

Product Review

Conducted By Paul K. Pagel,* N1FB

Yaesu FT-107M HF Transceiver

The FT-107M is a full-featured, completely solid-state transceiver offering the radio amateur a high degree of versatility which is further enhanced by a variety of available options. Standard equipment includes all the features we have become accustomed to in an advanced transceiver: smooth VOX operation, an effective noise blanker, semi-break-in cw and a good rf speech processor, to name a few. Band coverage is complete, 160 through 10 meters, including the three new WARC bands.¹

The all-solid-state PA is rated at 240 watts input on cw and ssb, and 80 watts input on a-m and fsk. Being solid-state, the PA is somewhat more sensitive to SWR than rigs using vacuum tube finals. Built-in protection circuitry automatically reduces input power in the event of high SWR, thus preventing damage to the output transistors. The power reduction is gradual, rather than the abrupt shut-off found on some rigs. Operating into a 2:1 SWR will result in approximately a 25% reduction in output power. The heat sink for the finals is fitted with a thermostatically controlled fan to cool the unit during long transmissions.

Other features of the FT-107M include a 20-dB attenuator, offset tuning on receive and/or transmit, and digital and analog frequency readout. Some of the more unusual features found on the '107 are an af peak/notch filter, SWR meter, 170-Hz fsk circuitry and variable i-f bandwidth. The af filter can be tuned from 300 Hz to 1.4 kHz in either the peak or the notch mode. Tuning in both modes is very sharp, and some care is required in adjusting the frequency for maximum effectiveness. The peak mode is useful on cw, even when the optional 600-Hz i-f filter is used. The variable bandwidth control is like that found on the FT-101ZD.² It allows the i-f bandwidth to be adjusted from 2.4 kHz to 300 Hz. This can be very helpful when operating ssb under crowded band conditions.

Power requirements for the FT-107M are 13.6 V at 20 A dc. For operation from the 117 V ac line, two power supply options are available. The FP-107E is an external supply with built-in speaker, while the FP-107 supply can be installed in the transceiver cabinet for compactness.

Digital Memory and DMS

Perhaps the most unusual option available for the '107M is its digital memory system. The DMS system provides a synthesized VFO (the main VFO is a conventional LC tuned oscillator) and 12 memories, each of which can be used to control transmit or receive frequency, or both. In addition, memory fine tuning and the normal offset tuning can be applied to

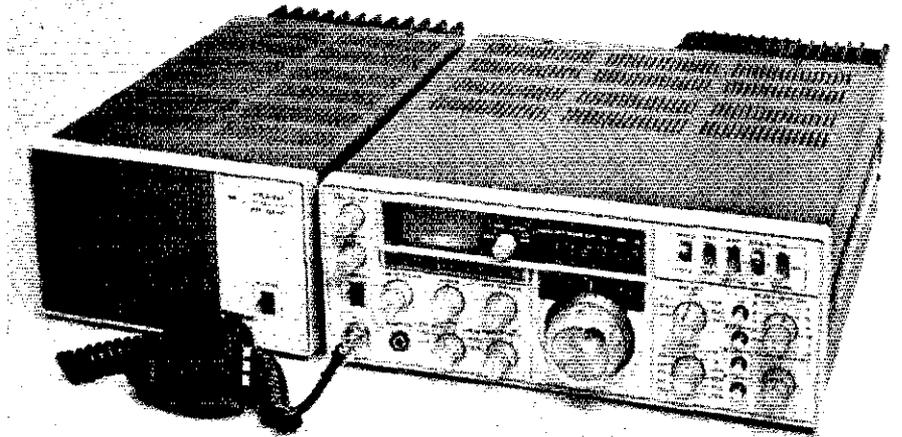


Fig. 1 — Yaesu's FT-107M and matching external ac-operated supply. The optional YM-35 microphone shown may be used for frequency control of the transceiver.

the memory frequency. This allows considerable flexibility in frequency control. But wait — there's more! The DMS (Digital Memory Shift) control enables the operator to shift a memory channel, in 100-Hz steps, to either the upper or lower band limit. This is done by means of an optically encoded, detented control. When combined with the op-

tional YM-35 hand-held scanning microphone, the operator can tune to any frequency in the band with just one hand. Three buttons, on top of the mike, control the direction and speed of scanning. As pointed out in the owners manual, a slight chirp may be heard when using the DMS. The chirp is very brief and not objectionable. It is caused by the relatively long

Yaesu FT-107M Serial No. 9N030626

Manufacturer's Claimed Specifications

Frequency coverage, (MHz)

1.8 - 2.0
3.5 - 4.0
7.0 - 7.5
10.0 - 10.5
14.0 - 14.5
18.0 - 18.5
21.0 - 21.5
24.5 - 25.0
28.0 - 29.9

Power input (dc): 240 watts (ssb, cw), 80 watts (a-m, fsk).
Output power: Not specified.

Carrier suppression: Better than 40 dB, (at 14 MHz).
Unwanted sideband suppression: Better than 50 dB, (at 14 MHz, 1 kHz tone).
Spurious output: Better than 50 dB down.
Transmitter third-order IMD: Better than 31 dB down.
Receiver sensitivity: 0.25 μ V for 10 dB S/N.
Rf attenuator: 20 dB \pm 3 dB.
APF, notch frequency range: 300 Hz to 1.4 kHz.
Notch filter depth: Not specified.
Audio output power: 3 watts at 10% THD (into 4 ohm load).

Receiver MDS: Not specified.

Receiver two-tone, third-order IMD dynamic range: Not specified.

Receiver blocking dynamic range: Not specified.

ARRL Lab Measurements

As specified plus 40 kHz beyond each band edge.

Greater than 125 watts on 160, 80, 40 and 20. Greater than 110 watts on 15 and 10 meters.

51 dB (at 14 MHz)
Better than 60 dB (at 14 MHz, 1 kHz tone).

47 dB down from carrier (1.8 MHz)
32 dB down from PEP.

0.16 μ V for 10 dB S/N (at 14 MHz).
21 dB.

260 Hz to 1.7 kHz.
35 dB.

Greater than 3 watts at less than 10% THD.

-133 dBm on 80 meters, -133 dBm on 20 meters.

82 dB on 80 meters, 90 dB on 20 meters.

Could not be measured because of receiver noise.

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¹The 10-, 18-, and 24-MHz bands are not yet open to U.S. amateur occupancy. See Baldwin and Sumner, "The Geneva Story," QST, February 1980, p. 53.

²Product Review, QST, December 1979, p. 52.

lock-up time of the synthesizer, which also ensures that the LO signal is clean, thus not compromising the receiver performance. ARRL laboratory tests confirm this; receiver measurements made using both the synthesized and the conventional VFO produced the same results.

Circuit Highlights

Each major functional unit of the transceiver is contained on a separate, plug-in circuit board. Extensive use of diode switching permits band and mode changes to be made by switching only dc control voltages to the various boards. The only point at which diodes are not used for rf switching is at the output of the PA; each of the output low-pass filters has a relay at each end.

During receive, the incoming signal is preselected by a single-tuned circuit and applied to a dual-gate MOSFET (a 3SK51-03) amplifier. The amplified signal passes through a two-pole band-pass filter before being fed to the doubly balanced diode ring mixer. Following the first mixer, the signal is band-pass filtered, buffered and then applied to the crystal filter. The i-f amplifier uses two dual-gate MOSFETs, while a doubly balanced diode ring is used as the product detector. The overall performance of the receiver is very satisfactory with the exception of poor cw filter performance. The skirt selectivity of the 600-Hz filter, while adequate for most operating, was far from outstanding. Also, the two-tone, third-order IMD dynamic range measured on 80 meters was less than expected, 82 dB compared to 90 dB measured on 20 meters. To determine if the unit received for review had a problem, a second FT-107M was solicited and the measurements were repeated. Nearly the same results were obtained with the second unit.

The transmitter section of the '107M is of conventional design. The local oscillator is a pre-mix type using a 5-MHz VFO frequency which is mixed with the output of a crystal oscillator. A separate crystal oscillator is used for each band, and the crystal frequencies are such that the LO signal is always above the signal frequency.

Low-power a-m operation is provided by modulating the 8988.3 kHz carrier signal. Fsk is generated in a similar manner: the carrier oscillator frequency is shifted the required 170 Hz. During a-m and fsk operation, the rated input power of 80 watts produces an output power of 10 watts.

Figs. 2 through 4 show cw keying waveforms obtained when operating the FT-107M under differing conditions. Fig. 2 shows the waveform when the DRIVE control is adjusted for maximum input power. It was noted during testing that the first dot transmitted has a different waveform, as shown in Fig. 3. This photo was taken by closing the manual transmit switch and then keying a single dot. This waveform variation is likely caused by the time constant of the a/c circuit. The waveform shown in Fig. 4 was produced by adjusting the DRIVE control to the point at which the a/c meter just begins to show an indication; the output power at this point was 100 watts. While the keying waveforms shown in Figs. 3 and 4 depart from the ideal 5 ms rise and fall times, on the air tests showed only the slightest "click" to the signal.

The spectral photograph in Fig. 5 shows the transmitter two-tone, third-order IMD performance to be reasonably good. Suppression of

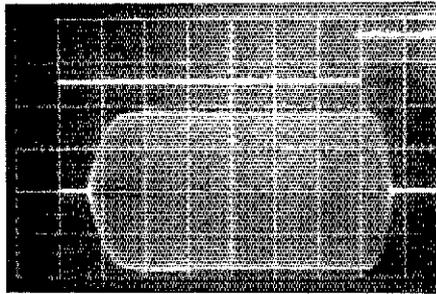


Fig. 2 — Cw keying waveform of the FT-107M with DRIVE control adjusted for maximum input power. Upper trace is the actual key closure; lower trace is the rf envelope. Each horizontal division is 5 ms.

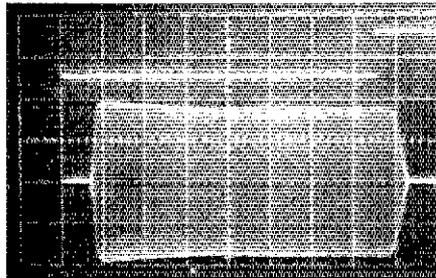


Fig. 3 — Cw keying waveform of the first dot in string. All operating conditions are the same as those used for Fig. 2.

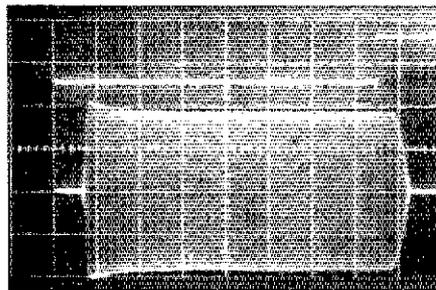


Fig. 4 — Cw keying waveform with the DRIVE control adjusted to the point at which the a/c indication just begins. All other operating conditions are the same as those used for Fig. 2. Note that under these conditions the rise time is reduced to about 1 ms and fall time to about 2 ms.

spurious emissions easily meets current FCC requirements (see Fig. 6). The maximum output power obtainable from the '107M tested was typically 126 watts, dropping to 112 watts on some bands. Other pertinent specifications and test results are listed in the table.

On-the-Air Operation

Using the FT-107M on the air was, for the most part, a pleasure. The broadband design allows quick, no-tune-up band changes — provided the antenna system used shows a reasonably low SWR on all bands. Both received and transmitted audio quality is excellent and the cw keying drew no unfavorable comments. Receiver sensitivity was more than adequate even when using small antennas.

A minor problem with the S-meter calibration was noted during on-the-air tests: The S-meter readings seemed rather high compared

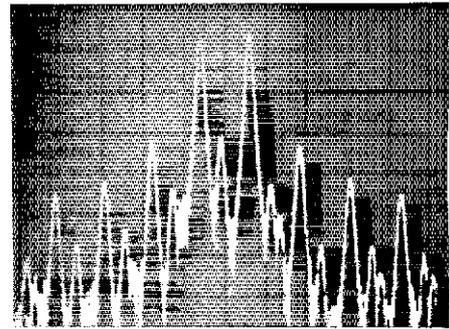


Fig. 5 — Spectral display of the FT-107M output during two-tone IMD test. Third-order products are 32 dB below PEP and fifth-order products are 41 dB down. Vertical divisions are 10 dB; horizontal divisions are 1 kHz. Transceiver was being operated at rated input power on the 20-meter band.

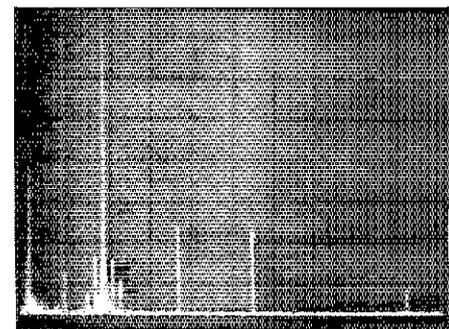


Fig. 6 — Spectral display of the FT-107M output operated at rated input power on the 160-meter band. Output power is approximately 125 watts. All spurious emissions are better than 40 dB below the carrier. Vertical divisions are 10 dB; horizontal divisions are 1 MHz. The FT-107M complies with current FCC specifications for spectral purity.

to those obtained with the station receiver normally used. Tests with a calibrated signal generator showed that an S-9 meter reading required only a 1.5 μ V signal! Following the S-meter calibration procedure given in the owner's manual resulted in a 52 μ V signal producing an S-9 reading. The number of decibels per S unit averaged 3.5 across the meter scale, which is somewhat less than the 5 or 6 dB per unit normally found.

Station accessories available include the FC-107 antenna tuner, ETV-107R vhf/uhf transverter, EV-107 external VFO and the SP-107P speaker/phone patch. All of the above accessories match the FT-107M in color and styling. Price class: FT-107M with DMS, \$1170; EP-107E, \$145. Manufacturer: Yaesu Electronics Corp., 6851 Waltham Way, Paramount, CA 90723. — *George Collins, AD0W*

KENWOOD TR-2400 2-METER FM TRANSCEIVER

□ Need a durable, convenient-to-use rig that should handle just about any 2-meter fm situation you're likely to encounter? Kenwood's Model TR-2400 synthesized hand-held is that kind of rig.

The TR-2400 is built around a sturdy aluminum frame, partially encased front and back with dark-gray high-impact plastic covers. The physical layout is well planned,