A Review of the FT780R Transceiver

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The FT78OR is the latest release from Yaesu in the line of small multimode transceivers. It is a worthy companion to both the 2 metre FT48OR and the 6 metre FT68OR.

The operating features in all these are similar as they have very similar computer control systems. This computer interfaces the panel controls dial and frequency display to the phase locked loop circuitry used for frequency generation.

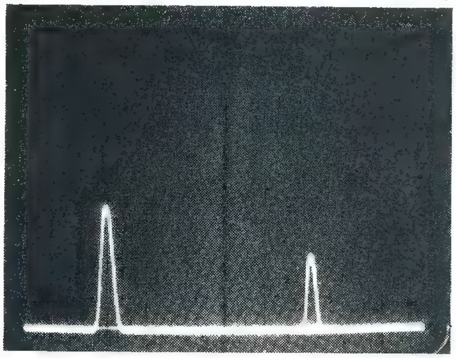
Thanks to the central system features like dual VFOs, scanning, memory channels, priority channel and repeater offset are a breeze.

One hint to band conditions in other parts of the world is the ability to search for a clear channel. This is hardly needed locally where one has to scan to find a busy channel even on the repeaters. Indeed in Melbourne one must know where the 70 centimetre repeaters are to find them in a reasonably short time. At the time of test, June 1981, only the VK3RAD repeater was initially found, although two others lay hidden in the silent band.

Aside from the operating features which are excellent the receiver hides a new development beneath a fairly bland handbook sensitivity claim. Yaesu have placed a Gallium Arsenide Dual Gate Mosfet right up front and they have backed it up with an antenna change-over relay and a real type N antenna connector. With a 0.5 microvolt signal in the SSB mode an excellent 23 dB signal plus noise to noise ratio was obtained, whilst on FM a 1 microvolt signal gave a 37 dB signal plus noise to noise ratio.

These receiver sensitivity figures would look good on many 2 metre rigs let alone on a 70 cm rig, and they are better than those claimed in the book. Further receiver tests yielded an image rejection of 75 dB and found that S9 on the line of LEDs used as an S meter represented a 10 microvolt signal with S1 being registered on a 1 microvolt signal. S5 was 2.5 microvolt signal and S3 was a 1.5 microvolt signal. The S meter is in fact a line of LEDs which double up on transmit as a power output indication.

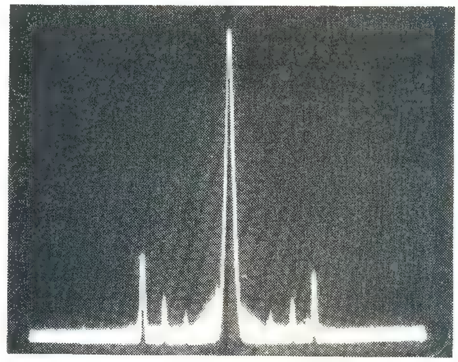
One interesting discovery when testing the rig on the spectrum analyser was the local oscillator leakage. This was at a very low level, being —46 dBm for a received frequency of 430 MHz and dropping to —59 dBm for a received frequency of 439.975 MHz. See photo 1. These are very small signal levels which would also be found on most equipment. They are much smaller than the local oscillator signals sometimes used in the past to track the fox on one sixteenth the frequency.



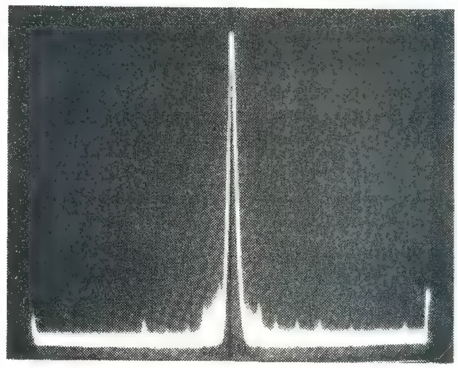
Receiver Local Oscillator Leakage. Reference 0 dBm. Outputs for 430 MHz Rx and 439.975 MHz Rx. 2 MHz/div. horizontal, 300 Hz bandwidth.

The transmitter uses one of the RF power amplifier modules. Yaesu once again hide the true performance by quoting an input power in one place and referring in another to 10 watts output. The transmitter produced an output of 14.5 watts at 430 MHz, which dropped slightly to 13.2 watts at 439.975 MHz. This is quite a good result for a nominal 10 watt rig. The output is all on the intended frequency as the spectrum analyser showed with the spurii being within the FCC limits for sale in the USA. See photos 2 and 3.

The indicated frequency was within 900 Hz of the measured frequency which is better than many two metre rigs and is well within specification.



Transmitter Output. Frequency 439.975 MHz. 5 MHz/div. horizontal, 10 dB/div. vertical referenced to max. output.



Transmitter Output. Frequency 430.00 MHz. 5 MHZ/div. horizontal, 10 dB/div. vertical referenced to max. output.

On air the FT780R worked well, both on SSB and FM. Some FM reports found the mic gain a trifle high with car noise intruding. This is a simple adjustment, however which does not affect the deviation of the signal. Yaesu have provided both a mic gain control for FM as well as a maximum deviation control. Sounds complex, but it is simple and it is preset.

On the repeaters the receiver sensitivity and the transmit power was nicely balanced.

The microphone has buttons which allow the operator to move up or down in frequency, and interesting features are that scanning may be stopped by touching either up, down or even the PTT button. In this instance the PTT button stops the scan and must then be pressed a second time to transmit.

Another interesting feature is the satellite switch which permits the user to shift frequency on transmit. Useful for satellite operation where doppler shifts have to be compensated.

One feature which is not used in Australia is tone burst. It is provided though and it is crystal locked.

A number of tuning steps are provided with 10 Hz being the smallest on SSB. This makes accurate tuning easy. A quicker 100 Hz step is also provided and the dial indicates to 100 Hz. You may also tune in kHz on SSB. On FM a fast tune position gives 100 kHz steps but the intermediate steps of 25 kHz are well adapted to the local channel frequencies.

Indeed if you are not afraid to lift the lid and apply a delicate soldering iron you may adjust the size of the frequency steps quite simply. This is a feature of this series of Yaesu processor controlled rigs which is not generally available to other processor controlled rigs.

The dial resets to 435 MHz when you remove the DC power to the rig. However if you leave DC permanently connected you may preserve the memory by throwing a switch on the rear. With 100 kHz steps available, tuning to frequency is rapid if you don't hold the memory by leaving power on the rig continuously.

The FT780R is indeed a worthy companion to the FT480 and the FT680 and it is certainly the 70 cm rig to beat. The only snag in Australia may be the price due to our customs. Imported on the same basis as 2 metre and 6 metre equipment the price would be very attractive.

The FT780R being reviewed attracted a lot of interest and sales should be brisk. The performance obtained could not be bettered except at very considerable additional expense and with a lot of fiddling.

The review FT780R was provided by Stan Roberts of Bail Electronic Services. Tests both on the air and on the test bench were performed thanks to Kevin Phillips VK3AUQ. ■

QSP

160m BAND

From 16th June, 1981, US amateurs will be allowed to use full power (1000W max. DC plate input) in the band segment 1800 to 1900 kHz. Some power and operating restrictions will continue in some parts of the USA for the segment 1900 to 2000 kHz to protect LORAN A systems operating in E. Canada. A1 and A3 emissions remain in effect for the entire 160m band. Worldradio, July 1981. ■

A Global Navigation System

To track a Great Circle route exactly (the shortest distance between two points on the earth) is every navigator's ambition. VLF Communication Stations and OMEGA make this possible. The lower "d" layer in the atmosphere (70 km day, 90 km night) reflects VLF transmissions and together with earth's surface gives a spherical band around our globe — a near perfect waveguide. VLF transmissions, locked to a caesium atomic clock, are phase stable, capable of long range and, unlike VHF, can be used at tree top height of 40,000 ft. or so. They are so stable that it is possible to determine standard time at any point on the earth's surface to one microsec.

Nine VLF transmission stations (like our NW Cape) use frequencies between 14 and 24 kHz (yes, kiloHertz) and radiate up to one million watts. Eight OMEGA stations transmit pulse sequences on 10.2, 11.33 and 13.6 kHz (imagine the size of the aerial system), with an identifying carrier frequency in such a format that no two stations are on the same frequency simultaneously. This format from eight stations (Gippsland will be one!) repeats every 10 secs. — radiating ten thousand watts on, sayl, 10.2 kHz for 1.3 secs., 11.33 kHz for 1.1 secs., and 13.6 kHz for 9 secs., plus ident carrier for 5 secs.

The Airborne (or Seaborne) Receiver, with its oscillator stabilized to the transmitter frequency, sets a basis for comparison of the phase of the signals occurring at its position. With many stations, therefore, a matrix of constant phase lines is interpreted. Also, in this way station redundancy (a strike?) only results in minimal inaccuracies. A computer then determines which station has sent which signal, and in the recent Mark III GNS500A presents a CRT display of eight lines and 14 characters to the pilot. The computer also has in memory ten flight plans. It computes the position every ten seconds by an optimum selection of the stations available to it, and updates the display, with bearing, track and distance to run; also supplying a correct signal format for the autopilot system.

Although developed in 1970 first, and now in use all over the world, the system is not certified in Australia by Transport Australia. However, with special departmental dispensation the system can be used. On December 3, 1980, Ansett Airlines of Australia, Boeing 727 VH-RMO on the inaugural Hobart to Christchurch flight, was the first aircraft (carrying passengers) in the world to use the latest GNS500A Mark III VLF OMEGA — an 18 kg (40 lbs.) system (one quarter the weight of a human navigator).—Condensed from "Aircraft", by Dave VK2ZEN (retired Ansett pilot). (The "Lyrebird", winter 1981.) ■