Radio Guide

Radio's Technology Forum

August 1995

Yes Operator, I'm Still Holding

A couple of issues ago, I told you that we'd be getting a toll-free number for our **Radio Guide** BBS system. Well . . . we're still waiting. Apparently there's a perpetual, nationwide 800 number shortage going on. According to the phone company, it could be up to 60 days. We'll let you know . . .

I thought it would be nice to pick an easy-to-remember number while I was at it. However, it seems as though *any* number with *any* translation to *any* user-friendly alphabetical rendering has already been taken. More than that, it seems as though large blocks of 800 numbers have been reserved for other "services."

I have this bizarre feeling that there are large "underground" companies buying up every worthwhile 800 number they can lay their hands on, just to be able to sell them at a large premium later on.

However, I may take pot luck with the 800 number, since I've always felt a certain irritation when cute alpha characters are given out instead of the actual numbers. My mind sort of goes into low gear, when dialing, with lips moving slowly . . . 1-800-NOBRAIN. Now if only they would develop a 36 button phone "dial." Hmmm . . . let's see, I'll just take this cell-phone, and . . .

You Can Always Get What You Want

Check out the back page of this issue, where you'll find our new "WANTED" form. If you need a part, a schematic, an answer to a problem, or even a strange, seemingly obsolete piece of equipment, tell us about it. We'll publish your request in the next issue of **Radio Guide**. This service is free of charge to all **Radio Guide** subscribers, so use it as much as you need to.

Ray Topp (publisher)

Here's How to Reach Us . . .

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Radio Guide

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The Radio Forum

By Ray Topp — Editor/Publisher

It's Nice to Know . . .

Internet Service From Audio Broadcast Group

ABG (Audio Broadcast Group) has announced the addition of an Internet World Wide Web (WWW) site. Customers can now access product information and pictures via the Internet. They now have a full-color, interactive product catalog available on the "net. "

ABG's Web site address: www.abg.com

Their other on-line addresses are:
Applelink: ABG
Compuserve: 75371,144
Internet: support@abg.com

Free Broadcast Newsletter From Eimac

If you would like to be placed on their **Eimac Broadcast Newsletter** mailing list, fax your name, company, address, and phone number to:

EIMAC — Attention: Seymour Paul
Fax 415-592-9988

Your Transmitter's Fallen and Can't Get Up?

Would you like to be able to reset your transmitter site breakers via remote control? Bill Wolf has the answer.

He has developed a device that will allow you to remotely reset a breaker after a trip caused by a phase drop, surge/spike — whatever. They come in many current ranges (adjustable), from 3.5 amps, all the way to 540 amps @ 600 volts, 3-phase.

No heaters are used in these devices, eliminating the usual fade or false trips experienced over time. These are magno-contactors, and do not generate destructive heat failures.

You can call Bill, in Oklahoma City, at **800-942-5430**.

I'll be looking for more useful information and products for next month's column. Check it out . . . Ray Topp

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Phone Line Basics

Joe Klinger — JK Audio, Sandwich, Illinois [815-786-2929]

Every engineer has had to deal with telephone lines at one time or another. If the application is back at the studio, you can take your time and make some calls to determine the right equipment, and the correct phone line configuration to order. Out on the road, it's a different story. Many offices are installing low-cost PBX (Private Branch Exchange) systems, which allow several telephones to be connected to two or three telephone lines. A PBX consists of a switch box and punch block located somewhere in the building, where the lines come in. The PBX telephones are connected point-to-point back to the PBX switch box. The wiring is typically 4 to 8 wires, in a standard RJ-11 or RJ-45 modular jack.

However, these are *not* standard telephone lines! Even a simple analog PBX line does not look like a standard phone line. On a PBX, two wires are often used as control lines which send key-press information to the PBX, and ringer and LED data to the phone. This control information is required to set up or answer a call. Luckily, most PBX installations still provide an outside line for use with fax machines and modems. The term "outside line" refers to a direct connection to the telephone line *outside* of the building, while the terms "outside line," "analog line," or "POTS line (Plain Old Telephone Service)," all refer to a standard residence type phone line.

The POTS line, open circuit, should measure around 48 volts DC. This drops down to the 3 to 9 volt range when a telephone on the line goes off-hook. A telephone typically draws about 20 milliamps of DC current to operate, at a DC resistance of around 180 ohms. The remaining voltage drop occurs back at the phone company, where there is usually 200 to 400 ohms of series resistance to protect from short circuits, and from the resistance of several thousand feet of copper wire underground and on utility poles.

To ring your telephone, the phone company applies a 90 volts RMS, 20 Hz AC signal to the line. Even with a thousand ohms of resistance, this still can deliver a bit of a shock, so be careful when you are probing around working on a POTS line.

Questions about bandwidth, signal to noise, signal levels, and two-wire to four-wire hybrids, are common, so let's look at those four characteristics.

POTS LINE CHARACTERISTICS

Bandwidth: 180 Hz to 3.2 KHz

The low end is rolled off early to stay away from the 60 Hz region. Also, telcom transformers would be more bulky (and expensive) if they had to carry signals down to, say 20 Hz. The high end cut-off is more critical. Voice on the telephone network is digitized at a 8 KHz sampling rate, which means that any signal above 4 KHz will be aliased back as noise in the voice band. Most CODECS roll off at about -25 dB at 4 KHz, with a -3 dB down point at around 3.2 KHz. The phone company decided years ago that the 180 Hz to 3.2 KHz range would be sufficient for speech intelligibility, while allowing them to multiplex many calls over coax and twisted pairs.

Signal to Noise: Approximately 45 dB

This is not as easy to quantify because noise comes in many forms. There can be line noise or hiss from the many amplifier stages in a voice path, as well as speech-correlated noise from non-linear speech digitizing or compression methods; even crosstalk from other conversations, etc. But the bottom line is that you can never count on more than 45 dB of signal to noise ratio.

Signal Level: -9 dBm average speech (at tip/ring)

Speech peaks out to +4 dBm are common but will start to clip. The FCC requires that all telephone audio interconnect equipment limit speech to -9 dBm, averaged over 3 seconds. Consult FCC Part 68 requirement for all the details.

Hybrids:

The voice on a tip/ring pair is full duplex balanced audio, which requires a two-wire to four-wire hybrid circuit or transformer to convert it into separate transmit and receive audio paths. Bulky and expensive hybrid transformers have been replaced in most telephone by IC's. Whether it is a transformer or IC, the hybrid must also provide 1500 volt isolation and surge suppression from lightning strikes.

In a telephone, the biggest contributor to poor quality is the handset microphone. Keep in mind that this microphone element is designed to survive years of close proximity spitting and shouting, as well as the occasional drop to the floor. In other words, it is designed for rugged use and low cost, and the result is an element that has considerable distortion, a jagged response curve, and substantial dynamic compression.

Strangely enough, fax machines and modems will keep analog lines available even in buildings with ISDN and digital PBX's. In addition, data transmission is less tolerant of compression algorithms, line noise, and distortion, so the phone company must keep this is mind when considering further "squishing" of voice channels or loosening of transmission tolerances.

Polarity Matters

Nick Kratz — Independent Broadcast Engineer, Albany, California [Nick_Kratz@bmug.org]

In this age of advanced technology (or at least so it seems to most of us at the present), many of us assume mundane factors such as polarity have long ago been standardized, or found to be universally inconsequential. Well, I'm here to testify that it ain't so.

Absolute Polarity (or phase) and the Freeman Effect

Does polarity matter? If, at an instant of time, the sound wave at the microphone is pushing in on the diaphragm, is it essential to accurate reproduction that the transducer at the other end also push? Or may it suck at that instant?

Although often taken as a given by individuals who find sonic nirvana by marking up CD's with green pens, freezing them, using vinyl whenever possible, and preferring almost any tube equipment to almost anything solid-state, some "more mainstream" authorities, such as acoustic consultant Chips Davis and recording studio maven Stephen St. Croix ("Sooner Or Later," MIX magazine, May 1991, p.19) maintain the same conclusion of the relevance of polarity. Mr. St. Croix goes as far as to say, "It *does* matter — always, under all conditions, except for really useless recordings."

Despite this admonition, critical listening at several of Mr. Davis' SBE presentations, and other attempts from time to time, this writer cannot claim to hear "absolute phase" differences on reproduced music, at this point {*see footnote 1*}. However, absolute polarity when listening to one's own voice "live" over headphones is as easily audible as one speaker of a stereo pair being flipped 180° in phase, and can be at least as annoying!

Enter Freeman

How is listening to one's own voice, as one is speaking, different from hearing a reproduction? Bone conduction, as pointed out by KIIS C.E. Michael Callaghan in his excellent article "The Freeman Effect" (**Radio World** 1 April 1987, p. 12. There have been at least two follow-up letters to the editor in **RW** over the last several years). Quick summary: one's voice via bone conduction is (by definition) "in phase" (non-inverting), so if a simultaneously audible electronic signal path is present, an overall polarity inversion in this electronic path produces a <u>relative</u> phase difference centered around 180° (ignoring goofy phase shifters) between the electronic {*see footnote 2*} and bone-conduction paths. This, as usual, introduces all the concomitant comb filtering and other "exciting" phase effects one usually gets under these circumstances. The solution? Flip the polarity somewhere in electronicsland to ensure no overall polarity inversion.

If you haven't yet personally experienced this phenomenon, don't take anyone's word for it. Set up the cleanest, most accurate mic-to-headphone chain easily available. If there isn't already some piece of equipment in the chain which switches polarity (a mic preamp or, oh say, an Auditronics A-210 console, whose headphone E.Q. In/Out switch also switches polarity {*see footnote 3*}), all the trade press articles on the Freeman Effect I've seen to date recommend changing the wiring or installing a switch at the mic end of the chain, since the signal here is balanced, and headphones almost never are. Set levels, and speak as an announcer normally would, then flip the polarity and repeat.

Expect to hear yourself in "good tone" in one position (non-inverting), and some combination of nasalness, "head stuffiness," "phasey" effects, and level drop in the other position (inverting). Audibility depends heavily upon headphone and mic quality: the more accurate the transducers, the easier it is to hear the difference. I found it quite difficult to decide which position was "correct" or "better" with cheap headphones and/or microphone in terms of sound quality. But no matter how poor the accuracy of reproduction, I was always able to find level nulls, with the electronics inverted (where my voice would sound as though it had dropped to nothing in the headphones), by moving my head-to-mic distance, but could produce no such nulls with non-inverting electronics.

So just wire the mics so they sound good, or put in a DPDT switch . . . simple, right? Well . . .

Are There No Standards? The Tin Can Analogy

If one takes it as a given that absolute polarity needs to be maintained from microphone to listener {*footnote 4*} in order to stay competitive, soundwise, at the Turn of the Millennium, flipping polarity at the mic (especially with a switch), or anywhere in line to the transmitter, rapidly loses desirability. Such gymnastics would be better reserved for the headphone path, yet it is often more difficult to flip at this end, esp. without adding a whole inverting gain stage. Are there not standards promulgated to relieve a dilemma such as this?

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Polarity Matters

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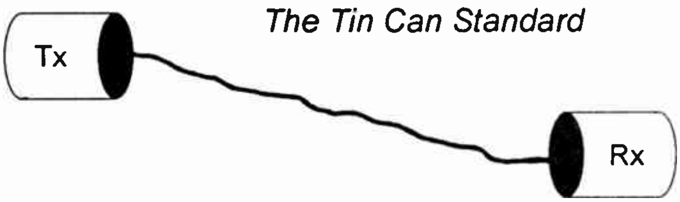
As a starting point, let us revisit a well-known, early standard audio system:



In this system, as normally utilized, a pressure wave (positive sound pressure) impinging upon the bottom of the "sending" can pushes this diaphragm inward, slackening tension on the string. The reduction in tension allows the "receiving" can diaphragm to push out, reproducing the original pressure wave. If one defines positive string polarity as a slackening of string tension originating at the sending end as non-inverting, then the overall tin can setup is non-inverting, and reproduces a pressure wave at the receiver when one hits the transmitter, just as though the listener weren't using a transmission system. Nicely intuitive and straightforward.

Do existing electroacoustic and electronic standards conform? Let's start at the microphone. Quoting Glen Ballou's presentation of EIA-221-A (formerly RS-221-A) in the Handbook For Sound Engineers — The New Audio Cyclopedia (section 13.15.3, p. 383-384), "The positive or in-phase terminal is that terminal that has a positive potential and a phase angle less than 90 degrees with respect to a positive sound pressure at the front of the diaphragm." Wiring all XLR or other connectors consistently (hopefully all XLRs pin 2 hi, pursuant to AES-14 1992, EIA-297, et al.), will thus present a positive potential to the mic preamp. So far, so good.

Though I could unearth no standards for polarity in amplifier stages, the overwhelming majority of professional broadcast and recent high-quality home audio amplification equipment measured, maintains non-inversion from input to output, at a minimum along the primary signal path (tape decks and such are more dicey). Non-inversion at each stage is intuitively appealing in that any number of stages may be used with no change in system polarity. Let us assume for the sake of this discussion that the overall electronic path to the monitor speaker terminals and headphone jack is consistently non-inverting, and that this is proper and desirable, especially since this definition would correspond with the "Tin Can Standard."

Though I have yet to run across a standard to this effect, every loudspeaker driver I have measured, equipped with a factory terminal polarity indication, produces a pressure wave when fed with a positive potential, in theory re-creating the pressure wave which originally impinged upon the microphone diaphragm — once again, Tin Can compliant! One would expect to find the same with headphones.

"Steeveee! My Head's Out Of Phase! "

So I proclaimed to Steve Hawes, KALX Chief Engineer, in early August 1994. We had just finished installing a new Auditronics A-210 console in the Production Studio, and I was performing final function checks. Having been diligent about maintaining correct wiring polarity (including all XLRs' pin 2 hi) throughout the room, I was amazed to hear my voice clearly "messed up" in my AKG, K-240 headphones, speaking over the Sennheiser MD-421U mic. Similar precautions had been undertaken in the Air Studio during its re-wiring in 1989, yet with the same model mic, and the same pair of headphones, there was no problem in that studio.

Just as I was about to decimate the integrity of the XLR on the MD-421U, based upon mouth popping test indications of pin 3 hi, Steve handed me a most interesting box, containing a 45 ohm intercom speaker with foam stuffed between the frame and the rear of the cone, a 9V battery, a 1000 uF 20V electrolytic capacitor, SPDT lever switch, and BNC connector. Using this Cosky Phaser (details to come in Sep-95 **Radio Guide**), I was able to more accurately test the 421, and found it did indeed already conform to the pin 2 hi standard. The rest of the system from mic pins to headphone jack clearly measured non-inverting (headphone E.Q. Out). My K-240s had been a reliable reference for over a decade. I was stumped, and was beginning to think maybe bone conduction <u>could</u> be inverting!

Things Are Not Always As They Seem

Further investigation revealed the answers: the Air studio mic cables were wired pin 3 hi, and the K-240s produced rarefaction with a positive potential applied (in other words they sucked when they should have been blowing) — definitely *not* Tin Can compliant. Was this a common headphone standard?

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Polarity Matters

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Measurements of 14 pairs of headphones, representing seven manufacturers, and all quality levels from recording studio mainstay to painful, revealed the majority push air with positive excitation (though two manufacturers preferred their products inhale with positive excitation). Sigh.

Ever fascinated, I surveyed a representative cross-section of manufacturers of headphones commonly found in broadcast and recording studios. Representatives of Koss, beyerdynamic, and Stax report no knowledge of a promulgated standard, but all their products (with the exception of an older Stax model) are claimed to comply with the pressure wave upon positive excitation "tin can" standard, which is each of these firms' internal working standard. Uwe Sattle, Technical Manager at Sennheiser recalls an AES or IEC standard to the effect of outward reproducer diaphragm motion with positive excitation, and notes that Sennheiser headphones conform to this. Most commendable perseverance on the part of Gary Henderson in the Sony Pro Audio division (thanks, Gary!) finally provided an answer from Sony's Sustaining Engineering Group in Japan: all Sony Headphone and speaker diaphragms move toward the user's ear when excited by a positive-going waveform ("tin can" standard). David Rohn of Harman/JBL Professional, representing AKG products, reports that AKG headphones are consistently wired to rarefy the air when positive excitation is applied, and that the Austrian parent company explains that this is part of their design philosophy.

Indeed, of the four pairs of headphones which rarefy when positively excited (inverted polarity per the tin can standard), three were AKG (very recent K-240M, 1982 K-240, 1983 K-340). The fourth was a pair of Telex 610-2 monophonic "language lab" headphones.

Is There A Headphone Polarity Standard?

After having spent most of the first half of 1995 in hot pursuit, what to my wondering eyes should appear, but EIA RS-331 (December 1966), which proudly proclaims (in part) "The following polarization is standard: The individual phones shall be polarized so that diaphragms move toward the listener's ear when a positive potential is applied to tip or ring, with negative return to the barrel" [sleeve]. It's intuitive, and matches the "Tin Can Standard." Seemingly, RS-331 has been lost to the ages, at least in the eyes of some headphone manufacturers. Then again, it proudly proclaims Tip=right and Ring=left, which was blown away by the Japanese/European(?) de facto (EIAJ?) Tip=left, Ring=right standard in the early '70's. (*Everyone* has agreed on this since about 1973, best I can tell. If you still use older American equipment wired to RS-331, you may wish to verify channel assignment.)

On the subject of polarity standards, SMPTE Recommended Practice RP 134-1994, Polarity for Analog Audio Magnetic Recording and Reproduction, has tons of useful tidbits for keeping polarity straight from mic to speaker. Besides re-confirming the Tin Can Standard for mic and speaker and XLR pin 2 hi, it defines a "positive magnetization is the same direction of magnetic flux flow as that observed in a bar magnet where the flux flows out of the north pole and into the south pole," and that this positive flux should be in the direction of physical movement of the magnetic medium. Best of all, it describes an easy way to measure this with a half-wave rectified sine wave (or other asymmetrical signal) and a piece of wire!

So Where Does This Leave Us?

Again, assuming one abides by keeping pressure waves non-inverted at least as far as the tower (or the recording medium du jour), the fundamental choices are: 1. Ensure all the facility's headphones are consistent in polarity (hopefully RS-331 compliant), and that all headphone signal handling is complementary (preferably non-inverting), or 2. Install headphone polarity inversion and switching circuitry (if none exists) and teach everyone what it is, and how to use it.

I personally feel this is no tempest in a teapot, but has everything to do with getting the best from your talent. Having worked closely for 15 years with many individuals hearing themselves electronically for the first time, and based upon my own early D.J./production experiences, let me assure you that self-esteem in regards to the sound of one's voice is critical, not only to the immediate performance, but to the decision to even pursue this line of endeavor in the first place. I feel it is especially critical for any broadcast/recording organization which considers itself a training facility for our future generations to expend the effort to maintain correct polarity from every mic to every headphone, and hereby encourage adoption of the polarization standard in RS-331 (same as Tin Can standard) by all equipment manufacturers and users.

Anyone having information on additional polarity standards, comments, criticisms, questions should e-mail the author at Sonic_Pure@aol.com or Nick_Kratz@bmug.org

FOOTNOTES

1. I believe it's important, and run my life accordingly, but still haven't heard it.
2. Actually electronic/electroacoustic
3. In = inverted. There by design, or by accident??
4. Don't gripe too heavily about polarity standards at the listening end. 13 years of home audio repair & testing revealed only one or two post-1975 tuners or receivers whose tuner sections differed in polarity from an arbitrary bench reference unit. Almost no power/integrated amps invert.

A Simple, Cheap Little Audio Amplifier

Frank Berry — St. Petersburg, Florida [813-577-0041]

For years, I have experimented with various circuits in search of "cheap, clean power." My latest circuit utilizes 1/2 of a 1458 (5532) opamp, driving one PNP Darlington output transistor and one NPN Darlington output transistor. The two output devices are connected in a base-driven common emitter arrangement. When powered by +/- 15 volts, the amplifier can easily deliver in excess of ten watts into 8 ohms. The amplifier sounds great

How Does It Work?

The amplifier should be powered by a bi-polar +/- 15 volt supply. The supply need not be regulated, but it should be able to deliver a couple of amps of current. Large filter caps (10,000 mFd) will improve the low frequency power-delivering ability of the amplifier.

The use of Darlington output transistors simplifies the overall amplifier design, by incorporating the driver and output transistor in a single package. With a gain of 1000, the TIP-112 and TIP-117 transistors can produce relatively large amounts of output power when driven by a simple little opamp.

Let's discuss the amplifier stage by stage. The 10K input pot serves two purposes. Obviously, it gives you control of the amplifier's gain. It also serves as a ground return path for the non-inverting (+) input of the opamp. The opamp operates with 10 dB of gain. The gain is determined by the 100K inverse feedback resistor and also the 10K shunt resistor from the inverting (-) input of the opamp and common ground. The output of the opamp feeds the center (zero voltage) point of a voltage divider resistor string. This voltage divider couples the output of the opamp to the bases of the Darlington output transistors as well as providing operating bias voltages for the transistors.

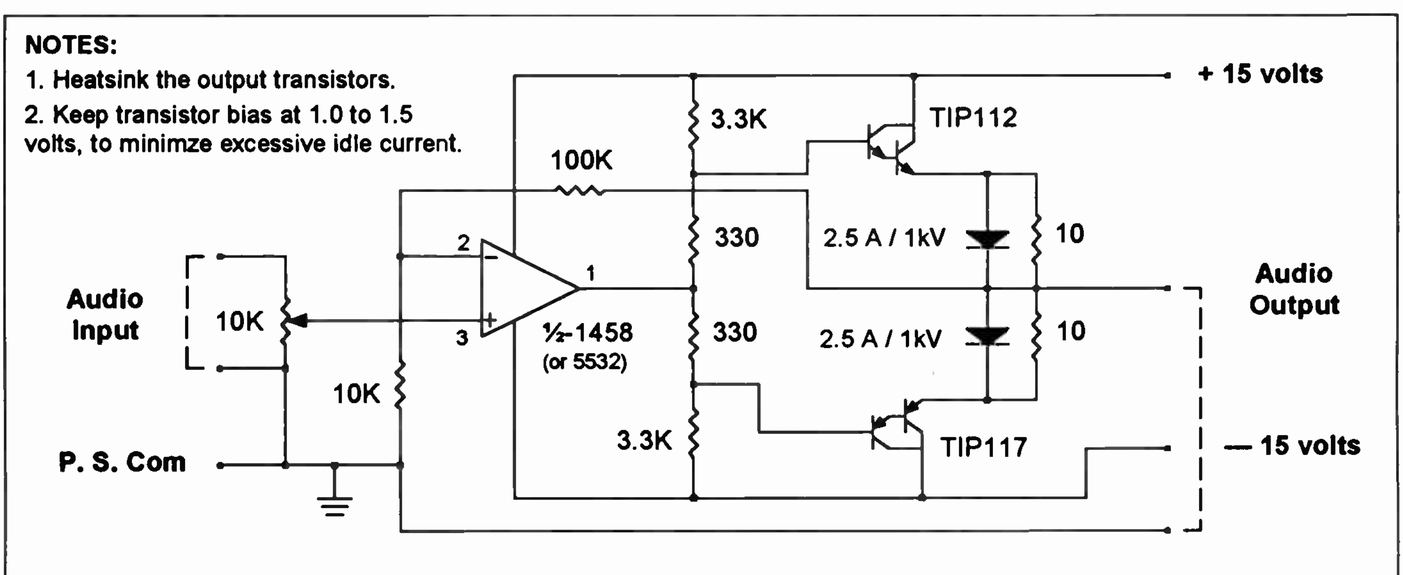
A parallel resistor/diode network in series with the transistor emitters provides bias stabilization and reduces "crossover" distortion at low output power. The 100K inverse feedback resistor is driven from the output side of these networks so that the opamp can compensate for any residual distortion introduces in the output stage.

Design Adjustments and Enhancements

This is a straightforward, basic little amplifier. With a couple of additions, you can squeeze the last bit of power from the basic design. Since the output transistors are driven through a voltage divider network, about 10% of the opamp output voltage swing is lost in the network. You can recover the loss by adding a 10 mFd capacitor across each of the 330 ohm coupling resistors. If you make this addition, also add a .001 mFd capacitor from the output of the opamp to ground, to reduce the potential for self-oscillation.

You can squeeze even more power from the design by increasing the power supply voltage to +/- 18 volts. Do not exceed this voltage or you may lose the opamp. When you increase the power supply voltage, reduce the value of the 330 ohm resistors in the divider network, to about 270 ohms. Actual resistor values should be chosen so that there is a 1.0 to 1.5 volt drop across the resistors when the amplifier is operating.

Basic Audio Amplifier



Heart of the Satellite System: The Parabolic Dish

Tom Harrington — President, Universal Electronics, Columbus, Ohio [614-866-4605]

The total satellite system is only as good as the antenna that drives the system. The dish antenna must furnish the following:

Suitable Physical Size — The antenna must have the physical size to yield an acceptable signal level with a passable signal-to-noise ratio. For SCPC and audio subcarrier reception, a minimum size would be 3 meters (10 ft.). A 3.7 meter (12 ft.) dish is preferred for all satellite formats, including digital services. You must have a suitable size dish to overcome adjacent satellite interference caused by the new 2° satellite spacing in the Clarke Belt. The beamwidth of the antenna must be well under 2° of the beamwidth of the signal. Small antennas have a wide beamwidth, allowing the dish to see more than one satellite.

Good Physical Condition — In order to perform well, the dish must be in good physical condition and have a true parabolic shape, with a smooth and accurate surface. (No dents or bumps, or other damage to the surface.) There are several ways to quickly evaluate your dish. A simple way is to sight across one lip of the antenna to the lip on the other side. the lips should appear perfectly parallel. If you see that one edge of the dish is lower or higher than the other, the dish is definitely out of shape and should not be used until the problem is corrected. **(See Figure 1)**

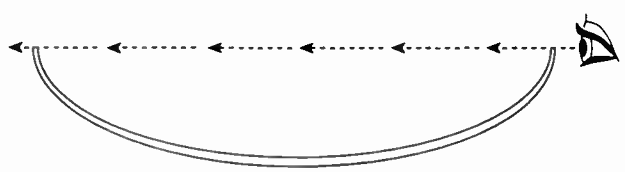


Figure 1 *Sighting a dish from one lip to the opposite side to check parabolic accuracy.*

Parabolic Integrity — The most accurate way to check a dish is accomplished by stretching two strings tightly across the lip to the opposite lip, at right angles (90 degrees) to each other, intersecting at the center of the antenna. These two strings should just touch at the center intersection. If these strings are crushed or squashed together, or have an open gap between them, it is an indication that the dish is not perfectly parabolic and will not perform correctly. Older antennas that were installed several years ago should be checked. If you have inherited a job that has an old dish, you should absolutely check the parabolic integrity as a first step on the job. A fiberglass antenna with five to six years of longevity should also be checked. **(See Figure 2)**

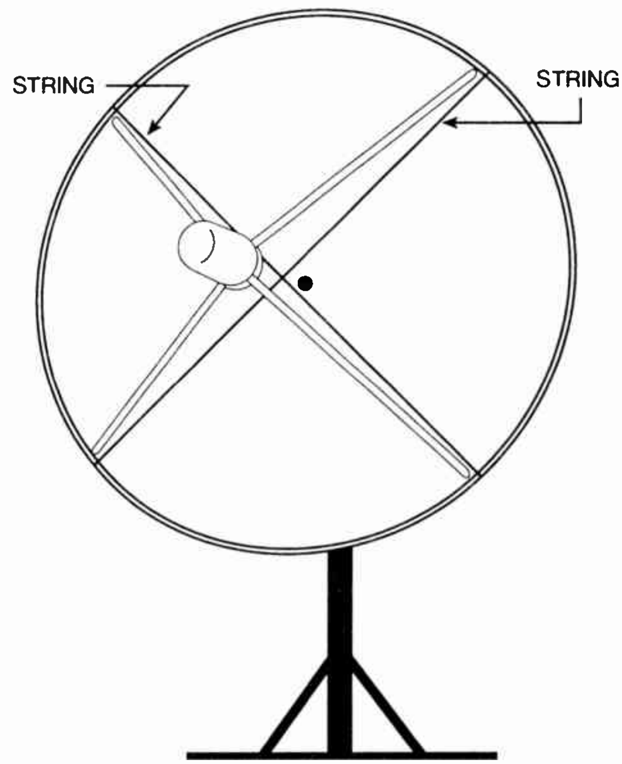


Figure 2 *An effective way to check for a warped dish is to run two strings attached to the edges of the dish which cross at 90 degree angles. If the strings push or pull on each other or there is a gap between them, the dish is warped.*

Correctly Positioned Feedhorn — The feedhorn on the antenna must be set to the correct focal point of the antenna. The focal point is measured from the bottom of the dish, at its center point, out beyond the rim at a known distance or calculated distance. All antenna manufacturers furnish these measurements. The other critical setting is the exact centering of the feedhorn to the center of the dish. This can be determined by measuring the edge of the feedhorn to the edge of the rim of the dish, in four equal spots, preferably at each of the four support rods.

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Heart of the Satellite System: The Parabolic Dish

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How to Calculate the Correct Focal Distance of the Feedhorn

In the absence of any documentation on the dish, you can determine the correct focal distance with the following formula:

$$f = \frac{D^2}{16d}$$

(See Figure 3)

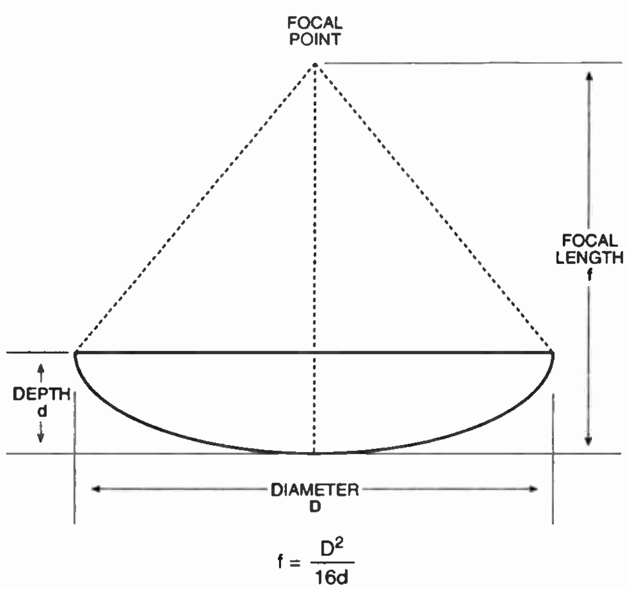

Figure 3 *Calculating Focal Distance and f/D ratio of an antenna.*

An example of an unknown focal distance:

In the above formula:

- **D** = Diameter of Dish
- **d** = Depth of Dish (Measured by a straight edge or string from edge to edge, and measured to center and bottom.)
- **f** = Focal Point (Focal distance measured from feedhorn to center bottom of the dish.)

Dish Measurements and Calculations for the Example:

D = 10 feet in Diameter (measured)

d = 20 inches Depth (measured)

10 feet x 12 = 120 inches; squared = 14,000

20 inches x 16 = 320

14,000 divided by 320 = 45 inches

In this example, the Focal Point or Focal Distance of the feedhorn from the bottom center of the dish is 45 inches.

We now have the correct position of the feed at the dish. Remember, we must be sure that the feedhorn is at the exact center of the antenna. The feedhorn should have a quad-type feedhorn support for positive and accurate alignment. Under no circumstances should you use a single tube support (buttonhook) to hold the feedhorn and LNB, unless you construct a 4-wire guy system to hold the buttonhook and feed to the absolute center of the dish, and to overcome wind movement of the feedhorn. Any wind movement will case a momentary loss of signal to the system.

Mount Integrity — The entire mount should be checked for any possible loose bolts, which would allow the dish to move in windy weather conditions. A slight movement of the dish will cause a momentary loss of signal which will cause the satellite receiver to go into the mute mode and then lose the programming. (The wind moves the dish off of the satellite enough to cause signal loss.)

Proper Grounding — Your dish (antenna) should be properly grounded to the mount system with suitable 7 to 8 foot grounding rods and large size copper grounding wire. Do not use aluminum wire. Non-grounded antennas are a source of hum and audio problems between receivers, antenna, and other equipment. An antenna located near a high RF field should use a triple-shield type coax cable. All audio cables should be of the shielded type.

EAS Standards and Keeping Cool

John Bredesen — Chief Engineer, KLCC, Eugene OR [503-726-2224 or e-mail jab@efn.org]

The life of the FCC has gotten increasingly complicated over the past couple decades. Back in the 60's when I was starting my career, the FCC was faced with establishing standards for emerging technology, much as they are today. The two landmark standards decisions I remember most clearly were those of FM Stereo and the NTSC system of color television. In both cases, the FCC examined, investigated and made a decision. That's an oversimplification, granted, but it was essentially the process. It was a case of leadership, of Father Knows Best.

This process led the FCC into legal skirmishes as our society became more litigious. Companies who "lost" in a decision would often cause enough legal ruckus that eventually, tired of being shot at every time a standards determination was made, the FCC came to the conclusion that market forces should be allowed to make the decision. One of the most outstanding examples of this revised approach is the debacle over standards for AM Stereo. The result of that fiasco is that we, for all intents and purposes, don't have AM stereo in this country, even though the FCC eventually made a decision. By the time that happened, the mood of the industry had become, "who needs it?" Digital transmission became one of the favorite buzzwords and added more uncertainty to the future of AM. Talk Radio had become increasingly the program content of choice and few saw much benefit to having stereo for that type of programming. (On the other hand, perhaps it would let people hear some of the talk radio hosts speaking out of both sides of their mouth more easily!)

Enter the need to upgrade the Emergency Broadcast System. Several years ago, just about everybody acknowledged that it was due for an overhaul. Last December the FCC issued rules covering the new Emergency Alerting System (EAS). Article upon article appeared in various publications, including this one, detailing the system and the timetable for implementing it. (You do have your two-tone decoders modified by this time to respond within 4 seconds, don't you?) The alerting scheme was based on the system that the National Weather Service has been using for years in its Weather Radio Specific Area Message Encoder (WRSAME).

The next milepost in the multi-year project was to have been July 1st, 1996, when the new EAS equipment was to have been installed. I say "was" because numerous petitions for reconsideration have been filed, all taking issue with some aspect of the new rules. One of these revolves around a potential problem resulting from a patent issued to a company several years ago. The company claims to have a lock on the type of codes which were to be used by the new system to identify specific geographical areas and specific alert codes, in spite of the fact that they have been used for years by the NWS.

It may take long enough to satisfy these petitions that the 1996 milepost may have to be moved back. At this point the FCC hasn't issued any certificates which would allow manufacturing of the alerting equipment to begin, and nobody seems to know when it will happen. Stay tuned.

Still on the subject of the EBS/EAS, the FCC has announced that it will have a new message to accompany the new shortened tones. Now that the tone duration for many stations is about 10-15 seconds shorter than that previously required, some stations are having a problem fitting the weekly test alert into their schedules. It's longer than a 30, but less than a 60. By the time you read this, the new message should be issued and, with that, the entire test will fit in a 30 second message, including tones.

The FCC has also discovered that about 1% of the stations are reporting having trouble with music from the monitored station tripping their decoders. It is apparently only happening with certain decoders. The FCC asks stations having this problem to call them at (202) 418-1220.

Keeping It Cool

This past week, much of Oregon was having the same problem with high temperatures the Midwest and the East Coast had been having a week earlier. The temperature exceeded 100 degrees in a few places, which is not unheard of out here but is unusual. Most homes, for instance, don't have air conditioning unless they've been built in the last decade or so. Then the air conditioning, in many cases, is a by-product of a heat pump installation. I suspect most transmitter rooms (all, here in Eugene) are not air conditioned, so adequate ventilation is a must, especially when temperatures rise.

Several years ago I had the opportunity to visit a large multi-transmitter facility serving Miami, Florida. Each transmitter room was fully air conditioned with a back-up A/C unit. As you may surmise, Southern Florida has a brutal climate for much of the year, with high temperatures and humidity. The name of the game in Miami is to stay on the air at all costs. And in a large market like that, the high cost of full air conditioning can be justified.

(continued on page 11)

EAS Standards and Keeping Cool

(continued from page 10)

Air conditioning a transmitter suite is expensive if you intend to cool everything. Our Continental 27.5 kW, running at just about 24 kW, throws off about 9 kW of waste heat from just the final amplifier. Add to that the heat loss from other components in the transmitter (transformers, bleeder resistors, etc), and you can add another 7 kW or so for a total heating load of about 40,000 watts. Other equipment in the room adds a relatively insignificant additional amount in our case.

40,000 watts for an hour is equivalent to 136,600 BTU (3.415 watt-hours = 1 BTU). On the basis of 12,000 BTU per ton of cooling, we would need over 11 tons of mechanical cooling simply to dissipate the heat load of the transmitter, and that doesn't include heat gain from the walls and ceiling. It simply isn't practical for a station in a market our size (about 135th) and climate to consider anything but a lot of outside fresh air to carry the waste heat away.

Our transmitter building was constructed about five years ago and was designed as a multi-user facility. Six stations are in individual suites in the 40' X 70'metal building. A design by Chris Reid Murray (Icabod), the site manager, resulted in a ventilation system which works quite well, winter and summer. Rather than having each station pierce the shell or roof of the building for air inlets and outlets, a unified system was designed and installed.

The transmitter suites are arrayed along a central hallway which enters at one end of the building from a "carport" included in the 70 foot dimension. It is under roof and the sides are enclosed. A 3 ft X 4 ft duct runs the length of the building above the hallway ceiling and all transmitters exhaust into this duct. On the end of the building opposite the carport, the duct connects to a large squirrel cage blower which draws the heated air from the duct and exhausts it to the outside. The other end of the duct terminates in another exhaust fan located above the hallway door in the carport, and which can pull the heated air into the carport. A thermostatically controlled logic circuit runs one exhaust fan or the other, but not both at the same time.

The building is constructed with the typical drop ceiling. Two high capacity blowers, high in the carport, draw fresh air from the carport through a rather coarse filter which functions to keep out insects, etc, and force it into the space above the drop ceiling. Each station was responsible for replacing an appropriate area of the ceiling in its suite with a grill or filter which allows air from the positive pressure area above the ceiling into the transmitter suite. The airflow path is complete with both an source of air to the suite and a means of exhausting the heated air. But I haven't yet explained the clever aspect of the system.

Outside temperatures in our corner of the world and at the altitude of the transmitter site (1300 AMSL) will occasionally drop down near zero. Icabod figured that it would be nice if the incoming air could be preheated in cold weather before it was introduced into the building. And what better way than to use transmitter waste heat? When the inside temperature drops below a set point, the logic system shuts off the motor of the blower which exhausts the waste heat outdoors and, after a suitable delay to allow motors to stop turning, turns on the exhaust blower in the carport. Some of the waste heated air is drawn back into the building because of the close proximity of the exhaust fan and the two fresh air blowers, thereby warming the total incoming air.

Always Above 60 Degrees

At least one other benefit is derived from this system. We occasionally have heavy fog at the site in cooler weather. If the unconditioned air were drawn into the building, the moisture would tend to condense on some surfaces before it became heated in the suites. Preheating the air completely eliminates this problem.

The net result of this system is that I have never seen the air temperature in the KLCC suite below 60 degrees, even in the coldest days of winter. I've never had to use the recirculating damper I had installed on the transmitter exhaust duct.

Radio Guide Quick-Tip

During these hot days, perspiration can spell trouble! Wet skin, from whatever cause, is a lot better conductor than when it's dry. So be especially careful around the transmitter site this summer season . . . and always.

Radio Guide Quick-Tip

Check out those portable 300 or 500 watt, Halogen work lights. You can find them at most building supply stores, and they're about as cheap as they can be ($12.00 at our local Menards store for a 500 watt unit). Great for the doghouse or TX building.

What Ever Happened to RCA Broadcast?

RCA

An Industry Status Report From Comark Communications

COMARK

RCA Broadcast is now part of Comark Communications, Inc. In 1994, Comark acquired RCA Broadcast transmitter service business and parts from General Electric.

Just as one remembers other news events occurring in life, many broadcasters will remember that day in 1985 when RCA Broadcast announced retirement from the broadcast industry. This article will provide the details of what has transpired since 1985, and may should help to quell the many rumors that have risen over the years.

Within a few months of that fateful day in October of 1985, the staff had diminished to just a handful of people who were retained to close down the various aspects of the business. On the other hand, some technical staff were retained to continue the contractual obligation of providing spare parts and technical support to all end-users of RCA Broadcast equipment. That same technical support and all original RCA spare parts are still available today from RCA Broadcast, a service of Comark Communications, Inc.

On September 1, 1986, the spare parts and technical support for all broadcast equipment was picked up by General Electric Support Services, based in Mt. Laurel, New Jersey. The entire stock of original RCA spare parts was moved from what was, at one time, the largest warehouse in North America, in Deptford, New Jersey, to the GE warehouse in Vineland, New Jersey. Consumer products, that occupied the same facility, were retained at the Deptford warehouse and were purchased by Thomson Consumer Products.

Eight years later, on March 22, 1994 at the NAB Show in Las Vegas, Comark announced that it had acquired the RCA Broadcast Transmitter Service Business and Parts from General Electric, as well as the rights to RCA trademarks, including "His Master's Voice" logo for the professional broadcast industry. All studio associated parts remained with GE.

In a news release at that time, Comark stated "with the commitment of Comark, this acquisition will insure continued long-term support of the RCA customer base and will permit continuity of the RCA brand name through a new generation of broadcast products. Comark is very proud to continue the heritage of the RCA brand name and its reputation for quality products.

Since March 1994, Comark has continued to provide the kind of support that was the specialty of RCA Broadcast. It was a known fact that one of the major reasons for an RCA purchase was the customer support reputation. Comark is proud to continue this tradition along with supplying original RCA spare parts to the hundreds of RCA AM, FM and TV transmitters that remain in operation, and will continue to do so as long as there is equipment in the field.

AM transmitters, from the earliest BTA-1 series, to the last BTA-50J manufactured, are supported, together with all BTF series of FM transmitters, such as the BTF-10E and the BTF-20E. All VHF and UHF TV transmitters are also supported. Stock of original RCA parts is quite extensive and is still identified by the same six-digit RCA stock number used in the instruction books. When stock is depleted, the purchasing department works closely with many of the original vendors who supplied parts to RCA as long as 30 years ago.

Here are some of the RCA Products available:

- Crystal Oscillators and Assemblies
- High Power Resistors
- Tube Socket Contact Assemblies
- Integrated Circuits
- Insulators — Rectifier Stacks
- Instruction Books and Schematics
- Switches — Diodes — Meters
- Finger Stock — Connectors
- RCA Brand RF Power Tubes
- Capacitors — Coils
- Transformers — Chokes
- Feed-Thru Capacitors
- Tuning Lead Screws

For more information you can contact:

Stu Cook — Technical Services Manager
RCA Broadcast
Phone 215-822-2108
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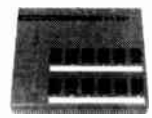

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Radio Guide

Technical Assistance Service

August-1995

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