RADIO GUIDE

A Forum for Radio Engineers

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November 1988 | Volume 1 - Issue 3 | Copyright 1988 - Rochester Radio | 511 18th Street SE | Rochester, MN 55904

Madison Matters

From October 17th through the 20th, I had the pleasure of attending the 34th Annual Broadcast Engineering and Telecommunications Seminar, in Madison, Wisconsin. This conference, in reality, must be called a regional conference (the attendees mostly from Wisconsin and adjacent states), and has a few attributes that other broadcast meetings and conferences just do not have.

First, there's only one technical session presented at a time. Second, this conference is first and foremost a technical conference; manufacturers display booths are available, but do not dominate the seminar. And, best of all, there is a relaxed atmosphere that allows attendees to really talk to one another and learn something. The technical sessions were excellent, and the program committee had the sense to separate TV and radio technical sessions in a logical way.

During a break in the sessions, Don Borchert of WHA radio and TV, the seminar director, brought up a point. He said that, although the conference was not in any immediate danger, it may have to change to accommodate other telecommunication interests. The Madison conference has been successful for many years precisely because attendees knew what to expect. They knew that when they sat down at the sessions, they would be presented with useful technical information they could use in their daily activities. They also knew that they would get this information within a few days at a reasonable cost. Is a change needed? Is it really prudent to attempt to cover the whole spectrum of telecommunications, in only a few days? I have my own ideas, and I'm sure you do too.

Instead of sitting on those ideas, let's give Don Borchert a call at WHA Radio, (608) 263-2157. This especially applies to those who have not attended in the past. Take the time to find out what this is all about, and then let them know what you need. I know that Don and the program committee really do listen to the input from station engineers. This can't be said of other broadcast conferences.

Do You Like What You See ?
Can You Use It ?
Are You Willing To Help ?

I've received numerous calls and letters telling me that you like what you see. I can only assume that if you like what you see, then it must be of some use to you. The Radio Guide was established on the concept of an open forum. The direction and content of the Guide will be determined by your contributions and comments.

Probably one of the last items on your priority list is writing articles for a technical publication. I knew that when I started the Guide. Still, if the concept of a self-directed technical forum has any merit, you must send those articles and tips into Radio Guide. Please don't assume that someone else will do the job or that your information is not important.

Equipment manufacturers are seeing the value of the Guide and are willing to support us. That support is tentative, though, and they are waiting to see if engineers will actually become involved with such a publication. It really is in your hands now. Let's create the publication we've always said we've needed.

Editor . . .

Contents

Noise Free Radio Marches On

George Yazell, PE (retired)
Lakeland, Florida

For those who missed the first two installments, NFR is a simple method of adding FM modulation to an AM Broadcast transmitter. Existing AM radios will continue to function as they always have, while the proposed new NFR radios will receive a noise free, interference free, high fidelity signal, just like you hear on the FM Broadcast Band.

Last month we described one method of modifying an AM/FM radio to receive NFR signals. And, we promised to tell you this month how to generate an NFR signal.

First, let's review the basic fundamentals of NFR. We know that it is possible to transmit a frequency modulated signal on the AM Broadcast Band, provided the modulation index (frequency deviation) is low enough to fit into the spectrum space allocated. One example is Motorola C-Quam Stereo, where L-R audio is added to the AM Broadcast signal by phase modulating the transmitter oscillator.

We also know that the superb characteristics of FM depend primarily on the receiver and its ability to ignore amplitude variations in the received signal (this removes most of the noise) and to "lock on" to the strongest signal on a specific frequency, while ignoring others on the same or near adjacent channels.

Major Armstrong, inventor of FM, determined that to achieve the quality of audio reproduction he wanted, his FM demodulator required a carrier deviation of at least +\- 75 kHz. And, to accommodate such a bandwidth, the carrier frequency of the IF amplifier would have to be above 10 mHz with a channel separation of more than 150 kHz. His final choice was an IF frequency of 10.7 mHz, and carrier separation was set at 200 kHz. Those "standards", selected almost 50 years ago, are still accepted around the world today!

We have two incompatible "standards". The transmitter must be limited to a bandwidth of 10 kHz and the receiver demodulator requires a bandwidth of 150 kHz. So what's the solution? Easy!

Last month we described a very simple NFR receiver where we received a Medium Wave Broadcast Band signal, frequency modulated with a +/- 3 kHz maximum deviation. We converted that, in our mixer stage, to a new "standard" IF of 430 kHz (+/- 3 kHz), and multiplied that signal 25 times to get 10.75 mHz (+/- 75 kHz).

Now we come to a simple NFR transmitter. In my early experiments, I used a function generator (Leader Model # LFG-1300S). It was a simple matter to tune the oscillator to some frequency in the Broadcast Band and inject the audio from a good cassette player into the VCG jack on the back of the generator while setting the audio level to provide +/- 3 kHz swing. Easy? - - Easy!

An alternative? If you have Motorola C-Quam Stereo on your broadcast transmitter, you could simply inject L+R into the phase modulator instead of L-R. It sounds great, but the modulation index is quite low. Incidentally, be sure to turn off the "pilot" during this test.

Our next planned test is to use a standard FM exciter, modified to deliver only a +/- 3 kHz deviation, and converted to a frequency in the Medium Wave Broadcast Band.

So, we now have a workable NFR transmitter and receiver. Where do we go from here?

We now have at least ONE solution. There are probably other, and possibly better, ways to do the same thing. I know several intelligent, enthusiastic people who are devoting time, energy, thought, and money to this fascinating project. If enough people get involved, we may have more solutions than we can use!

That's when the real fun starts. Frankly, I don't anticipate the FCC taking a firm stand on specific standards for NFR. I'm also quite sure the FM and TV members of NAB will not lend their enthusiastic support to a project that will solve the AM dilemma. That leaves AM broadcasters and electronic manufacturers. Neither of these groups is famous for their enthusiastic cooperation for the common good.

I remember that Major Armstrong, after 25 years of struggle and frustration trying to launch FM broadcasting, finally committed suicide. Well, I'm no Ed Armstrong, and I probably don't have 25 years to work on this. If things go the way I plan, I hope to be buried with a smile on my face.

I welcome your questions and suggestions. Phone or write me. And, if you expect a reply, enclose a 25 cent SASE. My social security check can only be stretched so far. If you have comments in support or in opposition to NFR, send them to Radio Guide. I'm sure that Radio Guide will find space for such input.

Thanks to all of you who have phoned and written!

George W. Yazell, PE (retired)

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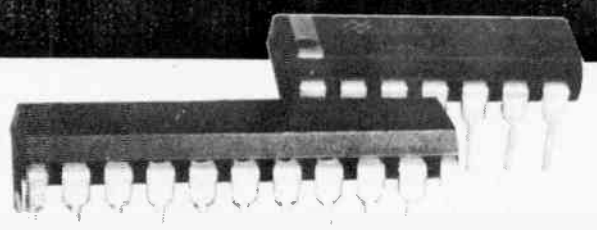
For Your Information . . .

A new and continuing feature of the Radio Guide, is the reader-service "coupon" located on page 8. Fill in all the information asked for, and circle any advertiser's number from which you wish to obtain more information. Along with the "coupon", feel free to send a couple of technical tips you may have lying around. We can use them!

Editor . . .

These 2 new ICs and RAMKO RESEARCH have just changed the whole concept of Broadcast Audio!!



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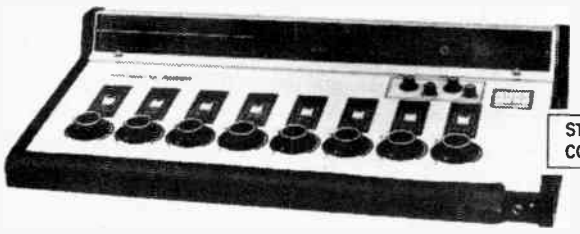

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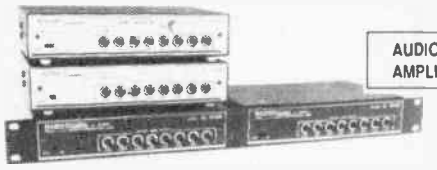

AUDIO DISTRIBUTION AMPLIFIERS

DUAL CHANNEL, PRECISION AUDIO DA'S. Two different units providing dual 1x4 or single 1x8 and dual1x8 or single 1x16 operation. Individual output level controls, XLR input connectors, rear panel switch for independent or single feed. Standard barrier strip or optional quick disconnect phone jack output connectors. Optional outputs metering/phones monitoring available. Balanced in & out. +25dBm out max; .008% dist; 10Hz to 100kHz resp.;-85dB s/n. xL4s/8m-table top & single or dual 1 3/4" rack mount. xL8S/16M- table top & single 1 3/4" rack.
❑ **xL4S/8M-$195. xL8S/16M-$360.** Call for option prices.

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6 MIXERS & UNMATCHED VERSATILITY. Three different models with: phones monitor; master level control; expansion port; metering; phantom power; mic & line inputs on each mixer & programmable voice gating. Dual XLR & phone jack connectors on each input and barrier strip outputs. Balanced in/out. 10Hz to 20kHz resp; .008% dist; -83dB line level & -72dB mic level s/n; +25dBm max out; UL listed supply. Talbe top or 1 3/4" rack. ❑ **xL6M1** (no metering or phantom pwr.)- $190. **xL6M1A** (metering & 21v phantom power) - $225. **xL6M1B** (metering, phantom pwr. & voice gating) - $295 ❑ **PS-20** (UL listed power source powers one to five units) - $25

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✳ **THIS IS ONLY A PARTIAL LIST OF OVER 80 DIFFERENT PRODUCTS MANUFACTURED FOR THE BROADCAST INDUSTRY.**
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From time to time, Radio Guide will provide the COMPLETE text of certain FCC public notices or releases, so that there will be no doubt as to the accuracy of the information provided. In keeping with the nuts & bolts concept of Radio Guide, only those FCC notices and releases of a technical nature will be provided.

Public Notice - FCC 88-194

Clarification of the Commission's Rules Pertaining to Broadcast Station Transmitter Remote Control Operation.

This notice is issued in response to the many questions received concerning use of the public switched telephone network for the remote control of broadcast transmitters, and to clarify the Emergency Broadcast System (EBS) equipment and operating requirements when off-premises remote control points are used.

A number of licensees have expressed uncertainty concerning the application of the Commission's remote control rules to telephone "dial-up" systems. The remote control rules are contained in Sections 73.1400 and 73.1410 of our Rules, and were established in MM Docket 84-110. In formulating the new remote control rules, we recognized that transmitters have become more reliable, and that advancing technology had created very reliable remote control systems as well. Thus, we intended to lessen the equipment burden on licensees considerably and to provide for the maximum flexibility permitted under the Communications Act of 1934, as amended.

However, flexibility is somewhat limited by the statutory requirement of Section 318 of the Act, which states that a licensed person must be on duty and in charge of the broadcast transmitter apparatus during periods of operation. This obligation is expressed in Section 73.1860 of the Rules, and must apply to all remote control systems. In addition, broadcasters must comply with EBS requirements contained in Sections 73.926 through 73.937, regardless of the transmitter monitoring and control system used. Specific guidelines regarding remote control operations are contained in Section 73.73.1410. These rules were designed to be general enough so that they would cover all broadcast station transmitter remote control systems, regardless of the method used in performing monitoring and control functions, and to provide a regulatory framework within which broadcasters could design their remote control systems. We do not contemplate specifying all the permissible remote control techniques. However, recognizing that it would be beneficial to clarify certain aspects of the remote control rules, particularly with regard to telephone dial-up systems, we believe the public interest would be served through publication of the following twelve guidelines.

1. The FCC does not specify the parameters that must be monitored or adjusted by remote control systems because these can vary from station to station depending on the nature of the facilities. A licensee bears full responsibility both to operate within the terms of the station authorization and all applicable rules. Thus, remote control and monitoring capability must be appropriate to the particular circumstances.

2. Dial-up telephone circuits, dedicated telephone circuits, special remote pickup (RPU) cue and control or microwave channels, and other systems are acceptable for metering, adjustments and control of broadcast station operations.

3. Authorized personnel (including the Chief Operator) may obtain technical data and adjust the transmission system by telephone from any location. However, this does not negate the requirement that stations have a designated operator on duty at a fixed position.

4. When a dial-up telephone circuit is used for transmitter remote control, the station licensee must either: (a) ensure that the dial-up circuit remains available at all times for the exclusive use of the duty operator; or (b) provide a means for the operator to interrupt or preempt any other telephone access to the remote control equipment at the transmitter. Alternatively, the station licensee may employ a method, independent of the basic dial-up circuit, which enables the duty operator to turn the transmitter off. Possible methods include, but are not limited to, use of interruptions to program audio, a second dial-up circuit, microwave studio to transmitter links (STL), or continuous radio frequency cueing and control circuits. The duty operator must be in control of the transmitter at all times and the station must be able to meet its EBS responsibilities without delay.

5. Remote control systems that rely, either wholly or in part, on portable paging receivers or mobile telephones to contact the duty operator do not excuse the duty operator from the requirement to be continually present at the fixed remote control location, to have a positive means to interrogate the transmitter, to turn the transmitter off, and to monitor EBS alerts and to carry out EBS functions (if assigned to the duty operator). See Sections 73.1860(a) and 73.1410(a).

6. The duty operator can be located at any fixed location and employed in other duties that do not detract from continuous attendance and the ability to respond to operational requirements. For example, a disc jockey can be designated as the duty operator, provided that there is sufficient transmitter monitoring and control equipment in the studio. See Section 73.1860(d). Also, EBS responsibility may limit operator locations. See Section 73.932.

7. Duty operators may be employed to supervise more than one station concurrently, provided such additional employment does not hamper their ability to respond to the transmission system operating requirements and the EBS requirements of each station.

8. Automatic alarms and warnings of out of tolerance conditions that may result in interference must be directed to the duty operator first. If a corrective response is not received by the remote control master equipment from the duty operator within five minutes, the remote control system must turn the transmitter of the air automatically. See Section 73.1410(e).

9. Automatic alarms, warnings and indications must be unambiguous and of sufficient precision to enable the operator to properly asses an out of tolerance condition.

10. The licensee is responsible for ensuring that the remote control system is tested and calibrated as often as necessary to ensure its proper operation. The test cycle will depend, in part, on the reliability and stability of the equipment used.

11. The licensee has three hours to restore remote monitoring of its operating parameters if its monitoring system fails. If monitoring has not been restored within three hours, either the station must have a duty operator in control of the transmitter at the transmitter site, or the station must shut down. The rules do not specify a certain time by which the licensee must be able to restore remote control capability if such capability is lost, provided that the monitoring system is functioning properly. However, if an out of tolerance condition having an interference potential develops and the licensee cannot adjust the transmitter parameters top within the tolerances prescribed in the rules, the station is required to shut down immediately. The ability to turn the transmitter off must be available to the operator at all times, without exception.

12. Regardless of the remote control point in use, each station must comply with EBS requirements, which include the requirement that a staff member monitor the EBS receiver and have the capability to activate the EBS encoder promptly and broadcast EBS tests and emergency action announcements. The transmitter duty operator at a location other that the main studio (off premises) can also be responsible for the station's EBS obligations. That operator must have the monitoring receivers and the facilities needed to transmit the attention signal and make appropriate announcements and programming changes. Additionally, participating stations must have the capability to broadcast national emergency and presidential messages live as they are originated. (Nonparticipating stations are required to leave the air after transmitting the attention signal and the EBS sign off message.) See Sections 73.932 and 73.933 in particular.

Mass Media contact - James E. McNally Jr. (202) 632-9669

Poor Man's Deviation Checker

Bob Hawkins, WENS
Indianapolis, Indiana

So your shop doesn't have a service monitor. Well, there's a way to accurately check deviation. All it requires is a scanner, a scope and either a frequency counter or synthesized Handi-talkie. Here's how:

1. Take the cover off the scanner and locate the detector chip (it usually has 18 pins or so and is located away from the microprocessor). Look for a pin with your Voltmeter, which rests around +2 Volts with no signal and varies above or below the 2 Volts as you vary the scanner frequency around a signal. This is the discriminator output (I put a jack on my scanner for easier access).

2. Hook your scope (set for DC input) to the discriminator.

3. The scope will now display the demodulated audio from DC to over 6 kHz. Choose one of the calibration procedures below:

A. Frequency counter: adjust Marti-Xmtr to licensed frequency. Set base line of scope to center of screen. Adjust Marti frequency 5 kHz high and note the new position of the base line. Adjust the Marti frequency 5 kHz low and note that position of base line. These noted lines represent +/- 5 kHz deviation limits.

B. Synthesized HT: Set scanner and HT to same frequency. Transmit and set base line to center of screen. Adjust HT frequency 5 kHz high and 5 kHz low and note base line positions that represent +/- 5 kHz deviation.

Marti RPT-30 Modification

Bob Hawkins, WENS
Indianapolis, Indiana

Does your PD mention that your Marti transmissions don't sound as "big" as your on-air mike? Mine has! Upon checking the deviation, it was observed that not only was the peak deviation set to roughly 2 kHz instead of 5 kHz (on a 1 year old unit), but the clipper was turned off. My next observation, upon adding some clipping, was that the negative peaks started clipping several dB before the positives. A Call to Marti revealed that the design did result in non-symmetrical clipping, but since the clipper wasn't used (?), that made no difference. To make an even longer story short, here's how to make your RPT-30 more compatible with your other on-air mike sources.

1. Change R25 on the audio board from 4.7k to 2.2k.

2. Feed 400 hZ at -10dB on the gain reduction meter. With pot R26 set for no clipping, adjust the deviation pot(s) on the modulator to 5 kHz deviation.

3. Plug in a microphone, turn the pot up all the way and note the overshoot. While monitoring the scope, adjust pot R26 until the voice peaks are clipped to exactly 5 kHz. Yes, they looked quite clipped, but instead of producing audible distortion, the result is a nice increase in density which adds "bigness" to the sound.

4. While it's on the bench, check the transmit frequencies. While the above procedures will not change the frequency, a check now will assure minimum distortion and a happier PD.

Tips From The Field

Neutralization Tip

Dave Stewart - KBNA - El Paso, Texas

If there is a Bird style wattmeter between your transmitter and the bandpass filter, or combiner, the reflected meter can be a sensitive indicator of the transmitter neutralization.

As the transmitter stages begin to oscillate, out of band signals are generated. The port that is on carrier will pass through the combiner to the antenna. Out of band signals will be reflected toward the transmitter and will show up as high reflected power.

One transmitter on 94.5 operated with 19.5 kW forward power and 10 Watts reflected power, under normal conditions. On one occasion, we found the transmitter doing 10 kW forward, and 2 kW reflected. After replacing some damaged neutralizing components and retuning, the reflected power was back down to 10 Watts.

TX Power Transformer Caution

Ray Topp - Editor

A while back, I was working on a problem in a Harris FM5-H3. From the symptoms that I was getting (blown wall breaker and mini-earthquake), it appeared that there was a possible short in the high voltage supply circuit. After removing and then restoring the line voltage connections to the power transformer, I placed a wrench on top of the transformer.

When I reset the wall breaker and tried to punch up the plate, that wrench flew across the room like a bullet. The short was still in the circuit somewhere and the extremely high current flowing through the transformer in the instant before the breaker tripped again, had created a magnetic field that affected the wrench. The wrench flew with enough force to cause personal injury, had I been in the wrong place.

Poor Cable Shielding

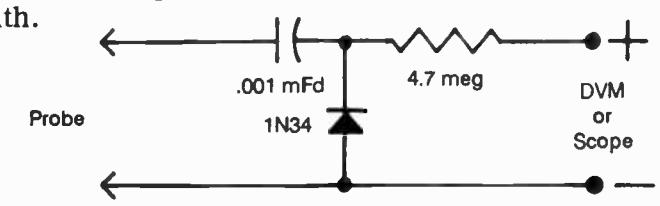
J.D. Kimple, CE - WMCO - New Concord, Ohio

When installing a new console in our on-air studio, we experienced RFI in one mike channel. When we tried to de-couple the RF from the console, we only dropped the interference level a small amount. After playing around for several days, we tried something: the mike cable that came with the RE20 mike didn't have a solid shield. When we replaced the cable with a solid shield cable, the problem disappeared.

RF Detector Probe

Roger Blouch, CE - KIYX - San Angelo, Texas

How many times have you had to troubleshoot an exciter or other low level RF stage and not had an RF voltmeter to measure stage gains or to see if that transistor is really amplifying the RF signal? I use this simple circuit built into an old scope probe. This will convert RF to DC and gives you a quantitative measurement to troubleshoot with.



Please-We Need Your Help!

If you have any short tech-tips, send them in or better still, call me at (507) 280-9668 and we'll talk about them. Remember, it doesn't do anyone any good if you keep that information to yourself. Don't assume that everyone knows about your special technical tip. Send them in - - they'll be printed in the next issue

Editor . . .

Contract Engineers

Radio Guide will provide space here for contract engineers wishing to expand their business. To be listed here, just give me a call at (507) 280-9668.

This list is not a recommendation of any particular engineer. You will have to determine for yourself the qualifications of a particular person for the job.

Tom Becker
Miami, Florida
305-825-7037

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Midamerica Electronics Service
New Albany, Indiana
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James Boyd
Boyd Broadcast Technical Service
Tualatin, Oregon
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Mike Brown
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Lee Freshwater
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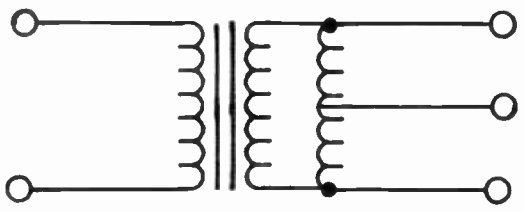
Modulation Transformer Testing

By Dan Elyea, Family Stations Inc.
Okeechobee, Florida

Take reference measurements on transformers and reactors while they are in good condition. This will be very beneficial when you are troubleshooting a problem that you think may involve these components. Some useful measurements that can be made are resistance, current, inductance, and voltage. Check the resistance of all windings. One result that can be very confusing here is that you might measure from the center tap to each side and get four ohms on each side. You'd probably expect to get eight ohms if you measured across the winding, from end to end. But you might well get something like six ohms. This puzzler comes about because some modulation transformer manufacturers incorporate an extra winding that is paralleled across the center tapped winding. I've never seen this extra winding on a schematic, but it sure is there in some transformers. Here is a sketch:



Probably not too many will have access to a simple means of measuring inductance. To get a useful reference on this with simple equipment, energize each winding with 60 Hz at an appropriate reference voltage and measure the current drawn by the winding. This could be with a clamp-on ammeter, an in-line meter, or by measuring the voltage drop across a reference resistor placed in series with the winding under test.

Also when energizing a transformer winding in this way, you can take reference voltage readings on the other windings. You can get a pretty decent profile of a "normal" transformer or reactor by taking all the reference readings such as these and logging them for future reference. Then, if you have reason to suspect the component, you can run some of the measurements again and compare them to the reference readings you logged previously. Another small point - - some transformers by design, have a slightly different resistance reading from the center tap to one side and the center tap to the other side. It has to do with distance of a winding from the core and maintaining a balance in AC operation, even though the DC resistance readings may not be exactly balanced.

Radio Guide
November, 1988 Volume 1 - Issue 3
Mail to: Radio Guide 511 18th Street SE
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