



select either 1200 or 9600 baud operation on a band-by-band basis. Each VFO, A and B, can also store the baud rate setting and this is preserved if the frequency is stored into a memory channel register. There's no dedicated packet mode on the front panel, instead whenever the transceiver detects a PTT control command on the packet connector this mode is recognised.

The three-pin 'data' connector lets you use other modes such as RTTY, AmTOR, PacTOR and SSTV, even weather-fax receive, in manually-selected SSB or AM / FM modes, also high-speed meteor-scatter CW using audio-keyed SSB. If you've connected your data unit's PTT line to the packet PTT line, the set's front panel mic audio is automatically muted on transmit.

connections

Also on the rear panel are separate antenna sockets for HF, 6m, 2m and 70cm, and you can select the HF socket to also be used for 6m, for example if you're using a compact HF / 6m Yagi.

The dedicated 'Tuner' socket interfaces with Yaesu's optional

satellite mode

With its built-in 'satellite mode', Yaesu refer to the FT-847 as an 'Earth Station'. It gives you full-duplex crossband transceiver, ie simultaneous transmit and receive between bands, and the push of a button allows your uplink (transmit) and downlink (receive) frequencies to track each other. As some satellite modes use inverting transponders, you can also select 'reverse tracking'; the sub-tune knob also gives you the capability of manual adjustment of your uplink.

It's the transceiver that many amateurs around the world have been waiting for. Having been publicised for several months before it became available, many amateurs had already put their deposit down to be certain of being one of the first. Being an equipment reviewer sometimes has its benefits!

In the FT-847, Yaesu have come up with a carry-around sized set giving multimode transceiver operation on HF, 6m, 2m and 70cm, including full-duplex satellite ca-

than the transceiver, as it's specified as requiring 22A for 100W RF output.

dsp

No transmitter is any use without a good receiver, and the FT-847 really scores here in terms of operating features. As well as having an IF shift and switchable attenuator, slow / fast AGC, IF noise blanker and RF amplifier, in common with Yaesu's other recent top of the range models an audio-based DSP (Digital Signal

Yaesu FT-847 reviewed

The first UK full technical review, by Chris Lorek, G4HCL

capability between band ranges. On transmit it offers 100W output on HF and 6m, with 50W output on 2m and 70cm, plus receive coverage across 100kHz - 30MHz, 36 - 76MHz, 108 - 174MHz and 420 - 512MHz. Not only that, but models supplied to the UK market have also had 4m transmit capability added; more about that later.

The set's packed full to bursting with operating 'bells and whistles', and many amateurs have naturally been attracted to the set as a 'do-everything' rig for their shack. Could this ideal be a reality? Let's find out...

dimensions

When you first cast eyes on an FT-847, you'll probably be surprised, as I was, with its size. It's rather smaller than you'd imagine, especially when compared with Yaesu's other base-station models. It measures just 260W x 86H x 270Dmm, ie less than a normal 30cm-long ruler wide or deep.

Operating from a 13.8V DC supply, and thus without an internal mains power supply unit, the weight is also kept down to a reasonably light 7kg. Your power supply will certainly weigh more

Processor) system is included.

This offers continuously variable low and high-cut audio filtering for speech modes and selectable 25, 100, 200 and 400Hz audio bandwidths on CW. There's also a DSP noise reduction mode, plus an automatic digital audio notch with the capability of notching multiple tones at the same time.

Ceramic IF filters are used for all modes, with available bandwidths of 2.2kHz (SSB / CW and Narrow AM), 9kHz (AM and Narrow FM) and 15kHz (FM). Optional Collins mechanical filters are also available, one for CW, giving a 500Hz bandwidth, and one for SSB which gives the same 2.2kHz bandwidth, but with a better passband response.

On transmit, a built-in CW keyer and an RF speech processor for SSB are fitted: an audio monitor lets you hear what your transmitted signal sounds like at any time. An optional voice synthesiser can be internally fitted, which gives speech readout of the operational frequency at the press of a button, which is naturally useful for visually-impaired operators.

Dual frequency displays show you exactly where you are at any time, and there's a dedicated satellite 'memory' VFO system which can store up to 12 operating modes into different memories, eg for different satellites and modes. There's also an 'alpha-tag' facility for these, where you can give a short name to each memory, which shows on the sub-VFO display each time you switch between satellite memories, reverting to the operating frequency after a couple of seconds.

data

Dedicated sockets on the rear panel are fitted for both packet and data. The 'packet' socket is dedicated to packet radio, and you can

FC-20 external tuner, or their ATAS-100 auto-tuning antenna system. The 'Stby' socket carries separate TX switching lines for each band range for use with separate linear amplifiers. An RS-232 CAT socket allows remote control of the rig, using one of the many readily-available amateur logging and rig control programs.

A small rear-panel mounted fan works in conjunction with a larger internal fan to keep the set's internal PA circuitry cool, the air being blown along an internal PA heatsink.

powering up

Connecting my 13.8V supply and switching on brought up a very readable blue



Yaesu FT-847 reviewed

The first UK full technical review of this new all-band

backlit display, which includes a curved bargraph indication of S-meter level and transmit power output. On FM it also produced a handy centre-zero discriminator meter - especially useful for 9600 baud digital microsats. Transmit ALC can be shown in place of the power output if you wish.

Although I was 'up and running' very quickly with the FT-847, I found a good read of the 100-plus page manual was essential to get the best out of the

transceiver. After almost every few pages I thought, "now isn't that a good idea", as Yaesu seem to have added plenty of useful operating functions to the set. For example, a press of the 'Fast' button, besides speeding up the VFO tuning, also changed the 'band' up / down to instead switch between 6m, 2m, 70cm, and just the last-used band on HF, rather than cycling through every HF band as well.

On 2m and 70cm, low-noise

internal preamps are switched in with the 'preamp' button, this can instead be programmed to supply DC voltage on to the antenna connector on either or both bands for powering a masthead preamp, as used by many VHF / UHF DX chasers. Many operating modes and settings, eg noise reduction level, CW delay time, DSP CW filter bandwidth etc, are controlled by a 'menu' system. There's a useful double-sided A4 card with a complete list of the menus supplied with the operating manual.

this (a touch too much and I was several MHz away!) I found this very useful as a 'lazy' way of tuning around looking for activity.

I'd quickly programmed the set's memories with my local VHF / UHF 'chat channels', as well as HF net frequencies and a number of satellite modes. It might seem ironic, with the FT-847 being an 'Earth Station', that on the very first evening with the receiver listening to my local 2m repeater frequency whilst I was reading the manual, an end-stop S-meter signal with Russian speech came up, several times. No, it wasn't a 'lift', it was one of the cosmonauts on the Mir space station. It certainly woke a few locals up who initially couldn't work out what was happening! Switching in my azi / ele controlled 2m and 70cm crossed Yagis and selecting 'Mir' from my PC

tracking program confirmed this - although I needed the FT-847's attenuator switched in to bring the S-meter level down to below 60 over 9!

I really appreciated the front panel control capabilities of the set, which



Close up showing setting of menu parameters.

Rear panel. Note use of N-type antenna socket for 430MHz.



on the air

Concentric to the main tuning knob is Yaesu's 'shuttle jog', a spring-loaded tuning ring which automatically steps up and down for you. The further you turn it the faster it tunes. After I'd got used to

laboratory

rece

All measurements carried out on 21.4MHz in SSB mode, with DSP, attenuator and 13.8V DC using supplied length of

sensitivity:

Input level in μV pd required to give 12dB SINAD, measured in standard bandwidth with internal preamp both off (Normal) and on (Preamp)

Freq MHz	SSB / CW		AM		FM	
	Normal	Preamp	Normal	Preamp	Normal	Preamp
1.8	0.52	0.24	1.52	0.73	-	-
3.5	0.36	0.18	1.10	0.52	-	-
7.0	0.26	0.13	0.89	0.51	-	-
10.1	0.34	0.18	0.93	0.48	-	-
14.0	0.34	0.18	0.90	0.54	-	-
18.1	0.38	0.17	1.00	0.52	-	-
21.0	0.36	0.17	1.04	0.50	-	-
24.9	0.40	0.16	1.02	0.47	-	-
29.0	0.35	0.15	0.96	0.48	0.24	0.19
51.0	0.17	0.13	0.63	0.27	0.23	0.18
70.2	0.53	0.32	1.50	0.89	0.74	0.44
145	0.12	0.09	-	-	0.18	0.12
432	0.13	0.11	-	-	0.21	0.16

selectivity:

Measured using standard filters and with optional Collins CW and SSB filters fitted

	CW / SSB	AM / FM Nar	FM	Optional CW	Optional SSB
-3dB	2.07kHz	9.27kHz	11.76kHz	527Hz	2.58kHz
-6dB	2.45kHz	10.77kHz	13.68kHz	569Hz	2.75kHz
-20dB	2.84kHz	13.09kHz	19.33kHz	749Hz	3.19kHz
-40dB	3.16kHz	15.47kHz	22.37kHz	1.07kHz	3.98kHz
-60dB	4.63kHz	18.10kHz	25.41kHz	1.89kHz	4.19kHz

Blocking:

Measured as increase over 12dB SINAD level of interfering signal, unmodulated carrier, causing 6dB degradation in 12dB SINAD on-channel signal, measured with preamp off (Nor), and on (Preamp)

21.4MHz:	Nor	Preamp
+/-50kHz:	99.7dB	99.7dB
+/-100kHz:	102.6dB	102.3dB
+/-200kHz:	104.2dB	103.6dB

51MHz:	Nor	Preamp
+/-50kHz:	100.0dB	101.6dB
+/-100kHz:	102.9dB	102.9dB
+/-200kHz:	104.2dB	103.1dB

image rejection:

Increase in level of signal at the first and second IF image frequencies, and the first and second IF, over level of on-channel signal, giving identical 12dB SINAD signal

Freq MHz	1st Image Rej	1st IF Rej	2nd Image Rej	2nd IF Rej
1.8	101.0dB	71.6dB	>110dB	>110dB
3.5	80.7dB	61.2dB	>110dB	>110dB
7.0	78.7dB	59.9dB	>110dB	>110dB
10.1	89.2dB	66.1dB	107.6dB	>110dB
14.0	85.7dB	64.7dB	99.6dB	>110dB
18.1	77.3dB	67.8dB	100.7dB	>110dB
21.0	83.9dB	69.4dB	98.8dB	>110dB
24.9	109.3dB	81.4dB	92.2dB	>110dB
29.0	101.7dB	80.8dB	92.0dB	>110dB
51.0	97.9dB	89.9dB	87.7dB	>110dB
70.2	74.9dB	88.7dB	83.5dB	>110dB
145	64.9dB	57.6dB	89.4dB	>110dB
433	68.3dB	81.2dB	>110dB	>110dB

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all-mode transceiver, by Chris Lorek, G4HCL

give the operating flexibility of an up-market HF transceiver on VHF / UHF bands as well. The two VFO frequencies, A and B, are both displayed and switching between these was very easy, for example I often used them to quickly flick between two frequencies on a given band. There's also a pair of 'QMB' (Quick Memory Bank) buttons which would quickly store and recall an interesting frequency I'd found on an initial tune around.

As well as having many

contacts on the HF bands with the set, I managed to enjoy plenty on 6m, 2m and 70cm as well. Until a couple of years ago I owned an FT-736 for some time and grew to appreciate its satellite capabilities, but the FT-847 goes one better, with its extra operating functions such as the built-in 9600 baud data capability and satellite name-tagging. It's a pity that the FT-847 doesn't have the facility of adding 23cm; there's no separate low-level transverter output, so you'll need to use one of the antenna ports, eg 2m, for an external transverter (be careful of the 50W max 2m power output) and relinquish that band for any full-duplex satellite work.

With my 'critical' hat on, I noted a slightly 'boxy' receive audio on all modes. Plugging in an external speaker or headphones gave the same result, and eventually I just became used to it.

On FM, the 'Nar' button on the front panel usefully reduces transmit deviation, as well as reducing

the bandwidth on receive. Testing this through my local 12.5kHz-spec 2m repeater certainly showed the difference, from badly distorted audio on the 'wide' setting to excellent audio in the 'Nar' mode.

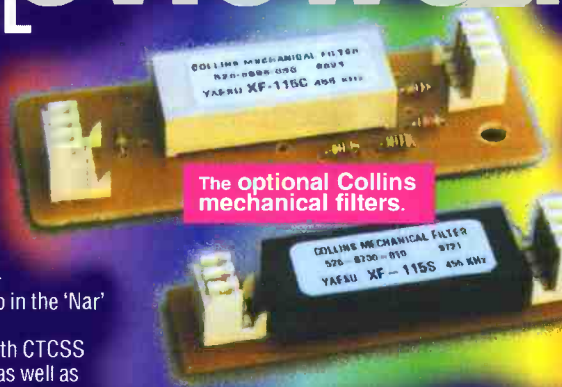
The FT-847 has both CTCSS and DCS capabilities as well as a 1750Hz toneburst, it can also be used as a cross-band repeater if you wish, either carrier squelch, CTCSS, or DCS activated.

filters

On HF SSB and CW, I found the supplied IF filtering wasn't really up to what I've become used to on £1000-plus HF rigs (the FT-847 is priced at £1695 at the time of writing). Although I often found adjacent-frequency splatter coming through, the low / high cut DSP audio filtering helped very well if the QRM wasn't too strong. On CW, the pre-set bandwidth narrow DSP audio filter worked very well indeed, although CW

enthusiasts and DX chasers would probably still wish to add the optional filter.

A call to Yaesu UK promptly brought the optional Collins CW and SSB filters through my letterbox, and fitting them took just a few minutes. The CW filter was a vast improvement for this mode. Coupled with the even narrower DSP filtering, and judicious use of the RF gain and DSP noise reduction, it allowed the rig to pull out otherwise unreadable signals, not only on HF but also for weak-signal VHF / UHF use. I'd certainly recommend this if you're planning to try things like meteor scatter or even moonbounce operation



The optional Collins mechanical filters.

Underside view from rear, before the optional filters were fitted.



Key results

Preamps disabled, with supplied IF filters and with set powered from stabilised DC lead, unless otherwise stated.

Transceiver

3rd order intermodulation rejection:

Increase over 12dB SINAD level of two interfering signals giving identical 12dB SINAD on-channel 3rd order intermodulation product, measured with preamp off (Nor), and on (Preamp)

21.4MHz:	Nor	Preamp	145MHz:	Nor	Preamp
10 / 20kHz spacing:	70.7dB	66.5dB	10 / 20kHz spacing:	69.1dB	63.5dB
20 / 40kHz spacing:	91.5dB	86.5dB	20 / 40kHz spacing:	79.4dB	73.4dB
50 / 100kHz spacing:	90.1dB	84.9dB	50 / 100kHz spacing:	79.0dB	73.8dB
100 / 200kHz spacing:	88.9dB	84.7dB	100 / 200kHz spacing:	80.3dB	75.0dB
51MHz:	Nor	Preamp	432MHz:	Nor	Preamp
10 / 20kHz spacing:	71.2dB	66.2dB	10 / 20kHz spacing:	67.8dB	60.3dB
20 / 40kHz spacing:	92.8dB	84.2dB	20 / 40kHz spacing:	91.8dB	86.9dB
50 / 100kHz spacing:	88.4dB	83.3dB	50 / 100kHz spacing:	86.9dB	82.2dB
100 / 200kHz spacing:	86.7dB	82.4dB	100 / 200kHz spacing:	83.7dB	80.7dB

s-meter linearity:

Measured at 14.25MHz

Indication	Sig Level	Rel Level
S1	2.61 μ V pd	-28.4dB
S2	3.34 μ V pd	-26.2dB
S3	4.51 μ V pd	-23.6dB
S4	6.46 μ V pd	-20.5dB
S5	9.40 μ V pd	-17.2dB
S6	13.6 μ V pd	-14.0dB
S7	22.0 μ V pd	-9.8dB
S8	36.1 μ V pd	-5.6dB
S9	67.9 μ V pd	0dB ref
S9+20dB	193 μ V pd	+9.1dB
S9+40dB	1.04 mV pd	+23.8dB
S9+60dB	186 mV pd	+68.7dB

s-meter s9 level:

Freq MHz	Sig Level	Preamp On
1.8	109.1 μ V pd	29.9 μ V pd
3.5	85.6 μ V pd	22.7 μ V pd
7.0	90.2 μ V pd	24.2 μ V pd
10.1	84.0 μ V pd	23.3 μ V pd
14.0	67.9 μ V pd	18.3 μ V pd
18.1	64.0 μ V pd	17.8 μ V pd
21.0	63.4 μ V pd	17.2 μ V pd
24.9	60.5 μ V pd	16.8 μ V pd
29.0	67.2 μ V pd	18.1 μ V pd
51.0	47.8 μ V pd	12.9 μ V pd
70.2	119.0 μ V pd	38.8 μ V pd
145	28.1 μ V pd	9.7 μ V pd
432	24.7 μ V pd	7.4 μ V pd

(watch out for the Doppler shift).

Moonbounce may seem to be 'pie in the sky' for some, but a couple of long Yagis and an add-on solid-state 'brick' amplifier, and you'll be well equipped to work some of the 'big gun' stations active on this mode. The FT-847 user manual even gives you some handy operating hints for this and other advanced VHF / UHF operating modes.

With its flatter response, the Collins SSB filter cleaned up the received SSB audio, but on crowded bands, such as 40m and often 20m, I'd have liked to be able to switch in a narrower SSB filter as well. The transceiver uses two identical SSB filters, one for the transmit path and one for the receive path (remember that it can transmit in crossband full-duplex mode), and you can fit the optional SSB filter in either path, or indeed one in both. But at just under £100 each, you'd have to think carefully about doing this!

lab tests

The results show that the FT-847 is a reasonable 'all-rounder' in technical respects. Although - possibly naturally - not having the performance of a top-flight dedicated HF transceiver, for the set's size the designers have managed to squeeze a lot in.

The receiver uses a dual conversion superhhet with IFs of

45.705MHz and 455kHz, and I noticed that, although the 1st image rejection was excellent on HF (this image falling in the Band II FM broadcast band) through the HF port, being above 100dB in each case, it was degraded when measured through the 70cm port; the figures in the test results table show this. But this should only be a limitation if you're in the rare position of being on the doorstep of a nearby Band II FM station and using a wideband VHF / UHF antenna without a diplexer / splitter on the 70cm port.

On transmit, the set was capable of being turned down in power from the front panel to less than 3W on any band, which QRP enthusiasts will appreciate, as many 100W transceivers only go down to 10W.

The 'far out' SSB inter-modulation products were well suppressed, giving a fairly clean, splatter-free, signal. Apart from the tabulated harmonics which were reasonably suppressed (and 4m, see below), on the 10 and 14MHz bands I noticed some spurious around 5MHz at around -46 to -48dBc, and around 12.5MHz when on the 24.9MHz band at -42dBc.

4 metres

Going back to my first day of testing, I found that on 4m, the trans-

ceiver gave around 35W output, but that it drew over 18A from my power supply. A check with my spectrum analyser showed that the transmitter was generating a significant amount of unwanted spurious here, a check on another set showing the same. However, a further set checked was reasonably clean and yet another checked was again fine if the transmit power was kept to 10W or less, although the current drawn was still rather high on this band for the achieved power output. Yaesu have never specified 4m transceive coverage in their FT-847 product information, and tell me they have only enabled transmit facility on this band on their dedicated UK models as a 'bonus' for UK amateurs. I'm told the internal circuitry of UK sets is slightly different for the 4m addition, so it looks like they really are giving us a 'bonus' here! Yaesu UK tell me they naturally can't guarantee performance on this frequency range, but they strongly suggest the transmit output power is kept to 10W or less if the transceiver is used on 4m, which I'd agree with.

conclusions

Yaesu have managed to cram an incredible amount of bands and operating facilities into a compact

box, and VHF / UHF enthusiasts, especially satellite operators, will no doubt have an FT-847 high up on their 'wish list'. It does of course give you a wide range of operating facilities on HF as well, and although it's arguably not up to the HF 'contest standard' of much larger HF-only transceivers, I'm sure many FT-847s will be used as a 'do-everything' transceiver in shacks throughout the world. I found the VHF / UHF performance and flexibility to be excellent, the designers seem to have thought about almost everything. It's also a reasonable 'carry-around' size and I can see it being used on many weekend hilltop-operating sessions. I really did enjoy using the transceiver in my shack, and I'm sure it will be an extremely sought-after set. UK models uniquely have the 70MHz transmit facility enabled, which can also be extremely useful for DX *PacketCluster* access, but remember to keep your transmit power down to 10W or less on this band to minimise any potential spurious problems.

My thanks go to SMC Ltd (tel: 01703 246222) for the loan of one of the very first FT-847s to arrive for sale in the UK, and to Yaesu UK for their help in loaning optional filters and in answering my many queries in the preparation of this review. The recommended retail price of the FT-847 is £1695.

transmitter

transmitter power and current consumption:

Measured under normal front panel selection

Freq MHz	Max Power	Min Power
1.8	98W / 17.9A	2.3W / 5.6A
3.5	112W / 16.5A	2.5W / 5.4A
7.0	110W / 17.1A	2.5W / 5.6A
10.1	110W / 15.2A	2.5W / 5.2A
14.0	109W / 17.9A	2.5W / 5.5A
18.1	108W / 15.9A	2.5W / 5.2A
21.0	109W / 18.5A	2.5W / 5.6A
24.9	108W / 17.5A	2.6W / 5.5A
29.0	107W / 17.6A	2.6W / 5.4A
51.0	96W / 16.8A	1.8W / 5.3A
70.2		
145	53W / 10.3A	2.9W / 4.2A
433	48W / 13.7A	2.5W / 5.0A

See text

harmonics:

Freq MHz	2nd	3rd	4th	5th	6th	7th
1.8	-66dBc	-61dBc	-74dBc	-69dBc	-72dBc	-73dBc
3.5	-52dBc	-64dBc	-74dBc	-74dBc	<-80dBc	<-80dBc
7.0	-68dBc	-62dBc	-73dBc	-66dBc	-75dBc	-74dBc
10.1	-63dBc	-58dBc	<-80dBc	-73dBc	<-80dBc	-75dBc
14.0	-67dBc	-62dBc	-73dBc	-68dBc	<-80dBc	<-80dBc
18.1	-62dBc	-62dBc	<-80dBc	-73dBc	<-80dBc	-61dBc
21.0	-61dBc	-60dBc	-70dBc	-72dBc	<-80dBc	-74dBc
24.9	-55dBc	-54dBc	-75dBc	-74dBc	-73dBc	-70dBc
29.0	-52dBc	-69dBc	-65dBc	-64dBc	<-80dBc	-75dBc
51.0	-68dBc	-67dBc	-68dBc	<-80dBc	<-80dBc	<-80dBc
70.2						
145	-70dBc	<-80dBc	<-80dBc	<-80dBc	<-80dBc	<-80dBc
433	-64dBc	<-80dBc	<-80dBc	<-80dBc	<-80dBc	<-80dBc

See text

ssb imd performance:

Measured with a two-tone AF signal, results given as dB below PEP level, measured at onset of ALC with RF processor off, and at mid ALC with processor on

	3rd Order	5th Order	7th Order	9th Order	11th Order
21.4MHz:					
ALC Onset	-25dB / -29dB	-44dB / -43dB	-50dB / -49dB	-53dB / -55dB	<-60dB / <-60dB
Proc On (Mid ALC)	-20dB / -22dB	-34dB / -38dB	-50dB / -50dB	-54dB / -51dB	-54dB / -51dB
51MHz:					
ALC Onset	-26dB / -32dB	-41dB / -41dB	-44dB / -44dB	-53dB / -53dB	-60dB / -58dB
Proc On (Mid ALC)	-27dB / -34dB	-43dB / -38dB	-48dB / -43dB	-58dB / -52dB	<-60dB / -58dB
145MHz:					
ALC Onset	-28dB / -28dB	-49dB / -47dB	-52dB / -48dB	-55dB / -54dB	-56dB / -60dB
Proc On (Mid ALC)	-21dB / -22dB	-33dB / -33dB	-48dB / -49dB	-55dB / -52dB	-65dB / -53dB
433MHz:					
ALC Onset	-20dB / -21dB	-31dB / -33dB	-47dB / -44dB	-55dB / -51dB	-56dB / -57dB
Proc On (Mid ALC)	-18dB / -19dB	-26dB / -28dB	-35dB / -39dB	-53dB / -52dB	-56dB / -54dB