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The Accidental EME QSO

Dave Scroggins, W7OJT, and Mike Hasselbeck, WB2FKO

While trying to set up a tropo scatter contact, the authors instead discover EME!

Do you think radio communication by moon reflection is the exclusive playground of megabuck stations with big amplifiers and enormous antenna arrays? That used to be the case, but with the availability of Joe Taylor's *WSJT* software, this is no longer true. I recently became a believer, and then only by complete accident!

WSJT stands for Weak Signal communication by Joe Taylor, K1JT. The software can be conveniently separated into two general modes. The *FSK441* mode uses very high data rates to allow communication via reflection from short-lived meteor ionization trails that randomly light up the upper atmosphere. These meteor bursts are called pings. The *JT65* mode of *WSJT* uses advanced signal processing techniques to decode very weak but generally steady signals that are often inaudible to the ear. This mode was designed primarily with EME (earth-moon-earth) communication in mind and is now in worldwide use for this purpose. The *WSJT* software is free and can be downloaded from **pulsar.princeton.edu/~joe/K1JT/**.

By the end of 2004, I was getting the knack of FSK441, having made dozens of contacts with stations throughout the western United States via meteor scatter on 144 MHz. Most of these were accomplished in non-shower conditions, using meteor pings that randomly but constantly enter the Earth's atmosphere. I have a fairly modest station at my Las Vegas, Nevada location: a single 10 element beam and a brick amplifier.

Coauthor Dave Scroggins, W7OJT, shows off the modest 10 el beam he used to make contact with world-class EME op Dave Blaschke, W5UN. W7OJT also holds a W5UN QSL card that documents the historic event.

We Try to Span the 500 Miles Between Us

Most meteor scatter QSOs are arranged by schedule on a Web site appropriately called "Ping Jockey" (**www.pingjockey.net/cgi-bin/pingtalk**). Late one winter evening, coauthor Dave, W7OJT, spotted his friend (and coauthor) Mike, WB2FKO, in Albuquerque, New Mexico, on Ping Jockey. We had previously worked each other on FSK441 meteor scatter, but we had been trying for several weeks to cover the 488 mile path between us using JT65. This mode is well suited for long-haul contacts like this, where the signals are extremely weak. JT65 is very effective at pulling information out of the white noise.

Without the aid of meteors, troposcatter enhancement or sporadic E, we found the Las Vegas to Albuquerque path to be a formidable challenge on 2 meters. The miles of tall mountains in northwest Arizona are probably the largest factor preventing us from completing a JT65 QSO. But we continued to try, making several attempts.

Using the chat site, Dave asked Mike if he'd like to attempt a QSO. He agreed and we moved to the JT65 page of Ping Jockey to choose the operating parameters. Both *WSJT* modes require the two stations to be appropriately synchronized—you have to be listening when your QSO partner is transmitting, and vice versa. In JT65, it is necessary to have the two stations' computer clocks closely synchronized. This is accomplished using one of a variety of time references on the Internet or a handheld GPS. You also have to agree on who transmits when—in JT65 you alternately transmit and receive every other minute.

We set the sequences and began to scan the band for a quiet frequency. Mike suggested 144.130 MHz, but I had a birdie there. *Birdie* is the general term describing a carrier or other noise from various electrical sources such as pagers, cordless phones, poorly filtered home entertain-

ment systems and computers. Birdies are all over the VHF bands in heavily populated areas. I asked Mike to move down to 144.129 MHz where it was quiet. He was fine with the new frequency and our attempt began.

So did we have an EME contact officially logged? No, not yet. A valid EME QSO requires exchange of both call signs and a report, which is typically the Maidenhead grid square coordinates of both stations. We both had to enter appropriate call signs in *WSJT* and start over. But I had a problem that made the situation urgent—the moon was rising up in the sky and out of the main lobe of my beam! W5UN can track the moon as it moves across the sky, as his antenna array can elevate. My antenna is fixed horizontally so I have no such luxury. Dave's JT65 signals were actually audible when Mike and I first started, but he was fading quickly!

Is *WSJT* Your "Next Big Thing"?

If your interest has been piqued, here are some other *WSJT* resources.

- J. Taylor, K1JT, "*WSJT:* New Software for VHF Meteor-Scatter Communication," *QST*, Dec 2001, pp 36-00. The article is available on the ARRLWeb at **www.arrl.org/tis/info/pdf/0112036.pdf**.
- S. Ford, WB8IMY, "*WSJT*—A Different Way to Enjoy 6 Meters" (sidebar to "What to Expect on 6"), *QST*, Aug 2004, p 51.
- S. Horzepa, WA1LOU, "High-Speed CW Meteor Scatter Simplified," *QST*, Nov 2001, p 86.

Another Party Heard From

I was surprised as a signal almost immediately appeared on the *WSJT* screen. We were off to a great start and it looked like Mike and I would finally complete this difficult QSO. But there was a problem: The signal I was monitoring was over 500 Hz away from the agreed frequency—I was certain Mike's transceiver was not that far off. I thought an inaudible birdie must be confusing the program. Then the signal started to decode on the *WSJT* screen and I saw an unexpected call sign—W5UN. Okay, now I was pretty sure that I was getting a bogus decode as *WSJT* struggled to make sense out of a weak birdie.

While all this was occurring, Jeff, K7XQ, was monitoring the JT65 EME chat Web site. Jeff was waiting for the moon to rise over his horizon, at which point he was looking to schedule an EME QSO with someone else monitoring the Web site traffic. A message from Dave, W5UN, on the EME chat page indicated that he was also receiving strange call signs from his enormous 2 meter array in Texas: these call signs were WB2FKO and W7OJT. Jeff recognized the calls and quickly realized what was going on—there was QRM off the moon!

W5UN moved over to the Ping Jockey page where Mike and I were and he informed me that he was decoding my signals by way of reflection off the moon. He was certain this was EME and not a freak terrestrial path because the time lag of my signal was just as would be expected for moon reflection. This was almost too incredible to believe, but it was indeed the case. Three coincidences allowed it to happen: (1) When I pointed my small beam at Mike I was also aimed at the moon rising on my horizon, (2) by complete accident Mike and I had picked the frequency that W5UN was operating on and (3) I fortuitously chose to transmit on the time sequence when W5UN was listening!

Wow—Low Power EME!

My small, horizontally polarized beam is designed to concentrate transmitted RF power on the horizon. It does a good job, but it's not perfect. Radiation lobes exist above and below the horizontal plane of the antenna and when the moon moved up into the first lobe, Dave's signals came back. We exchanged the required information and completed the EME QSO!

I never dreamed that EME was even remotely possible with my small setup. But the world-class EME station of W5UN and the incredible weak signal capabilities of the *WSJT* software made it happen. And a little of that Las Vegas luck that we are so famous for didn't hurt either!

David Scroggins, W7OJT, is employed as a Treatment Plant Operator for the county Water Reclamation District in Las Vegas, Nevada. Originally licensed as WN2IVX around 1963, he became more active after moving to the Southwest in 1976. He was mostly on HF CW until purchasing a small multimode 2 meter/70 cm radio. Now he's having a lot of fun using the WSJT digital modes on meteor and tropo scatter. David can be reached at 7615 Eaglehelm Ct, Las Vegas, NV 89123; **w7ojt@arrl.net**.

Mike Hasselbeck, WB2FKO, is a research scientist in the Physics Department at the University of New Mexico. First licensed in 1976 as WN2FKO, his present interest is in high speed meteor scatter on 144 MHz. You can reach Mike at 3209 Cagua Dr NE, Albuquerque, NM 87110; **mike@sportscliche.com**; **www.sportscliche.com/wb2fko/**.

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The RCS-12 is said to remember multiple antennas for one band, but selects the last antenna used for that band. It has a MANUAL/AUTOMATIC switch that will allow manual selection of antennas as well. It has eight LEDs to indicate which antenna is selected. The RCS-12 is designed to prevent antennas from switching while transmitting. A user programmable delay is used to give the relays enough time to switch to protect the transceiver from "hot switching." Price: RCS-12, auto controller with eight coax relay box, specified to 60 MHz, $299; RCS-12L, same eight coax relay box, with lightning arrestors, $339; RCS-12C, controller only compatible with RCS-8V/RCS-10 boxes, $229. For more information, see **www.mfjenterprises.com**. To order, or to find your nearest dealer, call 800-647-1800.

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