

**KB2EOQ's Quick and Dirty Guide to the New Digital Modes****Presented to CCAFMA October 23, 2000****(full html available at <http://www.netsync.net/users/obrienaj/psk.htm>)**

This presentation will focus on the current revitalization of digital modes for amateur radio, particularly the modes that support use of a simple sound card and PC.

Within the past 18 months the interest in digital amateur radio has increased. Led by the explosion of interest in PSK31, new modes have flourished. The amazing part of this development is that FREE software abounds, if you have a computer with a soundcard, you can be on the air in minutes. Currently the "new" digital modes are

PSK31 (and variants up to PSK125)

MFSK16

MT63

THROB

ALE

Soundcard RTTY

Since PSK31 has now replaced RTTY as the most popular digital mode I will start with it.

**What is PSK?**

PSK31 is a digital mode developed by Peter Martinez G3PLX (based on ideas from SP9VRC). The first PSK QSO was in April 1996. PSK was popularized after the distribution of free software by Peter (PSK31SBW) in early 1999. PSK is a digital mode that uses PHASE SHIFT KEYING (hence PSK!) that transmits at 31.25 baud or 50 wpm. It utilizes a very narrow part of the radio spectrum with a good signal taking up about 31 Hz. The normal bandwidth of other modes takes up about 300 – 500 Hz.

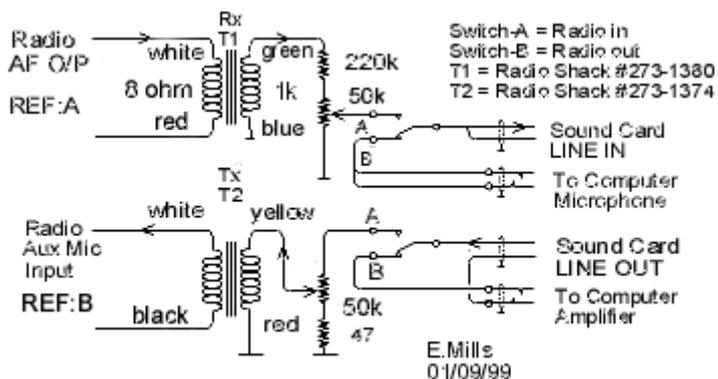
**What Good Is It ?**

In addition to its narrow frequency utilization it's claim to fame is a very robust performance under difficult HF conditions. Often PSK users report having good print out despite not being able to actually hear (with their ears) the PSK signal. Most users of PSK use low power (below 50 watts).

**What Do I Need To Get On The Air With PSK( and the other digital modes)**

In addition to your rig, you need a computer. A Pentium 166 or higher is needed for most PSK programs. If you have a 486, the program PSK31SBW will work fine. You also need a 16 bit soundcard and cables to (1) connect the audio out from your rig to the Line In of your soundcard and (2) connect the audio out from your soundcard to the audio in of your rig. Often people build a circuit that involves an isolation transformer.

Permission to reprint is granted by Ernie Mills WM2U (see more at <http://www.qsl.net/wm2u/psk31.html>)

**FIGURE 1**

Some people also build a cable connecting their serial port to their rig to allow for software controlled switching from transmit/receive or receive/transmit. This is not mandatory , see the section on transmitting.

### Painless Method of Getting On Air

Folks that , like me , are averse to soldering anything together can do essentially the same with a Radio Shack Ground Loop Isolator (part 270-054) for around \$10.00, I think. . Since the average soundcard's output is VERY hot, attenuation in the audio from soundcard to rig is often recommended. The Radio Shack gizmo does not have any attenuation so you will need to buy a 40-dB pad that they sell that will plug in inline (a couple of bucks)

If you want to spend a bit more hard earned cash you can now buy a device that is commercially made for your rig and sound card, just pay for it and plug it in! Look for the RIGblaster at <http://www.westmountainradio.com> , price \$89.95.

### Where Do I get Software?

The good part is that the software is free! The better known software products that are free include:

PSKSBW (<ftp://det.bi.edu.es/pub/ham/psk31/p31sbw108.zip>) , [Logger-Zakanaka Page](#)

DigiPan at (<ftp://det.bi.edu.es/pub/ham/psk31/digipan1.exe>) ,

WINPSK is at (<http://www.geocities.com/ae4jy/index.htm> )

WINWARBLER at (<http://www.egroups.com/files/digitalradio/>)

**Zakanaka:** Zakanaka is a new beta program that has many extensive new PSK applications, it's release is limited at the present time but you can try [Per il download della versione BETA 16 clicca qui](#) for the latest

**Logger :** The great program that does it all , **LOGGER** (<http://www.geocities.com/kc4elo/709full.zip>) Logger is a free logging program with PSK, RTTY, PACKET, and other digital supports. DOS, Macintosh, and Linux software us also available at <http://aintel.bi.edu.es/psk31.html> . Logger also seemlessly integrates with Zakanaka .

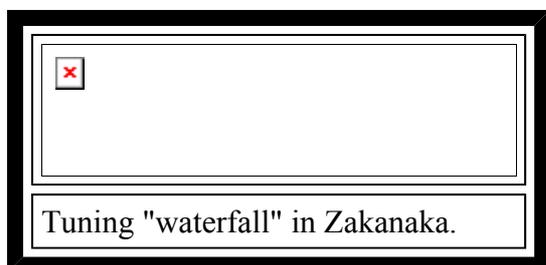
### Okay, I'm a set, where do I find PSK signals.?

1838.150 , 3580.150 , 7035.15 for region 1 and region 3, and 7080.15 for region 2, 10140.150 , 14070.150 , 18100.150 , 21080.150 , 24920.150 , 28120.150

The above are the standard freqs for PSK. Try 'em all but you will find that 14070, 28120, and 7080 will produce the best results.

### Now what do I do?

Tune your radio in USB to 14070 or so. Find a high pitched continuous tone . The tone is very different from RTTY, not chirpy like Pactor/Amtor, and not raspy like packet. If you really want to hear an actual PSK signal on the Internet connect to Ernie WM2U's page at <http://www.qsl.net/wm2u/psk31.html> and click on the icon at the top of his page.



In the above picture there are actually five PSK31 signals being received. Two very strong signals represented by bright colors, one medium strength signal, one weak signal, and one VERY weak signal that you can barely see. All you need to do is take your mouse and CLICK (left click) on one of the signals and you will be receiving PSK31, it's as simple as that!

### That was easy, now I'm ready to transmit. What do I do ?

Each piece of software requires you to enter your callsign in the set-up areas before they allow you to transmit. In DigiPan go to CONFIGURE and then PERSONAL DATA. In Zakanaka click on SETTINGS and then DEFAULT CALL SIGN. In PSK31SBW click on SET UP. In Logger it will automatically insert your call after you configure the software for it's first use.

The quick and dirty way to transmit is spend a couple of minutes to ensure a clean signal : The basics of getting a clean signal are: 1) Make sure your speech processor is off, 2) Set AGC to slow. 3) Keep you output power low, try around 30 watts until you get accustomed to PSK, 30 watts is a lot for PSK. 4) Make sure your station is grounded and RF into lines is minimized. And most importantly of all 5) Make sure your sound card audio is not over driving. Then just transmit ! In PSKSBW to start transmit you just type text into the transmit window (indicated by a flashing cursor above the SQUELCH indicator). In DigiPan type your text in the xmit window and click on TX. In Logger, click on PSK in the main logger screen, type your text and click on the TX button. The various software packages have instructions for wiring up a PTT capability that automatically puts your rig into transmit mode. This is achieved via a serial port hookup to the mic connector and the rig in VOX mode, or a serial port hookup to the accessory connector on the back of your rig. I still have not done this due to an aversion to soldering. Instead I do it the quick way, I just manually place my rig into transmit mode (pressing SEND on my TS440) It sounds like a hassle but it is not really a big deal! If you are more daring than I am, you can find very detailed info for hooking up various radios to serial ports at Ernie WM2U's web site <http://www.qsl.net/wm2u/interface.html>

I said this was the quick and dirty guide to getting on PSK. However I will devote a little more detail to the most important part of PSK... getting a good clean audio signal. If there is a tricky part to PSK31, transmitting is it. It is easy to transmit but it takes a little adjusting to get the much-desired "clean" signal. You should ask for reports on your signal when you go on air. If you have a problem, they will tell you that your signal is "wide" (in their tuning scope) or refer to your IMD level. The IMD (displayed as -27DB in figure 1) Peter G3PLX says that IMD is " a measure, in dB, of the level of the first pair of unwanted sidebands (at +/-46Hz from the centre-frequency) compared to the main pair of wanted sidebands (at +/-15Hz). The readout appears only when the signal is idling, that is, when the emission is actually the same two-tone signal that is used for checking the quality of SSB transmitters. In fact the dB figure in the quality readout is the same as the third-order intermodulation performance figure given for SSB transmitters." (G3PLX). The higher the dB figure the better the quality. Higher dB figures mean less interference. A normal SSB transmitter can give better than 25dB. If you get a report worse than this, there is probably something wrong. Some not-so-good transmitters may only give 20dB at full power and so it may be necessary to run lower power to get a better signal. A figure worse than 20dB usually means that the transmitter is overdriven from the soundcard. 10dB is the readout you would get by feeding square-waves to the transmitter instead of sinewaves. If it's worse than 10dB then the transmitter is being pulse-modulated"

### Sound Card Adjustments : Peter G3PLX says

*"To check that the soundcard is not overdriving the transmitter, first set the mike gain control to the normal level used for SSB voice and start with the soundcard output level at zero on the mixer control panel. Then key F8 in the PSK31SBW program to transmit a tuning tone and slowly turn up the soundcard output level while watching the transmitter output power. Stop when the power is just reaching maximum. The ALC meter will start to read. This is the correct setting. If the transmitter power jumps to maximum on the first step of the output control, you will need to make an attenuator to reduce the soundcard output level going to the transmitter. If you are using the transmitter mike input, you will certainly need to make an attenuator! The best way is to make the attenuator big enough so that you can leave the Mike gain at the normal setting and the soundcard output level at maximum. It will then be impossible to accidentally overdrive the transmitter. When you have reached the correct setting, you will see that changing from the tuning tone to typing text, will make the transmitter power swing from 50% (no typing) to 100% (typing or tuning-tone). This change in power is correct. It's quite OK to let the transmitter ALC line operate on PSK31. The ALC line will control the drive level without clipping in the same way that it does on voice operation."*

You will find that many PSK operators will take the time to help you adjust your signal while on the air. They will perhaps first ask you to let your signal to idle for 2- to 30 seconds so they can see the signal and get an IMD reading. After that they may ask you to transmit while raising your output (low to high) or soundcard level (low to high) as they watch the signal in their scope. Since there can be false readings, try to get signal reports from 3-4 stations in different geographical areas. After a half dozen or so reports, you should have your signal well set. If you try everyone's suggestions and STILL have problems try to borrow an oscilloscope to look at your soundcard audio level. For the best trouble shooting advice subscribe to the PSK Reflector at <http://aintel.bi.ehu.es/psk31.html>

You can find all you need to learn the full details of PSK operating at <http://aintel.bi.ehu.es/psk31.html> and <http://www.qsl.net/wm2u/psk31.html> . Locally, the Cyber Amateur Radio Club (<http://www.netsync.net/users/obrienaj/carc.htm> ) and it's reflector, often have PSK info.

### So I have a good signal, what can I expect on PSK?

PSK has been an active HF mode for just over a year now. The mode has active hams that appear to subscribe to the "rag chew" aspects of amateur radio. That is, many of the PSK pioneers want to establish the mode as different from the quick fire exchanges associated with RTTY contesting and DX hunting. So, a typical QSO will include not only signal reports and equipment details , but also a little keyboard chatting . Don't feel you are obliged to do this, there are still many folks that like the brief QSO. You will find many DX stations, there are over 100 active DXCC countries represented on PSK. There are a few contests , our own Chautauqua County Contest Club contest on Labor Day each year and the TARA Rumble (<http://www.qsl.net/wm2u/rumble.html> ) .

Enjoy PSK31 . Email me at [obrienaj@netsync.net](mailto:obrienaj@netsync.net) and let me know how you made out!

73 de KB2EOQ.

### MFSK 16.

MFSK16 is likely to be the next "hot" mode. While not as easy to tune-in as PSK31 it is very robust mode *and performs even better than PSK31 under weak or distorted conditions*. If you have your rig and computer already interfaced for PSK31, you are all set. All you need is the free software called STREAM (<http://www.qsl.net/zl1bpu/MFSK/software/>)

MFSK 16 sounds quite different from PSK31, it's tones have a musical sound to them. The best place to listen for MFSK16 is around 14080 to 14082. The mode is increasing in use and many DX stations are now trying it. You will not, as yet, always find a signal whenever you tune in but if you leave you rig parked around 14080 for 30 minutes of so, you will usually hear a station or two.

The quick and dirty version of what MFSK16 is ....

From the MFSK16 web site at ( <http://www.qsl.net/zl1bpu/MFSK/>).....

"MFSK is a technique for transmitting digital data using multiple tones, extending the RTTY two-tone technique to many tones, usually, but not always, one tone at a time.

*MFSK means **Multi - Frequency Shift Keying**, and should not be confused with MSK (Minimum Shift Keying).*

*MFSK uses relatively narrow tone spacings, so remarkable data rates are achieved for a given bandwidth - 64 bps in a signal bandwidth of 316 Hz is typical. .MFSK16 is always operated with FEC, so the text throughput is actually only about 42 WPM (31.25 bps).*

*MFSK has several performance advantage:*

- High rejection of pulse and broadband noise due to narrow receiver bandwidth per tone
- Low baud rate  for sensitivity and multi-path rejection - data bit rate higher than symbol baud rate
- Constant transmitter power
- Tolerance of ionospheric effects such as doppler, fading and multi-path

*Most important of all, with an MFSK system, the error rate improves as the number of tones is increased, so with as many as 32 tones the performance is unrivalled. With PSK systems the opposite is "*

### **MT63**

Since my initial presentation to PAWNY on PSK31 . MT63 has become a popular new mode although with significantly less activity than PSK31 . Connect to the CARC website and click on MT63 for the free software. The hardware set up and requirements are the same for MT63 as they are for PSK31. One major difference is that MT63 is a WIDE mode and takes up about 1 kHz bandwidth. The rule is to work MT63 in areas where you will cause no QRM to close by stations. 28130 is the best place to start. The MT63 software has some very nifty signal reporting features. Give it a try. If you need help on MT63, try KB2EOQ or N2TIF on the 146.67 repeater of via the CARC reflector. MT63 sounds like a roar of white noise, a very low tone. It also around 14080.

### **Throb.**

**Throb is an odd sounding "pulsing or a throb sound".** It is an experimental program using 9 tones and FFT detection and performs well under weak signal conditions, You can download the software at [Download throb25.zip \(http://www.lsear.freemove.co.uk/page3.html\)](http://www.lsear.freemove.co.uk/page3.html). The same URL will give you more technical details. Look for THROB aroundn 14080

### **RTTY !!!**

RTTY is now available via the great Japanese program MMTTY by Mako JE3HHT. Andy KB2EOQ is part of the beta testing and help writing team so contact Andy at [obrienaj@netsync.net](mailto:obrienaj@netsync.net) if you need special assistance. The program works extenely well and has been reported to out perform hardeare RTTY devices that cost hundreds of dollars. The special DSP capabilities of your PC's soundcard really do well with this program. Tuning in weak RTTY signals is a breeze. The latest version even has a notch filter to help with QRM. It is a great aide for RTTY contests too. The help file also contains a great file "RTTY Basics" that will be of help to the RTTY beginning. For more details connect to ([http://www.geocities.com/mmtty\\_rtty/](http://www.geocities.com/mmtty_rtty/)).

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