

The 756ProIII compared to the 7800.

(A review/comparison/commentary by Matt Erickson KK5DR, with technical editing and contributions by Adam Farson VA7OJ/AB4OJ)



(Image, courtesy of ICOM America)

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Apples to oranges?

Is comparing the ProIII to the 7800 like comparing apples to oranges? I would not say so, all things considered. Much of the design features of the "P3" were developed in the 7800. In exterior appearance, the P3 looks much like the previous ProII; the main differences are internal.

My main aim of this article is to show the reader how close the P3 performance gets to that of the bigger, more expensive 7800. I'll do this in a "real world" setup where I can "A/B" the P3 against my 7800.

I'm certain there will be areas where the cost difference between the two radios will be evident. However, basic

receiver performance is my primary concern. I'm not going to get into "lab numbers", or become obsessed with features that don't aid basic RX performance. This article is for those hams whose budget will not allow them to buy a 7800, but would like the "flagship" performance at a budget price.

The “user interface” of the 7800 evolved from the Pro series; however the P3 re-designed internal circuits were developed in the 7800, so it is much like a symbiotic relationship.

P3 vs. P2:

I quickly noticed that the NR and NB are both significantly better on the P3 than on the P2. Both of these features had less distortion and are more effective than the older P2. I owned a P2 for three years. Having owned all of the 756 series over the years, I have been able to follow the design improvements. Each step has been "Evolutionary", rather than "Revolutionary". You can rest assured that each model IS a significant improvement over the previous model. However, this does not mean that the older model is no longer useful, it just means that the older model is no longer on the cutting-edge of development.

Transmitter:

My friend Adam VA7OJ/AB4OJ could not tell the difference on the air between the P3 and the 7800, so I think that says it all.

Looks alike:

The outward appearance and most of the features on the P3 are very much like those of the P2 with a few changes, such as the “mini-scope” feature, dual clocks, and TBW menu items.

I noticed that the user’s manual is slightly thicker than the P2 manual.

This is where I’ll stop comparing the P3 to the P2, and move to the real theme of this article, P3 vs.7800.

Weak signals/sensitivity:

Test conditions: **A** vs. **B**, same antenna, same band, same RF gain and pre-amp settings, RX bandwidth and AGC.

The receiver is incredibly sensitive! The 7800 has about 3dB better sensitivity. Noise seems to be the limiting factor of the P3 in this test. The 7800 receiver is just a bit quieter to start with, so the P3 can’t quite keep up.

Selectivity:

This area is where the 7800 separates itself clearly from the P3. Measurements I did on both units showed that the P3 was within 1dB of the 7800, but the 7800's superior DSP filtering makes the difference between hard copy and easy copy of weak signals hiding in band noise and QRM. The filters in both units track closely in slope shape.

The P3 gets very close, but does not quite equal the 7800.

In the area of "roofing filters" the 7800 has the advantage of both 15kHz and 6kHz filters, but the P3 only has a 15kHz filter. Some hams have been considering adding a 6kHz filter to the P3, but the difficulties of such a project are great. The matching networks involved must be very precise; mis-terminated filters will cause more trouble than they will solve. In addition the benefits may not be as good as in the 7800, mainly because the RF front ends are completely different in these two radios. I would warn anyone contemplating the installation of such a filter to think twice or more about the benefits and costs before taking it on.

The advantage in the 7800 of switching from the 15kHz roofing filter to the 6kHz is a drop in interference of about 6dB. There is NO assurances that adding such a filter to the P3 would deliver the same benefit.

NB:

The Noise Blanker in the P3 works well, better than the old P2, but falls far short of the 7800 - mainly due to the fact that the P3 NB is in the analog domain, and the 7800 is fully digital. This makes it much more expensive. The P3 NB does well for itself on pulse noise, but on a crowded band with very strong signals near by, it will begin to distort badly if pushed too high.

The 7800 NB will distort as well, but only when signals, noise, and NB settings reach extreme levels.

NR:

The much-improved Noise Reduction of the P3 does a great job; however the 7800 exceeds, with more expensive performance in this area. The NR setting on the P3, is more effective at a lower level, which produces less distortion effects.

Notch:

I tested the P3 and the 7800 on notch performance. Both have equally good <AN> (Auto-Notch) function, fully eliminating an offending carrier of any size, but both de-sense the RX and the S-meter reflects the notched carrier signal level. The <MN> (Manual-Notch) eliminates the S-meter reading and removes the carrier from the RX. Both perform well.

Scope tests/MDS/S9 levels:

I performed a combination of <MDS> (Minimum Discernible Signal), S9 meter level readings, and spectrum scope linearity tests. Below are the results.

P3 w/o Pre-Amp MDS = $0.8\mu\text{V}$ (as detected on the scope), S9 = $55\mu\text{V}$ (on the meter) and 38dB on the scope.

P3 Pre-Amp #1 MDS = $0.27\mu\text{V}$ (scope detected), S9 = $16\mu\text{V}$ (on the meter) and 38dB on the scope.

P3 Pre-Amp #2 MDS = $0.18\mu\text{V}$ (scope detected), S9 = $7.6\mu\text{V}$ (on the meter) and 38dB on the scope.

7800 w/o Pre-Amp MDS = $0.8\mu\text{V}$ (scope detected), S9 = $50\mu\text{V}$ (on the meter) and 38dB on the scope.

7800 Pre-Amp #1 MDS = $0.20\mu\text{V}$ (scope detected), S9 = $13.3\mu\text{V}$ (on the meter) and 39dB on the scope.

7800 Pre-Amp #2 MDS = $0.04\mu\text{V}$ (scope detected), S9 = $7.5\mu\text{V}$ (on the meter) and 39dB on the scope.

The MDS readings are not absolute; the receivers could detect even weaker signals, but these don't show up on the scopes. The 7800 has a lot of "grass" in the first 10dB grid of the bottom end of the scope, so detection of weak signals in this area becomes difficult. The P3 did not seem to have the "extra grass" on its scope bottom. The 7800 appears to be able to "dig deeper" for the weakest of signals, but the P3 is close behind it if you pay no attention to the scope detection. The analog meters of both units track very closely, and appear to be well calibrated.

Scope RBW:

The resolution bandwidth (RBW) of the P3 spectrum scope is 1 kHz at -6 dB for all span settings. On the 7800, RBW is 1kHz at 6 db for $\pm 12.5\text{kHz}$ span (or greater), and 100Hz at -6 dB for $\pm 2.5\text{kHz}$ span.

Dual-watch:

The dual-watch system in the P3 is very different from the 7800 system. The P3 system is limited to in-band, same mode use. The 7800 system takes advantage of the true dual RX , so is not limited to the same band or mode.

Basic RX test conclusions:

Both the P3 and the 7800 detected the same signals, no matter how weak they were. However, in a noisy condition the 7800 wins out. But then, the P3 is \$7000 lower in price.

The DSP system in the P3 simply cannot compete with the multiple DSP systems in the 7800, which are much more powerful and expensive. The 7800 uses four fast DSP sets which share out the workload; all have much higher processing speeds than the single DSP of the P3. This is another area where the price tag shows the difference. There is nothing wrong with that, just as there is nothing wrong with driving an expensive import sedan or a small economy car. Both get you to the same place, just in a different style.

Spoiled rotten:

I must admit that owning the 7800 has changed me - I'm now spoiled rotten with its features. When I operate the P3, I find myself wishing it had some of the cool "creature comforts" found on my "big rig".

I purchased my P3 as a secondary/backup unit to the 7800. I can see that it WILL get its fair share of air-time, since it performs very well, and gets me very close to that of the 7800. It will also be a nice change of pace to use.

P3 on its own:

I'm on very familiar ground with the P3, as I have owned the entire 756 series now, so my learning curve was nearly non-existent. I like the easy-to-use menu system. There have only been a few changes and additions in it since my P2. Even those changes are reflected in my 7800 menu system, so I set up the P3 exactly the same.

There are plenty of reviews out there now that show "lab numbers" for the P3; I thought the reader could use a "real world" test, showing just where the P3 stacks up against the ICOM "flagship".

For the ham who cannot justify the huge expense of the 7800 but desires top level performance, the P3 is a very good option.

73 de Matt KK5DR

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