The "New" HF Digital Modes - PSK31

QST April 1999, pp. 50-51

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"I'll see you in Hell!" Insult, or technical challenge?

Most hams are familiar with some form of digital communication. Our oldest mode, CW, is actually binary data sent as a single tone turned on and off. The other modes in common use by hams are RTTY, Packet, AMTOR, PACTOR, PACTOR II, Clover, and G-TOR. These modes use combinations of two or more tones, which vary in frequency, phase, and/or amplitude. Except for RTTY and CW, the aforementioned modes are all capable of software error detection and, in some cases, error *correction* as well.

There are several "new" modes that are starting to gain ground. Some are truly new, while others are modern incarnations of old techniques. A small but growing group of amateurs in Europe, Australia, New Zealand and US have begun using them, and have been having a lot of fun in the process. Let's take a brief tour of four of the most popular of these.

Feld-Hell ("Hellschreiber")

Invented by Rudolf Hell in 1929, FeldHell was first used to send newspaper text over phone lines, and was later adapted by the German army for field use in World War II. Hell (which sounds like high speed CW) generates each character as a series of dots in a grid, looking something like the output of a dot-matrix printer (see Figure 1). To minimize errors in timing and/or phase, the inventor used the method of printing each character twice for each single transmitted character.

Due to the nature of the timing in Feld-Hell, characters tend to be slanted; therefore a specially designed font is used to maximize readability. While there is no electronic error correction, Hell is error *resistant.* The "wet-wear" between your ears is very good at decoding noisy visual input, and up to 20% of the signal can be corrupted before the text becomes unreadable.

MT-Hell (Multi-Tone Hell)

Originally described in 1937, MT-Hell has only been implemented in the past year. Concurrent MT-Hell uses combinations of 7 to 16 tones sent at the same time. This allows higher throughput, vertical characters, and the ability to use different fonts, underlining, bold, and italics (Figure 2).

PSK31

Initially developed by SP9VRC as *SLOWBPSK* and then later reworked by Peter Martinez, G3PLX, PSK31 is a very narrow bandwidth mode with a low 31 bit/

Figure 1—Feld-Hell in action.

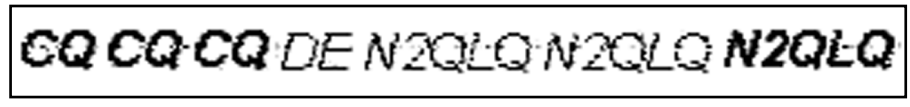

Figure 2—Changing fonts in midstream with MT-Hell.

Web Resources

Digitally active hams increasingly make use of the Web to exchange ideas and software. By going to the Web addresses shown below, you'll find plenty of software and helpful advice.

http://www.tapr.org/tapr/html/DSPF.html
KC7WW DSP56002EVM applications

http://www.tapr.org/
TAPR home page

http://members.xoom.com/ZL1BPU/Contents.html
ZL1BPU's "Fuzzy Hellschreiber" page

http://aintel.bi.ehu.es/psk31.html
EA2BAJ's PSK31 resource page

http://det.bi.ehu.es/~jtpjatae/ham.html
EA2BAJ's home page

http://www.accessone.com/~tmayhan/
K7SZL's "Unofficial" Hamcomm page

http://mars.superlink.net/driller
N2QLQ Home Page

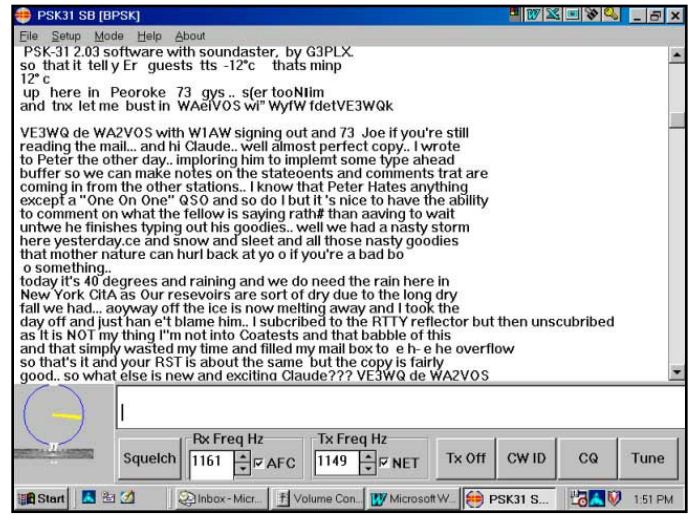

Figure 3—Could this be the successor to RTTY? PSK31 enthusiasts think so!

second data rate (hence the name). When operating in the QPSK mode, errors are corrected using a mathematical operator called a Viterbi decoder. The Viterbi decoder can keep track of its "guesses" for the past 20 received symbols, and can calculate how well the phase shifts match. This introduces a delay of about 640 ms into the received text, which is acceptable. A longer decoder would make even fewer errors, but the time delay would be too long for a normal QSO. Because of the narrow bandwidth, tuning PSK31 is touchy and needs stable VFOs (Figure 3).

Of all the modes discussed in this article, PSK31 seems to be winning the popularity contest at the moment. It offers weak-signal performance that rivals CW, yet achieves this without synchronized handshaking protocols. (PSK31 does not "chirp," it "warbles.") This means it has all of the advantages of Baudot RTTY in that it shares the ability to conduct roundtable QSOs, as well as the rapid-fire exchanges necessary for working contests and DX pileups. Its popularity was given a boost recently when a freeware version of the PSK31 software was released for sound-card-equipped PCs. (More about this in a moment.) Hams have started jumping on the PSK31 bandwagon in significant numbers; even W1AW has been making on-air PSK31 tests and contacts. (Look for a beginner's guide to PSK31 to appear soon in *QST*.—*Ed.*)

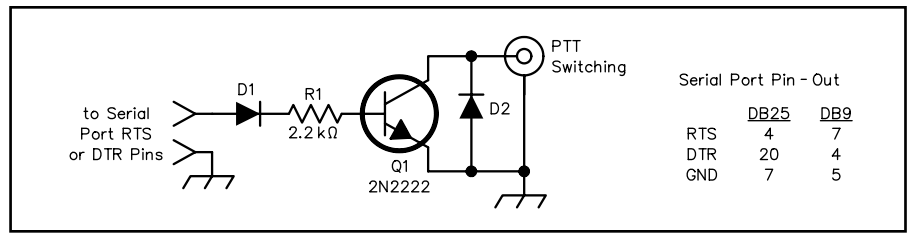

Figure 4—You can use this simple circuit to allow your computer to control transmit/receive switching from the serial (COM) port.
D1—1N914 diode
D2—1N4001 diode
Q1—2N2222 transistor
R1—2.2 kΩ 1/4 W resistor.

Requirements

Now the next logical question is; "What do I need to start using these modes?" If you have done any digital communications or SSTV, you probably have the necessary hardware for at least one or two of them.

If you use a sound card (true Creative Labs Soundblaster SB16 compatibility) or a Hamcomm type interface, you can get free software to enable transceiving of Feld-Hell and MT-Hell through DOS or *Windows*. PSK31 can be used with a sound card and *Windows* thanks to a release of new software by G3PLX. There is also a version for a sound card and the *Linux* operating system. All of the modes have software for the 56002. The 56002 is also being utilized for other amateur uses such as receiver filtering and demodulation. See the "Web Resources" sidebar for more information on how to track down the software and components.

The interface , if necessary, is connected to the audio in and out connectors of your SSB transceiver. While several of the digital modes you are familiar with use LSB (such as Baudot RTTY), the Europeans and VK/ZLs use USB, and that has become the defacto standard for the "new" modes. Transmit/receive switching can be accomplished by using VOX or a simple transistor switch keyed off one of the COM port lines.

Summary

No matter how long you have been involved with Amateur Radio, there is always something new to learn. One of the great aspects of our hobby is that it is not static. These new modes have the added appeal that they are slow speed and therefore meant for one-on-one QSOs. They will never be used for unattended use and will therefore keep the human contact aspect of the hobby alive!

I would like to thank Pesi Sorab, G3NDO, and Fred Salzwedel, OH/DK4ZC, for initiating my interest in these new modes, and their patient help in getting me up and running.

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