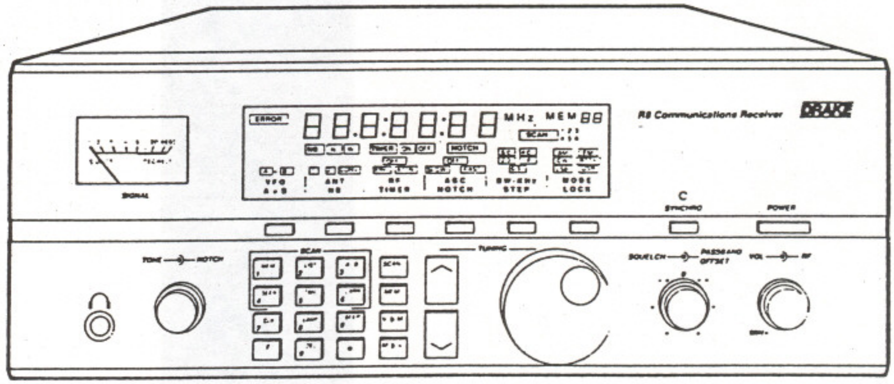
R67-8-1

Drake R8: A Second Look

Dallas Lankford, 28 VII 92

About a year ago I ordered an R8 from Drake and wrote about my unsatisfactory experiences with that first R8 in my review "Drake R8: Promising Or Fatally Flawed," in DX News, Vol. 59, No. 1, Oct. 7, 1991. Recently I ordered another R8 from Drake, and this time I kept it, so obviously I liked it.

For a MW DXer who wants to use a loop antenna near his receiver, there really is no other choice among the top of the line, current production, solid state receivers because all the others emit objectionable levels of display noise and other RFI throughout the MW band which gets into a nearby loop antenna. Of course, the R8 emits some RFI in the MW band which you can observe by placing a ferrite rod loop antenna directly in front of and a few inches away from the R8 display. But with the loop antenna in any reasonable operating position (i.e, beside the R8, or even on top of the R8), display noise or other RFI from the R8 should be unobservable. These remarks apply only to battery powered (amplified) loop antennas. When I powered one of my loop antennas from an AC power supply, objectionable levels of display noise were observed (apparently coupling to the loop through the power cords).



A line drawing of the R8 is provided above. The R8 case and knobs are black with white and colored lettering. The display is backlit green. The analog S-meter is apparently lit with a green tinted lamp. Some other reviewers have fussed about the R8 ergonomics, but I didn't find any serious problems in that regard. Yes, it would be nice to select the bandwidth you want without going through the other bandwidths, and yes it would be nice to select the mode you want without going through the other modes, and yes some of the buttons are a little closer to other buttons or knobs than I would like, and yes some of the knobs are a little small. But after knob twiddling with an R-390A or 51J-4, the R8 seems fine to me. The textured black paint on the flimsey removable R8 cabinet top reminds me of the 51J-4, another black beauty.

Of course, there is nothing flimsey about a 51J-4, and Drake really should reconsider the flimsey aspect of the removable top part of the R8 case. For a while I thought the power transformer in my new R8 had objectionable mechanical hum until I discovered that the flimsey R8 case top was somehow amplifying the power transformer vibrations and radiating the vibrations like a wolfer. Until I repositioned the flimsey top, you could hear 60 Hz hum all over the room and out into the hall when the R8 was turned off. A permanent solution to this problem may require cementing foam rubber of appropriate thickness at various places inside the flimsey removable top or along the sides of the R8 chassis.

You may recall that the first R8 I tried about a year ago had substandard image rejection. According to a statement attributed to Magne in a past issue of Numero Uno a number of early production R8's had substandard image rejection due to improperly matched 45 MHz filters (in the first IF). So naturally I

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checked my new R8 out immediately for images. There was not even a hint of the 100 KHz image of my superlocal KRUS 1490 KHz on 1590 KHz. Subsequently I measured the image rejection of my new R8 at several frequencies in the MW band and at SW frequencies and found the image rejection to be 80 dB or better.

There are some aspects of R8 image rejection which puzzle me. Originally Drake specified R8 image rejection as better than 60 dB from 100 KHz to 1.5 MHz, and better than 80 dB from 1.5 MHz to 30 MHz. However, in the operator's manual I received with my new R8 the image rejection is specified as better than 80 dB throughout the entire R8 tuning range. Another difference between previous R8 specifications and current R8 specifications is that previously R8 sensitivity below 1.5 MHz was derated (less than the sensitivity above 1.5 MHz), while in my new operator's manual the R8 sensitivity is rated uniformly throughout the entire R8 tuning range with preamp off. (In my new R8 the preamp is still deactivated below 1.8 MHz.) Maybe these two specification changes are related. And maybe both are related to the undocumented MW attenuator which I discussed in my recent note "Drake R8 MW Attenuator." I am especially puzzled that I get different measured image rejection values from one day to another at the exact same frequency using the exact same equipment. It is as if something inside my R8 changes from one day to another. For example, I have gotten measured image rejection values as low as 80 dB and as high as 89.5 dB. The measured image rejection values also seem to depend on signal levels. I tend to get lower image rejection values when the image is at or near the R8 noise floor than when the image is considerably above the noise floor.

To put the above R8 image rejection values into perspective, according to Magne's NRD-525 white paper, Sherwood Engineering measured the (455 KHz) image rejection of an NRD-525 as 82 dB. Consequently, on some days the image rejection of my R8 is slightly less than a typical NRD-525, and on other days it is somewhat more. In any case, better than 80 dB image rejection is excellent.

While I had my equipment out I checked some other specifications of my R8. The 6 dB bandwidths measured 5.7, 4.4, 2.5, 1.8, and 0.3 KHz respectively, while the 80 (yes, 80) dB BW were 11.1, 8.2, 5.4, 4.4, and 1.4 KHz respectively. That is excellent selectivity. The noise floor in the MW band was typically 0.125 microvolts (-125 dBm) for the 6.0 BW, while MW band sensitivity using 6.0 BW for a 10 dB S+N/N ratio was 1.5 microvolts in AM mode. For CW, USB, or LSB the MW band noise floor was much lower, namely 0.025 microvolts (-139 dBm) for the 6.0 BW, and the MW band sensitivity was better, namely 0.75 microvolts for the 6.0 BW. By comparison the MW band noise floor of an R-390A is typically 0.15 microvolts, and an R-390A MW band sensitivity is typically 0.4 microvolts. To put these sensitivity figures into perspective, it seems to me that I can hear a few weak daytime MW signals slightly (ever so slightly) clearer on my R-390A than on the R8. However, most DXers never hear MW signals as weak as I hear because my MW band noise levels are much lower than most DXers', and in addition I use a noise reducing antenna which further reduces my MW band noise floor. Thus I rate the R8 MW band sensitivity as excellent, almost as good as an R-390A. As a matter of fact, I can hear some weak daytime MW signals better on the R8 than on the R-390A, namely when the R8 noise blanker is effective. The AM mode 3rd order dynamic range of my R8 using the 6.0 BW and 20 KHz tone spacing was typically 87.6 dB in the MW band. Let me point out that Drake's spec of greater than 90 dB dynamic range refers to SSB mode and 2.3 BW. In that case I got a whopping 106 dB dynamic range (primarily because of the much lower CW/SSB noise floor of the R8). These measurements suggest that it may be advantageous to use ECSS techniques on some extremely weak MW band signals, and while I haven't checked it out extensively, listening tests seem to support this suggestion. A ham I spoke with told me he can hear weak CW signals in the ham bands using his R8 that he can't hear at all on his other receivers. Apparently Drake did a bang-up job on the CW/USB/LSB part of the R8 design.

The notch filter on the first R8 I received, in September 1991, didn't work at all. The notch filter in my new R8 works great, at least within the R8 notch frequency range of 500 to 5000 Hz. Sometimes the notch null is difficult to position (a vernier tuning knob for the notch would be helpful in some cases). And it is annoying that the notch will not tune below 500 Hz. In my opinion a tone control on a communications receiver is unnecessary. Maybe I can figure out how to disable the tone control and use the tone control knob to tune the notch below 500 Hz.

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At first I thought the noise blanker in my new R8 was intermittent. Fortunately a EE friend of mine had stumbled across the Allegro ULN3845A noise blanker chip data sheets and sent me copies a few weeks ago. After studying the ULN3845A data sheets and the R8 schematic I concluded the apparently intermittent blanking of the R8 noise blanker was normal. Here is what was happening. In the R8 the 3845A follows the 45 MHz filter but preceeds the selective 50 KHz IF tuned circuits. The 3845 chip is designed so that audio signals do not trigger the blanker. Since the 3845 "sees" all signals in the 45 MHz filter bandpass (12.5 KHz at 6 dB down, and 25 KHz at 60 dB down), adjacent signals which are somewhat stronger than the desired signal can and do inhibit blanking when the adjacent signals are stronger than the noise pulses. For daytime MW signals you will seldom obtain significant blanking action unless both adjacent channel signals are no stronger than the desired signal. When the R8 noise blanker is not "disabled" by stronger adjacent signals, it is very effective indeed.

The R8 front panel headphone jack is set up for stereo headphones. Yes, it works with mono headphones, but at reduced volume. My favorite headphones are Radio Shack Cat. No. 20-210A Lightweight Monaural Headphones with the 1/8 inch plug cut off and rewired with a standard 1/4 inch plug (the 1/8 to 1/4 inch adapter which comes with them introduces "static"). When using these headphones with the R8 I had to turn the volume up so high that the speker would almost deafen me unless I remembered to turn down the volume before unplugging the headphones. After I rewired the headphones using a 1/4 inch stereo plug, the situation was better. But I feel that Drake could have done a better job of equalizing headphone and speaker volume. Perhaps part of the problem is the 16 ohm impedance of the 20-210A headphones, but I doubt it. The R8 schematic seems to have omitted the headphone circuit. So I pulled off the flimsey removable top part of the case and peered around. Near the encapsulated PC board mounted stereo headphone jack I spotted two 100 ohm resistors and a 220 ohm resistor. Apparently these are dropping resistors for the headphones, in which case one can adjust the values of those resistors to equalize the headphone volume. Maybe Drake copied the NRD-525 headphone circuit, which has similarly low headphone volume. In his article about NRD-525 modifications (DX News, Vol. 59, No. 5, Nov. 4, 1991), John Tow mentioned a 100 ohm resistor in the NRD-525 as being responsible for the low headohone volume, and said that changing that resistor to 33 ohms muchly improved the situation. It remains to be seen if a similar mod will equalize R8 headphone volume. I had in mind 47 ohm resistors for the 100 ohm resistors, and a 100 ohm resistor for the 220 ohm resistor in the R8, but would want to breadboard the mod using the R8 rear panel speaker output before permanently modifying the R8 front panel headphone circuit.

My new R8 has the "static" problem due to tuning knob rotation at certain knob positions (once each rotation of the knob) when the R8 is not grounded to power line ground or a good external ground (using the ground nuts on the rear panel). According to remarks attributed to Magne in an E-mail memo of unnamed origin, Drake was supposed to have fixed this problem. Obviously they haven't. Why doesn't Drake just use a 3 wire power cord? When I get around to it, I'm gonna replace the two wire power cord with a three wire power cord.

The outstanding audio quality you get with an R8 is due primarily to two things. The R8 has excellent audio amplification - low distortion and adequate audio output power (2.5 watts into 4 ohms). Many DXers, as well as many radio design engineers, are unaware that a poorly designed AGC circuit can seriously degrade the otherwise excellent audio quality of received signals. If there is any significant amount of audio on the AGC line, the lower frequencies of received audio will be distorted, which is manifested by muffled audio. The NRD-525 in AM mode is a classic example of this defect. An AGC circuit should also have well-defined attack and release times. The NRD-525 in AM mode is again a classic example of a receiver which does not have well-defined attack and release times. For the NRD-525, the ill-defined AM mode attack and release times are manifested by distorted audio on very strong signals (which has been confused by some NRD-525 users as overload distortion), AGC hanging on noise spikes when trying to listen to weak signals (sound familiar, 525 users?), and other problems. To recapitulate, the R8 has outstanding audio quality on received signals because the R8 has excellent audio circuits and an excellent AGC circuit.

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As I said above, the R8 AGC circuit is excellent. I haven't measured the R8 AGC circuit parameters yet, but if Drake's published specs are correct, the R8 may have the best AGC of any current production receiver. I don't have to look at the R8 AGC line with a scope to know it doesn't have any significant audio on the AGC line; I can hear that it doesn't just by hearing the excellent audio quality of received signals. And my ears tell me that the R8 AGC attack and release times are probably well-defined because I hear no symptoms of ill-defined attack and release times. If the R8 AGC has any overshoot, it is well hidden because I don't hear any of the obvious symptoms of overshoot, such as pops or clicks on initial syllables of SSB transmissions. The published R8 release times of 300 mS FAST and 2 Sec SLOW are ideal choices. A 300 mS release time is fast enough so that the receiver does not hang on noise spikes or when you tune past strong signals, but slow enough to eliminate most audio from the AGC line. And a 2 Sec release time is ideal for listening to MW graveyarders, strongly fading SW signals, and SSB and CW signals. In addition, the R8 AGC can be turned off, which is desirable in some listening situations. Apparently Drake did everything right with the R8 AGC. The Japanese receiver designers have some lessons to learn from Drake in this regard. For example, the NRD-525 AGC can be fixed by disabling the AM mode AGC path and using the SSB/CW mode AGC path in all modes as I described in my recent article, "NRD-525 AGC Mod: Remove R102 And Jump Pins 3&4 And Jump Pins 8&9 Of IC7." And if JRC has done what I think they have done with the NRD-535, the the 535 AGC problems are unfixable unless they go back to the 525 AGC circuits. I almost had a heart attack prying off the surface mount resistor and fiddling with tiny jumpers while doing my 525 AGC mod on Russ' 525. Save yourself a lot of trouble and buy an R8.

I came within a gnat's whisker of returning my second R8 to Drake for a refund because of numerous spurs which manifest themselves as quite obvious hets on weak signals (S-1 to S-3) and as not so obvious hets or noise on moderately stronger (S-3 to S-7) signals. The Drake technician I spoke to about these spurs seemed to be unaware of them, or perhaps he was under instructions not to discuss them. So at first I thought my second R8 was defective with regard to spurs. Then I hit upon the idea of contacting other R8 owners to ask them if they had similar spurs in their R8's. Sure enough, they did. There are two types of spurs in R8's: type A you can hear easily by tuning around in CW mode using the 6.0 BW with no antenna connected to the R8, and type B you can hear easily by connecting a signal generator to the R8 with the signal generator output set to about 2 microvolts, and tuning slowly across the signal generator signal in AM mode using the 6.0 BW. To put these spurs into perspective, I asked Russ to check his NRD-525 for spurs. His 525 has about as many type A spurs as an R8, so the 525 and R8 are about equal with regard to type A spurs. His 525 apparently has no type B spurs. The R8 type B spurs seem to be much more numerous than the type A spurs, and seem to occur at any frequency where there is an external signal source. The R8 type B spurs cannot be detected with no antenna or external signal source connected to the R8. This is very curious indeed. It is as if an external signal finds two paths through the R8, and at certain display frequencies the single signal following two paths mixes with itself to produce a spur. The R8 type B spurs sometimes sound like ordinary hets, sometimes like warbling hets, and sometimes like modulated noise (put-putting at maybe 10 to 50 Hz). Most of the R8 type B spurs have another curious feature: a small change in the display frequency usually causes a large change in the spur tone. Normally when you tune across a spur, the tone of the spur (in Hertz) changes by exactly the same amount as the change (in Hertz) of the display frequency. But with these type B spurs, the spur tone may change from 5000 Hz down to zero beat and back up to 5000 Hz, i.e., a total of 10,000 Hz, for a change of only 100 Hz of the display frequency. This curious aspect of R8 type B spurs is important to eliminating them when you encounter them in an actual listening situation: merely retune your R8 a few tens of Hz and the type B spur can be raised in frequency to beyond audibility. The type A spurs can be eliminated with the notch filter, provided the type A spur is not within 500 Hz of the carrier of the desired signal. Unfortunately, the type A spurs drift around from hour to hour, and from day to day, and their frequencies seem to vary wildly from one R8 to another. Russ has suggested we call type A spurs Gypsy spurs because they are constantly on the move and can turn up anywhere. Once again I'm gonna fuss at Drake about the R8 notch filter: if they're gonna give us Gypsy spurs, then they should give us a notch filter that can get rid of all the Gypsy spurs, not just those with tones above 500 Hz.

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How serious are the R8 spurs? Well, they obviously didn't stop me from buying an R8 once I surmised everyone else had similar spurs in their R8's and found out that the NRD-525 has about as many type A spurs. There are two kinds of type A spurs in the R8, type A1 which are spaced about 200 Khz apart, and type A2 which are spaced about 400 Khz apart. That gives a grand total of 10 possibly audible type A spurs in the MW band. For most MW listening situations you are going to be listening to signals stronger than S-7, so you won't hear the type A spurs. For comparison, the NRD-525 type A spurs seem to occur mostly at exact multiples of 100 KHz, although there are three "random" type A spurs in the MW band on Russ' 525. It is similarly unlikely that you will hear type A spurs in the MW band on an NRD-525 during actual listening situations. And as I said above, you can usually eliminate the R8 type B spurs by changing the R8 tuning slightly. In summary, the R8 spurs are not serious, and the R8 type A spurs are no more numerous that spurs for other top of the line receivers. It would be nice if Drake would figure out how to get rid of the type B spurs. Until they do, a DXer will have to remember to "jiggle" the R8 tuning to see if some of the "mush" on a weak signal is due to a type B spur.

I did not discuss R8 spurs to deter you from buying an R8. As I said at the beginning of this article, in my opinion there really is no other choice for a MW DXer who wants to use a nearby loop antenna because of the objectionable display noise and other RFI in other receivers. For years I have been looking for a solid state receiver with MW band performance equal to or better than my HQ-180A, R-390A, and modified 51J-4, and I haven't found one yet. The R8 is close, but not quite there. On the other hand, I've concluded that I'll probably be in my grave before a solid state receiver appears which equals the weak signal performance of my venerable hollow state receivers. So it boiled down to the R8 or no solid state receiver for me. I took the R8, and I don't regret it. Try it, you'll like it.

Here are a few final things I intended to mention, but forgot. The squelch on the R8 is about as useful as mud flaps on a bicycle, i.e., useless. The SCAN VFO A TO VFO B feature doesn't work because the R8 doesn't stop scanning unless you fiddle with the squelch control while scanning, and it only stops at the strongest signals anyway, not at all signals above the squelch threshold. I guess Drake put a squelch control on the R8 because Japanese receivers have a squelch control. That is one feature Drake shouldn't have copied from the Japanese. What Drake should do is permit the user to scan between two frequencies in user selected frequency steps (of any size) and user selected pause times (of any size), WITHOUT SQUELCH. That might actually be a useful feature. I haven't tried any of the memory scanning features. They may be equally disappointing. I surely hope not.

Every R8 owner I have talked with gives the R8 AM synchronous detector a 5 on a scale of 1 to 10. Clearly Drake needs to go back to the drawing board on the AMSD. It is sometimes slow to lock, it sometimes gets "confused" when there are multiple signals on or near the same frequency, it sometimes loses lock during fades (as evidenced by growling or distortion), and it doesn't always improve audio quality in FAST AGC as it should. Fortunately, the R8 has such a good AGC that the AMSD isn't all that necessary. The R8 SLOW AGC is truly outstanding at clearing up MW graveyard jumbles and improving the audio quality of strongly fading SW signals. Like any fast attack, 2 Sec release AGC, the SLOW R8 AGC is occasionally hung briefly on noise spikes. That is, of course, normal for any 2 Sec release AGC. I am not suggesting Drake change the R8 SLOW AGC release time because 2 Sec is right for a slow release.

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Drake R8: A Third Look

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Don't mothball your R-390A yet for an R8. The R8 has some problems with second and third order intermodulation distortion products (IMD2 and IMD3), inadequate sensitivity, hiss, and filter ultimate rejection which may deter some DXers.

Receiver manufacturers should specify the second order intercept (ICP2) and the second order dynamic range (DR2) of their receivers, but they don't. I have been aware that inadequate ICP2 can cause a DXer problems for about 10 years, ever since I started building loop antennas. More recently, I have been educated on how difficult it is to tame IMD2 while trying to develop IMD2-free broadband active antennas. Take my word for it, it is a bad old problem. It is difficult to say what the minimum ICP2 and minimum DR2 should be for a receiver to be free from IMD2 under normal use. In fact, it depends on the receiver design and the antenna which is used with the receiver. An R-390A typically has ICP2 = +39 dBm and DR2 = 88 dB. Since I have never heard any IMD2 products on an R-390A which originated in the R-390A in normal listening situations, it follows that an ICP2 of +39 dBm and a DR2 of 88 dB is adequate for a receiver with a tuned front end, except in exceptionally high RF environments. Russ Scotka has told me that he can detect daytime IMD2 with the BFO on for one of his super local MW signals, and it is likely that other MW DXers in very high RF environments can similarly detect IMD2 on an R-390A. For a receiver with a broadband front end, like the R8, I do not know what ICP2 and DR2 values would be adequate. But it has become clear to me that the R8 values, ICP2 = +22 dBm and DR2 = 75 dB, are inadequate. Many evenings within a few hours after local sunset I have observed numerous IMD2 products on the R8 between 15.600 and 15.800 MHz. Most of them were only observable as hets in CW/USB/LSB modes, but a few were strong enough to be IDed had I been so inclined.

IMD2 arises as the sum or difference of two signals due to non-linearities in active devices, passive devices, and other components in a receiver. For two AM signals with carriers of frequencies f1 and f2, IMD2 will be found at frequencies f1 + f2 and f1 - f2 (or f2 - f1, depending on which frequency is greater). For example, an IMD2 product on 15.675 MHz could be caused by one signal on 6.125 MHz and another on 9.550 MHz.

The R8 also has inadequate third order intercept (ICP3) and inadequate third order dynamic range (DR3). Most days this fall I can observe IMD3 from my 1490 KHz super local and 1130 KHz Shreveport 70 miles away (2x1490 - 1130), and at night I observe many IMD3 products between 1600 KHz and 2100 KHz or so.

Where are these IMD products originating in the R8? I don't know for certain. But after doing some calculations using MiniCircuits data for their SBL-3 mixer, the R8 first mixer, I got an ICP2 of +22 dBm and an ICP3 of +6.5 dBm, which is in close agreement with the measured intercepts of my R8. This suggests that the IMD observed on an R8 originates in the first mixer. The R8 first 45 MHz IF amp could also contribute to the IMD products observed in the R8. So it would appear that improving R8 IMD performance would require major surgery on the R8 front end.

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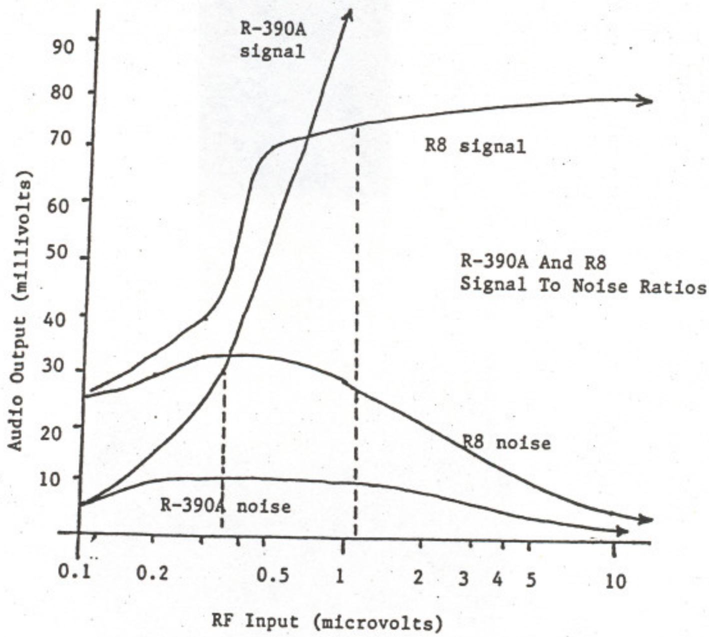
After several months of using the R8, it has become clear to me that the R8 sensitivity is not quite adequate. In addition to having a quiet location, I use a noise reducing antenna which makes my ambient man-made noise floor much lower than most DXers, especially those in urban areas. Below about 2 MHz during the day, and above about 7 MHz day or night the R8 does not hear weak DX (at my noise floor) as clearly as my R-390A. In some cases, namely when man-made or atmospheric noise is very low, signals can be heard clearly on the R-390A which cannot be heard at all on the R8. The graphs below of R8 and R-390A signal and noise ("signal" modulated by 1000 Hz at 50% modulation, "noise" unmodulated) reveal why weak signals are obscured by hiss in the R8. The R-390A requires about 0.35 microvolts for a 10 dB S+N/N, while the R8 requires slightly more than 1 microvolt for 10 dB S+N/N. That may not seem like much of a difference, but it should be remembered that many signals of interest to a DXer are less than 10 microvolts. The graphs reveal another aspect of S+N/N which is more important with regard to hiss than the sensitivity difference. For signals in the 1 to 10 microvolt range, the R-390A S+N/N is 20 dB or greater, while the R8 requires a signal of at least 10 microvolts for a 20 dB or better S+N/N. Thus, for a DXer at a quiet location, many signals of interest are clearer on the R-390A than on the R8. This is especially true of very weak daytime MW DX. For nighttime domestics or splits, which are stronger, there is no difference.

A substantial amount of the hiss (receiver noise) in my R8 originates in the 50 KHz IF. I determined this by disconnecting the miniature coax which connects the RF PC board to the IF PC board and observed that the hiss was only slightly reduced. Similarly disconnecting the R-390A IF subchassis from the RF subchassis produces a dramatic drop in receiver hiss. Thus, it appears that the R8 stage gain distribution is not appropriate.



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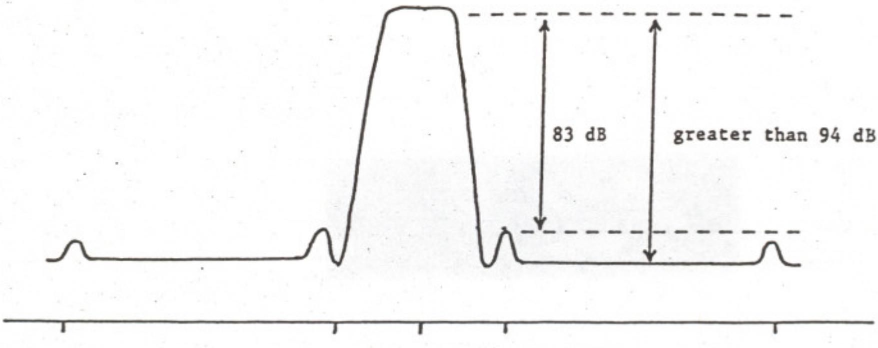
R8 Wide Filter Response



There are various ways of measuring filter response. One way, which reflects how a receiver is used in practice, is to inject a strong signal from a signal generator and observe the response as the receiver is tuned away from the signal. The above graph represents such an observation for a typical R8. Since the R8 S-meter (calibrated by a precision signal generator) was used for these measurements, the ultimate rejection was greater than the test instruments, i.e., the ultimate rejection could only be specified as greater than 94 dB. A curious aspect of these observations was the "blips" at about ±10 KHz and ±100 KHz. Strictly speaking, because of the blips, the ultimate rejection of the wide filter is only 83 dB even though the skirts are greater than 94 dB down throughout most of the skirt frequency range. The cause of the blips is not known, but because the R8 uses LC filters to establish the wide filter response, it is unlikely that the blips are due to filter leakage. Similar blips have been observed in NRD-525's. I do not know if the blips vary in height from one R8 to another. In a sample of two NRD-525's, the blips varied from one NRD-525 to another, and varied from one side to the other of the filter. For one NRD-525 the highest blip was down 75 dB, while for another the highest blip was down 86 dB. When using a signal generator to observe the blips, the blips sound like growling motor-boating. The blips are rarely heard in actual listening situations. For example, with my 83 dB blip R8, the blips can be heard as faint background growling when the R8 is tuned near my strong local aero beacon on 308 KHz. No blips have been heard on my 86 dB blip NRD-525. The 75 dB blip NRD-525 was not tested on the air. A possible cause of the blips is synthesizer noise sidebands. If that is the cause, then nothing can be done to improve the ultimate rejection of R8's and NRD-525's. Improved IF filters and improved IF shielding would not improve the ultimate rejection of R8's and NRD-525's because the synthesizer noise sidebands would already have mixed with strong adjacent signals at the first mixer before the IF filters. To confuse matters, according to Magne's Edition 2.0 (11 June 1987) RDI white paper for the NRD-525, some early production NRD-525's did have 455 KHz IF filter leakage which limited ultimate rejection to 65 dB. The filter leakage was attributed to "cross-coupling in the matching networks of the IF stages." It was said that this same problem occurred in NRD-515's. In both cases, Sherwood Engineering, 1268 South Ogden Street, Denver, CO 80210 for $39. Sherwood reports that 15 dB improvement is typical. for an NRD-525 with 65 dB ultimate rejection. Apparently the improvement is less in some cases, possibly because synthesizer noise sidebands (discussed above) limit improvement to a lower value.

After extensive listening comparisons between an R8, and R-390A, and an NRD-525 with modified AM AGC, it seems to me that the clarity of weak signals, signals below S-5 on the R8, is not as good for an R8 as for an R-390A or an NRD-525. Such weak signals are "muffled" or "fuzzy" on an R8 as compared to an R-390A or modified NRD-525. For stronger signals, the audio clarity is as good or better than any other receiver I have used. It is only for very weak signals that the R8 audio clarity begins to fade in comparison to other top receivers. Presently I don't have a clue as to the cause of this peculiar situation. Turning off the R8 AGC does not improve the clarity of weak signals, so it appears the AGC is not involved. Turning on the preamp for weak SW signals does not improve their clarity, but then the R8 preamp has a lot of hiss, so the somewhat low R8 signal to noise ratio below 10 microvolts is not ruled out as a possibility. As a matter of fact, the signal to noise characteristics of the NRD-525 used for the above comparisons were virtually identical to the R-390A, namely about 0.3 microvolts for a 10 dB S+N/N, and a 20 dB S+N/N for signals of 1.1 microvolts or greater. In other words, the signal to noise ratios of an R-390A and NRD-525 rise much faster than for an R8 as signal levels rise.