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Yaesu FT-736R VHF/UHF Transceiver

Reviewed by Mark J. Wilson, AA2Z

The Yaesu FT-736R gives VHF/UHF operators what HF operators have had for years: their favorite bands and modes in a single box. Yaesu broke new ground in the early 1980s with the popular FT-726R, a multimode, multiband VHF/UHF rig. The FT-736 is a worthy successor to the FT-726: It offers many of the same features as the '726—and adds much more.

One such addition is the number of bands available in the FT-736. The '736 comes standard with modules for 144-148 MHz and 430-450 MHz, and it can hold a total of four band modules. Optional bands are 50-54 MHz, 220-225 MHz and 1240-1300 MHz. (By comparison, the '726 holds only three band modules: 2 meters was standard; 10 meters, 6 meters and 70 cm were optional.)

Other FT-736 standard features include a built-in ac-operated power supply, full-duplex satellite operation, IF shift and notch filter, speech processor, versatile memory and scanning operation, VOX, and provisions for an optional internal keyer. With an optional cable, the rig can be powered from an external 13.8-V dc power source, which is handy for portable operation.

The FT-736 is a complicated radio. This is partly because of the number of bands, modes and styles of operating that it provides, and partly because of the way it was designed. Most of the front-panel push buttons perform two functions. (You press a function key first to activate the secondary function.) In fact, *24 of the 49* front-panel push buttons have secondary functions, and still others function differently depending on the mode of operation. And there are 18 rotary controls in addition to the 49 push buttons!

This excerpt from page 21 of the manual's operation section says it all:

> Sections 4.8 through 4.13 describe some of the more complex operating features involving programmable features, memories, scanning and tone squelch. We do not recommend random experimentation with the controls until after you have followed these procedures. Some keys and switches alter or disable other functions and may cause confusion: you may have to turn the transceiver off and set the backup switch (Section 2.2(1)) off and back on to reset the microprocessor if you lose track of operation...

Although the '736 does an awful lot of things, it's unlikely that any one operator will use all of its features. It's not a difficult rig to use for any one mode of operation, but it'll take you a while to learn to use this transceiver to the fullest.

Adding Options

We purchased all three optional band modules for the review FT-736R. To get the ball rolling, I installed 50 MHz and 220 MHz. I later removed the 50-MHz module and installed the 1.2-GHz module in its place.

Yaesu did a good job with the mechanical design of the '736. The radio is divided into upper and lower compartments. The 144- and 430-MHz modules mount in the upper compartment, and two optional modules may be installed in the lower compartment. All band modules are mounted to a common heat sink on the rear panel. There's plenty of room to work, and the front panel tilts away from the chassis to make installing modules even easier. You need only a screwdriver, patience and the ability to follow directions to add bands to the '736. Just about anyone can do it, but it involves enough work that you shouldn't plan to swap modules on a regular basis.

The review radio also has the optional internal CW keyer and 600-Hz CW filter. Keyer installation requires removing the top cover, cutting a jumper wire and inserting the keyer into a socket on a PC board. Filter installation requires dismounting the receiver IF PC board, soldering the four filter leads to the board, and reassembling.

Frequency Control

The FT-736R has many of the elaborate frequency-control features found on full-featured HF transceivers. It has two built-in VFOs, memories and scanning, RIT, and complete flexibility in selecting standard repeater offsets or programming oddball ones. All of this flexibility has a price, though: It takes some practice to cruise around the VHF/UHF spectrum at the controls of the FT-736.

Band Switching

First you need to decide what band to use. Most multiband HF transceivers have a prominent band switch that's either a rotary knob or a bank of push buttons, one for each band. On the FT-736, band selection is handled by the **BAND** push button on the right side of the radio. Pressing the **BAND** switch once moves you to the next higher band (50-144-220-430-1240-50 MHz, etc). The '736 knows which band modules are installed and skips those that aren't.

The **BAND** switch works best with the basic setup—it toggles back and forth between 144 and 430 MHz. If you add two more modules, say 50 and 220 MHz, it gets a bit more cumbersome. If you want to move from 220 MHz to 144 MHz, for example, you must toggle through 430 and 50 MHz to get there. It's hard to imagine an HF radio that makes you step through 160, 80, 40 and 30 meters to get from 10 meters to 20 meters.

The **BAND** switch is buried in a bank of 15 switches all the same size. I'd have preferred a more prominent **BAND** switch, and one that is more convenient to use.

Once you've chosen the band you want, the next task is getting to the correct frequency. There are a number of different ways to do this with the FT-736.

Getting on Frequency

The silver **MHz/CH UP/DOWN** switches to the right of the main tuning knob move the frequency up and down in 1-MHz steps. You can't use the **MHz/CH UP/DOWN** switches to change bands. Once you've used the **BAND** and **MHz/CH UP/DOWN**

Table 1

Yaesu FT-736R VHF/UHF Transceiver, Serial no. 7M020471

Manufacturer's Claimed Specifications	*Measured in the ARRL Lab*
Frequency coverage: 50-53.99999, 144-147.99999, 220-224.99999, 430-449.99999, 1240-1299.99999 MHz.	As specified.
Modes of operation: SSB, CW, FM, A3F on 1.2 GHz (optional).	As specified
Transmitter	*Transmitter Dynamic Testing*
Transmitter power: 30 W dc input on 50 MHz; 60 W dc input on 144, 220 and 432 MHz; 45 W dc input on 1.2 GHz.	Output power: 50 MHz: 9.4 W CW, 10.1 W SSB, 10.4 W FM; 144 MHz: 23.7, 26.1, 26.9; 220 MHz: 20.9, 21.5, 24.2; 432 MHz: 22.0, 22.0, 25.0; 1296 MHz: 9.1, 9.6, 10.3
Spurious-signal and harmonic suppression: >60 dB below peak power output	See Fig 1.
Third-order intermodulation distortion products: Not specified.	See Figs 2-5
Transmit-receive turnaround time (PTT release to 90% audio output with S1 and S9 signals): Not specified.	46 ms.
*Receiver**	*Receiver Dynamic Testing*
Sensitivity (bandwidth not specified): −135 dBm for 12 dB S/N + N.	Minimum discernible signal (noise floor) with 600-Hz filter: 50 MHz, −140.5 dBm; 144 MHz, −140.5 dBm; 220 MHz, −142.0 dBm; 432 MHz, −141.5 dBm; 1296 MHz, not measured.
Dynamic range: Not specified.	Blocking dynamic range:† 50 MHz, 119.5 dB; 144 MHz, 125.5 dB; 220 MHz, 105 dB; 432 MHz, 74.5 dB; 1296 MHz, not measured.
	Two-tone, third-order intermodulation distortion dynamic range:† 50 MHz, 82.5 dB; 144 MHz, 77.5 dB; 220 MHz, 71.0 dB; 432 MHz, 64.5 dB; 1296 MHz, not measured.
	Third-order input intercept: 50 MHz, −17 dBm; 144 MHz, −24 dBm; 220 MHz, −34 dBm; 432 MHz, −44 dBm; 1296 MHz, not measured.
S-meter sensitivity (μV for S9 reading): Not specified.	50 MHz, 4.4; 144 MHz, 4.4; 220 MHz, 3.6; 432 MHz, 5.2; 1296 MHz, not measured.
Other	
Power requirement: 85-132 or 170-264 V ac, 250 VA max, or 13.8 V dc ±10% at 8 A max on TX, 1.5 A max on RX.	Not measured.
Receiver audio output: 1.5 W at 5% distortion with an 8-Ω load.	2.0 W at 10% total harmonic distortion (THD) with an 8-Ω load.
Size (height, width, depth): 5.1 × 14.5 × 11.25 inches; weight, 20 lb. Color: gray.	

*See Table 2 for FM receiver specifications and test results.

†Blocking dynamic range and third-order IMD dynamic range measurements were made at the ARRL Lab standard signal spacing of 20 kHz.

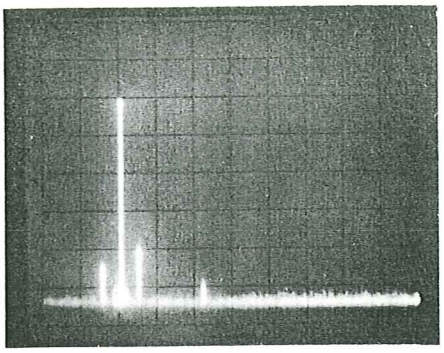

Fig 1—Worst-case spectral display of the Yaesu FT-736R. Horizontal divisions are each 100 MHz; vertical divisions are each 10 dB. Output power is approximately 25 W at 220 MHz. The fundamental has been notched approximately 20 dB to prevent spectrum-analyzer overload. All harmonics and spurious emissions are at least 60 dB below peak fundamental output. The FT-736R complies with current FCC specifications for spectral purity.

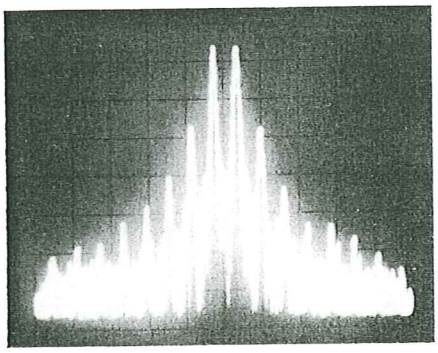

Fig 2—Spectral display of the FT-736R during 50.2-MHz, two-tone intermodulation distortion (IMD) testing. Third-order products are approximately 27 dB below PEP output, and fifth-order products are approximately 40 dB down. Vertical divisions are each 10 dB; horizontal divisions are each 2 kHz. The transceiver was being operated at 10 W PEP output.

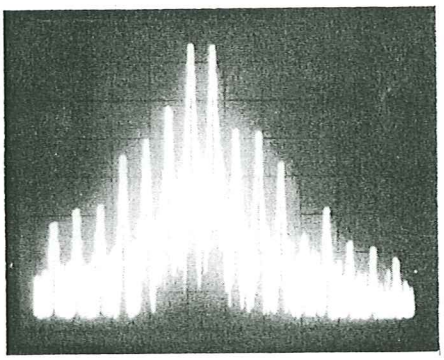

Fig 3—Spectral display of the FT-736R during 144.2-MHz, two-tone intermodulation distortion (IMD) testing. Third-order products are approximately 22 dB below PEP output, and fifth-order products are approximately 30 dB down. Vertical divisions are each 10 dB; horizontal divisions are each 2 kHz. The transceiver was being operated at 25 W PEP output. Operating the transceiver at less than 25 W PEP output on 144 MHz substantially improves transmitter-IMD performance.

switches to get to the desired MHz range, there are three different ways to tune to the desired frequency.

Method 1: Most obvious is the main tuning knob. On SSB and CW, normal tuning is in 10- or 100-Hz steps at 10 (or 100) kHz per knob revolution. The **STEP** switch toggles back and forth between these two tuning rates. Normal tuning in the FM mode is 100-Hz steps at 100 kHz per revolution.

Method 2: Pressing the **FM CH** or **SSB CH** buttons disables the main tuning knob and

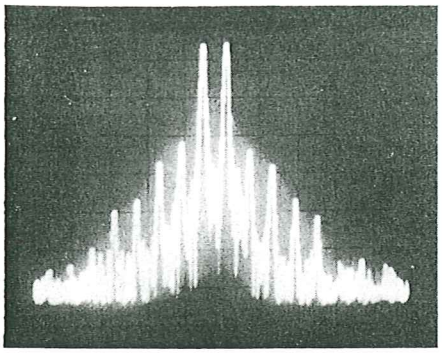

Fig 4—Spectral display of the FT-736R during 220.2-MHz, two-tone intermodulation distortion (IMD) testing. Third-order products are approximately 32 dB below PEP output, and fifth-order products are approximately 37 dB down. Vertical divisions are each 10 dB; horizontal divisions are each 2 kHz. The transceiver was being operated at 22 W PEP output.

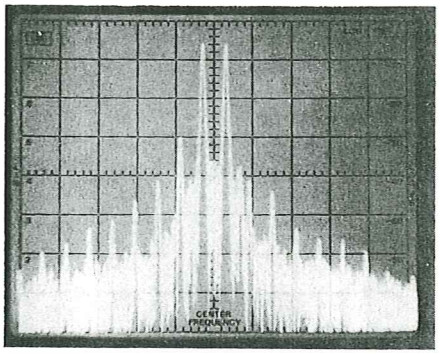

Fig 5—Spectral display of the FT-736R during 1296-MHz two-tone intermodulation distortion (IMD) testing. Third-order products are approximately 30 dB below PEP output, and fifth-order products are approximately 42 dB down. Vertical divisions are each 10 dB; horizontal divisions are each 2 kHz. The transceiver was being operated at 9.1 W PEP output.

transfers tuning control to the **CHANNEL** knob (and the companion switches on the mike). The **CHANNEL** control has detents and changes the frequency in preset, channelized steps. In **SSB CH** operation (SSB or CW), the steps are 2.5 or 5 kHz, toggled by the **STEP** switch. For **FM CH** operation, step size is easily programmed to any of eight values between 5 and 50 kHz. The **CHANNEL** feature is great for FM operation, but I can't see much use for it on SSB and CW.

Method 3: The silver **UP/DOWN** keys above the main tuning knob can also be used to move the operating frequency up and down. The **UP/DOWN** switches are also used to start the scanning feature (more on this later). These switches aren't really useful in normal operation, but they are useful during scanning.

D LOCK disables the main tuning knob (or the **CHANNEL** knob and mike keys during FM CH and SSB CH operation) and the **UP/DOWN** switches to prevent accidental frequency changes. **D LOCK** does not disable the **BAND** switch, and it does not inhibit frequency changes via the keypad.

Keypad

Ten light-gray, two-function push-button switches at the right side of the front panel comprise a keypad. The keypad functions are secondary, so you must first press the **ENT** key to access them. You can use the keypad to enter the desired operating frequency within a band (to 100 Hz), but you can't use it to change bands.

The keypad is also used in conjunction with several other features. They include:

- Setting repeater offsets.
- Selecting memory channels (0-99).
- Changing the step size in channelized FM operation.
- As a DTMF keypad in FM operation.

VFOs and RIT

The FT-736 has two built-in VFOs. They are selected by pressing the **A** or **B** buttons on the left side of the front panel. Split-frequency operation is available by pressing the **RB-TA** (receive on VFO B, transmit on VFO A) or **RA-TB** buttons. VFO A and B must be set for frequencies in the same band, but they need not be set for the same mode. (Full-duplex, cross-band operation is possible—see Satellite Operation, later.)

Usually, I kept one VFO tuned to the SSB/CW portion of the band and the other to the FM portion. VFO frequencies are remembered when you change bands. Surprisingly, there is no "A = B" switch to make the frequencies of both VFOs the same. Many operators use the A = B function found on other radios to mark a frequency so they can quickly return to it. You can't do this with the '736 VFOs; there is no way to bring them together quickly.

The FT-736 has receiver offset tuning with a range of ± 10 kHz, but this is one feature that could have been implemented a lot better. The **CLAR** button toggles the offset tuning on and off. During **CLAR** operation, the transmit frequency stays put and the main tuning knob controls the receiver frequency. The main frequency display tracks the receiver frequency as you tune, and it displays the transmit frequency when you transmit, but there is no display of the receiver's offset relative to the transmit frequency. I *really* prefer having a separate RIT knob and a display showing me the offset.

Another annoying feature is that the receiver offset *does not* remain in memory—although the manual hints that it does—when you turn off the **CLAR** control and change frequency. This is a handicap for moonbounce operation, where it's necessary to leave the offset on all the time when tuning around the band to compensate for Doppler-shifted echoes.

Repeater Offsets

Repeater offsets can be selected in a number of ways. For 2-meter FM operation, most of the time you can use the automatic repeater split (ARS) feature. The '736's microprocessor is programmed with the most common offsets (+600 kHz, −600 kHz, simplex—following the band plan) and automatically selects the correct offset as you tune the receiver with the **FM CH** knob. You can reverse the transmit and receive frequencies with the **REV** key, and you can change the standard offset to something other than 600 kHz. ARS can be disabled by a switch accessible through the top panel, allowing you to choose the desired offset manually (as on the other bands).

On bands other than 2 meters (and on 2 meters, when ARS is disabled), you can select the desired offset using the **+RPT**, **−RPT** and **SIMP**lex keys. In addition, you can use the split-frequency function of the two VFOs to set repeater transmit and receive frequencies.

Memories

The FT-736 has 100 memory channels (00-99) that store frequency, mode, repeater offset and tone-squelch settings. Pressing **MR** (memory recall) gets you into the memory mode. Once there, you can select the channel number several different ways. Turning the **CHANNEL** knob or pressing the **UP/DOWN** keys above the main tuning knob (or their counterparts on the microphone) allows you to select the desired memory (skipping the memories that have nothing stored in them). The **MHz/CH UP/DOWN** buttons (the same ones that move the frequency up and down in 1-MHz steps during VFO operation) and the keypad can be used to select any memory, even memories that are empty.

Here's a strange feature of the FT-736: "hiding" memories. You can mask a memory from display and operation by pressing **F** and **MR** while a given memory channel is selected. A hidden memory is not erased, it just can't be selected by the **UP/DOWN** or **CHANNEL** controls (the controls that scroll through programmed memories, skipping the blank ones). It can be selected by the **MHz/CH UP/DOWN** buttons or the keypad, though. On the display, a hidden memory channel looks just like an empty one except for the letters **CH** next to the channel number. (For a blank memory, you see only the channel number.) The only way to determine what's in hidden memory channels is to remember (or write down) the information, or else step through the hidden channels one by one and unmask them.

In addition to the 100 standard memory channels, two more memories, CALL1 and CALL2, can be accessed with single keystrokes. CALL1 is a single memory that is not band-specific. There's a separate CALL2 memory for each installed band.

Scanning

The FT-736 offers elaborate scanning functions that work only with the squelch closed. I was surprised that the radio won't

scan with the squelch open, a feature often used by weak-signal operators looking for signals that are perfectly copiable but don't break the squelch. Many a summer evening I've gone about other business with the 6- or 2-meter radio running in the background, scanning around the calling frequency. Fortunately the squelch is sensitive; Q5, S1 signals (common on VHF and UHF) sometimes open the squelch.

Scanning is activated by pressing the **UP/DOWN** buttons above the main VFO knob (or their counterparts on the microphone) for more than ½ second. Scanning continues until a signal breaks the squelch. You can set the rig to pause on a signal for as long as it is present (plus two seconds after it disappears), or to pause on each signal for about five seconds and then move on. Scanning is stopped by transmitting or by pressing the **UP/DOWN** switches again.

There are a number of ways to scan:

- If you're using a VFO, you can start scanning at any time. The rig will scan up (or down) the entire band from edge to edge, then wrap to the other band edge and continue.
- You can program scan limits for each band (for example, 432.050 to 432.150 MHz). This feature is called PMS, for programmable memory scan. Scan limits are programmed using the **VFO A**, **VFO B**, **F** and **PMS** keys. Naturally, during PMS operation the **MHz/CH UP/DOWN** buttons have yet another function: By pressing these keys, you can jump directly to the high or low scan limit.
- You can scan through the memories, in several combinations. When you start scanning, the '736 will step through all of the memories programmed to the band you're using. If you want to scan memories for all bands, press **BAND** briefly. If you want to scan only the memories programmed for FM operation, press the **FM CH** button. You can exclude memories from scanning by selecting the memory and then pressing **MR** again. According to the manual, a small arrowhead appears under the **CH** label to the right of the channel number, and memories with these flags will be ignored during scanning. The review '736 behaves differently: In practice, memory channels with these flags are scanned, and those without flags are ignored.

Receiver

One of the first things I noticed about the '736 is that the receiver is quiet, particularly on 220 and 432 MHz. In fact, some people who have used the radio were concerned that it was broken. The receiver is quite sensitive, though, as shown in Tables 1 and 2. In practice, the receiver is sensitive enough that most of the signals on a band can be copied. I didn't feel as though I was missing a lot.

SSB selectivity is fixed at 2.5 kHz. On CW, you have the choice of 2.5 kHz or 600 Hz (with the optional filter). The narrow filter, selected by the **CW-N** switch, works well. Standard FM operation uses a 15-kHz filter, but pressing **FM-N** switches in an 8-kHz-wide filter in the 455-kHz IF.

One of the most important receiver parameters on VHF/UHF (at least for those of us who live in populated areas) is the ability to handle strong in-band signals. It's not uncommon to try to copy a signal a few decibels above the noise with a rock-crushing local signal just a few kilohertz down the band. Strong-signal handling in multimode transceivers has improved drastically in the past decade, and the '736 can handle strapping signals on 50, 144 and 220 MHz with poise.

ARRL Lab tests (see Table 1) show blocking dynamic ranges of 120-125 dB on 6 and 2 meters. Although these numbers are 10-15 dB shy of today's best HF transceivers, they are excellent.[1] Blocking dynamic range is still more than 100 dB at 220 MHz, but the receiver falls apart at 432 MHz. Lab tests show a blocking dynamic range of only 74.5 dB on 70 cm. This poor performance is evident on the air. I live near several well-equipped 432-MHz stations, and when they are on the air, the '736 receiver folds up. Signals under S8 or S9 *simply disappear* when the locals start to transmit. My other 70-cm rig, a transverter and low-band radio, is usable when the locals fire up; the FT-736 is not. If you live in an area where there are no loud locals on 432 MHz, the '736 is fine. Mike Owen, W9IP, who lives in northern New York state, far from loud locals, used the review FT-736 on moonbounce and reports no problems hearing very weak signals.

The FT-736 has several useful receiver features. The **SQUELCH** control works in all modes. Besides the obvious uses on FM, it allows you to leave the receiver tuned to a weak-signal SSB calling frequency, say 50.110 MHz, with the squelch on and the volume control turned up.

[1]We were unable to test the FT-736's receiver performance on the 1.2-GHz band, for lack of the necessary test equipment. Approximate measurements indicate that the 1.2-GHz receiver sensitivity is on par with that at the lower frequencies, but we couldn't estimate blocking and IMD dynamic ranges.

The noise blanker works in the CW and SSB modes. It is very effective against automobile ignition noise and is somewhat effective against power-line noise. As with most noise blankers, though, strong signals overload the blanker and create spurious signals that mask weaker signals when it's on.

In the CW and SSB modes, three decay times are afforded by the **AGC** switch—**F**ast, **M**edium and **S**low. You can't turn the AGC off. The **S**low position is appropriate for strong-signal SSB work. On weak signals and on CW, the **M**edium and **F**ast settings are better.

During SSB and CW operation, the **IF SHIFT** and **NOTCH** controls can be used to enhance reception. Although these controls do help, I didn't have to use them very much. VHF/UHF operators tend to spread out more than, say, contest operators on the low end of 40 meters, so the problems these controls are there to solve are less serious to begin with.

The **PREAMP** switch can be used to power external preamplifiers for each band. With the **PREAMP** switch on and an appropriate internal jumper installed, 13.8 V dc at up to 300 mA is available at the RF-output connector of the selected band module during receive, saving you the trouble of running separate power/control cables to your preamps. Danger: If you use antennas that have dc-grounded driven elements, you can't use this feature unless you make it *impossible* for the 13.8-V preamp supply to get to the antenna. This seems like more trouble than it's worth. For example, if you inadvertently try to power a preamp with a dc-grounded 2-meter antenna connected, a small switching transistor on the 2-meter module's main board will be destroyed. The same thing happens on the other bands. There is no mention of this in the manual.

The manual shows how to wire the preamp-power connections. This feature works best when you use the '736 barefoot. If you use an external power amplifier and a mast-mounted preamplifier, you should use the '736's amplifier-control line to key a sequencer that keys the power amp and preamp in the right order. Otherwise, you

Table 2
Yaesu FT-736R Receiver FM Specifications and Lab-Test Results

Manufacturer's Claimed Specifications	*Measured in ARRL Lab*
Sensitivity (bandwidth not specified): 0.15 μV for 12 dB SINAD	μV for 12 dB SINAD: 52 MHz, 0.17; 146 MHz, 0.15; 222 MHz, 0.18; 440 MHz, 0.15; 1296 MHz, not measured.
Squelch sensitivity: <0.08 μV.	*Min* *Max* 52 MHz 0.09 0.64 146 MHz 0.06 0.60 222 MHz 0.09 0.92 440 MHz 0.10 0.70 1296 MHz, not measured.
Transmit-receive turnaround time (PTT release to 90% of full audio output): Not specified.	S1 signal, 46 ms; S9 signal, 46 ms.

run the risk of transmitting into the preamp.

Transmitter

Yaesu rates the FT-736R in terms of power input instead of output. As shown in Table 1, output is about 10 watts on 50 and 1240 MHz and 25 W on 144, 220 and 430 MHz. This power level is enough to allow many contacts, and is compatible with most of the current external solid-state and tube-type amplifiers.

VOX controls are on the front panel, and the VOX works in all modes. This is a welcome change from the FT-726, which offered no VOX operation. **MONITOR** controls the CW sidetone level. **PROC** activates the SSB speech processor. The processor helps when signals are weak, and local reports indicate that the processed audio sounds good.

When **BURST** is pressed, FM is selected and a repeater offset is programmed, the '736 transmits an 1800-Hz tone for ½ second whenever the PTT switch is pressed. When **TCALL** is pressed, the rig transmits an 1800-Hz tone. If you need subaudible tones, you'll need to install the optional FTS-8 CTCSS unit.

There's a DTMF pad hidden on the front panel as well. When you're transmitting, the keypad selects tones 0-9, the **MHz/CH UP/DOWN** buttons select tones A and B, the Function key selects tone C, **ENT** selects tone D, and **CALL1** and **CALL2** select * and #, respectively.

Another Perspective: QRP Contest Operation with the FT-736

"Hi! (pause) How would you like to use an FT-736 for the June VHF contest?"

"Interesting way to start a telephone conversation," I thought. After about half an hour the other shoe dropped. "Oh yeah. You can also write a few paragraphs for the product review." So, be forewarned that the following is the opinion of one guy who used the FT-736 for a contest weekend.

The scene was at the crest of Powder Ridge in Middlefield, Connecticut, at an elevation of close to 800 feet. Not a "real" mountaintop site, but a pretty nice view nevertheless. The antennas were typical of an average VHF contest participant. Single Yagis were used on 50 and 220 MHz and a pair each on 144 and 432 MHz.

My first observation was how easy the FT-736 is to use. It took very little time to adjust the controls, preset the VFOs, and figure out what the various controls really do.

Over the first hour, all spent on 144 MHz, it became obvious that the receiver section of the radio held up pretty well to the RF levels found in central Connecticut (more on this later). Nobody complained about the signal being particularly wide or obnoxious sounding. Even with the speech processor active, AA2Z claimed that the rig sounded "great."

A substantive problem appeared Sunday evening, during the local 432 MHz activity hour. Whenever one of the three or four *very* loud locals (particularly AA2Z) keyed their rigs, the FT-736 receiver blocked. Signals below S9 plain disappeared.

Overall, the FT-736 receiver is sensitive enough that most of the signals on the bands could be heard easily. Only four stations I heard all weekend didn't respond to my 10-watt signal.

The bottom line? Using the FT-736 didn't hurt my contest score in any way—it only helped—but I'd prefer a less fully featured transceiver that offered premium basic radio performance for my application (three or four contest weekends a year).—*Clarke Greene, K1JX*

Satellite Operation

If you were to ask what the FT-736 does best, the answer is probably "satellite operation." The FT-726 broke new ground by offering a complete, full-duplex satellite station in a single box, and the '736 offers even more. With coverage of the 144- and 430-MHz bands built in, and the optional 1240-MHz module, you're all set to operate most of the popular satellite modes.

Setting the radio up for satellite operation is easy. First, turn the **SAT** switch to **RX** and tune the receiver to the downlink frequency. You can set the receiver to any frequency on any installed band, except the band that the transmitter is tuned to. Tuning, mode selection and so forth work just like they do in terrestrial operation. Then, turn the **SAT** switch to **TX** and set the transmitter to the uplink frequency. So far, so good; using the '736 is like using two separate radios that happen to be in the same box.

Now for the good part. Set the **SAT** selector to **RX**, send a few CW characters and find your signal. When you've found it, set the **SAT** switch to **REV** and your transmit signal will automatically track the receive signal. As you tune the receiver in one direction, the transmitter automatically tunes the same amount in the other direction. If you set the **SAT** switch to **NOR**, the receiver and transmitter frequencies track in the same direction. The satellite mode you choose depends on which satellite transponder you're using.

It's possible to set VFO A and VFO B for completely different satellite bands and/or modes, and there are 10 memories (separate from the 100 memories described earlier) to store full-duplex pairs. Information stored during satellite operation does not affect normal operation, so switching back and forth between satellite and terrestrial work is as easy as turning the **SAT** switch.

Setup and Operation

The first thing I recommend doing after opening the box is *carefully* studying the manual. The '736 does a lot, and many of the functions are not obvious.

There are separate RF connectors for each band module (UHF for 50, 144 and 220 MHz; N for 430 and 1240 MHz). Control for an external power amplifier is handled by a 5-pin DIN jack on the rear panel. For maximum flexibility, I made up a box with four phono connectors to interface the '736 with the rest of my station.

As originally supplied, the FT-736 had two problems with external amplifier keying:

1) The manual did not specify the voltage and current ratings for the switching circuit. A call to Yaesu brought bad news: 12 V at 50-60 mA maximum, insufficient to key my amplifiers.

2) Whenever the '736 is in the satellite mode, the band module selected for transmit is keyed continuously. And, the external amplifier control line is keyed all the time.

Yaesu has fixed these problems in production and offers a modification to owners of early radios. The new amplifier key line rating is 100 V dc at 1 A, and the rig does not automatically transmit when satellite operation is selected. Yaesu offers two options for owners of early FT-736s: (1) Send the rig back to Yaesu, and they will modify it under warranty (even if your warranty has expired; you pay shipping one way). (2) Ask Yaesu to provide the parts and instructions (no charge) and do it yourself. We obtained the parts to modify the 144- and 430-MHz modules in the review '736. The modification involves installation of a small PC board for each band module, modification to existing PC boards and soldering some wires. I recommend that this modification be attempted only by individuals with some experience working on electronics equipment.

I spend most of my operating time on VHF and UHF working SSB and CW at the low ends of the bands. I used the '736 from my home station and for some portable contest operation. The FT-736 generally holds its own in weak-signal work. The receiver is sensitive enough to hear plenty of signals, and strong-signal-handling capability is first rate (except on 432 MHz, as described earlier). I used the rig barefoot a lot of the time, and made many enjoyable contacts. Once the amplifier-keying problem was solved, I was able to use the rig with a variety of solid-state and tube-type amplifiers. I worked a lot of DX with the '736 on tropo, aurora, meteor scatter and sporadic E.

The real test came at a mountaintop con-

test operation: W1XX/3 from western Pennsylvania. Although we had equipment for all bands, we brought the '736 along as a backup rig. Murphy made it necessary to use the '736 on 220 MHz, along with a 400-W amplifier and a pair of Boomer antennas (no external preamplifier). Although most operators agreed that the receiver was very quiet (some ran the audio gain near maximum), it was very sensitive and stood up to strong signals from other mountaintop operations. We worked 51 grid squares on 220 MHz during that operation, including some contacts of more than 600 miles. During another VHF contest, Clarke Greene, K1JX, used the review transceiver for a QRP portable expedition (see sidebar).

An additional capability Yaesu has added to the FT-736 is that of fast-scan-television (FSTV) operation. With an optional external TV camera/audio interface, you can work FSTV on the 1.2-GHz band. I didn't try this (we didn't purchase the interface), but it appears to be simple and interesting.

The '736 does have one annoying characteristic: The receiver must be retuned when you change modes between SSB and CW. Although this may seem like a minor point, I often found myself switching to CW to work distant stations after calling in vain on SSB. Every time I switched to CW, I had to tune in the station again.

I enjoyed having the FT-736 in my station. It's great having everything in one compact package, but it's not without compromises. The receiver and transmitter work well, although it would be nice to have 25 W available on 6 meters to drive my amplifier to full output. I found the transceiver easy to use (because I used only the basic functions). With the combination of a sensitive receiver and narrow filter, this is the best radio I've used on FM. It's ideal for satellite operation, and the satellite features don't intrude on normal operation.

The '736 is an expensive radio compared to other VHF rigs, but even with a couple of optional band modules, it's in the same price range as today's full-featured MF/HF transceivers. Who should buy one? If all you're looking for is an FM rig, you should probably look elsewhere. If you're just interested in SSB and CW DXing from a home station, consider also the HF transceiver/transverter route. If you use a lot of bands and modes and/or are into satellites, this rig should be a serious contender for your radio dollars.

Thanks to Clarke Greene, K1JX, and Mike Owen, W9IP, for contributing to this review.

Price class: FT-736R, $1570; 6-meter band module, $265; 220-MHz band module, $290; 1.2-GHz band module, $530; keyer, $20; dc cable, $10; FSTV interface, $150; voice synthesizer, $40; CTCSS encoder/decoder, $55. Manufacturer: Yaesu USA, 17210 Edwards Rd, Cerritos, CA 90701. QST

A Closer Look at Horizontal Loop Antennas

(continued from page 29)

low-angle radiation of the loop at 14.2 MHz. There is substantial high-angle radiation, useful for close-in communications on 20 meters. DX performance is excellent because of the low-angle radiation component. The loop remains omnidirectional, but note the numerous small lobes that have developed.

Fig 6 shows what happens when the antenna is operated at 21.2 MHz. Again we have excellent low-angle performance along with a high-angle component for short-skip work. Omnidirectionality remains, but the pattern is now split into countless small energy lobes.

Finally, we examine the antenna patterns for operation at 28.5 MHz (Fig 7). You can see that we now have high, medium and low angles of radiation. This makes the loop an outstanding antenna for all types of 10-meter communication. The system is still an omnidirectional one, and has many major lobes that form a 360-degree pattern. The gain notations (in dBd, gain in decibels referenced to a half-wave dipole) on the illustrations show that antenna gain increases with operating frequency. At 10 meters, the loop is on a par, in some respects, with a 3-element 10-meter Yagi.

Some Closing Comments

I have kept the narrative short in order to provide page space for the many illustrations. The point is that, if you have space for one, you can use a horizontal loop as a multiband antenna. You need not tailor it for 160 meters. A 75- or 40-meter full-wave loop will usually fit into a city lot. The higher you erect it above ground, the better its performance will be. But, don't give up the notion of a loop if you can't get it high above ground. Height extends the useful working distance of a loop, but many loops at low heights still permit good DX results at the higher end of the HF spectrum. The improvement in noise rejection during receive may be sufficiently rewarding to justify putting up a large piece of wire. This is especially true if you live in a noisy neighborhood.

One word of caution: Wire that has thick polyvinyl insulation (such as no. 14 electrical wire) causes the antenna resonance to be somewhat lower than the formula dictates. Apparently, the propagation factor of the wire, when used in a closed loop, causes this phenomenon. I have not observed this condition when using ordinary enameled wire.

I wish to express my thanks to Harold Johnson, W4ZCB, for his help in making this article possible. QST

New Products

ROTATING TOWER SYSTEMS FOR ROHN 25 TOWERS

☐ Rotating Tower Systems, Inc, has increased its product line by introducing a new rotating joint and guy-wire bracket for adding tower-rotation capability to Rohn 25 towers. A rotating tower allows the installation of stacked monobanders, tribanders, or VHF/UHF arrays, and installation of rotatable antennas at optimum height. All bearing surfaces are completely protected from the weather, and use standard automotive grease fittings to make lubrication easy.

Sold as complete systems, the rotating tower kits include one galvanized-steel rotating joint with a self-aligning bearing; one, two or three rotating guy-wire brackets; and all necessary installation hardware (nuts and bolts, ¾-inch threaded rods to fix the rotating joint during erection and servicing, an extension that allows mounting a gin pole far enough from the tower to clear the rotating joint and guy-wire bracket [and which can later be used as a side-mounted antenna bracket], etc). The rotating joint's vertical load capacity is more than 3000 lb, and the bearing is designed for easy replacement. Price class: rotating joint and one guy bracket, $1330; joint plus two brackets, $1860; joint plus three brackets, $2290. Shipping is by truck, COD, FOB Prosper, Texas. Rotating Tower Systems also manufactures similar products for Rohn 45 and 55 towers. For more information, contact Rotating Tower Systems, Box 44, Prosper, TX 75078, tel 214-347-2560.—*Rus Healy, NJ2L*