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MFJ Model 9406 6-Meter SSB Transceiver

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With the ever-increasing popularity of 6 meters (aka "The Magic Band"), I knew it wouldn't be long before an *affordable* single-band 6-meter SSB transceiver would come on the market. And MFJ did it! The MFJ-9406 is a compact 6-meter SSB transceiver that will get you on this special band with very little effort on your part. It's an excellent choice for the new operator, and it makes for a good back-up radio for the veteran VHF enthusiast.

The MFJ-9406 is small and lightweight. It's housed in a compact aluminum box and weighs just under 2 lb, making it an ideal radio for those backpack VHF expeditions as well as fixed-service operating. With the optional MFJ-416 module, the MFJ-9406 also can operate semi-break-in CW. The black-vinyl-finished top cover is held in place by six machine screws that provide relatively easy access to the inside of the radio. The model MFJ-9406*X* package, which we reviewed, includes a large mobile-type hand mike (MFJ-290) with a coiled cord. MFJ also offers a dc power supply (MFJ-4110) for the MFJ-9406, which we ordered and used during the review. It powers the radio quite well and never faltered, but it's a clunky bit of apparatus that's comprised of a huge plug-in cube (it covered up three outlets on a typical power strip) that supplies 14 V ac, and a separate in-line box that contains components to rectify and filter the supply voltage.

MFJ's power supply is not your only choice. Any well-filtered 13.8-V dc power source can energize this radio. For expedition-type operating, MFJ offers the optional MFJ-4114 dry-cell battery pack, which holds 10 D-cell NiCd batteries. That should provide up to approximately 12.5 V.

The manual says the MFJ-9406 will run off 12 V "at reduced RF output." We found, however, that our review unit behaved badly when the supply voltage dropped below 12.2 V, and it began to generate illegal spurs (MFJ says it has received no reports of this happening on other MFJ-9406s.). Adjusting the internal voltage regulator (**V-REG**) trimpot lowered the voltage at which the radio went haywire to 11.7 V. A second transceiver supplied by MFJ performed properly and did not generate spurs when the voltage was dropped below 10.5 V. Suffice it to say that the transceiver could operate erratically if the power supply voltage is less than 12 V, however, and you might want to tweak the **V-REG** adjustment if you plan to run the unit exclusively from battery power.

The '9406 at a glance

My first impressions of the radio itself were quite positive: Just take it out of the box, hook it up to the power supply, add a 50-MHz antenna, and away you go! Or, as MFJ puts it: "Just turn on and tune in."

Connected to a 13.8-V power source, it develops 10 W PEP RF output. At this output level, the radio consumes slightly more than 1 A on transmit and 140 mA on receive (including the S-meter lamp). Such low power consumption might even make the '9406 a good candidate for use with a solar panel, making the radio capable for use during "back-country" operating, for example (and for a portable antenna suggestion, see our review of the AEA HALO-6 in this "Product Review"—*Ed*).

The front panel has few controls, so it's an easy radio to operate. The analog dial has a vernier-driven plastic pointer. It tunes from 50.0 to 50.3 MHz. The silk-screened dial is calibrated in 25-kHz steps, with printed markers for 50.0, 50.1, 50.2 and 50.3 MHz. The dial proved surprisingly accurate across the band. But remember: this is an *analog* dial, and unless you keep a frequency counter handy, you won't know *exactly* where you are with the '9406. The VFO knob has a nice solid feel to it, however, and it tunes easily.

As a veteran user of an old ICOM IC-502 6-meter radio that also has an analog frequency display, I found tuning the '9406 to the desired operating frequency to be a snap. It was easy to be "pretty darn close" to the frequency that I wanted to dial in. Using another 6-meter radio as test receiver, I set the VFO on the MFJ to 50.100, 50.125 and 50.150 MHz. I found that the radio was usually right on the frequency displayed on my (uncalibrated) test receiver—not bad at all, I think. (In contrast, I could *never* do that with my old ICOM '502!)

I also tried to "split the difference," by attempting to tune the MFJ-9406 to exactly 50.137.5 MHz (halfway between the two front-panel dial markings of 50.125 and 50.150 MHz). When I transmitted, the digital display on my test receiver indicated 50.138.62. Now, to me, that's *analog accuracy*!

A front-panel **FINE TUNE** control (which MFJ calls VFT or Variable Frequency

BOTTOM LINE

The MFJ-9406 is a welcome economy-class ticket to "The Magic Band." A superb performer for its price and great fun to use!

Table 1
MFJ-9406 6-Meter Transceiver

Manufacturer's Claimed Specifications	***Measured in the ARRL Lab***
Frequency coverage: Receive and transmit, 50.0-50.3 MHz.	Receive and transmit, 49.99-50.32 MHz.
Modes of operation: USB and CW (with CW adapter)	As specified.
Power requirement: Receive, 60 mA (S meter lamp disabled); transmit, 2.0 A (max) at 13.8 V.	Receive, 140 mA (including the S-meter lamp); transmit: CW, 1.02 A; SSB, 1.4 A; tested at 13.8 V.
Receiver	*Receiver Dynamic Testing*
SSB/CW sensitivity (bandwidth not specified, 12 dB S/N): 0.15 μV.	0.12 μV (–135 dBm).
Blocking dynamic range: Not specified.	87 dB.
Two-tone, third-order IMD dynamic range:	72 dB.
Third-order intercept point: Not specified.	–33 dBm.
S-meter sensitivity: Not specified.	S9 signal, 6 μV
Receiver audio output: 1 W at 10% THD into 8 Ω.	0.6 W at 10% THD into 8 Ω.
Spurious and image rejection: Not specified.	IF rejection 104 dB; image rejection 130 dB.
Transmitter	*Transmitter Dynamic Testing*
Power output: SSB, 10 W PEP; CW, 5-8 W	As specified.
Spurious-signal and harmonic suppression: 60 dB.	As specified. Meets FCC requirements for spectral purity.
SSB carrier suppression: Not specified.	≥ 50 dB.
Undesired sideband suppression: Not specified	≥ 60 dB.
Third-order intermodulation distortion products: Not specified.	See Figure 1
CW keying characteristics: Not specified.	See Figure 2
Transmit-receive turnaround time (PTT release to 50% audio output): Not specified.	S9 signal, ≈110 ms.
Receive-transmit turnaround time ("tx delay"):	≈17.5 ms.
Composite transmitted noise: Not specified	See Figure 3
Size (height, width, depth): 2.5×6.5×6 inches; weight, ≈2 pounds.	

NOTE: Dynamic-range measurements are made at the ARRL Lab standard spacing of 20 kHz.

Tune), works in conjunction with the main VFO knob. VFT controls *both* your transmit and receive frequencies at the same time—allowing you to tune in SSB signals for clear, pleasant, voice recognition or just keep abreast of the drift (more on that later). The control shifts frequency approximately ±2 kHz from its midpoint.

The front panel also has a separate red (on and) **OFF** button. There is a 5-pin (DIN-type) **MIC** jack, a 1/8-inch CW **KEY** jack (for use with the optional CW board), a red LED **TX** indicator and an analog S meter. The S meter measures signal strength on receive and ALC (**PROCESS**) on transmit.

The rear panel has three jacks plus one potentiometer that sets the mike gain.

The jacks include the **ANTENNA** jack for a 50-Ω antenna, a 5.5×2.1-mm coaxial power jack (for 12 to 14 V dc) and an **EXT**ernal **AMP** phono jack, which provides a ground path during transmit for keying an external 6-meter power amplifier. (Be sure to follow all of the manufacturer's instructions before using an external power amplifier with the '9406.) The factory setting for the mike gain pot was at the 12-o'clock position. This worked fine on the air. All transmit audio reports were excellent: "Very clear, with some audio punch," was one typical report. "Sounds really, really good. Great audio!" was another. The MFJ 9406 has built-in speech processing that—according to MFJ—gives you an added "4- to 6-dB advantage."

At first glance, the MFJ-9406 seemed to have all the bases covered, but I uncovered one glaring exception. As an avid 6-meter operator, there are times when I just can't hear the other station. The received signal may be down in the noise a little, or, worse, the kids are causing (playtime!) QRM in the background! (I have two boys, Adam, 6, and Ben, 8). To help me overcome such "obstacles," I usually grab my headphones so I can get a little "closer" to the desired signal. However, when I went to plug my 'phones into the MFJ-9406, I got stopped in my tracks! *What, no headphone jack?!* That's right, there is *no* provision for headphones. (We had the same complaint when we reviewed the MFJ-9420 Travel Radio; see "Product Review," *QST*, Feb 1996, p 76.)

A headphone jack sure would make a more-than-handy addition to this radio, and MFJ says it plans to include a 1/4-inch headphones jack in the future on its SSB transceivers. As this review went to press, MFJ announced that it is offering an adapter kit (MFJ-62) to add a headphones jack to this and its other SSB transceivers. The retrofit will provide a 1/4-inch jack on the rear panel that accepts both mono and stereo plugs.

While we're on the subject of audio, I found the receive audio from the 3-inch, top-firing, internal speaker to be quite good; it offered plenty of volume—even in a noisy mobile environment (like that found inside my 4-wheel-drive truck, for example). Audio from a loud, strong signal will distort if you crank the volume up too far. By the way, operating mobile with the MFJ-9406 turned out to be a frustrating experience because there's no noise blanker to kill the ignition noise. It may not be a problem in *your* vehicle, however. Of course, you could always use it only when you're stopped, say on a nice high mountain or hill. If MFJ had included an effective noise blanker, I'd have no problem recommending this radio to mobile ops.

The *Instruction Manual* for the MFJ-9406 is only seven pages long, but it still provides a good description of all the radio's features and controls. It also gives you good insight into why the 6-meter band is often called "The Magic Band." To introduce newcomers to 6 meters, it covers the different types of operating conditions you may encounter while on the air. For ragchewers and DXers alike, the manual also gives a brief explanation of the many different types of propagation typical on the 6-meter band, including tropospheric bending, sporadic E and FAI, meteor scatter, F2 and others. Sections on theory of operation and troubleshooting, a one-page schematic, a block diagram and a pictorial diagram—showing internal adjustment points—also are included. For convenience, the manual even reproduced the *ARRL Grid Locator for North America* map. For those who want to chase grid squares and earn your ARRL VUCC Award, all you have to do is work and confirm 100 different grid squares to qualify for the initial award. Try it! It's one of the most prestigious VHF operating awards the League offers. (Bill Moore, NC1L, DXCC Supervisor, e-mail **bmoore@arrl.org**, has details.)

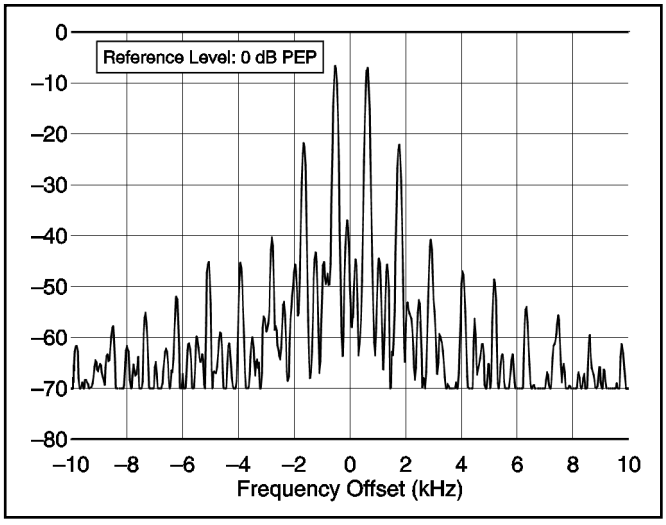

Figure 1—Worst-case spectral display of the MFJ-9406 transmitter during two-tone intermodulation distortion (IMD) testing. Worst-case third-order product is approximately 22 dB below PEP output, and the fifth-order product is approximately 40 dB down. The transceiver was being operated at 9.2 W PEP output at 50.2 MHz.

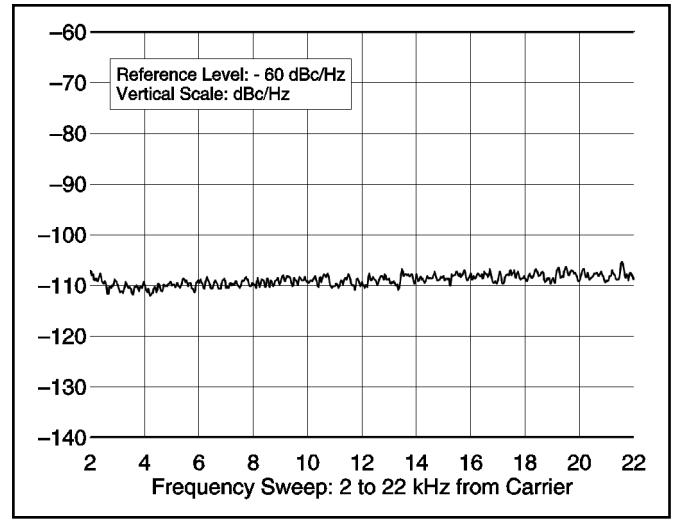

Figure 3—Worst-case spectral display of the MFJ-9406 transmitter output during composite-noise testing. Power output is 6 W at 50.2 MHz. The carrier, off the left edge of the plot, is not shown. This plot shows composite transmitted noise 2 to 22 kHz from the carrier.

On the Air!

"CQ 6 meters, this is KB1HY" With the band fading after a really good opening (as indicated by the "spots" on the local packet node), I was greeted by a reply to my CQ from a fellow ham in grid square EM-91 in southeastern Georgia! We exchanged reports—and out went the band. I was very pleased—especially during such marginal conditions—that my 10-W signal was being heard. That's part of the "magic" of this band!

My second contact was with a local, Joe, N1SBA, in Durham, Connecticut. Joe was also using a MFJ-9406, so this gave me a chance to hear his reaction to the radio, and to hear the transmit audio firsthand. Joe lives on a farm and mentioned that he was able to hear QRN from his electric fence and milking machine. (Another op also found it was quite vulnerable to computer hash that wasn't audible on his other 6-meter radio.) During the course of the review, we worked several other more-distant stations that were also using the MFJ-9406. On this end of the circuit, they all sounded quite impressive. One fellow allowed he was "having a ball" with his.

I have to say that I was impressed with the receiver, though. The preamp on the front end made it easy to copy signals that were way down in the noise. While we were occasionally troubled by QRM from strong, close-in signals when the band was crowded, most times, its six-pole crystal IF filter did an adequate job. On the transmit side, the MFJ-9406 also has a built-in seven-element low-pass filter to help minimize the chances of FM broadcast interference and TVI (you wouldn't want any phone calls or knocks at your door from your neighbor while you're making contacts with those rare grid squares).

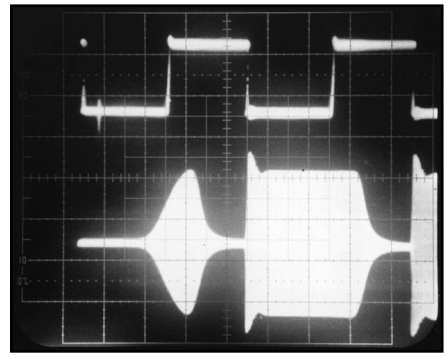

Figure 2 —CW keying waveform for the MFJ-9406 in the semi-break-in mode. The upper trace is the actual key closure; the lower trace is the RF envelope. Horizontal divisions are 10 ms. The transceiver was being operated at 6 W output at 50.1 MHz. Note the significant shortening and slower rise time of the first dit.

I did encounter a problem with frequency stability. The review radio would shift (or drift) from its initial operating frequency. ARRL Lab testing confirmed this. When first turned on, the radio drifted lower in frequency by a few dozen Hz, then drifted higher in frequency—less than 450 Hz all told in the space of an hour. Curiously, I didn't notice the drift problem while talking to N1SBA. Perhaps it was because we were both using the same radio and were drifting along in sync! During other contacts, however, I found myself retuning a lot as the QSO progressed. Just a small correction with the **FINE TUNE** control was enough to put the radio back on track. This wasn't a problem when making quick contacts. But, while ragchewing for any length of time, it was pretty annoying for both parties.

Conclusions

After many years as a 6-meter operator—and after owning numerous radios for this band—I enjoyed the MFJ-9406 immensely. It's an affordable, compact, easy-to-operate transceiver. While it doesn't have some of the typical creature comforts—like a noise blanker or a headphone jack—it does incorporate many excellent features.

When the band was open, I found its 10 W of SSB output let me work just about any station I could hear. The built-in speech processor gives you the punch needed to cut through QRM, too. Don't let the analog tuning scare you away. Earlier, I coined the phrase "analog accuracy," because I believe you'll have few problems when tuning to your favorite operating frequency. The CW adapter board lets you run 5 to 8 W. The sidetone is via a piezo sounder on the adapter board, however, not through the speaker.

All in all, I think this radio would make an excellent choice for your first 6-meter station. While the MFJ-9406 lacks some of the features of "full-sized" 6-meter radios (or HF radio/transverter combinations), it sure puts you on the band quickly and at minimal expense (about the same as you might spend for a transverter to use with your HF transceiver). The MFJ-9406 puts The Magic Band within easy reach.

My thanks to Rick Lindquist, KX4V; Mike Gruber, WA1SVF, of the ARRL Lab; and Glenn Swanson, KB1GW, for their valuable contributions to this review.

Manufacturer: MFJ Enterprises Inc, PO Box 494, Mississippi State, MS 39762; tel 601-323-5869; fax 601-323-6551; Manufacturers suggested retail price, MFJ-9406, $249.95; MFJ-9406X (includes the MFJ-290 hand mike), $259.95; MFJ-4110 ac power supply, $39.95; MFJ-4114 battery pack, $69.95; MFJ-416 CW adapter; $39.95. MFJ-62 headphones adapter, $4.95.