



IC-781 vs. IC-7800

A comparative study.

By Matt Erickson, KK5DR

Overview:

In this article I wish to illustrate the similarities and the differences in what could

be called one of the best analog based radios ever made, and most recently one of the best digital based radios currently available from ICOM Inc.

I will not do any “lab” tests; I believe that lab testing of these units has been fully covered by the ARRL, RSGB, and various other testing entities.

The testing that will be covered in the article will be performed in “side-by-side”, A-B, “real world”, on-air feature-for-feature testing.

My results may not be typical results; they may vary from the results obtained by others performing the same tests. These variations can also be attributed to the elements of subjectivity and personal opinions of the author. This article should not be taken as the ultimate authority on the subject, but rather one person’s perspective tempered with experience and technical knowledge.

Those readers who "live and die by the numbers" will need to look elsewhere to find them, I’m not posting any here. This page is not intended to guide you as to which radio to buy or keep; that is your decision to make.

The 781:

In its day, the IC-781 was the most cutting-edge, yet at the same time the most expensive radio available to the average ham. This is also true of the currently-available IC-7800.

The 781 was the first transceiver with a built-in real time spectrum scope. This was a jaw-dropping feature at the time, but has now become somewhat commonplace.

The 781 boasted a huge feature set, and one of the most complete installed filter arrays available in a ham transceiver at the time it was produced.

Sadly, time and advancements in technology have left the 781 behind, but it is truly a modern classic, coveted by many hams still today - myself included.

The unit under test for this article is a late serial number, unmodified radio in excellent condition.

The 7800:

Currently, the 7800 is one of the most expensive transceivers available to radio amateurs. It is one of the most sophisticated radios on the market today. It also

has a very high-grade spectrum scope built-in. The primary difference between it and the older 781 is that the 7800 is fully DSP-based, with very few analog circuits in it. The 7800 is coveted by many hams, and owned by a lucky few who took the leap financially and technologically (myself included).

The unit under test for this article is an early serial number that has not been hardware-updated to Rev. 2 (RXPLL replacement and installation of the 3 kHz roofing filter). Only the firmware has been updated to 2.1; the unit is in excellent condition.

Test protocol:

In the interest of fairness to both radios, the settings on each will be as close as possible to being completely equal on both units for all testing. An “A-B” switch will be used to select a given unit nearly instantaneously so that band conditions will be virtually equal for the test.

Test list:

(1) Basic Receiver (weak signal work):

The receiver of the 781 has more noise than the 7800. It is difficult to measure without special equipment, but my ears tell me that the level is about 6dB. Basic signal strength is about the same in both radios, but due to the additional noise in the 781, the 7800 has a slight advantage in this area.

(2) Basic filtering & selectivity (SSB & CW):

This is where things get interesting. The stock wide and narrow SSB filters in the 781 were NOT as effective as the SSB filters of the same width in the 7800. The narrow SSB filter in the 781 had little or no effect at all. The 7800 has much greater selectivity with the same width filters, than those in the 781. On CW it was much the same, the 7800 has greater selectivity, however, when narrow CW filters are selected on the 7800, increasing DSP distortion artifacts can be heard, and they become greater with the selection of more narrow filters. The 781 has no such problem, the narrowest of CW filters in the 781 has no distortions, and little to no ringing effects.

On SSB, the 7800 has the clear overwhelming advantage, but on CW the 781

sounds better due to lack of audio distortions that are generated in the DSP of the 7800. Depending on your preferred mode of operation, one radio might be better to use than the other.

The 7800 can dig deeper for the weak signals since its selectivity is better, but the sound of the received audio becomes less pleasant and more fatiguing for the operator over time. If you were a casual operator who rarely chased weak signals, the 781 would do you fine, but if you need to dig weak signals “out of the muck”, the 7800 might be the weapon you need.

(3) Twin PBT (Pass-Band Tuning):

The twin pass-band tuning in both the 781 and the 7800 operate much the same, and are basically equal in effectiveness, but the 7800 TPBT is much more precise, using digital precision and an on-screen display of the slope and amount of shift. This gives the 7800 an advantage in what otherwise would be nearly equal.

(4) Notch filter (Manual type only):

In this test, I found that the manual notch filters in the 781 and 7800 were effective. However, the 7800 has the added advantage of a selectable width manual notch filter which allows the notch to remove a greater amount of the offending carrier signal. So, basic manual notch is about equal, but using the manual “wide” setting is more effective than the 781 manual notch filter alone.

(5) NB (Noise Blanker):

The NB on the 7800 has a clear advantage here. It takes lower levels of NB to blank the same amount of noise as would be needed on the 781. The 7800 has lower levels of NB-induced distortion on the received audio as well. Aside from these differences, the NB systems work much the same on each radio. The 7800 has on-screen NB level and depth-setting scales, while the 781 has a less accurate system.

(6) AGC system:

The AGC system on the 781 is completely analog and continuously variable from very fast to very slow, or can be switched off. The 7800 AGC is completely digital operating within the DSP system, but operates very much the same as the

781. The 7800 has more user control over the settings, having a user preset menu for AGC in all the modes, as well as a user-controllable continuous AGC adjustment. The 7800 has an advantage with its AGC system.

Basic receiver:

One of the reasons the 781 is at a disadvantage in a comparison such as this one, is that it IS an older design with certain shortcomings of that fact. It does have a higher level of phase noise in the receiver due to the older PLL/DDS design, and other shortcomings that have been overcome in the newer 7800. There is a long list of features I did not test, because both models did not have the same features. Many features can be clearly seen by readers, so there was no real need to test them here in an article that was intended to test the basics of both models.

Conclusion:

You have just read the comparison; it is now up to you to draw a conclusion. I am simply reporting my findings. With both radios sitting in front of me, it is easy enough to do.

As for me, I think the 781 is a very good radio with great features. Most 781's are getting a little old, but with care they should keep going to years to come. It has become a legend in its own time.

73 de Matt

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