There are many digital programs available for amateur and shortwave radio listeners, from individual modes to all-in-one packages, but with MultiPSK I have found a real treasure. I call this a “diamond in the rough” because for many folks the initial configuration screen and the program screen seem, well, awkward. We have become used to very glamorous GUIs, with many programs trending with ribbon bars and lots of bells and whistles. By comparison, MultiPSK seems rather barren. Nothing could be further from the truth!

In this article I will describe the program, highlight some of the more interesting/unusual features, and hopefully convince you this is a program more than worthy of the time it takes to get comfortable with the interface!

First, Some Background

If you are new to working digital modes over amateur radio or shortwave radio, some of the terms may be unfamiliar as well as some of the concepts. Digital modes are modes of transmission which either start with digital information (such as a picture or text file or text typed into a computer) or convert analog input to a digital format (such as sound through a soundcard) before being transmitted (modulated) by a radio over the airwaves. This digital information can then be demodulated (decoded) by a computer connected to a radio on the receiving end.

The soundcard in a typical computer can do a great job of handling this conversion process as they are designed to take analog signals as input and convert them to something a computer can understand. The reverse is also true—they take digital signals and convert them back to analog signals so we can hear our favorite MP3 files or the like. Combine this ability with a radio and the possibilities are almost endless! Fortunately one does not have to understand the process fully to enjoy the benefits, but a little learning is always a good thing, and who knows? One of us may just invent the newest best digital mode for the world to enjoy!

Amateur and Shortwave Radio

Both amateur and shortwave radio offer a lot of opportunities to explore digital modes and MultiPSK is an excellent program for this pursuit. The program’s author is Patrick Lindecker F6CTE, an engineer by trade who has been developing the software for a number of years. The program runs under most versions of Microsoft Windows, and should work fine with Windows emulators such as VirtualBox. After installation, the program opens up with a configuration screen for the initial setup. This can then be configured to open each time the program starts, or programmed to go directly to the main program.
The configuration screen above (Figure 1) is where the audio input source is chosen along with the output, and there are several options. (As an aside, the program does not insert entries into the Windows registry file which means it may be deleted or copied to another directory without performing an uninstall action. Also, virtually all of the program runs without .DLLs which means it can run under Linux using WINE.)

There are two sets of sound card inputs/outputs allowing for multiple sound cards or one sound card and one virtual sound card. Each sound card pair can use whatever sound card inputs are available to the computer, such as the physical sound card, audio CODECs and the like. This can be particularly useful when there is an external audio device such as a SignaLink USB or Rig Blaster, and a second audio source such as an SDR with direct I/Q input. This might be a good time to mention some of the many ways this program can be used to accept input from an audio source.

In addition to input from a transceiver or typical shortwave receiver, audio can be piped in through the sound card from almost any device capable of sending out audio. This means a handheld radio, a portable shortwave receiver, a tablet, a phone, Softrock, or an SDR Dongle, to name a few, or a combination of any of the above.

For example, using an Internet-connected phone or tablet I can pipe the audio out of my tablet headphone/speaker jack to the input of my non-Internet connected laptop and use one of the remote SDR or web-based remote control rig sites to receive audio.

In my current setup I use both an external sound card and vb-cable virtual audio driver to connect my main transceiver and my Elad SDR, respectively. A simple change to the sound configuration in MultiPSK allows me to switch between inputs. I can also use one software program for one mode and another software program for another mode if needed, and switch between input/output settings. You can also run multiple instances of the program by installing each instance of the MultiPSK program into separate folders. Only your CPU speed and number of radios/input options can hold you back!

Modes supported by MultiPSK 4.29.1 (Latest version as of this writing):

Phase Shift Keying modes:
- BPSK: BPSK31-63-125-250 / CHIP (64/128) / PSK10 / PSKFEC31 / PSKAM10-31-50
- BPSK with SSTV: PSK63 F - PSK220F + DIGISSTV “Run”
- QPSK: QPSK31-63-125-250
- 8PSK: VDL2
- MFSK: MT63
- PACKET BPSK1200-250-63-31 + APRS+ DIGISSTV “Run”
- IL-STD-188-110A - 4285
- HFDL
- EPIRBL-ELT-PLB beacons
- ARGOS (beacons/satellites)
- AUTEX
- On-Off Keying Modes: CW / CCW-OOK / CCW-FSK / QRSS
- Amplitude modulation mode: APT faxes (NOAA satellites)
- Frequency Shift Keying modes:
  - PACKET: 110-300-1200 bauds + APRS+ DIGISSTV “Run”
  - PACTOR 1 / AMTOR FEC-Navtex / AMTOR ARQ / SITOR A
  - ASCII / RTTY 45-50-75-100-110-150-200 / SYNOP + SHIP / IEC 870-5
  - 1382 / BIIS / GMDSS DSC / ACARS (VHF) / DGPS / NWR SAME / ARQ-E / ARQ-E
- Multi Frequency Shift Keying modes:
  - MFSK8 / MFSK16/32/64 (+SSTV)
  - OLIVIA / Contestia / RTTYM / VOICE
  - THROB/THROBX
  - DominoF / DominoEX / THOR
  - PAX / PAX2 Automatic Link Establishment (see http://www.hflink.com) MIL-STD-188-141A+
  - ARQ FAE / ALE400 + ARQ FAE
  - DTMF, SELCAL
  - JT65 (A B and C)
  - LENTUS
  - COQUELET
- Base band modes: POCSAG, AIS, Packet 9600 bauds (G3RUH)
- Hellschreiber modes: FELD HELL / FM HELL (105-245) / PSK HELL / HEL 80
- Graphic modes: HF FAX / SSTV / PSK SSTV modes (mentioned above) / MFSK16 SSTV (mentioned above)
- PPM (by positioned pulses) modes: mode S (ADS-B included)
- DSP modes: Filters / Analysis / Binaural CW reception
  - RTTY, CW, BPSK31, BPSK63 and PSKFEC31 Panoramics Identifiers: Video ID / RS ID / Call ID
- TCP/IP digital modem

Figure 1
Integrated SDR Demodulator/Modulator

The rest of the configuration screen offers options for sound recordings (sound files can also be selected as an input source), the Beacon mode (allowing automated TX/RX in many modes), loading saved program parameters (useful for starting the program in a particular mode), serial port options (if used), panoramic windows (or waterfalls) for various modes, as well as QSO and logbook options. There are also controls for setting the transmit offsets for various modes, personal data settings, sound mixer control and registration/version history.

The Program Screen

After configuring the sound card interface and other useful data it is time to press the [RX/TX screen] button to go to the main program (I am using the convention of indicating actual button titles in brackets). Depending on the screen size/resolution there will be several blocks of information with dozens of buttons which at first look like an old Tetris game (see Figure 2 above). “There is nothing wrong with your television set. Do not attempt to adjust the picture.” – The Outer Limits (sorry, I couldn’t resist!)

The buttons or tiles on the upper right upper side of the screen are the various modes that can be chosen depending on the version of the software. The amateur modes are separated from the professional modes, mainly for convenience, in that commercial services often use modes contained in the amateur modes category (I have counted nearly 100 modes and variants, but there may be more—I have not explored all of the sub modes yet!).

On the left upper side of the screen there are numerous configuration settings based on the mode chosen. While it is impossible to include all the options here, I will give a few examples below to illustrate the program logic. I would also mention here there is an extensive help system based in the program (you do not have to be online, thankfully!), and numerous resources available for particular modes written by users, which may be found here. Most buttons either bring up a help “bubble” when the mouse is hovering, or a right mouse click will bring up context-sensitive help.

One other thing to note here is the main screen will look different on different screen resolutions and/or whether or not it is opened full-screen. (See Figure 3 below) Notice in this smaller screen the professional modes are listed. The button bar underneath which is labeled [Amateur modes] has become an active button to switch over to the amateur modes, and the reverse is true—when the amateur modes are displayed the [Professional modes] button is visible which allows switching over to those modes. I personally like running the program full-screen on a large monitor, but for those who do not, it is worth knowing what happened to half the modes!

Context Menu Options and Help

As mentioned above options on the upper left half of
the screen will change depending on the mode selected.

On the top are the configuration options for HFDL (a kind of ACARS for HF), while on the bottom are options for PSK31. Some of the configuration options remain the same such as logging options, program integration options with DXKeeper and DXLab, and TCP/IP networking options. The red [MODE] button will show what mode is active for both TX (if any) and RX. The [QRGs] button brings up a list of common frequencies used by the mode selected, and also allows integration with the free DXLab CAT control program Commander. There is, in fact, tight integration throughout the program with DXLab, but there is also support for HRD (Ham Radio Deluxe) and several other programs.

As an example of a typical RX, I have captured a screen with some of the relevant information and options. In the waterfall area, the signal(s) can be seen and selected with the demodulated text displayed below in Figure 6.

With the [RX RS (Reed-Solomon) ID] button checked, the program will attempt to identify the call and display the information in the RX time + callsign + mode window on the right. Here CO4SM from Pine Islands (a new one for me!) is shown, along with the mode and time. Note the macro buttons below the waterfall. These allow common text strings to be stored for transmit, and multiple sets may be configured; up to 10 sets of 12 pairs can be stored for an amazing 240 possible macros! When in a receive-only mode the macro options are grayed out as in the HFDL mode shown above.

The waterfall window also serves as a spectrum window, and those controls are on the right of the waterfall shown here. The waterfall can be searched, rewound, and the frequencies can be adjusted very precisely. The rewind option is particularly interesting as the user can rewind the waterfall signal from 10 seconds to 3 minutes (licensed version). This can be quite useful when a desired signal is discovered already in progress.

**Beacon Modes**

Two modes worth special mention for amateur use are the familiar JT65 mode and the newer, not-so-familiar Lentus mode. JT65 control in MultiPSK is quite a bonus as few programs incorporate this into their suite of modes, and Lentus is fairly new mode (developed by the author of Multi-psk) which is gaining a following as well. This mode is used for QRP transmissions (down to a minimum S/N ratio of -34dB) either in LF, MF and HF (14 MHz maximum). (See Figure 7 above)

Both of these modes are designed with low power in mind, and require precise clock calibration. There are instructions and suggestions for how to set your computer’s clock to the required accuracy in the help file along with several software solutions, including the author’s own clock program, as well as a discussion of appropriate power levels. These are interesting modes to work in that you can see how far extremely low power can take you around the world. They both also have the ability to set “canned” responses to ensure proper amateur contact protocol is followed, but allowing for free-form text as well. Most users will stick to the automated responses so as to fit within the alternating
Several ground stations provide global network coverage. Modulation is 2-PSK, 4-PSK or 8-PSK with effective bit rates of 300, 600, 1200 or 1800 bits/sec. Several ground stations provide global network coverage and system status updates.

The HFDL network has 17 nodes (ground stations) covering aviation worldwide, and provides a LDOC (voice network) providing phone patch services and more. Each node (or ground station) has a pool of frequencies available for use, and chooses two depending on Ionospheric conditions. Ground stations transmit a status approximately every 30 seconds on the two active frequencies in order to allow aircraft to know which frequencies are in use.

For me the most interesting part of the program are the professional mode options for utility listening. There are numerous modes within MultiPSK, which simply are not available on other free or relatively inexpensive software suites, and I am not in a position to pay thousands of dollars for programs such as Hoka (would that I could!!). There are modes here that I had never heard of before getting this program, and this makes things all the more exciting.

The ARGOS satellite system was one such mode, where a system of beacons and satellites transmit scientific data measuring temperature, pressure, humidity and sea levels. The system is also used to track yacht races and animals. Very nice!

If you are like me, you enjoy listening to commercial and military aircraft, and MultiPSK has several very useful modes for this purpose. One of favorites is HFDL mentioned above.

High Frequency Data Link protocol (HFDL) is defined in ARINC specification 635-3, and it is operated by ARINC as GLOBALink service through a worldwide network of HF stations, with a standard protocol:

- Transmissions on HF are in USB on a sub carrier of 1440 Hz with a symbol speed of 1800 baud.
- Modulation is 2-PSK, 4-PSK or 8-PSK with effective bit rates of 300, 600, 1200 or 1800 bits/sec.
- Several ground stations provide global network coverage and system status updates.

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Sample HDFL Display Captured with MultiPSK 4.28

<300 bps 1.8 sec 1439 Hz> 02/17/2015 18:37:03MPDU CRC control: OK[Unnumbered Data LPDU] - DownlinkLPDU CRC control: OK[Unnumbered Data LPDU] [Performance data HFNPDU] UTC time: 18:36:58 UTC Flight identifier: BAW191 Latitude: 56-31.57N Longitude: 073-30.29W Performance version: 10 “Flight leg” : 149 Ground Station Identifier: 4 - Riverhead, NEW YORK, USA (072-38-22W 40-52-47N) Frequency number: 4 (11387.0 KHz) Previous frequency search count: 15 Current HF data disabled time: 1102 sec Current HF data disabled time: 8826 sec SPDUs received without error: 0 (1800 bps) / 0 (1200 bps) / 2 (600 bps) / 17 (300 bps) SPDUs received with errors: 0 (1800 bps) / 0 (1200 bps) / 0 (600 bps) / 0 (300 bps) SPDUs received with errors: 0 MPDUs transmitted: 0 (1800 bps) / 0 (1200 bps) / 0 (600 bps) / 0 (300 bps) MPDUs delivered: 0 (1800 bps) / 0 (1200 bps) / 0 (600 bps) / 0 (300 bps) No frequency change since the last “performance data” HFNPDU<End frame>

Abbreviations:

BDU - Basic Data Unit
HFNPDU - High Frequency Network Protocol Data Unit
LPDU - Link Protocol Data Unit
MPDU - Media access Protocol Data Unit
SPDU - Squitter Protocol Data Unit

One of the more useful MultiPSK features available in modes like HFDL is the [Explanations] button which attempts to give hints as to some of the abbreviations/codes used in an HFDL transmission. These are offset by parentheses in the body of the text, such as “MPDU (Media access control Protocol Data Unit) – Downlink” and “Frequency number: 4 (11387.0 KHz)” making things a bit clearer. Also convenient is the [HFDL frequencies] button, which gives a quick reference set of current frequencies of the ground stations. This is updated with each software revision of the program.

A similar mode is VDL2 (VHF Data Link mode 2), which captures automatic transmissions between planes and ground stations exchanging positional and logistical information through AVLC frames. These are best captured through an SDR Dongle or similar device using PSK, but can be captured with standard receiver in USB mode. These transmissions are only found on 136.975 MHz.

SELCAL

SELCAL (SElective CALing) is another mode, which is interesting for aircraft monitoring. It is in essence a paging system for aircraft. The use of SELCAL allows an aircraft...
crew to be notified of incoming communications even when the aircraft’s radio has been muted. If the tones match the programmed code for the aircraft then a chime or gong will sound in the cockpit and a light will come on the radio panel to indicate which radio (HF1, HF2 etc.) received the SELCAL tone. If the tones do not match the programmed ones they are ignored.

On reception, the program overlays the possible letters and the tones are spaced to align with the proper letter. It takes a bit of practice to see the slight level differences between the two pairs, but eventually it becomes fairly easy and the patterns become obvious. (See Figure 8 above)

On several of the aircraft modes such as SELCAL and HFDL there are program links to connect with Internet databases for aircraft identification based on the information received such as the www.airframes.org database which can be queried by registration, SELCAL or ICAO identifications. There are several maritime modes such as GMDSS (Global Maritime Distress and Safety System), SYNOP/SHIP, and AIS. The mode AIS (Automatic Identification System) is used in VHF for maritime navigation. The main aim of this system is to identify ships and their position. Navigational information is transmitted from one ship to another or to coast stations. This system secures maritime routes by seeking to avoid collisions but has other uses such as search and rescue operations.

SYNOP/SHIP mode offers information about surface meteorological observations from a land station (manned or automatic) and from other sea stations.

The program will identify the stations and place them on a map (there are a number of modes which make use of built-in or user defined maps). Just make sure the desired map option is selected before data reception as the mapping features are usually done in real-time for most modes, which make use of this feature.

GMDSS is designed to transmit search and rescue information, logistical information, and bridge-to-bridge communications between vessels. While the system has been around a number of years, more and more ships are using this mode as the use of Digital Selective Calling (DSC) VHF radios increases.

A similar system for both maritime and aviation distress/SAR services is the ERIB (Emergency Position Indicating Radio Beacon) network located on 406 MHz. There are three types of beacons used to transmit distress signals, EPIRBs (for maritime use), ELTs (for aviation use), and PLBs (used for land-based applications). A ship and plane database can be used to identify broadcasts and mapping functions are available for this mode as well.

**Figure 8**

**Modes, Modes, and More Modes!**

There are a number of other modes in the program such as POCSAG for pager systems, FM/RDS for FM broadcast stations, National Weather Service SAME broadcasts, ACARS, AMTOR/SITOR modes, improved GPS signals with DGPS (Differential Global Positioning System), NAVTEX, ALE (Automatic Link Establishment), Digital Voice and Packet/APRS modes.

There are simulated DSP filters that may be applied to a variety of signals, as well as channel separation filters for specialized audio needs. There is an I/Q window when using SDR devices with its own waterfall, modulation schemes, and sampling frequency adjustments. There are also several tools available for signal analysis including a dual-trace oscilloscope function and a dual-trace spectrum analyzer function. There are even network/Internet integration options for satellite tracking, webservers for various modes, and more.

You can use as many or as few of the modes/options/functions that fit your needs or the interest. I have little doubt if a person spends some time learning the interface and taking advantage of the context-sensitive help, there will be more here to explore than most folks have time for, including myself! The usual disclaimers apply—I have no connection with the author of the program and I did indeed pay full price for my registered version. I can say without hesitation it is some of the best software registration money I have ever spent, period.

When I started this article, I noticed on the Yahoo MultiPSK group a new mode getting ready to be added to the next release (I started this review in late April), which would feature a chat mode. Before finishing this piece it has been tested by users, tweaked, and already added into version 4.29. This is the mode description given by the author:

"-The AUTEK modes permit to organize a meeting between 2 or 4 people maximum (7 and 13 people in the next test versions). Text messages can be transmitted from any person to any other person participating to the meeting, in pseudo full duplex (protocol one, not physical one), each person being sure that his messages will be read by the other
participants. So, each one will be sure to read all the texts sending by the other participants to the meeting. It is a mode without errors (if an error is detected, the frame is re-transmitted until complete reception). So, it can be considered as an extended ARQ mode.”

And, as an example of “minor” version releases, here is the list of changes from 4.29 to 4.29.1:

• New message mode in all ARQ modes
The “Message mode” button, in pushed position, allows the user, for all “ARQ” modes (Packet FSK110-300-1200 bauds/Packet PSK1-63-250-1200 bauds, PAX, PAX2, 141A(ALE), ALE400, AUTEX 2, 4, 7, 13) to prepare the message and then to send it when it is ready. The transmission is done with the “Send” button or with the <Esc> key. If not in “message mode”, the message is sent as and when it is written (previous way to do). In “message mode”, the “Transmission on <Enter>” option is ignored.

• Display of the GMDSS coast stations positions on maps.

• Update of the Shipdata.txt file and display of the ship type, if known, in GMDSS and AIS.

• The “CPU” button (at the top of the RX/TX screen) gives the number of cores of the CPU, followed by the CPU theoretical speed and the volume of data (RX/TX). It allows the activation of the CPU and memory measurements of the PC.

• New macro <ALIGN> (for “Alignment on an AF frequency”) allows an action equivalent to push on the “Align” button of the “Transceiver” form.

I would call this revision impressive! I would also add questions within the MultiPSK Yahoo group are often answered by the program author himself, and he is extremely responsive to bug reports and requests for software additions.

Wrap-up

I hope you will give this program a try. I am confident you will find it as amazing as I do. I have it running on two old XP machines (1.7 MHz Dual-core Intel processor laptop and a 2.4 MHz Pentium 4 desktop), a Win7 2.4 MHz quad-core AMD machine, and a Win10 quad-core Intel i5 machine. I have been extremely happy with the performance on all the machines and have yet to find it stressed by low resources. My only problem is the lack of additional antennas so I can have more instances of the program running! There are more modes to track than I have antennas!

This is indeed the Swiss Army knife of digital mode software, and I cannot wait to see what Patrick will come up with next!

Learn more about MultiPSK here: http://multipsk.eqth.info