IRCA TECHNICAL COLUMN
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The Ten-Tec RX-320 as a MW receiver

Description

The Ten-Tec RX-320 is a small "black box" style receiver which boasts only a power switch, two antenna inputs (one of which is for a whip antenna), power input from a wall transformer, audio line and speaker output, and a serial port DB-9 connector (see Figure 1 for the rear view of the radio; the front panel simply contains the company logo). It tunes 100kHz to 30MHz and is intended to be controlled from the serial port of a PC by a program supplied by the manufacturer which runs under 3.1 and later versions of Windows. The program displays a receiver front panel (see Figure 2) which is controlled by mouse clicks and/or keyboard entry. There is also more sophisticated software (Worldstation) available from a Ten-Tec reseller, Dxtra (http://www.dxtra.com) as well as from Gerd Niephaus (http://members.tripod.com/~gniephaus/gnrx320/gnrx320.html). For further background on the receiver, see http://www.tentec.com/ where you can view manuals and data sheets, and download the program which runs the receiver from a PC. You can also try the receiver from the comfort of your home by going to http://www.ralabs.com/webradio/ and trying a web controlled RX-320 sited near Syracuse, NY.

Figure 1 -- rear view of RX-320

As you can see from information on the above websites, the receiver has a final intermediate frequency of 12 kHz, but rather than the conventional analog detection of the signal at that frequency, it is instead digitized, and its IF filtering, detection and AGC are all done by digital signal processing inside the receiver. This isn't an uncommon approach in recent high end receiver design, but you must remember that this radio is priced at about US$300. Of course, that price doesn't include a PC, but many DXers already consider a PC an important part of their listening post, so have the capability on hand. In addition, the software runs on simple PCs using versions of Windows which are now considered obsolete. Such PCs may otherwise be headed for the trash heap, so one could in fact dedicate an otherwise unwanted PC (including geriatric laptops) to running this receiver.

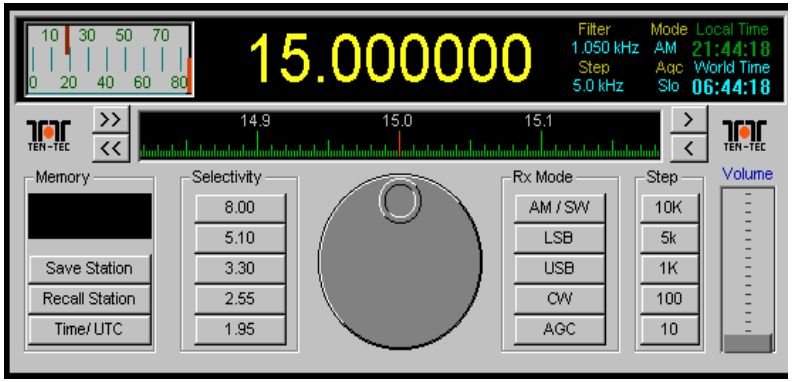

Figure 2 -- screenshot of RX-320 virtual front panel

Ten-Tec doesn't claim this to be a top of the line radio. The specifications are somewhat roughly defined, but in combination with its software, it does boast many of the features of a reasonable communications receiver, for example, 10 Hz readout, 3 AGC speeds, 34 (!) IF filter passbands of 300 Hz through 8000 Hz (claimed to have shape factors of 1.5:1), AM/USB/LSB/CW, variable tuning steps to 10 Hz, memories, and a spectrum analyzer display.

How does it work?

Reviews of this receiver (for example. http://www.rnw.nl/realradio/rx320a.html and http://www.anarc.org/naswa/issues/1298/equip1298.html) have tended to emphasize its shortwave performance, and feature out of date displays and options (no AGC adjustment or S-meter, and fewer IF filters). I decided to look at its medium wave capabilities, comparing it with a Drake R-8, and occasionally with my homebrew receiver, and was pleasantly surprised.

The software worked much as advertised, though when using Windows 3.1 on a 25 MHz 386 PC, I got reasonably frequent communication error messages which often coincided with a mouse clicked command. These errors were not apparent on faster PCs running later versions of Windows. Although only 5 IF filter buttons are displayed on the front panel display, you can choose what you consider to be your most desirable passbands of the 34 available. These displayed passbands can be easily changed with a couple of mouse clicks.

Unfortunately, most urban MW DXers use indoor loop antennas which are sensitive to nearby noise sources; most PCs, or at any rate, their monitors, are a noise source at medium wave frequencies, especially at close quarters. Unless you have a quiet PC or use external antennas with well shielded lead ins, it may be difficult to seriously consider this receiver. I didn't have the luxury of a quiet PC, so my tests were done using a random wire antenna fed through a matching transformer with isolated windings.

My expectations were that the RX-320 would have a tough time of it using such an untuned antenna with two 10 kilowatt locals within five miles. In fact, in comparison with the Drake R-8, the RX-320 did remarkably well. A third order spurious product from the locals were observed on 1240 kHz using the random antenna, but these were also heard on the R-8, and even a bit on my homebrew receiver with four stages of front end tuning. As noted below, the R-8 has considerably more sensitivity at this frequency, however. Where the radio failed more definitely was in its rejection of second order products. Using an untuned antenna resulted in a spur on 1670 from my local on 1070 and a Vancouver station on 600 kHz. Similar spurs were found on several upper band

frequencies.

Further evidence of signal overload on the RX-320 was that strong sideband splatter had a less defined and denser sound than it did on my homebrew receiver, and to a degree, the R-8. On 1260 kHz, for instance, noisy splatter from 1250 obliterated any evidence of daytime audio (though there was a carrier noted), but weak audio could be heard through the sharper sounding splatter on both the R-8 and the homebrew. However, this was not a common occurrence. Occasionally the more sensitive R-8 showed more signs of overload than the RX-320 when using the random wire; my 900 local showed up on 840 kHz, for example, if the R-8's front end attenuator wasn't used. I would have liked an RF gain control or front end attenuator on the RX-320, as sometimes the audio output had a compressed sound as if it had been overdriven in earlier stages.

Although sensitivity is supposedly degraded below 500 kHz, I did not see any evidence of a lack of sensitivity at the lower end of the MW band. If the R8 or the homebrew heard a carrier on a channel, but no audio, then the RX-320 heard it also. (For example 640, 740, 780, 1220 and 1440 kHz during a February day in Victoria, and 1566kHz at sunrise on the following morning) If audio did fade up, it appeared almost as quickly on the RX-320 as it did on the other receivers. Having said this, using a signal generator with this RX-320 revealed that it was at least 20 dB more sensitive at 10MHz than at 1MHz, and that the Drake was easily 20 dB more sensitive at MW frequencies. In an urban environment, that extra sensitivity didn't seem necessary and would have highlighted the RX-320's poorer signal handling capabilities.

Although the IF filters seemed to be reasonably steep sided, and to have more or less the passband claimed (the carrier on a signal pinning the S-meter disappeared 3400 Hz away when a 3000 Hz filter was used for example), the wide variety of passbands seemed to be unnecessary. For the most part in MW DXing, it seems more important to have good demodulation capabilities to avoid the worst effects of sideband splatter. As with several other receivers, I found the best mode for DXing with this radio was to use ECSS (exalted carrier selectable sideband), by switching to USB or LSB and zero beating the signal. I noted that the display was about 100Hz low in the unit I was using, which apparently is not uncommon. Although the Ten-Tec software does not have passband tuning, the software from Dxtra and from Gerd Niephaus appears to feature it, which would make this approach to DXing even more productive.

The AGC was a pleasant surprise, as many consumer grade receivers of the past 20 years seem to have been unable to deliver a suitable AGC characteristic for MW or tropical band DXing. Even the respectable NRD-535 had a rather slow "fast" AGC characteristic which left noticeable holes in the desired audio after splatter or noise bursts. If it wasn't for the ability to switch off the AGC on such receivers, they would not be much use for MW DXing. The RX-320's fast AGC recovers quickly from noise bursts, and allows the listener to use his ears as much as possible to dig out a signal from under the noise and splatter, which is just as well, because it can't be switched off. I did not find many situations where AGC "pumping" (on signals with a sub-audible heterodyne) was a problem that couldn't be solved by moving to the next slower AGC speed. Front end attenuation would likely have also helped to reduce pumping. The S-meter on the display is marked 0 to 80, so is not useful for reading a signal in "S" or any other units, but it does have a fairly wide dynamic range (I found it to handle -100 to -30dBm at 1 MHz, and linear enough that you could consider the markings to be in dB), and is useful for finding loop nulls, if the noise from your PC hasn't already drowned out the signals.

Other features

There is the capability of storing thousands of channels in memories in a file on your PC hard drive. Frequency, mode and filter are stored along with any additional information that you want to enter about the channel. AGC setting isn't saved however, and there's enough of a delay between hearing one station and the next when recalled from memory that it would be difficult to check for parallels using the memory function.

There is also a spectrum analyzer display accessible in the software; a scan takes 20 seconds, mutes the receive and can cover ranges from 3 kHz to 1500 kHz. Although the display gives a pretty clear indication of which frequencies are active, I've never developed the patience to wait for scans of this sort to complete; I can tune through the frequencies more swiftly, particularly using the memories. Can't deny the entertainment value, however.

Conclusions

Considering the price tag, this could be a very worthwhile receiver for medium wave DXing, as it has many features found on more expensive receivers, and acquits itself quite well in selectivity, AGC, S-meter and general demodulation capabilities. It has reasonably good strong signal handling, and though it is at the price of reduced sensitivity at MW frequencies, the reduced sensitivity is unlikely to be a problem in urban areas, but might be so in isolated and electrically quiet areas. Unfortunately, the PC and its monitor required for running the radio are well known noise generators at medium wave frequencies and preclude the antenna setup of choice for many DXers: the tuned loop antenna at the radio. The RX-320 is a good enough performer that it might be worth searching for a quiet PC to accompany it. John Fallows, from whom I borrowed the receiver for this test (many thanks!), says that there are relatively quiet PCs and monitors out there.

This receiver has struck a chord with those who like to modify receivers. There are hardware changes to allow full sensitivity to 100 kHz, and tuning down to 10 kHz (details at http://www.amrad.org/projects/lf/RX320LFMod.html). Palm OS (http://wb4huc.home.texas.net/rx320/) and MS-DOS (found at http://home.att.net/~jacksonharbor/rx320imp.htm) control programs exist, as well as the design for a handheld controller (http://www.interlog.com/~cfraser/RX-320home.htm). The controller, or the use of a Palm Pilot to control this receiver may well be a way to avoid the local noise generated by a controlling PC.

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While checking out the above sites, you might also want to look at http://www.kn4lf.com/kn4lf5.htmI which offers 7 day mediumwave propagation forecasts; you can also get on a mailing list for these forecasts.

Finally, on the K9AY group, it was suggested that those looking for Vactrols to terminate their antennas might want to visit the following site http://www.bgmicro.com