

## Hard on the heels of the recent FT-897 comes the FT-857 ultra-compact transceiver from Yaesu. Virtually identical to the FT-897 in terms of features, circuitry and most of the software, the FT-857 has been engineered to provide a smaller unit adapted to the needs of the mobile user.

In many ways the FT-857 replaces the FT-100, being similar in size, concept and features, and is also provided with a detachable front panel for remote mounting. The radio was available in the US for a few weeks prior to release in the UK, but the UK-sourced model is fully CE approved and supplied with DSP as standard. I eagerly collected the radio from Yaesu on the same day that they received their first shipment.

A full review of the FT-897 was recently published in *RadCom* (April 2003) and the description of the features given also applies to the FT-857. To avoid unnecessary duplication, only a summary of the key features is given in this review; please refer to the FT-897 review for more in-depth information.

### BASIC FUNCTIONS

The FT-857 provides all the functions of a fully-featured HF and 50MHz transceiver with a 2m and 70cm multitime together with coverage of the broadcast FM/AM and aircraft VHF AM bands and all this in a unit measuring only 155W x 52H x 233Dmm. It is slightly larger than the earlier FT-100, a little deeper with a similar front panel area but is lighter, at 2.1kg. The radio is powered from a nominal 13.8V supply with a current

consumption peaking 22A. SSB, CW, AM and FM modes are provided with extensive capabilities for digital modes accommodating both AFSK (RTTY/PSK-31 etc) and FM (Packet) based systems. The transmit power output is 100W maximum on HF/6m, 50W on 2m and 20W on 70cm.

The radio is very ruggedly constructed on a diecast aluminium chassis with two internal cooling fans and a rather small 55mm diameter speaker in the case top. Layout of the main PC boards is virtually identical to the FT-897. Two antenna sockets are provided, an SO239 for HF/6m and a type N for 2m/70cm. Other connectors on the rear panel provide external speaker and key jacks, two mini DIN connectors for data input and control, and DC power input on a flying lead. Control and power is provided for the ATAS-100 and ATAS-120 mobile antenna systems covering all bands from 40m to 70cm. The ATAS-100 was reviewed together with the FT-100 in the June 1999 issue of *RadCom*. The ATAS-120 is a later model with a faster tuning time. Both models tune automatically using motor driven adjustment of the antenna length.

The front panel of the FT-857 may be

unclipped and mounted remotely from the main body of the radio. This enables mobile operation where space is very limited or removal when unattended to deter theft. Data is communicated between the main unit and the front panel via a separation cable at 31.25kbps. A separation kit is available from Yaesu as an extra. The microphone plugs into a recess in the main body of the radio, having first removed the front panel for access. Both the microphone and separation cable use RJ telephone style connectors. The radio is provided with a standard hand microphone, MH-31, but alternative DTMF keypad microphones, MH-36 and MH-59, are also available as extras. The MH-59 is new providing full remote control of all the main functions of the radio directly from the microphone. It is bristling with buttons and even contains a rotary control for tuning and channel selection.

Yaesu's current range of HF transceivers has been developed around two different platforms. The high performance platform forms the basis of the FT-1000MP series. The standard platform covers the FT-817 portable, FT-897 transportable and now the FT-857 mobile transceiver. This platform adopts a double conversion superhet architecture with IFs of 68.33MHz and 455kHz, a common first mixer and all downstream circuitry for all bands HF to 70cm, a common transmit path for all bands



# Yaesu FT-857 HF/VHF/

YAESU FT-857 MEASURED PERFORMANCE

#### RECEIVER MEASUREMENTS

FREQUENCY	SENSITIVITY SSB 10dBs+n:n		INPUT FOR S9	
	PREAMP IN	IPO	PREAMP IN	IPO
1.8MHz	0.18µV (-122dBm)	0.4µV (-115dBm)	7µV	22µV
3.5MHz	0.16µV (-123dBm)	0.35µV (-116dBm)	9µV	25µV
7MHz	0.14µV (-124dBm)	0.35µV (-116dBm)	8µV	22µV
10MHz	0.14µV (-124dBm)	0.35µV (-116dBm)	8µV	25µV
14MHz	0.14µV (-124dBm)	0.32µV (-117dBm)	6µV	18µV
18MHz	0.14µV (-124dBm)	0.28µV (-118dBm)	5µV	16µV
21MHz	0.14µV (-124dBm)	0.32µV (-117dBm)	6µV	16µV
24MHz	0.14µV (-124dBm)	0.32µV (-117dBm)	6µV	18µV
28MHz	0.14µV (-124dBm)	0.32µV (-117dBm)	6µV	16µV
50MHz	0.1µV (-127dBm)	0.2µV (-121dBm)	4µV	13µV
144MHz	0.13µV (-125dBm)	-	3µV	-
432MHz	0.13µV (-125dBm)	-	3µV	-

AM sensitivity (28MHz): 0.7µV for 10dBs+n:n at 30% mod depth. FM sensitivity (144MHz): 0.16µV for 12dB SINAD 3kHz pk deviation. AGC threshold: 1.3µV 100dB above AGC threshold for +1.5dB audio output. AGC attack time: 1-3ms AGC decay time: 30-200ms (fast), 0.3-3s (slow). Max audio before clipping: 8Ω 1.9W, 4Ω 3W at 2% distortion. Inband intermodulation products: -17dB to -25dB.

S-READING (7MHz)	INPUT LEVEL SSB PREAMP IN	IPO
S1	1.6µV	4.5µV
S3	2.0µV	5.6µV
S5	2.8µV	8µV
S7	4.5µV	13µV
S9	8µV	22µV
S9+	63µV	200µV
S9++	630µV	2mV

MODE	IF BANDWIDTH		
	-6dB	-50dB	-60dB
SSB ceramic	2380Hz	3575Hz	5200Hz
2.3kHz mech	2390Hz	3600Hz	4990Hz
500Hz mech	575Hz	1660Hz	2750Hz
AM	7140Hz	13.3kHz	14.3kHz
FM	14.3kHz	21.9kHz	22.4kHz
FM(N)	10.3kHz	15.1kHz	15.2kHz

#### INTERMODULATION (50kHz Tone Spacing)

Frequency	PREAMP IN		IPO	
	3rd order intercept	2 tone dynamic range	3rd order intercept	2 tone dynamic range
1.8MHz	+2.5dBm	89dB	+2dBm	84dB
3.5MHz	+6dBm	92dB	+10dBm	90dB
7MHz	+7dBm	93dB	+14dBm	93dB
14MHz	+9.5dBm	95dB	+21dBm	98dB
21MHz	+10dBm	96dB	+22.5dBm	99dB
28MHz	+11dBm	96dB	+21dBm	98dB
50MHz	+0.5dBm	91dB	+8dBm	92dB
144MHz	-6.5dBm	85dB	-	-
432MHz	0dBm	90dB	-	-



through to the PA driver and options for DSP to provide receive and transmit audio functions. Front-end switching enables separate receive preamplifiers for HF, VHF and UHF with switchable bandpass filters. Two transmitter power amplifiers are fitted, one for HF/6m and the other for 2m/70cm. The local oscillator uses a combination of DDS (direct digital synthesiser) and PLL to achieve fast tuning, small steps and low spurious outputs. Broadcast FM uses a separate RF path from the front-end filters to a single IC mixer/IF/demodulator.

#### FEATURE SUMMARY

Undoubtedly the most important control on any HF radio is the main tuning knob. For ease of use this needs to be of a reasonable size and a reasonable tuning rate. On a small unit such as a mobile or portable it is difficult to achieve the ideal but for the FT-857 a 43mm weighted knob is fitted, somewhat dominating the front panel. This gives a significant improvement to the tuning performance over the FT-100 and the FT-817. The rotary detented channel selector provides faster tuning and channel stepping together with memory selection, menu and function

key selection, as well as the clarifier and IF shift functions which had a separate control on the FT-897. Although substantially smaller in front panel area compared with the FT-897, the lack of a separate clarifier is the only difference in the controls between the two radios. The band up/down keys, VFO/memory and lock keys are grouped around the periphery of the tuning knob to save space. The FT-100 was not provided with a head-telephone jack, but in the FT-857 a small 3.5mm jack on the side of the front panel may be switched to function either for external speaker or for head-telephone use. This is in addition to the external speaker jack fitted on the rear panel of the main body and plugging in to either of these jacks mutes the internal speaker in the normal way.

As with the FT-897, three buttons below the display select most of the functions of the radio with 17 sets of button allocations selectable and scrollable via the rotary channel selector. The FT-100 used a similar concept but this radio used four buttons and 9 sets of allocations. One set of button allocations is programmable so you can bring the three most frequently used keys into one row, providing you do not need the default

functions. The MH-59 microphone also has three programmable keys that can provide direct access to three most used functions in a similar way. The menu system in the FT-857 accesses some 91 parameters of the radio and is identical to the FT-897.

The usual variety of methods for tuning and fast frequency changes are provided with memories, comprehensive scanning and twin VFO 'split' operation including a quick split key press which sets the transmit frequency 5kHz above the receive frequency. With 200 alpha-numerically tagable memories available there is plenty for all needs and the manual describes how part of the memory can be used to simplify Low Earth Orbit FM satellite operation and allow for Doppler shift.

Although tiny in size there is still sufficient space provided to fit an optional high stability reference oscillator and two optional Collins mechanical IF filters from three available bandwidths, 300Hz, 500Hz or 2.3kHz. Both wide and narrow CW filters could be fitted if desired. The SSB filter can also be used on trans-

**Above: The FT-857 has a detachable front panel.**

# UHF Mobile Transceiver

#### CLOSE-IN INTERMODULATION ON 7MHz BAND

Spacing	PREAMP IN		IPO	
	3rd order intercept	2 tone dynamic range	3rd order intercept	2 tone dynamic range
3kHz	-42dBm	61dB	-34dBm	61dB
5kHz	-36dBm	65dB	-28dBm	65dB
7kHz	-31dBm	68dB	-23dBm	68dB
10kHz	-23dBm	74dB	-16dBm	73dB
15kHz	-12dBm	81dB	-4dBm	81dB
20kHz	-4dBm	86dB	+3dBm	86dB
30kHz	+7dBm	93dB	+14dBm	93dB
40kHz	+7dBm	93dB	+14dBm	93dB
50kHz	+7dBm	93dB	+14dBm	93dB

#### RECIPROCAL

FREQUENCY OFFSET	MIXING FOR 3dB NOISE	BLOCKING PREAMP IN
3kHz	72dB	-36dBm
5kHz	77dB	-36dBm
10kHz	84dB	-35dBm
15kHz	89dB	-30dBm
20kHz	92dB	-25dBm
30kHz	97dB	-17dBm
50kHz	102dB	-9dBm
100kHz	107dB	-9dBm
200kHz	116dB	-9dBm

#### TRANSMITTER MEASUREMENTS

FREQUENCY	CW POWER OUTPUT	SSB(PEP) POWER OUTPUT	HARMONICS	INTERMODULATION PRODUCTS	
				3rd order	5th order
1.8MHz	99W	100W	-63dB	-27 (-21)dB	-38 (-32)dB
3.5MHz	99W	100W	-68dB	-27 (-21)dB	-38 (-32)dB
7MHz	99W	100W	-60dB	-28 (-22)dB	-38 (-32)dB
10MHz	98W	100W	-58dB	-29 (-23)dB	-38 (-32)dB
14MHz	98W	100W	-58dB	-28 (-22)dB	-38 (-32)dB
18MHz	98W	100W	-53dB	-28 (-22)dB	-36 (-30)dB
21MHz	99W	100W	-56dB	-26 (-20)dB	-34 (-28)dB
24MHz	99W	100W	-65dB	-27 (-21)dB	-34 (-28)dB
28MHz	100W	100W	-65dB	-25 (-19)dB	-32 (-26)dB
50MHz	96W	98W	-68dB	-23 (-17)dB	-30 (-24)dB
144MHz	50W	50W	-70dB	-26 (-20)dB	-32 (-26)dB
432MHz	19W	19W	-67dB	-32 (-26)dB	-38 (-32)dB



**FT-857 rear panel.**



**Under the top cover, showing the main PCB.**

Two-tone transmitter intermodulation product levels are quoted with respect to PEP, figures in brackets are with respect to either tone. **Carrier suppression:** >60dB. **Sideband suppression:** 60dB @ 1kHz. **FM deviation:** 4.7kHz (wide) 2.3kHz (narrow). **SSB T/R switch speed:** mute-TX 20ms, TX-mute <1ms, mute-RX 12ms, RX-mute <1ms. **NOTE:** All signal input voltages given as PD across antenna terminal. Unless stated otherwise, all measurements made on SSB with the receiver preamp switched in.



**Right: Buttons around the tuning knob on the FT-857.**

mit. IF shift, an IF noise blanker, DSP audio filters, notch and noise reduction are all provided as standard.

On transmit VOX, speech compression and DSP frequency response tailoring is provided, and on CW a full message keyer is included. The maximum transmit power directly in watts is settable via the menu, separately for HF, 6m, 2m and 70cm. For the FM enthusiast, comprehensive repeater access facilities are provided with auto enabled offsets and CTCSS, DCS and ARTS selective access systems. Power saving features include auto power-off following lack of control activity, a transmission time limiter and auto turn-off of the display backlighting.

The LCD panel fitted into the FT-857 is a little smaller than that used with the FT-897 and FT-100 transceivers and as a consequence the amount of information displayed at any one time is less. The same multicoloured backlighting as used on the FT-897 is retained together with different colour allocations that can be set for different bands, modes, memory groups and other operating status conditions. Frequency readout is to within 10Hz but the meter bargraph has been compressed to the top left corner of the display and is accompanied by a numerical S reading on receive. A socket on the underside of the front panel allows an external analogue meter to be used as well. Correct CW tuning is indicated by a blue LED. This same LED glows green when the receiver is un-squelched and red on transmit.

**Right: DSP board with optional filters.**

The FT-857 includes a spectrum scope monitor which monitors activity 10, 15 or 63 channels on either side of the receive frequency and displays relative signal strength as a bargraph on the LCD. The channel step size is selectable and either the instantaneous amplitude or maximum peak-hold values may be displayed. Normal receiver operation is disabled whilst the spectrum monitor is sweeping which may be either a single sweep or continuous sweep.

Remote control from a PC is supported for many of the main functions, by no means all but sufficient for use with

logging and DX Cluster programs. Interfacing to the PC requires a level converter and Yaesu have available an optional cable for this purpose (CT-62). As with the FT-897, and indeed also the FT-100, as only one socket is provided for linear, ATU or PC control, only one function can be used at a time.

Full operation of the transceiver is covered in the comprehensive 128-page manual which also includes circuits. The omissions and errors in the FT-897 manual have been fixed.

**MEASUREMENTS**

Measurements were made with the review radio powered from a 13.8V supply and are summarised in the table. The review radio was fitted with 500Hz and 2.3kHz mechanical filter options.

As would be expected the measured results were very similar to the FT-897, but there were differences. In particular, the oscillator phase noise performance of the FT-857 was some 4dB better close to the carrier and this significantly improved the immediate adjacent channel performance. It is not known if these were just spreads between different samples or whether there were some design changes. However, the FT-100 measured in 1999 showed 3dB better close-in phase noise than the FT-857 although all three radios showed similar performance further out than 30kHz from the carrier.

IF bandwidth measurements showed a noticeable improvement at the -60dB skirt level due to the lower phase noise. However, phase noise is still the main limitation to the skirt bandwidth and this questions the benefits of fitting the 2.3kHz bandwidth mechanical filter option. The overall selectivity and adjacent channel results are shown in Fig 1 (below, left).

The current consumption on receive measured some 650 to 700mA depending on the display colour used (green and red are the most efficient) reducing to 590mA with the backlighting off.

The sensitivity was very good on all bands but reduced significantly at LF (3µV at 136kHz). The rejection of spurious responses was generally very good. Some slight birdies found on 80m with the FT-897 were absent with the FT-857. Possibly this emanated from the switched mode PSU used in the FT-897. The AGC recovery time was again very dependant on level and set rather too fast for my liking. The strong signal performance (intercept and dynamic range) was rather poor close-in but fairly average at wider spacings where it was significantly better than the FT-100. The in-band distortion was poor particularly at fast AGC settings.

On transmit the results are generally good with the CW keying waveform of low distortion although the fall time is a



little sharp. SSB intermodulation products are average to poor but data switching times are good.

**ON THE AIR**

I found the FT-857 to be a good all-round performer. Similar in ergonomics to the FT-897 and FT-100, the larger tuning knob is a definite improvement over the FT-100. Although I did not have the opportunity to evaluate the radio in the car, on the home station antennas the receiver was very lively, sensitivity was excellent and coped well with most situations although some strong signal problems could

be provoked on the lower bands during darkness.

Often the front-end attenuator needed to be switched in circuit to give clean results. The internal speaker gave adequate communications quality but the frequency response was limited and it tended to rattle at higher levels. With an external speaker or headphones the quality was very much improved. However, even on headphones there was a certain roughness to the SSB audio quality not present on AM or FM or on my FT-1000MP. This is possibly due to the AGC attack characteristic or the rather poor measured inband intermodulation performance. Reducing the RF gain control made a noticeable improvement. I preferred to use the AGC slow setting on all modes, except perhaps when using full break-in, to prevent background noise returning between Morse characters and speech symbols.

On transmit good audio quality reports were received and the CW keying was effective at semi and full break-in. Although simple, I found the CW tuning aid a particularly helpful feature.

**CONCLUSIONS**

The FT-857 is an excellent do-everything radio for mobile use and where space is at a premium. The radio is currently listed at £849 inc VAT but lower price deals will no doubt be available from the main retailers. My thanks to Yaesu (UK) for the loan of the review item. ♦

