

# THE YAESU FT-817

Peter Hart, G3SJX\*, reviews Yaesu's latest mini marvel

**Y**AESU RECENTLY launched the FT-817 in the UK, a novel and truly portable HF to 70cm transceiver covering all modes. The radio has already been available in the US for a while and has attracted much interest. Of obvious appeal to the QRP enthusiast, this 5W radio with its self-contained batteries is small and light enough to carry anywhere. Take it on holiday or a business trip and you are in touch with the bands at all times. A lightweight wire antenna takes up little extra luggage space and, with the current excellent state of the higher HF bands, 5W will give plenty of contacts including DX with relative ease given the right conditions. As an added bonus the radio also includes all the features of a 2m / 70cm portable and a broadcast receiver. The FT-817 is, in many respects, the portable companion to the FT-100 mobile transceiver which was introduced by Yaesu a couple of years ago.

## BASIC FUNCTIONS

The FT-817 measures only 135 x 38 x 165mm and weighs a little over 1kg. It is supplied with a shoulder carrying strap, hand microphone (MH-31 as used on most Yaesu radios) and a three-piece 'rubber duck'-style whip antenna for 6m / 2m / 70cm. There are two antenna sockets, a BNC on the front panel and an SO239 on the rear and it is possible to select either front or rear separately for the four band-groups, HF, 6m, 2m and 70cm. The rear panel socket is used with the radio horizontal, for example on a table top, and the front panel socket for a whip antenna with the radio carried vertically.

The radio can be powered using 9.6V to 13.8V either from an external DC supply or from internal batteries. These batteries can be either 8 AA size alkaline cells or the Yaesu FNB-72 Ni-Cd rechargeable battery pack which supplies 9.6V at 1000mAh capacity. Models supplied from UK dealers include the rechargeable battery as standard, together with a mains wall charger. Although the manual states that this charger can only be used when the radio is switched off, it is rated at 500mA which is just sufficient to power the radio on receive as well as charging the battery, although insufficient to provide power on transmit. A higher power external 13.8V supply (rated at 2.5A) will allow the batteries to be charged also whilst



using the radio to the full. The charging time can be set to 6, 8 or 10 hours and the remaining time to full charge is displayed when the radio is switched off. This is reset if the charging current is interrupted for any reason.

The receiver in the FT-817 tunes from 100kHz to 56MHz, 76 to 108MHz (wideband FM mode only), 108 to 154MHz and 420 to 470MHz. The transmitter is enabled only within the exact amateur allocations with variants for different regions. Up / down keys scroll through the various amateur bands, general coverage and broadcast bands, and another pair of up / down keys scrolls through the modes - LSB, USB, CW, CW-R, AM, FM, Digital and Packet. Digital mode uses AFSK on SSB modes and is intended for RTTY, PSK31, SSTV etc. Packet mode uses FM and has settings for both 1200 and 9600 baud operation.

There are four transmit power output settings - 5W, 2.5W, 1W and 0.5W with 2.5W as the default setting on internal batteries.

The radio is solidly constructed on a diecast aluminium chassis with controls on the front and top edge, a 55mm diameter speaker in the top, microphone and headphone sockets on the side, access to the batteries underneath and sockets on the rear for key, data terminals and PC

control. The radio is fully controllable from a PC, but needs a special interface cable available as an option which includes a built-in RS-232 level converter. Electrically, the radio uses a double conversion superhetero-receiver with IFs of 68.33MHz and 455kHz. The transmitter PA and drivers and receiver front-end mixer are all wideband covering a remarkably wide frequency range from 160m to 70cm.

## PRINCIPAL FEATURES

THE FT-817 IS packed with features, indeed virtually the full feature set as found on most larger radios is provided. It is always a challenge with a small radio, and hence limited panel area, to provide a simple and user-friendly access to its many functions. Some dedicated controls are essential, such as tuning, band and mode change, volume etc, but other functions are accessible through context and menus. Three buttons below the display select most of the functions of the radio. A quick press of the 'F' key displays the function associated with these buttons and a small click-step rotary control 'Select' scrolls through 12 sets of button allocations. In addition the menu system allows some 57 parameters of the radio to be set. This is accessed also with the 'F' key and the 'Select' control with the rotary tuning control to set the parameter.

Tuning makes use of a small rotary control in conjunction with the detented 'Select' control mentioned above. Tuning is in 10Hz steps at 2kHz per revolution or 20Hz steps at 4kHz per revolution on SSB / CW, which is rather slow and tedious with the small 25mm diameter knob and so the 'Select' control which tunes in 1, 2.5 or 5kHz steps is used for coarse navigation. This also provides 1MHz stepping for large frequency excursions. AM or FM tuning is normally achieved via the 'Select' control with a selection of separate mode-dependent step sizes, although rotary control tuning at 10 times the SSB rates can be selected for this purpose.

Despite its compact size, the FT-817 provides comprehensive memory features. 200 regular memories are included which may be partitioned into 10 groups of 20 channels and each channel may have an eight-character alphanumeric label attached for easy identification. A one-touch quick



Under the top cover of the FT-817.

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memory store allows one frequency to be rapidly stored and recalled and a separate home channel for each of the four band-groups may be selected at the push of a button.

The radio includes a number of power-saving features. Auto power-off will automatically turn off the radio if there has been no control activity for a period (1 - 6h) and the transmit time can be limited (1 - 20min). The display backlighting can be turned on or off or set to auto (default) where the backlighting is on for only 5s after any key presses. The backlighting colour can be set to blue or amber, I preferred amber in most situations. The LCD indicates frequency to 10Hz resolution, memory channels or labels, mode and VFO status and a number of small icons. The battery voltage can be permanently displayed and there is a bargraph type S-meter which indicates power, SWR, ALC level or modulation on transmit. One of the menu settings shows DSP as a label for one of the buttons. Don't be misled, this selects double display height for clearer frequency indication: the radio is not fitted with Digital Signal Processing.

## MAINLY HF FEATURES

TWIN VFOs are incorporated each with separate band stores. These can be used separately for CW and SSB segments or used together for split frequency operation. A clarifier (receiver incremental tuning) covers  $\pm 10\text{kHz}$  and functions on receive only, IF shift helps in reducing adjacent channel interference and an IF noise blanker is included for reduction of ignition and other impulse noise. The radio is provided with a 2.4kHz ceramic IF filter for SSB and CW modes but space is provided to install a 10-pole Collins mechanical filter, either a 500Hz filter for CW and digital modes or a 2.3kHz filter with improved shape factor for SSB.

Other receive features include fast / slow AGC, RF gain control / squelch and variable CW pitch over the range 300 - 1000Hz. For strong signal situations, the receive preamp may be switched out (IPO) and a 10dB attenuator may also be switched in. On 2m and 70cm the receive preamp is permanently in circuit.

VOX is provided, functioning on all voice modes, but there is no speech processor. A semi break-in system is included for CW with recovery delay times separately adjustable for CW and VOX. Although not specifically designed for full break-in, the minimum recovery delay time of 10ms effectively emulates QSK operation. A built-in CW electronic keyer is adjustable in speed over the range 4 - 60WPM and has adjustable dot:dash weighting but does not include any memo-



FT-817 rear panel connectors.

ries or contest-related features. For occasional or emergency use it is possible to assign the up / down keys on the microphone for generation of dots and dashes.

The FT-817 is well equipped with facilities to handle digital and packet modes. Audio input levels are separately adjustable for each data mode as are display and passband offsets. As well as the predefined modes of PSK31, RTTY and Packet, two user-definable modes (USB and LSB) are also included. These can be used for SSTV or a future new digital mode. The FT-817 with a small laptop PC makes an effective and very lightweight station for PSK31 given the excellent low-power performance of that mode.

## MAINLY VHF / UHF FEATURES

THE FT-817 includes all the features which are available on a modern FM hand portable. Both wide and narrow FM modes are provided, covering 25 / 12.5kHz channelling on VHF / UHF or 10kHz on 29 / 50MHz. Both the receiver bandwidth and transmitter deviation levels are set appropriately.

For repeater operation, the shift is separately programmable on 10m, 6m, 2m and 70cm and can be automatically selected according to the bandplan in use in the relevant region on 2m and 70cm. The transmit and receive frequencies can be reversed by a single key press to check for activity on a repeater input channel. Both a 1750Hz tone burst and a CTCSS tone encoder are provided for repeater access and a CTCSS decoder provides Tone Search to detect and store the CTCSS tone transmitted by a received station or repeater.

A Digital Code Squelch (DCS) system is also built-in. This uses one of 104 selectable codes to implement a squelch controlled link and is more robust and less prone to false triggering than CTCSS. A Code Search feature allows the DCS code transmitted by a received station to be detected and stored.



The display can be set to blue or amber

Complementary to the DCS system is the ARTS (Auto Range Transponder System) also fitted. This uses DCS signalling to inform when you and another ARTS-equipped station are within communications range.

Several scanning-related features are provided. Scanning can be initiated in VFO mode, up or down from any start frequency or between programmed limits with user-programmable pause / resume status. In memory mode, memory channels can be scanned sequentially up or down and channels can be selected for skipping. Dual Watch allows VFO-B to be checked every 5s whilst using VFO-A for normal communication purposes. In a similar way, Priority Channel Checking lets you operate on a memory channel while checking memory channel 1 every 5s. Smart Search is a useful feature when travelling in a new area and functions on AM and FM. A scan is initiated in VFO mode and the first 50 active channels are loaded into special memory.

The FT-817 also includes a spectrum scope monitor which monitors activity five channels on either side of the receive frequency and displays relative signal strength as a bargraph on the LCD. Normal receiver operation is disabled whilst the spectrum monitor is functioning. Although operational on all modes, the result is only really meaningful for monitoring FM channels. The IF bandwidth for the spectrum scan is set to the FM bandwidth and channels are scanned according to the step size set for the 'Select' channel stepper. This step size needs to be set appropriately to get the desired result, normally the operational channel step size.

## MEASUREMENTS

MEASUREMENTS MADE on the review radio are summarised in the tables on page 45. The current consumption on receive measured some 300 - 380mA depending on band and the receive audio level with an additional 30mA for the LCD backlight. On transmit, the current consumption was 2A at 5W output reducing to 0.5A at 0.5W output. The current consumption at 9.6V and 13.8V is similar. This gives around 2 - 3 hours maximum usage on receive-only between battery charges, reducing of course according to the amount of transmit time. When charging the internal batteries, the external current consumption rises by about 170mA, the battery charge current, and takes about 6 - 8 hours to charge the battery fully. Note that when switched off, the radio still draws 25mA from an external 13.8V supply.

The overall receive performance was very creditable considering the size and nature of the radio. Significantly better than

most other QRP radios available and comparable with many much bigger transceivers. The sensitivity was entirely adequate on all bands and generally well maintained outside the amateur bands except at LF. Below 1MHz the sensitivity reduced markedly with lowering frequency, yielding  $5\mu\text{V}$  at 200kHz and  $50\mu\text{V}$  at 136kHz. The S-meter range was significantly compressed, similar to most FM receivers rather than SSB receivers, and the AGC recovery set rather too fast. This was very noticeable in listening tests. The slow recovery setting was similar to the fast setting in most other radios. The image and IF rejection was quite respectable (70 - 100dB) with second image around 55dB. The strong signal performance measured up very well for a portable, the overall selectivity and adjacent channel results are shown in Fig 1.

On transmit the various power levels were close to specification but there was a tendency for the power output levels to drop substantially when hot, with 5W reducing to 3W or less in some cases. SSB distortion levels were quite reasonable and CW keying was low distortion with no difference between semi break-in and 'quasi' full break-in. The rise time was well rounded but the fall time was a little sharp. Transmit / receive switching times showed a somewhat longer than average time for the receiver to recover and reach full sensitivity (36ms).

### ON THE AIR

THE RECEIVER in the FT-817 really performed very well. In tests on my home station antennas, there were very few signals which couldn't be copied as well on the FT-817 as on my FT-1000MP. On the low bands with large antennas the preamp needed to be switched out (IPO) in most cases to avoid overload, but rarely was it necessary to switch in the attenuator. The receive audio was fairly 'toppy', but good communications quality and with plenty of punch. I used the AGC slow setting on all modes, in the fast setting background noise would return to full level between Morse characters and speech symbols in a disconcerting way. Surprisingly the S-meter decay was much slower to respond. The filters were good and the narrow CW filter well recommended. Broadcast AM and wideband FM both gave excellent results and quality. The transmit audio was clear and punchy and good quality and the CW break-in system was effective. I worked a number of DX stations with remarkable ease.

For table-top use the radio is best propped to angle the front panel for convenient access. I found the rotary tuning knob too small

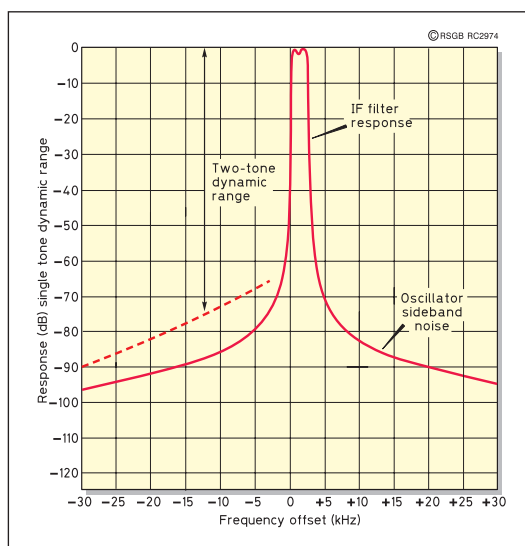


Fig 1: FT-817 measured overall selectivity.

for easy use and the finger detent ineffective for adult fingers, but this is the price which must be paid for a radio of this compact size. Also I found the tuning knob very easy to knock and move frequency, but there is a lock button to prevent this. The control ergonomics for most functions are quite cleverly arranged and easily mastered after a brief learning period. I would have preferred the



The FT-817 with supplied YHA-63 antenna.

button legends to be displayed continuously, they share the same display area as the S-meter and revert back to the S-meter display a second or so after each key press. Although there is a low battery icon, it is not very attention-grabbing. When the battery voltage drops, there reaches a point when the radio just switches off with no prior warning.

### CONCLUSIONS

THE FT-817 IS a remarkable little radio with a performance and feature set which matches many of its bigger brothers. It really is a radio you can take anywhere and there is nothing else similar to compare it with. It has a list price of £799 inc VAT, but deals are available by shopping around.

Thanks to Yaesu (UK) for the loan of the model reviewed.

### ANTENNA APPENDIX

WATERS & STANTON market a range of base-loaded telescopic whip antennas intended for use with the FT-817 and these plug into the front panel BNC connector (see photo at top of p45). Each comprises a 4ft telescopic whip section in conjunction with a loading inductor moulded into the base. The AT series are monoband antennas with separate models covering all bands from 80m to 70cm. Fully extended the length is 1.4m collapsing to about 26cm. The ATX-Walkabout is a novel multiband antenna with a tapped loading inductor and a jumper lead which shorts out various sections of the inductor. This single antenna is adjustable on all bands from 80m to 6m, 1.65m fully extended and only 32cm dismantled.

The antennas are tuned by adjusting the length of the telescopic section whilst observing the VSWR display on the FT-817. As the antennas are very short compared with the operating wavelength, the bandwidth is quite narrow and tuning is fairly sharp, particularly on the lower frequency bands. A ground plane wire or earth lead must be connected to the ground terminal on the back of the radio to obtain any reasonable performance on receive and is a must on transmit. As these are fairly rigid antennas, care should be taken to avoid any knocks which may damage the BNC socket. However, the socket is quite strong as it is mounted on a metal sub panel and not directly on to a PCB as is the case with some radios. 'Rubber duck' VHF antennas, being flexible, present less strain on the antenna socket.

The antennas certainly work and I found them quite effective particularly on receive for monitoring band activity. The AT-xx monoband antennas are priced between £39.95 and £9.95 depending on band with most of the HF range at £24.95. The ATX Walkabout is priced at £69.95.

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# YAESU FT-817 MEASURED PERFORMANCE

**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.

## RECEIVER MEASUREMENTS

FREQ	SENSITIVITY SSB 10dBs+n:n		INPUT FOR S9	
	PREAMP IN	IPO	PREAMP IN	IPO
1.8MHz	0.32 $\mu$ V (-117dBm)	1.0 $\mu$ V (-107dBm)	28 $\mu$ V	110 $\mu$ V
3.5MHz	0.28 $\mu$ V (-118dBm)	0.8 $\mu$ V (-109dBm)	32 $\mu$ V	110 $\mu$ V
7MHz	0.25 $\mu$ V (-119dBm)	0.7 $\mu$ V (-110dBm)	28 $\mu$ V	100 $\mu$ V
10MHz	0.22 $\mu$ V (-120dBm)	0.63 $\mu$ V (-111dBm)	25 $\mu$ V	90 $\mu$ V
14MHz	0.22 $\mu$ V (-120dBm)	0.56 $\mu$ V (-112dBm)	20 $\mu$ V	60 $\mu$ V
18MHz	0.20 $\mu$ V (-121dBm)	0.56 $\mu$ V (-112dBm)	18 $\mu$ V	70 $\mu$ V
21MHz	0.22 $\mu$ V (-120dBm)	0.63 $\mu$ V (-111dBm)	20 $\mu$ V	70 $\mu$ V
24MHz	0.20 $\mu$ V (-121dBm)	0.63 $\mu$ V (-111dBm)	20 $\mu$ V	70 $\mu$ V
28MHz	0.20 $\mu$ V (-121dBm)	0.56 $\mu$ V (-112dBm)	20 $\mu$ V	70 $\mu$ V
50MHz	0.13 $\mu$ V (-125dBm)	0.35 $\mu$ V (-116dBm)	14 $\mu$ V	60 $\mu$ V
144MHz	0.13 $\mu$ V (-125dBm)	-	13 $\mu$ V	-
432MHz	0.13 $\mu$ V (-125dBm)	-	13 $\mu$ V	-

AM sensitivity (28MHz): 1.1 $\mu$ V for 10dBs+n:n at 30% mod depth  
 FM sensitivity (144MHz): 0.18 $\mu$ V for 12dB SINAD 3kHz pk deviation  
 AGC threshold: 2.2 $\mu$ V  
 100dB above AGC threshold for +1.5dB audio output  
 AGC attack time: 3 - 10ms  
 AGC decay time: 20ms (fast), 200ms (slow)  
 Max audio before clipping: 8 $\Omega$  - 1.0W, 4 $\Omega$  - 1.7W at 2% distortion

Freq	INTERMODULATION (50kHz Tone Spacing)			
	PREAMP IN		IPO	
	3rd order intercept	2 tone dynamic range	3rd order intercept	2 tone dynamic range
1.8MHz	+4.5dBm	88dB	+2.5dBm	80dB
3.5MHz	+4dBm	88dB	+9dBm	85dB
7MHz	+5dBm	89dB	+16dBm	91dB
14MHz	+8dBm	92dB	+18dBm	93dB
21MHz	+10.5dBm	94dB	+20dBm	94dB
28MHz	+9.5dBm	94dB	+25dBm	98dB
50MHz	-1dBm	89dB	+13dBm	93dB
144MHz	-12dBm	82dB	-	-
432MHz	-6.5dBm	86dB	-	-

Spacing	CLOSE-IN INTERMODULATION ON 7MHz BAND			
	PREAMP IN		IPO	
	3rd order intercept	2 tone dynamic range	3rd order intercept	2 tone dynamic range
3kHz	-32dBm	65dB	-21dBm	66dB
5kHz	-29dBm	67dB	-18dBm	68dB
7kHz	-26dBm	69dB	-15dBm	70dB
10kHz	-22dBm	72dB	-10dBm	73dB
15kHz	-14dBm	77dB	-3dBm	78dB
20kHz	-8dBm	81dB	+3dBm	82dB
30kHz	+3dBm	88dB	+14.5dBm	90dB
40kHz	+5dBm	89dB	+16dBm	91dB
50kHz	+5dBm	89dB	+16dBm	91dB

FREQUENCY OFFSET	RECIPROCAL		
	MIXING FOR 3dB NOISE	BLOCKING PREAMP IN	BLOCKING IPO
3kHz	69dB	-45dBm	-32dBm
5kHz	76dB	-44dBm	-31dBm
10kHz	85dB	-43dBm	-29dBm
15kHz	88dB	-39dBm	-25dBm
20kHz	91dB	-35dBm	-22dBm
30kHz	96dB	-30dBm	-16dBm
50kHz	101dB	-18dBm	-6dBm
100kHz	104dB	-18dBm	-6dBm
200kHz	101dB	-18dBm	-6dBm

S-READING (7MHz)	INPUT LEVEL SSB	
	PREAMP IN	IPO
S1	2.8 $\mu$ V	10 $\mu$ V
S3	3.2 $\mu$ V	11 $\mu$ V
S5	4 $\mu$ V	14 $\mu$ V
S7	5 $\mu$ V	18 $\mu$ V
S9	28 $\mu$ V	100 $\mu$ V
S9+	70 $\mu$ V	250 $\mu$ V

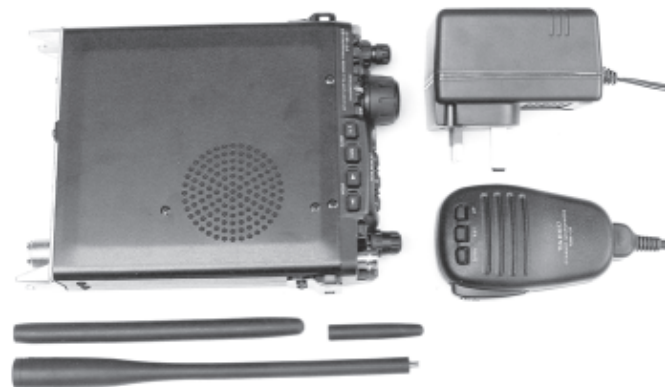
MODE	IF BANDWIDTH		
	-6dB	-50dB	-60dB
SSB, CW	2400Hz	3520Hz	4870Hz
CW(N)	555Hz	1640Hz	2375Hz
AM	7590Hz	12.7kHz	14kHz
FM	15.3kHz	24.3kHz	25.3kHz
FM(N)	10.4kHz	16.2kHz	16.6kHz

FREQUENCY	CW POWER OUTPUT		SSB(PEP) POWER OUTPUT		INTERMODULATION PRODUCTS	
	OUTPUT	HARMONICS	OUTPUT	HARMONICS	3rd order	5th order
1.8MHz	5.1W	5.4W	5.4W	-55dB	-32 (-26)dB	-41 (-35)dB
3.5MHz	5.4W	5.7W	5.7W	-66dB	-31 (-25)dB	-43 (-37)dB
7MHz	5.3W	5.5W	5.5W	-75dB	-31 (-25)dB	-42 (-36)dB
10MHz	5.2W	5.4W	5.4W	-56dB	-30 (-24)dB	-43 (-37)dB
14MHz	4.9W	5.2W	5.2W	-62dB	-31 (-25)dB	-42 (-36)dB
18MHz	4.9W	5.2W	5.2W	-60dB	-30 (-24)dB	-42 (-36)dB
21MHz	4.9W	5.2W	5.2W	-65dB	-29 (-23)dB	-42 (-36)dB
24MHz	5.0W	5.2W	5.2W	-67dB	-28 (-22)dB	-41 (-35)dB
28MHz	5.0W	5.3W	5.3W	-62dB	-28 (-22)dB	-41 (-35)dB
50MHz	4.9W	5.2W	5.2W	-68dB	-28 (-22)dB	-42 (-36)dB
144MHz	4.8W	5.0W	5.0W	-65dB	-25 (-19)dB	-37 (-31)dB
432MHz	4.4W	4.6W	4.6W	-63dB	-26 (-20)dB	-37 (-31)dB

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: 4.3kHz (wide) 2.0kHz (narrow)  
 SSB T/R switch speed: mute-TX 20ms, TX-mute 6ms, mute-RX 36ms, RX-mute 1ms

## TRANSMITTER MEASUREMENTS



FT-817 with supplied accessories.