DIGITAL COMMUNICATIONS

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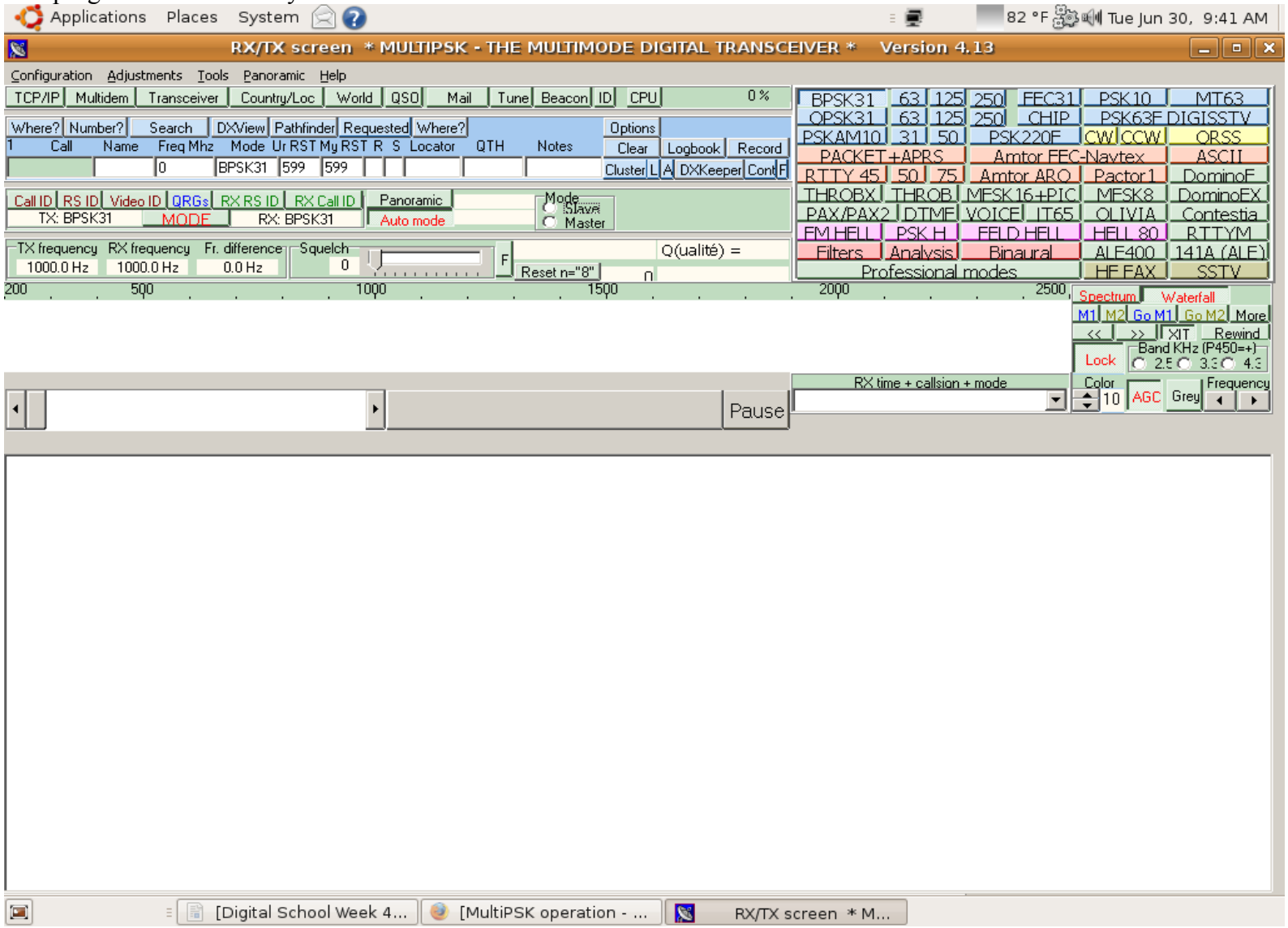
Disclaimer:
These are my comments on digital communications and are not necessarily all there is to know on the subject. As with everything computer related – there are at least six ways to do the same thing. Given this caveat, let me say this is opinion and not the complete story. I only relate to you my experience of 5 or more years using digital modes to give you the benefit of my experience. I will leave the rest for you to research as you see fit.

Digital Sound Card Software:
In an effort to make sense of the vast selection of software available to ham operators, this session will be devoted to supplying information to help you in deciding what software will best suit your application. Selection of software is highly subjective in that it depends almost entirely on the operator and situation as to which software is appropriate or useful. What we attempt to do here is give the capabilities of software on a comparative basis and allow you to make those choices as needed.
We will group the available applications into three basic catagories: 1) digital text, 2) digital voice, 3) digital image and video.
All software applications mentioned can be used with the computer soundcard as the modem. Some also allow the use of external computer sound interfaces like the Tigertronics SignaLink modem which has a soundcard built in and does not rely on the soundcard in the computer. Offloading the soundcard duties in this manner increases the efficiency of the interface function several orders of magnitude given the modest cost of $99-$125. The new WinLink protocol WinMOR is being tested using the SignalLink interface. Some applications also allow external TNC controllers to be used in KISS mode (e.g. the SCS Pactor TNC). All applications allow cut and paste of messages from one application to the other.
Many of these applications may run under Windows 95, and 98. However, significant sacrifice in performance will be noticed. Some may not work at all if the CPU is too slow. It is recommended that you use a Pentium class machine with a CPU of at least 166Mhz or more (preferably P4 1Ghz+) and no less than 512Mb memory. This is easily withing the range of desktops and laptops available to hams at low to moderate cost. All the applications capable of image transmission should use a Pentium 4 class CPU at 1Ghz or faster with 1Mb ram for best performance.

DIGITAL TEXT

MultiPSK

This popular program was written by F6CTE Patrick.



The major features include:Modes supported by Multipsk:

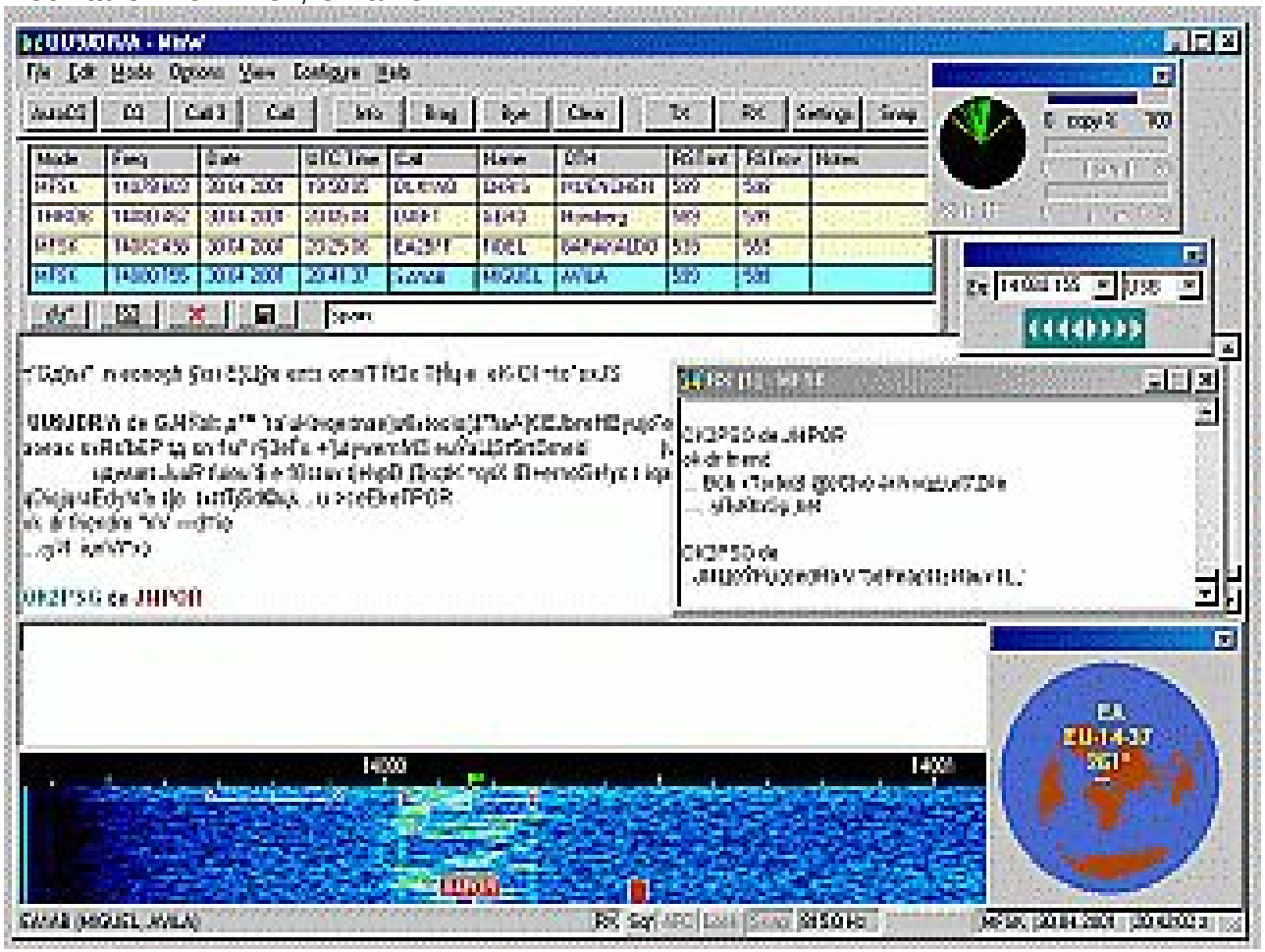
- Phase Shift Keying modes:
- BPSK: BPSK31-63-125-250 / CHIP (64/128) / PSK10 / PSKFEC31 / PSKAM10-31-50
- BPSK with SSTV: PSK63 F - PSK220F + DIGISSTV "Run"
- QPSK: QPSK31-63-125-250
- MPSK: MT63
- PACKET BPSK1200-250-63 + APRS+ DIGISSTV "Run"
- On-Off Keying Modes: CW / CCW-OOK / CCW-FSK / QRSS
- Frequency 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
- 1382 / GMDSS DSC / ACARS (VHF) / DGPS
- Multi Frequency Shift Keying modes:
- MFSK8 / MFSK16 (+SSTV)
- OLIVIA / Contestia / RTTYM / VOICE
- THROB/THROBX
- DominoF / DominoEX
- 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)
- Hellschreiber modes: FELD HELL / FM HELL(105-245) / PSK HELL / HELL 80
- Graphic modes: HF FAX / SSTV / PSK SSTV modes (mentioned above) / MFSK116 SSTV (mentioned above)
- 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
- Integrated SdR demodulator/modulator

It is easily noted that this is an impressive list of modes, almost all of which MultiPSK excels at. The OLIVIA and CW decoders are among the best around. On the downside, the operator interface takes some getting used to; as can be seen from the

illustration below:

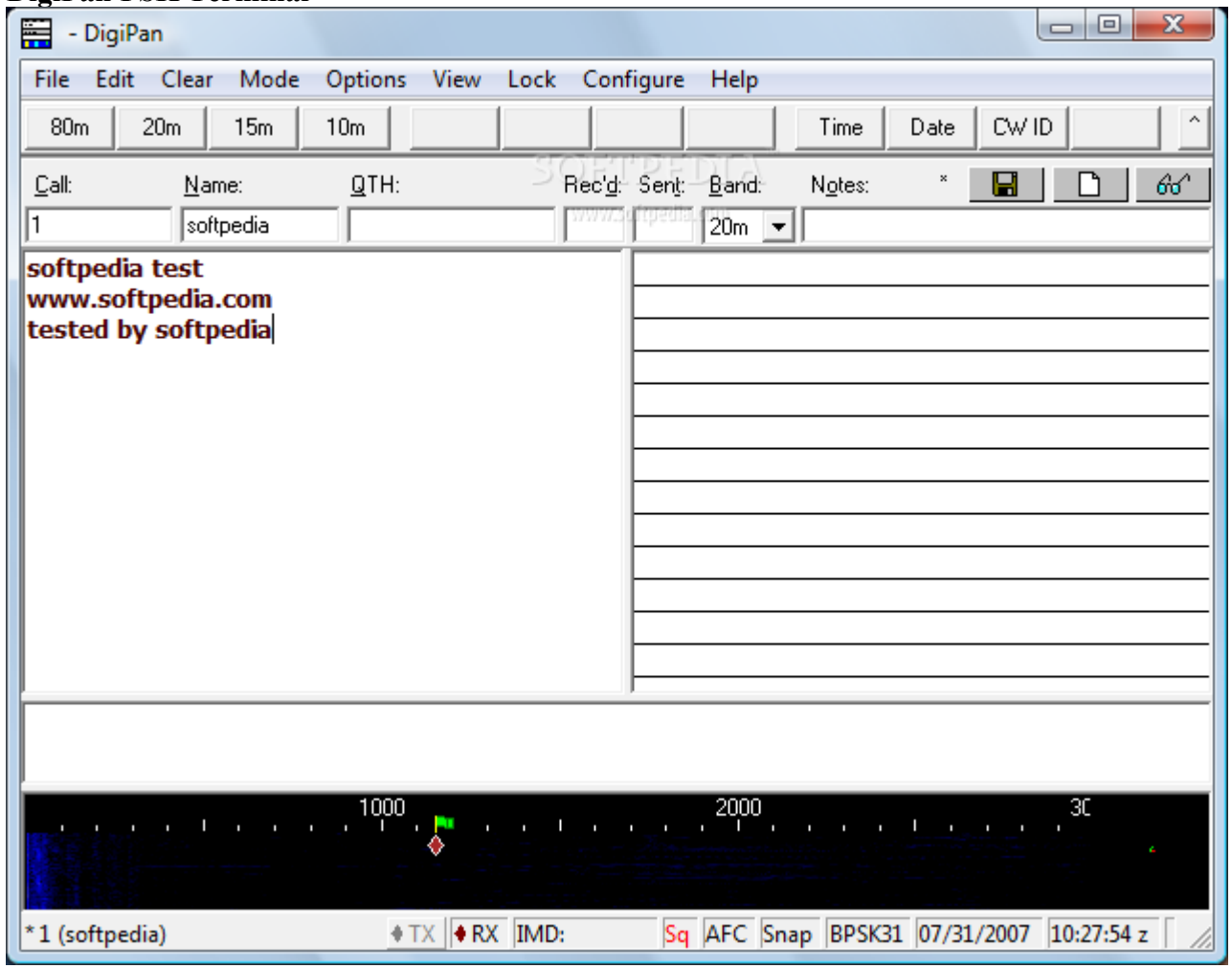
MixW Multimode Terminal

MixW is a multi-mode, multi-functional software application for every day logging and contests. It has many useful features that make your QSO logging process almost a 100% automatic procedure. MixW may be used with or without an external TNC. The only requirements are a computer running Windows 9x, ME, NT4, 2000, XP or Vista operating system with compatible soundcard and a USB interface. You may download fully functional 15-day trial version of MixW and try it for free. MixW supports different TNCs, antenna rotors, antenna switches, regular and contest logging formats, etc. It also allows using TCP/IP connection over AX.25 packet radio protocol. It is a commercial product by UT2UZ Nick Fedoseev and UU9JDR Fred Nechitailov from Kiev, Ukraine.



Now able to support dual call signs(2). MARS members or another member living in the same household may now use the current version by having a "Dual" registration. MARS members holding a second call sign may now request a new registration file (FREE) by submitting the MARS or family member's call sign for registration. If you are a registered user of MixW software and either hold a MARS call sign or have a member of your family wishing to use MixW who resides in your household (Same Address required). You may request a NEW MixWreg1.dll registration file.
MixW gives you the ability to send and receive RTTY, CW, PSK31,Hellschreiber, MFSK16, FSK31, PSK63, Throb, MT63, SSTV, packet (HF and VHF) and AMTOR. You can also receive PACTOR I and fax with MixW. MixW will interface to your transceiver if it is CAT compatible, which many are these days. This means you can manipulate your rig from within MixW With software; you can even do this remotely. MixW can also interface with your antenna rotator if it is designed for computer control. MixW incorporates a proprietary logging program that includes a "contest mode" with configurations for a number of popular digital contests. When you click on a call sign in the receive window, MixW enters the call into the log and displays the country information according to the prefix.

DigiPan PSK Terminal



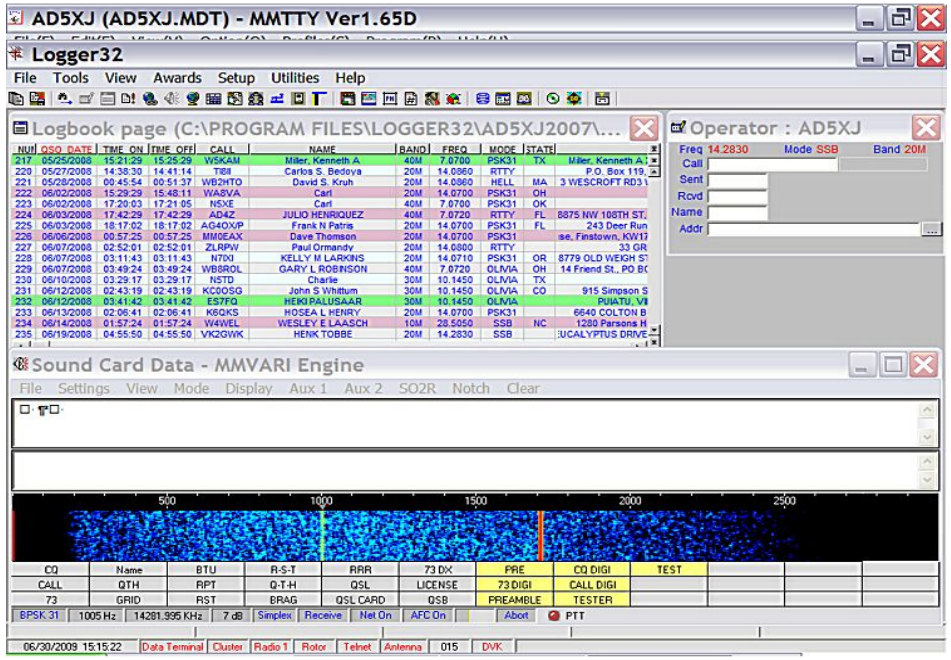
DigiPan stands for "Digital Panoramic Tuning" and brings the ease and simplicity of PANORAMIC reception and transmission to PSK31 and PSK63 operation. DigiPan provides a panoramic display of the frequency spectrum in the form of an active dial scale extending the full width of the computer screen. Depending upon the transceiver IF bandwidth, it is possible to "see" as many as 40 to 50 PSK31 stations at one time. Low-cost transceiver kits for 10 meters, 20 meters, 30 meters, 40 meters, and 80 meters, the PSK-10, PSK-20, PSK-30, PSK-40, and Warbler (PSK-80), are available from Small WonderLabs that make full use of DigiPan's panoramic capabilities through the use of a 3000 Hz wideband IF. An article about DigiPan and the panoramic transceiver can be found starting on page 33 of the June, 2000, QST magazine. DigiPan does not decode anywhere close to the number of modes as MultiPSK but it does enjoy a considerably simpler interface; as can be seen here:

MMTTY / MMVARI

Everyday more and more Amateur Radio operators are operating on the HF digital modes, in particular, RTTY. In each RTTY contest I find about 8-10% new calls that I've not seen before. RTTY is in common use on emergency nets and for point-to-point Emcomm type message transmission. No matter what your reason might be, it is the purpose of this information to assist getting you started on RTTY.

Even though I've been active on RTTY for over 5 years, I don't claim to have all the answers. I do have a technical background and am familiar with many of the technical aspects of operating RTTY. RTTY is the most fun I've had in over 13 years of Amateur radio. It can be both complicated and simple. So I'll try to keep things simple.

Anyone can operate RTTY. You don't have to know how to “touch type” to run RTTY or PSK. The “hunt & peck” method works fine. Every program I know for RTTY includes special "macros" which hold pre-typed message segments and commands that can be sent by pressing a function key or clicking a button on your screen with a mouse. The late N5JR was a paraplegic and earned RTTY DXCC before he died (this call has since been re-issued to Joel Rubenstein who is an active RTTY operator too). He operated RTTY with a stick in his mouth. He should be an inspiration to all of us and shows that even those with disabilities can enjoy these very fun and exciting modes. There's really no excuse not to try.



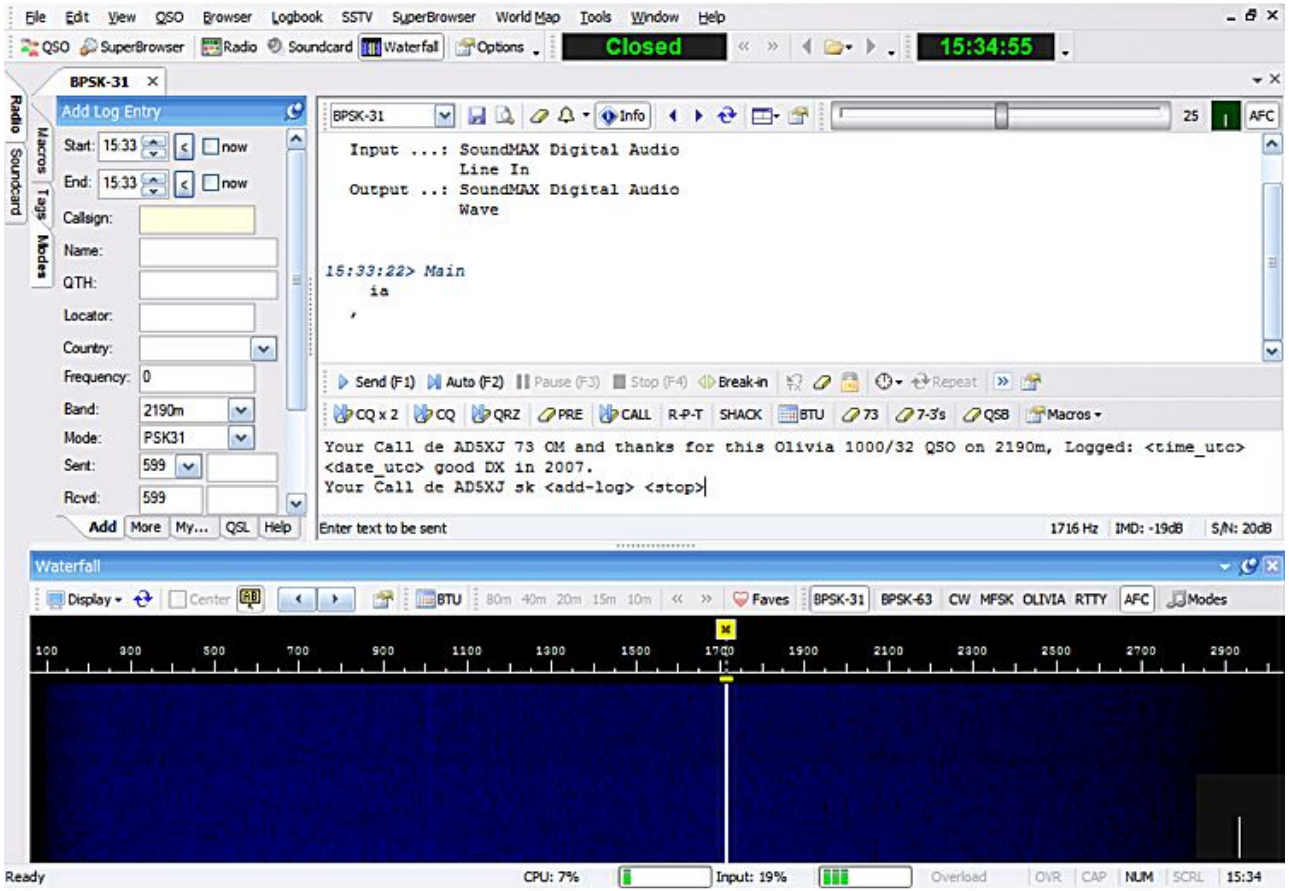
The most widely used and hailed programs for RTTY and some other digital modes are MMTTY for RTTY and MMVARI for PSK and MFSK digital modes. These are very capable programs from JE3HHT Makoto Mori. Mori San has provided one of the simplest and most capable applications available today for RTTY, MFSK, and PSK. Both MMTTY and MMVARI have programming interfaces that allow these applications to be integrated into programs like logging applications. One such application is Logger32 by Bob Furzer K4CY. With Logger32, logging automation and soundcard decoding of RTTY, PSK and MFSK is available in an easy to use single interface. The illustrations show MMTTY standalone and MMVARI inside Logger32:

Ham Radio Deluxe / Digital Master 780 (DM780)

Ham Radio Deluxe (HRD) is a suite of free Windows programs providing computer control for commonly used transceivers and receivers. HRD also includes mapping, satellite tracking and the digital mode program Digital Master 780 (DM780)

HRD is designed for Windows 2000 or higher (XP, Vista, 7), also Internet Explorer 6.0 (or higher) is required. It may work with Windows 98 but this is not supported. The policy is to support Windows versions which are supported by Microsoft (in other words not available on

Linux/Unix and Mac). It is quite attractive, having been written in Visual C++ for Windows by Simon Brown HB9DRV.

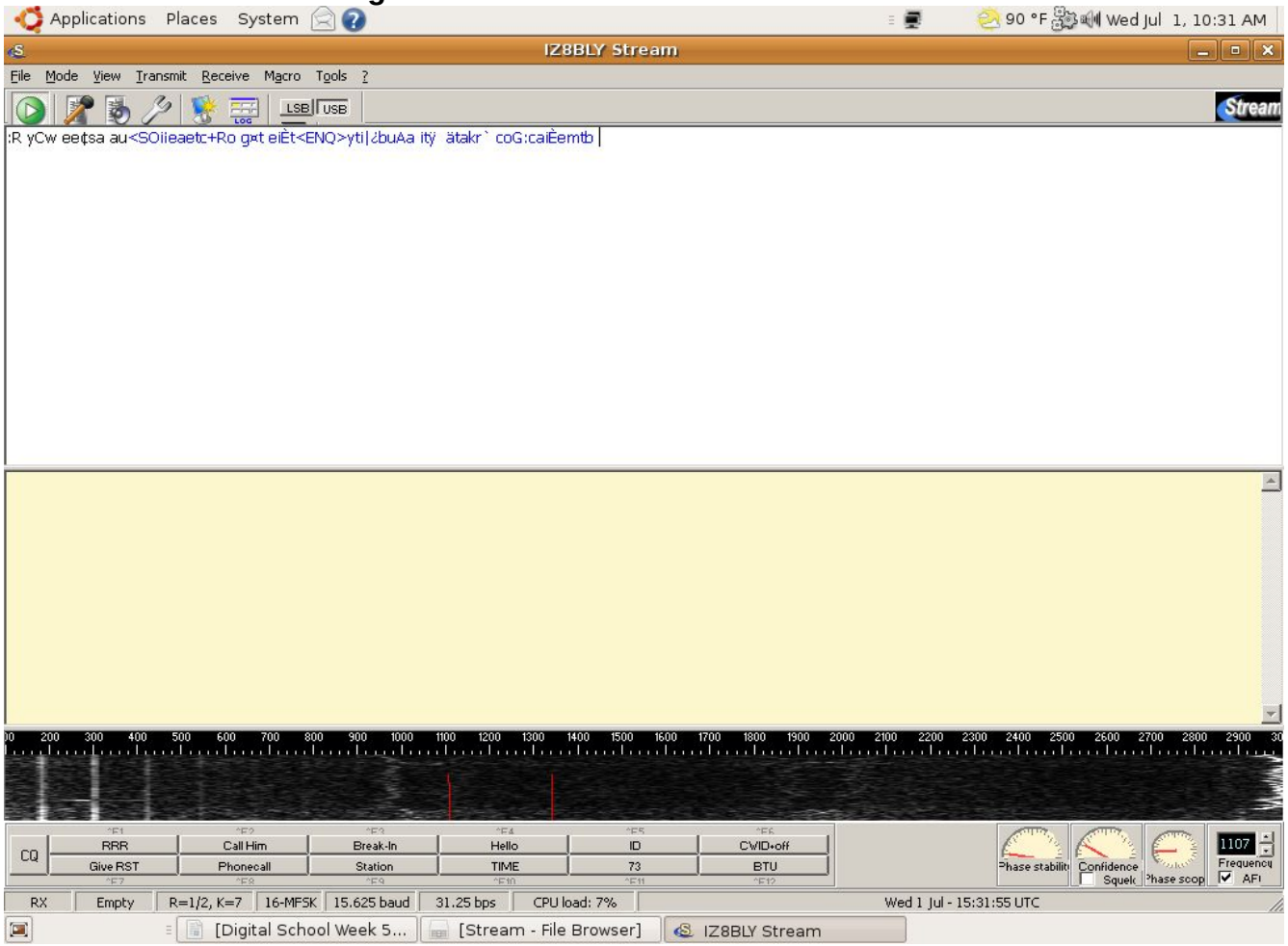


Digital Master 780 is a modern multi-mode program which uses HRD for radio control.

- PSK, QPSK, CW, DominoEx, Hell, MFSK, MT63, OLIVIA, RTTY, THROB.
- Proprietary logbook with limited export/import capability.
- Skinning - adjust look and feel as desired.
- SuperBrowser shows all PSK traces on the band in one window
- SSTV in Scottie and Martin modes.

Digital Master 780 is shipped with HRD v4.0 and higher.

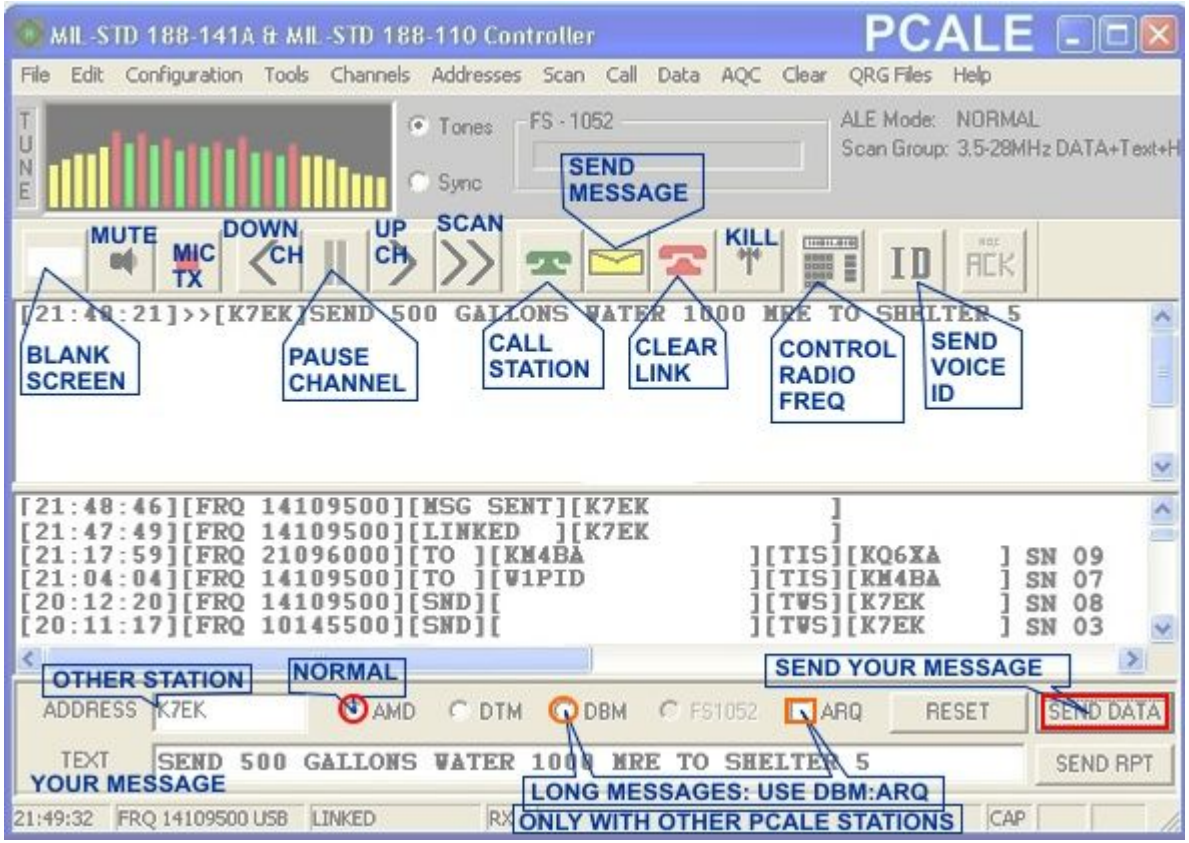
IZ8BLY Stream / MT63 Digital Terminals



During our discussion of digital modes we covered the mode MT63 and its' importance in ham radio. Stream and MT63 terminal are software modems and TNC applications by IZ8BLY Nino Porchino. Nino has made a very attractive and functional interface that decodes the MFSK8 and MFSK16 modes in the Stream application. He has the MT63 version that decodes MT63 mode as well. They are very similar in appearance and functionality. The information provided by the interface controls is relevant and helpful. Interface to the rig PTT is via the serial port or computer interface of your choice. While these applications will run on Windows 95 and 98, it is recommended that you use a Pentium class computer with a speed of at least 133 Mhz and Windows XP to avoid speed and lockup problems. Stream and MT63 can run under Linux Wine if the CPU is P4 class or higher running at least 2Ghz.

PCALE ALE Mil-STD-188-144A Automatic Link Establishment

For the past **7** years, a group of Amateur Radio operators has joined together for communications using ALE and Selective Calling. The number of hams has grown from just a handful active in 2001, to the thousands of enthusiasts in it today. Some are following the traditional ham curiosity to explore interesting aspects of communications; others are developing dependable HF nets, or just using it to keep in touch with a circle of ham friends. The need to call up emergency nets or interoperability and liaison with government HF systems has led many hams to adopt the government ALE standard, called **FED-STD-1045** or **MIL-STD 188-141**. This standard caught on slowly in the ham community, initiated by a few operators with limited government surplus gear and some with expensive commercial equipment having



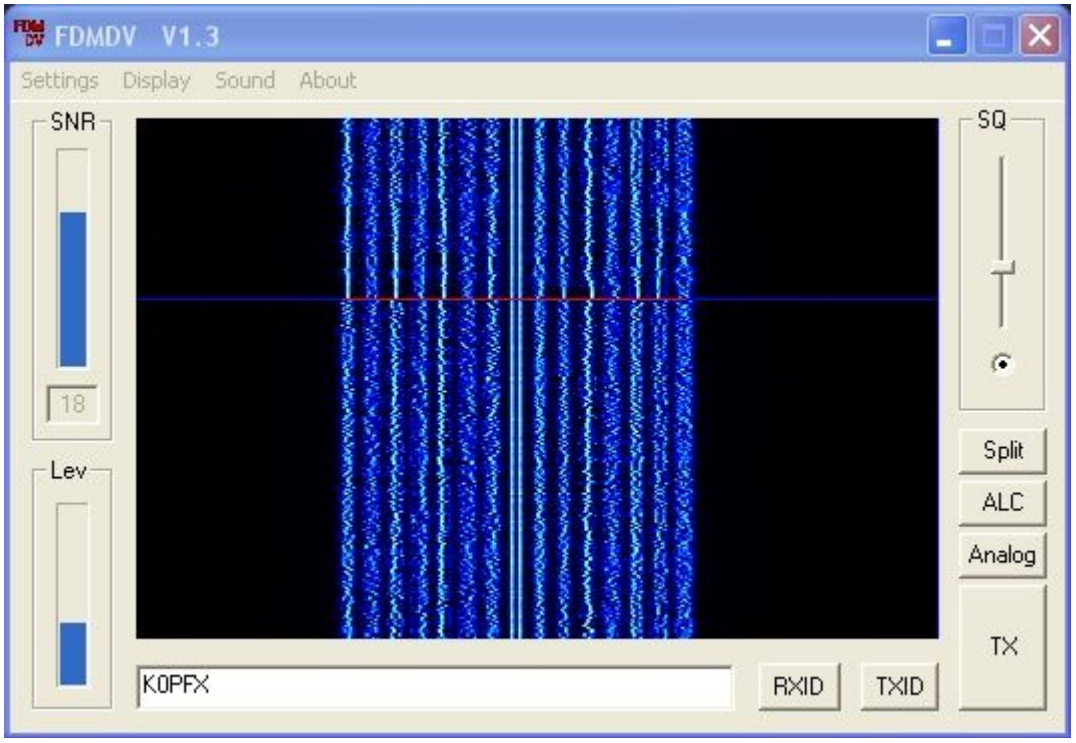
embedded ALE or hardware *controllers*. Recently, the cost of embedded ALE transceivers has been reduced, and they are now available at similar to the cost of a medium priced ham radio. Also, with ALE software, a ham HF transceiver, a PC computer as the controller, and an appropriate antenna system, hams can harness the power of ALE.

The illustration shows a typical EMCOMM message being sent to a specific station using ALE alerting. The annotations explain the many controls and functions of the ALE controller application.

Digital Voice

FDMDV

FDMDV is the latest digital voice mode on HF - it caters to high quality digital voice under poor band conditions, **in only 1100Hz bandwidth!**. FDMDV is a digital voice mode intended for transmission and reception over high- frequency (HF) radio. It uses a frequency division multiplex (FDM) modem with 15 carriers and no forward error correction (FEC). An open source, low-bit-rate coder- decoder (CODEC) provides voice quality audio without the listener fatigue caused by noise and interference normally associated with analog single sideband (SSB) voice. Setup and operation of the Windows®-compatible program was developed to make operation straightforward. An HF transceiver, personal computer and soundcard are required. Path simulation and on-the-air HF testing have shown that decoding voice is possible at a signal-to-noise ratio of 3 dB. FDMDV is based on ideas by Peter Martinez, G3PLX, and written in C for Windows XP by Francesca Lanza, HB9TLK.



It is possible to send and receive FM quality audio on SSB with moderate noise being undetected. This is a semi-secure way to provide high quality voice on HF and VHF SSB. Transmissions on any band from 20 meters to 70cm SSB in 2.5 to 1.1 kc are possible with very high quality. Since the normally analog voice transmissions are digitized, the signal is only intelligible by operators running similar software.

D-Star Digital Voice and Data

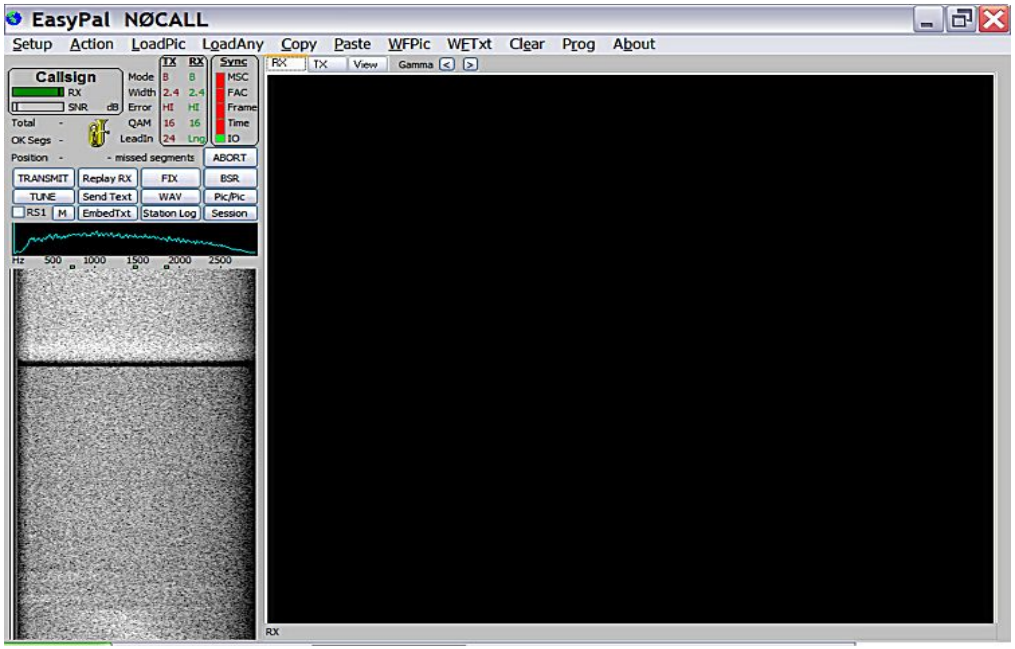
D-STAR (Digital Smart Technologies for Amateur Radio) is a digital voice and data protocol specification developed as the result of research by the Japan Amateur Radio League to investigate digital technologies for amateur radio.While there are other digital on-air technologies being used by amateurs that have come from other services, D-Star is one of the first on-air standards to be widely deployed and sold by a major radio manufacturer that is designed specifically for amateur service use.

D-Star compatible radios are available on VHFand UHFand microwave amateur radio bands. In addition to the over-the-air protocol, D-Star also provides specifications for network connectivity, enabling D-Star radios to be connected to the Internet or other networks and provisions for routing data streams of voice or packet data via amateur radio callsigns.

The first manufacturer to offer D-Star compatible radios is Icom. As of December 30, 2008, no other amateur radio equipment manufacturer has chosen to include D-Star technology in their radios. This year Kenwood has offered rebranded Icom D-Star radios in Japan.

Currently this is a hardware-only application, available only from Icom; but is worth mentioning here.

Digital Images



EasyPal

Since leaving "HamPal" Eric VK4AES has developed a line of programs with the "EasyPal" name. First there was "EasyPal" and "EasyPal Lite". "EasyPal" was developed to become "EasyPal Full". Development of the old "EasyPal" stopped and "EasyPal Full" was called "EasyPal". Confused! EasyPal is still based on hamdrm.dll so is mostly compatible with WinDrm, and HamPal. To remain compatible with the earlier programs the Reed-Solomon encode feature must be switched off. This is done by un-checking the "Encode" box. This affects only transmission from EasyPal to the other programs. (if left on the other station will receive a blank picture file 10KB in size.). "Progressive receive" has been a feature of the EasyPal programs. This enables the receiving station to see the picture gradually appear during reception. Nothing special has to be done at the transmitter for this to happen.

Reed-Solomon encoding is an additional form of redundancy to help with unreliable transmission paths (e.g. as on the lower HF bands). The operational price is additional transmission time. A spectrum display is included as well as the waterfall display. This enables an easier check on audio frequency response (the flatter the better, however I have had very good success with my TS-440SAT). The RX & TX screens are tabbed for easy switch. A third Tab (View) displays the TX & RX history with options to delete, display full size or send to TX. EasyPal is still experimental but works quite well. High Quality digital images may be sent and received with moderate noise and Doppler shift conditions. Program control allows different transmission modes to increase the noise tolerance under changing conditions. For instance, 40 meters requires the slower configurations while 20 meters and above are quite enough to allow 16 QAM and short interleave operation at a fairly fast transmission rate. Digital pictures of 640 by 480 may be sent in under 2 minutes. Resolutions of up to 1024 by 780 are allowed although with much longer transmission times. Images of strictly black and white (grayscale), rival fax transmission speed with quality rivaling digital copiers. This is a fast and efficient way of sending documents that are otherwise not reproducible using conventional ARRL message handling methods or where short point to point transmissions (e.g. on 10 meters or VHF), of documents do not fit WinLink 2000 use. The only hardware requirements are a computer and soundcard with optional scanning printer and rig interface.

Decision Matrix

	Digipan	HamScope	MMTTY	MMVARI	TrueTTY	WinPSK	IZ8BLY Stream / MT63	MultiPSK	HRD/D M780	MixW	Fldigi	PCALE	MMSSTV	Cr
Operating System	Win XP	Win XP	Win XP / Linux Wine	Win XP	Win XP	Win XP	Win XP / Linux Wine	Win XP	Win XP	Win XP	Win XP / Linux	Win XP	Win XP / Linux Wine	Wi
Price	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free/ $50	Free	Free	Free	Fre
CW		X						X	X	X	X			
PSK	X	X		X		X	X	X	X	X	X			
MFSK		X		X			X	X	X	X	X			
Packet		X						X		X	X			
Q15X25								X		!				
MT63							X	X	X	X	X			
APRS								X		X	X			
Pactor 1								X**		!				

Amtor								X		X	X			
Sitor								X		X	X			
RTTY			X		X			X	X	X!	X			
MFSK				X				X	X	X	X			
Olivia								X	X	!	X			
Contesia								X		!				
Throb								X	X	X	X			
Domino								X	X	X	X			
Pax								X						
ALE Mil-Std-188							*	X	*	*	*	X		
SelCall DTMF								X						
Hell								X	X	X	X			
Fax								X	X	X	X			
SSTV								X	X				X	X

HDSSTV														
Voice														
Radio Contrl	X+	X+##	X+	X+	X+	X+	X+#	X+##	X+##	X+#	X#	X+	X+	X+

X Built In Feature

! May need downloaded module

* With external ALE decode only

** Receive only

+ Using serial port directly

Using HamLib or RigCAT for radio contol

Using HRD interface for radio contril