



Product Review & Short Takes Columns from QST Magazine

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Product Reviews

Yaesu FT-817 Multiband Multimode Transceiver

MFJ-616 Speech Intelligibility Enhancer

Short Takes

2001 Super Frequency List CD-ROM

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PRODUCT REVIEW

Yaesu FT-817 Multiband Multimode Transceiver

Reviewed by Rick Lindquist, N1RL
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For today's on-the-run population, the multiband, multimode FT-817 means that you can take along much more ham radio than that FM-only H-T you've been tossing into your bag up until now. In a short time, this (so far) one-of-a-kind transceiver has proven to be one of those "killer" Amateur Radio products that come along every so often and capture our imaginations with their unique universe of operating possibilities.

Because this is a low-power radio (5 W), its introduction at hamfests as early as last summer attracted particular attention from the QRP crowd. But, let's be clear about something up front: The FT-817 is a low-power radio that *everyone* can enjoy, and it was not developed with the QRPer specifically in mind. This carry-along transceiver only happens to be low-power because it needs to be, especially when you're running it off internal batteries.

With all-mode transmit and receive capability on all bands between 160 and 2 meters plus 70 cm plus wide LF, MF, HF, FM broadcast, and VHF-UHF receiver coverage in a package that almost but not quite fits in the average jacket pocket, additional output power might possibly be the *only* other feature you could possibly desire, but it's one we found we didn't miss either.

A Unique Radio

In case you're wondering about the nomenclature, Yaesu seems to be subtly suggesting that this little transceiver shares some DNA with the company's FT-847 multiband, multimode HF+VHF+UHF+satellite transceiver. Indeed, both rigs cover essentially the same bands. The '817 is not capable of full duplex satellite operation, however.

In terms of form factor, the FT-817 is reminiscent of the early "sack pack" radios that were popular in the 1970s—the Kenwood TR-2200A and the closely related Drake TR-33 come quickly to mind, as well as the ICOM IC-502. In their day, these radios bridged the gap between the somewhat clunky H-Ts and a full-blown FM mobile. Later hand-held transceivers overtook that trend, but by and large, the H-T style never adequately made the transition to HF transceiver design. One ex-



ception is the still-popular but hard-to-find Tokyo Hy-Power HT-750. This was perhaps the sole successful attempt to meld a usable transceiver with HF capability into an H-T package. While the HT-750 offered 2 W or so, SSB and CW, on 40, 15 and 6 meters and includes a real superhet receiver, it never took off and no longer is marketed in this country. Perhaps it was simply ahead of its time.

I Just Gotta Have Me One of These!

Think back a few short years, and consider those products that generated the biggest "buzz" on the bands (today we'd say "on the 'net"). Remember in 1993 when Kenwood awed the amateur community by introducing the first compact 100 W HF transceiver, the TS-50S? For those of us weaned on Hallicrafters and Johnson gargantua, this was a huge leap in the direction of Dick Tracy's mythical two-way wrist radio.

The race for small was on! While Kenwood seems to have dropped out for reasons best known to itself, Alinco, ICOM, and finally Yaesu came out with ever-more compact transceivers, upping the ante with additional capabilities and features with each succeeding unit.

With the FT-817 you get an economically priced transceiver you can carry,

instead of lugging around, just about anywhere—not quite an H-T in form, yet much more than an H-T in function. And that's the whole idea. The FT-817 offers a lot of features you're already familiar with from your H-T as well as those you enjoy on a typical HF transceiver. It's kind of an H-T *plus*, and that's spelled with a "p" for *portable*!

Cost vs Capability

When it comes to ham radio gear, we like to say that you get what you pay for. Viewed in those terms, the FT-817 might just be one of the best values in the Amateur Radio marketplace today.

The FT-817 wears a lot of hats. It's a CW, SSB, or digital mode rig for HF, VHF and UHF; it's a FM rig for repeater work (a multi-section H-T style rubber ducky antenna for the VHF and UHF bands is included); and it's an on-the-road listening post—LF, AM broadcast, FM broadcast, HF amateur and shortwave, AM aircraft, and more.

As any HF transceiver worth its salt does, the FT-817 offers VOX for SSB (sorry, no speech processor, however) and a built-in keyer for CW. There are separate VOX delay settings for SSB and CW—some larger rigs don't even have this feature, but should. It has both an RIT and an IF shift, plus you can add one optional filter for either SSB or for CW in the 455 kHz IF. For digital work, it includes provisions to discretely adjust the audio input (ie, from your sound card or TNC) for digital modes. There's a noise blanker that really works. Great!

Bottom Line

What a great little radio, and what a great little price! This carry-along does it all. You *can* take it with you after all! As one user declared: "It's a keeper!"

Table 1
Yaesu FT-817, serial number OM050276

Manufacturer's Claimed Specifications

Frequency coverage: Receive, 0.1-30, 50-54, 76-108 (WFM), 144-148, 420-450 MHz; transmit, 1.8-2, 3.5-4, 5.168¹, 7-7.3, 10.1-10.15, 14-14.35, 18.068-18.168, 21-21.45, 24.89-24.99, 28-29.7, 50-54, 144-148, 430-450 MHz.

Power requirement: Receive, 0.45 A; transmit, 2.0 A (5 W output). 8.0-16.0 V dc (13.8 nominal)

Modes of operation: SSB, CW, AM, FM, AFSK.

Receiver

SSB/CW sensitivity, bandwidth not specified, 10 dB S/N³: 1.8-30 MHz, <0.25 μV; 50-54 MHz, <0.2 μV; 144-148, 430-450 MHz, <0.13 μV.

AM sensitivity, 10 dB S/N³: 0.3-1.8 MHz, <32 μV; 1.8-30 MHz, <2 μV; 50-54 MHz, <2 μV; 144-148, 430-450 MHz, Not specified.

FM sensitivity, 12 dB SINAD³: 28-30 MHz, <0.5 μV; 50-54, <0.32 μV; 144-148, 430-450 MHz, <0.2 μV.

Blocking dynamic range: Not specified.

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

Third-order intercept: Not specified.

Second-order intercept: Not specified.

FM adjacent channel rejection: Not specified.

Measured in the ARRL Lab

Receive, 0.1-56², 76-108 (WFM), 108-154, 420-450 MHz; transmit, as specified.

Receive, 0.37 A; transmit, 1.9 A. Tested at 13.8 V.

As specified.

Receiver Dynamic Range

Noise floor (MDS), 500 Hz filter:

	<i>Preamp off</i>	<i>Preamp on</i>
1.0 MHz	-117 dBm	-127 dBm
3.5 MHz	-123 dBm	-133 dBm
14 MHz	-126 dBm	-134 dBm
50 MHz	-129 dBm	-140 dBm
144 MHz	see note 4	-139 dBm
432 MHz	see note 4	-140 dBm

10 dB (S+N)/N, 1-kHz tone, 30% modulation:

	<i>Preamp off</i>	<i>Preamp on</i>
1.0 MHz	7.5 μV	2.45 μV
3.8 MHz	3.3 μV	1.2 μV
50 MHz	1.68 μV	0.52 μV
120 MHz	see note 4	0.67 μV
144 MHz	see note 4	0.62 μV
432 MHz	see note 4	0.63 μV

For 12 dB SINAD:

	<i>Preamp off</i>	<i>Preamp on</i>
29 MHz	0.77 μV	0.28 μV
52 MHz	0.45 μV	0.16 μV
146 MHz	see note 4	0.18 μV
440 MHz	see note 4	0.20 μV

Blocking dynamic range, 500 Hz filter:

	<i>Preamp off</i>	<i>Preamp on</i>
3.5 MHz	107 dB	106 dB
14 MHz	106 dB	104 dB
50 MHz	110 dB	107 dB
144 MHz	see note 4	108 dB
432 MHz	see note 4	106 dB*

Two-tone, third-order IMD dynamic range, 500 Hz filter:

	<i>Preamp off</i>	<i>Preamp on</i>
3.5 MHz	86 dB	86 dB
14 MHz	87 dB	84 dB
50 MHz	89 dB	87 dB
144 MHz	see note 4	88 dB*
432 MHz	see note 4	82 dB*

	<i>Preamp off</i>	<i>Preamp on</i>
3.5 MHz	+8.2 dBm	-3.1 dBm
14 MHz	+5.0 dBm	-5.6 dBm
50 MHz	+0.8 dBm	-12 dBm
144 MHz	see note 4	-11 dBm
432 MHz	see note 4	-12 dBm

Preamp off, +84.0 dBm; preamp on, +88.4 dBm.

20 kHz channel spacing, preamp on: 29 MHz, 66 dB; 52 MHz, 65 dB; 146 MHz, 64 dB; 440 MHz, 65 dB.

An expanded test result report is available to our members on our Web site. Printed copies are also available to those without Web access.

The FT-817 has incorporated all the useful features you've come to know and love on your FM-only rig, too. There are automatic repeater shift menu settings for 2 and 70 cm (although apparently not one for 6 meters); up to 200 memories (that can be partitioned into 10 groups each holding up to 20 memory channels); alphanumeric memory labeling; scanning capability, including programmed memory scan and dual watch (a priority-channel monitor); a time-out timer; and

1200 and 9600-bps packet.

Other niceties include features you might not have on your "big rig" such as AM mode on transmit, should you be so inclined; a spectrum scope; *Smart Search* (in AM or FM mode, the '817 can search and store active frequencies in a special bank of 50 memory channels); Yaesu's exclusive *Auto Range Transpond System*; the ability to set power levels independently for the HF+50 MHz, 144 MHz and 430 MHz bands; scratchpad

"QMB" (quick memory bank) memory channel plus four one-touch "Home" channels, in addition to regular memories; and 5167.5 kHz Alaska Emergency Frequency capability.

With all these features you'd figure Yaesu must have cut corners in the design and engineering to keep the price down below \$800. Well, perhaps here and there, but as the ARRL Lab data in Table 1 demonstrate, the FT-817 is a decent performer across the board, exhibit-

FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz channel spacing, preamp on: 29 MHz, 67 dB; 52 MHz, 68 dB*; 146 MHz, 66 dB*; 440 MHz, 66 dB; 10 MHz channel spacing, preamp on: 52 MHz, 109 dB; 146 MHz, 94 dB; 440 MHz, 81 dB.
S-meter sensitivity: Not specified.	S9 signal at 14.2 MHz: preamp off, 54 μ V; preamp on, 16 μ V; 52 MHz, preamp off, 49 μ V; preamp on, 6.7 μ V; 146 MHz, 5.9 μ V; 432 MHz, 4.7 μ V.
Squelch sensitivity: SSB, 1.8-30 MHz, <2.5 μ V; 50-54 MHz, <1 μ V; 144-148, 420-450 MHz, <0.5 μ V; FM, 28-30 MHz, <0.32 μ V; 50-54 MHz, <0.2 μ V; 144-148, 430-450 MHz, <0.16 μ V.	At threshold, preamp on: SSB, 14 MHz, 1.62 μ V; FM, 29 MHz, 0.14 μ V; 52 MHz, 0.10 μ V; 146 MHz, 0.09 μ V; 440 MHz, 0.07 μ V.
Receiver audio output: 1.0 W at 10% THD into 8 Ω .	1.1 W at 10% THD into 8 Ω .
IF/audio response: Not specified.	Range at -6 dB points, (bandwidth): CW-N (500 Hz filter): 404-1100 Hz (696 Hz); CW-W: 329-2689 Hz (2360 Hz); USB-W: 276-2759 Hz (2483 Hz); LSB-W: 224-2676 Hz (2452 Hz); AM: 108-4030 Hz (3922 Hz).
IF rejection: 60 dB; image rejection: 1.8-30 MHz, 50-54 MHz, 70 dB; 144-148, 430-450 MHz, 60 dB.	First IF rejection, 14 MHz, 92 dB; 50 MHz, 91 dB; 144 MHz, 104 dB; 432 MHz, 127 dB; image rejection, 14 MHz, 66 dB; 50 MHz, 99 dB; 144 MHz, 119 dB; 432 MHz, 79 dB.

Transmitter

Power output: SSB, CW, FM, 5 W (high);
AM, 1.5 W carrier (high).

Spurious-signal and harmonic suppression: ≥ 50 dB
on HF; ≥ 60 dB on VHF & UHF.

SSB carrier suppression: ≥ 40 dB.

Undesired sideband suppression: ≥ 50 dB.

Third-order intermodulation distortion (IMD)
products: Not specified.

CW keyer speed range: Not specified.

CW keying characteristics: Not specified.

Transmit-receive turn-around time (PTT release to
50% audio output): Not specified.

Receive-transmit turn-around time (tx delay): Not specified.

Composite transmitted noise: Not specified.

Bit-error rate (BER), 9600-baud: Not specified.

Size (HWD): 1.5x5.3x6.5 inches; weight, 2.6 pounds.

Note: Unless otherwise noted, all dynamic range measurements are taken at the ARRL Lab standard spacing of 20 kHz.

*Measurement was noise-limited at the value indicated.

Third-order intercept points were determined using S5 reference.

¹Alaska emergency frequency (see Section 97.401[d] of the FCC Rules).

²Sensitivity reduced below 400 kHz.

³IPO off (preamp on).

⁴IPO not available above 70 MHz.

Transmitter Dynamic Range

CW, SSB, FM, typically 5 W high, 0.5 W low; AM, typically
1.5 W carrier high, <0.5 W low.

HF, 50 dB; 50 MHz, 58 dB; 144 MHz, 63 dB; 430 MHz, 55 dB.
Meets FCC requirements for spectral purity.

As specified. >50 dB.

As specified. >60 dB.

See Figures 1 and 2.

4 to 57 WPM.

See Figure 3.

S9 signal, 32 ms.

SSB, 16 ms; FM, 15 ms. Unit is suitable for use on AMTOR.

See Figures 4 and 5.

146 MHz: Receiver: BER at 12-dB SINAD, 1.7×10^{-3} ; BER at
16 dB SINAD, 7.6×10^{-5} ; BER at -50 dBm, $<1.0 \times 10^{-5}$;
transmitter: BER at 12-dB SINAD, 7.7×10^{-4} ; BER at 12-dB
SINAD + 30 dB, $<1.0 \times 10^{-5}$.

440 MHz: Receiver: BER at 12-dB SINAD, 1.3×10^{-3} ; BER at
16 dB SINAD, 7.2×10^{-5} ; BER at -50 dBm, $<1.0 \times 10^{-5}$;
transmitter: BER at 12-dB SINAD, 7.5×10^{-4} ; BER at 12-dB
SINAD + 30 dB, $<1.0 \times 10^{-5}$.

ing performance that is comparable to and even rivals some compact and even a few full-size transceivers out there.

A Low-Power Version of the FT-100?

A lot of first reactions to the FT-817 are along the lines of “Honey, Yaesu shrank the FT-100.” It has a similar, but obviously smaller, look and feel, and, as with your H-T, you might have just a bit more trouble getting your fingers on the controls. Besides, there are fewer controls

to start with, and some have multiple functions to conserve panel space, so learning to use the FT-817 is a bit more like learning your way around a new H-T.

The FT-817 is just a really cool radio for a lot of reasons, but the main one is that Yaesu had packed so much into the little package that it almost boggles the mind. The radio is not perfect, but the pluses outweigh the minuses. We’ll touch on both along the way.

Most prominent on the front panel

(aside from the rubber ducky, if you’ve got it mounted) is the **MAIN** tuning dial. Yaesu included a dimple, ostensibly for finger-spinning the knob. You might be able to spin this knob with the eraser end of a pencil, but given the diminutive size of the knob, any physical advantage is practically nonexistent. You’re better off spinning it by holding your index finger against the outside rubber grip. For fast excursions, you’ll want to use the multi-function **SEL** knob, a detented control that

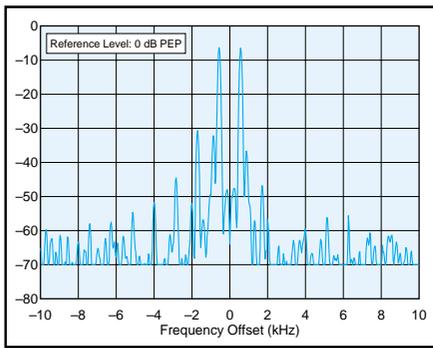


Figure 1—Worst-case HF spectral display of the FT-817 transmitter during two-tone intermodulation distortion (IMD) testing. The worst-case third-order product is approximately 32 dB below PEP output, and the worst-case fifth-order product is down approximately 46 dB. The transceiver was being operated at 5 W PEP output at 18.12 MHz.

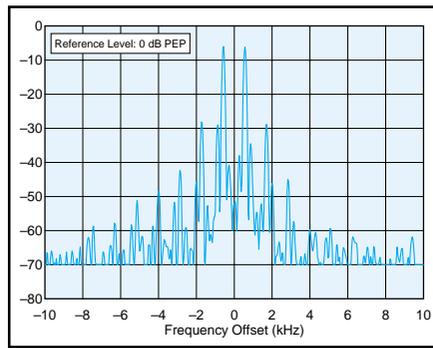


Figure 2—Worst-case VHF/UHF spectral display of the FT-817 transmitter during two-tone intermodulation distortion (IMD) testing. The worst-case third-order product is approximately 30 dB below PEP output, and the worst-case fifth-order product is down approximately 44 dB. The transceiver was being operated at 5 W PEP output at 144.2 MHz.

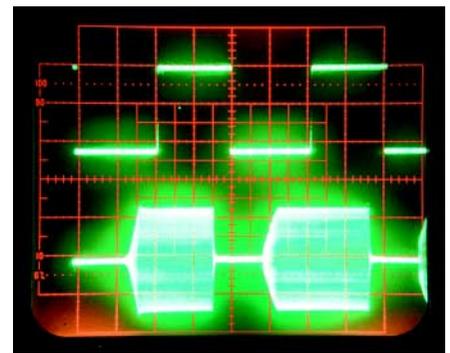


Figure 3—CW keying waveform for the FT-817 showing the first two dits using external keying. Equivalent keying speed is 60 WPM. The upper trace is the actual key closure; the lower trace is the RF envelope. The transceiver was being operated at 5 W output at 14.2 MHz.

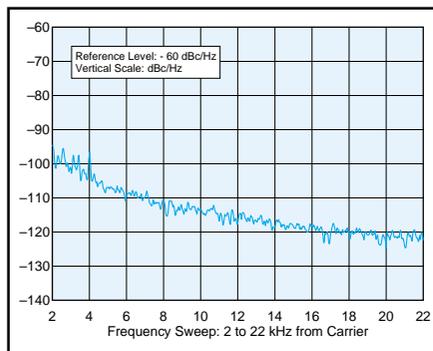


Figure 4—Worst-case HF spectral display of the FT-817 transmitter output during composite-noise testing. Power output is 5 W at 3.52 MHz. The carrier, off the left edge of the plot, is not shown. This plot shows composite noise transmitted 2 to 22 kHz from the carrier.

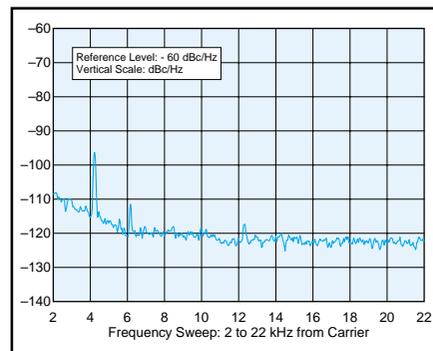


Figure 5—Worst-case VHF/UHF spectral display of the FT-817 transmitter output during composite-noise testing. Power output is 5 W at 432.02 MHz. The carrier, off the left edge of the plot, is not shown. This plot shows composite noise transmitted 2 to 22 kHz from the carrier.

serves for fast tuning (press it in, and you can jump one MHz at a time), as well as for function-key and memory selection and—if that weren't enough—for RIT and for IF shift and a couple of other minor functions. As a result, the **SEL** control can be a bit befuddling. You'll want the *Operating Manual* for this one.

The FT-817's little rectangular display (it's about $1\frac{5}{16} \times 5\frac{5}{8}$ inches) includes a lot of operating information, some of which—unless you've got great vision—might not be visible to the naked eye. H-T users already are familiar with this phenomenon. The important stuff like the frequency, the operating mode and the meter display all is easy-to-see—the default numbers are about $\frac{1}{8}$ -inch tall—but you might have trouble deciphering bottom-tier data, which are about half as large and include such things as whether the CTCSS encoder or decoder is enabled, the repeater shift direction, and the transmitter power level. For the analog-challenged, the FT-817 offers a digital S meter readout—no more guessing about meter peaks!

A function key setting lets you switch the display between small and large (double-size) character modes, at the expense of information at the top of the display, like VFO or memory-channel and mode setting. It's also possible to substitute the current battery voltage for the VFO or memory channel readout.

A menu setting lets you choose between two backlight colors, blue or amber. The amber's great, but the black display characters on the blue background are not as readable. Other menu settings let you set contrast level and whether you want the display illuminated all the time, off entirely, or only for five seconds after each button press in order to save energy.

There are more pushbuttons than knobs on the FT-817 front panel, plus a few more on the top right over the display. The only other ones beside the **MAIN** and **SEL** knobs are the concentric **AF** and **SQL/RF** controls. Again, with this sort of interface, we're squarely in H-T territory. The BNC antenna connector on the lefthand side of the front panel completes the picture.

Of the buttons you'll get to know well, the **F** key and the three **FUNC** keys (**A**, **B**, and **C**) along the bottom of the display window, are the ones you'll use the most. The inclusion of software-defined multifunction keys is a design trend found on more than one amateur transceiver these days. The FT-100 uses it.

Used in conjunction with the **F** button—which is just above and slightly to the left of the **MAIN** tuning knob, the three **FUNC** keys provide access the most important transceiver functions—things like noise blanker, filter selection, VFO selection, memories, receiver preamplifier, VOX, search and scan, and CW keyer. In all, there are a dozen rows of functions, 33 individual items in all. *Lots* of choices! You use the multifunction **SEL** knob to select the various rows of functions.

In theory, this concept works great. In practical terms on the FT-817, it works pretty well most of the time, and you'll need some practice to get good at it. A major stumbling block to smooth operation of the **F/FUNC** keys system includes the fact that the **F** button is recessed just enough to make it a bit dicey for some operators to easily press it momentarily, as required to enable the **FUNC** keys, without pushing the radio off the table or bumping the tuning knob at the same time. Another problem is that once you press a particular **FUNC** key, its label disappears, although it (usually) will continue to enable the particular function you'd selected. It requires another press of the **F** key to return the labels, although some labels return momentarily if you press a **FUNC** key.

Other front-panel buttons let you power the radio on or off, lock the tuning, swap between memory and VFO, enable the RIT (clarifier) and the IF shift and access the bank of **HOME** memory channels. The LED lights green on (unquelched) receive and red when you transmit.

The two **MODE** buttons and **DWN** and

UP BAND buttons are right over the display on the speaker side of the case. These can be easy to mix up at first. One more control, the **SP-PH** switch, is on the side of the radio next to the **SP/PH** jack. This lets you switch between an external speaker or headphones. The *Operating Manual* doesn't say so, but the **SP/PH** jack accepts a 1/8-inch stereo plug, so you can use a set of off-the-shelf headphones. The RJ-45 modular-type **MIC** jack also is on the side panel.

The most prominent feature on the rear panel is the SO-239 antenna jack. By default, the BNC connector on the front is for VHF and UHF, while the SO-239 on the back is for HF and 50 MHz, but these can be reassigned through a menu setting. There are also the key jack, the mini-DIN style **DATA** and **ACC** connectors, a **GND** (ground) screw, and—oops, we almost forgot—the coaxial-style power jack. Yes, you can run the FT-817 from an external power source of up to 13.8 V dc. We'd recommend this if you're planning to do any extended operating.

The supplied MH-31 dynamic microphone almost seems to dwarf the radio it's attached to and adds substantial heft to the total package weight. In addition to the **DWN/FST/JUP** buttons, the mike has a two-position **TONE** switch on the rear side to equalize the audio for differing voices. A DTMF keypad is not provided.

Would You Like Fries With That, Mr Heinz?

In addition to activating the soft-key functions, the **F** key—when you press and hold it—opens the door to up to 57 (get it?) individual menu items that you can configure to personalize your FT-817 to suit your operational preferences.

There's a cornucopia of configurable settings here, ranging from the commonplace (CTCSS tone—50 available, keyer speed setting, mike gain settings, display color and contrast, and VOX gain and delay) to the less-frequented (CW weight, paddle sense, tuning steps on various modes, antenna port selection, packet rates, and time-out time) and the downright esoteric (DCS normal or inverted coding and "extended" menu items that let you set the carrier point for LSB and USB in both transmit and receive—when was the last time a transceiver offered you those choices?).

On the Road or in the Shack

With an internal battery installed, the FT-817 is instant ham radio—just add antenna. Of course, VHF and UHF rubber ducky antennas are provided for local repeater and simplex use, although it's sometimes easy to lose sight of the fact that you need at least a modestly efficient and effective antenna to get results on HF. (As

an aside: the Tokyo Hy-Power H-T included a collapsible loaded whip antenna for HF that actually worked, although you always wondered what laws of physics had been displaced to make it happen.)

At the 5 W setting (or even at 2.5 W, 1 W or 0.5 W—there are four power levels available), you can work a good deal—even DX—and this power level was just fine for VHF and UHF repeater work with the duck antenna.

On a visit to my brother's, I took the FT-817 along. He runs what's often called "vintage" tube-type gear, and I wanted to wow him with something new and small that hears at least as well as his rig but doesn't drift. Just to see what would happen, I plugged the feedline of his multi-band dipole into the SO-239 without benefit of an antenna tuner and fired up the radio on 40-meter SSB using the internal batteries. There was a fair amount of SWR, but even with a couple of watts I soon found myself engaged in QSO with three stations in different states. Audio reports were uniformly favorable. It was literally plug and play! How easy is that?

In terms of operating, the FT-817 has more bells and whistles for CW than it does for SSB or FM. The internal keyer, for example, was a joy, although having to go to the menu to change the speed is less than convenient. You can press and hold the **KEYR** function key to access the speed menu, but you still need to then press and hold the **F** key to save the setting. The speed menu can show WPM or CPM for CW speed. By the way, in another menu window, you can alter the dot-dash ratio if you desire, for heavier or lighter keying. The only thing lacking was a CW memory or two.

While the FT-817 was not designed to be full-break-in (QSK), you can emulate full-break-in performance by setting the CW delay to its lowest value, 10 ms. The tradeoff here is that at a delay setting much below 50 ms, the relay will follow the keying, and you'll then have to listen to the relay clacking away like some railroad telegraph in days of yore.

The CW sidetone volume is adjustable via the menu. Pressing the **HOME** key gives you the proper note to zero beat a station you're listening to—a nice touch. The CW pitch is adjustable between 300 and 1000 Hz.

An absolutely must-have accessory for CW is the optional YF-122C 500-Hz Collins mechanical filter. Many new FT-817 owners (ourselves included) lamented that this filter was not available at the time these radios began showing up on the market. That's because the stock ceramic filter does not offer single-signal reception on CW—you'll hear the note on both sides of zero beat

(the same is true of ICOM's IC-706, by the way). When there's a lot of activity on the band, this renders the radio almost unusable on CW.

The YF-122C is a seven-pole affair that goes in the 455 kHz IF. It's hugely effective. Installation is simple yet tricky. Your instincts might be to install the filter upside-down, but it installs with the pins on the transceiver PC board coming up through what seems to be the wrong side of the connectors on each end of the filter board. A diagram in the manual shows the proper configuration. You must make sure the pins all are straight and even. Then it's just a matter of aligning the pins with the connector holes and pressing down gently but firmly on each end of the filter board. A 2.3 kHz SSB filter, the YF-122S, is also available.

For more demanding operating situations, users will find the **IF SHIFT** control a welcome companion. Enabling it requires tapping the **CLAR** button and using the multifunction **SEL** control. The best approach was to first enable the RIT function—even if you didn't plan to use it right away—then pressing and holding the **CLAR** button for a moment to enable the IF shift function. You can return to the RIT with a quick tap of the **CLAR** button. It sounds more inconvenient than it really is.

Don't try to use the **SEL** knob to adjust the **IF SHIFT** or **RIT** while transmitting. You'll find that control reverts to its coarse frequency setting function while in transmit mode.

We've got three words for you about FM operation: Push to talk. The FT-817 lets you set the FM mike gain (essentially the deviation) separately. And before you ask, yes, you can enable VOX (talk to talk?) for use on FM—something that might come in handy if you're using a headset with a boom mike.

For repeater operation, pressing the **RPT** function key sets up the shift; it also can be set independently for each band. When you have the RPT function key menu up, you also have access to the **REV** and **TON** keys.

I got great audio reports on FM too, although even at 2.5 W, the alkalines I'd loaded up didn't hold up very long during an afternoon on the local weather-spotter net during a snowstorm. One second I was transmitting, the next I was looking at a dark display and a silent radio, which had shut itself down without warning while I was in mid-transmission.

The FT-817 includes the ability to search for the CTCSS tone or DCS code being used by a repeater or another station, provided the other station or repeater "pass" the information. After pressing the **TCH** function key to activate the encoder/decoder, the unit will start scanning for incoming tones. When it detects the tone,

it will let audio pass. Pressing and holding the **TCH** key will store the detected tone as the current tone.

The **DATA** jack on the rear panel allows access to the connection points necessary to configure digital modes, such as RTTY or PSK31—an ideal mode for a radio at this power level—or packet. You can use the 500-Hz filter for RTTY or PSK31, by the way, and there are separate mode settings for packet digital work.

What's Cool!

Users like the fact that this was a very capable FT-100-like radio that you could hold in your hand and power off AA cells. "It puts the fun back into ham radio," one new owner enthused. "It's very well-made, rugged, has a good feel and nice features—it feels like a *real* radio, in other words" (well it *is*, of course).

Users found the receiver's solid (but unspectacular) performance another plus. Consider that, with the optional CW filter installed, the two-tone third-order IMD dynamic range is in the mid to upper 80s, and sensitivity more than adequate, especially with the preamp enabled (see Table 1). This is right in the ballpark with larger compact transceivers on the market such as the big brother FT-100 or the competing IC-706 and TS-50.

Users enjoyed the fact that they could dial up some music or news on the FM or AM band when not operating. Even the teeny built-in speaker turned out acceptable audio in those modes—at least as good as the typical portable radio.

You can send CW (although not very fast and only with practice) using the microphone **DWN/UP** buttons. One user said the implementation on the FT-817 was less usable than on the ICOM IC-706, the first radio we'd encountered that incorporated this quirky feature. The **DWN/UP** buttons are recessed and on the front of the mike, and actuating them takes some doing, but this feature might come in handy should you forget to pack a key.

Yaesu has provided the option of being able to control the FT-817 via a PC, using the CT-62 accessory cable, which contains a built-in level converter so it can be directly connected from the transceiver to the serial port on your computer. The manual contains the **CAT** system data protocol and commands. (As an aside, the FT-817 offers a "clone" function so that you can copy the memory contents from one '817 to another via a cable.)

Users also appreciated the fact that the *Operating Manual* was well-written and comprehensive—a Yaesu hallmark in our experience.

Perhaps best of all, users considered the FT-817 a great value, a marriage of the best the small HF or top-end QRP

transceivers have to offer with the features of the most capable VHF/UHF FM hand-helds in an all-mode package.

What's Not

Users found the plastic battery cover especially difficult to remove. The spring catch is tight, and there's no spring to "pop" the cover up. You have to either have good fingernails or use a knife blade or screwdriver to pry it up—or turn the radio over and risk dropping batteries on the floor or ground. Some users griped that the battery holder springs lose their tension.

Several users commented on the noisy relay in CW, which can get downright annoying to some ops when in the almost-but-not-quite-full-break-in mode. One user we know described it as sounding like "a threshing machine."

The cast-aluminum "base" (actually the rear apron) is rather unstable when the radio is set down on its "bottom"—as you'd likely do while using the included carry strap.

The rubber ducky antennas come in three pieces, and some felt these might be easy to lose. You can store these in the strap handle, but the small tip piece is especially vulnerable to ending up in the lost and found.

Some users wanted the ability to easily unsnap the carry strap, which can get in the way once you set the radio down to operate, in which case they also missed a bail to boost the radio up toward the user while on a flat surface. (The shoulder strap is readily adjustable, however.)

The internal batteries will not power the radio very long. On receive, the radio draws 370 mA, according to the ARRL Lab (see Table 1).

Speaking of power, some users faulted Yaesu for not including a somewhat heavier-duty external power cable, although the one provided certainly is up to the task and doesn't add much to the total weight of the package. The manual specifically warns of the dire consequences of reversing the polarity—but there are no fuses in the power cord, and no recommendations in the manual to add them. If you have any doubts as to your abilities to keep these connections straight, fuse the cables!

Recently-shipped '817s include a snap-on ferrite choke for the power cord. Some early users had reported problems while connected to an external power source and transmitting on UHF with the rubber duck antenna. Earlier purchasers can contact Yaesu to make arrangements to get the choke.

Other minor whining: There's "audio" noise while it's squelched (FM mode), and turning down the volume control all the way does not totally kill the audio.

Frills

As noted, the FT-817 includes a *Spectrum Scope Monitor* that lets you "view" activity on what Yaesu calls "five channels" above and below the current operating frequency when in the VFO mode. What "five channels" translates to in terms of actual frequency range is not clear, but when tuned to 7.020 MHz, the radio still spotted a signal transmitted at 7.000 MHz. The height of the vertical bars displayed represents the relative signal strength of these adjacent-frequency signals. There are two modes—one sweeps repeatedly until the feature is turned off, the other sweeps one cycle every 10 seconds. In either mode, the receiver's audio is muted while it's sweeping, and the S meter is disabled.

Unlike similar implementations in other radios, the Spectrum Scope Monitor does not include a tunable pointer or cursor that lets you jump to a particular swept "signal" marker.

This potentially handy—and totally unexpected—feature is great to check for other nearby signals—say while waiting for a VHF or UHF band to open up during a contest—but its usefulness is limited by the inability to readily identify just where a spotted signal is, so you can tune to it.

Never at a Loss

Although it's a low-power radio, the FT-817 offers features galore—including some that most ops will never use—and we never felt the need for more power (there's a solution if you ever do—buy an FT-100). With a decent antenna on HF, the radio's 5 W more than held its own, and it was a comfort to know that the receiver would come through under all but the most demanding situations (don't try sidling up to one of the big guns in a contest with any radio like this).

It's a delightful transceiver package to take on the road or just enjoy closer to home, such as in the car, on the patio or while sitting on the river bank waiting for the big ones to start biting.

Thanks to Yaesu for ratcheting up Amateur Radio portability a few more notches and for showing us that less sometimes really can be more. This little radio will put smiles on a lot of faces. As one user so aptly put it: "The FT-817 puts the fun back into ham radio!"

Manufacturer: Yaesu USA, 17210 Edwards Rd, Cerritos, CA 90703; 562-404-2700; fax 562-404-1210; www.yaesu.com.

Manufacturer's suggested retail price: \$950. Typical current street price: \$750. List prices of selected optional accessories: YF-122S 2.3 kHz SSB filter, \$173; YF-122C 500 Hz CW filter, \$173; TCXO-9 High Stability Reference Oscillator, \$99; FNB-72 NiCd battery pack, \$60; NC-72B NiCd battery charger, \$18.

MFJ-616 Speech Intelligibility Enhancer

Reviewed by Steve Ford, WB8IMY
QST Managing Editor

This is a tale of misspent youth. I spent the later half of the '70s finishing up college and running the soundboard for an unbelievably thunderous rock 'n roll band. Night after night I stood before a wall of Marshall amplifiers that generated enough acoustic energy to rattle the fillings in my teeth. After graduation, I spent a number of years as a rock radio DJ—and I loved setting my studio monitors to the threshold of pain. It was an exciting life, but there was an inevitable price to pay: my hearing.

No, I'm not deaf—at least not yet. But I have difficulty distinguishing individual voices in noisy environments. At age 46 I can't bear the thought of hearing aids, so I assemble the sentence fragments as best I can and hope that I understand the essence of what the person is saying. If all else fails, I smile and nod my head, not always quite certain what I am agreeing to.

Hamfests are particularly brutal environments for people like me, but a crowded HF phone band can be every bit as torturous. Whether you're listening to a speaker or headphones, your radio is dumping a firehose stream of audio with a bandwidth ranging from about 300 to 2500 Hz, depending on how you've configured your transceiver. The actual speech energy, however, is not constant throughout that passband; it tends to concentrate in particular frequency ranges (see the sidebar, "Speech Intelligibility and Frequency"). The rest is extraneous audio that interferes with your ability to understand what is being said.

DSP filtering will eliminate the annoying carrier whistles and clean up certain types of noise, but it does nothing to restrict or enhance specific audio frequency bands. (Worse still, DSP can often add an aliasing effect that gives speech a wispy, otherworldly sound.)

Enter the MFJ-616

What hearing-impaired amateurs need is a way to tailor the audio outputs of their receivers to match the response characteristics of their own hearing. The most efficient way to do this (as any home audio buff will tell you) is with an *equalizer*. An audio equalizer allows you to filter the audio signal in specific frequency groups to create an output that is best suited to your listening environment.

The MFJ-616 Speech Intelligibility Enhancer is essentially an audio equalizer designed for amateur use. It allows



you to enhance or attenuate audio signals in four frequency ranges: 300, 600, 1200 and 2400 Hz, with an overall range of 100-5000 Hz. By adjusting the response in each band, you end up with a composite audio signal that matches the response of your hearing.

The MFJ-616 is packaged in a black enclosure measuring $2\frac{1}{2} \times 10 \times 6$ inches. On the front panel there are six rotary potentiometer controls for **VOLUME**, **BALANCE**, **300 Hz**, **600 Hz**, **1200 Hz** and **2400 Hz**. You also find a pushbutton **BYPASS** switch (to compare the effect of the '616 to the actual audio output of your radio), an **INPUT A/B** switch (to select either of two audio inputs), a **SPEAKER ON/OFF** button and a **POWER ON/OFF** button. A $\frac{1}{4}$ -inch stereo headphone jack is available as well.

On the rear panel, the MFJ-616 is equipped with a coaxial dc power socket (it requires 12 V dc at 1.5 A), **LEFT**, **RIGHT** and **STEREO** speaker outputs ($\frac{1}{8}$ -inch jacks) and the **A** and **B** inputs (RCA phono jacks).

Inside the MFJ-616, the circuit design is straightforward. Unless you've opted to hit the **BYPASS** button, the audio from input **A** or **B** is fed to the **VOLUME** pot, then to the input of one section of a TL084 quad JFET-input general-purpose operational amplifier chip. After this initial boost, the audio goes to another TL084, this one using all four channels to provide four octaves of adjustable audio conditioning. The signal is recombined at yet another TL084 section functioning as a summing amp. At the output of this amplifier, a bridge-type **BALANCE** control splits the audio and sets a drive ratio for the output preamplifiers (yes, more TL084 sections). Two TDA1013B monolithic amplifiers handle the output chores. These chips are rated at 4 W output, but the MFJ-616 design runs them at a more conservative 3-W level.

Setting up the MFJ-616

Installing the MFJ-616 Speech Intelligibility Enhancer is a snap. The most

elegant approach is to take audio from the auxiliary (accessory) jack of your transceiver, where it is usually available at a fixed level, and route it to either the **A** or **B** input. (The MFJ-616 has two inputs for those of us who own two radios.) My ICOM IC-706's line-level output was more than adequate to drive the unit. Alternatively, you can tap the audio at your radio's headphone or external speaker jack, but take care not to overdrive the input of the '616.

For the output of the MFJ-616, you have your choice of speakers or headphones. When I began hooking everything up, I wondered why the output was provided in stereo, even though the inputs were monaural. A split-second later, I understood. If you are listening to speakers, the room you are in will have its own acoustic damping or enhancing characteristics that can be balanced (as far as your ears are concerned) by adjusting the output of the individual speakers. And if your ears are unevenly matched in sensitivity, the ability to balance the channels when using headphones is a big help.

On the Air with the MFJ-616

My first experience with the MFJ-616 was on the 75-meter phone band. It was the best band I could think of for an endurance test. If you frequent 75 meters at night, you know it is a jumble of signals—some made by man and others contributed by Mother Nature. The result is a disconcerting audio stew.

After setting up two speakers (we purchased the MFJ-72 All-in-One accessory pack, which includes a pair speakers, a set of headphones and a power supply—see Figure 6), I switched in the '616, turned up the **VOLUME** to a comfortable level, and tweaked the **BALANCE** until the audio appeared to be centered directly in front of me. All of the equalizer's frequency controls were set to the neutral (12 o'clock) position.

Now the fun began. I tuned in a net and listened for a few minutes with the

BYPASS activated. I could understand everything that was being said, but I had to listen carefully. After placing the **BY-PASS** in the **OFF** position, I began to adjust the four frequency knobs.

I expected a subtle effect at best, but I was astonished. Rolling off the low-end of the frequency range did wonders for me. Ditto for cranking in some attenuation in the 600-Hz passband. I left the 1200-Hz control at neutral, but added some enhancement at the high end with the 2400-Hz pot. The result was remarkably clean, understandable speech without hissing, ringing or other strange effects. After listening for a while, I began to forget what my radio really sounded like. A quick jab at the **BYPASS** button reminded me in the worst way!

Slipping on the headphones, I did a little more fine-tuning. For SSB I found that I achieved the best fidelity with the 300-Hz control fully counterclockwise (12 dB attenuation), the 600-Hz control at 9 o'clock, the 1200-Hz control at 11 o'clock and the 2400-Hz control at 1 o'clock. Of course, I'd find myself having to tweak a bit here and there, depending on the nature of the transmitted audio, as well as the person who was speaking.

Paul Pagel, N1FB, also spent some time twisting the knobs on the '616. Here's his impressions:

"Following tests some years ago, I learned that I've got built-in 4-kHz-wide audio filters. I've lost most of my aural high-frequency response (I used to be able to hear the squeal of TV horizontal oscillators). Now, chirping birds are more difficult to hear and my wife better understands that I'm not ignoring her. Although I can hear her, I don't always understand her!

"I readily accepted an invitation to give the MFJ-616 a try—not knowing what to expect. A glance at the control labels intuitively told me what each control would do, and brief experimentation verified that. A short spell listening to SSB signals with and without the '616 found me twiddling the controls to enhance the mid-range frequencies, dropping off some of the low and most of the high frequencies. Even with my high-frequency hearing loss, enough high-pitched noise typically gets through to be irritatingly distracting. Using the device to tailor the audio to my liking made listening more comfortable and enjoyable."

It's worth noting that the MFJ-616 also markedly improved the intelligibility of AM audio—especially shortwave broadcast audio. If you venture outside the amateur bands, you know that some shortwave broadcasters have less than sparkling fidelity. I found that the



Figure 6—Accessories that are available for the MFJ-616 include the MFJ-1316 12 V 1.5 A dc wall transformer power supply, the MFJ-281 speaker and the MFJ-392 communications headphones. An accessory pack (MFJ-72) containing the headphones, the power supply and two speakers is also offered.

Speech Intelligibility and Frequency

The MFJ-616 manual includes some interesting results of research on speech intelligibility.

- The frequencies important for speech intelligibility range from 500 to 4000 Hz. The consonant sounds that fall in this range contribute 83% of word intelligibility.
- Frequencies from 500 to 1000 Hz contribute 35% of word intelligibility and 35% of sound energy.
- Frequencies from 1000 to 4000 Hz contribute 48% of intelligibility, but only 4% of the total sound energy.
- Frequencies from 125 to 500 Hz contribute 55% of the sound energy, but only 4% to word intelligibility.

In other words, nearly half the speech intelligibility is contained in the 1000 to 4000 Hz frequency range with only 4% of the speech sound energy. On the other hand, the low-end frequencies have most of the speech energy, but contribute *very little* to intelligibility. The idea of using the MFJ-616 is to maximize the frequencies that contribute the most to intelligibility, while minimizing those that do not.

MFJ-616 often made a dramatic improvement in my ability to listen to these stations and clearly understand what was being discussed.

Conclusion

The MFJ-616 Speech Intelligibility Enhancer is designed in recognition of the fact that many of us need effective assistance to counterbalance our hearing disabilities, whether due to aging, illness, injury... or mistakes in our youth. Even those without hearing deficiencies, however, will enjoy the ability to tailor their receive audio. The benefits of the MFJ-616 are so profound, and yet the design is so clear-cut, it almost makes you kick yourself for not thinking of it first!

Manufacturer's suggested retail price: MFJ-616 Speech Intelligibility Enhancer, \$169.95. MFJ-72 All-In-One Accessory Pack (including two MFJ-281 speakers, a set of MFJ-392 Communications Headphones and the MFJ-1316 12 V dc power supply): \$58.80. These items are also sold separately.

Manufacturer: MFJ Enterprises, 300 Industrial Park Rd, Starkville, MS 39759; tel 662-323-5869; fax 662-323-6551; www.mfjenterprises.com. 

NEW PRODUCTS

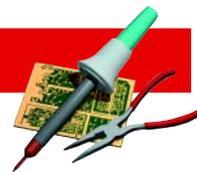
SELF CONTAINED DTMF KEYPAD

◇ Intuitive Circuits, makers of the DTMF 8 decoder, have recently announced the DTMF-ENC15, a self-contained dual tone multiple-frequency encoder board.

The 2⁹/₁₆ × 2¹³/₁₆ × 1³/₈ board has a full size 16-button keypad and can be powered by a 9 V battery or through a 2.1 mm dc input jack. Audio output is provided through a standard phono-type plug.

The DTMF-ENC15 is just the ticket for adding DTMF capabilities for autopatch, repeater control and remote control to radios that lack built-in keypads.

Price: \$89. For additional information contact Intuitive Circuits LLC, 2275 Brinston Ave, Troy, MI 48083; tel 248-524-1918; fax 248-524-3808; sales@icircuits.com; www.icircuits.com. 



2001 Super Frequency List CD-ROM

With so many HF transceivers sporting general-coverage receivers these days, hams often find themselves venturing outside their usual haunts to listen to what the rest of the radio world is doing. There is a lot going on below 30 MHz—including hundreds of utility stations of various types and nearly as many domestic and international broadcast outlets. You can tune the bands and find some interesting “catches” by chance, or you can improve your odds substantially by using a frequency guide.

Klingenfuss Publications produces separate annual shortwave and utility station guides in the form of thick books available from the ARRL and other sources. But if you prefer your information in electronic form, Klingenfuss combines both lists on a single CD-ROM for Windows—the *2001 Super Frequency List*.

Set Up and Use

The *2001 Super Frequency List* CD-ROM contains 10,200 domestic and international broadcast frequencies, 10,900 utility station frequencies and 17,900 “formerly active frequencies.”

You can run the lists directly from the CD. Using the **RUN** selection under the *Windows* Start menu, you can select either the English or German language opening menus. From there you can access the broadcast, utility or formerly used frequency databases.

Once you select your database, you can sort the entries by frequency, call sign, country, language, time or (in the case of the utility stations) modulation type. This feature is convenient when you want to page through the list in a particular order (sorting and listing by frequency is particularly handy).

I found the “word search” function to be the most useful.



The *Super Frequency List* opening menu.

Rather than just re-sorting the entire list in a particular order, word search creates a new list consisting of only the target information specified in your search. For example, let’s say that you want a list of all station broadcasts in Esperanto. (I actually attempted to learn Esperanto once. It’s a tragic story.) You enter the language code from the drop-down list (“ep” for Esperanto), click on the **OK** button and within milliseconds you are presented with a list of all known times and frequencies of all Esperanto broadcasts. In case you’re curious, the *2001 Super Frequency List* turned up 27 entries in my search; Radio China International seems especially fond of Esperanto—go figure.

A Comprehensive Tool

The *2001 Super Frequency List* is an excellent timesaving tool to have on hand whenever you want to cruise the airwaves. The information is highly accurate—even for some of the more obscure utility and broadcast outlets. You’ll find signals you never knew existed and recapture the pleasure of listening to the voices of other nations and cultures.

The CD-ROM runs from just about any Windows-equipped PC. It ran as easily on my old 133-MHz Pentium laptop as it did on my 933 MHz desktop machine. For the desktop I loaded the entire CD-ROM onto my hard drive—all 567 Mbytes of it. By doing so, I could run the *Super Frequency List* without having the CD-ROM in the drive. My only nit to pick with the *Super Frequency List* on CD-ROM is that it does not allow you to print any portions of the lists, even the limited results of a word search. Unless you have a computer within easy reach, you’ll have to jot the results down on paper or do a copy-and-paste to *Notepad* before you head for your receiver.

Manufacturer: Klingenfuss Publications, Hagenloher Str 14, D-72020 Tuebingen, Germany; tel 49-7071-62830; www.klingenfuss.org. The 2001 Super Frequency List CD-ROM is available from the ARRL for \$24.95, shipping additional. Call 860-594-0355, or shop on line at www.arrl.org/shop/. QST

Freq.	Station	TxSite	Chy.	Language	Target	Time	Remarks
2310.0	Northern Territory SW Alice Springs	AUS	En	Ve	dom	08:30-21:30	MLBA
2325.0	Northern Territory SW Tennant Creek	AUS	En	Ve	dom	08:30-21:30	VLST
2340.0	Fujian People's BC Shifou	CHN	Mn		dom	21:55-16:00	news station
2350.0	Korean Central B. Stat Serwon	KRE	Kr		dom	20:00-18:00	
2360.0	R. Maya de Berillas Huehuetenango	GTM	Sp	Ve	dom	10:30-14:00	
2360.0	R. Maya de Berillas Huehuetenango	GTM	Sp	Ve	dom	22:30-03:30	
2390.0	Worldwide Christian RN Nashville	USA	En	Ne	La	04:00-12:00	until 28 Feb
2390.0	Worldwide Christian RN Nashville	USA	En	Ne	La	05:00-12:00	from 1 March
2390.0	R. Hueyacocotla Hueyacocotla	MEX	Sp		dom	12:00-16:00	
2390.0	La Voz de Atitlán Santiago Atitlán	GTM	Sp	Ve	dom	18:00-00:00	Sun
2390.0	R. Hueyacocotla Hueyacocotla	MEX	Sp		dom	21:00-03:00	
2390.0	La Voz de Atitlán Santiago Atitlán	GTM	Sp		dom	22:00-01:15	Mon to Sat
2410.0	R. Enga Webeg	PNG	Pi	En	dom	07:00-12:00	
2415.0	Wenzhou People's B Wenzhou (Zhejiang) CHN	CHN	Mn		dom	02:20-04:50	

The broadcast list sorted by frequency.

Freq.	Station	TxSite	Chy.	Language	Target	Time	Remarks
4005.0	Radio Vaticana	Vatican City	VAT	Ep	Eu	20:20-20:30	Sun, Holy Da
4960.0	China Radio Internacional		CHN	Ep	Eu	20:00-20:30	
5883.0	Radio Vaticana	Santa Maria de GoTA	ITA	Ep	Eu	20:20-20:30	Sun, Holy Da
5945.0	Radio Austria International	Moosbrunn	AUT	Ep	Eu	21:30-22:00	Fri + Sun
5955.0	Radiotelevisione Italiana	Prato Smeraldo	ITA	Ep	Eu	20:20-20:20	Saturday
6155.0	Radio Austria International	Moosbrunn	AUT	Ep	Eu	21:30-22:00	Fri + Sun
6950.0	China Radio Internacional		CHN	Ep	La	22:30-23:00	
7130.0	Radio Polonia	Warsaw	POL	Ep	Eu	19:00-19:25	
7170.0	China Radio Internacional		CHN	Ep	As	11:00-11:30	
7250.0	Radio Vaticana	Santa Maria de GoTA	ITA	Ep	Eu	20:20-20:30	Wed, Thu
7275.0	Radio Polonia	Warsaw	POL	Ep	Eu	14:30-14:55	
7285.0	Radio Polonia	Warsaw	POL	Ep	Eu	14:30-14:55	
7290.0	Radiotelevisione Italiana	Prato Smeraldo	ITA	Ep	Eu	20:00-20:20	Saturday
7405.0	China Radio Internacional		CHN	Ep	Eu	20:00-20:30	
9575.0	China Radio Internacional		CHN	Ep	As	11:00-11:30	
9645.0	Radio Vaticana	Santa Maria de GoTA	ITA	Ep	Eu	20:20-20:30	Wed Thu
9820.0	Radio Habana Cuba	La Julia	CUB	Ep	Na	07:00-07:30	Sunday
9860.0	China Radio Internacional		CHN	Ep	La	22:30-23:00	
9900.0	China Radio Internacional	Urumqi	CHN	Ep	Eu	20:00-20:30	
9995.0	China Radio Internacional		CHN	Ep	Eu	20:00-20:30	

The word search function allows you to generate lists sorted by specific criteria. In this instance, I asked for a list of all Esperanto broadcasts, sorted by frequency.

