

Product Review

Drake TR-7 HF Transceiver

The time was, some years ago, when any self-respecting ham was equipped to hear just about anything that might be happening in the radio spectrum. The usual receiver found in a ham shack was a "communications receiver" that tuned continuously from the standard a-m broadcast band to well above 10 meters. Amateurs tracked Amelia Earhart's ill-fated global adventure in 1937. Some sold their station receivers to the government for use in military installations during World War II, and others gained considerable press coverage in 1957 by providing their friends and neighbors with a unique view of the dawn of the space age by reception of signals from the first Sputnik.

The advent of "modern" equipment changed all that. Suddenly, our radio horizon was limited to the amateur bands, with barely enough overlap at the end of the dial to receive CHU and, possibly, to participate in MARS. To be sure, the trade-off was well worth it. We obtained vastly improved stability, sensitivity, selectivity, frequency readout and operating convenience in the bargain. But somehow, those of us who cut our Amateur Radio teeth on a general-coverage receiver never quite got used to not knowing what was going on next door in the radio spectrum.

All that has been changed with the introduction of the Drake TR-7. An outstanding feature of this transceiver is that, with the optional DR-7 digital readout feature, it becomes a general-coverage receiver with all the features and the high performance we have come to expect from "ham-bands-only" units. An added bonus is that the transmitter section can also be equipped for operation anywhere from 1.5 to 30 MHz — provided you can show Drake the license to operate there! This sort of flexibility in equipment was difficult to imagine just a few years ago.

The most important element in the Drake design, and the one which makes this performance and flexibility possible, is dubbed "up-conversion." Instead of being at a frequency such as 3, 5 or 9 MHz, the first i-f in the TR-7 is at 48 MHz, well above the highest operating frequency. There are several advantages to this approach: Image rejection problems all but disappear, gaps in the continuous coverage are eliminated, and good i-f rejection is provided relatively easily. Up-conversion is not new to Amateur Radio; it was employed in the Signal/One CX-7 10 years ago. However, with the TR-7, Drake has gone a couple of steps further: There is a four-pole crystal filter at the first i-f with a bandwidth of about 8 kHz, and no active devices in the signal path ahead of the filter. The objective is to minimize the effect of strong signals on the performance of the receiver.

On the transmitting side, the TR-7 features an all-solid-state design permitting broadband operation. The only thing the operator needs to do to change bands is flip the band switch. The TR-7 will deliver at least 100 watts output into a 50-ohm load on cw and sssb, and also on RTTY if the optional cooling fan is used. On

a-m (carrier plus one sideband) the output is on the order of 35 watts.

From an operating standpoint, the TR-7 is the most convenient rig this reviewer has ever used. The styling is functional, and is similar to that used in modern, high-fidelity audio equipment. Four different values of receiver selectivity are available with optional filters, which may be selected independent of the transmitting mode by front-panel push buttons. All of the controls are on the front panel; there is no need to grope inside the cabinet or behind the rig to reach anything. The different 500-kHz segments in a given frequency range are selected by push button as well. A touch of the "up" button, for example, results in a 500-kHz frequency increase. It may seem a bit tedious to push a button 12 times to go from 21 MHz to the 15-MHz WWV frequency, but a quick flip of the band switch to another range and back again will return you to 15 meters. The only transmitter-metering functions available are power output and reflected power, although a green LED is there to let you know that the ale is in operation. The wattmeter on our test rig

was reasonably accurate except on 160 meters, where 100 watts of rf output read 150 watts on the meter.

Receiver dynamic range is among the best we have seen: Noise floor is -133 dBm on both 80 and 20 meters, blocking above the noise floor is in excess of 120 dB, and IMD (third order intercept) is 90 dB (20 meters) and 84 dB (80 meters), using the procedures outlined by Hayward in July 1975 QST. With no rf amplifier and a passive first mixer, the receiver does not have the apparent sensitivity of some equipment designed with lots of front-end gain. Even so, with a good antenna in a quiet location, it is external noise, not sensitivity, which is the limiting factor in hf reception, even on 10 meters. Internally generated spurious signals ("birdies") were all within Drake's specification of less than a 1-microvolt equivalent signal, although a signal of that strength can sound surprisingly loud in a quiet receiver. The receiver age threshold is about 2 microvolts; an increase in signal strength above that level results in little change in audio output. Reducing the rf gain will raise the age

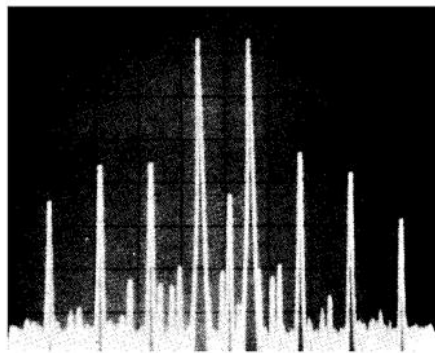
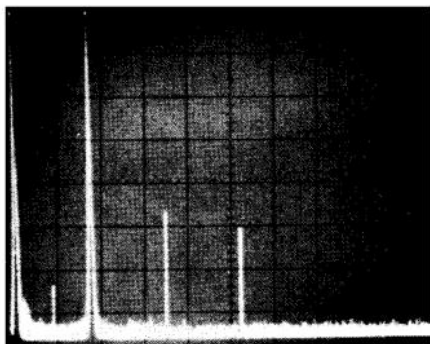
Drake TR-7 HF Transceiver

Receiver Performance:	Claimed by Manufacturer	Measured in ARRL Lab
Sensitivity	Ssb/cw, less than 0.5 microvolts for to dB S + N/N.	0.3 microvolts w/sss filter, 0.13 microvolts w/cw filter.
Selectivity	2.3 kHz at -6 dB and 4.1 kHz at -60 dB (standard filter).	2.1 kHz at -6 dB and 4.1 kHz at -60 dB.
Transmitter performance:		
Spurious output (nonharmonic)	Greater than 50 dB down.	52 dB down (worst case).
Harmonic output	Greater than 45 dB down.	46 dB down (worst case).
Intermodulation distortion:	30 dB below PEP.	33 dB below PEP.

For other comparisons, see text and accompanying photos.
Frequency coverage: 1.5 to 30 MHz receive (with DR-7); 1.5-2.0, 3.5-4.0, 7.0-7.5, 14.0-14.5, 21.0-21.5, 26030.0 MHz transmit (with DR-7).
Modes of operation: Usb, lsb, cw, RTTY, a-m (transmits full carrier and one sideband).
Power supply requirements: 11-16 V dc (13.6 V nominal), 3 A receive, 25 A transmit.
I-f: 48.05 MHz and 5.645 MHz.
Dimensions (HWD): 4.6 x 13.6 x 12.5 in. (117 x 345 x 318 mm) excluding knobs, connectors, and feet.
Weight: 17.1 lb (7.8 kg).
Price: TR-7/DR-7, \$1295; power supply, \$195; accessory filters, \$52 each.
Manufacturer: R. L. Drake Co., 540 Richard St., Miamisburg, OH 45342.



The Drake TR-7, shown here with matching MS-7 speaker.



These spectrum-analyzer photos were both taken with the TR-7 operating at full rated input power. In the top picture, the operating frequency was 1.8 MHz (worst case). Vertical divisions are 10 dB and horizontal divisions are 1 MHz each. The fundamental is shown here full scale. The most significant spurious output is the second harmonic, down approximately 46 dB. All other spurious outputs are down at least 50 dB with respect to the fundamental. The Drake TR-7 complies with current FCC regulations pertaining to spectral purity. The bottom photo shows the 14-MHz output of the TR-7 during a two-tone IMD test. Vertical divisions are 10 dB; horizontal divisions are 1 kHz. Third order distortion products are down approximately 33 dB from the PEP output. Individual tone outputs are down 6 dB from the PEP output. All measurements were taken in the ARRL lab.

threshold if you prefer, but the age cannot be defeated. Fast and slow age action may be selected from the front panel, and the time constants are automatically changed when the various modes are selected. The time constants were not measured in the lab, but the values selected provide appropriate performance for cw and ssb. The receiver incorporates the passband-tuning feature which was so popular on earlier Drake receivers; however, in the TR-7 the feature can be defeated for simplicity of ssb operation.

The transition from engineering prototypes to large-scale production runs is difficult with any piece of complex rf equipment, and the TR-7 was no exception. The review unit was one of the first off the assembly line, and some problems crept up which necessitated its return to Drake a number of times over the course of seven months of hard use. Drake tells us that the majority of the problems we encountered were corrected at the factory before more than a few dozen rigs were delivered, and that the rest were the result of random component failures, the likelihood of which has now been reduced thanks to a stepped-up program of

quality control. This can happen with any piece of gear, and when it does it is reassuring to know that there is a company with a solid reputation standing behind the product. The TR-7 comes with a 90-day limited warranty.

Accessories

The unit supplied for review was outfitted with 300-, 1800-, and 6000-Hz second i-f filters in addition to the standard 2300-Hz unit, and each proved to be useful during the course of the evaluation period. The NB-7 noise blander was not available for evaluation, and other accessories were not requested. The PS-7 power supply is very rugged and includes circuitry to protect both itself and the transceiver from damage. The DR-7 digital display is so important to the versatility of the rig that it is not really an accessory in the conventional sense; it is difficult to imagine the rig without one, and Drake probably will not sell many "stripped" units. Finally, one promised accessory which we eagerly await is a complete service manual. The instruction manual supplied with the unit is a very professional job, but it is almost completely devoid of technical information and does not even include identification of which circuit board is which. It is not known whether Drake plans to add vhf/uhf transverters to its "7-line" series, but there is no provision for a separate low-level transmitter output for this purpose. There is provided, however, a separate receiving antenna jack which has a variety of potential uses.

In closing, a word to sports-car buffs: In spite of anything you may have heard about the relationship between Triumph sports cars and Drake transceivers, the TR-7 does not have a sloping front panel! — **David Sumner, K1ZZ**