

Radio Guide

Radio's Technology Magazine



Special Issue - Including Equipment Guide

New Product Guide Section:

Modulation Monitors - Page 35-37

Digital Automation and Storage - Page 38-40

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Radio Guide

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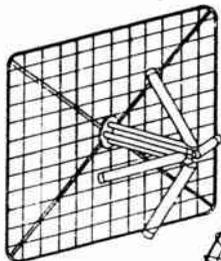
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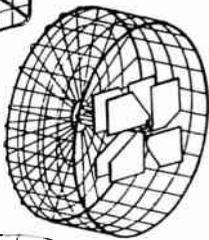


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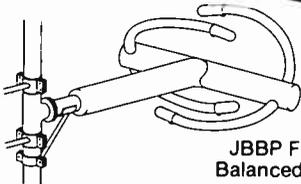
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More After This!

Never Sit Still

As you've no doubt noticed, we took a little sabbatical for the summer. During this time, we've talked with a fair number of readers and, with your help, have examined what **Radio Guide** has accomplished in three short years and what you'd like to see in future issues. We've also taken a look into our editorial souls and found that from time to time, we've drifted from our original vector. As I've said many times before, your suggestions and comments are the magnetic heading by which we steer.

Many of you said you wanted to see more maintenance articles, while others simply wanted to know where to find that vacuum, time-delay relay for that old AM transmitter (you know who you are). Still others were curious about FCC developments and the progress (or lack of) of digital radio. A few of you also questioned why, with NRSC a matter of "law," that receiver manufacturers couldn't get on the ball. Let's find out who's got their foot against the door!

A surprising number of you expressed an interest in the historical aspects of radio. You're right; radio has gotten to the point where its background is in real danger of fading away. We'll try not to let that happen. There's a rich history out there, and radio engineers created much of it!

We will be incorporating the **Equipment Guide** classified ads into the main body of **Radio Guide**. In addition, we will be adding short tech-tips throughout the **Equipment Guide** section. So, you guessed it... I'M BACK ... and I'll be annoying you once again with my not-so-subtle requests for your tech-tips. For each tech-tip that we publish, you will receive a \$14.95 copy of the book, Radios: The Golden Age. This book is a pictorial history of the "Bakelite" age of radios - directly from shelves of the **Recommended Radio** bookstore.

Speaking of books, we'll be reviewing and selecting an assortment of technical (and not-so-technical) books for you to purchase through our **Recommended Radio** bookstore, at as-

Editorial Changes

By Ray Topp - Publisher

tounding discounts. Yes, all of our books will be R-Rated (for Radio). Towards the end of the year, we'll be offering a customized binder for your 1991 issues of **Radio Guide**. These will be made from the skins of genuine old Cetec Centurion Console arm rests and, as you can well imagine, there will be a limited supply. We'll keep you posted.

Radio Guide-Net BBS

The **Radio Guide-Net BBS** is on line! After all this time, it's just nice to see it in print (excuse my ego). This BBS is a joint effort of **Radio Guide** and **AVS Services**. This BBS will be run a bit differently than most. Menus will be simple and straight-forward, and the files and messages found on-line will actually be of some practical use. We're in the process of installing optical disk drives for many megas of storage capacity. Read about this BBS in Steve Schrader's Bits, Bytes & BBS column on page-6. Dial the **Radio Guide-Net BBS** at (804) 468-4957

Fax-Guide System

We have installed a Fax retrieval system which we call the **Fax-Guide**. With this system, you will be able to retrieve specific product information on your fax machine with no delay. Using the code numbers found next to each ad, follow the instructions on page-5 and then phone the **Fax-Guide** at (507) 280-4045.

Such a Deal

Quite a few of you have requested additional reference copies of **Radio Guide** in advance of our normal mailing date. Even more of you have "complained" that you would like to receive the **Equipment Guide** classified ads ahead of the actual **Radio Guide** press date. We are now offering **Radio Guide** (including **Equipment Guide**) at a special 1st-Class mailing subscription rate. See page-5 for details.

Later ...

Take a look at the changes we've made - there will be more to come. If you like what you see, tell us. If you see the need for some additional changes, we need to know that as well.

You Wanted It ... Now You've Got It!

By popular demand, we are offering the *Radio Guide* at a special First-Class mail delivery subscription rate of \$59.⁰⁰ per year.

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3. You'll be eligible for a 25% discount on all books from the **Recommend Radio** bookstore.
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4. Follow the verbal instructions from our computer system, and enter in each product code.
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If you like, you may ask for, and fill out, our **Radio Guide Q-Card**. Your suggestions will be used to "fine tune" **Radio Guide** magazine to your specifications. In fact, you don't even need to select product information when you call. You may simply select the **Q-Card**, from time to time, just to let us know how we're doing.

Roy Rogers, Captain Kangaroo, Howdy Doodie, The Mickey Mouse Club, TRSDOS, CPM, MSDOS ... If these terms are familiar to you, you are now an adult and you have grown up in the "Computer Age." Depending upon your past experiences, you either look upon computers as a blessing, a curse, a tool, or black boxes you know nothing about. After struggling with these infernal contraptions for a number of years, I have finally come to the conclusion that as a tool, a computer system with the proper software is great! For those of you that already use computers in your daily life, this column will acquaint you with software and computer systems that pertain to the broadcast industry. For the "Non-Believers", I am going to try my best to drag you out of the darkness and help you better understand the use and usefulness of computers in your own world.

And Away We Go ...

How would you like having access to information and programs that would enable you to determine a station's geographic coordinates, or perhaps the distance between your station and another station? How would you like to have a copy of the FCC Broadcast Rules so that you can actually

find the rule you are looking for and not have to have a magnifying glass to read? How would you like the ability to keep track of your department expenditures so that you can answer those tough questions from management? If you thought to yourself, "Yes that would be handy," then you need a computer, software and access to an electronic data bank. But ... It has to be inexpensive. Well, do we have a surprise for you! Radio Guide and AVS Broadcast Services is building an Electronic Information System (BBS for short) that will give you instant access to program files, data, and general information pertaining to the broadcast biz and ... Access to the system is free of charge (That's pretty inexpensive!). In addition to large amounts of FCC data and thousands of programs you will be able to communicate directly with Radio Guide, AVS Broadcast Services and other users of the system. Since the system is new and in the "Construction" stage, all of the system's features will not be available immediately.

Using the System ...

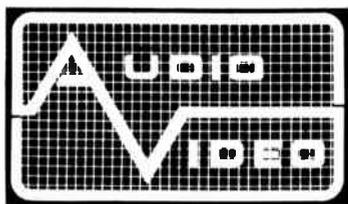
If you have a computer, modem and communications software you will be able to access the system. If your station or business has access to ARB Trends or does

Arbitron AID runs, then you're all set. For those without a modem, a 2400 baud board can be purchased for about \$65.00. When initially signing on to the system you will be asked your name, address and a number of other questions. After you have completed this questionnaire you will have complete free access to the BBS. You will find that our system has been set up so that it is easy for you to use. We have tried to make the system completely menu driven so that all you have to do is pick the item you want and the system does the rest. To spark your interest, the system will allow you to :

1. Search the FCC AM, FM databases
2. Determine the HAAT of any TX site
3. Calculate any FM or TV contour with the same accuracy as the FCC
4. Look up FCC rules without touching the book
5. Search for tips on broadcast equipment
6. Leave messages for other users of the system
7. And much more

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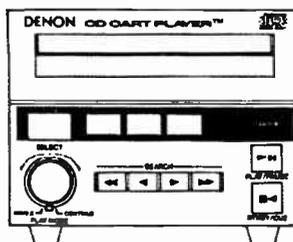


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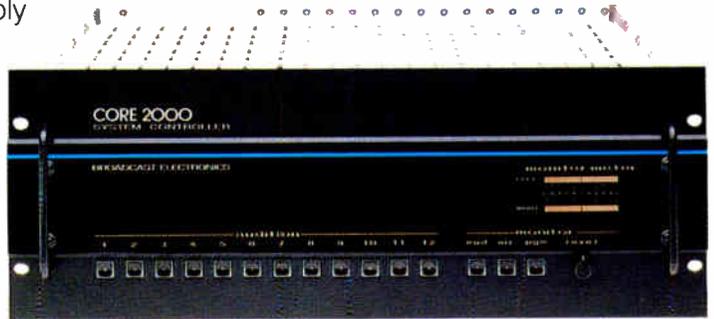


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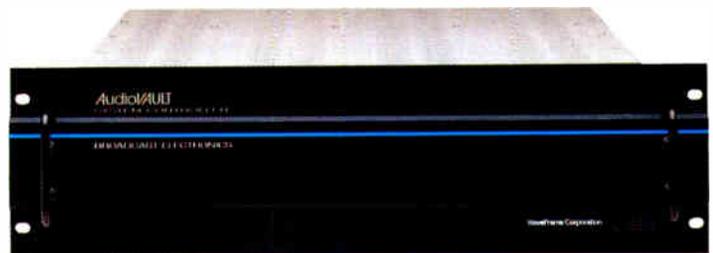


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Radio Redux

A New Introduction to an "Old" Column

By John Landry - WBZ, Boston - (617) 787-7000

Here it is ... September. The game plans for next year are being finalized, along with the budget. Out at the transmitter site the field is turning brown, with some of the Goldenrod starting to blossom. So as the seasons change, we are reminded of the passing of time. In the radio engineering business, that also means the changing of technology.

In the coming months ahead, it is my intent to share with you the interesting and sometimes quaint practices of radio's past, a subject that many radio engineers have a respect for. What has led me to the typewriter (alright - it really is a word processor) to elaborate on this subject is the feedback from others when I have had the opportunity to write or speak about the "good ole' days." I have been asked questions such as: "Where can I get a schematic for a McMurdo Silver Masterpiece VI?" or "I recently acquired an old phonograph ... the name EDISON is on the top at the back ... Where can I locate information about it?" For the answers to these and other similar historical questions, I invite you to let me do the research.

First, a bit of my background. I've been in the broadcast engineering business for six years. I have also been a licensed Amateur operator for 15 years. At age nine, I resurrected an old AM/Shortwave radio I found in the basement, and that started it all for me. Having been blessed (or cursed, as my wife might think) with both curiosity and an unflinching memory, I was the candidate for writing this article.

Now, having been on this earth as long as FM stereo, I must say that I cannot reminisce firsthand about most of Radio's history, but I must point out that there are many historians in other fields writing volumes about times and places they never were. History requires perseverance and preservation. The former was done by those who were there; the latter is where I come in.

Later editions of this column will deal with historical details and how they relate to our business today (this DAB standards debate, for example, doesn't seem too different from the

difficulties in selecting a color TV system back in the 50's). I may also deal with the origins of some of today's practices, perhaps asking why we continue some of them. I will probably write about some of those interesting

"We discovered that the new console counter top was too long to make it up the short stairs."

remotes. Broadcast engineering isn't too much different from professional sports when it comes to having "bloopers." Of course we seldom have a camcorder handy to capture these ... too bad.

I am reminded of a situation at a small station in Massachusetts that I used to work at. We were building new

studios, and we discovered that the new console counter top was too long to make it up the short stairs. After looking things over carefully, we decided the only way to get the counter up to the second floor was to hoist it onto the roof with rope. With the help of a sportscaster and two news reporters, who were standing below on a ladder supporting it, we did manage, but not after almost dropping it twice.

There are also many anecdotes to tell and re-tell. At one station in New Hampshire, I was told the story behind why the news director didn't like to use the Marti RPU. It seems that a year previous to my employment there, the station covered the gubernatorial inauguration live, using a two-hop Marti shot. The repeat site had a gas generator supplying the power, and the overnight jock from a sister station was assigned to baby-sit it. At a critical moment in the governor's address, the generator ran out of gas, and there was no response on the two-way radio from the jock up there. He simply had fallen asleep.

Since this is a technical magazine, what would an "old radio" column be without some space devoted to such topics as Heising modulation, Hartley vs Colpitts oscillators, the relaxation oscillator method of testing capacitors, the best way to test tubes, famous old transmitters ... you get the picture.

This business is very rich with history. Much of it however, is told by word of mouth and shared only amongst those who work together. I know of only one novel written specifically about the radio business that was actually based on the real life experiences of someone who worked in the business. I invite you to solicit anything you wish to share with us, and send it to me. I also hope that if I'm wrong or unclear about something, that someone will tell me.

I'm looking forward to our upcoming visits here in Radio Guide. There is a lot of old stuff to wade through out there, and when I find the good stuff, you can read all about it right here. Enjoy what is left of the Summer, and remember to SWITCH ... to safety.

Radio Guide Page-9

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For the last few months we have been looking at various aspects of studio maintenance. We looked at how to set up a maintenance program and maintaining analog tape recorders, turntables, and compact disc players. This should cover most of the major parts of the studio audio chain except one - the electronics (consoles, pre-amps, and other amplifiers).

"Wait a minute!" you say, "Amplifiers just keep on working until some day when they fail. You might get a dirty switch or pot in the console, but these things don't need maintenance like a tape recorder or cart machine." I'm sorry to disillusion you, but amplifiers do some mighty strange things on the way to total failure.

In the "Good Old Days" of vacuum tubes (you might remember them, they were educated light bulbs) you had to frequently check bias and tube emission to make sure everything was working properly. Today, with solid state electronics, the failure modes are different and a bit more infrequent, but they still happen. The FCC recognized that performance would deteriorate over time and used to require annual Proof-of-Performance measurements.

A few years ago, in the early days of deregulation, they did away with the requirement for this annual exercise, but they did not remove the requirements for minimal performance. Many stations have not checked the audio performance of their system since then. However, performance may have degraded to the point where your equipment does not even meet the broad requirements of the FCC.

Accurately measuring the performance of amplifiers and consoles requires test equipment that is much more precise than that needed for most other parts of the audio system. For instance, it is not uncommon for a modern console to achieve total harmonic distortion (THD) numbers below .006% at output levels up to +27 dBv and signal-to-noise ratios of better than 125 dB. If you are unfamiliar with the dBv designation, it means dB refer-

enced to .775 volts, which is the voltage equivalent of dBm. Many older signal generators and analyzers are unable to generate or resolve these specifications accurately. If your generator will only do .25% THD, it will not be much good for close inspection of your audio electronics.

Under normal operating conditions, consoles may develop any number of minor problems. Most of these are related to dirt, such as noisy or intermittent switches and dirty faders. In the case of many switches, the use of a good contact cleaner may solve the problem. However, some switches which are not used often may actually acquire a "memory" and will refuse to work at a certain point. No amount of cleaning will help these -- you will simply have to replace them. When replacing switches that carry audio, try to find an equivalent switch with gold contacts that is sealed or at least has a dust cover.

While this switch may cost a bit more than the original, it will save you a lot of trouble in the future, since the gold contacts will not oxidize as quickly as brass or tin plated contacts. If you cannot get gold contacts or sealed switches, be sure to treat your new switch with a good contact preserver and lubricant, such as Cramolin Blue. (Cramolin products are available from Caig Laboratories, 1175-O Industrial Ave., Escondido, CA, 92025-0051, telephone (619) 743-7143, or their distributors.)

Noisy faders may be a bit more trouble to fix than a dirty switch, since using a cleaner on some types of faders will destroy the resistive element. Before attempting to clean a noisy fader, check with the manufacturer of the console or the fader as to the suitability of your cleaner for that product. Even after cleaning, some faders may still be noisy or may jump in level. If so, they will need to be replaced or repaired. Some faders are built in such a way that they must be replaced if they have a problem. Others, such as some from Penney and Giles, can have their element and slider replaced, saving a

good bit of the cost of a total replacement. Also, some faders require lubrication after repair or cleaning. Proper lubrication will extend the life of the fader and make operation much smoother. Again, check with the console or fader manufacturer for details.

One other area of concern in some consoles may be internal contacts, such as for plug-in circuit boards. Intermittent problems here can usually be dealt with by cleaning with a good cleaner such as Cramolin Red and application of a contact preserver, such as Cramolin Blue. When removing and inserting circuit boards into their sockets, be sure power is off if possible. Depending on the design of the equipment, the power surge may damage the circuitry or the edge connector.

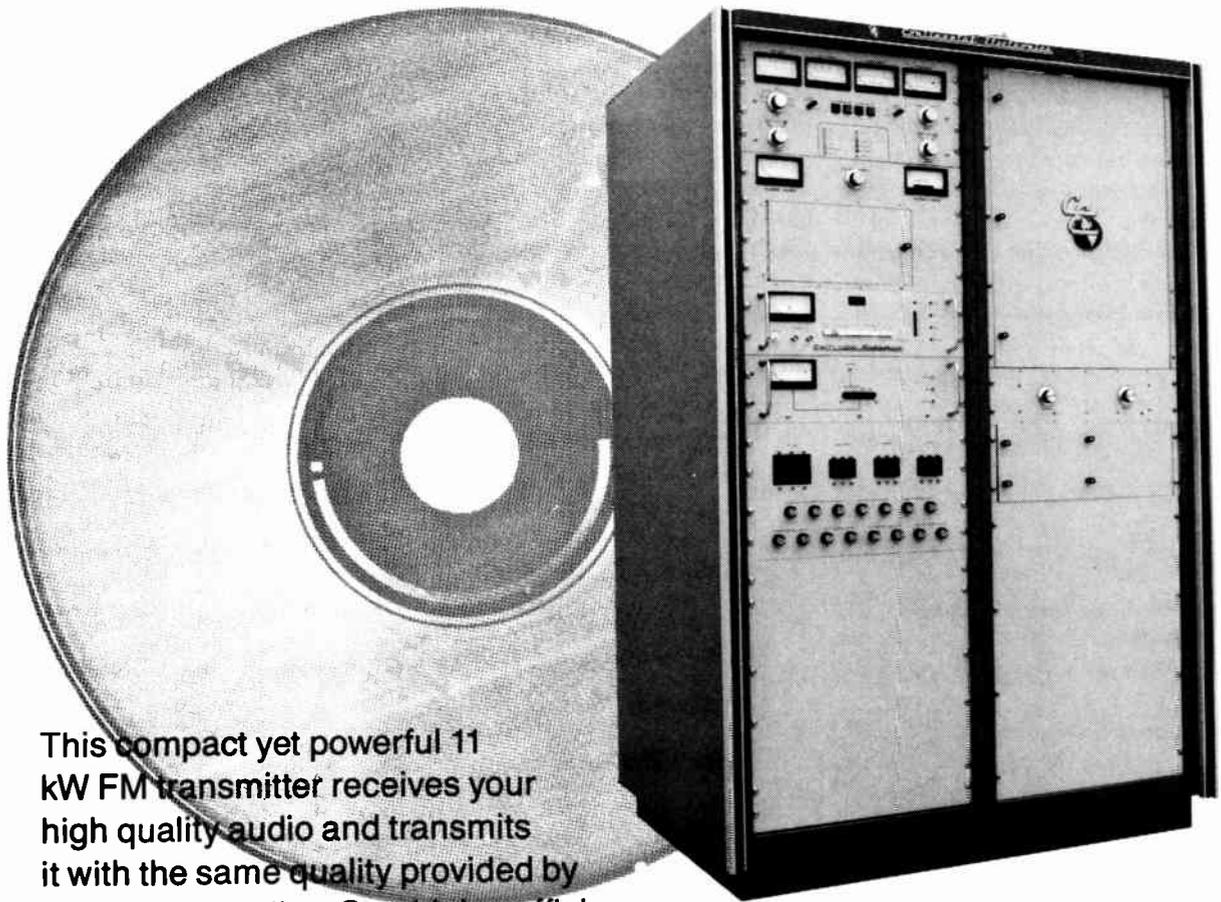
While you are cleaning your faders and switches, try a good surface cleaning of your equipment. While this will not make a bit of difference in the operation or reliability of the equipment, keeping it clean will give everyone the impression that you are doing a good job. Keeping the surface of the equipment clean may also help keep the dirt from working its way into the switches and faders, and may eventually extend the life of the equipment.

After you deal with the obvious problems of bad switches and faders, you may have to dig a bit to find other problems. Just because you can't hear any problems doesn't mean that there aren't any. A regular check-out of the electrical performance of any piece of equipment may help detect problems before they become audible. Knowing what to look for and how to look for it is the key to doing this effectively.

A piece of equipment with a number of outputs and inputs, such as a console, may take quite a bit of time to check out. Planning your test procedure before you move in any test equipment will help reduce this time. Make up the necessary cables to connect the device under test (DUT) to

(continued on page-12)

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your test equipment. Adapters are not a good idea here, since they can introduce any number of possibilities for bad contacts and incorrect connections. If you have a variety of connector types and input/output configurations, you should make different cables for each one and be sure you mark them appropriately.

If your test equipment is unbalanced and your DUT is balanced, an interface of some sort may be necessary. This interface may consist of a good audio transformer or some electronics. Remember that this interface has to have excellent audio characteristics, since it becomes a part of your test system. You may also want to add

some other features to it to make your life easier. I have built many over the years, each one being better than the one before and having more features. Time and space do not permit more details of this here. If there is sufficient interest, this may be the topic of a future column in this same space.

While you are planning your test procedure, you should decide what the appropriate things are to test and how to test them. In other words, what are you looking for and how do you find it. Make sure your test equipment is ready to go and is working properly. If you can put everything on a cart and wheel it into the place where you are performing the tests, this may also save

some time and hassle.

Each parameter you are testing requires different test signals and measurements. The chart shown below will help give you some idea what to do with this. Of course, check the specifications on the piece of equipment you are testing or your previous measurements for normal performance.

Each of the above tests may reveal a problem with either the adjustment of the equipment or a component within the equipment not working properly. Each input and output of a piece of equipment should be tested

(continued on page-14)

Parameter	Test Signal	Measurement	Look For	Comments
Output level	1 kHz normal input level sine wave	dBv or voltage at output load	Specified output with specified load	All controls set for normal operation
Meter Calibration	1 kHz normal input level sine wave	dBv or voltage at output	Zero level on meter	Adjust meter calibration for proper indication
Signal Clipping	1 kHz maximum input level sine wave	Scope connected to output	Flattening of top or bottom of sine wave	If clipping is encountered, try to isolate stage in which it occurs
Frequency Response	Normal input level sine wave varied across frequency range of DUT	dBv or voltage at output	Excessive variation in level with frequency	Make sure all equalization circuits are defeated for measurement
Signal to Noise Ratio	No input signal. Terminate input with proper load	dBv or voltage at output	Signal greater than specified residual level	If possible look for repeating pattern on scope, especially at power line freq. or multiple thereof
Total Harmonic Distortion (THD)	Normal input level sine wave varied across frequency range of DUT	THD at output	Excessive THD, especially at low frequencies	This measurement is somewhat level sensitive, make sure you are measuring at the proper level. If S/N is too high, it will affect this measurement.

- Audio Parameter Test Chart -

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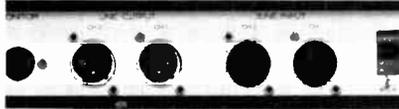
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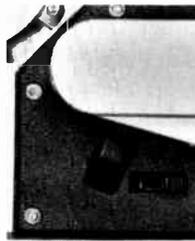
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for proper operation. Not only is this necessary to assure that everything is working properly, but will also help to isolate any problems that you may encounter.

Checking the output level of the equipment with a normal input signal will show that everything is adjusted properly. If the output is too high or too low, with the specified input signal, a gain control may be misadjusted which may cause other problems as well. This could also indicate a defective component in the system. If the problem is consistent with all inputs, you could have a bad resistor, integrated circuit, or transistor in the output stage.

If the level is 6 dB lower than it should be, and you have a balanced transformerless output stage, check your connections to your test equipment. You may be looking at only one side of the line. If your connections are correct, one side of the output amplifier may be dead. Further investigation may be necessary to determine the exact cause of the problem.

Proper meter calibration is necessary for the equipment to relate to the operator in a meaningful way. In normal operation, the meters on the equipment are the only way the operator has of knowing that his adjustments are correct. If the meters are faulty he may be feeding too much or too little signal to the next device. This is especially important when feeding any type of tape recorder (including DAT) or any processing gear. Improper levels can cause all kinds of problems with this other equipment. It is important that you measure the same output that the meter is monitoring or you may have some very confusing results.

Also, remember that some outputs of some consoles may have a different

reference level than others, so be sure to check the book. Some audio equipment has no means of adjusting the meter calibration. In this equipment there is seldom anything that can cause an improper reading other than a defective meter. If the meter has a buffer amp between it and the signal line it is measuring, the buffer may be at fault. If you cannot bring the meter into proper calibration using the adjustment pot, you could also have a defective meter or driver.

Signal clipping is a problem that may be present in your system, but you may never really know it is there unless you look for it. Your audio may sound a bit harsh on the louder peaks, but this can also be masked by other problems such as marginal speakers. The level at which your system clips is the absolute maximum level that it can handle.

Depending on a lot of variables from system to system, the clipping level should be anywhere from 12 dB on up, relative to your nominal output

level, in a piece of electronics. Remember that this is just for the electronics, not a system such as a tape recorder.

This difference from normal level to clipping is sometimes called headroom. If you do not have enough headroom in your system, peaks will be clipped. This may or may not be audible under normal circumstances, depending on the amount of headroom and the type of audio you are using. Any change in the headroom from the normal amount for your equipment can indicate improper adjustment of levels, a bad transistor or integrated circuit (usually in the output stage) or a faulty power supply. If you suspect the power supply, check all DC voltage rails powering your amplifier.

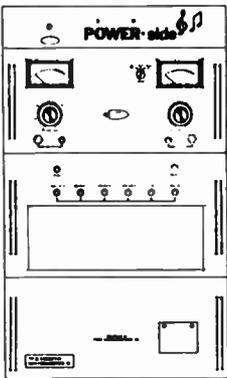
Most equipment using integrated circuits have bi-polar power rails. You should check for DC voltage with a voltmeter, but also check the rails with a scope for excessive ripple and variation with signal. A filter capacitor or regulator in the early stages of failure may work fine until you change the load quickly, such as when an audio peak goes through the system. Only the scope can find this sort of problem.

While checking the frequency response on most solid-state electronics may seem like a waste of time, it really is not. Most consoles and amplifiers use capacitors in the circuitry for inter-stage coupling and feedback control. Electrolytic capacitors are commonly used, and some equipment may use tantalum capacitors. As these capacitors age, they frequently lose capacity before they fail completely. Variations in the frequency response

(continued on page-16)

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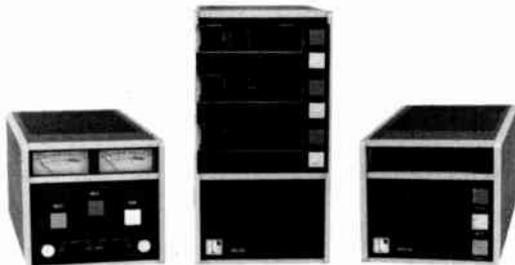
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from normal, especially at low frequencies, may indicate a bad capacitor. Again, further investigation will be necessary to find the defective component, but it may avert a more serious problem, especially if the capacitor decides to short out when it fails.

The signal-to-noise ratio of a piece of equipment may be one of the most revealing measurements you can make. Transistors, integrated circuits, resistors, and capacitors may all contribute to excessive noise in an amplifier. However, this may all go unnoticed because noise is easily masked by the signal that is normally going through the equipment.

When making your measurements, be sure you use the same reference level that was used in creating the original specification. Some equipment is specified using the nominal "zero level" as the reference. Other equipment may use the clipping point or something close to it as the reference. The specifications should specify this reference level. Also, noise measurements are seldom made over an unrestricted bandwidth. Many audio voltmeters are flat up to a few hundred kHz.

While this is fine for measuring frequency response, it can be a problem when trying to measure noise. Noise is usually measured over a bandwidth of about 20 or 25 kHz, depending on the equipment. In some cases, it is measured using a weighting filter. The most common for electronics is the "A" weighting filter. This filter has a frequency response that has been standardized to approximate how the human ear responds to noise in electronics. If you try to measure noise with the wrong filter or over too wide a bandwidth, you will get readings that will never agree with the specification.

When measuring noise, it is good to look at the signal with a scope. If you can look at an output from your meter's electronics it can be even more revealing. If the noise is random, which is fairly typical, you will see a fuzzy line or grass across the screen. You will not

be able to make the scope give you any more detail since the noise is random. Excessive random noise is usually caused by a bad semiconductor device or resistor.

If you see a very high frequency sine wave along with the grass, something is oscillating. This could be a bad bypass capacitor or even something as simple as an input wire too close to an output. This may even come and go as you adjust the gain of the circuit. It may even be caused by using an "improved equivalent" IC in place of the original. Don't fool yourself by thinking that the high frequency of the oscillation will not be heard. While it may not be heard directly, it may cause noise in switches and faders that you cannot get rid of and a general "grunginess" in the quality of your sound.

If you see a low frequency component on the scope that is synchronous with the power line (usually 60 or 120 Hz) look for a power supply problem, usually a filter capacitor that is not doing its job. This may also indicate an improper connection between your equipment and the test gear, so that is another vote for cables made specifically for that purpose.

Total harmonic distortion (THD) is a common measurement that can yield more information than many people think. Remember, though, that you will not get an accurate THD measurement until you get your noise where it belongs, since most equipment that measures THD is actually measuring THD plus noise. Since you are really measuring the signal with the noise, you will generally see lower THD readings as you increase the level until you reach the clipping point. Then you will see a sharp increase in the amount of THD with a very small increase in level.

By the same reasoning, the THD readings will increase as you decrease the level. Measuring THD used to be a very time-consuming process, since you had to manually adjust a number of controls until you got a minimum reading. I remember one THD analyzer that had eight controls on it to get

a proper reading. Now there are some analyzers that adjust the level and null automatically and give you a reading. These are generally much more accurate than manually nulled analyzers, and as a result can show you a lot more about your equipment.

THD should be checked at a number of frequencies, since different components can cause problems at different frequencies. High THD figures in the mid-band may indicate a bad IC or transistor, or improper bias somewhere in the system. Normally the THD will increase as you lower the frequency in a system with audio transformers due to core saturation. Excessive amounts of low frequency distortion could indicate a problem with the transformer, or the presence of excessive DC through the transformer.

Excessive amounts of high frequency THD may indicate a decoupling problem or a slew rate limitation with a solid state device. Slew rate is the rate of change of the output voltage of the device (usually measured in volts per microsecond). This was a common problem with some early solid state designs, but can also result from improper substitution of an IC or transistor. Again, looking at the output of your analyzer on a scope can be helpful in determining the exact nature of the problem.

There are a number of other measurements that can be made on your signal electronics. While they all have a certain amount of value and can give you useful information, the procedures are generally more difficult or the equipment more expensive than is needed for the measurements above.

The first time you do any of this it may seem like a lot of trouble for nothing. However, like many other things, the more you do it the easier it will become. With some practice, you will be able to do all of this in only a few minutes, unless you find a problem. Of course, when you find a problem before it becomes a disaster, the whole exercise has shown its worth.

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One of the questions I'm asked most often about automation is "What special items do I need to keep my automation in shape?" After talking with a lot of experienced engineers and working on a few systems myself, I compiled this list of items that are absolutely mandatory to the maintenance of an automation system. These items are, in no particular order:

1. A broken cart
2. A drum stick
3. A bottle of Formula 409
4. A vacuum cleaner
5. A two-drawer filing cabinet
6. Several "D" size batteries

Not what you expected, huh? Well, as far as test equipment goes, if you have the stuff to repair and align a modern cart machine or reel-to-reel deck, you're pretty well covered. The same goes for hand tools. Remember, these are the special items for maintaining automation.

Items One Through Three

More make-goods have probably been generated by dirty pinch rollers than any other maintenance problem in automation. Pinch rollers on Carousels, GoCarts, and AudioFiles should be cleaned at least once a week. It's easy to get people into the habit of keeping pinch rollers clean if they don't have to go inside the racks to do it. Just take a broken cart out of the reload box and remove the lid, tape pack, and pressure pads. Insert the cart bottom into an empty tray on the machine, tray it in, and start the machine. A cotton swab, taped to a drum stick and moistened with Formula 409 will clean pinch rollers and keep them pulling tape for years to come. Formula 409 is great for cleaning cart machine pinch rollers - it removes tape lube from the roller, and helps prevent glazing. After cleaning the pinch roller, use a clean swab moistened in alcohol or a commercial head solvent to clean the capstan shaft and the heads.

Item Four

Nothing works well in a dirty environment (including you). An automation system should be kept clean so that proper heat dissipation and ventilation can be maintained. Dust and grit can cause major problems in moving parts. It's a good idea to vacuum the automation system about once a month or so. The system will run better, you won't have sneezing fits when you have to pull maintenance, and the staff will have pride in clean equipment. A clean system also looks darned impressive to visitors and prospective clients that might drop by for a visit.

Items Five and Six

It's two in the morning, you've been called in to check on the automation, and there's a problem. Now where is the manual for the automation brain ... it was here two months ago ...

Nothing wastes more time and makes tempers shorter than to have to call the GM in at 2:00 a.m. because an important manual was locked in someone's office. Small two-drawer filing cabinets are cheap, and are just the right size for equipment manuals, maintenance logs, etc. Be sure station employees know that they are welcome to read the manuals (a novel idea) as long as they return them when they're done. The filing cabinet also makes a great place to keep several flashlight batteries. When you're trying to see into a dark corner of the system in the dead of night, a good ol' flashlight with fresh batteries is hard to beat.

Those Are The Brakes

In a previous column, Steve Walker mentioned that VIF International had bought ITC's inventory of spare parts for the 750 reel-to-reel. One of Gordon Mackechnie's projects was to design a new brake band for the beast to replace the sticky-leather original. He has done just that; the new brake bands feature pads made of a material called Accobest. We've tried some sample bands here, with excellent results. Gordon is also planning to offer a replacement assembly for the ITC

brake roller (what you and I call the reel turntable). The replacement will be made of stainless steel, and promises to be a great improvement for the machine. If you need brakes (or anything else) for your 750, call VIF at (408) 739-9740.

Killer Beehives ... The Final Chapter

One last bit of old business. We were all hoping for a terminal emulation in the latest version of Procomm Plus, that would emulate the old Beehive terminal used by Cetec on the original 7000 Level-I automation. Unfortunately, none of the terminal emulations resemble the quirky control protocol of the old Beehive.

Next time, let's take a look at one of the true veterans of radio automation, the 250 Carousel. We'll look at some of its quirks, and ways to keep it thumping merrily along. Also, if you have any tips you'd like to pass along, give me a call. I'll be happy to include them in a future column.

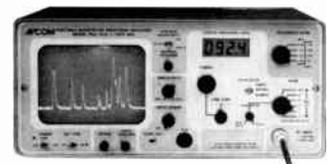
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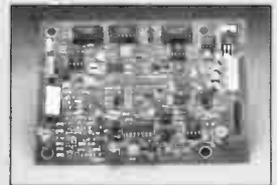
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In 1946, the idea for Radio Station WSIR in Winter Haven, Florida was conceived at the Pentagon in Washington, D.C. The war was nearing its end, and Major Jack Brandstetter and Captain Lawrence A. (Larry) Rollins were stationed in the Office of the Chief Signal Officer. Both were looking for a post-war business opportunity. One of their friends in the Pentagon

was the owner of Radio Station WSWA in Harrisonburg, Virginia, and he told the two that he would join them in this venture if they could locate an area needing broadcast service. Because of Rollins' previous experience as a news editor for the Miami Herald, he was familiar with the central Florida area, and chose Winter Haven as the site for the new broadcast property. Winter

Haven is in the Florida citrus belt, and the trio organized Citrus Belt Broadcasters, Inc. An application was filed with the Federal Communications Commission for a license to operate on 1490 kHz with 250 watts of power. In November, 1946, the application was granted for full-time operation.

The WSIR studios were located in downtown Winter Haven, while the transmitter building was located on a lake about three miles away. STL's were not in existence at that time, so the program was carried to the transmitter via telephone lines. Neither were telephones plentiful, with the one at WSIR's transmitter being the only one within the immediate area.

The transmitter used was a Raytheon RA-250 originally in service on a naval vessel. It had no harmonic filters, and Chief Engineer L. Orden Craig, who joined the WSIR staff shortly after it began, installed one in the building and one in the LTU. Open-wire transmission lines were used, which had an impedance of 230 ohms, and were notorious for RF signal leakage. The antenna was 200 feet series fed with a driving impedance of 185 ohms. Because there was no remote controlled transmitter monitoring equipment, the transmitter site had to be manned at all times during broadcasts.

As the second radio station in this county of now over 450 thousand residents, WSIR was heavily involved in the community and saw few dull moments. Once four convicts on a road gang in a nearby area overpowered a guard, commandeered a tourist's automobile at gun point, and fled down some back roads. The Winter Haven Police Department was not equipped with two-way radios at the time, so they requested WSIR's help in broadcasting an appeal to anyone observing the convict car to call the police department. This was successful, and within a short period of time, the convicts were back in custody.

(continued on page-22)

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Station Stories

A History of Station WSIR - Winter Haven, Florida

Continued from page-20

There was one other episode in which a giant of a man, remembered to be about seven feet tall, entered the WSIR studios and demanded to be put on the air to broadcast a message to the world. Chief Engineer Craig was on duty at the station at the time, along with announcer Dick March. According to Craig, the man had just been to a revival meeting. He entered the studio, ripped the record off the turntable that was on the air, and smashed several other recordings, saying they were not proper to air. He was put in a small news studio while Craig and March pretended to make the broadcast by putting the studio on audition. Regular morning programs continued to be aired during this time, although a listener noticed that something was wrong, and called the station to ask if the police should be notified. A few minutes later, the subject was apprehended, taken to the county jail, and later institutionalized.

One of the first projects was a broadcast marathon hosted by Program Director Dick Eyrich. This was an around-the-clock stunt to publicize a fund-raising campaign to benefit the

Winter Haven hospital. Active throughout the years in community involvement, WSIR was frequently asked to broadcast appeals for blood donors and was credited with helping to save several lives.

In 1962, WSIR applied to the FCC for a power increase to 500 watts daytime, 250 watts night. When this authority was granted, purchase of a Bauer 707 one kilowatt transmitter in kit form for \$7,200 was decided upon, and the transmitter was assembled by Chief Engineer Craig. Early in 1975, WSIR was granted another power increase to 1 kilowatt daytime and 250 watts nights. A few years back, when the FCC granted a more or less blanket authority to all class IV stations to run one kilowatt full-time, WSIR did so. The Bauer 707 is still the main transmitter and has had an outstanding service record. The Raytheon RA-250 remains as a standby transmitter.

Monthly frequency measurements used to be a requirement. Originally, WSIR employed a measuring service out of Fort Lauderdale. At a specified time and night of each month, Craig put the transmitter on the air. One

month he forgot to do this, and when a frequency measurement report showed up, the decision was made to employ another company. By then, a local measuring service was in operation.

I assumed the duties of Chief Engineer of WSIR in early 1975, replacing Mr. Craig who had done an excellent job as Chief since very shortly after the station opened. Under new ownership, we undertook an extensive renovation. New consoles, cart equipment, tape decks, turntables and processing gear were installed. On April 11, 1975, we installed a folded unipole antenna on the tower. This yielded an increase in the primary service area, as well as afforded increased protection from lightning strikes on the tower. The unipole's driving impedance is 73 ohms and it is still in use today.

In a recent short tenure as Chief Engineer at WSIR once again, I was absolutely amazed to find my maintenance logs from 1975 through 1977. I am now in possession of these, and they certainly bring back many memories. I was also amazed to find the old RCA passive equalizer that I used in the program line back then. These units are relics, but pass incredible audio because there is no phase shifting that sometimes occurs with the active designs.

Just like most AM stations, WSIR has felt the impact of the FM market; however, it continues to be a visible public servant because it fills a niche in community relations that is not generally found on the FM band. It has been a pleasure for me to have been associated with them for many years, and I continue to wish them well.

If you have a story about your station or project, please send it to Radio Guide for publication

...editor

← Hnat Hindes,
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Computer Connection

A Floppy Drive for the AT&T PC

By Kelly Klaas - KEZJ - (208) 733-7512

Well, I finally did it. I finally sprung for a 3.5 inch floppy diskette drive for my AT&T 6300 computer. It was actually quite painless after I finally figured out what was going on. And it even works.

The drive I got was the Mitsubishi drive from Jameco Electronics. I also purchased the software for it that allows it to work in the high-density mode without upgrading the BIOS chip. Actually, that won't do me any good right now as I don't have a high-density controller anyway, but if and when I do get one, it should work without a BIOS upgrade. At this point in time, though, I am content to be a little more compatible with the rest of the computer world.

The AT&T 6300 has room for only two half-height drives. Those two bays are already taken up with a 5.25 low-density drive and a Micro-Science

20MB hard disk. I also have a hard disk card inside using one of the slots. So, the big question was where to put the 3.5 inch drive. Several years back I purchased a disk drive for my Radio Shack Color Computer. It was mounted in a box that already had a power supply. I just took out the archaic single-sided floppy drive and replaced it with my Mitsubishi 3.5 inch drive. It took a little ingenuity and fumbling, but I finally got it to fit.

My next project was to connect the drive, which has a standard edge-connector plug on the drive, to the existing female edge connector plug inside the computer. I had another ribbon cable but I needed a male plug rather than the female plug that was on it. I finally ended up disconnecting the female plug from my ribbon cable and soldering all 34 wires to a printed circuit board I had which was connected to a

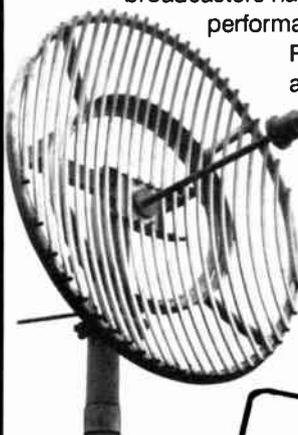
male-type edge connector. I plugged that into the plug in the computer and the connections were made.

Now, all I had to figure out was what commands to use to make my computer recognize the 3.5 inch low-density drive. I have booted up to PC-DOS 3.3 for some time now, and I did finally get the right commands in my CONFIG.SYS file by using the DRIVER.SYS command. I could then access my 3.5 inch drive, which I designated the B: drive. But if I wanted to use the DISKCOPY command or FORMAT a diskette in the B: drive, I had to refer to it as the E: drive. I felt like this was the same thing as walking ten blocks to get across the street. I tried using the DRIVPARM command, but it

(continued on page-24)

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Computer Connection

A Floppy Drive for the AT&T PC

Continued from page-23

wouldn't work with PC-DOS (who says they are both the same?). When I booted up with MS-DOS, I could use the DRIVPARM command and always refer to the B: drive no matter what I wanted to do.

To make a short story long, I backed up my C: drive and reformatted it using MS-DOS 3.3. Now, whether I want to FORMAT or DISKCOPY or whatever, I just refer to the B: drive as the B: drive, and life is a little less complicated.

The command needed in the CONFIG.SYS file is: DRIVPARM=/D:1 /F:2 /H:2 /S:9 /T:80. The /D:1 tells the computer that there is a diskette drive designated B: and that it is a 3.5 inch low density /F:2. The /H:02 tells it that it has two read/write heads. The /S:9 indicates that there are 9 sectors per side and the /T:80 tells it there are 80 tracks per side. Needless to say, all the parameters must be exact or it simply won't work.

My next project will probably be to convert the low-density drive to a high-density drive, but I think I will wait a while.

I have run across another program which I have had in my collection for some time, that is great for drawing diagrams and simple plans. It is called Paint Show Plus. If you need to draw some simple plans from time to time so a machinist or carpenter can built from your plans, this is a great little program to use. It is by no means an AUTOCAD type program, but it is simple to use and quite effective for simple draw-

ings. It even allows you to edit pixel by pixel in the MAGNIFY mode.

I recently had a need to draw some plans for a promotional sign for parades and remotes. I had a ten foot section of a Rohn 25G tower that I need some legs put on so it would be self-standing. I got out Paint Show Plus and proceeded to draw the plans. The machinist had no problem reading the plans (at least he didn't say he did) and the boss felt a little more acceptance for the computer.

If you wanted, you could use the program to draw simple circuit diagrams, but if you had some sophisticated circuitry to draw, you would be better off using Orcad or some such program. But for kicking out a quick and dirty diagram, a program like Paint Show Plus is a good one to have around. You can get it mail order for about \$35. One word of caution, if you don't have a mouse, you will have to get one. It requires a mouse.

There are several drawing programs available that will fit this little niche. In fact, I am in the process of ordering some shareware drawing programs so I can look at each one and report on them to you. I have found that it doesn't necessarily take the expensive, RAM-hungry programs to do the little jobs around the station. Most of the one's I use are the \$25 to \$50 programs, or even shareware. I have seen several shareware programs that beat the commercial one's hands down. A case in point is

AS-EASY-AS. I reported on it in a previous article, but it can give LOTUS-1-2-3 a run for the money, and the registration fee is only \$50, compared to LOTUS's \$495. I expect to find the same results with some of the drawing programs from shareware. I'll take a look, see what I find, and let you know.

Meanwhile, please send me your ideas. If you have an idea for an entire article, let me know so we can discuss it. The FAX number here at KEZJ is 208-733-7525.

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Tips From the Field

Tech-tips From Our Readers

H.V. Stack Check

Henry Hoffman - WLRH - Huntsville, Alabama

Here is a little elaboration on an idea that ran several months ago in the Radio Guide: To check any high voltage rectifier stack use a 100 watt light bulb in series with a 1N4001 (or similar) diode and a 120 volt AC line.

Disconnect the stack completely and place it in series with the light bulb and diode combination. If the leads are hooked in one direction, and the lamp lights, yet when the leads are hooked in the reverse direction, the lamp does not light - the stack is probably good.

If the light is on when the leads are connected in both direction, it could be a shorted stack. No light with either connection may mean an open stack.

Holaday, Fax-Guide Code #118 →

Moseley PCL-606C Mod

John Stortz - WKES - St. Petersburg, Florida

At WKES, we've found the Moseley PCL606C to be a reliable STL - we're using four of them. One problem has developed when attempting to record the receiver signal level at the remote transmitter site. After a power failure (we have lots of them), the 606C comes back up monitoring the audio instead of the desired RF level.

A footnote on the schematic of the metering and status board lists how to fix this. It recommends cutting or drilling the PC board to alter the preset configuration of U2. Since U2 is mounted in a socket, we simply removed U2 from the socket and bent pin #1 out of the way so that pin #1 did not go back into the socket when U2 was re-installed.

By altering the preset in this manner, the board is not disturbed and all presets are still available without cutting or soldering the circuit board. Any of the other presets may be achieved in the same manner.

Tascam 122 EQ Fix

Steven Herbert - KCRW - Santa Monica, California

Over the years, I've observed the frequency of our aging Tascam 122 and 122-B cassette decks gradually decline, occurring in the reproduce mode at the high end.

After a year or so of adjustments, the EQ pots were set a maximum. Replacing the heads typically would bring the machine into specification with little or no headroom. Replacing electrolytic capacitors, suspected of drying out, did nothing and all the transistors in the circuit were operating as specified in the service manual.

Finally, replacing the EQ pots themselves brought the high end up and gave back some adjustment range on the pots. Replacing and R20 (part #5280004002 from Teac) yielded an increase of 4-5 dB at 10kHz on average. It appears that the tin coating on these metal variable resistors began to corrode over time. Our cassette decks are within a mile of the Pacific Ocean in a suburb of Los Angeles; both factors that probably accelerates the aging process. A shot of contact renew and lube may bring the old pot up 1 or 2 dB but for our money, it is better to replace them outright.



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Equipment Guide

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- STL, RPU, TSL, Remote Control
- AM Transmitters
- FM Transmitters
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Phelps Dodge FMHP-8, 8-bay high power antenna on 93.3. Make offer. Chuck Springer, KLMR, P.O. Box 890, Lamar, CO, 81052. Phone 719-336-2206 Fax 719-336-7973.

300' Andrew 1-5/8" HJ-7-50 with 2 flanged fittings, \$2,000. 150' Andrew 7/8" LDF5-50A with 2 female 75AN fittings, \$440. 300' 1/2" Andrew LDF4-50, \$300. 170' 1/2" foam Andrew FHJ-1-50B, \$170. 130' Cablewave 1/2" foam, \$130. 60' 7/8" foam with one female 75AN, \$150. Vern Bawinkle, WWJQ-WJQK, 5654 143rd Ave., Holland, MI, 49423. Phone 616-394-1260 Fax 616-394-9008.

500' 5" Helix with connectors, spooled, \$2,750. Dave Bischoff, KKCW-FM, 12655 SW Center St #500, Beaverton, OR, 97005. Phone 503-643-5103 Fax 503-641-9292.

2) RF tower lighting chokes, \$100 each. 14) Side lights for tower, make offer. Syl Huling, KFFA, P.O. Box 430, Helena, AR, 72342. Phone 501-338-8361 Fax 501-338-8332.

ERI 5-bay, G8CPS-6AC-3 on 102.1 mHz, \$1600 per bay. 3-1/8" hardline, (4) 9' sections and (2) 4' sections. John Maples, WMYU, 8419 Kingston Pike, Kunyville, TN, 37919. Phone 615-673-1020 Fax 615-673-8897.

170' Rohn self support tower, unpainted and disassembled, \$6,000 or best offer. John Lackness, KQXY, 117 Nederland Ave., Nederland, TX, 77627. Phone 409-724-1292 Fax 409-724-7055.

Jampro JSCP-8, 8-bay antenna on 99.1 mHz, with radomes, in good condition. Mark model P-9A72G 6' dish. Don Patrick, Patrick Electronics, 3701 Old Jenny Lind, Fort Smith, AR, 72901. Phone 501-646-6141 Fax 501-646-6142.

ERI 1-bay H antenna on 95.9 mHz. New in 1987, \$1,000 plus shipping. John Wiggins, WWFN, 1513 Heritage Lane, Florence, SC, 29505. Phone 803-661-6000 Fax 803-661-5995.

Collins (ERI) 6-bay FM antenna on 96.9 mHz. May be tuned +/- 1 mHz. 120' 1-5/8" rigid transmission line with hangars. 195' unjacketed Andrew 1-5/8" transmission line with end fittings. \$4,500, FOB site. Joe Miller, KULP, 515 East Jackson St., El Campo, TX, 77437. Phone 409-543-3303 Fax 409-543-0097.

190' self supporting tower. 150-feet to platform with 40-foot of 45G tower on platform. Best offer. Alan Baron, 211 Front St., Lynden, WA, 98264. Phone 206-354-5252.

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Dielectric 2-bay FM antenna tuned to 106.3 mHz. Used two years, less inner bay. Will trade for usable FM exciter, best offer. Jim Broadus, WTLN, 8317 W. Hwy. 98, Panama City, FL, 32407. Phone 904-233-6606 Fax 904-233-1541.

150' Andrew HJ11-50 (4") Helix with Andrew 81RF (3") connectors at each end. Purchased in 1985, never used, still on spool, \$1,500 plus freight. Electro Impulse 10kW FM dummy load, \$300. Dean Kannes, KTAR, 301 Osborn Rd., Phoenix, AZ, 85013. Phone 602-274-6200 Fax 602-266-3858.

Shively6810, 1-bay FM antenna with radome, tuned to 92.7 mHz. Excellent condition, in use only 7 months, \$900. Melvin Gollub, WMJS, P.O. Box 547, Prince Frederick, MD, 20678. Phone 301-535-2201.

Alliance V-110 antenna rotor (2 sq ft wind load), new in box, \$48. Lonnie Domnitz, 750 La Playa Suite 1100, San Francisco, CA, 94121. Phone 415-750-0431.

Andrew LDF4-50A, 1/2" coax. (2) Pieces, 125' and 28'. Each has type-N male on one end and type-N female on the other. \$125 for all. Scott Morton, Morton Technical Services, Homer, AK, 99603. Phone 907-235-4136.

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Schafer 903 automation: (4) Otari ARS-1000 decks with new heads; (3) SMC 252 Carousels; (2) Harris Criterion II playback carts; (1) Audicord network delay R/P cart deck; TTY interface with Xtel printer; solid state spares kit; (4) blue equipment racks; (2) heavy duty roll-around steel bases. Includes one installation and operations manual and two maintenance manuals. Total price \$8,000. Joe Miller, KULP, 515 E. Jackson St., El Campo, TX, 77437. Phone 409-543-3303 Fax 409-543-0097.

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Harris automation system: (4) Scully reel decks; spare parts; switcher; clock; overlap control; detector and source controls; silence sensor, documentation. Removed from service 5/91, make offer. Gill Dye, KWNE, P.O. Box 1056, Ukiah, CA 95482. Phone 707-462-4389 Fax 707-462-4670.

Sono-Mag (SMC) DP-2 with (4) Carousels, (4) reel decks and all associated equipment. Best offer. Chuck Springer, KLMR, P.O. Box 890, Lamar, CO, 81052. Phone 719-336-2206 Fax 719-336-7973.

IGM-EC automation system. Nearly new and fully operational. Includes: (1) IGM-EC chassis; (2) IGM GO-Cart 24; PC computer with IGM-EC software; Epson LX-800 printer; Alpha 250 uninterruptible power supply; 6-foot blue rack; all cables and manuals. \$7,000 or best offer for all, you ship. Willing to consider offer for less than full system. Ray Dobbs, KOZI-AM/FM, 123 E. Johnson St., Chelan, WA, 98816. Phone 509-682-4033 Fax 509-682-4035.

BE-16 automation system: (3) IGM Go-Carts II's; printer; monitor; 3000 events. On air now (also have (4) Scully playback decks if wanted. Best offer. Dan Brown, KVLE, P.O. Box CC, Page, AZ, 86040. Phone 602-645-8181 Fax 602-645-3347.

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Schafer 800 Automation "brain" and (4) Scully 270-series reel decks. All in working order, priced for quick sale. Robb Swanson, WMTE, P.O. Box 190, Manistee, MI, 49660. Phone 616-723-9906.

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SMC MSP-12 complete satellite music automation system. Dual cart playbacks, dual SMC 452 Carousels, CRT, 2000 event memory. New in Fall of '88, used only 6 months, will sell at 1/2 price. Dennis Carpenter, KKSJ, P.O. Box 699, St. Cloud, MN, 56302. Phone 612-253-9600.

Format Sentry with Commodore 64, \$2,500. (2) IGM Go-Cart-24, \$2,000 each. (3) Audicord S-series cart PB units, \$500 each. (4) Otari ARS-1000 reel reproducers, \$850 each, (1) Reel sensor unit, \$100. (2) Racks for all above, \$300 each. Bob Toole, KGVO, 127 North Higgins, suite 107, Missoula, MT, 59802. Phone 406-721-1290 Fax 406-728-9464.

IGM RAM Automation. Has mono SMC Carousels, no reel decks, best offer. John Lackness, KQXY, 117 Nederland Ave., Nederland, TX, 77627. Phone 409-724-1292 Fax 409-724-7055.

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(3) SMC 250 Carousels with rack, \$700. (1) Howe Phase chaser model 2000, \$25. Misc. Schafer 903 automation cards and cables, will trade. Dwight Morgan, KJYE-KNZZ, 1360 East Sherwood Dr., Grand Junction, CO, 81501. Phone 303-241-9230 Fax 303-245-7551.

Cetec 7000 automation system. (2) Audiofile and (3) ITC-750 reel decks. Best offer. Dennis Bornhoff, KSMA, 2215 Skyway Dr., Santa Maria, CA, 93455. Phone 805-925-1200.

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UMC 11-113 mono reproduce cart deck with 3 tones, \$325. (2) ABCO wire cart racks on floor stands, holding 500 carts each, \$175 each. (1 set LEL alignment gauges for Ampco cart decks, \$15. MCI JH-110B FT stereo for 14" reels, in metal roll-around cabinet, \$2,075 or trade for computer, ect. Phil Wells, KJQY, San Diego, CA. Phone 619-238-1037 Fax 609-238-6157.

RCA cart player, antique and good for parts. Paul Tinkle, WCMT-AM/FM, Box 318, Martin, TN, 38237. Phone 901-587-9526.

Tascam 34, 4-track reel deck, \$990. Dennis Kinkaid, KXBS-FM, 5200 Valentine Rd., #230, Ventura, CA, 93003. Phone 805-644-6800 Fax 805-644-6181.

Ampex AG-350 mono full track portable in console, good condition, \$300. Crown 801 mono full track portable with matching speaker/amp, \$200. Brenton Weiss, KLSI, 3101 Broadway, # 460, Kansas City, MO, 64111. Phone 816-753-0933

ITC SP mono, \$200. (2) ITC SP's, one mono and one stereo without cards or heads, \$50 each. ITC RP mono, \$250. ITC RP mono without case or cue card, \$175. Peter Walkowiak, WWWWM, P.O. Box 167581, Oregon, OH, 43616. Phone 419-255-1470 Fax 419-691-0396.

TEACA-3300-S, 2-track tape deck, \$300. Panasonic RS-296 US automatic, 20-cassette auto changer, \$275. Bob Michael, Mr. Music Inc., 1003 Rose Way, Naples, FL, 33942. Phone 813-643-1552.

CCA Citadel RP cart deck, like new, \$230. Gregg Nemitz, 3909 B Park Rd., Benicia, CA 94510. Phone 707-746-6970 Fax 707-746-5769.

MCI JH-110A tape deck. In low profile cabinet, well maintained in excellent mechanical condition. Heads replanned 6 months ago, 3-speed plus variable speed, \$1,000. Andrew Symons, World Media Group, 8472 Brookville Rd., Indianapolis, IN, 46239. Phone 317-353-1113 Fax 317-353-0750.

Used Fidelipac 300-series carts in all lengths. 50-cents each plus shipping. Al Cannon, WRQR Radio, P.O. Box 1546, Greenville, NC, 27835. Phone 919-830-0944 Fax 919-830-0047.

ITC mono RP cart deck, \$600 plus shipping. ABCO Lazy Susan, 500-cart, cart rack, \$350, you pick up. Robert Statham, WHLG/WSTU, 1000 Alice Ave., Stuart, FL, 34944. Phone 407-692-1000 Fax 407-692-2231.

Scotch-Cart II's. Fidelipac "Master Carts, \$3.50 each. Audiopac carts, \$2.95 each. (10) 10-1/2" metal reels of Scotch 208-250, Maxell, Ampex 406-456, \$20 each or best offer. Mr. Garrison, 11710 Hoyt St., Tampa, FL, 33617. Phone 813-988-0496 Fax 813-988-1354.

Audio carts, all over 2-1/2 minutes. (343) Fidelipac Mastercart and (224) Audiopac AA-4's. Call for list of times. ITC SP stereo cart deck, 3-cue, \$500. Paul Reamann, WEZY, P.O. Box 827, Lakeland, FL, 33802. Phone 813-682-4191 Fax 813-682-3143.

ITC 750 R/P reel deck, \$500 or best offer. Casio portable DAT recorder, \$600, like new. Andrew Armstrong, P.O. Box 1122, Windham, ME, 04062. Phone 207-892-6999.

Spotmaster 500C mono playback cart deck, \$350 plus 15¢ UPS. Lloyd Spivey, WLLS-AM/FM, Highway 231 South, Hartford, KY, 42347. Phone 502-298-3268 Fax 502-298-9326.

Ampex AG440-C, full-track mono reel deck. Stored for last 5 years, new condition, has motion sensing, \$800. Mike Morrissey, KYGO, 1095 S. Monaco Highway, Denver, CO, 80224. Phone 303-321-0950

2,000 Scotchcart II's in black shell. 2-1/2 to 7-1/2 lengths, will ship any quantity. 1000+, \$2.50 each. 500+, \$3.00 each. 100+, \$3.50 each. Under 100, \$4.00 each. Frank Befera, WCDK-FM, Box 954, Virginia, MN, 55792. Phone 218-741-2233

ITC model SP mono PB cart deck, \$250. Harris/Gates model 994-6701002 R/P cart deck, \$250. Harris/Gates model 9946705 R/P cart deck missing record head, \$250. All in working order when removed from service. Griffin Broadcasting, KERV/KRVL, 301 Junction Highway, Suite 333, Kerrville, TX, 78028. Phone 512-896-1230 Fax 512-792-5555.

(6) UMC Beaucart Type-10 mono cart decks. 3-tone, manuals, good condition. One R/P and 5 PB, \$2,000 for all or make offer. Neil Hopper, 37526 Oxford Dr., Palmdale, CA, 93550. Phone 805-273-2439.

(2) Ampex 350R reel decks, \$100 each. (2) Ampex 300 reel decks, \$50 each. Many spare parts for Ampex reels, will trade. Dwight Morgan, KJYE/KNZZ, 1360 East Sherwood Dr., Grand Junction, CO, 81501. Phone 303-241-9230 Fax 303-245-7551.

OTC Delta 3-deck in good condition, \$3,000. ITC Delta R/P in excellent condition, \$2,500. Both for \$5,000. Jay Pearce, KWNR, 1515 E. Tropicana, B200, Las Vegas, NV, 89119. Phone 702-798-4004 Fax 702-798-3076.

ITX 99B stereo cart deck with all tones, 2 years old, \$2,800. Ben Downs, KTSR, Box 3248, Bryan, TX, 77805. Phone 409-846-1150 Fax 409-846-1933.

Spotmaster "10-spot" in fair condition; needs work and parts, \$200. ABC Carousell; new but incomplete and missing heads and trays, \$250. Infonics open-reel duplicator, full-track, 30-IPS, 3 copies per pass, \$250. Infonics open-reel duplicator, two-track, 30-IPS, 3 copies per pass, \$250. Auditronics AV123-4TS open reel duplicator, 1/4-track, 3 copied per pass, \$250. Schafer logger, 10-1/2" reels, good condition, \$200. (3) Spotmaster 505's (2 R/P, 1 PB), good condition, \$200 each. (5) Magnacord PT-6 decks; three stereo and two mono, need work, all or part best offer. 2" tape transport components, best offer. Sparta cart delay deck, like new, \$500. R. Meyers, 4700 SW 75th Ave., Miami, FL, 33155. Phone 305-264-5963 Fax 305-264-2357.

(3) Otari ARS-1000DC stereo decks with tone sensors, new heads, clean, excellent maintenance and condition. Priced to sell, \$1,800 for the package. Includes a new spare capstan motor and new head. Also have (1) Otari ARS1000 chassis for parts, as-is \$150, you pay shipping. Paul Miller, 522 E Culew Place, Tarpon Springs, FL, 34689. Phone 813-934-3466.

(4) ITC Delta mono R/P cart decks in excellent condition, \$1,800 each. (4) ITC Delta mono PB cart decks, \$1,000 EACH. (1) ITC RP-003 R/P, \$600. (1) ITC SP-003 mono PB, \$300. Bob Van Buhler, KNIX, P.O. Box 3174, Tempe, AZ, 85261. Phone 602-921-6311 Fax 602-921-6396.

BE Phase-Track 90 stereo R/P cart deck. (1) BE Phase-Track 90 stereo PB cart deck. (200) Scotchcart II carts (3.5 and 4.5 min). In service less than one year. Over \$7,500 new, complete package: \$5,000. Eddie Provost, KDEA, P.O. Box 12948, New Iberia, LA, 70562. Phone 318-365-6651 Fax 318-365-6314.

2,000 carts recorded with oldies music. Fits \$750 take all. Will ship freight collect in U.S. Jane Lewis, WBSR, P.O. Box 8057, Pensacola, FL, 32505. Phone 904-438-4982 Fax 904-433-7932.

1,800 model 300 and 350 Fidelipac shells. Goos cases, all need re-load. Asking \$400. Jim Graham, WSSL, P.O. Box 100, Greenville, SC, 29602. Phone 803-242-1005 Fax 803-271-3830.

Pentagon cassette duplicator. Copies from cassette or reel, pro-series, \$1,000 or best offer. Ampex 440 tape machine in good working condition. Three to chose from, all are mono. Some spare parts. Dean Kannes, KTAR, 301 Osborn Rd., Phoenix, AZ, 85013. Phone 602-274-6200 Fax 602-266-3858.

BE Spotmaster stereo cart machine with secondary and tertiary tones, automatic fast-forward, low hours, excellent condition. Record/play model 3200 RPS, \$1,600. Play only model 3200PS, \$850. Both for \$2,250. Otari, 1", 15/30 IPS, 8-track tape deck model MX-7308 with low hours, in excellent condition with remote, \$4,500. Ampex model 612 playback tape deck (antique?), \$50. Lon Wagner, Ardnigva Radio Network, P.O. Box 1788, Orlando, FL, 32802. Phone 407-299-1299.

MCI/Sony JH110B2, 2-track reel tape deck with metal roll around cabinet, \$2,000 plus freight (2) ITC RP mono delay cart decks with 3 tones, \$650 each. (1) Nakamichi MR-1 cassette deck, factory fresh, \$650. Dan Glenn, WTKN, 11300 4th St. N, Suite 318, St. Petersburg, FL, 33716. Phone 813-577-7131.

(4) Scully 270 reproducers, all in good condition, adapter hubs included to fit 10" NAB reels. Gary Pettet, 105 Kedzie Hall, Kansas State University, Manhattan, KS, 66506. Phone 913-532-6890 Fax 913-532-7309.

Teac X-1000R, 1/2-track reel deck with dBx, 10-1/2" reels, with auto reverse, clean, needs work \$295. Studer Revox A-77, \$495. Lonnie Domnitz, 750 LaPlaya, Suite 1100, San Francisco, CA, 94121. Phone 415-750-0431.

(700) Scotchcart II's. 4-1/2 - 5/12 minute with oldies format. \$1.75 each or \$1,100 for all. (3) A-Line 200-space cart racks, \$90 each or \$250 for all. Joe Urbiel, WIQB, 3001 Brassow Rd., Saline, MI, 48176. Phone 313-662-2881 Fax 313-429-7837.

Audio Source: CD, TT, Mikes, Hard Disks

Electro-Voice RE-20 mike, \$290. Dennis Kinkaid, KXBS, 5200 Valentine Rd., #320, Ventura, CA, 93003. Phone 805-644-6800 Fax 805-644-6181.

(2) Neumann U-87's. Like new in excellent condition, including wind screen and shock mounts, \$1,250 each. Sennheiser MD-441U mike. Like new with case, in excellent condition, \$200. S. Kowaleki, WXXL, 337 S. Northlake Blvd., Suite 1067, Altamonte Springs, FL, 32701. Phone 407-339-1067.

(2) Crown PZM microphones model 30GPG with PX-18B power supplies, like new, \$400 for both. Benton Weiss, KLSI, 3101 Broadway, Suite 460, Kansas City, MO, 64111. Phone 816-753-0933 Fax 816-753-6854

(3) QRK Turntables with Russco arms in very good condition, \$50 each. Dwight Morgan, KJYE, 1360 East Sherwood Rd., Grand Junction, CO, 81501. Phone 303-241-9230 Fax 303-245-7551.

Technics SLP-1200 and SLP-1300 compact disc players. Both still in use in FM on-air studio. No remotes included, \$800 each or \$1,500 the pair. Technics SP-10 turntable with SME 3009-R tone arm, Ortonfon MC-10 Super Allied Shock Absorber pedestal, \$1,350 or best offer. (3) UREI 1122 transcription pre-amps, \$45 each. Peter Walkowiak, WWW, P.O. Box 16781, Oregon, OH, 43616. Phone 419-255-1470 Fax 419-691-0396.

SP-10 turntable base with cover and Audio Technica tone arm, \$200. Andy Armstrong, P.O. Box 1122, Windham, ME, 04062. Phone 207-892-6999.

(2) Technics SL-1200 CD players, \$850 each. Tom Pless, WHVY, 112 Main St., Annapolis, MD, 21401. Phone 301-626-0103 Fax 301-267-7634.

Electro-Voice RE-635A dynamic cardioid mike, \$74. Technics SL-1800 turntable, \$109. Shure SM-58 mike, \$67.50. AKG D58E mike, \$74. Electro-Voice RE-10 mike, \$115. Radio Shack Lab-1500 turntable with linear tracking, \$69. Lonnie Dornitz, 750 La Playa, Suite 1100, San Francisco, CA, 94121. Phone 415-750-0431.

Consoles and Mixers

Gates Unimote and Unitmote-70 remote phone mixers. Gates Yard, 8-channel console. Power supply for Gates Yard console. Will sell cheap, must move! Paul Tinkle, WCMT-AM, P.O. Box 318, Martin, TN, 38237. Phone 901-587-9526.

Shure M67 Mixer and M675 Production Mixer. Good condition, sold as set only, \$200. S. Kowalski, WXXL, 337 S. Northlake Blvd., Suite 1067, Altamonte Springs, FL, 32701. Phone 407-339-1067.

Sparta A-10B mono console in mint condition, \$200. Benton Weiss, KLSI, 3101 Broadway, suite 460, Kansas City, MO, 64111. Phone 816-753-0933 Fax 816-753-6654.

Collins 808A-1 console, \$200, or will trade. Dwight Morgan, KJYE, 1360 East Sherwood Dr., Grand Junction, CO, 81501. Phone 303-241-9230 Fax 303-245-7551.

Shure SE30 Gated Mixer, \$185. Gary Wachter, KFYI, 631 N. 1st Ave., Phoenix, AZ, 85003. Phone 602-258-6161.

Peavy 16-channel MD Mixer MD-12 in perfect condition, \$300. Tax MB-20 6-channel audio mixer with meter bridge, \$200. Bob Michael, Mr. Music Inc., 1003 Rose Way, Naples, FL, 33942. Phone 813-643-1552.

Gates Ambassador, mono 5-pot solid state console with step attenuators, modules, power supply, and new and accurate manual. Needs work, great for spare parts, \$450 or best offer plus shipping. Mike McCarthy, McCarthy Radio Engineering, 1116 Tamarack, Mt. Prospect, IL, 60056. Phone 708-640-8965.

Radio Systems ESA-10 console. Must sell, \$3,000. Brian J., 4680 E. 2nd St. #6, Benicia, CA, 94510. Phone 707-746-6970 Fax 707-746-5769.

LPB, 5-mixer stereo console in good condition, \$1,500 plus shipping. QRK 3-speed turntable in good condition. Needs head shell, \$100 plus shipping. Robert Statham, WHLG, 1000 Alice Ave., Stuart, FL, 34994. Phone 407-692-1000 fax 407-692-2231.

(2) Technics SL-1200 MKII turntables. Like new, never put into service, \$375 each. Rick Phillips, KAKN, P.O. Box 214, Naknek, AK, 99633. Phone 907-246-1492.

Gates model M6377A Diplomat console. 10 channels, mono, complete with manual, working when removed, make offer. Bernie Garcia, KBOR, 1411 Roosevelt Ave., Burlington, IA, 52601. Phone 319-752-2701.

Autogram IC-10 stereo console with all options. Transformer balanced inputs, stereo program and audition buss, mono mixdown, time-temp clock, step attenuators. Two years old, removed from the newsroom of AOR station, so it's just like new. Good sounding, trouble-free board. \$6,700 plus shipping. Kirk Wesley, WQMF, 4010 Dupont Circle, Louisville, KY, 40207. Phone 502-896-4400 Fax 502-896-1496.

Radio Systems ESA-10 console with copy stand, \$5,125. Broadcast Electronics 5S-150, 5-channel console, \$1,500. Tom Pless, WHVY, 112 Main St., Annapolis, MD, 21401. Phone 301-626-0103 Fax 301-267-7634.

RCA BC-18A, 8-channel mono console in excellent condition, \$850. Jeff Twilley, WQHQ, 213-219 West Main St., Salisbury, MD, 21801. Phone 301-742-1923 Fax 301-742-2329.

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RCA model BC-7A stereo/dual mono 10-mixer console. In working order, fair cosmetic condition, with manuals, \$350. Steve Konopka, 115 S. Jefferson St., Green Bay, WI, 54301. Phone 414-435-3771.

(2) Arrakis 150SC stereo consoles. 6 mixing positions, 12 inputs, with built-in monitor amplifiers and many other features. These consoles are in current production and are like new, \$1,250 each. (2) Broadcast Electronics model 4M50A mono consoles with 4 mixing positions with built-in cue and monitor amps; like new. \$500 each. (2) Audio Technica model AM-500 stereo Consolettes, 6 mixing positions, 9 input, plus other features. Bill Cook 1412 S. 21st St., Colorado Springs, CO, 80904. Phone 719-594-9496.

Harris Solid Statesman console. Handles 9 input sources, has power supply and documentation. Removed from service 2/91. Make offer. Gill Dye, KWNE, P.O. Box 1056, Ukiah, CA, 95482. Phone 707-462-4389 Fax 707-462-4670.

(3) Audiotronics model 200VC mike compressor modules for 200 Series consoles. (2) Audiotronics 201 PEQ Mike equalization modules for 200 Series consoles with "personality" plug-in modules. All in good condition with documentation. Howard Ginsberg, WMEE, 2915 Maples Rd., Fort Wayne, IN, 46816. Phone 219-447-5511 Fax 219-447-7546.

Autogram AC6 console in good condition. Manual included. Dean Kannes, KTAR, 301 W. Osborn Rd., Phoenix, AZ, 85013. Phone 602-274-6200 Fax 602-266-3858.

Opamp Labs 2008-4E console. 20 input, 8 sub plus stereo mix out. Good production board, very clean. \$3,500. Lon Wagner, Ardnigva Radio Network, P.O. Box 1788, Orlando, FL, 32802. Phone 407-299-1299.

LPB, 5-channel, 12-input, mono console with manuals, \$500. Dan Glenn, WTKN, 113004th St. N., Suite 318, St. Petersburg, FL, 33716. Phone 813-577-7131.

RCA BC19A stereo console; 4 channel, works, needs some work, \$300. Ampro AC-10S dual buss, 10 channel console; looks good, condition unknown, no manual, \$750. Wayne Nauman, WLWJ, 400 J. Royal Commerce Rd., Royal Palm Beach, FL, 33411. Phone 407-793-5555.

Audio Processors, and EQ

CRL SEP-800 stereo 4-band compressor. SMP-800 stereo modulation Processor. SPP-800 stereo preparation processor. Best offer. Chuck Springer, KLMR, P.O. Box 890, Lamar, CO, 81052. Phone 719-336-2206 Fax 719-336-7973.

Inovonics MAPII 8-band AM audio processor, \$800. Robin or Larry, KORE, 2080 Laura, Springfield, OR, 97499. Phone 503-747-5643 Fax 503-746-0680.

Gates Solidstatesman limiter, \$275. Phil Wells, KJQY, San Diego, CA. Phone 619-238-1037 Fax 619-238-6157.

Gates SA-39 antique limiter. Paul Tinkle, WCMT-AM, P.O. Box 318, Martin, TN, 38237. Phone 901-587-9526.

Yamaha SPX-90, \$390. Dennis Kinkaid, KXBS-FM, 5200 Valentine Rd., #230, Ventura, CA, 93003. 805-644-6800 Fax 805-644-6181.

CBS Audimax, \$75. Dwight Morgan, KJYE, 1360 East Sherwood Dr., Grand Junction, CO, 81501. Phone 303-241-9230 Fax 303-245-7551.

CRL SMP-900 AM Stereo Matrix Processor, \$1,000. Mark Young, WJON, P.O. Box 220, St. Cloud, MN, 56302. Phone 612-251-4422.

Digital TC-4 delay processor, \$800. Tom Press, WHVY, 112 Main St., Annapolis, MD, 21401. Phone 301-626-0103 Fax 301-267-7634.

CRL SEP-400A, mono, \$100. CRL SEP-400B, mono, \$100. (2) Valley People Dynamite, 2-channel, \$175 each or \$300 the pair. CBS Labs Volumax-4000, mono, \$75. Peter Walkowiak, WWWM, P.O. Box 167581, Oregon, OH, 43616. Phone 419-255-1470 Fax 419-691-0396.

RCA BA 43,45 and 46 audio processor with rack mount frame, \$65. James Cunningham, KEOR, Route 2 Box 113B, Stonewall, OK, 74817. Phone 405-265-44496.

Modulation Sciences Stereo Maxx Spatial Enhancer. Brand new, works with all on-air processing. Sell for \$1,800 or trade for Orban XT2 chassis. Bruce Whitsler, WJER, 646 Boulevard, Dover, OH, 44622. Phone 216-343-7755.

CBS Labs Volumax 4110, great condition, \$100. Aphex II Broadcast Aural Exciter; great condition, best offer plus shipping. Al Cannon, WRQR, P.O. Box 1546, Greenville, NC, 27835. Phone 919-830-0944 Fax 919-830-0047.

Aphex Aural Exciter Type B, for sale or trade. Would like to trade for a stereo production limiter. Tom Weedon, WMTV, 615 Forward Dr., Madison, WI, 53711. Phone 608-274-1515 Fax 608-274-2737.

Modulation Sciences Stereo Maxx, \$1,500. (2) DAP 310's, \$200 each. BBB Sonic Maximizer, \$100. Andrew Armstrong, P.O. Box 1122, Windham, ME, 04062. Phone 207-892-6999.

Harris MSP-100 audio processor. Mono, complete manual, working when removed from service, make offer. Bernie Garcia, KBOR, 1411 Roosevelt Ave., Burlington, IA, 52601. Phone 319-752-2701.

Howe Phase Chaser with manual, \$800. Ben Downs, KTSR, P.O. Box 3246, Bryan, TX, 77805. Phone 409-846-1150 Fax 409-846-1933.

(2) Dorrrough 610 FM processors as stereo pair. With manuals, \$750 for the pair. dBx model 160X compressor, with manual, \$75. Steve Konopka, 115 S. Jefferson St., Green Bay, WI, 54301. Phone 414-435-3771.

Harris/Gates model 994-66229-004 Solidstatesman AGC. R. Elm, WWJC, 1120 E. McCuen St., Duluth, MN, 55808. Phone 218-626-2738.

Modulation Sciences CP-803 composite clipper including track mount. Orban Optimod 8100A/XT26-band limiter chassis. Orban 245E stereo synthesizer. CBS Audimax 4450A stereo AGC. Eventide BD-932 stereo audio delay. All in excellent condition with manuals. Howard Ginsberg, WMEE, 2915 Maples Rd., Fort Wayne, IN, 46816. Phone 219-447-5511 Fax 219-447-7546.

CBS Volumax, \$150. Lon Wagner, Ardnigva Radio Network, P.O. Box 1788, Orlando, FL, 32802. Phone 407-299-1299.

Harris MSP-100 audio processor (AM). Can be used with NRSC on AM or to tailor you sound. 3 band AGC, compression expansion limiter, polarity control for auto or plus/minus. Lots of user adjustable settings. Complete manual and set-up book. Extender card included. \$975. Mike Casey, WJEX, Drawer I, Johnston, SC, 29832. Phone 803-275-4444 Fax 803-275-3185.

dBx 900 mainframe with power supply. (3) dBx 942 Type II noise reduction modules. dBx 140 Type II noise reduction system. All for \$400. Dan Glenn, WTKN, 11300 4th St. N., Suite 318, St. Petersburg, FL, 33716. Phone 813-577-7131.

Aphex II Broadcast Aural Exciter. In very good condition, \$700 or best offer. Bill Emanuel, KHYL-FM, 2435 Marconi Ave., Sacramento, CA, 95821. Phone 916-338-2800 Fax 916-974-0802.

Cerwin Vega DB-10 subsonic filter, \$49. UREI 501 subsonic filter, \$49. Lonnie Domnitz, 750 La Playa, Suite 1100, San Francisco, CA, 94121. Phone 415-750-0431.

Orban 8000A in excellent condition, \$1,350. Aphex Studio Dominator, used in air chain 6 months, \$800. Micro FX noise gate, \$100. Rick Pogson, 9139 PA Route 18, Cranesville, PA, 16410. Phone 814-756-3053.

STL, RPU, Remote Controls

Marti RR30/150 dual frequency receiver, \$500. Mark Young, WJON, P.O. Box 220, St. Cloud, MN 56302. Phone 612-251-4422.

Moseley TRC-15 remote control system, \$1,000. Syl Kuling, KFFA, P.O. Box 430, Helna, AR, 72342. Phone 501-338-8861 Fax 501-338-8332.

Moseley MRC1600 remote control. 16 channels of telemetry, control, and status. Excellent condition. Pat Delaney, Quality Audio Broadcast Services, Route 2, Box 106A, LaCrescent, MN, 55947. Phone 507-895-2065.

Marti RPT-2 VHF transmitter, single frequency, with manual, \$375. Marti RPT-15 VHF transmitter, single frequency, with manual, \$450. Steve Knopka, 115 S. Jefferson St., Green Bay, WI, 54301. Phone 414-435-3771.

Gates M-5846 remote control for phone line use. Make offer. Gil Dye, KWNE, P.O. Box 1056, Ukiah, CA, 95482. Phone 707-462-4389 Fax 707-462-4670.

(2) TFT model 7771 composite STL receivers. Contained in separate mainframes and are configured for automatic switchover. Excellent condition, including documentation. Howard Ginsberg, WMEE, 2915 Maples Rd., Fort Wayne, IN, 46816. Phone 219-447-5511 Fax 219-447-7546.

AM Transmitters

CSI model 25,000, 25 kW AM transmitter; tuned to 1200kHz, like new condition; \$30,000, you ship. CSI model T-1000A, 1 kW AM transmitter; tuned to 1480kHz, very good condition; \$7,000, you ship. Sparta model 701, 1 kW AM transmitter; tuned to 1190kHz, very good condition; \$6,000, you ship. RCA model BTA-10U2, 10 kW AM transmitter. Tuned to 1220kHz, very good condition; \$15,000, you ship or trade for console and STL gear. George Arroyo, WONG, 2483 John Young Pkwy., Orlando, FL, 32804. Phone 407-687-9345.

AM Radio transmitter, up to 50 watts, tube type, rack mount, \$300 as-is or \$500 tuned to your frequency (modified). Custom Built 50W carrier current transmitter, adjustable 2-50 watt output with instruction and schematic, \$500. James Cunningham, KEOR, Route 2, Box 113B, Stonewall, OK, 74871. Phone 405-265-4496.

1986 Nautel, 2.5 kW AM transmitter on 1200kHz. Only 10 hours use as a backup. Was \$30,000 new, asking \$20,000. Some spare parts and all manuals. Scot, WDCO, 1227 Del Prado Blvd., Suite 202, Cape Coral, FL, 33990. Phone 813-574-1200 Fax 813-574-6576.

Harris 1kW AM transmitter in great condition. Early 80's vintage, tuned to 1400kHz. \$10,500, you pick up. Located in South Georgia. John Wiggins, WWFN, 1513 Heritage Lane, Florence, SC, 29505. Phone 803-661-6000 Fax 803-661-5995.

Harris MW-50 spare parts. Includes (1) new 4CX-35,000C final and (4) fresh Econco rebuilt drivers. Also includes wide assortment of misc. parts. Was \$13,000 list price, now asking \$8,000. Bob Van Buhler, KNIX, P.O. Box 3174, Tempe, AZ, 85281. Phone 602-921-6311 Fax 602-921-6396.

BE 5kW transmitter, less exciter. Like new, used about 4 years, new tube. You pay shipping and packaging. Griffin Broadcasting, KERV, 301 Junction Highway, Suite 333, Kerrville, TX, 78028. Phone 512-896-1230 Fax 512-792-5555.

FM Transmitters

BE 5kW transmitter, less exciter. Like new, used about 4 years, new tube. You pay shipping and packaging. Griffin Broadcasting, KERV, 301 Junction Highway, Suite 333, Kerrville, TX, 78028. Phone 512-896-1230 Fax 512-792-5555.

B-300 solid state RF amplifier. Broadband 88-108 mHz, full metering and remote control. Maximum output, 300 watts. New combiner available. Chuck Springer, KLMR, P.O. Box 890, Lamar, CO, 81052. Phone 719-336-2206 Fax 719-336-7973.

Rotron Centrimax blower CX33h3G, 230 volts, for CCA or CSI transmitter. Excellent condition, ever used. \$900 plus \$15 UPS charge. Lloyd Spivey, WLLS, Highway 231 S., Hartford, KY, 42347. Phone 502-298-3268 Fax 502-298-9326.

New plate transformer for RCA BTF-5E1 FM transmitter. \$500 and you pay shipping. Jim Ward, WARD, P.O. Box 1550, Pittston, PA, 18640. Phone 717-655-5521 Fax 717-883-0950.

AM/FM Exciters, Stereo & SCA Generators

Motorola C-Quam AM Stereo generator and mod monitor. Original owner and manuals. New cast \$16,000, asking \$10,000 or best offer. Mark Hoskins, KMDN, N. 210 Rainbow Hotel, Great Falls, MT, 59401. Phone 406-761-7600 Fax 406-761-5511.

Marti SCG-10 SCA generator, \$300. Andrew Armstrong, P.O. Box 1122, Windham, ME, 04062. Phone 207-892-6999.

Wilkinson FME-10 exciter on 106.3 mHz. Recently overhauled by factory. It works and sold as-is with manual. \$850, including UPS ground. CCA FM-10D exciter for parts, as-is, \$75 including UPS. Lloyd Spivey, WLLS, Highway 231 S., Hartford, KY, 42347. Phone 502-298-3268 Fax 502-298-6326.

(2) Moseley SCG-3T stereo generators, \$300 each or \$500 for both. Jeff Twilley, WQHQ, 213-219 West Amin St., Salisbury, MD, 21801. Phone 301-742-1923 Fax 301-742-2329.

Dourrough model 80-B stereo generator with manual, \$100. Steve Knopka, 115 S. Jefferson St., Green Bay, WI, 54301. Phone 414-435-3771.

Gates TE-3 solid state FM exciter including external composite interface adapter and 67kHz SCA generator. Good condition, works OK, includes manual. Sparta-680 solid state FM exciter with composite input, in excellent condition, including manual. (2) Modulation Sciences CLD-2501 composite line drivers in separate rack mounts; excellent condition with documentation. (2) Gates 994-6533-001 stereo generator modules for TE-3 exciter, includes documentation. Howard Ginsberg, WMEE, 2915 Maples Rd., Fort Wayne, IN, 46816. Phone 219-447-5511

Test and Monitor Equipment

Jewell AM frequency monitor, antique tube model. Miratel air alert EBS monitor (Old). McMartin TBM-8000 FM modulation monitor. Paul Tinkle, WCMT-AM, P.O. Box 318, Martin, TN, 38237. Phone 901-587-9526.

Hickock digital frequency counter system, model DP-150. Digital readout, printer ports, best offer. Tecktronix 504 Scope in good shape, best offer. Vintage TO-5 Sprague Capacitor analyzer, TELO-MIKE, good shape, best offer. Global Research Labs, 747 Wire Rd., Suite 200, Auburn, AL, 36830. Phone 205-826-0390.

Gorman Relich EBS Encoder/decoder, \$400. Tom Pless, WHVY, 112 Main St., Annapolis, MD, 21401. Phone 301-626-0103 Fax 301-267-7634.

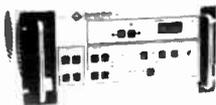
TFT model 760 EBS system with AM receiver module, with manual, \$500. ABC Radio Network 32-pulse controller with manual, \$50. Steve Knopkas, 115 S. Jefferson St., Green Bay, WI, 54301. Phone 414-435-3771.

HP1741A, 100mHz dual trace storage scope, \$888. Paratronics 5000 logic analyzer with pods, \$475. HP8444A tracking generator, \$1,250. HP5341A counter, \$1,200. HP8445B preselector, \$1,100. HP717A variable klystron power supply, \$67. Gary Wachter, KFYI, 631 N. first Ave., Phoenix, AZ, 85003. Phone 602-626-6161.

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Model DRO-333A, 1GHz frequency counter with book, \$250. Model DRO-309 (500 mHz), \$125. Tektronix model 2236 Scope with counter, current calibration, \$1,600. WJ model RD-160 with counter and display to 1 GHz. Michael Murphy, 11621 Valle Vista Rd., Lakeside, CA, 92040. Phone 619-561-2726.

McMartin TBM-2200A FM stereo monitor in good condition; has not been used in years, best offer. McMartin TBM-3700 mono frequency and modulation monitor in good condition, \$695. Al Cannon, WRQR, P.O. Box 1546, Greenville, NC, 27835. Phone 919-830-0944 Fax 919-830-0047.

GR 916-AL antenna impedance bridge and Delta RG-1 RF generator and receiver. Sold as set only, \$1,200 for both. Units very clean and in excellent condition. B&W 410 distortion meters, have several, \$100 each, plus shipping. Gates gain sets, have several, best offer. Walter Johnson, P.O. Box 1055, Lillington, NC, 27546. Phone 919-893-4183.

Gorman Redlich EBS system model CEB with schematic. Richard Mize, KZMK, 3514 Kings Court Way, Sierra Vista, AZ, 85635. Phone 602-458-9631.

McMartin 3000A digital frequency monitor. Good for parts and experimenting (boat anchor?) \$60 plus UPS, with manual. For Sale or Trade HP 200AB audio oscillator and HP 330B distortion meter; \$50 each or will trade for late model Leader distortion meter. Send SASE for additional list. Lloyd Spivey, WLLS, Highway 231 South, Hartford, KY, 42347. Phone 502-298-3268 Fax 502-298-9326.

Biddle Instruments TDR model CME-110-A1 with model CME-111-1 long range pulse amplifier. Comes complete with new 4.5 A/H NiCads, new training and repair manual, quilted carrying case. Very good condition, great operation, AC/DC. Will see through most lightning blocks, coax or twisted. Asking \$1,150. Gary Minker, WIRK, 4763 10th Ave N., Lake Wroth, FL, 33463. Phone 407-965-9211 Fax 407-965-9233.

TFT 886 (AM) EBS system, 1 year old, mint condition, \$1,000. Cris Alexander, KPBC, P.O. Box 561307. Phone 214-445-1700 Fax 214-438-6574.

Heathkit model ID-4530, 10 mHz Scope, \$100. John Houser, WPRZ, 504 Rogers St., Fredericksburg, VA, 22405. Phone 703-371-3581.

GR 1606-A RG bridge in excellent condition. With case and operating manual, \$1,000. Robert Lund, 34 Lorna Dr., Auburn, MA, 01501. Phone 508-832-2611.

Belar AMM-3 AM modulation monitor, \$450. Delta toroid current transformer TCT-1 with 0-20 and 0-40 amp meter, \$350. Dan Glenn, WTKN, 11300 4th St N., Suite 318, St. Petersburg, FL, 33716. Phone 813-577-7131.

(2) Moseley CSA-3 DC amplifier chassis. (1) Moseley MMA-1 modulation monitor adapter. Potomac Instruments RMP-19D (210) digital remote meter panel for "19" series antenna monitors. Potomac Instruments DAP-II digital antenna monitor processing system for automatic logging of antenna monitor directional parameters; includes PTR-II printer. All in good condition, with manuals. Howard Ginsberg, WMEE, 2915 Maples Rd., Fort Wayne, IN, 46816. Phone 219-447-5511 Fax 219-447-7546.

Will trade HP model 206A audio signal generator (needs work) for Crown DC-35 or 50 watt per channel or equivalent audio PA. J.P. Robillard, WYLD-AM/FM, 2228 Gravier St., New Orleans, LA, 70119. Phone 504-826-7745.

Antique Test Gear: HP model 330D distortion analyzer. HP model 206A audio signal generator. \$50
Radio Guide Page-32

each, you pay shipping. Bill McManus, KZJH, 475 N > Cache, Jackson, WY, 83001. Phone 307-733-1770 Fax 307-733-0304.

McMartin TBM-4500 FM stereo modulation monitor in mint condition, just had factory update and calibration. A real buy at great price. 3 meters, all functions for operation and test. you pay shipping. Gates GTM-885 FM modulation monitor.; reads stereo L/R, main, pilot, phase, now in service, with manuals. Paul Mueller, 522 E. Curlew Place, Tarpon Springs, FL, 34689. Phone 813-934-3466.

PA and Sound Equipment

Peavy Pa system with 350W Bi-amp, \$500. Rane MA-6, 6-channel amp, make offer, must sell. \$765. Greg Nemitz, 3909 B Park Rd., Benicia, CA, 94510. Phone 707-746-6970 Fax 707-746-5769.

24-foot, 4-wheel trailer jam box remote studio with PA gear, 4000 watt generator, air conditioning, white and blue, 2 large speaker type box cabinets on each side of the window studio. Original cost \$33,000, make offer. Gilbert Garcia, KVET-FM, 600 Congress Ave., Suite 1270, Austin, TX, 78701. Phone 512-478-6900 Fax 512-477-7789.

Phase Linear 400 watt stereo power amp, \$400. Paul Rebman, WEZY, P.O. Box 827, Lakeland, FL, 33802. Phone 813-982-4191 Fax 813-682-3143.

Crown D60 power amp, \$200. Bogen model C35B power amp, \$100. Harris PX-91 phono pre-amp, \$75. Dan Glenn, WTKN, 11300 4th St N., Suite 318, St. Petersburg, FL, 33716. Phone 813-577-7131.

Celestion HF-50 tweeters (JBL 2405 clone), \$49. Radio Shack Optimus-50 speaker system, 3-way, 12", \$69. TOA A-912A, 120 watt mixer amp, mono, \$369. BES C-60D speaker flat panel, 24"x24"x2", \$75. JBL Foreground "industrial" speaker, 8", 2-way, \$47. JBL MA-15 woofer mounting bracket kit, \$6. Many misc. JBL speakers, all prices. Lonnie Dornitz, 750 La Playa, Suite 1100, San Francisco, CA, 94121. Phone 415-750-0431.

Tubes and Components

Shallco rotary faders. Stereo with cue detent in good working condition. Have the following numbers on them. 320Q-2B3-6, A354, 7920 or 7850. (8) available at \$30 each. Phillip Hess, 134 DerWent Drive, Pittsburgh, PA, 14237. Phone 412-366-1249.

10 kW modulation transformer for 829R's. Filter choke used in 10kW transmitters. Sola constant voltage transformer: Primary 190/380V to 260/520 volts @ 1000VA; Secondary 188V @ 8.46 amps, 236 V @ 4.23 amps. Wire wound resistors, very low to high resistance, large assortment of 200 watt, some 100 watt and 50 watt sizes. Misc transmitting capacitors and vacuum capacitors call for list. R. Elm, WWJC, 1120 E. McCuen St., Duluth, MN, 55808. Phone 218-626-2738.

TV, Video

2) RCA TR-70C video tape recorders, one operational and one for parts, both for \$2,000 or best offer. TV Transmitter, 50 watts ITFS channel 1A, with Andrew dual polarized antenna, used 2 years, \$10,000 or best offer. (2) Sony BVU-200B, 3/4" video cassette tape recorders, both work, \$200 each FOB KOZK-TV, Springfield, MO. Bill Ellis, KOZK-TV, MPO Box 21, Springfield, MO, 65801. Phone 417-865-2100 Fax 417-863-1599.

3) Sony SLHF300 Beta VCR machines, \$150 each. Greg Strickland, WPOW, 20295 NW 2nd Ave., Miami, FL, 33169. Phone 305-653-6796.

Misc. RF Equipment

50W carrier current transmitter, \$500. Navy Tdd-5 transmitter, 50W, used, on your frequency, rack mount, \$350. James Cunningham, KEOR, Route 2, Box 113B, Stonewall, OK, 74871. Phone 405-265-4496.

2-tower phasor for AM directional, excellent condition, includes (2) RF contactors and lots of new fixed and variable inductors, best offer. 5kW resistive dummy load, "Ohmite Brand", good condition, with handle, 7500 watts, best offer. Johnson RF contactor, 17kV, DPDT, new, \$175. Doug Barton, KMTI, P.O. Box K, Manti, Utah, 84642. Phone 801-835-7301 Fax 801-835-2252.

Plate transformer for 3.5 kW FM transformer. 3-phase only. \$325 you ship, \$350 I ship within 200 miles of Binghamton. Kevin Fitzgerald, WKGB, 495 Court St., Binghamton, NY, 13904. Phone 607-723-2925 Fax 607-723-5268.

Electro-Impulse DACT-5KFM RF dummy load in excellent condition. Convection cooled, 1-5/8" EIA flange, \$900 plus shipping. Steve Johnston, WARM-FM, Susquehanna Plaza, RD #4, York, PA, 17406. Phone 717-764-1155.

Classifieds continued on page-34 ...

"Wise Tips"

By Bernie Wise - Energy Onix

This column features a Q&A format that allows you to submit your questions regarding FM transmitters, to Bernie Wise. You may send your questions to Radio Guide or directly to Mr. Wise at 752 Warren St., Hudson, NY, 12534. Phone (518) 828-1690 Fax (518) 828-8476 ... editor

Question:

I have a 3.5kW FM transmitter that has an 8122 RF driver. We have had difficulties in getting a replacement tube and had fair amount of problems with the screen capacitor. We ultimately changed this tube to an 8874, which is a grounded-grid tube, but we find that it is still a problem getting a replacement tube for this driver stage. It's very expensive, and I still don't get very good tube life. I would like to know if it is possible to convert the input stage so that it can be driven from an external RF source, and I can eliminate the driver tube completely.

Answer:

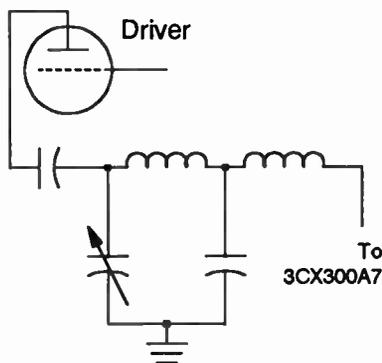
In CCA configurations, you utilize essentially a double Pi network in which the output impedance of the driver is fairly high and the output of the double Pi network is approximately 40-60 ohms which represents the input impedance of the 3CX3000A7.

In order to drive the final stage from a 50-ohm source, the input circuit must be converted to a single "inverted Pi" network. A conventional Pi network cannot work since the first quarter wave is present within the tube structure itself. Thus, the tuning capacitor in the inverted Pi serves to tune out the series inductance and achieves resonance for the inverted Pi, while the input capacitor is used to achieve proper loading. The series capacitor is insulated from the chassis, while the input capacitor rotor is connected directly to ground. a 7-inch length of 10-gauge copper wire is used to connect the PA socket to the the tuning capacitor, and a very low inductance strap is used to connect the loading capacitor to the tuning capacitor.

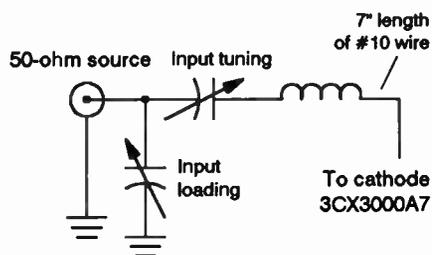
When the appropriate components are installed, the final stage will have facilities to tune and load its input circuit so that it achieves a perfect match to the external RF source. A nominal RF drive of 200 watts would be required to achieve 3.5kW output power.

Energy Onix can supply this conversion kit as well as an independent 300 watt solid state amplifier.

Existing CCA Input Circuit



Suggested Circuit



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1kW	1976	Harris FM1-H3
2.5kW	1978	CCA 2500R
10kW	1990	BE FM10 w/FX-50
10kW	1975	RCA BTF-10ES1
20kW	1975	Collins 831G2
20kW	1973	RCA BTF-20E1
30kW	1981	BE FM-30

AM Transmitters

1kW	1979	Harris MW-1A
1kW	1986	Continental 314R1
1kW	1974	Harris BC1-H1
1kW	1976	RCA BTA-1S
2.5kW	1982	CCA 2500
5kW	1980	McMartin BA5K
5kW	1972	CCA AM5000D
5kW	1977	RCA BTA-5L
10kW	1972	Harris BC10H
10kW	1972	RCA BTA-10U

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We also offer turnkey construction on AM directional and non-directional antenna systems at prices only a fraction of what you'd expect to pay from the big guys. We also can help you locate or sell your used transmitters - or any other broadcast equipment you have. Give us a call.

Joe McClish & Stan White

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Misc. Audio and Telco

Pre-wired rackmountable patch bay (52 I/O) with 8 feet of snake, tie terminated to a phone punch block. Negotiable price and buyer pays shipping. Gina Allen, WGGT-TV, 330 South Greene St., Greensboro, NC, 27401. Phone 919-274-4848 Fax 919-230-1315.

(1) ADC single and (1) ADC double PJ341 jackstrips with rack mount and mats; these have 10-foot numbered wires attached; make offer. (5) xmas tree terminals, make offer. (12) Switchcraft 17QF17, 3-foot patch cords, some are new in boxes, make offer. (2) Panasonic EASA speakerphones, make offer. Bill Spitzer, KKLS, P.O. Box 460, Rapid City, SD, 57701. Phone 605-343-6161 Fax 605-343-9012.

Symetrix TI-101 telephone interface with manuals. Perfect condition, best offer over \$150. R. Robertson, 11012 Mandarin Station DR. W, Jacksonville, FL, 32257. Phone 904-268-4705.

Gentner SPH-4 hybrid. New, \$350. Stuart Engelke, WZZO, 117 Ridge Pike, Lafayette Hill, PA, 19444. Phone 215-828-6965 Fax 215-828-8879.

Misc. Equipment

Misc. audio and RF tech manuals for Sparta Electronics Corp. Call or write for list. Dan Peluso, KJUL-FM, 2880 E. Flamingo Rd., Suite E, Las Vegas, NV, 89121. Phone 702-732-2200 Fax 702-731-1211.

(2) Abco wire cart racks, 500 slots each. (1) Heathkit 4001 weather station, display only, \$50. Phil Wells, KJQY, San Diego, CA. Phone 619-238-1037 Fax 619-238-6157.

Grundig 7030 radio in restorable condition, \$75. Stromberg Carlson radio console, 1940's vintage, restorable, \$25. James Cunningham, KEOR, Route 2, Box 113B, Stonewall, OK, 74871. Phone 405-265-4496.

Laser Compact XT, 640K RAM, 10mHz, 5-1/4 and 3-1/2 drives, clock/ calendar, CGA color monitor, MS-DOS 3.3 and BASIC, all manuals. Like new \$650. Panasonic KXP-1180 printer, \$140 extra. Call Mike Martin, Phone 507-454-2918.

2) Okidata 82A printers. One good and one for parts. \$100 for both. Elvis Moody, KJEM, 216 North Main, Bentonville, AR, 72712. Phone 501-273-9039 Fax 501-273-9030.

Mita copier DC-131 with stand, hardly used, \$1,000. Olympia ES100 typewriter, \$60. Chris Warden, KHQN, P.O. Box 379, Sp. Fork, UT, 84660. Phone 801-798-3559.

Commodore 64 computer with manual, in good condition with very little use, approximately 6 years old, \$50 and buyer pays shipping. Flotrol Lorain 37 ampere rectifier model M37F50, output 56VDC @37A, input 115/230VAC (1-phase) @ 28.3/14 DA, 50-60Hz. Used previously with Okidata Discovery telephone system. Unknown condition. Buyer pays shipping or picks up. Price negotiable. Gina Allen, WGGT-TV, 330 South Greene St., Greensboro, NC, 27401. Phone 919-274-4848 Fax 919-230-1315.

Peter Dahl transformer. Primary 197-240 VAC-CT, single phase. Secondary 8000 VAC-CT, single phase at 2.2 amps. New, \$400 plus shipping. Stuart Engelke, WZZO, 117 Ridge Pike, Lafayette Hill, PA, 19444. Phone 215-828-6965 Fax 215-828-8979.

Modulation Sciences ModMinder

By Eric Small - Modulation Sciences

The Promise:

Modulation Sciences decided to put its money and reputation behind its technical claims. If a station uses a ModMinder and follows some simple rules, MODULATION SCIENCES CERTIFIES THAT STATION WILL NEVER PAY A FINE TO THE FCC FOR OVERMODULATION. If you're following The Program and yet still receive a citation for overmodulation from the FCC, we assume full responsibility for your defense. If we are unable to satisfy the authorities that no overmodulation took place, then we will assume responsibility for any penalties, etc.

No catch, no strings ... and no charges either. The Program is free to all registered ModMinder owners who meet its conditions. Of course, nothing can release you from the responsibilities inherent in your FCC license, but we can promise you legal

modulation levels in total confidence.

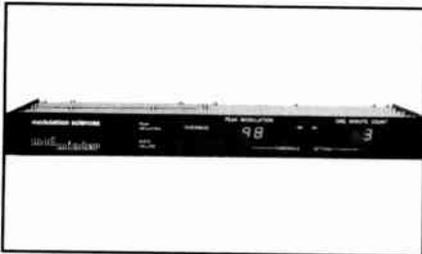
The Program

The rules to qualify for the program are simple. You install, at your transmitter site, a ModMinder (with the internal RF demod option) set to the standard "FCC Mode" peak response time of nine cycles of 10 kHz, along with an inexpensive modem (1200 Baud) attached to your transmitter room telephone. Adjust your air chain so that peak modulation, as indicated on ModMinder, does not exceed the legal limit with ModMinder connected to an RF sample port on the transmitter or transmission line.

We check compliance using ModMinder Remote software at random intervals. If you are overmodulating, we notify you immediately and you have twelve hours to correct the situation. Modulation Assurance costs you absolutely nothing, and remains in effect as long as you meet the Program conditions. The only other requirements is that you return ModMinder to the factory for calibration every 24 months for a nominal charge.

How Can We Do This

We can make this offer because of the unique features of ModMinder. ModMin-



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Modulation Sciences
Somerset, New Jersey
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der is the first digital modulation monitor with all the inherent accuracy and stability that comes with digital circuitry. It has an overall accuracy, from RF input to indicator, of +/- 1.0%. It maintains this accuracy from 32 to 114 degrees F. when we factory calibrate and seal your unit, we certify its accuracy for 24 months. Regardless of what happens to the unit after it leaves our hands, we stand behind the calibration as long as the ModMinder passes its internal diagnostics and its seals are intact.

The final element that makes ModMinder work under Modulation Assurance is its remote control capability. Using a standard 1200 Baud modem, ModMinder can be monitored with full accuracy from across town or around the world using free MSI supplied PC software.

Titus Composite Audio Monitor

By Larry Titus - Titus Technologies

Between the stereo generator and the antenna there was no inexpensive and accurate means to measure the composite audio signal, until now. Titus Technological Laboratories has developed the Composite Audio Monitor to fill this gap.

The Composite Audio Monitor provides a unique method of accurately metering and measuring an FM stereo station's composite signal at several points in the air chain. The signal can be measured prior to broadcast or after the signal has been received. The Composite Audio Monitor has balanced, bridging (and floating) inputs and can be placed in series with a stereo generator or a composite clipper prior to an FM exciter. The Composite Audio Monitor is quite fast, having a response time faster than

3 microseconds and a bandwidth exceeding 500 kHz. The monitor skirts the current battle of being "FCC legal" by providing a truthful look at peaks and overshoots on the composite signal prior to transmission.

The Composite Audio Monitor also provides a semi-demodulated, absolute value scope output of the composite stereo waveform for further precise signal analysis.

Attaching the Monitor to the output of a stereo generator ("looping" the signal through the rear panel BNC connectors) the Composite Audio Monitor can be set to measure the performance of the stereo generator. At this point the Composite Audio Monitor is also measuring the signal input to the STL transmitter. If the Monitor is then brought to the transmitter site and connected to the output of an STL receiver the exact level of the STL receiver can be measured and corrected to be the same as that present on the input to the STL transmitter. Any signal to noise problems on the STL become obvious. Redundant composite audio air chains or STL receivers can easily be matched using this method.

Attaching the Composite Audio Monitor



Fax-Guide Product Information

For more info, on your fax machine immediately, call the Fax-Guide, at (507) 280-4045, and select Code #121

Titus Technological Laboratories
Glastonbury, CT
Phone 203-633-5472

to just prior to the FM exciter, allows the user to very precisely set the clipping level of the composite clipper and perform a final QC on the signal prior to broadcast.

The Composite Audio Monitor is designed to be either a portable or a fixed piece of test equipment. It measures 8-1/2" wide by 1-3/4" deep, and weighs under 4 lbs.

The Composite Audio Monitor provides an engineer with a diagnostic tool much like a DVM (digital volt meter). It presents a graphic and dynamic picture of what the composite audio is doing and assists the engineer in analyzing his composite signal and accurately adjusting it for maximum loudness and competitive edge.

Belar Wizard Modulation Analyzer

By David Hirsch - Belar Laboratories

The Wizard FM Digital Modulation Analyzer is the newest in Belar's line, and represents the next generation of FM modulation monitors. Controlled by a sophisticated microprocessor, the Wizard can tell you just about everything you ever wanted to know about your FM signal. Just a few of the features are:

1. Digital reading of Peak Modulation (in both percent and kHz deviation) with variable hold time from instant to 10 seconds. In addition, the Wizard can display the highest peak since last reset, or blank the display under non-peak conditions.

2. Adjustable Peak Modulation indicator - you decide what you want to call a peak, from 0% to 200% in 0.5% increments.

3. Adjustable Peak-per-minute (PPM) Alarm - you decide at what PPM level you want the alarm triggered, from 1 PPM to 100

PPM, in 1 PPM increments.

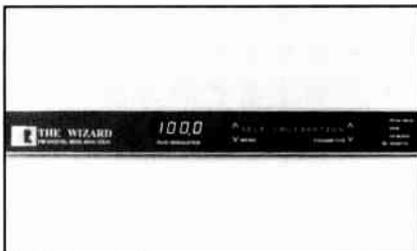
4. Adjustable PPM duration window, from 5mS all the way up to 10 seconds, depending on your preference for peak duration. The longer the window, the fewer peaks the Wizard will count.

5. Eight different peak weighting time constants, from 3 cycles to 45 cycles, plus a weighting-off setting. At a setting of 10, for example, the monitor will ignore peaks of 9 cycles or less (at 10kHz).

6. Actual PPM count, averaged over a 1 minute window.

7. Built-in configurable "Audio Sentry" loss-of-program alarm. Simply set a minimum acceptable modulation (0-100%) and a maximum time (1-60 seconds). When modulation falls below the set threshold for the set time, the alarm will be triggered.

The Wizard will also work with our FMM-2, FMS-2, and SCM-2 series of monitors, displaying Pilot injection, Pilot modulation, SCA injection, and more. To insure the highest quality measurements, the Wizard can accept the composite signal from the FMM-2 or can be ordered with an optional internally-mounted precision demodulator. The Wizard with the internal demod will even re-calibrate itself at the push of a button! The internal demod has the same low



Inovonics Sentinel Monitor

By Jim Wood - Inovonics

The Sentinel is first an all-mode radio receiver. It tunes the "expanded" AM band in NRSC mono and C-Quam Stereo. Dual IF selectivity gives full response to 9kHz or a hard cutoff starting at 4.5kHz. Switchable selectivity for FM allows either a very low distortion figure or improved rejection of adjacent channels. In addition to FM and FMX Stereo reception, there's a tuneable SCA decoder for both analog and digital SCA and RDS Subcarriers. Twenty-four non-volatile station memories may be preset with any intermix of AM and FM frequencies.

The AM/FM/SCA receiver is a modular subsection, allowing The Sentinel to be easily updated to future digital broadcasting standards. A 10-watt-per-channel power amplifier rounds out the receiver and drives

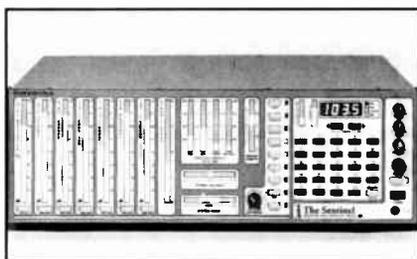
headphones or a modest speaker system. Two balanced line inputs permit A/B testing between direct and off-air signals, and a line-level output can feed a recorder or additional analysis gear.

The "heart" of The Sentinel is the program audio diagnostics section. Parameters of the demodulated audio are displayed on high resolution LED bar-graph readouts and may also be fed to a computer through an optional interface.

Aside from the expected Left, Right, Sum and Difference channel readouts, other measurements show program dynamics and spectral content. A special mono mix is synthesized for some of these measurements; this Quadrature-Derived-Monaural (QDM) signal approximates the way Left and Right program channels combine in a listening environment. (For example, out-of-phase channels do not cancel when listed to in full stereo.)

The Sentinel includes a readout of Dynamic Range calibrated directly in dB. This display is alongside the CBS Loudness Level so that processing may be adjusted while checking for compromises.

The "sound" of a station often reflects a static "house" EQ curve or the effects of multiband processor setup. The Sentinel



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Belar Electronic Laboratory
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distortion (typically <0.003%), high Signal-to-Noise ratio (typically >95dB), and the same separation capability (typically >70dB) as our FMM-2 monitor. The internal demod also has 2 wideband, buffered 75-ohm composite outputs.

With the Wizard software, every function of the Wizard (even re-calibration) can be accessed from anywhere at anytime. Just connect a 2400 Baud modem to the Wizard and to your PC, and dial it up! Besides giving you a picture of the Wizard's front panel on your computer screen, the software enables your PC to log and display in graphical format (even if your computer has no graphics capability) the last 24 hours of peak modulation, which can be saved to disk or even printed for future reference. Now you can know more about the characteristics and quality of your FM signal than ever before.

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Inovonics
Santa Cruz, CA
408-458-0552 - Fax 408-458-0554

features a 4-band graphic display of program spectral content but, unlike conventional real-time analyzers, the displays are calibrated in percentages of total energy.

A unique function of The Sentinel is the visual display of stereo "image." This function not only shows how wide the stereo signal appears to sound, but reveals "hole-in-the-middle" and other mono-compatibility problems. Coupled with this display is a separate readout which averages Left and Right channel energy over an extended period to indicate long-term imbalance between channels.

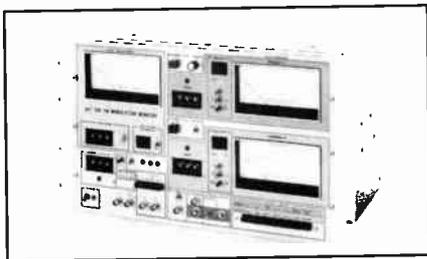
There is also a display of Program Symmetry. Though little attention is currently paid to "absolute phase" and related factors in broadcast audio, the quest for more accurate sound reproduction will doubtless see this parameter more important in the future.

QEI 691 Modulation Monitor

By Bill Howzel - QEI

The QEI 691 is the first and only FCC approved modulation monitor to incorporate such a wide variety of important test functions into a stand-alone modulation monitor. The entire instrument, including power supply, is contained in a 10-1/2" x 12" x 19" rack mountable package. Large switchable auto-ranging meters, adjustable peak flashers, test outputs, clearly labels color coded controls, a built in signal sampler, and many more unique features allow a wide variety of tests to be made.

Absolutely no overshoot in the measurement of any complex modulation waveform and level is assured by the highly accurate quadrature detector input circuitry. Additionally, the 691 monitors and tests off-air or in high RF environments normally found in common transmitter sites, with equal precision and accuracy.



The QEI model 691 is the only modulation monitor/test set with a built in calibrator and field calibration function by a Bessel null. Because the 691 has all necessary circuitry to convert any X-Y input oscilloscope to a spectrum analyzer, engineers can be absolutely sure of the calibration of their test equipment without relying on the unknown of the built in calibration circuitry.

The baseband portion of the QEI 691 contains a **Total Modulation Meter** which is switchable to display either positive or negative modulation peaks. The **Peak Mod** thumbwheel - peak flasher, and **Peaks Per Minute** LED display provide peak modulation indications from the operator setting of 1% to 199% in 1% increments. This portion also contains the **Carrier Frequency** thumbwheel, **RF Level** indications **Power** switch, **Mute** switch, and baseband test outputs. These outputs include the BNC connections to drive the oscilloscope as either a spectrum analyzer or a vectorscope. The vectorscope display can provide a quick check of mono balance. The 691 also contains a signal sample which can handle up to 50 watts of RF. Simply attach a suitable load to the rear panel BNC and connect your "sick" exciter directly to the 691 test set to utilize all of its features for troubleshooting.

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QEI Corporation
Williamstown, NJ
800-334-9154 - Fax 609-629-1751

The stereo and SCA portion contains all the necessary controls, meters, and outputs for these measurements and tests. The two large meters are grouped vertically and are switched together for ease in making the most common stereo measurements. Switching to auto-range operation permits a very rapid check of separation, crosstalk, or noise. Each meter has a separate peak flasher and thumbwheel peak level set switch with a range of 1% to 199% in 1% increments for indicating instantaneous modulation level.

For many years, the QEI model 691 FM Modulation Monitor / Test Set has been providing the most accurate modulation and test information possible to the most conscientious broadcasters.

TFT Model 844A Mod Monitor

By Peter Kalenak - TFT

The TFT Model 844A FM Stereo Modulation Monitor provides FM stations with an accurate system to reach maximum allowable modulation levels, and to do a proof-of-performance measurement of the Stereo Generator, STL, as well as, the FM transmission system.

The Model 844A has an exclusive Peak Modulation Duration Differentiator (PMDD) circuit to distinguish true peak modulations from other peak indications caused by transient overshoot and multipath distortion. True peaks that exceed the pre-set

width between 0.1 and 0.9 msec will trigger the PMDD peak flashers.

It also features a frequency-agile RF preselector, a baseband demodulator, and a stereo demodulator all in one unit. The equipment also performs complete stereo measurements of L+R, L-R, Pilot, 38kHz, L, R, as well as, AM Noise and Multipath indications. Total harmonic distortion is less than 0.1% and signal to noise ratio is better than 80dB.

Two frequency markers are built-in for calibrating the modulation meters and peak flashers. The accuracy and stability of the markers remain stable well within 1% regardless of temperature changes or component aging. This feature eliminates calibration by Bessel Null Method.

The Model 844A was designed to ensure the optimum operation of FM transmitters and to maximize an FM station's modulation levels. It can be



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TFT
Santa Clara, CA
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used for making proof-of-performance measurements of off-air monitoring of FM modulation. It is equipped with two sets of digital frequency tuning switches for easy modulation comparison between stations.

There is also a popular, cost-effective alternative to the Model 844A. The Model 884 Stereo Modulation Monitor also allows for maximum modulation levels. It is ideal for use in the studio or at the transmitter.

Smartcaster Digital Audio

By John Schad - Smarts Broadcast

The SMARTCASTER was introduced in December of 1989 as an offshoot of the SMARTS Broadcast Systems billing, accounting and traffic package. SMARTCASTER has since become predominant in the industry with units in the field approaching the 200 mark.

The SMARTCASTER may be used with satellite services or used as a complete automation system, driving open reel or cassette program sources. It may also do both, slaving to a predominant satellite network, but breaking away from the network for local material. Multiple satellite networks may also be used.



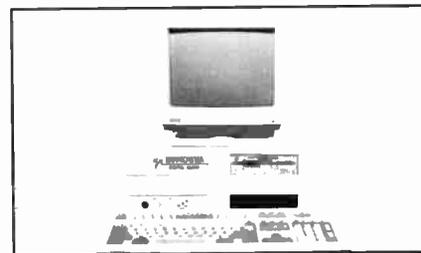
The new SMARTCASTER CD system combines digital audio with 18 disc decks to make an affordable automation alternative for stations that do not subscribe to satellite music. This allows the station to purchase an automation system for overnight programming, or a more complex system to run throughout the entire day.

The SMARTCASTER also interfaces to the SMARTS billing, accounting and traffic system, that handles the business end of broadcasting. This system, in the field for almost 10 years, produces all links to the SMARTCASTER to program an entire day's schedule. The unit may be programmed for a full week in advance. In special applications the unit may be programmed for unlimited walk away time.

SMARTCASTER units are available in many different configurations, from economical 10 kHz mono units to full featured 16 kHz stereo. All SMARTCASTERS may be upgraded in the field

for higher fidelity, stereo, or additional record time.

SMARTS does not charge any fees for software support on the SMARTCASTER, and offers a full year warranty on the hardware.



Broadcast Electronics AudioVAULT

By David Evers - Broadcast Electronics

The AudioVAULT is a new Digital Audio Storage and Retrieval system oriented toward the recording and playback of radio station program material such as commercials, jingles, liners, ID's and promos. It allows up to 4 users to simultaneously and independently access a common inventory of digital audio. For example, a production studio may be recording a new spot into the AudioVAULT at the same time that a live announcer on FM is playing a commercial, an automation system on AM is playing a jingle, and a second studio is auditioning a promo. A modular system architecture allows the matching of storage requirements to actual needs; up to a total of 28 hours of stereo, CD quality audio.



Basic Capabilities

We designed the AudioVAULT with the specific requirements of radio stations in mind. The standard configuration of the AudioVAULT includes the following features:

1. Recording and playback of 16 bit, 44.1 kHz sample rate (CD quality) digital audio with no data compression.
2. Up to 4 simultaneous, independent users accessing the common digital audio inventory. All 4 users may even be playing the same selection at the same time.
3. Up to 28 hours of stereo audio storage (56 hours mono) with standard 600 MB SCSI disk drives. 1 GB drives are currently available, and 2 GB drives are on the horizon to extend this audio capacity even further.
4. Complete Satellite format capability with full-day playlists and automatic announcer ID & Liner changes

How Does It Work?

Think of the AudioVAULT as a "black box" holding all the short duration audio elements in a radio station: commercials, jingles, promos, ID's, etc. A single production studio can record the material into the AudioVAULT, even while up to 3 other

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Smarts Broadcast Systems
Emmetsburg, IA
Phone 800-747-6278

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Broadcast Electronics
Quincy, IL
Phone 217-224-9600

users are simultaneously drawing on previously recorded selections

The basic unit of recording is the cut. Multiple cuts may be grouped together to form a direct equivalent to a tape cartridge with one or more rotating selections

"Carts" may be grouped into stacks. A unique feature of AudioVAULT stacks is that different users may collect stacks that may contain carts from other users stacks; a physical impossibility with tape cartridges without duplicates

Finally, the AudioVAULT allows playlists, or a list of all carts to be played in a given period. Playlists provide the programmability necessary for live assist and satellite programming; and may be generated either within the AudioVAULT software or by external means.

Audisk Digital Audio Storage

By Tim Valley - Macromedia

A well-proven, easy to use system for network or live operations, now enhanced with variable-length audio files, time commands, and many other new abilities. Complete systems from \$13,900.

System Features:

- * Simultaneous recording and playback from a single unit.
- * Multiple systems (up to 255) may be slaved from a single master workstation
- * May be scheduled either manually or automatically from most Traffic & Billing systems
- * 7-day complete walkaway time
- * Very simple, menu-driven system with online help - no experience needed
- * Automatic closed-circuit-feed recording



- * Programmable for multiple background recordings from any sources
- * No hard disk or hardware maintenance required
- * Audio storage available from 3 hours to over 200 hours
- * Hard disks may be mirrored for complete redundancy
- * Digital dubbing feature eliminates multiple analog generations
- * Time synchronized precisely to network time automatically
- * Logs to printer or hard disk
- * 16x16 mono, 8x8 stereo crosspoint switcher included
- * Balanced, professional-level audio on all inputs and outputs
- * Rack-mounted chassis design for complete RFI protection
- * Complete remote access by modem and/or Touch-Tone (option)
- * Mono or stereo recording, software-selectable at any time; mixable
- * Distortion is better than 88 dB
- * Signal to noise, separation and dynamic range are better than 90 dB
- * Public RS-232 protocol allows interface

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Macromedia
Northfield, MN
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2. Real-time commands
3. Serial RS-232 commands
4. Full-size keyboard
5. Programmable direct-access keyboard
6. Other automation systems
7. Mixer "channel-on" buttons
8. Modem and/or Touch-Tones (optional)
9. 25/35 Hz Tone detectors (optional)

Sales, leasing, installation and service available through Harris-Allied Broadcast Equipment (800) 622-0022

Format Sentry System

By Mike Bettellie - Sentry Systems

Format Sentry is a PC-based automation controller now in use in over 200 radio stations. The Format Sentry controller has 12 stereo inputs (expandable to 24) for a variety of audio sources including: CD players, reel-to-reel, DAT's, carts, and now hard-disk record/play.

The Sentry DS-1 hard disk system is fully compatible with existing Format Sentry controller units. It is equipped in its standard form with a color monitor, keyboard and 350 megabyte disk. A number of different playback and storage configurations are available. Storage capacity ranges from 45 minutes in



stereo at 15kHz with no compression - to 8-1/2 hours in stereo at 10kHz in the ADPCM compressed mode (with optional 700 megabyte disk).

Sentry Systems can create a completely digital sound through utilization of their CD playback of music with either the Pioneer PD-M Series six-pack players or the Sony 006 Juke Box 60-disc player. Sentry interfaces with popular PC-based music software systems like Selector and Power Play to automatically load the day's music log into the Sentry PC program.

Loading commercials into the DS-1 hard disk system is as simple as keying in a "cart" number for each audio message and feeding the audio from a console into the hard disk. The system cables to the Format Sentry switcher, where any spot, jingle or announcement can be instantly played back. The system seamlessly plays commercials back to back and offers an overlap of audio when returning to another source.

Format Sentry also interfaces with

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Sentry Systems
Seattle, WA
206-728-8651 - Fax 206-441-6582

PC-based traffic systems to load a day's (or a whole weekend's worth) of traffic logs onto the floppy disk that holds the Sentry Program. Logging can be accomplished by plugging a printer into the IBM or clone PC that controls the system.

Stations will often use the Format Sentry as a live-assist operating system with the PC keyboard acting as the operator's control system for all audio sources. Songs, commercials and all "on-air" events are seen on the PC monitor in the control room.

Format Sentry will have a complete system in the Broadcast Programming booth at the fall NAB Radio Conference in San Francisco.

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Digital Commercial System

From Computer Concepts

The latest innovation in digital technology is to use the computer for storing digital audio. With a computer, it's possible to have a convenient method for storing (recording) and retrieving (playing) audio on a random, instantaneous basis.

There are other benefits to a computer-based digital audio system, too. With proper integration, it can communicate with your traffic system and know what to play when - and then verify successful airplay. It can also be a switching device for stations using a satellite programming service.

The successful use of computer-based digital audio delivery systems has created a whole new set of considerations when making the selection process. We've listed for you the features to consider as you review systems today. They include the following:



1. Recording flexibility. The ability to record in mono or stereo at varying sample rates and storage methods all on the same machine.

2. Multi-cut "carts." The ability to have multiple cuts for each "cart" and the ability to control the rotation of those cuts with ease and flexibility.

3. Simplicity of user interface. Allows station personnel to turn out productive work quickly by the use of help screens which provide step-by-step information.

4. Record and play simultaneously. Simultaneous recording of a full 16 bit 32 kHz sample rate source along with the playing of two stereo 16 bit 32 kHz sample rate playback files on one system with one hard disk drive. This capability is necessary in order to handle the requirements of the satellite formats which send closed circuit information needing to be recorded during certain breaks while the local station is playing commercials which are filling the break.

Digital Commercial System has the net effect of doubling the storage capacity while retaining sound quality. Redundancy. Allows every change to commercials in the production room to be automatically updated to the system in the control room. Each system has its own disk drive set so that

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Computer Concepts
Lenexa, KS

913-541-0900 - Fax 913-541-0169

the failure of either system has virtually no impact on the station's ability to continue to air commercials.

As technology continues to evolve, more and more good quality audio boards will become available. At that point, the thing to look for is the vendor who supplies the software that drives the audio equipment. Look at his track record in software development and support. Find out how much he knows and understands the radio environment. Compare the quality of his product to that of his competitors. Ask the users of his product what they have to say about system performance and how quickly he produces results. Find out how long he's been in business and what his prospects are for staying in business.

These are all important items to consider when installing a digital audio system.

DAWN Digital Audio Workstation

By Kelly Hannig - Gentner Communications

Gentner's DAWN (Digital Audio Workstation Network) system is a digital audio mass storage system that electronically links radio station production rooms, on-air studios, traffic, programming and news departments by using a local area computer network.

The following application example will give you a feel for DAWN's abilities. This example describes current technology available for a paperless and tapeless radio station operation:

Copy is first created on a desktop PC. When the copy is completed, the DAWN system attaches the copy to cart number 102 (the cart the Traffic department has asked Production to create for a client).

A member of the Production department walks into the studio and selects cart

number 102 from the cart wall shown on the DAWN display. DAWN brings up the copy and displays it for the talent to read.

The talent now does a level check using the VU meters shown on the DAWN display, then "rolls tape" and reads the copy. Of course, there's not actually any tape, nor is there a physical cart being used.

This "cart" is now available to all studios which have a DAWN workstation. DAWN can make the same spot available instantly for playback in two or more locations at the same time.

Now it's time for the afternoon show. There is no need for the talent to get a copy of the log, go through it and pull all the carts that are scheduled to play during the afternoon show. Gentner's DAWN system has already downloaded the day's log from the traffic department's computer, displayed the log on screen in the master control room, "pulled" all of the spots needed, and cued the spots in the order shown by the log.

At this point, the talent simply presses the "Start" button at the appropriate time and a complete stopset is played.

When the talent wants to roll a liner that's not written in on the log, there's no problem. She simply presses the button on



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Gentner Communications
Salt Lake City, UT

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the dedicated keypad for the desired liner and it rolls.

After a full day of playing spots, news reports, and music, the DAWN system provides even more support. The billing department can now ask DAWN to generate a report that shows all of the commercials that weren't aired as scheduled. For example, DAWN can create a list of all commercials not run within two minutes, three minutes, etc., of their scheduled times.

Using digital technology, the time we have all been waiting for has finally arrived. Although we've only looked at a few of DAWN's capabilities, you can see that a paperless and tapeless on-air radio studio is now a reality.

The one-two punch for quality remotes.



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Fidelipac CTR-series Cue Tone Fix

By John Caracciolo - WDRE-FM - Westbury, New York

Our Production director said our Fidelipac CTR14 stereo R/P deck machine was not stopping.

After troubleshooting the machine, it seemed like it was not putting down the 1kHz cue tone - the 150Hz and the 8kHz tones seemed to be recording just fine.

After checking the 1kHz oscillator stage and following the path to U14, the quad analog gate, we noticed something weird at U15A (the summing amp). On the scope, it looked like the 1kHz tone was being recorded, but only for a split second. The short 1kHz tone lead us to R90 and C50, which

sets the length of the cue tone. C50 was removed and replaced ... and our cue tone is a cue tone once again.

We spoke to Fidelipac, and they informed us that if your machine is about 2-3 years old, and it looks like no 1kHz cue tone, changed C50 on the Record-Logic PWA.

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By Fred Baumgartner - Indianapolis, Indiana

I asked Ray Tattersfield (of LDL, London) what he thought of America, to which he asked "which America?" He was right; the differences between parts of America can be more than between many countries. SBE chapters are like that too. Some have BBSs, certification classes, and publish newsletters; while others get together for lunch every now-and-again.

The reoccurring conflict in most chapters is whether they are predominately radio or TV, and will a given program draw well from one or both groups? It has always been difficult for me to understand, only because I love "broadcast engineering" and have been lucky enough to bounce between the two in my career.

Most of the professional concerns I have are "broadcast engineering" ones. Working conditions, certification, training, professionalism, frequency coordination, and FCC regulations, are all common ground.

I can think of only one area where there is a difference, and that is technology. Even there, the only difference is the existence or absence of imaging equipment. It is the same COAX, the transmitters often take the same tubes in the same designs made by the same manufacturers, just like the towers, STLs and antennas.

In my radio stations, I dragged a whole bunch of video in, and I never for a minute regret my love of sound and processing in the TV world. I have borrowed studio design ideas, wiring patterns, telephone interfaces, parts sources, and documentation schemes from both Radio and TV stations, and their engineers.

When it comes to knowledge of downlinks, uplinks, noise reduction, auxiliary power, environmental, automatic and remote control, FCC forms, standard practices, traffic interfaces, support communications, dealing with "talent," ownership and broadcast management etc., it seems there is little difference between Radio and TV.

It is a cliché, but also a truth that in any society, the strength comes from both the common ground and the dissimilarity. The SBE is blessed with both.

The actual composition of the SBE is 22.4% AM, 30.5% FM, 33.9% TV, and 13.2% other. If you assume that the "others" are mostly production houses, it's pretty close to 50-50.

In order to make the SBE work, there is the need for "critical mass." All of the good things that the SBE can do get better with size. Instructional programs, publications, legislative efforts, professional efforts, all improve. It would be a shame if the society was only half-strength because, for whatever reason, one chapter of the other felt it was only TV, or Radio.

No professional organization lives up to its potential until its members agree to look at the benefits of the whole instead of reasons for division.

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CRL is proud to introduce our new **Real Time Event Sequencer**. This one rack height unit is a seven day programmable event sequencer. Any combination of eight or one of 255 outputs can be controlled via a rear panel connector. The unit can store up to 200 events. The outputs are selectable either to latch on or provide half or one second contact closures. Programming is done via a simple key pad, and is displayed on a back-lit LCD. Security keylock and battery backup included. To control time more easily, write, FAX, or phone:



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Our **AUTO-SKIM** solves the problem of controlling a cassette or reel skimmer to sample audio. Its on-off cycle is adjustable to provide a flexible range of sampling. The dry contacts permit interfacing to any tape unit on the market. Your PD or GSM will enjoy its easy setup and you'll enjoy its reliability.

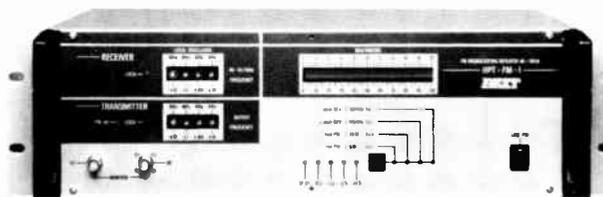
Our **FORMKITS** will save you hours of work. Each kit includes two copies of 22 common forms, from blank patchfield diagrams, to standard operating and maintenance logs, to equipment discrepancy reports. All these forms make your life easier by helping you to organize, document, and track your engineering department, your facility, and your equipment problems and maintenance.

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The workhorse HPT combines the features and flexibility of BEXT receivers and exciters in one compact frame. A common BEXT advantage: its input and output frequencies are programmable in the field. Available with either an FM band input range or STL band input range, the versatile HPT can be fed with an STL or FM signal or with L&R audio channels. FM band output power is continuously variable from zero to 20 watts, so no separate exciter is necessary, and local audio input capability removes the need for an extra modulator card or box. Options include a call sign keyer and a built-in high quality stereo generator for recombining L&R signals from phone lines or from satellites.

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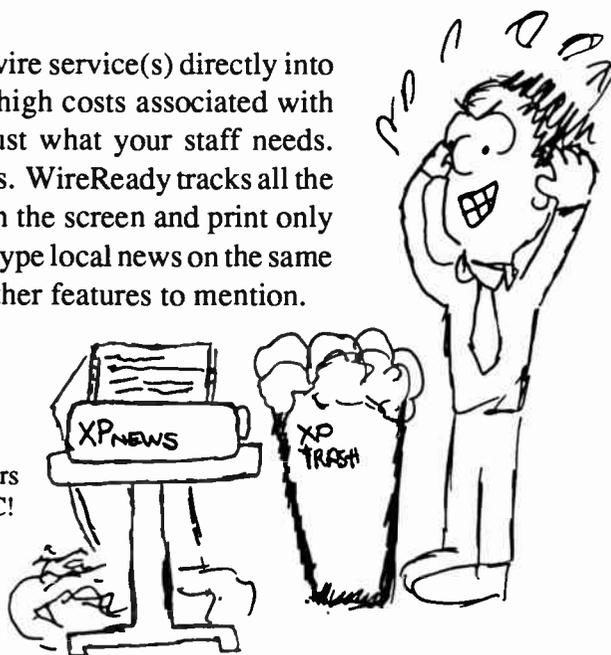
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BBS Listing

Broadcast Oriented BBS Listings

Special thanks to Mark Leff of CNN/Atlanta for the original list.

<u>PHONE #</u>	<u>BOARD NAME</u>	<u>SYSOP</u>	<u>CITY</u>	<u>PROGRAM/SPEED</u>	<u>PURSUIT</u>
201 769-1779	Visions Infoline II	Jeff Morgan	Plainfield, NJ	Wildcat - Speed: 3/12/24	NJNEW
201 857-8880	Rockboard	Adam Curry	Verona, NJ	Hermes (Mac) - Speed: 3/12/2400	NJNEW
203-438-9908	Orion's Nebula	Ward Carpenter	Ridgefield, CT	OPUS - Speed: 1200/2400	
205 859-3030	Traveler	Mike Bennett	Huntsville, AL	Phoenix - Speed: 3-2400	
206 443-6170	W. WA. Freq Coord	Walt Jamison	Seattle, WA	OPUS - Speed: 3/12/24	WASEA
206 566-1155	AmoCat	Rich Langesford	Tacoma, WA	Wildcat - Speed: 3-9600 HST	
209 526-9987	Programmers Retreat	Brad Johnson	Modesto, CA	Custom - Speed: 2400 N81	
212 415-3500	HyperCube Systems	Mike Oswald	New York, NY	PCBoard - Speed: 3/12/24	NYNYO
212 645-8673	Communication Specialties	Rich Brooks	New York, NY	Searchlight - Speed: 12-9600HST	NYNYO
214 647-0670	DFW Freq Coord Counc	Darryl Doss	Allen, TX	OPUS - Speed: 3-96 HST	TXDAL
215 364-3324	Satalink	Ron Brandt	Huntingdon Vly, PA	PCBoard - Speed: 12/24/9600	
216 529-0121	Signal BBS	Lynn Laymon	Rocky River, OH	PCBoard - Speed: 3/12/2400	OHCLE
219 256-2255	Radio Daze AM & FM BBS	Mike Shannon	Mishawaka, IN	Wildcat 2.55N - Speed: 300-14.4	
301 725-1072	FCC Public Access	Bob Weber	Suburban DC, MD	Custom - Speed: 300/1200	DCWAS
303-341-0129	Colorado Broadcast(CBFCC)	Jeff Brothers	Aurora, CO	OPUS - Speed: 2400 Baud	
303-949-3253	Master Control	Lynn Osburn	Avon, CO	OPUS - Speed: 300-9600v.42	
305-828-7909	Telcom Central	Ray Vaughn	Miami Lakes, FL	OPUS - Speed: 300/1200/2400/9600HST	
315 474-5070	SBE Chapter 22	Steve Hines	Syracuse, NY	RBBS - Speed: 3/12/2400	
317 935-0531	Harris-Allied Bulletin Board	Bob Groome	Richmond, IN	Michtron - Speed: 3/12/2400	
402 289-2515	KFMQ 102 Connection	Dan ?	Lincoln, NE	WWIV - Speed: 1200/2400	
404 320-6202	AV-Sync Atlanta (tm)	Bill Tullis	Atlanta, GA	PCBoard - Speed: 12-9600HST	GAATL
404 982-0960	Rock & Roll Atlanta	Bob Helbush	Atlanta, GA	PCBoard - Speed: 1200-2400	GAATL
407 239-2607	Producer's Circle	Skeeter Durham	Orlando, FL	GT Power - Speed: 3/12/2400	
407 649-9834	Electronic Arts Info	Jeff Alwin	Orlando, FL	QuickBBS - Speed: 3/12/24	
408 985-8675	KOME Silent Side	Greg Argendeli	San Jose, CA	Michtron(Atari) - Speed: 300/1200	CASJO
412 981-3151	Mabel's Mansion	Charles Ring	Sharon, PA	OPUS - Speed: 12-9600HST	
414 873-7807	Second Opinion	Terrance Baun	Milwaukee, WI	Wildcat - Speed: 14.4 HST	WIMIL
415 391-2657	NCFCC	Tim Pozar	San Francisco, CA	RBBS - Speed: 3-2400	CASFA
415 571-6160	Production World	Wes Dorman	San Mateo, CA	Red Ryder Host - Speed: 3/12/24	CAPAL
415 641-4373	Information Radio	Dave Evans	San Francisco, CA	Wildcat - Speed: 3-2400 v42	CASFA
419 228-7236	Black Hole BBS	Fred Vobbe	Lima, OH	TBBS 2.1 Multiline (8 Lines) - Speed: 3-14.4	
501 753-6536	N.L.R.-80	James Padgett	Little Rock, AR	Spitfire - Speed: 12-2400	
518 283-4067	Northeast Networks	John Nelsen	Albany, NY	PCBoard - Speed: 12/24	
601 373-0160	Net-Works	Herb Jolly	Jackson, MS	Galacticomm - Speed: 1/24	
602 438-0459	CRL	Hank Langlinais	Phoenix, AZ	Wildcat - Speed: 12-2400	AZPHO
602 482-1001	Catalyst	David Kidder	Phoenix, AZ	TBBS - Speed: 3/12/24	AZPHO
602 872-9148	Broadcasters BBS	Mark Shander	Phoenix, AZ	RemoteAccess - Speed: 3/12/2400	AZPHO

BBS Listing

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Continued

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608 274-7776	Communications Exchange	David Willow	Madison, WI	GT Power - Speed: 12-9600HST	
614-766-2162	Radio Link	Steve Craver	Columbus, OH	Quick BBS - Speed: 300-2400	
616 530-0821	Trillion	Dick Castanie	Grand Rapids, MI	Wildcat - Speed: 3/12/24	
617 439-5699	Boston CitiNet	JAE/Koch	Boston, MA	Yellow - Speed: 300/1200	MABOS
619-268-9625	Radio-Active BBS	Steve Asaro	San Diego, CA	WW4 - Speed: 300/1200/2400	
619 298-4027	So. Calif. MediaLine	Steve Tom	La Jolla, CA	PCBoard - Speed: 12/24/96H	CASDI
703 455-1873	VideoPro	Tom Hackett	Burke, VA	PCBoard - Speed: 3/12/24	DCWAS
703 538-6540	East Coast Pub Net	Charlen Kyle	Suburban DC, VA	PCBoard - Speed: 3-2400	DCWAS
707 553-8452	KDA Message System	Keith Davidson	Vallejo, CA	PICS - Speed: 3-2400	
713 997-7575	Ed Hopper's	Ed Hopper	Houston, TX	PCBoard - Speed: 3/12/24	TXHOU
713 855-4382	Cloud Nine	David Armstrong	Houston, TX	PCBoard - Speed: 3-96HST	TXHOU
713 284-1090	SBE Chapter 105	Frank Rainey	Houston, TX	PCBoard - Speed: 3-12-2400	TXHOU
717 731-8966	Cat's Castle	Dale Fedorchik	Harrisburg, PA	Wildcat - Speed: 3/12/2400	
719 634-5661	ColoSprgs Broadcast	John Anderson	ColoSprings, CO	TBBS - Speed: 3/12/2400	
800-766-1720	Idiot Box BBS	Michael White	Hemet, California	RBBS - Speed: 1200/2400	
800-283-5313	The Spin-Off BBS	Michael White	Hemet, California	RBBS - Speed: 1200/2400	
801 266-2426	Planet Vulcan	Chuck Condron	Salt Lake City, UT	Paragon - Speed: 3-14.2KHST	UTSLC
804 393-6390	Tidewater Media Link	George Randell	Portsmouth, VA	PCBoard - Speed: 12/2400	
804 550-3338	Flamethrower	Jeff Loughridge	Richmond, VA	Binkley/OPUS - Speed: 3/12/24	
804 973-8235	Broadcasters BBS	Pat Wilson	Charlottesville, VA	PCBoard 12 - Speed: 3/12/24	
806 352-2482	Radio Online	Ron Chase	Amarillo, TX	PCBoard - Speed: 12-96HST	
813 527-5666	St Pete Pgm Exchange	Bill Blomgren	St Petersburg, FL	PCBoard - Speed: 12-96HST	
818 248-3088	Hot Tips	Mike Callaghan	Glendale, CA	Wildcat - Speed: 1200/2400	CAGLE
818 363-3192	Call Sheet	Wayne Parsons	Los Angeles, CA	TBBS - Speed: 300/1200	CAGLE
818 567-6564	Hotline	Jon Badeaux	Glendale, CA	PCBoard - Speed: 12-19.2HST	CAGLE
916 338-5227	KBBS	Mark Stennett	Sacramento, CA	QBBS - Speed: 3/12/24	CASAC
916 646-3600	FM102	Les Tracy	Sacramento, CA	QuickBBS - Speed: 300/1200	CASAC
916 646-9358	Scratching Post	Stacy Rothwell	Sacramento, CA	QuickBBS - Speed: 3/12/24	CASAC
916 728-5700	Entertain-Net	Les Tracy	Citrus Heights, CA	TBBS multiline - Speed: 3/12/24	CASAC
918 437-9004	The Radio BBS	Clark Dixon	Tulsa, OK	QuickBBS - Speed: 2400	
919 481-2947	Recording Studio	Greg Nowak	Cary, NC	WWIV - Speed: 3/12/24	NCRTPT

If your BBS is not listed here - it should be. Call Radio Guide at (507) 280-9668 and let us know about it.

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