank you for sending us *Radio World*. I find it outstanding in its excellent articles and observations written by people who use radio and know the troubles we take everyday. I hope you will go on with this superior kind of publication which I read cover-to-cover. Your publication really is an open window for us to see that there is progress out there in this big world which unfortunately other people are trying to deny us right now.

Rudolf H. Rahn
YSMF/FM "Musica Feliz"
San Salvador, El Salvador

RW Replies: Thanks for your comments Rudolf. For those of you who might not know, RW has gone to Central and South America since July, 1980, in a special bi-lingual edition.

Gear in BEE Moves

Dear RW:

I use your exchange every month and always read RW. Keep up the good work.

K. Dean Stephens/Pres.
Broadcast Developments Int'l
St Just PR

RW Replies: Thanks for the compliments. Remember that listings in BEE are free and that they work, so send in yours today!

9 kHz Again!

Dear RW:

According to Djalma Ferreira's letter in the August issue, if we don't go to 9 kHz channel separation in Region 2, we will be faced with heterodyne interference from "powerful African stations." This is not the first time I have heard these claims and I am beginning to think that this "heterodyne interference" is really a misleading issue. Here's why.

Region 1 (Europe and Africa) has long been operating with 9 kHz spacing, with many transmitters in the 100 to 1000 kW range. If heterodynes against Region 2 stations were really a problem, surely someone would have complained about it long ago.

I was living in Florida in the winter of 1975-76, during the sunspot minimum, which contributes to stronger skywave signals at medium-wave frequencies due to lowered ionospheric absorption. The only noticeable heterodyne caused by a Region 1 station was from the 800 kW station in West Germany on 1586 kHz. This was noted, incidentally, on a reasonably good communications receiver.

A great number of stations have been operating on "split frequencies" (eg: 625, 765, 825, 1035, 1075, etc) in Central and South America for decades. The only consistent interference problem reported in the US has been from Radio Belize on 934 kHz. Even though these stations probably should conform to Region 2 standards, there has been no outcry from the general public in the US about interference. I do not know, however, about the interference impact of such stations as Radio Surinam on 725 or ZP10 in Paraguay (1305 kHz) on broadcasters in Brazil.

Given that a greater number of transmitters in the megawatt range are expected to be installed in Region 1 in the future; even if heterodyne interference should be a problem, it would be only from local sunset to about 7 PM Eastern Time in North America, since most European stations sign off around midnight local time.

I wonder which "powerful African stations" Mr. Ferreira is talking about. Upon consulting the "1981 World Radio-TV Handbook," I see only 17 medium-wave stations located in countries along the West Coast of Africa having powers of 100 kW and over.

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Bill Sacks on the Audio Process

Norton Amps Take out the Garbage

Arlington VA . . . Readers are certainly aware of the wide variety of opamps available today. Opamps have given us standard gain blocks to simplify our lives. There are hundreds of opamps available, each optimized for a particular specification or situation.

The Norton current differencing amplifiers that are about to be described have 2 features which distinguish them from ordinary opamps. The standard opamp requires a bipolar power supply. The Norton amp is content to operate over a power supply range of +4 to +36 volts and will also operate using a bipolar source of +/- 2 to +/- 18 volts.

The other distinction between this amp and a normal opamp is that the inputs are current differencing rather than voltage differencing. The symbol for a Norton amp is shown in Figure 1.

Inside the Norton amp

The input stage of a regular opamp is a matched differential transistor voltage gain stage operating off of a constant current source. The Norton amp has a unique input configuration (Figure 2) and is essentially a common emitter transistor stage. This is an inverting stage.

Most of our applications will require 2 inputs, one inverting and one noninverting. The noninverting input is provided by connecting a current mirror directly across the inverting terminal. This is the Norton differential amplifier mode.

Remember this amp differences current and not voltage. The inputs can easily be converted to voltage sensing by placing resistors in series with the inputs. The output stage is operated Class B and can drive 10k. The standard package (LM3900) provides 4 of these amps in a 14 pin standard DIP for about $0.85.

Here is the bad news. It is a rotten audio amp. The slew rate is a mere 0.5 V/uS. What good is it? It's great for all kinds of non-critical applications and control circuits which only have a unipolar power supply available.

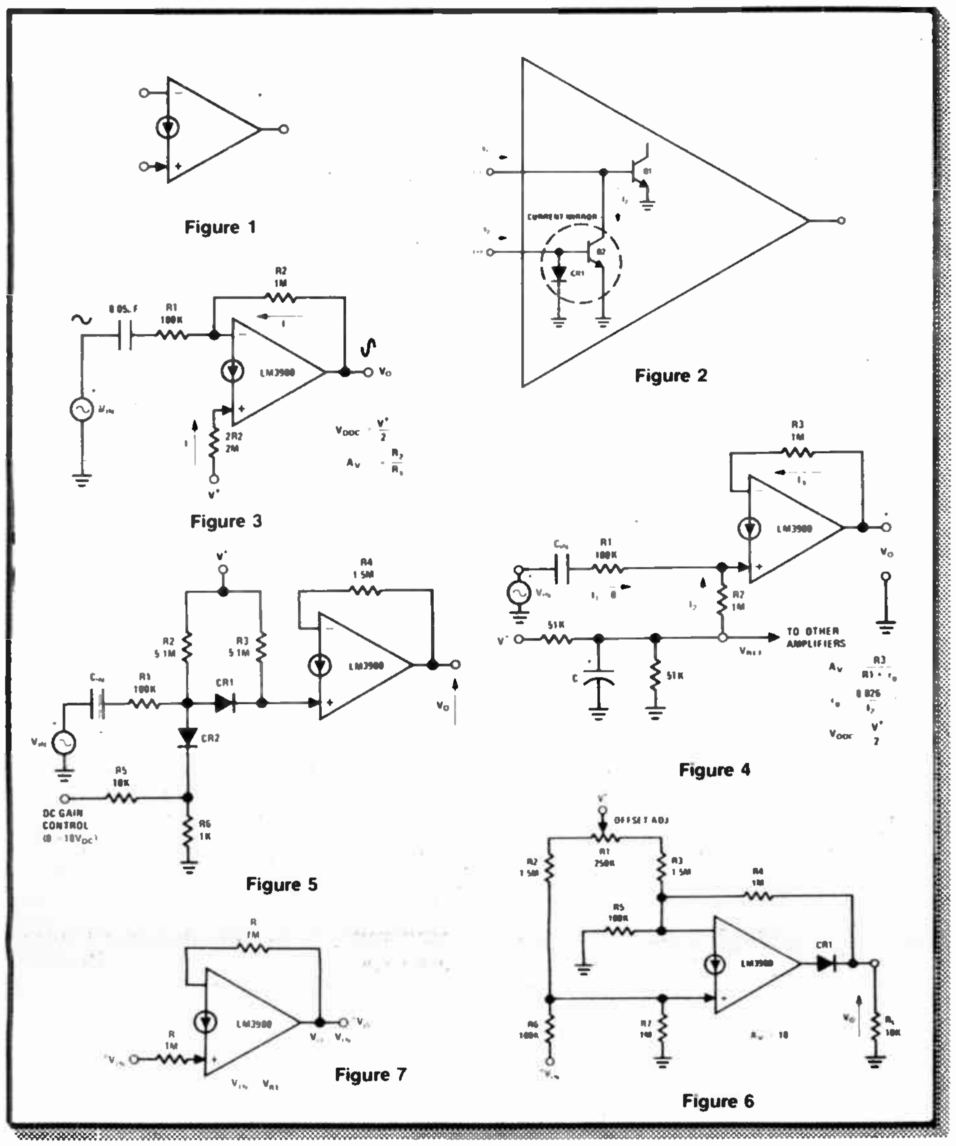

Figure 1, Figure 2, Figure 3, Figure 4, Figure 5, Figure 6, Figure 7

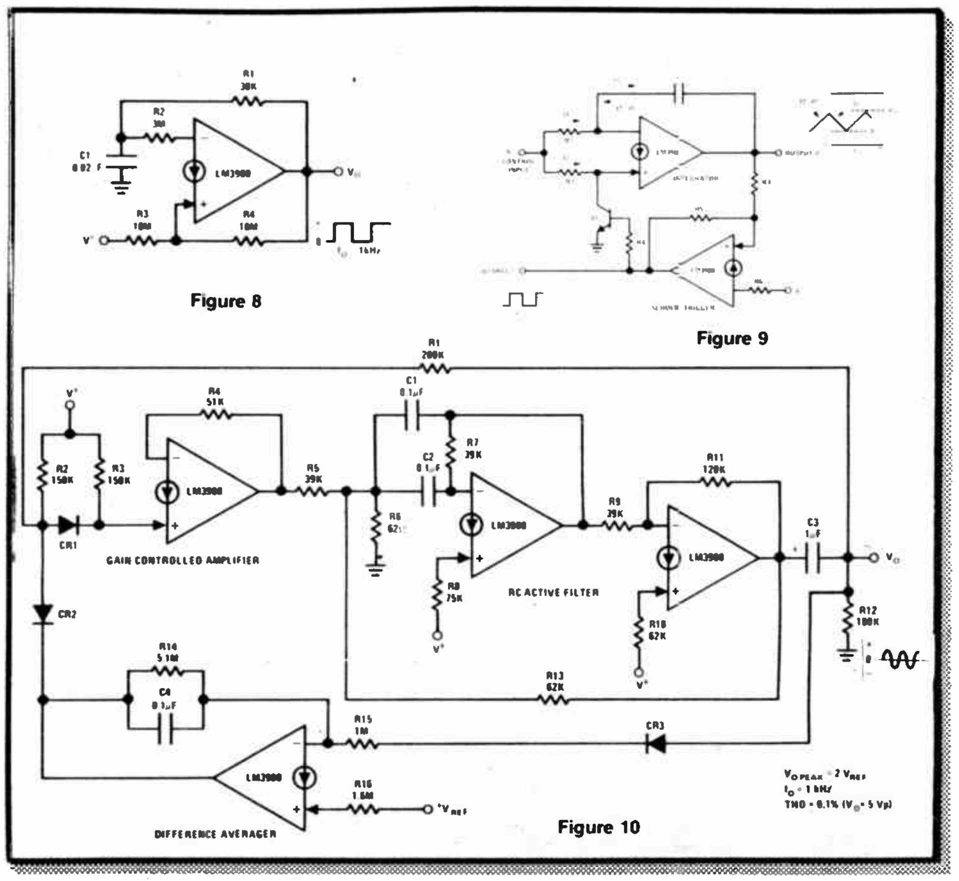

Figure 8, Figure 9, Figure 10

An inverting amp configuration is shown in Figure 3. Note the bias resistor on the non-inverting input going to V+. Its value should be twice that of the feedback resistor. The output will be biased at half the supply voltage.

Figure 4 shows a noninverting configuration with a bias circuit. Figure 5 is a voltage controlled amp, increasing the DC control voltage increases the gain. A non-inverting DC amp with the ability to go to 0 output voltage is

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A Future for Engineers?

by Mark Durenberger
The Ex-Ranger

Minneapolis MN ... The radio engineer as we know him will soon cease to exist. The broadcast engineering fraternity is undergoing a dramatic and categorical change, and some of us could be in real trouble. If I were a CE at an AM station knocking down big bucks, I'd be seriously concerned about my security and future.

If I were Chief of an FM station and couldn't find the time to keep abreast of the rapidly emerging technologies, I'd be a tad worried also. The trouble signs are most evident at the big trade shows where you're afforded the opportunity to listen to what many owners and managers are thinking about the future of engineering. You'll find that engineering is rapidly becoming, in their eyes, an unnecessary evil.

And why?

There are a lot of reasons. The broadcasters who endorsed abolition of the First Phone intended to save money in salaries and compliance costs. And those broadcasters who are followers rather than leaders look at it this way, "If the FCC in its infinite wisdom, can eliminate the First Phone requirement, perhaps engineering isn't so vital after all." Then there are the transmitter manufacturers who are touting "remote maintenance."

"Just tie your transmitter into our black box," they say, "and call us on the telephone. We can read transmitter parameters and diagnose your problem. We'll tell you which module to replace!" If you were an owner concerned with maintenance costs and were approached by these manufacturers, wouldn't you be tempted to feel you could handle these maintenance chores by yourself with their help?

There's a cataclysm brewing for our fraternity and it may not be long before most of the good engineers are working elsewhere. And it's unfortunate that it's mostly our fault because it lies in our hands to learn how to correct the problem before it's too late. The problem is easily identified as a lack of regard for the importance of engineering.

In the past two weeks a couple of things have happened to bring this all home. First, the NRBA Convention. It's worthy of note that what might have been the most important engineering conference was the most poorly attended. It was a session on engineering/management coexistence and it was there, Monday morning, September 14, 1981, that the future of broadcast engineering was dissected. If you were there you were worried by the totally unrealistic outlook of one of the manager panelists about the need for engineering support.

He's hot about the concept of remote maintenance and was vocal about what he sees as a declining desire among engineers to try to master every aspect of the industry, and while he felt the idea of module-swapping was great for him, he was critical of engineers who have become module-swappers. The fact that most of them aren't allowed to buy necessary test gear wasn't important in his opinion. Much the same feeling was evident at the recent Chicago NAB Conference, if you took the time to listen to the right people.

Happens here

The other occurrence of significance was the recent transfer of Art Schreiber from KSTP, Minneapolis to KOB, Albuquerque. In my 25 years in engineering, he's the first manager I've worked for who firmly believed that engineering was highly important to his operation. So important that he insisted engineering be part of the management team, and be involved in policy decisions.

It was no coincidence that he was on that same NRBA panel explaining his feelings about engineering and was well received by the audience. If it's never happened to you, let me tell you it's a great experience to work for someone who does more than pay lip service to the importance of engineering.

Incidently, the 2 engineers on that panel felt that in a few years many of today's best broadcast engineers will be moving into management and sales, both as a means of maintaining a decent living standard and as a way to maintain job satisfaction. I guess that's a solution for a few, but they'll leave the engineering fraternity poorer by their departure. What are the options for those who elect to stay in the engineering biz? Do they specialize?

We know it's no longer possible to completely master all of the technologies important to broadcasting, there just isn't enough time. And there aren't many stations willing to make the financial committment to attract and keep those few who can do it. What else can you do? Do you become a Field Service Engineer, responsible for several stations? That gets old real fast in Minnesota in mid-winter. And what happens when 3 stations are down at the same time? The point is that you'll be entertaining one of these options or others, because in a few years, very few stations will be employing full-time Chief Engineers who aren't pulling other duties to help justify their salaries.

Why stay with it

Why not just decide to move into something less frustrating? I don't have to tell you that once you've been "bitten by the bug" you're probably in it for life. But a lot of stations aren't fun to work at, are they? Sometimes you do have the good fortune to work with

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Audio Processing & Listener Fatigue

by Ed Buterbaugh/VP Eng
CKLW/Windsor

Windsor Ont ... I would like to discuss the effects of over-processing, improper processing, processing without regard to system limitations, and most importantly, the direct relationship of these factors to the stations ratings, and consequently bottom line revenue.

I plan to deal primarily with the AM radio service, simply because it is the area that needs the most help right now. But we will also be crossing into some common ground areas pertaining to listening fatigue in both the AM and FM bands.

The receiver

The primary problem with the AM service, as we all know, is the receiver itself. The narrow bandpass of the IF stages, we are told by the receiver manufacturers, is the only cost effective method of providing decent selectivity and adjacent channel rejection. Fortunately, there is some indication from the receiver manufacturers that once AM stereo is approved some effort will be made to upgrade AM receiver standards.

Until that happens, however, the onus has been placed on the AM broadcaster to try and compensate for this narrow receiver bandwidth by altering the transmitted signal. Unfortunately, the AM broadcaster has additionally been forced into a loudness battle in which the artillery can range from equalizers, to multiple band processors, to cascaded multiple band processors, to smart clippers, dumb diodes, reverb and on and on and on until finally we have managed to produce the loudest and most offensive distortion known to the human ear.

It's no wonder people have stopped listening to AM radio. It is interesting to note that in 1976, 45% of the share of the Detroit radio audience listened to FM. In the same period in 1980, 64% of the audience was listening to FM, a 19% increase in FM listening in just 4 years.

What happened?

A little over a year ago, CKLW decided to conduct extensive research to determine the answer to the question, "Where have all the listeners gone?" A number of interesting statistics and conclusions were developed from this research. From a programming standpoint, for instance, we learned that listeners in a given market tend to become used to a particular programming sound or calibre of programming. The standard of comparison then is based almost entirely on the individual market and what they are used to hearing, or, I should say, the best they are used to hearing becomes their reference point.

Relating that theory to the technical area, people have finally become used to the "superior" sound of FM, and it has now become the standard of comparison in terms of broadcast fidelity. We conducted a number of "focus" group sessions in conjunction with our research, in which people from all areas of life were invited to sit down and talk about radio. During the course of the focus study, it became more and more apparent that people perceived CKLW as being a super loud, hard sounding, AM radio station, and they were right.

This was what previous programming policies had dictated, and it was the sound that had helped make us a winner in the past. But the standard of comparison has changed and listener fatigue, rather than listener excitement had become the dominate factor. After a careful analysis of all the facts obtained from research, the conclusion was that under current technological conditions (that is, without AM stereo and improved AM receiver design) it is almost impossible for an AM radio station to increase its cume (or, in other words, its number of different listeners per week) without making drastic changes in its programming format, or advertising heavily to promote the station.

So it becomes extremely important that those listeners remaining on the AM band listen longer in order to increase, or at least maintain your ¼ hour share of the ratings. Therefore we decided to back out of the loudness war in Detroit, in favor of a clean, clear, easy to listen to technical sound, while maintaining the same basic programming format, with some minor adjustments in the music.

The results

The results are pretty amazing. Our listening duration has increased to 15-20 minutes per day per listener, or about 50%. What this can mean under ideal conditions is if your cume remains stable and you can increase your daily listening time by ¼ hour per person,

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Birdwatching for CE's

Selecting & Installing Your Dish

by Chuck Kelly/CE
KIUP-KRSJ/Durango

Durango CO ... "You wanted to see me sir? We are going to get a satellite dish to receive our network? Great! I've heard how good they sound, and just think, no more Ma Bell too. Huh? You want me to install it?"

Stranger things have happened. Now I'm not going to give you Heathkit instructions as dishes, your site and requirements will vary widely, but let's review the basics of how to install your satellite RO (receive only) station.

Supplier first

The first consideration will be to select the supplier and system desired. We all know it's best to stick with a known brand name with some field experience, don't we? There are a lot of small companies springing up these days to fill the demand for home reception of satellite TV but not all of them are competent or provide the service back-up you may expect.

Determine who the top 3 suppliers are from reputation and request their installation manuals. It will probably cost some but you will gain a tremendous insight into the equipment. Also, ask for a users list and call a few at random, preferably broadcasters.

In selecting the equipment, the most obvious choice you have to make is the size and type of dish you want. Since bandwidth is a factor in signal-to-noise, our audio signals can get by with smaller dishes for the same signal-to-noise figure than can TV.

Another factor in this choice is the LNA or low noise amplifier you choose. The better the preamp, the smaller the dish you can use. The LNA noise versus dish size trade-off is akin to the FM transmitter power versus number of antenna bays consideration. There are proponents on both sides. LNA's are rated in noise temperature in degrees Kelvin. The lower the number, the lower the noise and the better the preamp.

Other criteria

However, signal-to-noise should not be the only criteria you use in selecting your dish. The larger the dish the narrower it's aperature or beamwidth, or put even more simply, the smaller the spot in the sky it sees. The spacing between satellites may be decreasing soon, so to avoid interference from adjacent satellites (remember they are on the same frequencies), a larger dish might be required. A lot of radio stations who don't plan ahead will become aware of this sad fact in the future and will be stuck with crosstalk.

On the other side of the ledger, the larger the dish, the tougher it is to aim and maintain alignment. Also, wind loading is proportional to surface area and can prove to be quite substantial.

All of these factors need to be thoroughly covered with your supplier. Don't skimp on planning! Select the site carefully. Does it see the proposed satellite without intervening buildings or trees? How about the other satellites? What if you change satellites? Terrestrial microwave uses the same frequencies as well and some dishes have had to be built in pits for shielding.

Now mounting

Obviously there are a lot of considerations. Once you decide where to mount it, you must figure out how to mount it. If you choose a ground mount, there are several choices. A post mount is convenient for small (6' or smaller) dishes. A hole is drilled in the ground about 14" in diameter and 5' deep (make friends with your utility pole man), a 4" steel pipe is set in and concrete poured around it. Simple.

Another common mount is the tripod base where the 3 legs are set in concrete. More stable but more costly.

If you are considering a roof mount, consider the loading factors on the roof structure. Not just the dead weight of the dish assembly. Don't forget that the wind will want to fling your dish through the front of that Maserati dealership across the street. Just like a frisbee. What happens when the snow builds up on the roof? Does it sag? A 1 or 2 degree sag will misalign your dish to the point that you may lose reception entirely.

Grounding is essential, the electronics involved in a satellite receive system are both vulnerable and costly. To avoid lightning damage, 2" copper strap from the dish, mount, and electronics to a low impedance earth ground should be installed. Nothing is ever 100%, but every little bit helps.

LNA placement

In many installations the LNA is mounted on the antenna at the focal point of the dish and the amplified 3.7 GHz signal is routed behind the dish where the downconverter heterodyne the signal to a 70 MHz IF. Common CATV cable routes this signal into the station to the demodulator. Even though the losses in the cable at 70 MHz may be small, it is wise to keep the cable as short as possible.

Once you have mounted the dish, connected the electronics, and performed the manufacturers recommended power-up checks, it is time to aim the dish at your satellite. First you start with what you know. The required accuracy is about a degree so don't say, "I think the highway is pretty close to north." Find out what the magnetic declination is for your area. This is the error between magnetic and true north. It approaches 25 degrees in some parts of the US.

Align the elevation angle of the dish first using an inclinometer. Then using a compass and correcting for declination, adjust the dish for proper azimuth. Many mounts display some interaction between these adjustments, so recheck each.

Typically the downconverter has a test jack for monitoring AGC or received signal strength. Watch this point with a VOM while adjusting elevation

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A Future for Engineers?

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a broadcaster who is keeping current with technology changes by buying you test equipment and carrying on a more or less continuous studio-upgrading plan. His stations sound great and his studios are a place of pride.

More often than not, however, you come to work in cramped studios, perhaps in the basement of a house or at the transmitter building. You may or may not have a dedicated shop area and a desk. The studios can be a drag. In winter they're hot and dry, in summer hot and humid. But the Sales Department and other offices are comfortably furnished. (Is this too cynical? I think we've all been there at least once.) But you will stick with it because you're a dedicated engineer. So how do you go about improving your lot at the station and improving the image of engineers as a whole?

Get involved

Art Schreiber and others will tell you that from a manager or programmer's point of view, it's the engineer's fault for living a life apart from the rest of the staff. They don't understand what we do, and they certainly don't understand our day-to-day problems in keeping equipment going on a limited budget. And it certainly doesn't do a bit of good to gripe about your situation to the jocks you see every day or to take it home every night to your wife.

There are some positive steps you can take if I've convinced you that you have a responsibility to get involved. First, ask your manager if you can sit in on the next couple of sales meetings or programming conferences. You might be bored to death at first, but don't be surprised if you find yourself able to contribute to a discussion from the engineering point of view. Most importantly, you'll show them you're interested in what they're doing and in what their problems are. Sometimes you might be able to help. And as a side benefit you might find out about that next remote more than a day in advance!

Then what?

After you've been to a few meetings, you may discover you're asked to participate. Suddenly not only will you have become a part of the station operating and decision-making team but you'll get more personal satisfaction in being a part of the stations' successes. It's important to remember that you'll have to attend these conclaves armed with the proper attitude (non-defensive for sure) and you must have the ability to communicate with other departments in non-technical talk. Hopefully you'll learn a bit about their language.

Unless it's pure lip service, most programmers and managers have been telling us recently that they want engineers to be more forceful, more visible, more helpful, more important to the operation. If you agree with the idea of trying to get involved, and if you take the approaches suggested here, and apply a good deal of finesse and tact, and you still find yourself rebuffed by the management "team," perhaps they don't deserve you, and you ought to look elsewhere for work.

By its very nature, broadcast engineering is highly technical. Broadcasters would like their equipment to be much simpler, more foolproof, more reliable. But the more you try to simplify things, the more complicated the actual system often becomes. The addition of sophisticated remote-control systems and automated control equipment is cost-effective and should be endorsed by us all, but it adds to the complexity of the operation, and requires more understanding on our part.

The problem is that the more you integrate emerging technologies, the more important it will be that someone be able to master all of it. The alternative will be to hire several specialists. The master or the specialist is not going to be the norm in most stations as long as the engineer is considered a second-class citizen.

If I haven't made the point more than several times, here it is again. The future is still in our hands as engineers, but it may not be for long. We still have the option of making something of engineering. I hope you'll accept the challenge before it's too late. I'd like to hear from you if you have some ideas on what we can do as engineers and what your own experiences have been in dealing with this problem. Please write me in care of *Radio World*.

Pass this column on to your manager if you're concerned. He's 1 of the 2 people who can do something about a very real problem before it's too late and you both lose. The second person is you. Communicate, be visible, be forceful but tactful, become interested in the rest of the station. Start to realize how important you really are as part of the station's operating team. And put some interest back in your job while you secure your future!

Next month, who knows? Maybe we can go 2 months in a row without telephone talk!

What are the Causes of Listener Fatigue

(continued from page 7)

you will pick up the same amount of new quarter hours as the total number of your cume audience.

For example, if your cume was 100,000 people with an average daily listening time of 30 minutes for each person, and you could increase that listening duration by 15 minutes to make it 45 minutes, you would then pick up 100,000 new quarter hours or a 50% increase in your quarter hour share, assuming the rest of the market remained stable.

Since making these changes in processing, CKLW-AM has gone from a 2.8 share to a 4 share. This was achieved with a 25% reduction in cume from the last time we had a 4 share, but with a 50% increase in listening duration! All of this rating information is intended to do one thing, and that is prove to all of you the effects of listening fatigue on the ratings. Now, let's look into some of the causes of listener fatigue.

The whys

From a technical standpoint, listener fatigue can be caused by a number of factors. Excessive compression resulting in an overly dense signal with no dynamic range is a major cause. But distortion plays a much more important part in the tune-out factor. Harmonic distortion, although certainly an important consideration, does not seem to contribute as significantly to listener fatigue as does intermodulation distortion.

Tests conducted by Bell Laboratories have shown that systems having a high degree of listening fatigue may demonstrate a reasonably tolerable amount of harmonic distortion. First order intermodulation distortion, on the other hand, because of its non-harmonic relationship to the fundamental frequencies, tends to be extremely annoying.

Unfortunately, one of the major contributors to IM distortion is the basic, so-called "soft" clipper. Sold by a number of major broadcast equipment manufacturers, this circuit consists of a reversed biased transistor, operating in the linear portion of its range, and with compensation to round the leading and trailing edges at the threshold of clipping.

I've conducted distortion tests on this type of clipper and found that with 3 dB of asymmetrical clipping, the harmonic distortion would approach 6%, but the IM distortion, under identical conditions, measured 21%. There have been several improved clipper circuits developed recently, and in fact, the new Gregg Labs AM processor, on which I've done some prototype testing, incorporates a unique discriminate clipper circuit at the output of each of its 5 VCA's.

The threshold of clipping is fixed and a rather elaborate filter system is used to remove the harmonic and IM distortion products prior to resumming the audio. The question then arises, how much distortion may be tolerated by the average listener? This tends to be a very complex question to answer.

The average listener doesn't recognize listener fatigue as such and doesn't even know why he tunes out a radio station after a short period of time. Unless of course, he doesn't like a particular record, or the programming of the station. In other words, the fatigue factor is subliminal.

High freq response

The distortion fatigue factor is directly proportional to the high frequency response of the processed signal and the amount of distortion present in that signal. This is unfortunate because most AM processing systems are intended to increase high frequency response as well as loudness. If this is to be done without offending the listener, it must be done without creating distortion.

For instance, in a wide band audio system, the third harmonic will become annoying at less than 2%, whereas the even or 2nd harmonic will be tolerable up to approximately 5%. However, using a sharp lowpass filter at 6 kHz, the listener may tolerate harmonic distortion up to 10%.

If the high frequencies are cut off just below 3 kHz, up to 15% total harmonic distortion may be tolerated. Basically the same holds true for IM distortion. As I have previously stated, systems having a low percentage of intermodulation distortion generally sound cleaner than those having a comparable amount of harmonic distortion. Going one step further, and involving the rating demographics, women tend to become even more offended by high frequency distortion than men. The reason for this is simple!

Due to hearing losses directly related to age, women at the age of 40 have, on the average, a 6 dB greater sensitivity to high frequencies as do men of the same age. At age 65, women have approximately 20 dB greater sensitivity to high frequencies than men of the same age group. On the other hand, the younger demographics (18-24) show an insignificant male/female difference in high frequency sensitivity. The attenuation of high frequency sensitivity begins to occur around 25-30 years of age.

Excessive compression

In addition to certain types of distortion, excessive compression and loss of dynamics induced listener fatigue tests have shown that over-emphasizing the frequency band between the 6th and 7th octaves (or from 512 Hz to about 2,000 Hz) is an additional cause of listener fatigue even if distortion is not present in the signal.

Accentuating the 8th and 9th octaves (or the frequencies between 3,000 Hz and 8,000 Hz), adds presence to the transmitted audio, and if transmitted without annoying distortion, will reduce listener fatigue by permitting the labial and fricative sounds of the human voice to become more distinct. In addition, this adds clarity and brilliance to music.

It is imperative that very careful equalization techniques be employed in processing the audio for AM. One must be careful to avoid over-emphasizing. Those frequencies that are annoying to the listener in emphasizing portions of the 8th and 9th octaves inversely coincide in frequency response to the IF attenuation curve of most AM radios.

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And What You Can Do About Them

(continued from page 10)

All of this must be done while maintaining proper transmitted bandwidth. Experience has shown that a very steep pre-emphasis curve can be achieved without creating out-of-band emissions or overshoot by utilizing a very sharp cut-off, high order, phase linear, elliptical function, low-pass filter.

Discriminate processors have become almost mandatory in the AM service, especially in the more competitive markets. For the most part, they have permitted the broadcaster to compensate for some of the deficiencies in modern day AM receivers. Faster attack and release times have helped produce a louder signal and permit proper equalization curves without cross modulation or pumping of the frequency bands. But they have also opened up new areas of concern.

As I mentioned earlier, the human ear likes to hear dynamics. A dense, heavily limited signal will lead to listener fatigue and consequently poor listening duration. The dynamics of some processors contribute enormous amounts of IM to the audio signal and in addition, many manufacturers of audio processing equipment have given little or no consideration to the phase distortion and other undesirable effects created by low-pass and band-pass filters.

Phase distortion

Phase distortion is caused by delaying certain frequencies of a complex waveform. In a multiband processor, it can affect transient response, frequency response and distortion, and tend to mask some of the natural harmonics of a complex waveform.

The overall phase shift of the system is not important, but the relative phase shift between the frequencies of the complex waveform is important. The ideal bandpass filter with a flat frequency response and no phase shift in the pass band is virtually unattainable in practice, especially with higher order filters yielding an 8 or 12 dB per octave roll-off.

A Butterworth filter, for instance, will produce a flat frequency response, but the phase shift varies with frequency and its response to a square wave induces overshoot and ringing. A Chebyshev filter has a considerably sharper cut-off than a Butterworth filter, but has an uneven ripple-like response in the pass band and displays non-linear and erratic phase response characteristics. A Bessel filter, on the other hand, has a linear phase frequency characteristic, but does not have a flat frequency response.

It becomes obvious that these deficiencies must be corrected if true high fidelity processing is to be obtained. Recently several processing manufacturers have designed phase-correction circuits, or all-pass networks in their systems, in order to restore the relative phase of all the signal components. One of the systems has a total phase rotation of almost 1,100 degrees resulting in a complete phase restoration of the signal components.

Finally, and probably most importantly, everything must work as a system. The more sophisticated the audio processing becomes, the greater the demand for clean audio from the studio. Turntable tracking errors, amplifier headroom, improperly maintained tape machines, and system noise are of utmost importance.

The transmitter must have good square wave response. The transmitter and antenna networks must be able to handle and radiate the processed signal flawlessly. Trying to force high frequencies through a narrow band antenna system will only cause distortion and splatter.

The final stage of the transmitter must see a constant load from the antenna system at all modulating frequencies. The antenna system must also be able to radiate these frequencies. It's a good idea to measure distortion and frequency response in the far field and compare negative modulation levels sampled at the transmitter with those measured in the far field. You might get some interesting results.

Higher levels of quality ... not distortion.

Let's not forget that one of the most non-linear devices known to modern technology is the simple unbiased envelope detector implemented in the design of most AM receivers. I've made tests on a number of different receivers and have obtained typical harmonic distortion measurements in the neighborhood of 4% with a modulating signal of 80% at 1 kHz.

The harmonic distortion increased typically to 10% or higher with a modulating signal of 98%. This is just one more reason why synchronous detection should be implemented by the receiver industry. Unfortunately, the distortion in most AM receivers also increases with frequency due to the IF slope characteristics.

Let me state in summary that the technology is available to produce good high fidelity AM radio. The broadcaster, the receiver manufacturers, and the equipment manufacturers have unnecessarily driven the listeners away from AM, and with the introduction of digital cable music systems, listeners are sure to dwindle away from the already over-processed FM band.

It's about time we, as broadcasters, realize the "standard of comparison" is a constantly changing element which is forcing the listener, from either an awareness standpoint, or from a subliminal factor, to upgrade his point of reference. Consequently the listener will demand higher levels of quality and not higher levels of distortion!

(Ed Note: This article was originally presented by Mr. Buterbaugh at the NRBA Convention in Miami Beach FL.)

IEEE Broadcast Meeting Held in DC

by Ray Barkley

Washington DC ... The Broadcast, Cable and Consumer Electronics Society (BCCES) section of the Institute of Electrical and Electronics Engineers (IEEE) held their 31st Annual Broadcast Symposium in mid-September in Washington, D.C. The IEEE, in early 1960's, absorbed the Institute of Radio Engineers, formerly the best known scientific organization for broadcast engineers, and the BCCES has become the broadcaster's reference point within IEEE.

The two day conference was composed of sessions devoted to teletext, recent FCC events, Region II happenings, as well as radio and TV. Those in attendance, some 200 in number, were broadcast engineering executives, equipment manufacturers, consultants, staff engineers (largely from the FCC, but also from other government agencies), and other interested individuals.

BCCES structure

The BCCES annual symposium is usually managed by one of the broadcast consultants located in the Washington area. BCCES, one of the 40 or so groupings that compose the IEEE, is directed by an advisory committee. This Committee appointed Drew Larson as the 1981 Symposium Chairman, and he was largely responsible for the success of the conference.

Drew is a senior engineer with the consulting firm of Moffet, Ritch & Larson. Next year's Chairman will be Robert Culver, a partner in the firm of Lohnes & Culver, and in 1983 the Chairman will be Robert du Treil of Jules Cohen and Associates.

Phil Rubin, of the Corporation for Public Broadcasting is editor of the "BCCES Symposium Transactions," the journal which publishes papers read at the Symposium. Engineers wishing copies of papers presented at the symposium should contact Phil Rubin at the CPG offices in Washington DC.

Of interest to radio engineers were papers presented the second day of the conference. These included a paper by John Kean from National Public Radio on the laboratory and field testing of several FM/SCA frequencies. During his tests John found that 92 kHz appeared to be a good potential SCA channel and one that would not cause more problems than its solves.

Robert R. Weirather and David L. Hershberger, of Harris Corp, discussed amplitude and phase bandwidth and the saturation characteristics of power tube cavity FM amplifiers. Their paper described how to operate equipment to get good response and how to tell if distortion is present.

Ludwell A. Sibley, of the Intercollegiate Broadcasting Systems, described how to install a cost effective college station, not a task as easy as one might imagine. David C. Claes, of the Ohio Edison Company, presented a paper entitled, "Radio and Television Influence Voltage Contribution of a 345 kV Transmission Line." His conclusions were that interference caused by high voltage lines is inconsequential.

Leonard R. Kahn, in a paper entitled, "AM Broadcasting, Carrier Spacing, and Bandwidth Restrictions," pointed out that broadcasters had better start demanding full use of the AM bandwidth or it will be lost to them. According to

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Tips for Prospective DA Owner

(continued from page 2)

tive reactance caused by the coupling L(m) in the power divider. Perhaps this is a picky point, but I would rather have my phaser designed and adjusted right in the first place, wouldn't you? It is so much easier to make a change on the drawing board than in the field.

Why are phase-shifter coils sometimes ganged? It is felt by some designers that this reduces interaction between phase and ratio adjustment. A good adjustment analysis will compare the ganged and non-ganged cases for each phase-shift control, because the results are often surprising. Sometimes ganged coils produce exactly the effect they were intended to avoid.

Did you ever wonder why some phasers seem to be extremely over-designed? You know, 60 amp, 40 uH coils where 5 amps and 6 uH are shown as nominal. Could this be a sign that the designer is expecting trouble, or that he just does not care about spending your money?

Perhaps over-design is a symptom of previous failures caused by a lack of understanding the points brought up in this article and the referenced articles. If so, then you had better brace yourself for a prolonged adjustment period. But if the designer has any confidence in his driving-point impedances and general abilities, he should be able to produce a cost-effective design having a reasonable adjustment window. This leads to an important question. Does the person adjusting the array understand the design as well as the designer does? He had better!

These questions cover some of the major trouble spots that are correctable during the design process of a phaser. I have not addressed the more obvious principles of phaser design, leaving those to the common sense of the designer and the buyer.

The intent of this article is not to put the phaser designer under suspicion, but to save the station some time and expense that may otherwise be lost in misunderstandings. I am sure that any designer would be happy to respond to the questions in this article.

References:

1. Homer Ray, "Antennas, Bandwidth, and Simple Computer Methods," Continental Electronics, Dallas, Texas.
2. Grant Bingeman, "Optimizing Phaser Adjustability," Continental Electronics, Dallas, Texas.
3. Grant Bingeman, "Tall Towers in Phased Arrays," *Radio World*, Sept, 1981.
4. Kuo & Strait, "Improved Programs for Analysis of Radiation and Scattering by Configurations of Arbitrarily Bent Thin Wires," Syracuse University, Jan, 1972.
5. Grant Bingeman, "Negative Towers," *BM/E*, Nov, 1980.

What's Next for NRBA?

(continued from page 1)

was a Tuesday afternoon discussion on FM antenna practices led by Jim Gabbert, and a Wednesday morning session devoted to the Cuban interference problem which weighs particularly heavy on the minds of Florida broadcasters. The FM antenna session was interesting because the consultants on the panel (Ben Dawson, Ogden Prestholt and Harv Rees) were enticed into giving out some of their closely held information on what to concern yourself with when faced with selecting an antenna, and how to minimize interference. Mr. Gabbert, drawing upon his considerable experience in this area, joined the discussion a number of times, not so much as a moderator, but more as another panelist with his own opinions.

Back on the floor

Between sessions all attendees had ample opportunity to visit the exhibition floor, and most probably did so at least once. Unfortunately, since most of the people who went to the show did not go for the express purpose of buying equipment, many of the exhibitors did little in the way of business. Some booths, though, were active in spite of this.

Broadcast International (who took over RCA's booth space when RCA cancelled at the last minute) had excellent results from the show, particularly from Latin American visitors. So did Lita Broadcast Distributors, CSI and others who serve the Latin market. BI had a drawing for free equipment with Bill Michaels of WHLY winning a video cassette recorder, and John Chauvin of WFPR winning an Xcelite tool case.

The few exhibitors showing new equipment, such as Processing Plus, also drew considerable interest from attendees. All of the companies promoting either satellite related equipment, programming or services found themselves busy because this new technology is something everyone wants to know about. Activity in selected hospitality suites was also good, again depending on what product or service was involved.

The NRBA seems to be in almost a "no-win" situation with regards to keeping the exhibitors happy. The fact

of the matter is that the NAB's Spring show is so strong that it dominates the industry. Every other show is, by definition, an "also-ran" when compared to the big NAB show. The only option is to target oneself at a select audience as the local State and SBE shows try to do (with great success in some cases).

The situation has gotten to the point where some exhibitors are pulling out (such as RCA this year). Add to this the NAB/RPC show, which draws away some attendance and exhibitors, the fact that most manufacturers gear their new product introductions to the Spring NAB show, and that most CE's get to make only one big trip a year (and the favorite is, you guessed it, the Spring NAB show), and you begin to get an idea of the magnitude of NRBA's problems.

It's easy to empathize with NRBA, but there is no clear answer to their situation. They can continue to increase the quality of their workshops as much as possible, and do whatever they can to improve their relationship with engineers so that engineers will attend the NRBA Convention. Whether it's too late or not remains to be seen.

Birdwatching for CE's

(continued from page 8)

and azimuth alternately for a peak. Note the peak value, then check not to tune in a minor lobe on the dish by swinging both axis 3 or 4 degrees. When you have maximized the major lobe, lock the hardware tightly and record the AGC value for future reference.

Most demodulators provide a 600 ohm balanced line level output so don't throw away all that nice fidelity by loading every console in the station across it. Use a distribution amplifier. You may not be able to hear the difference on the telco net feed, but you will with the satellite.

Typically there is little the average radio station can do to maintain a satellite RO installation. Keep the dish clear of snow, ice and dirt and make sure that as the ground settles the dish does not lose alignment. If a failure does occur, it is nearly always better to swap assemblies with the manufacturer than to dig in with a Simpson 260.

The satellite RO terminal has proven itself superior in terms of long term costs, performance and reliability. I trust it will prove the same for you when your time comes.

(Ed Note: This column was originally presented at the NRBA Convention in Miami Beach.)

IEEE Meeting

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Mr. Kahn the industry is reacting in the wrong way to the limitations of the AM receiver. He feels that everyone in the broadcasting field must insist that better receivers be built.

The final paper of interest to radio broadcasters was by T. Vaughan, of Micro Communication, and R. Tell, of the Environmental Protection Agency. Vaughan and Tell described, from their measurements and computational analysis, the safe power density levels from a FM transmitting antenna.

Planning for next year's symposium is already underway. A call for research papers will be issued early next year. Those interested in participating are urged to call next year's Chairman, Robert Culver at 202-296--2722.

Hi Power Transmitter Review

(continued from page 3)

kW's tabulated, you will find IM's from 2.5% to 10%, so it pays to spend some time on this one.

CCIF IM distortion does not always measure out the same and is an important spec for Optimod freaks. Do the tests with a spectrum analyser.

Transient intermod distortion is a new area under study and you should get an honest assist from the manufacturer. In general, if the overall feedback loop does not include the RF stage, the results should be better, so check the feedback loop within the transmitter. Look for more to happen in this area. Transient intermods show up with heavy processing and pre-emphasis and you can hear them!

Performance of accessories such as peak clippers, and lowpass filters. For clippers, listen to them and check the schematic. One might deduce that a box full of diodes might not sound as good as a more elegant design, but listen for yourself and be sure to clip more heavily than you normally would. Always check low pass filters with square waves and also for phase linearity.

What is this filter's function? Does it cover over a transmitter defect, or does it allow for more audio set-up flexibility? The transmitter should perform the same up to each of the cut-off frequencies and to 15 kHz.

Don't get hung up on your favorite waveform when testing the transmitters. Square waves are wonderful for many kinds of tests. Drive the transmitter to 150% mod with square waves and see if the test engineer blushes. Sine waves are essential for such tests as harmonic distortion; clipped sine waves show positive modulation linearity. Triangle waves are great linearity testers. They are also good for driving the transmitter to absolute maximum (voltage break down) modulation.

Triangular waves are not the way, however, to test for positive peak cap-

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TABLE 1	CCA AM10000D	HARRIS MW 10	CONTINENTAL 316 F	MCMARTIN BA 10K
Basic price (w/cutback)	48,250	60,000	52,000	51,840
Approx. freight	1500	INCL	1500	1500
Based of exchange of	.85¢	current	.85¢	.85¢
Recommended Semis	none	$992	1064	534
Essential spare tubes	3600	5339	3235	3866
Overload memory ckt	extra	incl.	extra	extra
VSWR protection	$1,000	incl.	incl.	$1,000
Program peak clipper	500	incl.	incl.	500
Factory test	N/C	$450	N/C	N/C
Total price FOB	$51,944	$60,500	$53,500	$53,034
w/essential spare	55544	64847	56735	58900
w/full spares	56444	64847	57843	62232
Line current meter?	$525	525	525	525
Est. tube cost/year	3,000	2,173	2,171	3,332
Est. power/year	9000	9000	9000	9000
Est. tube life/yrs	1½	2 (?)	2	1½ (?)
Power Consumption				
carrier	not given	21.3KW	23.6KW	19KW
50% program	not given	23.2	25	21
100% mod	28	29.4	28.4	27
number of tubes	10	2	2	4
Spare oscillator	no	yes	no	no
Spare crystal	yes for all			
auto restart (power fail)	yes	yes	yes	optional
Weight	3000 lbs.	1500	1650	2100
Number TX's Canada	35	16	>65	1
Number TX's Worldwide	>100	>50	>200	>20
Design Age	15 years	2	9	2
Complex wave fidelity	Fair	Exc.	Good	unknown
Plate voltage	5200	9000	9000	5300
12 phase supply?	no	yes	no	yes
type modulation	plate	pulse	collector and linear	plate
oil filled mod XFMR?	no	not applicable		yes
Documentation	fair	excellent/good		good
Blower Drive	direct	belt	direct	direct
accessibility	good	exc.	good	exc.
Performance with change in load	exc.	good	good	exc.

TABLE 2	HARRIS MW 50	CONTINENTAL 317 C 2	MCMARTIN BA 50 K
Value of full set of tubes	$18,738	$18,972	$7,200
Value essential spares	9,369	9,468	1,800
Average cost of tubes (5 yrs.)	4,786	4,578	3,000
Recycle time	2 sec.	instantaneous	10 seconds
Minimum start time	20-30 sec.	1½ sec.	10 seconds
Single phase protection	no	yes	Yes
Number belts on blower	2	1	2
Auto power cutback	no	yes	No
600 volt primary standard	no	yes	Option
Filament variacs standard	yes	no	Yes
Total space required	63 sq. ft.	62 sq. ft.	104 Sq. Ft.
High voltage supply	25 KV	18 KV	9.5 KV
Power cutback	incl.	option	Option
Method of modulation	PDM	Screen/ Impedance	Plate
Dual drivers/buffers	yes	no	yes
Method of power adjustment	low level	variac	low level
VSWR/ARC protection	yes	yes	Yes
Number of tubes used	4	6	4
number of tube types	2	3	1
Typical SNR	56-60	58-62	60
External regulatory required	yes/15KVA	yes/20KVA	Yes/?
Total net weight	6500	6881	15,000
Number in Canada	8	45*	0
Number worldwide	125	133*	5
Parts availability	Canada	Factory	Factory
Checkout service	Extra charge	included	Extra charge

*Number in use would have to include the previous versions of the 217, which do not meet all the same specs as the 317 C-2.

Canadian Content: Transmitter Review

(continued from page 3)

ability, as they do not require the same amount of power as does a square wave. Some function generators can provide asymmetrical triangular waves. This provides an opportunity to probe various aspects of the transmitter's linearity without running full bore all the time. You can, for example, generate a triangle wave that is only negative going. This would allow you to inspect negative modulation aspects of the transmitter under test without consuming power in the positive peak.

Study seriously the performance of the test transmitter into various types of antenna loads. While only some units seem to be load sensitive, other units could be equally so. The best solution here, of course, would be to work on your antenna so that you have a decent load. This is not always practical, but is really the solution to long term performance for your station.

It is appalling the number of management types who are not willing to allow the necessary funds for cleaning up a poor array, but will waste fortunes on processing and other gimmicks. I had a recent experience that proves this point.

I ran identical processing on 2 stations in the same market. One had a good transmitter and a good antenna considering the number of elements. The other was brought to state-of-the-art at the transmitter and the antenna turned out to be even better than the first station. The result is exactly what one would imagine even on a Delco "low fi" automobile radio.

Obviously some of the more obscure aspects of the transmitter art can make a difference that even an accountant can observe. Good luck with your new transmitters. Next month, if we can hold the presses, a look at the CCBA Convention in Toronto.

My new address is CJJD Radio, 2 King Street West, Hamilton, Ontario, L8P 1A1. Telephone: 416-526-1280.

Reader's Forum

(continued from page 4)

Only two of these, Dakar on 765 and Conakry on 1404, are regularly heard in North America by DXers using fairly sophisticated equipment.

Australia, Asia and Western Pacific went to 9 kHz a few years back, but no heterodyne problems seem to be apparent. There may be two reasons for this. First, propagation from this region is normally possible only to the western areas of the Americas, only during the pre-dawn hours (when listenership is minimal) and only during the winter months. Secondly, there are relatively few "superpower" stations in Region 3 capable of reaching North America. These are mostly in Japan, China, Korea and Siberia. The signals from most of Region 3 are absorbed by the Asian landmass and the aurora over the North Pole and do not reach the US at all.

Because of the foregoing factors, it would seem to me that the "heterodyne interference problem" is a bogus issue, the effect of which has been overstated.

Glen Kippel/CE
KAMB/Merced CA 95340

RW Replies: The 9 kHz issue continues to be controversial. Any other comments out there?

Norton Amps

(continued from page 5)

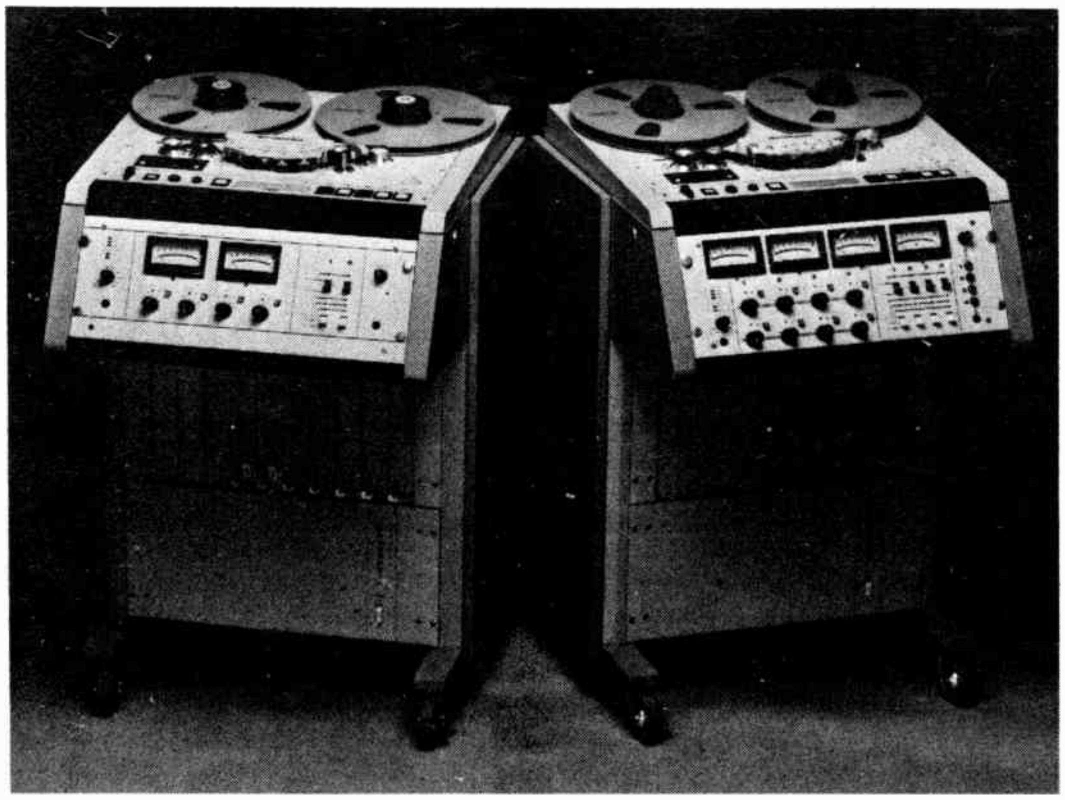
shown in Figure 6.

A unity gain non-inverting DC amp requires only 2 resistors. Note that the minimum DC input must exceed the input base/emitter junction voltage as shown in Figure 7. A simple 1 kHz square wave oscillator can be constructed with only one fourth of the package. See the illustration in Figure 8.

A voltage controlled oscillator with square and triangle outputs is shown in Figure 9. The sine wave oscillator in Figure 10 may look like a lot of parts, but remember all 4 amps are in one package. The 1 kHz THD is 0.1%. Next month these amps will be featured as a teletype bell alarm. Stay biased until then!

P.S. Credit is due for the fine schematics to the "Linear Applications Handbook" published by National Semiconductor Corp, Santa Clara CA 95051. Telephone: 408-737-5000.

If you're the one who runs the station, read this ad.



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