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Number 10 on your Feedback card

The Quest for Super Sounding Audio

How to improve your on-the-air image by 10 dB.

Whether your preferred mode of operation is SSB, FM, or AM, here is the inside info on radiating a big-time signal with million dollar–sounding audio.

An increasing number of amateurs are becoming seriously interested in full-bodied audio. This is apparent on all bands and modes of voice communications, and is also reflected in the transceivers and accessories operators select. Some of the resulting on-the-air signals sound so good that you just stop tuning and marvel at their richness — rather than focus on what the operator is saying. Why this dedication to super-terrific audio? Everyone has his own opinion, but I think it's because of our instinct to experiment as well as our desire to project a special on-the-air image.

"But my factory-supplied mike is a plug-in match for my transceiver, and my rig's ALC meter reads full range when using it. Surely that's good enough for general QSOs and mild-mannered DXing — right?"

"Good enough," sure. Outstanding? Questionable. Only when the audio response of your transmitted signal coincides with the audio range and response that brings out the best qualities in your own voice can you sound really superb. Accomplishing that goal calls for bringing together several variables in proper proportions.

***Photo A.** Heil Sound's new "GoldLine" microphone is the ideal way to have a terrific studio grade sound plus a pileup-busting signal for DXing with one economically priced mike. What's the secret? It has two elements you select as desired by a small toggle switch mounted above the PTT slide switch. Details in text.*

Paths to great sounding audio

Let's look at the various ways extraordinary audio can be pursued.

The first place for possible improvement is the microphone used with your rig, as its audio response determines how much bass, midrange, and treble are initially available for processing. Next is the range and level of audio frequencies or tones passed, emphasized, and/or attenuated by your rig. Then, too, factory and/or in-field adjustment of injection oscillator frequencies (often called transmit DSP) determine the response of IF stages and crystal filters. This, in turn, influences whether a rig sounds predominantly bassy or tinny. Finally, multiband audio equalizers like those found in professional recording studios are being utilized in some "all out" amateur setups to tailor a preferred mike for a specific response and sound. Let's take a closer look at each of these variables, beginning with amateur radio's most familiar and most continuously popular accessory: the microphone.

The mike makes the difference

Over the years, amateurs have strived to obtain the most robust audio

Phantom-Powered Mikes

A large number of today's HF and VHF transceivers are supplied with and/or equipped for microphones utilizing condenser or "electret" elements. These mikes require DC power in the range of 1.5 to 8.0 volts to operate their element's associated preamp (which may be built into the element's case or contained on an adjacent/in-mike PC board). This "phantom mike voltage" (so nicknamed because it goes unnoticed or unrealized) is output from the transceiver's microphone socket and routed to the mike via its cable.

If a different type of microphone or mike element is directly substituted for a transceiver's matching electret microphone, phantom voltage may thus burn out the mike element. If the element can withstand phantom voltage without burnout, it can short-circuit phantom voltage and damage the transceiver.

How do you avoid this dilemma? Simple: Just be sure that you interrupt phantom voltage on the microphone's "hot" or positive wire before substituting another type of microphone or element. You may also need to increase mike gain to compensate for reduced gain from the disabled preamp — or you may be able to change only the mike element and leave the operating preamp intact.

Here's a simple way to identify and block phantom voltage. First, check your transceiver's manual and use your VOM to determine if and which mike socket pin carries phantom voltage. Then check inside the mike's case to determine if the voltage is applied directly to the element or only to an adjacent preamp (you may be able to continue using the preamp).

Next, insert a 1 to 5 µF 10 to 25 volt nonpolarized capacitor in series with one of the mike/element's leads to block DC and pass AC (audio). If a nonpolarized capacitor is not available, use two regular capacitors wired "back to back" as shown in **Fig. A**. Finally, check your new mike for proper gain and frequency response, and then enjoy projecting your new on-the-air image. — K4TWJ.

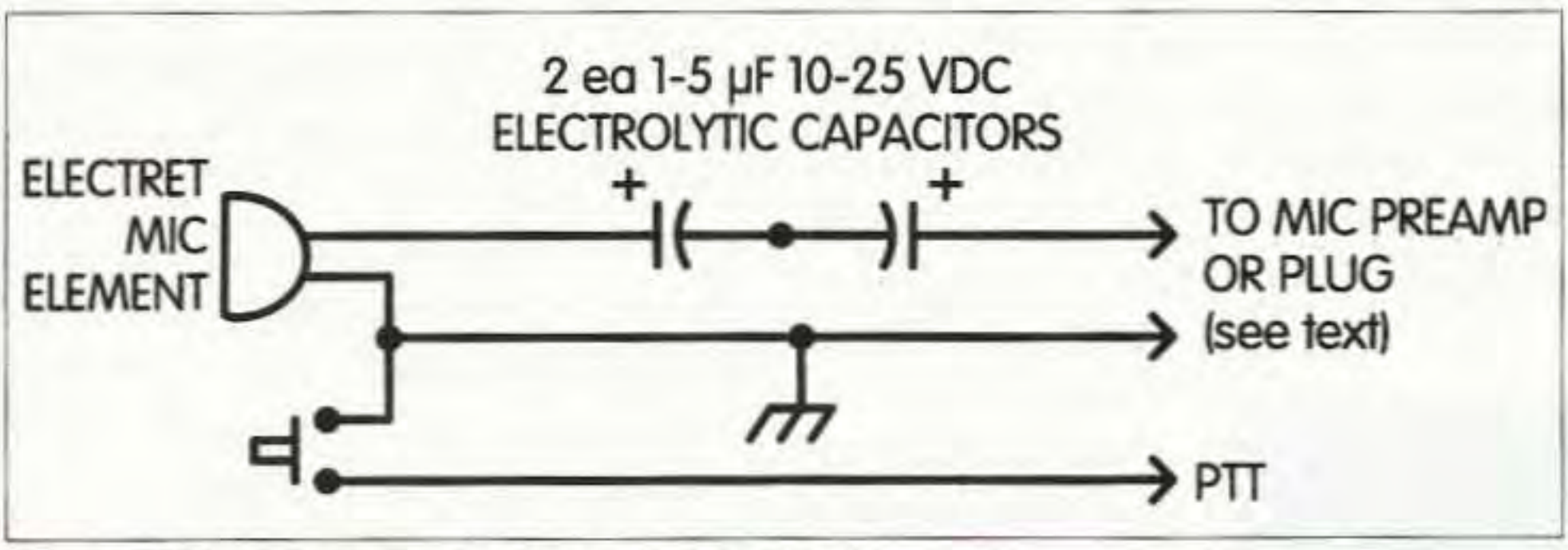

Fig. A. *Using regular capacitors back-to-back.*

possible on AM, FM, and SSB. Generally speaking, this was done by selecting a microphone or mike element that best fit your voice, or by adding an audio equalizer in the line between a favored mike and rig. Some all-time classic mikes making that list include Astatic's D104, Shure's 55SH and 444, Electro Voice's 664, and Collins' SM2.

One of the best sounding and most reasonably priced microphones I have used and heard in use is Bob Heil's new "GoldLine" Model GM-4 or GM-5 shown in **Photo A**. Rather than being tailored for maximum talk power like Heil's HM-10 mike or HC-4 "DX element" cartridge, this new GoldLine mike's main element is expressly designed to produce a full-range "million dollar sound" for super QSOs. A second and switch-selectable element you

Photo B. *Bob Heil's optional boom and preassembled mike-to-rig cables get you cooking with a new sound, a new image, and more desk room in short order. The boom and cable also add a professional "finishing touch" to a GoldLine mike's installation.*

choose at time of purchase is also included in the GoldLine: a medium range and mellow sounding HC-5 or a more concentrated range and pileup-cracking HC-4. You can thus project a "studio on the air" image one minute and (flip the mike's switch) a big-time DX signal the next minute. It's two mikes in one case!

Technically speaking, the GoldLine's main (studio grade) element has a frequency response of 50 Hz to 16 kHz, with a smooth rise of 4 dB centered on 2 kHz. This rise coincides with the upper range of most rigs' SSB filters, so, assuming sufficient mike gain, it adds a nice peak to the transmitted passband's upper end while retaining excellent low end bass. As a familiar comparison, Heil's HC-5 element has a response of 300 Hz to 4 kHz, with a sharper rise of 6 dB at 1800 Hz (less bass, fewer highs, and greater midrange peaking). The well-known HC-4 element's response is 600 Hz to 2800 Hz, with a 10 dB peak at 2 kHz: an even sharper response with more peaking and "punch" for DXing.

Thanks to an optional desk-type support boom and optional cable sets (**Photo B**), installing and setting up a Heil GoldLine mike is a snap. The boom clamps to a desk edge (side or rear), is adjustable in length and tilt angles, and frees up desk space for contest logs, etc. The cable sets are preassembled for plug-in-and-operate convenience. They include DC blocking capacitors to prevent mike or rig damage from phantom power, and are available for most popular transceivers (phantom power is typically used to power a rig's mating "factory mike").

Another option to consider (especially if your wallet is flat) is purchasing only a Heil HC-5 or HC-4 element and installing it in your existing microphone's case (use a capacitor to block DC/phantom voltage, however!). These elements do not produce "GoldLine-grade sound," but they outperform stock mikes by a mile. GoldLine mike elements are not sold separately. They are available only as complete microphones. If you have an older vacuum tube–type rig, Heil also has a low-to-high impedance audio transformer for matching a GoldLine, HM-10, HC-5, or HC-4 to the vacuum tube circuitry (**Photo C**). All of these mike goodies are available from Bob Heil K9EID and friends at Heil Sound Ltd., 5800 North Illinois, Fairview Heights IL 62208; telephone (618) 257-3000. Check them out!

Photo C. *Want to make your classic DX-100, Johnson Ranger, HT-37, or KWM-2 sparkle with dazzling GoldLine audio? This little low-to-high impedance transformer available from Heil Sound does the job in high style.*

Rig notes

Like microphones, various makes and models of transceivers also exhibit their own distinctive on-the-air sound qualities — which can vary from "flat" to "fantastic." These variations are influenced by a rig's interstage coupling and bypass capacitors, IF bandwidth, and local oscillator or mixer injection oscillator's frequency.

How so? Coupling and bypass capacitors determine how much bass and treble pass through audio stages. Then, bandpass filters in IF stages shape and define the overall frequency response of the transmitted signal. Bear in mind that I am referring to *transmitted* bandwidth here, *received* bandwidth — which is usually the only measurement of selectivity listed or advertised in a transceiver's specs. *Usually, but not always, transmitted and received bandwidths are the same — but don't take that for granted.* Close study of your rig's circuitry tells the real story here.

Typical filter bandwidths for SSB are 2.1 or 2.2 kHz and 2.4 or 2.5 kHz, and in some rare cases, 2.7 or even 3.1 kHz. That addition of 300 or 400 Hz (bass or treble) may initially seem insignificant, but when associated transceivers are compared side-by-side, the difference is amazing. Narrow bandwidth rigs exhibit the most audio "punch" and "talk power," but wide bandwidth rigs just sound marvelous — assuming inclusion of a full range mike, naturally. Some lunchtime-type "napkin notes" should help clarify those statements.

Fig. 1 shows some approximate frequency response curves for Heil Sound's GoldLine, HC-5, and HC-4 mike elements (from top to bottom, respectively). The frequency response curve for an IF filter with a passband width of 2.2 kHz at its 6 dB points and 4.8 kHz at its 60 dB points is shown in

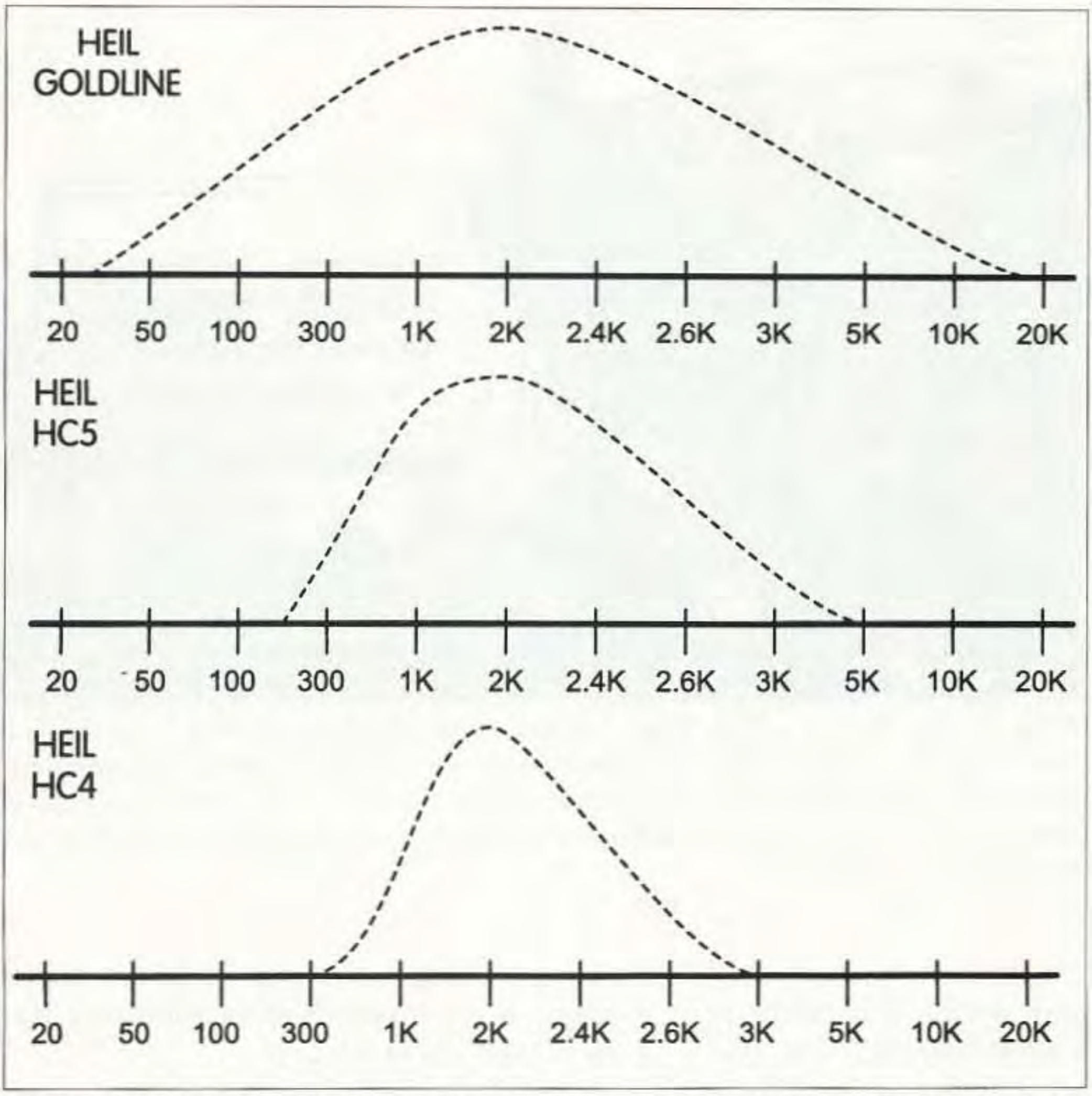

Fig. 1. *Graphical analysis of how response curves of various mikes and a transceiver's IF passband filter mate to produce an overall on-the-air sound favoring bass, treble, full range, and narrow range response. Explanation and discussion in text.*

Fig. 2. Above that response curve is a straight-line graph (no peaks or nulls) illustrating the full voice range of 20 Hz to 20 kHz. Plot your selected mike's

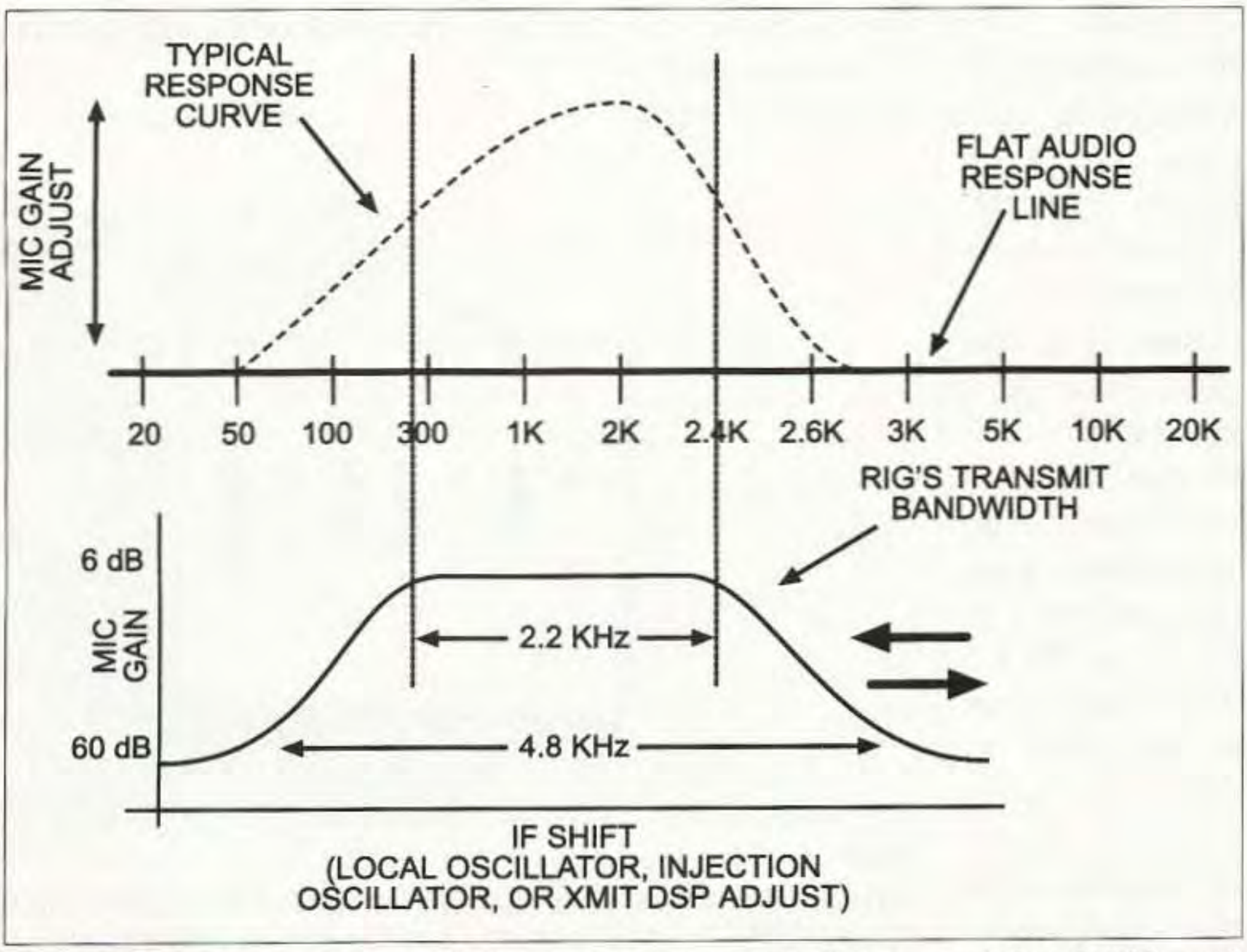

Fig. 2. *Observing how your mike's response curve and rig's transmit bandwidth work together.*

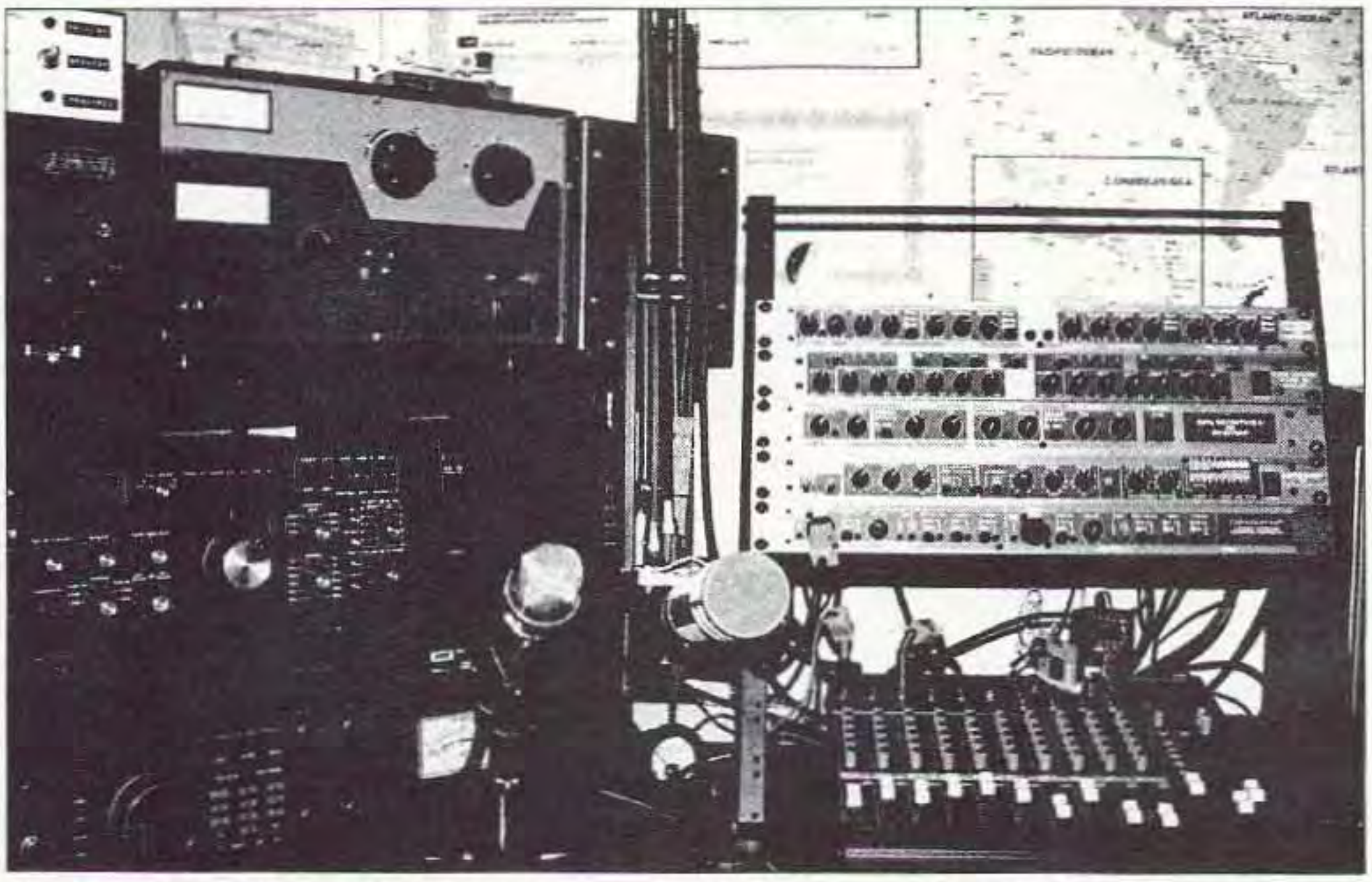

***Photo D.** John Basilotto W5GI gives us a peek at his secret ingredients for cooking up a super sounding signal. A Heil GoldLine mike connects to Aphex audio equipment consisting of a four-band parametric equalizer, an aural exciter, a "big bottom" booster, a compressor, a limiter, a reverb, and a mixer. Audio is then routed to his Icom 761 and Drake L4B amp. Whew!*

response curve above the straight line (my dotted line serves as a getting started example), then plot your rig's transmit bandwidth curve on a piece of clear plastic or wax paper to lay over it. By placing one curve (transmit) above or under the other (mike), you can see how the two work together, emphasizing some tones, dropping others, etc. You can also see that a 2.2 kHz bandwidth (vertical dotted lines) has the added benefit of simultaneously transmitting more DX-grabbing high tones and more robust and delightful-to-hear low tones.

Now, you can slide your rig's transmit curve left or right and notice how, even with a narrow passband, bass tones in the 50 to 300 Hz range or high tones in the 2200 to 2500 Hz range (but not both) can be included in the transmitted signal. That effect simulates adjustment of a rig's injection oscillator, and it also explains how two identical rigs can sound different.

Here is another interesting point. Newer transceivers have software/menu-adjustable injection oscillators. This feature is nominally called transmit equalization or transmit DSP, and gives you the ability to mate your rig's audio response with your mike and voice through menu-selected adjustments.

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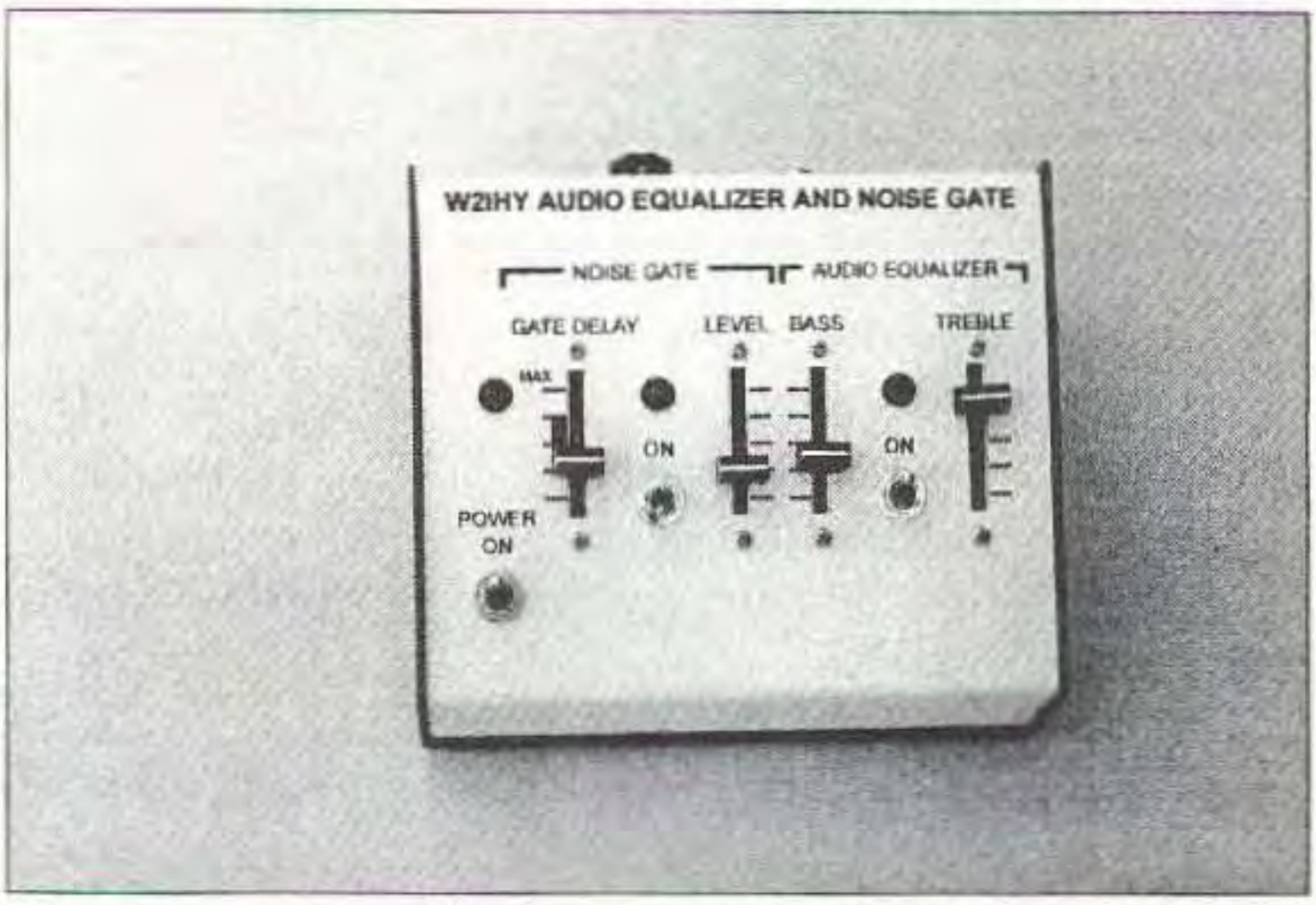

***Photo E.** This combination two-channel audio equalizer and noise gate is available in kit or preassembled form from Julius Jones W2IHY. It works with all 8-pin KenYaeCom rigs and mikes. Unit also works with Heil mikes and produces big-time sound at small-time cost.*

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Modern transceivers with this capability include Kenwood's TS-570, 870, and 950; Yaesu's FT-1000; Icom's IC-706 and 746; and Kachina's 505. Details are in their operating manuals. Just remember to monitor your actual transmitted signal with a wideband receiver when making changes.

Earlier, I mentioned that some transceivers have different transmit and receive bandwidths (and a couple even have 3.1 kHz bandwidth). When combined with a wide range mike like Heil's GoldLine, the resultant audio can really knock your socks off. Collins' famous KWM-1 transceiver utilizes a 3.1 kHz mechanical filter, and its on-the-air sound is marvelous. Icom's IC-761 uses different transmit/receive bandwidths. On receive, several filters give selectable bandwidths of 2.2 and 2.7 kHz. On transmit, fewer and wider-width filters give a bandwidth of 3.1 kHz. Newer style and more fancy-looking transceivers are quite appealing, but I personally cannot find another rig comparable to my dear IC-761.

Audio equalizers

Taking a lesson from recording studios and large church audio systems, some big-time audio enthusiasts are integrating professional-grade audio equalizers into their stations (**Photo D**). These equalizers have fully adjustable low, mid-, and high ranges that can be set to accentuate your personal voice characteristics while minimizing

sizzled S's and popped P's. Further, switch selection of various channels gives one or two connected microphones the ability to produce many different sounds such as "double level bass," reverb, etc.

An alternate and less expensive approach to the recording studio–type setup, and a unit especially designed to work interchangeably with KenYaeCom rigs and mikes (plus Heil mikes with KenYaeCom cables), is the W2IHY dual channel audio equalizer and noise gate shown in **Photo E**. This little tyke has separate bass and treble controls so that you can have a big bass sound when signal paths are good, or emphasize high tones for weak signal work or DXing. The W2IHY equalizer is available in kit or preassembled form from Julius Jones W2IHY, 19 Vanessa Lane, Staatsburg NY 12580; telephone (914) 889-4933.

One final thing to ponder: Remember those classic SSB phasing-type transmitters? They shifted an unwanted sideband 180 degrees in phase instead of removing it with a narrow crystal filter. Super sounding audio galore! Now, *that* should set fleamarket traders and rig restoring enthusiasts reeling and rocking!