Comparisons among Kenwood TS-990S, Icom IC-7300 and IC-7610

by Rob Sherwood NC0B. Edited by Adam Farson VA7OJ/AB4OJ. January 6, 2018.

I don't own a TS-990S now, as I gave it to my friend and repair genius N0QO, who got it working perfectly again. (For those who don't know, a very near lighting strike EMP took out my 990S in 2015.) After 40+ hours of troubleshooting and repair, and $500 in parts, the 990S is good as new. Since Ken is moving QTHs, and has no towers/antennas yet, I used the TS-990S during ARRL 160 CW contest in December 2017 along with my IC-7300. I'll compare those in a moment.

My 7610 arrived just in time for the December 2017 ARRL 10m contest. Due to awful conditions, except for a brief E skip opening on SSB to Washington state in particular, most of my time was spent on CW. The big improvement between the 7300 and the 7610 is QSK and APF (audio peak filter). Of course dual watch (dual receivers) is important for DXpeditions, but of little significance most of the time. Some split operation exits on 40m, but during October 2017 CQWW SSB, I worked only one SSB station split on 40m.

Let's ignore the bigger size, bigger screen, more buttons and knobs between the 7300 and the 7610. It goes without saying that the larger 7610 has advantages due to its size. Aside from QSK and APF, the two Icoms work about the same. Selectivity is excellent, Icom NR (noise reduction) is the best I have ever used, and ergonomics are particularly good on the larger 7610.

On 160m I used significant attenuation to get band noise below AGC threshold. Since I was going back and forth between the 990S and 7300, I set the Kenwood to 18 dB attenuation and the IC-7300 to 20 dB, its only choice aside from the RF gain. This put band noise 8 to 10 dB below AGC threshold. Occasionally I had to turn up the AF gain on a weak 160m CW signal, but in return band noise fatigue was minimal.

I ran the 7300 NR on 3 out 10 most of the time, and that even further reduced band noise annoyance. On the other hand, NR on the Kenwood was useless.

The TS-990S and IC-7610 have the same type of solid-state T/R switching, and thus QSK is excellent on both the 990S and the 7610. Eventually I'll have the 7610 hooked up to my Alpha 89, which like the 87A, has PIN diode T/R switching. In the past, the 990S / 89 combo was wonderful on CW. I am sure the 7610 will also be great with the Alpha 89, but I haven't run those together yet.

For the ARRL 10m contest I had the 7610 at Ops3 with the Acom 1000, which isn't a slouch on QSK either, but it is vacuum relay, not PIN diode. With the 7610 arriving at the last minute, there was no way I had time to tear down Ops1 (IC-781 + Alpha 99) or Ops 2 (IC-7300 + Alpha 89) to hook up the 7610 for the 10m contest. I used the 7610 at the third operating position with the Acom 1000, which had no rig setup at Ops3 at that time.

I also operated the 7610 during the Stew Perry W1BB CW Top Band contest on December 30th. It resulted in my second best score in this contest, being only a few percentage points behind my results in 2009. While the signal density / QRM level in the W1BB contest was not as high as in the very popular ARRL 160m CW contest, the new 7610 performed very well separating stations. The W1BB contest was more of a pile-up test than the ARRL 10m event, which mostly dealt with copying very weak signals.

I can only indirectly compare using the 990S to the 7610 by comparing the 990S to the 7300, and then the 7300 to the 7610. NR (noise reduction) was a big win for the Icom. QSK between the 990S and 7610 is a wash, and both are excellent. APF is also very good for both. The bandscope is significantly better on either Icom, even with the smaller display of the 7300.

I haven't tested the 7300 or 7610 on transmit IMD, but my guess is the Kenwood is ahead by about 5 dB since it is a 50 volt PA. On the TS- 990S, IMD3 is about -40 dB relative to PEP on all bands between 50 to 200 watts. Most 13.8 volt rigs have IMD down about 35 dB relative to PEP.

After owning big, heavy rigs for decades (two IC-781s, one IC-7800 briefly, and the TS-990S), I am happy to have 10 and 20 pound radios now. I hope to sell my backup IC-781, but I'll keep the main 781 as long as I can keep it working as my analog reference radio. It always sounds excellent on receive, and has a cleaner transmitter than most 13.8 volt rigs as it has a 32 volt PA.

It was fun to use the TS-990S for three years in many contests. It is a fine radio, but newer technology has some advantages. On CW I run the Icom bandscopes on either ±2.5 kHz or ±5 kHz. Resolution is better on the Icom radios, though with that narrow a span, internal noise on the Kenwood display isn't an issue as it is with wider spans. (Resolution bandwidth is coupled to the span setting.) With wide spans you cannot see weak signals on the Kenwood that you can easily work. You also cannot see received signal detail on the Kenwood that is clearly obvious on the direct sampling radios, be it CW or SSB.

Kenwood never got the preamp gain right on 12 and 10 meters, and that should have been a user-adjustable setting. Normally on 10m on the 990S I would run the preamp in addition to 6 dB attenuation to get the band noise/AGC threshold right. The 7610 has an interesting feature if you hold the attenuator virtual button down for a few seconds. Suddenly you can set the attenuation in 3 dB steps from 0 to 45 dB using the multi-function knob. I don't know why one would want 30+ dB of attenuation, but the 3 dB granularity makes setting the net gain of the receiver a snap. I prefer the step attenuator to using the un-calibrated RF gain control. On any band I want band noise below AGC threshold, and 3 dB steps of attenuation is a great feature.

One problem that no Japanese OEM has gotten right is handling impulse noise. Neither Icom, Kenwood nor Yaesu has got this right in its modern DSP radios. The analog IC-781 is perfect, as is the 756 Pro III. No radio from Icom since the Pro III handles impulse noise properly. An electric fence, for instance, totally captures the AGC. The IC-7000 was the absolute worst radio I have ever owned from that respect. Kenwood tried to fix this flaw with two beta code attempts, but failed. Elecraft gets it right, as do some of the Ten-Tec DSP radios. Otherwise it is a parameter that is totally screwed up on most radios in production today. It is much worse on SSB than on CW since the rise time of an impulse is degraded by a CW bandwidth filter.

I notice that the Flex and Elecraft reflectors are making a big deal about the blocking (BDR) data of the 7610, which is really the ADC overload (OVF) point for out-of-passband signals. In reality the Flex 6300 is only 3 dB higher, and the 6700 8 dB higher. The 6300 is no longer in production, and the 6700 will for the most part be supplanted by the 6600. Neither the 6400 nor 6600 are shipping, so I have no test data on them yet. Excluding the Flex 6700, all direct-sampling radios I have tested have an ADC overload point 122 to 125 dB above receiver noise floor.

It should be understood that as long as the ADC clips long before the gain stages (preamp, ADC driver) go into compression, blocking does not occur in a direct-sampling SDR and thus BDR is not a valid metric for this type of receiver. With this understanding in mind, the sort of futile debate referred to above can be avoided.

No question the K3S has a high blocking number, but it is more a theoretical than a practical benefit. Blocking of the 990S is only 5 dB less than the K3s, so legacy radios win on that point. In reality, when we are talking about 90 to 100 dB dynamic-range radios, usually a radio is in distress for some other reason way before it blocks. I have only seen my 7300 OVF once, and it was caused by a trucker/CB'er 700 feet from my 10m tower when I was running preamp 2 on the 7300 during the 2016 ARRL 10m contest. Was the CBer running more than 5 watts? Hmmm.

On the other hand, I don't live on the east coast or in Europe, so OVF without careful use of attenuation may be an issue. Remember that at night on 40m, band noise is about -100 dBm. That is 30 dB above receiver noise, so significant attenuation should be run at night on 40/80/160m to get band noise reduced to not moving the S meter.

While the 7610 has Digi-Sel, (a single-pole tracking preselector), I don't know how much difference it will make in practice. On 20m and up, the additional attenuation at 100 kHz spacing is modest at best. On 80 and 160m additional attenuation is 8 to 11 dB, but I don't think powerful stations within the ham bands 100 kHz removed are an issue in these cases. 40 meters is the big unknown in Europe where megawatt broadcast stations are above 7.2 MHz. For the CW operator on the low end of 40m, Digi-Sel may be helpful. Whether the modest additional attenuation from Digi-Sel in the 40m phone band will be helpful has yet to be determined.

I did run Digi-Sel briefly during the W1BB 160m contest. Relays switch every 10 to 20 kHz, and cause an electrical "pop" in the receiver, plus make acoustic noise. The L and C switching relays are in the RF signal path, hence the light "pop". The IC-7700 had the same behavior. There was no practical need to run Digi-Sel on 160, so I turned it off early on in the contest.

Direct-sampling radios are a different breed, and net receiver gain needs to be adjusted more carefully than with legacy radios. I don't think many hams currently do that, but they should. Is an Icom OVF likely to flicker on the low bands with the preamp OFF and appropriate attenuation selected? I doubt it, but time will tell. If at night on 40 meters, for example, 12 dB of attenuation is selected, OVF won't happen until out-of-passband signals are S9+75 dB. That is a very large signal that I don't see in Colorado.

Field Day will also be a good test in a multi-transmitter environment. A K3S likely wins on Field Day. I doubt many TS-990S radios get hauled to Field Day due to size and weight.

The reason I run attenuation on the lower HF bands with the 7300/7610 is not because the ADC is overloading, but because there is no reason for band noise to be capturing the AGC. This is true of any radio, legacy or direct sampling.