

AUDIO FILTERING

A VARIETY OF APPROACHES TO IMPROVED AUDIO

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You are probably wondering why you need another gadget to use with your new 'super - rig'. Why must you stack outboard accessories atop that fine piece of equipment, and especially something that won't help it receive any better than it did without the new accessory? It is really quite simple - your fine piece of equipment truly has a terrible audio section, desperately in need of external improvement.

Let's face it, we SWL's and DXer's are not the prime market for receivers. The best receivers from Icom and Kenwood, for example, are merely receiver sections from their respective amateur transceivers. These receivers are not totally optimized for SWL/DXing, especially the Icoms. In fact, it is my contention that the Icom R70/71A receivers were designed by committees - and non-interactive ones at that. Let me explain.

My R70 had a boomy bass response on AM. A quick check of the RC time constant comprising the diode detector load (The product of the diode load resistor's resistance and the accompanying bypass capacitor's capacitance.), the audio amplifier's high frequency roll-off bypass capacitors, and the negative feedback components around the output amplifier shows that a strange dichotomy existed - a communications receiver with distorted audio driving a wide bandwidth, near hi fi, audio amplifier. The impedance levels were not matched between the diode detector's output, the remote controlled gain stage (volume control), and the power amplifier resulting in a low pass audio frequency roll-off beginning below 1,000 Hz! In fact, a 6 db peak at 120 Hz was noted, not bad for a 'Ghetto Blaster' but hardly fair for a communications receiver. The result is predictable: the tiring, boomy, and distorted audio that Icom is now famous for.

I did not intend to indict Icom; even Drake, Collins, and JRC receivers, as well as many others, can use some external assistance in the audio department. The simplest improvement has always been to add an external MFJ, Autek, or other audio filter to the receiver and go on. In the simplest analysis, distortion is additive as you cascade amplifier stages. Following a receiver output stage beset with it's own distortion and bandpass problems with an add-on device will add to the distortion as well as detract from the add-on filter's true capabilities by having to attempt to mask the receiver's poor audio response. This can be remedied in most cases by simply connecting your add-on filter through the record or line level output present on most modern receivers. Since most add-on filters are normally placed in the audio output or speaker lines, they typically have a voltage gain of one. Most communications

receiver's record output is in the 50 - 100 mV range making an external variable gain stage mandatory to return the output level to normal headphone or speaker levels.

There is another alternative - try an equalizer and amplifier combination from your stereo or portable 'boom box'. Simply hook the equalizer between the record output of your receiver and the input of your amplifier. Set the lower frequency controls (< 350 Hz) at maximum cut, the middle frequency controls ($350 \text{ Hz} < f < 3,500 \text{ Hz}$) at maximum boost, and the higher frequency controls ($> 3,500 \text{ Hz}$) at maximum cut. I just have a 5 band equalizer from Radio Shack's bargain table fed through an old AR amplifier to an Advent speaker as a demonstration. My younger son's boom box works at least as well, especially if you do most of your DXing at night with headphones as many of us do. Don't be afraid to adjust the controls. Through experimentation you can optimize for the speech clarity you prefer. It can really help in IDing that weak one. You can even reduce the effects of static crashes.

Perhaps the most important aspect of using an equalizer and external amplifier connected to the record output is that it allows modification of the purest detected audio in your receiver. That is, the record output generally comes just after the detector and before the volume control and power amplifier. This is without doubt the cleanest audio one can easily obtain without the need for surgery.

I was able to run a simple comparison of the typical equalizers ability to notch or null a frequency. Using the 1 kHz band at maximum attenuation on a Radio Shack 31-2020A 10 band equalizer, I noted a rather broad 14 db deep null. Compare that with the sharp and tunable auxiliary notch on the Autek QF-1A which I measured to be 25 db deep. The main notch can be adjusted to yield 35 or more db of notch depth. The combination of both of the QF-1A's filters can yield a single frequency notch depth of over 50 db, if you need it! Needless to say, the typical equalizer cannot approach the QF-1A or similar filters in their ability to adjust to the frequency and then offer a very good notch depth. Since true IF notches that cover the entire IF passband seem to be practically a thing of the past, the external notch filter is the only help available to most of us for hetrodyne reduction. The equalizer does have its place in adjusting the audio response of your amplifier, however.

While you have your stereo involved in your DXing, try taping your listening sessions. I used to use throw-away cassette decks for my 'IDing' along with el-cheapo tapes. Try an inexpensive stereo cassette deck (I wouldn't use my best three head solenoid operated cassette deck!). They generally have a high frequency bias oscillator instead of the permanent magnet bias common to the throw-away decks, adjustable levels and level indicators, and noise reduction circuitry. I usually use mine straight - no Dolby. I have learned to use decent tape, with CrO types being the best. When I am heavily into DXing, I

leave a cassette running at all times - you can always record over it later if you want. A fairly good recorder can be had for as little as \$60 if you check the local or mail order audio emporiums. I used two Sharp RT-150's for a year or more each before giving them to my sons for their stereos - and they still work fine! Not bad for \$60 each! (My sons have really abused them since, though thankfully no Twisted Sister!)

The best part about using an equalizer and a high fidelity amplifier is the amount of control you can have over the audio pass band. You can even listen in 'stereo' by using two receivers fed by different aerials for a form of space diversity reception. This method will allow the 'cerebral filter' to decode the stronger of the two signals, often permitting an ID to be made when normally one wouldn't be forthcoming. For a real 'treat', try the false stereo imaging, or wide-stereo, or IMX enhancement if your amplifier has one. These circuits present some strange mid-frequency phase shifting and recombination and can sometimes really enhance speech frequencies. At other times they sound a bit like a reverb, so beware!

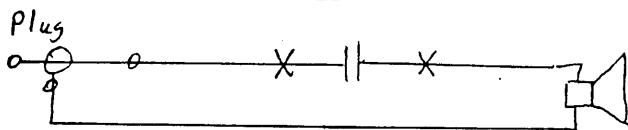
Suppose you don't want to spend big bucks on this audio tinkering - what can you do? Simple. Try using either a dedicated midrange type speaker or externally limit your speaker's low frequency response (This means you must use an external speaker.). I recently purchased a grab bag speaker from Radio Shack, a new replacement speaker for their Mach II's midrange, for \$4. I have connected it through a 25 microfarad non-polarized capacitor (two identical 50 microfarad 15 volt polarized caps can be used if their positive terminals are connected together and the input and output connections are then made on the remaining two negative leads.) directly to the output of my R70. Instant speech response! Good riddance to low frequency distortion, though their ill effects still influence the remainder of the audio a bit, it is a quick and easy attempt at a cure. The equalizer and external amplifier is better - no doubt.

Most DXers prefer headphones to speakers for critical listening. Perhaps greater accuracy is embodied in the following statement: Most DXers' spouse, siblings, parents, friends, and even pets prefer headphones to speakers for critical DXing. Wide bandwidth, or high fidelity, headphones have been generally, and I feel unfairly, disliked as DXing aids. Connecting a pair of Koss PRO-4X or similar dynamic headphones to an unmodified R-70's headphone jack can result in a very bassy sound with a significant background hiss - tiring to say the least. Connect the same headphones to the output of your stereo amplifier and equalizer combination and the hiss will be all but gone with a flatter low frequency response to boot - all of this with the controls at 'flat' response. Peak the midrange response while rolling off the high and low frequency response to obtain the greatest speech clarity.

The same simple approach at limiting low frequency response of your external speaker can be attempted with your headphones. Simply make an extender or adapter cable with a plug to fit your receiver on one end of a 1-5 foot two conductor cord (Speaker cable will do nicely.) with the smallest Radio Shack plastic case on the other end. Mount an open circuit headphone jack to match your favorite headphones in the box. In fact, mounting a 1/4" mono, 1/4" stereo, and 1/8" stereo jacks in the box should cover most possibilities. Parallel both channels of the stereo jacks and connect one side of the cord to the outer or ring connection on the jack(s). The center, or tip, will be connected through a non-polarized capacitor to the other cord conductor. Use a smaller capacitance than you did with the speaker. 5 microfarads should suffice for normal dynamic headphones with a lesser value, even as low as 1 microfarad, being required for the higher impedance 'Walkman' type headphones. Again, series connect two identical polarized capacitors of twice the aforementioned capacitances and rated at 10 V minimum if non-polarized capacitors cannot be found. Remember to connect the positive terminals together with the input and output taken from the remaining negative leads. A simple SPST toggle switch can be installed to short the capacitors to regain low frequency response.

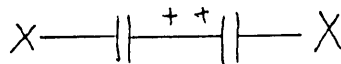
The key here is simple - experiment! Don't blow out your favorite speakers or headphones when tuning across those strange tunes with the audio gain wide open. Also, don't record over your favorite Twisted Sister or Cyndi Lauper tapes. Come to think about it - go ahead! Record over Willie Nelson as well! Don't erase that Andean flute music. Save room for that elusive 90 mb goodie - you never know when Tristan will sneak through ...

Receiver (Speaker Output) (Or Non Polarized Capacitor (Two Identical Polarized Capacitors) Speaker
25 microfarads at 15 Volts



Alternate

50 microfarads at 15 Volts each



Plug to match Headphone jack

1 - 5 microfarads at 10 Volts non-polarized Headphone Jacks

