Product Review Column from *QST* Magazine

July 1993

MFJ 9017 18-MHz QRP CW Transceiver

PacComm PSK-1T Satellite Modem and TNC

Conducted By James W. Healy, NJ2L
Senior Assistant Technical Editor

MFJ 9017 18-MHz QRP CW Transceiver

Reviewed by Bruce S. Hale, KB1MW

I built my first QRP transmitter (a Tuna-Tin 2) just after I got my General-class license. Since then, I've used a number of home-brew QRP rigs (and a modified Heath HW-7). My latest favorite is a home-brew 1.5-watt, 18-MHz transceiver, so when I saw that the MFJ QRP transceiver series includes one for 18 MHz, I jumped at the chance to review it.

Out of the Box

The MFJ 9017 doesn't look complicated. I like that; a QRP rig should be simple, not intimidating. It's got only three knobs (**VOLUME, TUNE**, and **RIT**), one switch (**POWER**), and two LEDs (**PWR** and **XMIT**) on the front panel. The back panel supports an SO-239 antenna connector, two ⅛-inch phone jacks (for the key and headphones) and a small coaxial power connector. The case is MFJ's familiar black with a brushed aluminum front panel, and the speaker is mounted in the lid.

The manual is simple, but the first-time setup instructions don't start until page 5. Page 1 is an introduction, pages 2 and 3 are the technical specifications and circuit description, and page 4 shows the front- and back-panel layouts. I'd prefer to have the quick-setup directions appear first. The manual includes sections on antennas, getting the most from your QRP station, troubleshooting, alignment procedures, and a complete parts list and schematic diagram.

Versions of this radio are available for all the ham bands from 40 through 15 meters. The series has but two options: an internal CW keyer and an audio filter to narrow its stock receiver bandwidth to 700 Hz.

Setup

Getting the 9017 on the air is a breeze. MFJ provides a coaxial plug to match the power jack (it's a standard size, so you can buy more at Radio Shack to connect your gel cells for portable operation, car battery and so forth). I plugged my dipole into the antenna jack and connected the power supply and key with clip leads. This is when I wanted the setup instructions first in the manual—I was in a hurry, and I needed the power-plug polarity. The rig is protected from clumsy writers who won't read the directions—MFJ includes a protection diode in the rig so that it blows a fuse if you get the polarity wrong.

Once everything was connected, I switched on the rig and was rewarded with plenty of signals. The audio amplifier puts out barely enough power to drive the speaker; I ran it close to full volume most of the time. With headphones, however, full volume is painfully loud.

The rig's power output is internally adjustable to less than 1 µW. The manual explains the adjustment procedure, and cautions you not to increase power past the factory-preset level to avoid adversely affecting the rig's spectral purity. There's one catch: Sidetone level is proportional to power output; below 10 mW or so, the rig doesn't produce useful sidetone output.

On the Air

The 9017 performs well on the air. 18 MHz is a great QRP band; I worked almost everything I could hear. I didn't spend much time calling CQ—I stuck with more effective QRP operating techniques like answering CQ calls or "tail-ending" (calling one of two stations who've just finished a QSO). I even worked a station in Japan during the first hour I had the rig on the air, using a dipole antenna 8 feet off my roof.

The receiver includes the audio-derived AGC circuit published in *QST* by its designer.[1] As is all but guaranteed by audio-derived AGC, this results in overshoot-induced popping at the onset of strong signals. With moderate to weak signals, you won't hear it. This characteristic, though sometimes objectionable, is acceptable in a transceiver of this price class and complexity.

When you key the transmitter, a relay switches the antenna and mutes the receiver. The relay switches back to receive after an internally adjustable delay of 10 to 720 milliseconds. At the fastest setting, you can hear the band between keyed elements—but the relay is *very* loud and distracting to operate this way. I recommend setting the delay somewhat slower. The manual mentions that this adjustment can be made, but doesn't tell you how. The schematic shows that potentiometer R44 sets the delay.

As you can see from the lab results, the 9017 has a hard keying waveform. This results in audible key clicks in the lab tests, but none of my on-the-air contacts could hear key clicks (I asked).

What I Like, What I Don't Like

Overall, I like this rig. It's easy to set up and operate. With a gel cell and the optional built-in keyer, it makes a great portable station. The receiver is sensitive and selective enough (although the optional filter would make it better), and the tuning is smooth. The case is rugged and it looks like it could survive even an airline baggage handler.

Of course, I'd change a few things (have *you* ever owned a radio so wonderful that you wouldn't change *anything*?). I'd try to find a quieter TR relay. I wish the sidetone level and pitch was adjustable. You can adjust the sidetone pitch, but the sidetone is generated by injecting some of the transmit oscillator into the receiver, so adjusting the sidetone pitch shifts the transmit offset. I'd also replace the monaural phone jack with a stereo jack to make it easier to use portable

[1] R. Littlefield, "Construct an Audio Amplifier with AGC for Your Simple Receiver, *QST*, Apr 1983, pp 28-31.

The Bottom Line

A small, lightweight QRP transceiver with basic features and good performance, the MFJ 9017 is fun to use and represents a good dollar value.

Table 1
MFJ 9017 18-MHz QRP Transceiver, Serial #17E2376

Manufacturer's Claimed Specifications	*Measured in the ARRL Lab*
Frequency coverage: 18.060-18.115 MHz.	18.065 to 18.110 MHz.
Mode of operation: CW.	As specified.
Power requirement: 12-15 V dc at 1 A max (transmit) and 50 mA (receive).	At 13.8 V: transmit, 1 A max; receive, 46 mA typ.
Receiver	*Receiver Dynamic Testing*
Sensitivity: "Better than 18-MHz noise floor."	Minimum discernible signal (noise floor): –129.7 dBm.
Blocking dynamic range: Not specified.	Blocking dynamic range:* 101 dB.
Third-order IMD dynamic range: Not specified.	Two-tone, third-order IMD dynamic range:* 80 dB.
Third-order input intercept: Not specified.	–10 dBm.
Receiver audio output: Not specified.	120 mW at 1% THD into 8 Ω (maximum audio output).
Receiver IF/audio response: Not specified.	At –6 dB: 1181 Hz, centered at 700 Hz.
Transmitter	*Transmitter Dynamic Testing*
Power output: More than 4 W into 50 Ω.	Internally adjustable from 0 to 4.1 W.
Spurious-signal and harmonic suppression: At least 30 dB below carrier.	As specified. The MFJ 9017 meets FCC specifications for spectral purity for equipment in its power-output class and frequency range.
CW-keying characteristics: Not specified.	See Fig 1.
Transmit-receive turnaround time (PTT release to 50% audio output): Not specified.	Adjustable from 10 ms to 720 ms.

Size (height, width, depth): 2.5 × 6.5 × 7.25 inches; weight, 1.8 lb.

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

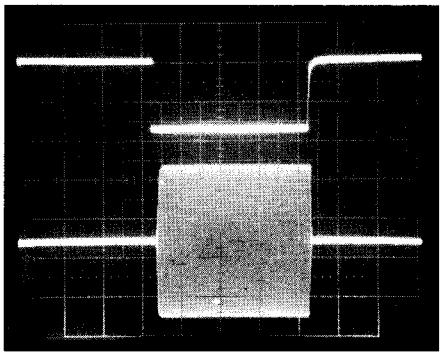


Fig 1—CW-keying waveform for the MFJ 9017 in the semi-break-in mode. The upper trace is the actual key closure; the lower trace is the RF envelope. Horizontal divisions are 5 ms. The transceiver was being operated at 3.9 W output at 18.070 MHz.

stereo headphones.[2] Finally, the optional built-in keyer is a great idea, but its speed control mounts on the back panel. I'm not sure if I'd really change this, though; the front panel is nice and simple as it is, and most people will probably want to use an external keyer anyway.

[2]MFJ says that they now use a quieter TR relay and stereo headphone jacks in these radios. —*Ed.*

Conclusion

This is a well-designed, well-built radio. If you've got an older rig that doesn't cover 18 MHz, this is a great way to try the band (and QRP at the same time). If you're looking for a rig to take on your next vacation, think about one of the MFJ series. And if you're like me and you want to simplify your radio activity, this rig will get you back to the basics and let you think about what's on the air, instead of how you got there.

Manufacturer: MFJ Enterprises, Inc, PO Box 494, Mississippi State, MS 39762, tel 601-323-5869, fax 601-323-6551. Manufacturer's suggested retail prices: MFJ 9040, 9030, 9020, 9017 and 9015 (one each for the 40- through 15-meter ham bands), $179.95 each; MFJ-726 optional audio filter, $29.95; MFJ-412 optional keyer, $39.95.

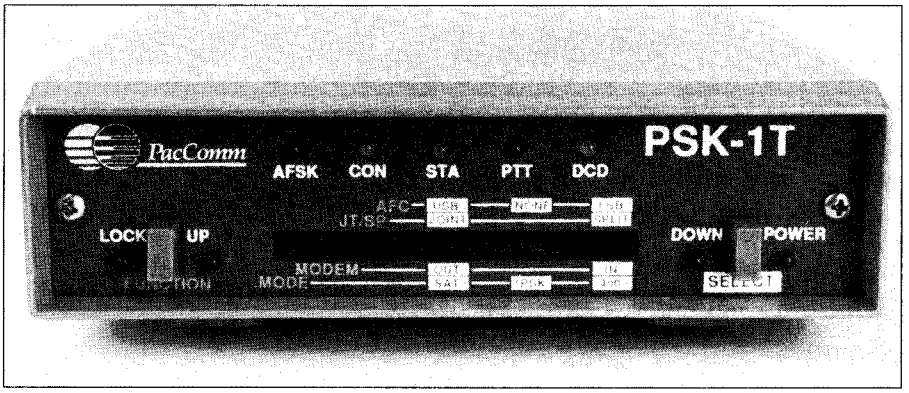
PacComm PSK-1T Satellite Modem and TNC

Reviewed by Steve Ford, WB8IMY

Four 1200-bit/s packet satellites are in orbit (OSCARs 16, 18, 19 and 20), and a few more are on the way. These satellites use *Manchester* FSK on their 2-meter FM uplinks and PSK (phase-shift keying) on their 70-cm downlinks. They're ideal for packet enthusiasts because they offer the ability to exchange messages and other files with hams throughout the world, with simple equipment requirements. All you need is a 2-meter FM transceiver for the uplink (20 to 30 watts will do) and a 70-cm SSB receiver for the downlink. In many cases, the satellites can be accessed without directional antennas.

The only potential stumbling block is the TNC. The TNC you use for connecting to your local packet bulletin board won't do the job for packet satellite operating. The problem is the TNC *modem*. Not only must this modem generate a Manchester FSK signal for the uplink, but it must have the ability to decode the PSK downlink signal. One solution is to purchase an outboard packet satellite modem and wire it into your TNC. If you're comfortable with the idea of bypassing your TNC modem and connecting the outboard modem, you're home free. Otherwise, you'll be looking for a more elegant alternative. This is exactly what PacComm provides with its PSK-1T satellite modem/TNC.

In the PSK-1T, PacComm combines its



The Bottom Line

For those interested in terrestrial and satellite packet operation—but who don't need or want a more comprehensive multimode communications processor—the PSK-1T offers solid performance at a reasonable price.

PSK-1 satellite modem and its Tiny-2 TNC in a single enclosure. You can enable the satellite modem when you want to operate the PACSATs, or switch to the AFSK modem for terrestrial packet. The switching function is performed without connecting or disconnecting cables: You select the mode via a front-panel switch or your terminal software.

Installation

Two manuals are provided with the PSK-1T: one for the PSK-1 modem and one for the Tiny-2 TNC. The PSK-1 manual contains the information needed to install the PSK-1T, although this wasn't clear until I spent a few moments exploring both books. The PSK-1 manual also describes how to switch between the satellite modem and the TNC.

The installation instructions are sufficient for any ham with a reasonable amount of technical competence. An appendix offers useful information concerning the use of the PSK-1T's up/down control lines to automatically compensate for Doppler shift of the receive signal. The appendix also provides modification tips for the Kenwood TS-711A and -811A, and the Yaesu FT-736R.

The best advice is to read the manual *carefully*. A number of instructions apply *only* to the PSK-1 board—not the PSK-1T as a unit. Because the model designations differ by only a single letter, it's easy to become confused!

The procedure for connecting the PSK-1T to your computer is the same as that for any standard packet TNC. A shielded serial cable—with female DB25 and DB9 connectors—is provided with the PSK-1T. This cable connects the satellite modem to an RS-232-C computer port. (The PSK-1T doesn't support TTL interfacing.) All you need is standard terminal-emulation software to communicate with the PSK-1T. The default data rate is 9600 bits/s. You can change the PSK modem's data rate through your terminal software. The Tiny-2 TNC data rate must be changed via an internal DIP switch.

The radio connections are more involved, depending on your station configuration. If you own a dual-band satellite transceiver, all connections are made via the **MAIN RADIO** connector with an 8-pin DIN plug. A prewired cable is provided, although you must attach the appropriate connectors to interface your radio. Transmit audio output, the PTT line, the receiver audio input, and the receive UP/DOWN control lines are available at this port.

If you're using two separate rigs (such as a 2-meter FM transceiver and a 70-cm all-mode transceiver), you'll also use the PSK-1T's **AUXILIARY** connector. This is a handy solution to a potential wiring nightmare. You can connect your receiver to the auxiliary port and your transmitter to the **MAIN RADIO** port.

Transmit-audio connections are made to the microphone input, or to an auxiliary audio input, if one is available. Receive audio is obtained from the external speaker jack or auxiliary audio connector. I find it best to use the auxiliary receiver audio output because it lets me continue listening to the satellite's signal while I'm tuning.

My initial use of the PSK-1T was hampered by a frustrating problem. Whenever I connected the PTT (push-to-talk) line to the transceiver, the rig keyed immediately and continued to transmit until the cable was removed. I checked the usual suspects, such as the cable wiring, software configuration and so on. Everything appeared to be okay.

That left the keying FET (Q2) as the most likely culprit. As it turned out, Q2 was not defective—it was installed *backward*. After the FET was properly installed, the PSK-1T keyed the transceiver reliably.[3]

The PSK-1T provides two openings on the rear panel to permit access to trimmer pots for AFSK and PSK level adjustments. You don't need to worry about the PSK level unless you're using the PSK-1T to operate terrestrial PSK packet. The convenient AFSK level adjustment made it easy to control the transmit-audio level to my 2-meter FM transceiver for FSK satellite work and terrestrial packet.

Satellite Operation

When you apply power to the PSK-1T, you're presented with a configuration menu that indicates the current state of the unit. The PSK-1T defaults to the AFSK TNC mode at power-up, as indicated by the **AFSK** LED on the PSK-1T's front panel. You can use the front-panel **SELECT** button to switch to the PSK satellite modem, or make the choice via the configuration menu.

The on-screen configuration menu gives you quick access to parameters such as the *maximum step rate*, which controls the rate at which the PSK-1T sends the UP/DOWN tuning pulses to the receiver. I use a step rate of six per second. It's best to use the highest step rate that produces reliable performance with your radio.

Using Fuji-OSCAR 20 with my 70-cm receiver in the SSB mode (USB or LSB, whichever offers the best copy), I find it a simple matter to tune the signal until the **LOCK** LED illuminates. At that point, the PSK-1T begins sending tuning pulses to my receiver to maintain a lock on the downlink frequency. As with any PSK satellite modem, it takes a little experimentation to tune the signal properly. Even though the PSK-1T indicates a signal lock, that doesn't mean you're exactly on frequency. In each case, I had to tune back and forth through the passband until text began appearing on my screen.

[3]According to Bob Klock, PacComm Chief Engineer, this problem arose from an error on the PC board silk screening. They revised the silk screen, and all units shipped since early this year should key radios correctly.

The PSK-1T offers excellent performance on weak signals. This makes it much easier to tune the satellite signal as soon as the bird pops over the horizon—even when the signal is buried in noise. Once the signal is correctly tuned and locked, the PSK-1T doggedly tracks it throughout the pass. It sometimes loses lock during deep fades, but quickly recovers when signal strength increases.

With the PSK-1T, I was able to make a number of connections to OSCAR 20 with an uplink power of only 25 watts and omnidirectional antennas. Even so, I connected and communicated with the satellite reliably.

It's worthwhile to note that the PSK-1T can receive 400-bit/s OSCAR 13 telemetry. This function is selected from the configuration menu.

Terrestrial Operation

It's quite convenient to be able to switch back to terrestrial AFSK packet operating after a satellite session. As I mentioned, this is accomplished from the configuration menu or the front-panel **SELECT** switch.

When operating terrestrial packet, the PSK-1T functions just like a normal packet TNC. Since the Tiny-2 TNC in the PSK-1T is essentially a TAPR TNC-2 clone, packet users will find most of its commands familiar. The Tiny-2 manual is well written and explains packet operating practices. HF and VHF packet are supported by the PSK-1T.

The PSK-1T also includes a personal message system (a TNC mailbox). The personal message system, *PMS*, makes it possible for friends to connect to your station and leave messages to you or others. The PMS also supports forwarding from, and reverse forwarding to, your local (home) PBBS. By making the appropriate arrangements with the PBBS SysOp, you can receive and send mail directly from the PMS.

I found the performance of the PSK-1T on terrestrial packet to be comparable with other TNCs I've used. The PMS feature functioned reliably, although I did not use the forwarding features. The computer interface is straightforward and easy to use. I also successfully operated the PSK-1T in the KISS mode on the local TCP/IP network.

Summary

The PacComm PSK-1T is a good choice if you want to be active on terrestrial and satellite packet, switching between the two in seconds. The convenience of having this dual capability in a single device is well worth the cost. (The alternative is a multimode DSP controller at more than twice the price.) The PSK-1T also offers a solution to the hassle of wiring external PSK modems to existing TNCs for satellite operation. With the PSK-1T, you simply make the proper connections and you're on your way!

Manufacturer: PacComm Packet Radio Systems, 4413 N Hesperides St, Tampa, FL 33614-7618, tel 813-874-2980. Suggested retail price: $379. QST