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Product Review

Yaesu FT-710 AESS MF/HF and 6-Meter Transceiver

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The FT-710 is Yaesu's newest and least expensive software-defined radio (SDR) transceiver. Unlike the higher-priced FT**DX**10 and FT**DX**101D/MP, it's a direct-sampling SDR rather than a hybrid design with roofing filters. The FT-710 covers 160 through 6 meters, with a 100 W transmitter, excellent receiver performance, and a wide range of useful features including a high-resolution, 4.3-inch TFT color touchscreen.

The shipping box includes the FT-710, an SP-40 external speaker and hardware to mount the speaker to the side of the radio, a dc power cable, an SSM-75E hand microphone, a spare fuse, and a printed operation manual. The Acoustic Enhanced Speaker System (AESS) and SP-40 speaker offer surprisingly good-sounding audio from a small package. The radio requires a 13.8 V dc power source at about 20 A. See Table 1 for more details.

Initial Setup

As with all modern radios, it's a good idea to check the firmware version in your new FT-710 and see if a later version is available from Yaesu's website. An SD memory card slot on the left side of the FT-710 is used for firmware updates, storing received audio files and transmitted voice messages, saving radio settings and memory contents, and saving screen captures from the display. You'll need to provide an SD card, and the card must be formatted in the radio before use.

Although the FT-710 is highly customizable through menu settings, the default settings are fine for getting started on the air right away. Menu labels are self-explanatory, but the well-illustrated manual goes into quite a bit of detail about the various settings and choices.

The rear panel connections include an SO-239 antenna jack and four-pin power jack (see Figure 1). The FT-710 can be programmed to automatically tune an

accessory like the ATAS-120A multi-band auto-tuning mobile antenna when connected to the SO-239 antenna jack. The **EXT SPKR** jack is for the SP-40 external speaker. The **KEY** connector works with the internal CW keyer or with an external keyer (menu selectable). This jack requires a stereo 3.5-millimeter plug, with the tip used for external keying devices. The 3.5-millimeter **REM/ALC** jack can be used with the optional FH-2 remote keypad or for automatic level control (ALC) connection with an external power amplifier.

The eight-pin mini-DIN **TUNER/LINEAR** jack has several menu-selectable functions. It can be used with Yaesu's optional FC-40 automatic antenna tuner, for transmit-receive (TR) switching with an external linear amplifier, or as an additional computer-aided transceiver terminal. Band data for controlling external filters, antenna switches, or other devices is available at this jack as well.

Amplifier switching is relay-based, and quiet clicking is audible when this function is selected for the **TUNER/LINEAR** jack. The **QSK DELAY** menu sets the time be-

Bottom Line

Although it's Yaesu's least expensive SDR, the FT-710 AESS offers features and performance rivaling more expensive radios. With 160- to 6-meter all-mode coverage, it could be the centerpiece of many home or portable stations.
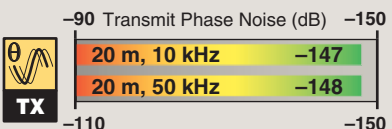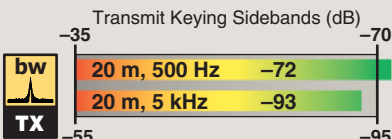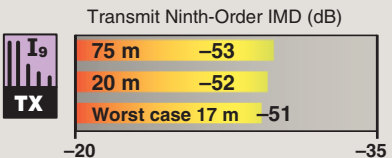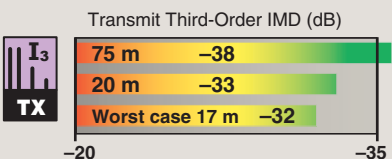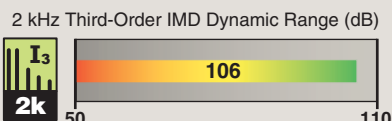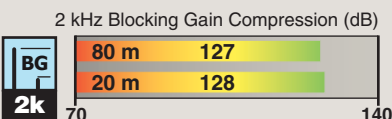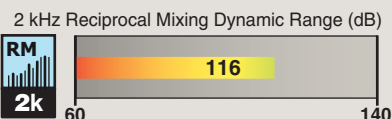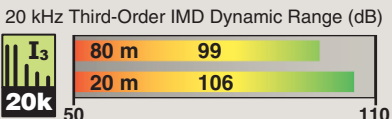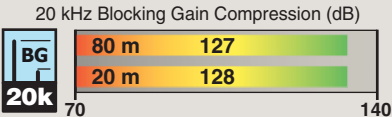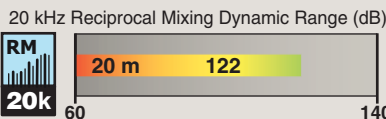
Table 1
Yaesu FT-710 AESS, serial number 2K030972, SP-40 External Speaker, serial number 2K003
Main Firmware – V01-09, Display – V01-07, SDR – V01-04

Manufacturer's Specifications

Frequency coverage: Receive, 0.030 – 75 MHz; transmit, 1.8 – 54 MHz (amateur bands only).

Power requirements: 13.8 V ±15%; receive, 1.8 A with no signal, 2.2 A with signal present; transmit, 21 A at 100 W RF output.

Modes of operation: SSB, CW, AM, FM, FM-N (FM narrow).

Receiver

SSB/CW sensitivity, 10 dB (S+N)/N, 2.4 kHz filter, preamp 2 on: 0.16 µV (1.8 – 30 MHz); 0.125 µV (50 – 54 MHz).

Measured in the ARRL Lab

Receive and transmit, as specified. Five CW and five SSB memory channels programmed for 60-meter operation.

At 13.8 V dc: receive, max. brightness, max. volume, no signal, 1.4 A; transmit, 18.2 A (typical) at 100 W RF output; 6.0 A at 5 W output. No change in RF output at minimum specified supply voltage.

As specified.

Receiver Dynamic Testing

Noise floor (MDS), 500 Hz bandwidth:

Preamp	Off dBm/µV	P1 dBm/µV	P2 dBm/µV
0.137 MHz	−85/12.0	−95/3.8	−94/4.4
0.475 MHz	−108/0.90	−117/0.30	−125/0.13
1.0 MHz	−112/0.57	−121/0.19	−129/0.08
3.5 MHz	−126/0.11	−135/0.04	−141/0.02
14 MHz	−127/0.10	−136/0.04	−142/0.02
50 MHz	−129/0.08	−139/0.02	−142/0.02
70 MHz	−125/0.13	−135/0.04	−138/0.03

Noise figure: Not specified.

Preamp off/1/2: 14 MHz, 20/11/5 dB; 50 MHz; 18/8/5 dB.

AM sensitivity: 6 kHz BW, 10 dB (S+N/N), 30% modulation, 400 Hz tone: 6.3 µV (0.5 – 1.8 MHz, preamp off); 2 µV (1.8 – 30 MHz, preamp 2 on); 1 µV (50 – 54 MHz, preamp 2 on).

10 dB (S+N)/N, 1-kHz tone, 30% modulation, 6 kHz BW:

Preamp	Off dBm/µV	P1 dBm/µV	P2 dBm/µV
1.02 MHz	−81/19.7	−91/6.5	−99/2.6
3.88 MHz	−95/4.0	−104/1.4	−111/0.64
50.4 MHz	−98/2.7	−108/0.88	−110/0.68
70 MHz	−95/4.1	−105/1.3	−108/0.92

FM sensitivity: 12 dB SINAD, 12 kHz BW, 3.5 kHz deviation, preamp 2 on: 0.25 µV (28 – 30 MHz); 0.20 µV (50 – 54 MHz).

For 12 dB SINAD, 3 kHz deviation, 12 kHz BW:

Preamp	Off dBm/µV	P1 dBm/µV	P2 dBm/µV
29 MHz	−105/1.20	−115/0.42	−121/0.20
52 MHz	−108/0.90	−118/0.29	−120/0.22
70 MHz	−105/1.33	−114/0.43	−117/0.31

Spectral display sensitivity: Not specified.

Preamp off/P1/P2 (default sensitivity): waterfall, −106/−113/−125 dBm; 3DSS, −108/−117/−128 dBm.

Blocking gain compression dynamic range: Not specified.

Blocking gain compression dynamic range, 500 Hz BW:*

Preamp	20 kHz offset Off/P1/P2	5/2 kHz offset Preamp off
3.5 MHz	127/127/122	127/127 dB
14 MHz	128/128/122	128/128 dB
50 MHz	125/126/117	125/125 dB

Reciprocal mixing dynamic range: Not specified.

3.5 MHz, 20/5/2 kHz offset: (preamp off) 118/114/113 dB; 14 MHz, 20/5/2 kHz offset: (preamp off) 120/117/116 dB; 50 MHz, 20/5/2 kHz offset: (preamp off) 118/115/111 dB.

Two-Tone Intermodulation Distortion (IMD) Testing (500 Hz bandwidth)

Band/Preamp	Spacing	Measured IMD Level	Measured Input Level	IMD DR
3.5 MHz/Off	20 kHz	−126 dBm	−27 dBm	99 dB
14 MHz/Off	20 kHz	−127 dBm	−21 dBm	106 dB
14 MHz/P1	20 kHz	−136 dBm	−29 dBm	107 dB
14 MHz/P2	20 kHz	−142 dBm	−37 dBm	105 dB
14 MHz/Off	5 kHz	−127 dBm	−21 dBm	106 dB
14 MHz/Off	2 kHz	−127 dBm	−21 dBm	106 dB
50 MHz/Off	20 kHz	−129 dBm	−29 dBm	100 dB
50 MHz/P2	20 kHZ	−142 dBm	−45 dBm	97 dB

Manufacturer's Specifications
Receiver

FM adjacent channel rejection: Not specified.

FM two-tone third-order IMD dynamic range: Not specified.

DSP noise reduction: Not specified.

Notch filter depth: Not specified.

S-meter sensitivity: Not specified.

Squelch sensitivity: Not specified.

Receive bandwidth: Not specified.

Audio output: 2.5 W into 4 Ω at 10% THD.

Receive processing delay time: SSB mode. Not specified.

Measured in the ARRL Lab
Receiver Dynamic Testing

P1 on: 29 MHz, 89 dB*; 52 MHz, 85 dB.*

20 kHz offset, P1 on 29 MHz, 85 dB; 52 MHz, 85 dB; 10 MHz offset, P1 on 29 MHz, 105 dB.

Best case: DNR level 3: 11.5 dB @ S-7 input.

Adjustable manual notch, 0.2 to >70 dB.

S-9 signal, preamp off/P1/P2: 14 MHz, 86.0/29.8/8.31 μV; 50 MHz, 87.0/28.5/8.12 μV.

At threshold, FM, P1 on 29 MHz, 0.25 μV; 52 MHz, 0.19 μV; 14 MHz SSB, P1 on 5.88 μV.

Range at –6 dB points:† CW (500 Hz BW), 448 – 949 Hz; SSB (3 kHz BW), 108 – 2894 Hz; AM (4 kHz BW), 73 – 4136 Hz.

As specified. THD 0.20% at 1 V_{RMS}.

25 ms.

Transmitter

Power output: 5 to 100 W (AM, 5 to 25 W).

Spurious-signal and harmonic suppression: ≥50 dB (HF); ≥63 dB (50 MHz).

Third-order IMD products: Not specified.

CW keyer speed range: Not specified.

CW keying characteristics: Not specified.

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

Receive-transmit turnaround time (TX delay): Not specified.

Transmit phase noise: Not specified.

Amplifier key line closure to RF output: Not specified.

Transmitter Dynamic Testing

As specified.

HF, >70 dB typical; worst case, 62 dB (30 m); 50 MHz, 73 dB. Complies with FCC emission standards.

3rd/5th/7th/9th order, 100 W PEP: 3.5 MHz (–38/–38/–44/–53 dB); 14 MHz (–33/–37/–42/–52 dB); 50 MHz (–32/–41/–48/–54 dB); worst case, 17 m (–32/–36/–41/–51 dB); at 50 W PEP RF output: 14 MHz (–34/–40/–51/–52 dB); 50 MHz (–40/–43/–55/–55 dB).

4 to 60 WPM, iambic mode A, B, Y, semiautomatic (bug).

See Figures A and B.

S-9 signal, AGC fast, SSB: 33 ms; AGC fast, CW, full break-in: 64 ms.

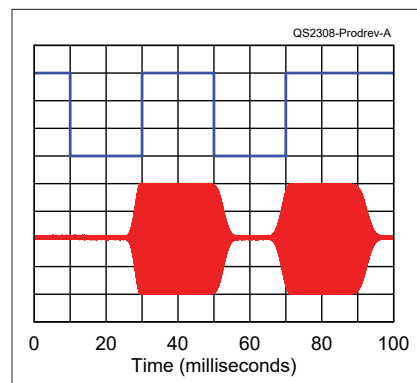SSB, 21 ms; FM, 21 ms (29 MHz), 20 ms (52 MHz).

See Figure C.

15 ms.

Size (height, width, depth, including protrusions): 3.1 × 9.4 × 9.7 inches.

Weight: 9.92 pounds.

"Preamp off" measurements are with the Intercept Point Optimization (IPO) setting.
*Measurement was noise limited at values indicated.
†Default values; bandwidth is adjustable via DSP.

Figure A — CW keying waveform for the Yaesu FT-710 showing the first two dits using external keying. Equivalent keying speed is 60 WPM. The upper trace is the key closure; the lower trace is the RF envelope. Horizontal divisions are 10 ms. The transceiver was being operated at 100 W output on the 14 MHz band, using QSK set to 15 ms. The first-dit rise time is 2.5 ms; the fall time is 3.9 ms. The second-dit rise time is 3.6 ms; the fall time is 4.7 ms. The first-dit on delay is 18 ms; the off delay is 22.7 ms. The second-dit on delay is 18.8 ms; the off delay is 22.6 ms.
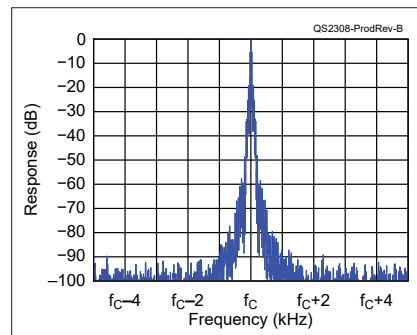

Figure B — The spectral display of the Yaesu FT-710 transmitter during keying sideband testing. Equivalent keying speed is 60 WPM using external keying and the default rise time setting. Spectrum analyzer resolution bandwidth is 10 Hz, and the sweep time is 30 seconds. The transmitter was being operated at 100 W PEP output on the 14 MHz band, and this plot shows the transmitter output ±5 kHz from the carrier. The reference level is 0 dBc, and the vertical scale is in dB.
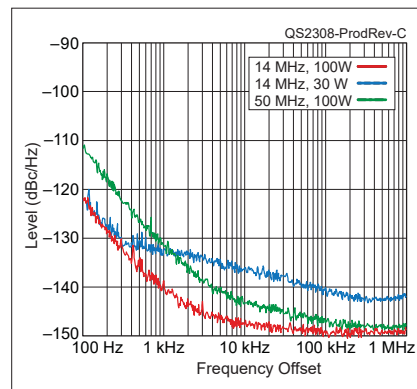

Figure C — The spectral display of the Yaesu FT-710 transmitter output during phase-noise testing. Power output is 100 W on the 14 MHz band (red trace), 30 W on the 14 MHz band (blue trace), and 100 W on the 50 MHz band (green trace). The carrier, off the left edge of the plot, is not shown. This plot shows phase noise 100 Hz to 1 MHz from the carrier. The reference level is –90 dBc/Hz, and the vertical scale is 10 dB per division.

tween when the amplifier control switches and RF output appears at the FT-710 antenna jack. This delay allows time for amplifier relay contacts to settle before the radio starts to transmit, preventing damage from hot switching. Although the menu name suggests that this setting is for full break-in (QSK) CW operation, the manual clearly states that the delay is effective for all modes.

A six-pin mini-DIN **RTTY/DATA** jack can be used with an external digital mode data controller or sound card for digital modes. Connections for fixed-level receiver audio output, frequency shift keying (FSK) RTTY, audio input for sound card modes, and PTT control are available.

A fan in the center of the rear panel keeps the radio cool. In my station, the fan came on after about 15 minutes of receive-only operation, and it stayed on much of the time after that. The fan speed seemed to stay constant whether I was transmitting heavily or just receiving. In a quiet room, the fan noise seems loud, but I didn't find it bothersome with other equipment running and the radio volume turned up to listen to signals.

Next to the fan are USB-B and USB-A jacks. The USB-B connector is for connection to your station PC, and the USB-A connector can be used with a keyboard or mouse to select items on the display or enter characters. The mouse cursor speed is adjustable, and I found using a mouse to be more accurate than my fingertip for selecting signals on the touchscreen spectrum display.

After installing the USB driver (available at **www. yaesu.com**), connect the radio to your PC with a standard USB-A to USB-B cable, and apply power to the radio. In your PC's **DEVICE MANAGER** screen, look under **PORTS (COM & LPT)** for **SILICON LABS DUAL CP2105 USB TO UART BRIDGE**. There will be two new virtual COM ports with COM port numbers, one "standard" and the other "enhanced." You'll use these COM port numbers when configuring logging, digital mode, and other software.

The **EXT DISPLAY** jack is a DVI-digital (DVI-D) connector for using an external monitor to show the contents of the FT-710 display. It looked good on my older

Figure 1 — The FT-710 rear panel.

20-inch wide-screen computer monitor using the 800 × 600 pixel setting. Note that current-generation monitors tend to have HDMI and/or DisplayPort interfaces instead of DVI-D. You can easily find online a DVI-D-to-HDMI adapter.

Receiver and Transmitter Settings

Receiver bandwidth filtering is adjustable for each mode, with a menu-settable narrow filter available with a press of the **NAR** button. Additional interference mitigation is available through use of the **IF SHIFT**, **NOTCH**, **CONTOUR**, and audio peak filter (**APF**) settings along with the digital notch filter (**DNF**) for automatically attacking AM broadcast carriers and other steady tones.

The FT-710 offers adjustable DSP noise reduction (**DNR**) and noise blanker (**NB**) features. **DNR** has 15 possible settings, but with early versions of the firmware I heard distortion and watery-sounding audio at settings greater than 3. A firmware update in late March 2023 greatly improved **DNR** operation, eliminating the watery sound in settings 1 to 7. Higher settings offer increased noise reduction that's very effective, but with varying degrees of the watery sound. Audio quality at the higher settings can be improved to some degree by lowering the RF gain and/or adjusting the **CONTOUR** filter shape.

You can tailor receiver audio separately for each mode with adjustable bass/mid/treble settings and low- and high-frequency cutoff filters. While listening with the speaker, there is very little audio output until the **AF GAIN** control reaches the nine o'clock position, and then volume suddenly increases. Listening with headphones, there is an audible pop as you start to increase volume, but there is more control at low audio levels.

The AESS feature blends the audio from the FT-710's internal top-facing speaker with audio from the SP-40 mounted on the side of the radio. You can adjust the balance between the two speakers using the AESS setting and the function knob. The internal speaker on its own has plenty of range, and the SP-40 seems to add more depth to the mid range. I didn't hear the "three-dimensional acoustical effect" described in the manual, but I thought that the two speakers working together sounded good.

Transmitter power is adjustable in 1 W steps. The minimum power output is 5 W, and from a menu you can set the maximum power output separately for HF, 6 meters, and AM mode.

The internal antenna tuner is rated for loads from 16.7 to 150 Ω (3:1 SWR) on 1.8 to 30 MHz, and 25 to 100 Ω

on 6 meters. I had no trouble matching my antennas, which have an SWR of 2.5:1 or less across the bands. Antenna tuner settings are memorized, so tuning is nearly instantaneous after the initial tune.

Touchscreen and Settings

The 4.3-inch color touchscreen on the left side of the front panel shows all sorts of useful information (see Figure 2). Brightness, contrast, colors, and screensaver options are available in the menus. The meter in the upper left corner looks and acts like a traditional analog meter. The default meter scales are transmit power and receive signal strength. Touch the meter area on the screen to change the lower scale to monitor compression level, ALC, drain voltage, drain current, or SWR.

To the right of the meter are displays of frequency and mode for the two VFOs. Below the VFO B information is a display showing signals in the receive filter passband. The graphic changes with adjustments to the filter bandwidth, shift, notch filter, or contour filter controls.

Pressing the function (**FUNC**) knob brings up a screen to access many of the radio's settings (see Figure 3). Touching the label for a parameter such as **RF POWER** or **CW SPEED** allows adjustment by rotating the **FUNC** knob, and that parameter remains adjustable after you return the screen to normal operation. Touching any of the **SETTING** labels across the bottom of the screen brings up another menu screen with more options. While experimenting with different settings, I found it helpful that default values are indicated in bold type in the manual and in a different color on the screen.

For the most part, menu functions are obvious from the labels, and the operation manual does a good job
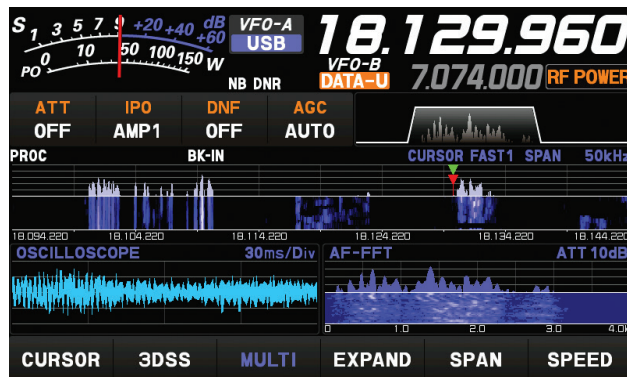

Figure 2 — The FT-710's high-resolution 4.3-inch touchscreen packs a lot of information into a small space.
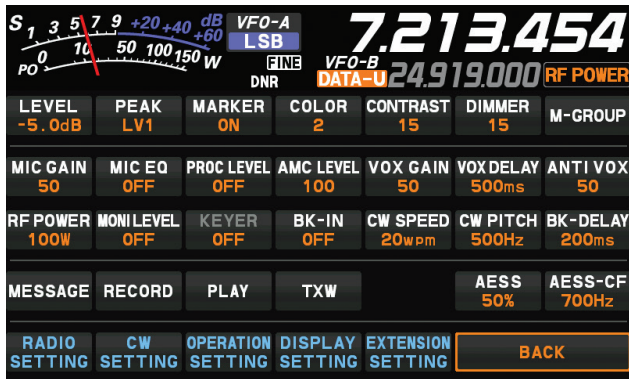
Figure 3 — Pressing the **FUNC** knob brings up a screen to access many of the radio's settings. Touch one of the onscreen labels, and rotating the **FUNC** knob adjusts that function even after the screen returns to normal operation. In this case, **RF POWER** is selected. The blue **SETTING** labels at the bottom bring up additional menus for parameters that are adjusted infrequently.
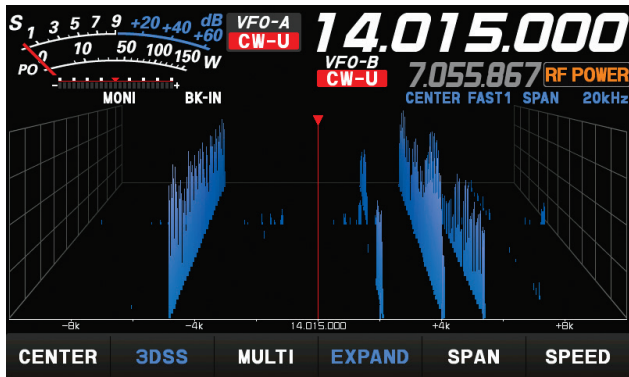

Figure 4 — The **3DSS** setting changes the spectrum scope to a three-dimensional view with signals marching off the back of the screen over time. A standard waterfall display is available when the 3D view is deactivated.

of explaining what each one does. It didn't take long to become comfortable navigating the menu system, settings, and controls. I did notice that some pop-up screens disappear after about 3 to 5 seconds if you don't make a selection.

Like the FT**DX**10 and FT**DX**101D/MP, the FT-710's band scope can show a traditional panadapter/waterfall display, add inset displays of the received audio with both oscilloscope (time versus amplitude) and spectrum analyzer views, or switch to the 3DSS three-dimensional view (shown in Figure 4) with time marching out the back of the screen. Frequency span, sweep speed, sensitivity, colors, and other parameters are adjustable.

The cursor in the spectrum display shows the tuned frequency. In addition to using the tuning knob, you can tune to signals in the display by touching the screen or by using a mouse if you have one connected to the FT-710's rear panel USB port. In **CENTER** mode,

the cursor (received frequency) is fixed at the center of the screen, and the waterfall moves left or right as you tune. In this mode, signals shown in the waterfall skew as the waterfall moves. In **CURSOR** mode, the waterfall is static and the cursor moves as you tune. When the cursor reaches the left or right side of the screen, the waterfall scrolls to keep up. In **FIXED** mode, the selected frequency range in the waterfall doesn't move when the cursor reaches the side of the screen. Icons light up to indicate that you have tuned outside the fixed range.

The spectrum display would benefit from averaging capability. Signal peaks come and go very quickly. With averaging, weaker signals would slowly grow out of the noise at the bottom of the screen, making them easier to find.

Voice Operation

The FT-710 offers SSB, AM, and FM voice operation. Extensive customization of the transmitted audio characteristics is possible using a three-band parametric equalizer. Separate equalizer settings can be stored for use with the speech processor off or on, making it easy to switch between mellow audio for conversation or punchy audio for DXing or contesting. On-air reports indicated that the FT-710 sounded good when used with either the supplied hand microphone or my INRAD W1 headset.

On SSB, the transmit filter bandwidth menu offers several options, ranging from 400 – 2600 Hz to 50 – 3050 Hz. The default setting of 50 – 3050 Hz worked just fine for me. Separate transmit bandwidth settings are available for AM and data modes.

With the current solar cycle progressing, 10 meters has been hot, and that's sparked renewed interest in 10-meter FM at the high end of the band. The FT-710 is ready for FM operation on 10 or 6 meters, either simplex or on repeaters using the **RPT SHIFT** feature to set a repeater offset. CTCSS tone encoding and decoding are available for repeater access.

You can record up to five voice messages for transmission. Maximum recording time is 90 seconds per message, and messages are stored on the SD card. Record and playback functions can be controlled from the touchscreen or from the optional FH-2 external keypad. You can also record received audio, up to a maximum of 16 hours per file, using the SD card for storage. File selection and playback options are handled from the touchscreen, if you want to listen to recordings using the FT-710. I didn't see mention of a way to play back recorded audio on the air. Recordings are standard

.wav files, so I was able to copy them from the SD card and play them on my desktop computer. This is a great way to document memorable QSOs.

CW Operation

The FT-710 supports semi break-in CW operation with adjustable delay or full break-in CW (QSK). TR switching is relay based, so you can hear relay clicking but it's very quiet. Typical of relay-based TR systems, I found that QSK worked well up to 20 WPM or so. Above that speed I could not really hear received audio between characters.

The built-in CW keyer offers iambic modes A and B, a bug mode that generates dots only (dashes sent manually), and a couple of other modes described in the manual. Keyer speed can be adjusted from 4 to 60 WPM, weight is adjustable, and dot/dash paddle polarity can be switched from a menu. There are five CW message memories with up to 50 characters each, and memories can include incremental serial numbers for contests.

CW pitch is adjustable, and there are several useful tuning aids. Press the **ZIN/SPOT** switch with a signal in the passband, and the radio automatically tunes the received signal to the correct pitch. Alternatively, you can press and hold that switch to generate a tone that corresponds to the pitch of your transmitted signal, then tune your receiver until the tone of the received signal matches. A tuning offset indicator (a row of dots below the meter on the display) gives a visual indication of the pitch of the received signal, and you can also see the received signal in the onscreen passband display.

Digital Modes

For digital mode operation, you can connect an external computer to the FT-710 through the USB port and use the radio's internal sound card for FT8, FT4, PSK, MSK144, AFSK RTTY, SSTV, or any other sound card modes. The FT-710 does not have built-in RTTY, PSK, or CW decoders and transmit message memories like the FT**DX**10.

Setup couldn't be simpler. After installing the USB driver, install a USB cable between the radio and the computer. When power is applied to the radio, **USB AUDIO DEVICE** shows up as a sound device on the computer. I selected that device for receive and transmit audio in the *WSJT-X* **SETTINGS** menu. The sound card modes use the FT-710's **DATA-U** mode. Touching the onscreen **PRESET** button configures the radio for FT8 operation.

Final Thoughts

I really enjoyed using the FT-710. I found the controls to be logically placed and easy to access, and adjusting key settings didn't require a deep dive into a cryptic menu system. Although the radio is highly customizable, the default settings were a fine starting point as I explored the effects of various settings. The FT-710's receiver holds up well with strong signals on a packed band, with various filters and other interference-fighting features available as needed. In terms of price versus performance and features, the FT-710 offers a lot of value.

Manufacturer: Yaesu USA, 6125 Phyllis Dr., Cypress, CA 90630, **www.yaesu.com**.