

EQUIPMENT REVIEW

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THE YAESU FT-ONE GENERAL COVERAGE ALL-MODE SOLID STATE TRANSCEIVER

About a year ago, a message came along the grapevine that Yaesu were about to release a new super transceiver with the unlikely title of FT-ONE. For quite a time many thought the whole thing a great hoax, but slowly details of this new transceiver started to filter through and it soon became apparent that the FT-ONE was far from being a hoax, it indeed was to be a super transceiver. Yaesu have put in every feature and facility that both you and they could think of, and here it is.

WELL JUST WHAT IS THE FT-ONE AND WHAT DOES IT HAVE TO OFFER? LETS SPELL IT ALL OUT

FREQUENCY COVERAGE

The receive coverage is from 150 kHz to 29.9999 MHz continuous. Transmit coverage is for all amateur bands from 160 to 10 metres, including of course the new bands at 10, 18 and 24 MHz. In this aspect, I imagine that Yaesu have more than the amateur market in view and it would seem that full coverage transceiver would be quite a possibility for the commercial market.

MODES OF OPERATION

The FT-ONE has provision for SSB, CW, AM, FSK and, as an optional extra, FM. However, as sold in its standard form, only the SSB filter is included. A wide variety of filters for the other modes are available as options. We shall look at these in further detail later.

GENERAL DETAILS

The FT-ONE contains an incredible number of semi-conductors, 214 transistors, 35 FETs, 72 ICs and no less than 344 diodes. One wonders how we ever got along with a dozen tubes with a 5V3 in the power supply. It seems that times have changed.

The FT-ONE is both large and heavy. It measures 380 mm x 165 mm x 465 mm and weighs in at 19 kg. Although the transceiver will operate direct from 12V DC you will need a very roomy car to fit the set into for mobile operation. However, an AC power supply is a standard inbuilt fitting and this accounts for a fair percentage of the total weight and bulk of the transceiver.

DESIGN CONCEPT

I feel the best way to put this is to quote directly from the Yaesu brochure:—

"It is a curious fact that top of the line amateur transceivers usually boast of very low noise, spurious free dynamic range, clear audio receivers, while selectivity and sensitivity are treated very low-key, or not mentioned at all.

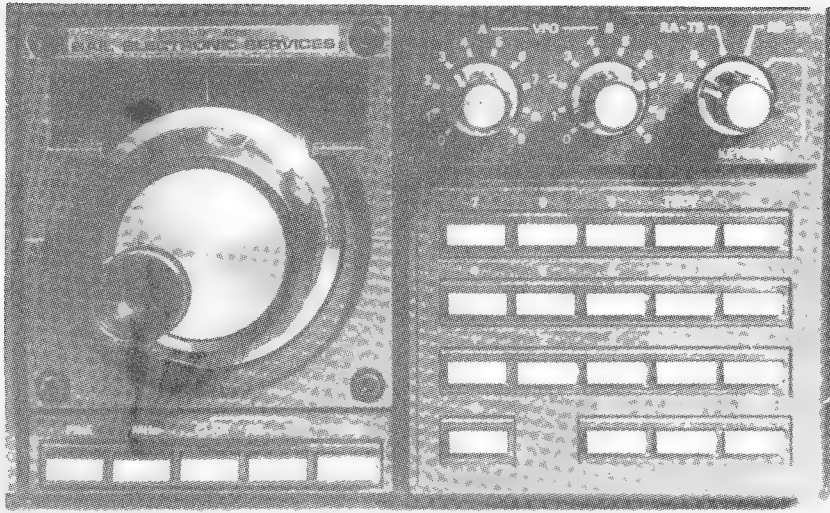
Often manufacturers will show you each specification under optimum conditions for measuring that particular quality, neglecting to mention the degradation of the other factors and of overall performance in actual operation. Others will draw your attention to one or another outstanding specification, such as super sensitivity; while either pre-

senting in a confusing manner or not mentioning at all the specification that had to suffer, such as selectivity, dynamic range or image response. This is done of course to try to make you think that a transceiver is better than it really is!

The FT-ONE was developed with the goal in mind of a finely balanced harmony of each attribute of the circuit, with the only constraint being that of the state-of-the-art of the electronics industry. The focus of the design effort was performance, without limit to cost or complexity, and the result is a transceiver that can truly offer you top performance with regard to high sensitivity and selectivity without sacrificing IF image rejection and receiver IMD or dynamic range. We invite you to test the performance yourself."

These are certainly brave words, so let us see just how the FT-ONE shapes up. In this regard I will later be introducing you to our new standardised checking system to be used in all our equipment reviews from now on, however a few more comments first.

The procedure for using the FT-ONE is quite different to any normal transceiver. Firstly there is no band switching in the accepted sense. At initial SWITCH ON the receiver is tuned to 0.000.0 kHz. One can then tune higher either with the tuning knob, by pushing the scan buttons on the



Main tuning dial and scan buttons, right hand side of panel

keyboard or the microphone or by entering the required frequency onto the key board. Tuning can be accomplished in steps of 10 Hz, 100 Hz or 1 MHz. There is, therefore, one band that covers from zero to 30 MHz. In the scan mode, the transceiver will stop when it hears a signal, the level of the signal required to stop the scan action is set by the position of the RF gain control.

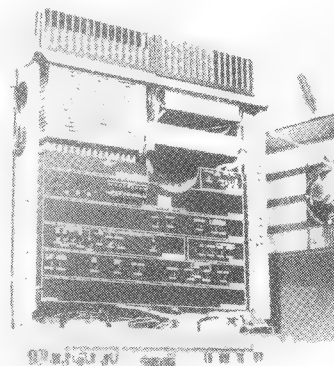
THE FT-ONE TECHNICAL FEATURES

The FT-ONE is chock full of interesting circuit developments. Unfortunately, without the help of a circuit diagram or circuit description I am only able to comment on a few of the more important features.

The receiver front end has come in for some unusual design. The RF amplifier for instance uses two medium power transmit bipolar transistors in push-pull to give a claimed output intercept point of +40 dBm. The same amplifier is used as a transmitter driver stage.

Pin diodes are used in the RF attenuator circuit and it would appear that the AGC also operates the front end attenuator on strong signals. Up conversion to 73 MHz is employed which means that images are non-existent. Yaesu claims a receiver dynamic range of 90 dB in the SSB mode and 97 dB in the CW mode.

Selectivity is taken care of with no less than 22 poles of crystal filtering. With the



Top view with cover removed. Speaker is mounted in top cover.

full complement of filters installed, the following selectivity figures are available, at -6 dB. For SSB, CW/wide and FSK/wide, 2.4 kHz. For CW/narrow, 300 Hz. For CW/medium and FSK/narrow, 600 Hz. For AM, 6 kHz, and for FM with the optional FM unit installed, 12 kHz. All of these represent maximum figures and of course can all be reduced with the use of the bandwidth control.

VFO selection, clarifier, scanning and filter selection are controlled by the central processor unit. It also selects the appropriate transmit output and receive input

filters to suit the operating frequency. The main tuning knob drives the synthesizer via an optical coupling system which means there is no mechanical load on the control. Considering this, the tuning has a very heavy feel. There is no adjustment to vary the tension on the tuning control. Tuning rates are 2 kHz, 20 kHz and 10 MHz per turn of the knob. The main tuning knob also operates the clarifier for receive, transmit, or both. The actual offset is displayed on an LED display to the right of the main frequency display.

The CW operator has been well taken care of in the design of the FT-ONE. In addition to the wide range of selectivity mentioned above, a CMOS keyer unit with front panel control can be installed. Either full or semi-break in keying can be selected, with full break in available up to about 50 w.p.m. As a further aid to the CW operator, audio peak and notch filters are included as standard features. The peak control used in conjunction with the narrow CW filter and shift/width controls enables signals to be pulled through almost impossible interference. The notch filter is useful to eliminate the heterodyne caused by stations tuning up close to your operating frequency. It does, however, have two slight disadvantages. Firstly, being an audio filter as distinct from an IF filter it is limited in the extent that it can remove a strong heterodyne from a weak signal due to receiver AGC action. The other factor is that its top frequency response is about 1.6 to 1.7 kHz. Above this frequency it is necessary to use the shift control, which I must admit, is most effective.

But perhaps the most incredible part of the FT-ONE is the tuning and memory system. The ten separate VFOs or memories if you prefer can be set up on each of the amateur bands, perhaps one on your favourite AM broadcast station, one on VNG to check on the accuracy of the digital readout (it's always spot on) and still have one to spare. You can even receive on one amateur band and transmit on another. The owner of an FT-ONE really needs a prolific imagination to sort out all the possibilities.

Some of the other nice additions you will find include the monitor system. This is great for checking microphone quality or compression level. If you record and replay other amateur transmissions it is an indispensable feature. Wear your headphones for microphone checking. The AMGC or Automatic Microphone Gain Control has been a feature on some Yaesu transceivers now for several years. With no close speaking input to the microphone the output from the speech amplifier is reduced to zero. Great to cut out that background from the family if you are lucky enough to have the gear inside the house.

Mention must be made of the excellent metering on the FT-ONE. Both meters are softly but clearly illuminated, the right one for "S" and ALC and the left a multi-functional meter for IC, voltage, discriminator (centre zero), processor compression and forward and reflected output indication for the transmitter. Top marks, Yaesu!



Close-up of operating controls, left hand side.

SPECIFICATIONS

TRANSMITTER

Frequency range:

160m band	1.8 to 2.0 MHz
80m band	3.0 to 4.0 MHz
40m band	7.0 to 8.0 MHz
30m band	10.0 to 11.0 MHz
20m band	14.0 to 15.0 MHz
17m band	18.0 to 19.0 MHz
15m band	21.0 to 22.0 MHz
12m band	24.0 to 25.0 MHz
10m band	28.0 to 29.99 MHz

Tuning steps:

Selectable 1 MHz, 100 kHz, 100 Hz, 10 Hz

Emission types:

LSB, USB (A3J/J3E*), CW (A1/A1A*), AM (A3/A3E*), FSK (F1/F1B*), **FM (F3/F3E*)

* New emission designation per WARC '79

** With optional FM unit installed.

Power output (minimum):

	160m through 15m	10m
SSB, CW	100W (PEP)	90W (PEP)
AM	25W	25W
FM, FSK	50W	50W

Carrier suppression:

better than -40 dB below peak output.

Unwanted sideband suppression:

better than -50 dB below peak output, (measured at 14 MHz, 1 kHz tone)

Non-harmonic spurious radiation:

better than -40 dB below peak output

Harmonic radiation:

better than -50 dB below peak output

Audio response:

better than -6 dB from 300 Hz to 2700 Hz

3rd order intermodulation distortion:

better than -31 dB below peak output

Frequency stability:

less than 300 Hz drift during the first 30 minutes after 10 minutes warm-up; less than 100 Hz every 30 minutes thereafter.

Modulation type:

A3J:	Balanced Modulator
A3:	Low Level Modulation
F3:	Variable Reactance

Maximum deviation (FM, optional Unit installed):

± 5 kHz

FSK shift frequency:

170 Hz.

Output impedance:

50 ohms, unbalanced (nominal)

RF attenuator performance:

from 0 dB to 25 dB attenuation, continuously adjustable

Dynamic range:

better than 90 dB with standard SSB filter
better than 95 dB with optional 600 Hz CW(M) filter
better than 97 dB with optional 300 Hz CW(N) filter

Audio output power:

3-watts minimum (into 4 ohms, with less than 10% THD)

Audio output impedance:

4 to 16 ohms

Microphone impedance:

Low Impedance (500 to 600 ohms)

RECEIVER

Frequency range:

150 kHz to 29.9999 MHz (continuous)

Clarifier range:

± 9.9 kHz

Sensitivity:

(CW, SSB, and AM figures measured for 10 dB S+N/N)

(*) 1.8 to 30 MHz (**) 150 kHz to 1.8 MHz

SSB/FSK(W)/CW(W)

* better than 0.3 μV, ** better than 5.0 μV

CW(N)

(with optional XF-8.9KCN filter installed)

* better than 0.2 μV, ** better than 2.5 μV

CW(M)/FSK(N)

(with optional XF-8.9KC filter installed)

* better than 0.25 μV, ** better than 3.0 μV

AM

* better than 2.0 μV, ** better than 30 μV

AM

(with optional XF-8.9KA filter installed)

* better than 3.0 μV, ** better than 50 μV

FM

(with optional FM unit installed)

better than 0.6 μV for 20 dB of Quieting from 1.8 to 29.99 MHz

Intermediate frequencies:

1st IF: 73.115 MHz

2nd IF: 8.9875 MHz

Width/Shift IF: 10.76 MHz

Noise Blanker IF: 455 kHz

FM IF (with optional FM unit installed):

455 kHz

Image rejection:

better than -80 dB

IF rejection:

better than -70 dB for all frequencies

Selectivity:

-6 dB -60 dB

SSB, CW(W), FSK(W) 2.4 kHz 4.0 kHz

CW(N)* 300 Hz 900 Hz

CW(M)*, FSK(N)* 600 Hz 1.3 kHz

AM* 6 kHz 11 kHz

FM** 12 kHz 24 kHz

* with optional filter installed

** with optional FM unit installed

NOTE: These figures apply as maximum bandwidths with Width control set to maximum.

FT-ONE AVAILABLE OPTIONS

Internal CMOS Keyer Unit

FM Unit

RAM Unit

IF Crystal Filters:

CW-N; 300 Hz*, 8-pole, 8.9882 MHz

CW-M (FSK-N); 600 Hz*, 8-pole, 8.9982 MHz

CW, FSK; 800 Hz*, 6-pole, 10.7593 MHz

AM; 6 kHz*, 8-pole, 8.9875 MHz

* -6 dB BW

Evaluation and On-Air Test of the FT-ONE

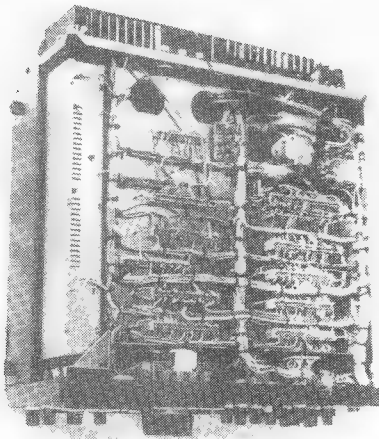
CATEGORY	RATING	COMMENT
APPEARANCE		
Packaging	***	Double carton with foam inserts.
Size	**	Largest transceiver yet reviewed.
Weight	**	One kg heavier than the old FT-401.
External Finish	***	Typical very good Yaesu finish.
Quality of Construction	***	Appears well put together.
FRONT PANEL		
Location of Controls	***	All come to hand easily.
Size of Knobs	***	Better than most current gear.
Labelling	***	All easy to read.
Meter(s)	****	Best of any transceiver yet seen.
VFO Knob Feel	**	Rather stiff. No spin action.
Dial Readout —		
Analogue	NA	
Digital	****	Very easy to read.
REAR PANEL		
	**	Most connections hidden below heatsink.
RECEIVE OPERATION		
VFO Stability	****	Total drift below 100 Hz.
Digital Dial	****	Shows exact frequency in each mode.
Analogue Dial	NA	
Memories	****	Most effective and easy to use.
Sensitivity	****	Equal or better than other top line transceivers.
RF Attenuator	***	Continuously variable.
RF Gain Control	***	Smooth progressive action.
Selectivity	****	Review transceiver contained all optional
IF Shift	****	filters and, in conjunction with shift/
Pass Band Tuning	****	width control, would take care of all needs.
Notch Filter	**	Only works up to 1.6 kHz heterodyne.
Optional Filters	****	Excellent range available.
SPURIOUS RESPONSES		
"S" Meter	*	None audible.
AGC Performance	***	Ideal for DXpeditions. Gives everyone "S" 9 or better.
Signal Handling	****	Very smooth.
		Could not find any overload.
STATUS INDICATORS		
RIT Operation	****	12 LED indicators.
	****	Separate digital readout to indicate offset.
NOISE BLANKER		
Line Noise	**	Reasonably effective on most types of electrical and appliance noise.
Auto Ignition	***	Almost complete elimination of ignition noise.
Woodpecker	*	Very little apparent reduction.
Effect on Signal Handling	***	Slight cross mod. with full NB action.
QUALITY OF RECEIVED AUDIO		
Int. Speaker	*	Mounted in top of cabinet with very little baffling.
Ext. Speaker	***	Much better quality from my own speaker.
		Strangely, no external matching unit offered.
Headphones	***	Output level good for low imp. stereo phones.
COOLING FAN NOISE		
	*	Fan noisy and operates at all times.
TRANSMIT Operation —		
CW Power Output	**	160 80 40 30 20 15 10
PEP Power Output	**	110 100 100 95 90 85 80 watts.
Audio Response	***	As indicated on scope, within 10% of above.
Audio Sensitivity	***	On air reports very good.
ALC Action	***	Plenty of MIC gain.
Speech Processor	***	Smooth action. No flat topping on scope.
Metering	****	Effective RF processor.
Cooling	***	Best yet.
Relay Noise	***	Heatsink always cold due to continuous fan operation.
VOX Operation	***	Not obtrusive.
	***	Smooth VOX system. Controls not grouped on front panel.
MANUAL (Owner's Handbook)	**	See comments in text.
ACCESSIBILITY FOR SERVICING	***	Most boards are of plug-in type.

* Poor

** Satisfactory

*** Very Good

**** Excellent



Underside view of chassis

MANUAL

I was somewhat disappointed with the standard of the FT-ONE handbook. While it covers the operating aspects of the transceiver quite well and also the installation of options such as the FM unit, keyer unit and the additional filters, there is no technical information. However, Bail Electronics inform me that they have just received stocks of the complete workshop manual for the FT-ONE which will be included with every transceiver sold and will be forwarded to all present owners who have purchased their "ONE" from Bail Electronics or one of their accredited agents. I look forward to seeing a copy of the manual and will comment on it in a future issue.

Yaesu also offers the FT-ONE(G) transceiver for use by government agencies and other users authorised to transmit on frequencies from 1.8 to 30 MHz. The FT-ONE(G) is a completely self-contained general coverage transceiver incorporating all of the features of FT-ONE plus the added capability of general coverage transmission. The FT-ONE(G) is available by special order through any authorised Yaesu dealer.

CONCLUSIONS

The FT-ONE, as sold in Australia, represents very good value. If you consider that the selling price in the USA is around \$2,300 we are getting them at bargain price. The combination of facilities in the FT-ONE is not obtainable in any other transceiver.

It is of course up to you whether you can make use of the various facilities included in this transceiver.

My thanks to Bail Electronics for the loan of the FT-ONE used to compile this review. All enquiries about price and availability should be directed to them or to one of their accredited agents.

HELP WITH INTRUDER WATCHING

Safety Precautions for Beryllium Oxide



The following information on the use and handling of Beryllium Oxide was kindly supplied by courtesy of Geoff VK3YFA and The Scalar Group. (Reproduced by arrangement from The Radio Bulletin, EMDRC, May 1982.)

Sintered beryllium oxide (beryllia) parts can be handled and used without any risk of toxicity providing a few simple rules are observed. There is, however, toxic hazard if dust or fume from the material are inhaled, resulting in a serious respiratory disease.

In addition to the hazard from inhaling beryllium products, there have been reported cases of skin reaction from contact with beryllium. These occur mainly from contact with water-soluble beryllium compounds and not beryllium oxide. However, it is a wise precaution to handle beryllia parts with gloves or similar protection. This is imperative if the operator has any cuts on his hands. If, due to a cut or abrasion, beryllia enters the skin, it should be dealt with immediately by washing and normal first-aid whence it will be generally found to cause no further trouble.

CONTROL OF DUST OR FUMES

If dust or fumes are created in the operations carried out on beryllia, there must be adequate extraction of the contaminated air in the working zone to prevent it being inhaled. Should there be any doubt about liberation of dust or fume, it is recommended that air samples be taken to measure the contamination. It is laid down that the maximum permissible air contamination by beryllium is as follows:—

- (a) In a process area:—
 - (i) The maximum allowable concentration of beryllium in the breathing zone averaged over any 8 hour period is 2 micrograms per cubic metre.
 - (ii) The daily average must be within the above limit but even in exceptional circumstances the concentration must not exceed 25 micrograms per cubic metre.
- (b) Outside a process area:—

Concentrations must not exceed 0.01 micrograms per cubic metre averaged over a month and calculated with reference to the breathing zone. This level may be observed by stack

monitoring and by controlling discharge to an appropriate daily amount.

It is emphasised that these are maximum values and all exposures must be kept as low as is practicable.

The normal method of extraction is an enclosed working zone which is exhausted by a blower and the extracted air passed through an absolute filter. The extraction rate should be great enough to provide an inward flow of at least 150 ft. per minute at any aperture in the enclosure. The enclosure is most readily constructed from transparent acrylic plastic and may have an opening at the front sufficient to enable access of the hands for working with the parts.

This arrangement can be used for housing metallizing furnaces, grinding machines, etc., or any other operation giving rise to dust or fume. If beryllium oxide powder is being handled, an enclosed glovebox is recommended.

Handling of clean beryllia parts, such as in assembly or inspection need not be done in an enclosure since there is virtually no risk of toxic amounts of dust being produced.

Sintered beryllia is very hard and slight abrasion does not normally create dust. However, continuous abrasive action should be avoided.

Very simple hand lapping operations can be done with the parts submerged in a liquid provided that safe disposal of the liquid can be arranged.

Liquids used for processing beryllia, e.g. acid cleaning solutions, electroplating baths, should not be disposed of through normal sewage unless the beryllium content is less than 1 part per million.

Scrap beryllia should be placed in polythene or similar bags otherwise suitably wrapped and sealed. We shall be pleased to advise about disposal of scrap. If beryllia is broken, the fragments should be gathered and treated as scrap.

Heating in a moist atmosphere, such as metallizing in wet hydrogen, may cause volatile Be(OH)₂ to be evolved. The rate of volatilization is not appreciable below about 1,000°C but in any heating operation of this sort attention should be paid to the possibility that a toxic contamination could arise. ■



WARNING!!

Disposing of your old rig??
Please ensure it goes ONLY to someone licensed to use it on YOUR bands.