

JT65 — The “Musical” Mode

If you’ve been hearing something that sounds like music on the HF bands lately, it may not be your imagination.

Steve Ford, WB8IMY

“I’m hearing a strange signal on several HF bands. It sounds like someone sending random tones or music. It plays slowly for almost a minute, stops for a while, and then plays again. What is it?”

At the time this article was written, this question was arriving in e-mail IN boxes of the ARRL Headquarters Regulatory Branch at a rate of about one per week. Some amateurs even send audio recordings of the suspicious signals. Chuck Skolaut, KØBOG, our Field and Regulatory Correspondent, always smiles as he listens to the recordings because he knows the answer by heart: *JT65*.

By now amateurs are used to the sounds most digital modes create. They’ve learned to recognize the constant warbling tones of PSK31, the rhythmic pulses of PACTOR, the scratchy rumbles of Hellschreiber or the multi-tone music of RTTY, MFSK16, Olivia and others.

But *JT65* is unique. It marches, as Thoreau said, to the beat of a different drummer. If you’ve never heard it before it will stop you cold. As you tune across a *JT65* signal you’ll hear tones of varying pitch that “play” slowly, like someone lazily blowing on an electronic flute.

Cryptic and strange as the tones may be, you might be surprised to learn that they carry call signs, signal reports and other bits of information. Even more surprising is the fact that this information can be extracted even if the *JT65* signal is almost inaudible.

The “JT” in JT65

JT65 debuted as part of the *WSJT* software suite created by Dr Joe Taylor, K1JT. As a Nobel Prize winning scientist who studies pulsars and other distant astronomical objects, Joe has a keen interest in weak signals. Joe’s software exploits the power of modern desktop and laptop computers to separate weak signals from noise and decode the information they contain. With just a transceiver and a sound-equipped computer or an external sound device, *WSJT* makes it possible for hams with modest stations to enjoy VHF meteor scatter communication and even moonbounce, in which signals are literally bounced off the surface of the Moon and returned to Earth.

Soon after its debut, *JT65* attracted the attention of the moonbounce community and it was an instant success. Thanks to *JT65*, amateurs with single long boom Yagi antennas and 150 W of RF output could experience the thrill of communicating over the longest “long path” of all.

But it wasn’t long before someone wondered what would happen if *JT65* were used on the HF bands. Digital communication on HF isn’t nearly as challenging as getting a signal to the Moon and back, so it stood to reason that there would be plenty of “performance margin” to provide fascinating results here on Earth. To no one’s surprise, this turned out to be true. Using a variant of *JT65* known as *JT65A*, even a few watts of *JT65* modulated RF applied to a wire dipole antenna resulted in transcontinental and even global communication.

Dedicated JT65 Software

JT65 is one of several modes in the *WSJT* package, available for free downloading on the web at physics.princeton.edu/pulsar/K1JT/Download.htm. However, Joe Large, W6CQZ, thought more amateurs might try *JT65* on HF if it were available in a form designed to appeal to the less computer savvy among us. The result was his *JT65-HF* appli-

cation and it soon proved John’s hunch correct.

Since Joe’s software appeared, *JT65* activity on the HF bands has increased substantially. As with *WSJT*, *JT65-HF* is also free for downloading at sourceforge.net/projects/jt65-hf/files.

So What is JT65 Anyway?

The short and simplified answer to this question is that *JT65* is a weak signal digital mode that uses precisely timed transmit-receive sequences. You transmit for about one minute and listen for one minute. Transmission actually begins 1 second after the start of a UTC minute and stops precisely 46.8 seconds later. There is a 1270.5 Hz synchronizing tone and 64 other tones. The combination gives *JT65* its unusual musical quality.

Tight time and frequency synchronization is critical to *JT65*. Your SSB transceiver needs to be reasonably stable, although I’ve yet to see a modern commercial radio that is too “drifty” for *JT65*. Drifty computer time is a different matter, however. *Windows* PCs are notorious for sloppy timekeeping. You can’t always rely on the *Windows* Internet time application to keep you in sync. Instead, I recommend the free time-synchronizing application *Dimension 4* that you can download at www.thinkman.com/dimension4/.

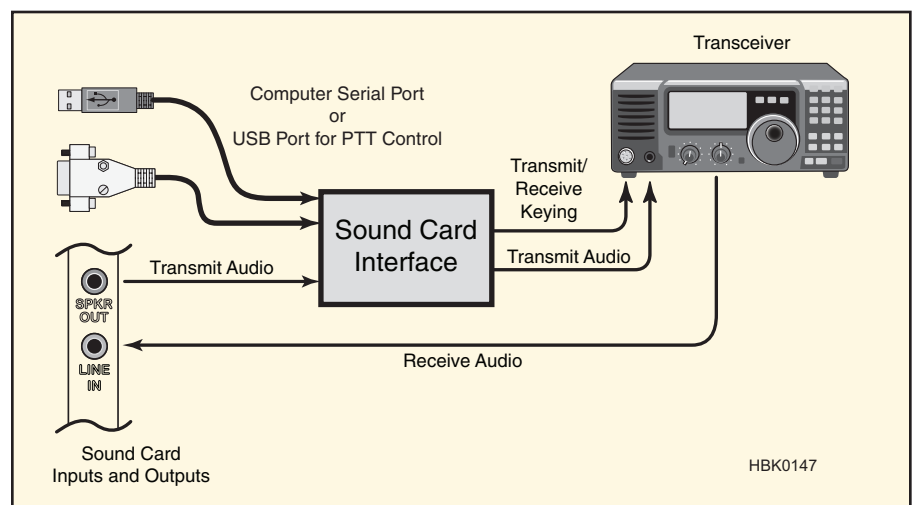


Figure 1 — To operate *JT65*, you’ll need an interface between your computer and your transceiver.

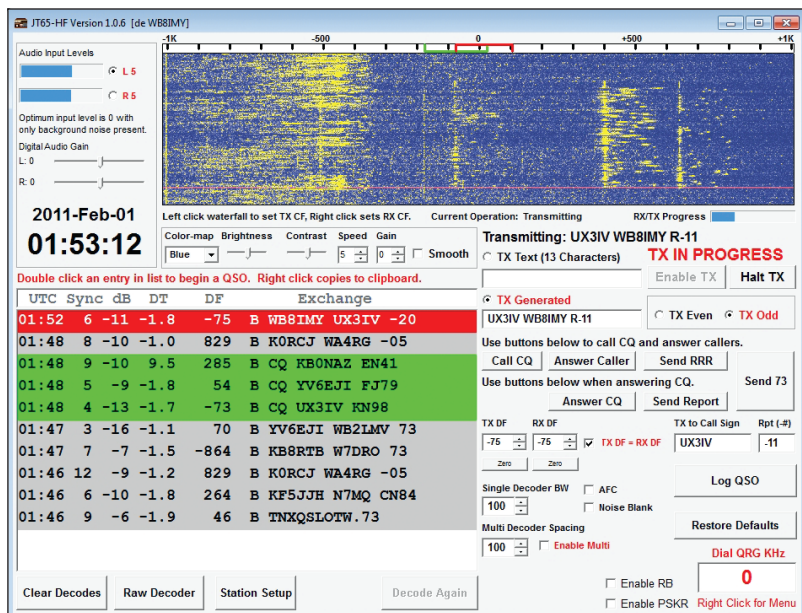


Figure 2 — JT65-HF in action on 20 meters. Note the green painted text. These are stations calling CQ. See the red line? That's UX3IV giving me a signal report. I'm -20 dB at his end, which is pretty weak. Then again, I was only running 5 W on 40 meters to a vertical antenna!

Install the application and set it up so that it loads and runs constantly in the background whenever you start your computer.

JT65 is not a “conversational” mode as, for example, PSK31. Instead, the idea is to exchange just the basic information required for a valid contact — call signs and signal reports. This isn't to say that you can't send other information. I've occasionally seen stations send such things as brief descriptions of their antennas, or how much power they were running.

JT65 contacts count for many awards such as Worked All States or the DX Century Club. Aside from the fun of award chasing, it is amazing to see who you can contact with JT65 while using minuscule amounts of power. Some JT65 enthusiasts are using output levels in the *milliwatt* range.

JT65 performs so well, it has been a boon to hams living with severe antenna restrictions. Amateurs running 5 W to indoor antennas are making DX contacts on a daily basis with JT65, even with our less-than-stupendous band conditions.

Getting Started

Most amateurs trying JT65 on the HF bands are using W4CQZ's software. If you're already set up for digital modes such as PSK31 and RTTY, getting on the air with JT65-HF is as easy as installing and configuring the program. Step-by-step instructions about how to configure and use JT65-HF would require more QST pages than I have available, so the best course of action is to download and read W6CQZ's excellent setup guide at hfradio.org.uk/jt65-hf_setup.pdf.

If you are starting entirely from scratch,

Table 1 Common JT65 Frequencies

All frequencies (kHz) assume a transceiver display in USB mode.

1838
3576
7076 (European stations often use 7039)
14,076
10,139
18,102
21,076
24,920
28,076

you'll need an interface to route the audio from your computer to (and from) your HF transceiver. This same interface also controls transmit/receive switching (Figure 1). Some interfaces also have sound devices built-in and use USB cables to attach to your computer; they're virtually plug-and-play. Check with your favorite dealer or the advertising pages of QST and you'll find interfaces from MFJ, microHAM, Rig Expert, Tigertronics, West Mountain Radio and others.

It is important to stress that you must avoid overmodulating your transceiver while transmitting JT65. If you see any movement of your ALC meter, or if the ALC meter indicates that the modulation level is edging out of the normal range, you'll need to decrease the audio from your computer. Overmodulated signals are not only difficult if not impossible to decode, they'll also obliterate nearby signals, making you very unpopular very quickly.

To properly configure the JT65-HF software, you'll need to know your Maidenhead grid square designation. If you don't know

your grid square, you can find out online by using K2DSL's handy calculator at www.levinecentral.com/ham/grid_square.php. Just enter your postal ZIP code.

Regardless of the sound device you're using, compensating for sample rate errors is important for getting the best performance from JT65. Fortunately, most JT65-HF users can simply check the setup box labeled ENABLE AUTOMATIC RX/TX SAMPLE RATE CORRECTION and the software will take care of it.

Speaking of the JT65-HF software, once you have it correctly configured, using the program is surprisingly easy. In Figure 2 you'll see a typical on-air screen. Text from any station calling CQ is highlighted in green. If you want to make contact, just double click your mouse on one of the green lines. JT65-HF will automatically generate the exchange text and will determine when to transmit.

Stations take turns transmitting, depending on whether it is an “even” or “odd” minute. For example, let's say that you decoded my CQ at 2144 UTC. That's an even minute since 44 is an even number. If you double click on my CQ line, you'll notice that JT65-HF automatically sets itself up to transmit on the odd minute because it “knows” that I am transmitting on even minutes. If you waited until 2146 to click on my text, JT65-HF won't begin transmitting until the next odd minute: 2147. When you call CQ, you can choose to transmit on either odd or even minutes.

When the other station replies with your call sign, the line will be painted in red. Double click that line and JT65-HF will set up the next exchange. In theory, you can complete an entire contact by just clicking your mouse on the decoded lines, so long as JT65-HF can make sense of what the other station is sending. If not, you'll have to switch to manual.

JT65 contacts aren't rapid fire affairs. You can putter around your station, work on a project, carry on a conversation and do other things while occasionally glancing at the screen and clicking your mouse as necessary.

Where to Find JT65

Most JT65 activity appears to be taking place on 20 meters at the time of this writing. Even so, I've heard JT65 on 40 and 80 meters as well. A list of common JT65 frequencies appears in Table 1.

And if you've never heard JT65 on the air, go to the QST In Depth page on the ARRL web at www.arrl.org/qst-in-depth. Scroll down to the 2011 files section, expand it and look for the audio file JT65.mp3. When you find it, click on the file name and either open it or save it to your hard drive. When you play the file you'll hear an example of JT65 activity recorded on 20 meters in late January.

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