



# TBARC Programs Digital Modes Class

**July 27, 2016 Class**

**By Israel AD7ND & Andy K3WYC**

# Before We Start...



- **This material was put together as an attempt to fulfill a request from the TBARC Board for a digital training class for our members.**
- **The primary purpose of this presentation is to introduce the basics of digital modes to an audience that is yet to try them.**
- **Due to our approach to keep this material as simple as possible, many other aspects of the applications, as well as explanations, were left out on purpose.**

# Acronyms



- **AFSK = Audio Frequency Shift Keying**
- **ASK = Amplitude Shift Keying**
- **BW = Bandwidth**
- **CAT = Computer Aided Transceiver**
- **FEC = Forward Error Correction**
- **FSK = Frequency Shift Keying**
- **MFSK = Multiple Frequency Shift Keying**
- **NTP = Network Time Protocol**
- **OOK = On-Off Keying**
- **PSK = Phase Shift Keying**
- **QPSK = Quadrature PSK**

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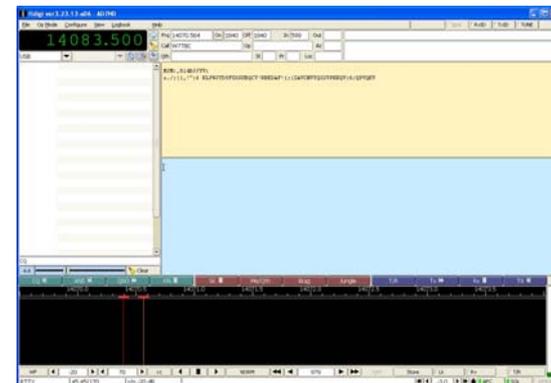
# Thank You Note



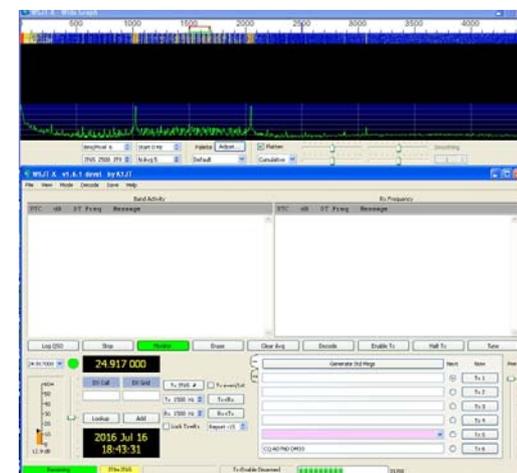
- Thanks to the generosity of hams like Peter Martinez (G3PLX), David Freeze (W1HKJ) and Joe Taylor (K1JT) as well as many others who support them we can enjoy free digital mode applications like FLDIGI and WSJT-X



David Freeze W1HKJ



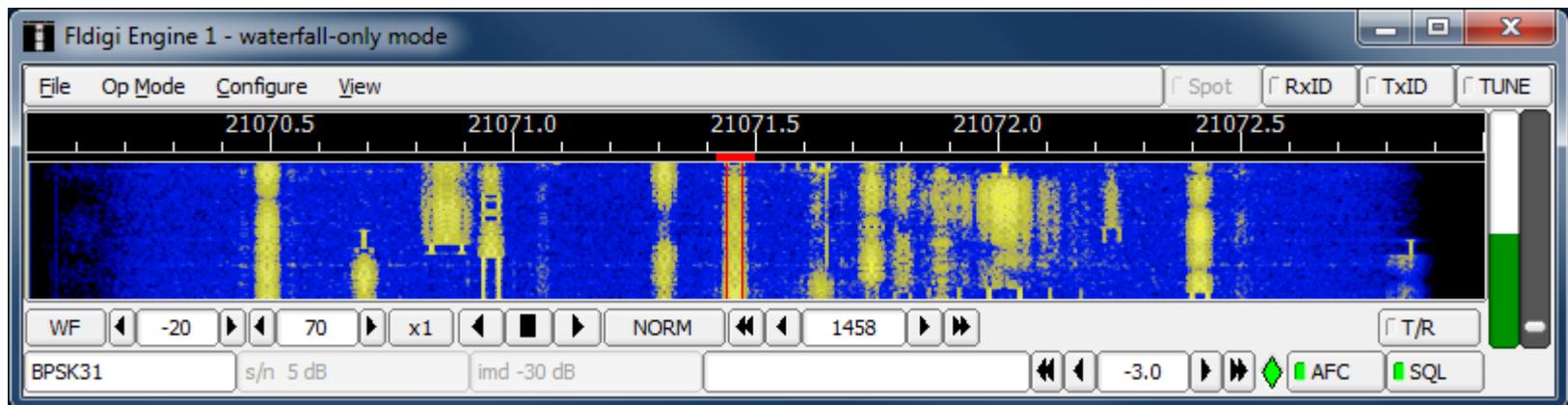
Joe Taylor K1JT



# What is a Digital Mode?



- For the purpose of this presentation, a digital mode is any mode that:
  - Requires the use of an encoding/decoding system
  - It is **not** analog voice (SSB, FM or AM)
- Examples of digital modes include:
  - **PSK**, QPSK, **RTTY**, MFSK, HELL, PACTOR, THROB, **OLIVIA**, **JT65**, **JT9**, SSTV, DominoEX, THOR, WSPR, OPERA, etc.



# Reasons to Operate Digital Modes



- **Reasons to use digital modes include:**
  1. **More punch than (analog) voice**
  2. **Better signal to noise ratio (S/N)**
  3. **Forward Error Correction (FEC) - not all digi modes**
  4. **Bandwidth efficiency (better usage of spectrum)**
  5. **Better performance relative to analog SSB/AM**
  6. **Entire QSO can be recorded (and played back)**

# Reasons to Operate Digital Modes



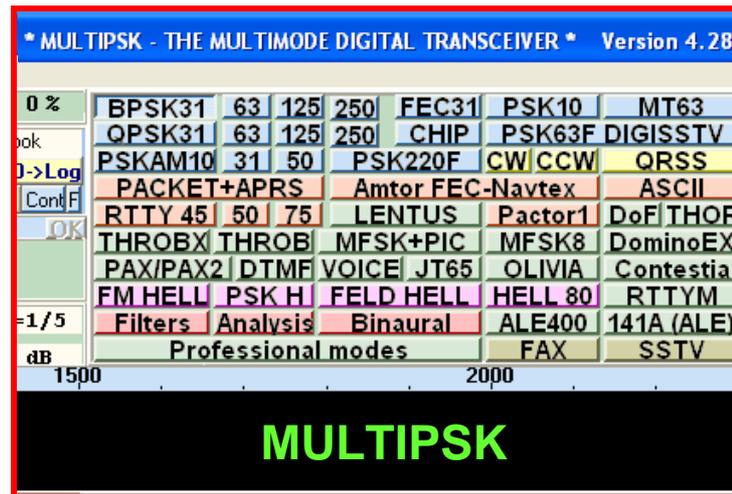
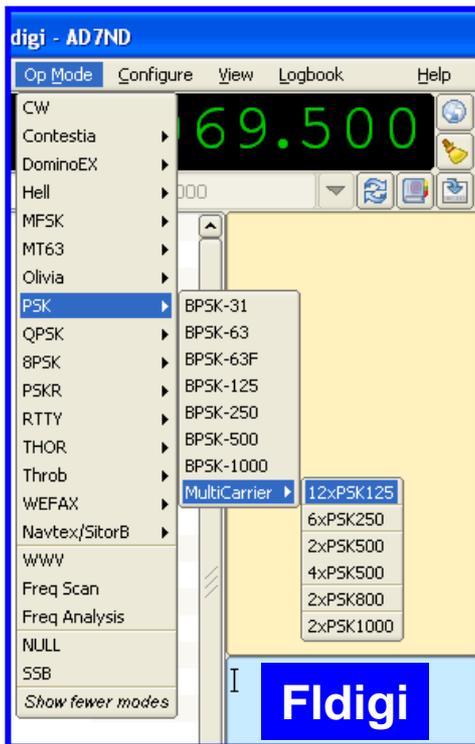
Mode	SNR (dB)	Performance	
JT65	+24	JT65 Outperforms CW	
OLIVIA	+13	OLIVIA Outperforms CW	
PSK31	+8	PSK Outperforms CW	
<b>CW</b>	<b>0</b>	<b>Reference</b>	
RTTY	-5	CW Outperforms RTTY	
FM	-10	CW Outperforms FM	
SSB	-17	CW Outperforms SSB	
AM	-29	CW Outperforms AM	

Source: Data from QST Dec 2013 How Much "Punch" Can You Get from Different Modes? by Kai Siwiak, KE4PT and Bruce Pontius, N0ADL.

# How Many Digital Modes Are There?



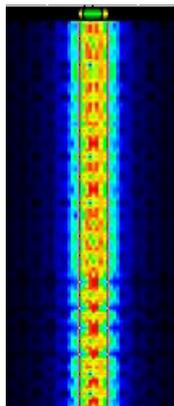
- Probably 30+ modes and over 200 submodes
- New modes are constantly being added



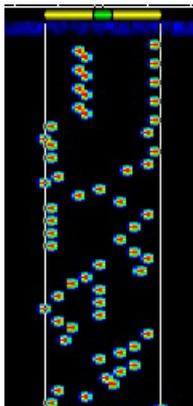
# What They Look on the Waterfall...



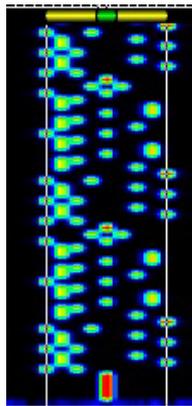
PSK31



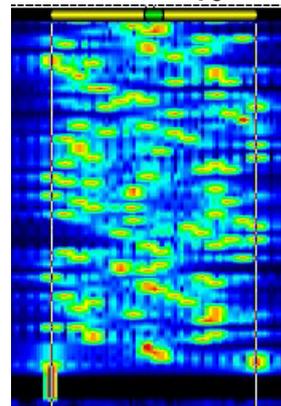
DominoEX



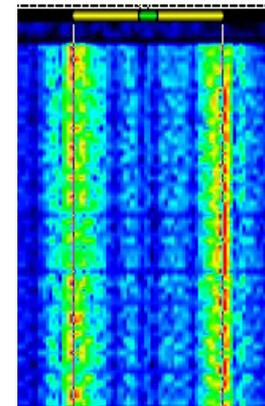
Throb4



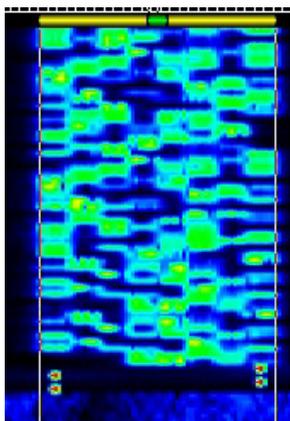
MFSK<sub>16</sub>



RTTY

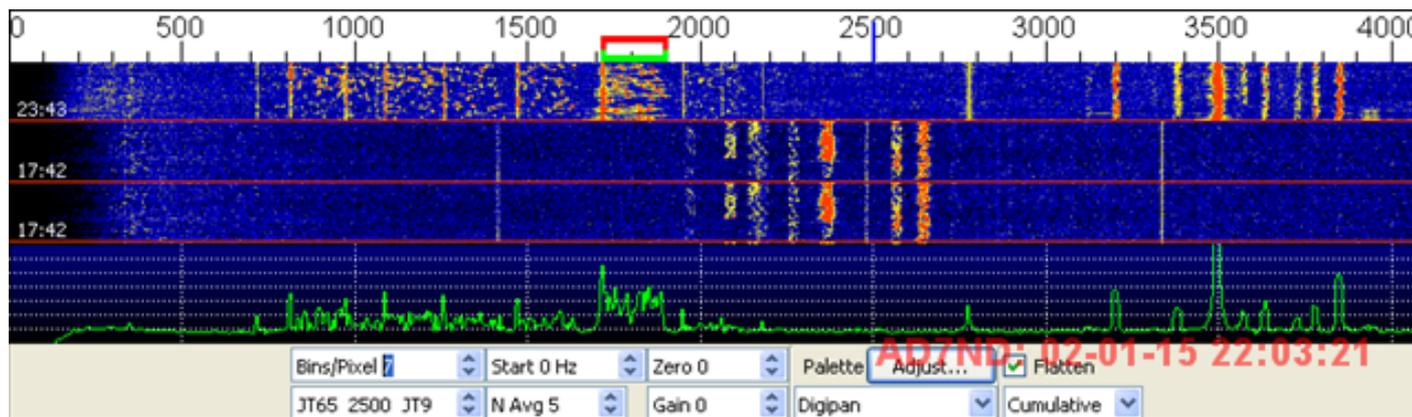


OLIVIA<sub>250/8</sub>



JT65

JT9



# Digital Modes Comparison



Mid-Latitude Disturbed NVIS Ionospheric Simulation using AE4JY 'Pathsim' simulator for 0dB S/N in a 2.4kHz band

Performance	Parameters	Best	Poorest
Propagation	Error Rate vs Mode Speed (WPM)	MT63 MFSK16	PSK RTTY
Bandwidth	Bandwidth	JT9	Olivia
Coding	Coding Gain (WPM/Symbol Rate)	Throb MT63	Feld-Hell
Signal/Noise	(S+N)/N	JT9/JT65 Opera	RTTY

# Digital Mode Modulations



<b>AFSK</b> (Audio Freq-Shift Keying)	<b>RTTY, AMTOR, PACTOR, CLOVER</b>
<b>MFSK</b> (Multi Freq-Shift Keying)	<b>JT65/JT9, FSK441, OLIVIA, DominoEX, THROB, WSPR</b>
<b>PSK</b> (Phase-Shift Keying)	<b>PSK31, PSK63, MT63, Q15X25</b>
<b>Other</b>	<b>CW, HELL, ON-OFF KEYING (OOK)</b>

<http://wb8nut.com/digital/>

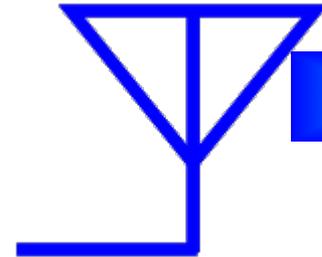
# Digital Mode Basic Setup



Interface



Transceiver



Ant

This setup works for most digital modes



PC+Application

Radios like TS-590 and IC-7300 do not require an interface

# What is Needed to Get Started?



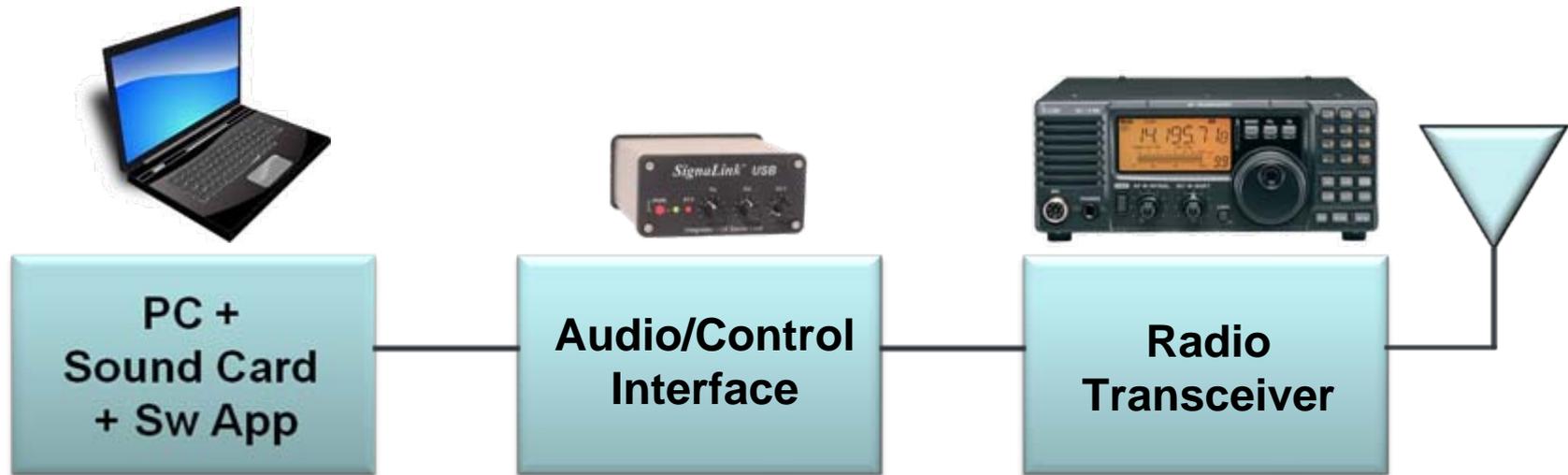
- **At a minimum:**

1. PC running Windows XP or better
2. SSB HF or VHF transceiver
3. Means to connect PC to Radio (e.g. Signalink, Rigblaster)
4. Connecting Cables
5. Software Applications (e.g. FLDIGI, WSJT-X, etc.)

Some digi mode applications are supported by Linux and Apple.



# Digital Communication System



- Most digital modes have 100% duty cycle
- Operating rig at full power may result in overheating and damage to the rig
- Choose appropriate power level for the mode and the capabilities of the rig.

Audio modulation level and ALC adjustment are very important as transmitter must maintain linear operation to avoid distortion of the digital signal.

# Basic Steps



- 1. Download Applications**
- 2. Install Applications**
- 3. Connect PC, Interface and Radio**
- 4. Configure Audio & CAT**
- 5. Configure Applications with Station Information**
- 6. Turn off any speech processor or compression**
- 7. Adjust Signal Levels, ALC, Power, etc.**
- 8. Check reception and signal decoding**
- 9. Transmit into a dummy load for testing**
- 10. Ask another ham to monitor and report your first transmissions**

# Downloading Applications



- **FLDIGI**
  - David Freeze's webpage: <http://www.w1hkj.com/>
  - Download FLDIGI from here:  
<https://sourceforge.net/projects/fldigi/files/>
  - FLDIGI Wiki is here:  
<https://fedorahosted.org/fldigi/wiki>
- **WSJT-X**
  - Home Page: <http://physics.princeton.edu/pulsar/k1jt/>
  - Download WSJT-X software and documentation from here:  
<http://physics.princeton.edu/pulsar/k1jt/wsjtx.html>
- **JTAlert**
  - <http://hamapps.com/>
- **Dimension-4**
  - <http://www.thinkman.com/dimension4/>

# Downloading FLDIGI and WSJT-X



## Downloads

Be sure to refer to the online **WSJT-X User Guide** for [Version 1.6](#).

### Windows

- Latest full release, Version 1.6: [wsjtx-1.6.0-win32.exe](#).

### Linux

Installation instructions for Linux can be found [here](#) in the User Guide. Download system, from the list below. (Versions installable on your system, as package maintainers create the packages.)

- Latest full release, Version 1.6
  - Debian, Ubuntu, ... (32-bit): [wsjtx-1.6.0-32bit.deb](#)
  - Debian, Ubuntu, ... (64-bit): [wsjtx-1.6.0-64bit.deb](#)
  - Fedora, RedHat, ... (32-bit): [wsjtx-1.6.0-32bit.rpm](#)
  - Fedora, RedHat, ... (64-bit): [wsjtx-1.6.0-64bit.rpm](#)

**Recommendation is to download the latest stable version**

**Do not forget to download the manuals**

fldigi  
Ham Radio Digital Modem Application  
Brought to you by: dave-w1hkj, sb42

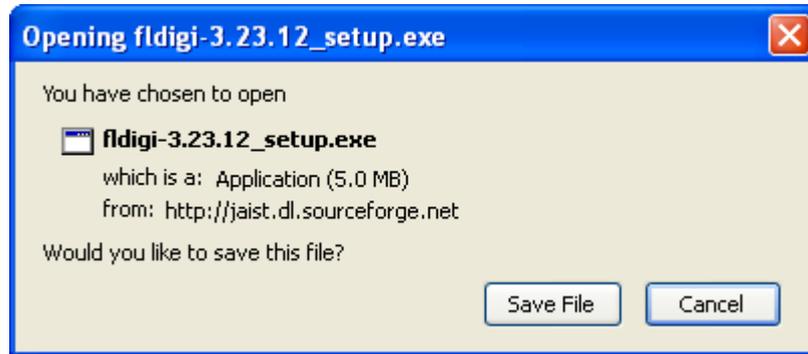
Summary | Files | Reviews | Support | Mailing Lists | Git ▾

Looking for the latest version? [Download fldigi-3.23.13-alpha01\\_setup.exe \(5.3 MB\)](#)

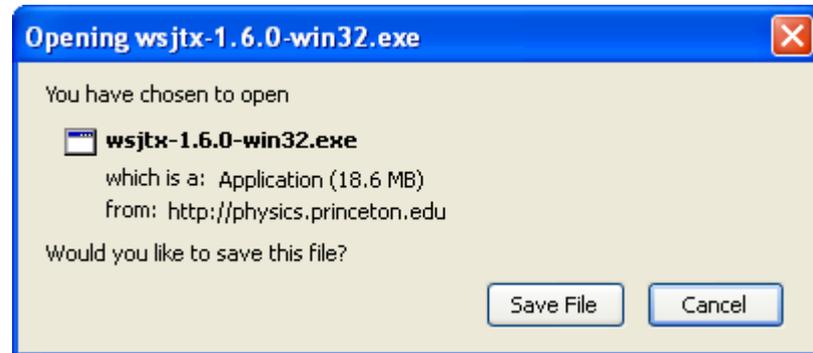
Home

Name	Modified	Size	Downloads / Week
alpha_tests	< 16 hours ago		1,692
pets	2016-06-29		38
flrig	2016-06-25		920
fllog	2016-06-24		975
flmsg	2016-06-22		608
<b>fldigi</b>	2016-06-22		<b>3,218</b>

# Downloading FLDIGI and WSJT-X



**Save these files to your computer then install them...**



# Installing Applications



**Installation instructions are available in the FLDIG and WSJT-X User Guides**

- **Install FLDIGI**
- **Install WSJT-X**
- **Install Dimension-4 or other NTP<sup>(\*)</sup> like Meinberg**

***(\*) NTP (Network Time Protocol) application is needed to synchronize the computer's clock***

# Connecting PC-Interface-Radio



- There are many types of interfaces, the link below provides step-by-step instructions to connect a Tigertronics Signalink™ USB, which is a popular interface used by many hams operating digital modes:

[http://www.tigertronics.com/sl\\_suprt.htm](http://www.tigertronics.com/sl_suprt.htm)



Adobe Acrobat  
Document

- Rigblaster, Unified Microsystems, kits available in the internet and even homebrew can be used

<http://www.qsl.net/wm2u/interface.html>

***Remember... some modern rigs don't need an external interface.  
Check before you buy hardware that you may not need.***

# Configuring Audio



- Audio card should be set in Windows and digital mode applications (e.g. WSJT-X and FLDIGI)

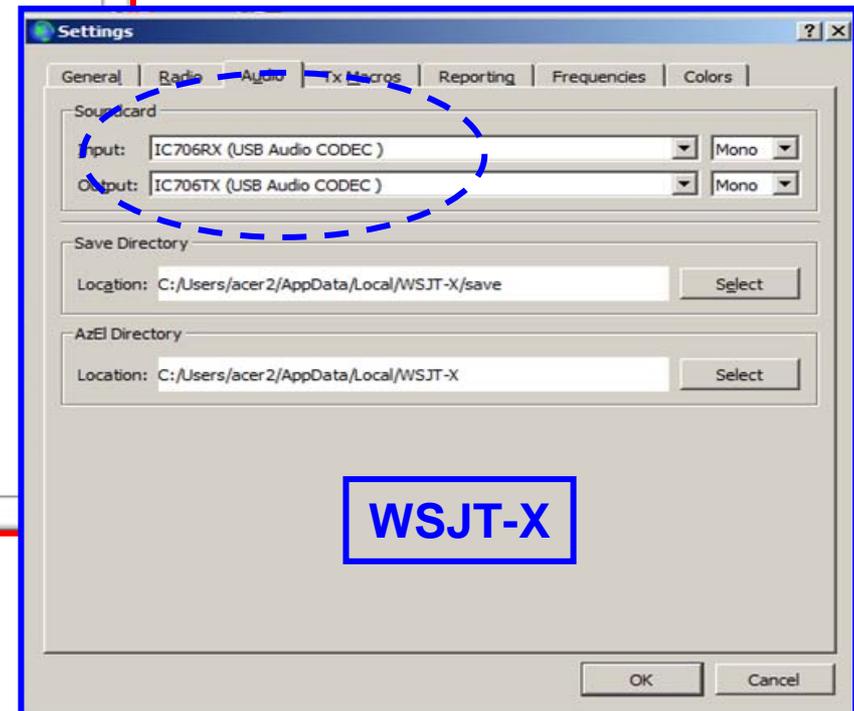
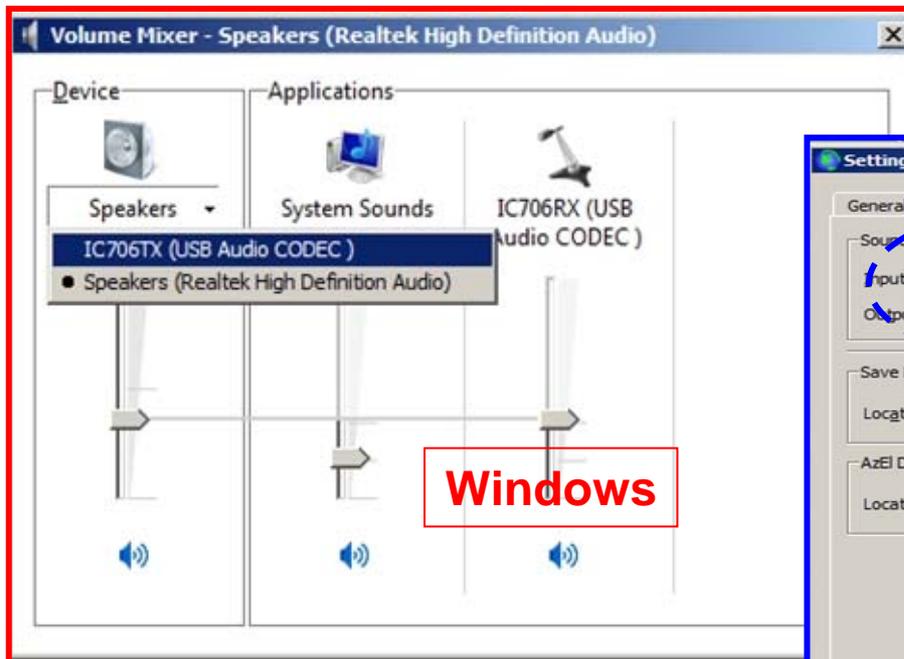
The image displays three overlapping windows illustrating audio configuration:

- Volume Mixer - Speakers (USB Audio CODEC):** Shows the 'Device' column with 'Speakers' selected and the 'Applications' column with 'WSJT-X v1.6.0' selected. A red box highlights this window, with the word 'Windows' written in red below it.
- Microphone Properties:** Shows the 'Levels' tab with a volume slider set to +26 dB. A dropdown menu is open, showing 'percentage' and 'decibels' (selected). A red box highlights this window, with the word 'Windows' written in red above it.
- Settings:** Shows the 'Audio' tab with 'Soundcard' settings: Input: Microphone (USB Audio CODEC), Output: Speakers (USB Audio CODEC). It also shows 'Save Directory' and 'AzEl Directory' paths set to C:/Users/acer2/AppData/Local/WSJT-X/. A blue box highlights this window, with the text 'WSJT-X' written in blue below it.

# Configuring Audio



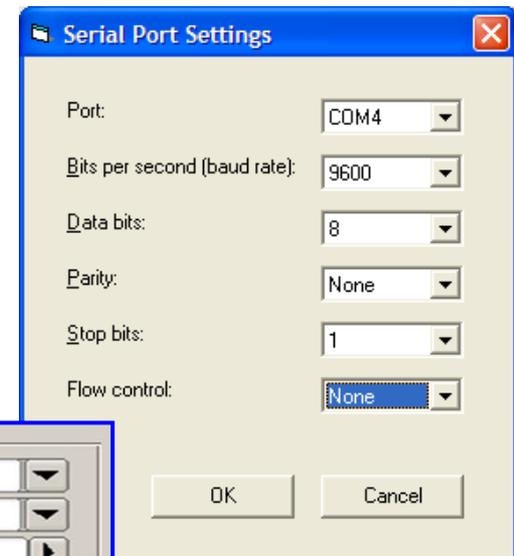
Recommendation to rename the interface/rig audio CODEC, e.g. change "microphone" to **"IC706 RX"** and change "speaker" to **"IC706TX"**. Always ensure that the interface/rig is **NOT** the default sound device!



# Configuring CAT



- Most Radios require a Serial/USB cable interface to connect to the computer
- Serial/USB cable adapter usually requires a driver installation
- Port, Baud Rate, Stop Bits, Data Bits, Parity and Handshake information is usually required
- Radio's baud rate must match the serial port information



# Why Adjusting Signal Levels?



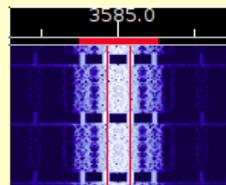
Excerpt from Digital Modes – Sight & Sound: <http://www.w1hkj.com/FldigiHelp-3.21/Modes/>

Below are examples of what **not** to do on the ham bands. In both cases the audio drive to the transmitter was set **too high**, either **by mistake or because the operator thought that more power is better**. When the audio stages of the transmitter are overdriven with clipping then you might possibly see 3<sup>rd</sup>. harmonic audio images of the PSK signal.

**Be careful when evaluating a received signal. The receiver might also be overdriven and result in similarly distorted waterfall signatures.** You can always check your local signal path by inserting 20 dB of attenuation at the antenna. If things get better then the distortion is in the receiver and not in the transmitter.

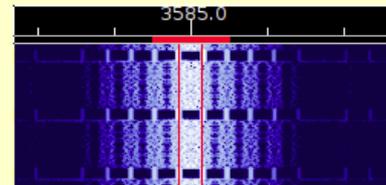
You **cannot** achieve better communications **by overdriving the audio** on any of the digital modes that require linearity. These include all of the modes that have an amplitude modulation component. Some like PSK and THROB have both an amplitude and frequency or phase modulation component.

An overdriven signal can produce more decoder errors than a properly driven signal of lesser power. This is particularly true for all variants of PSK.



BPSK-31, imd = -18 db, about 6 dB of ALC

[Sound](#)



BPSK-31, imd = -14 db, about 12 dB of ALC

[Sound](#)

# Adjusting ALC



## ALC = Automatic Level Control

- **ALC is a transmitter closed loop control function that is intended to keep the transmitter operating in the linear region, and at set power, when the input signal (drive) varies in amplitude.**
- **ALC will only work correctly within the design range of audio signal drive levels**
- **Below the design operating range ALC will not maintain power**
- **Above the design operating range ALC may introduce significant distortion in the transmitted signal**
- **Know how ALC operates in your transmitter and understand how the acceptable ALC operating region is displayed**

# Adjusting Power



## Two approaches to adjusting power:

1. **Set required power level on rig and then adjust audio input for correct ALC indication**
2. **Set rig power setting to maximum and control power by adjusting audio input level (for low power settings ALC will be outside the design range and there will be no ALC meter reading)**

# Adjusting Power



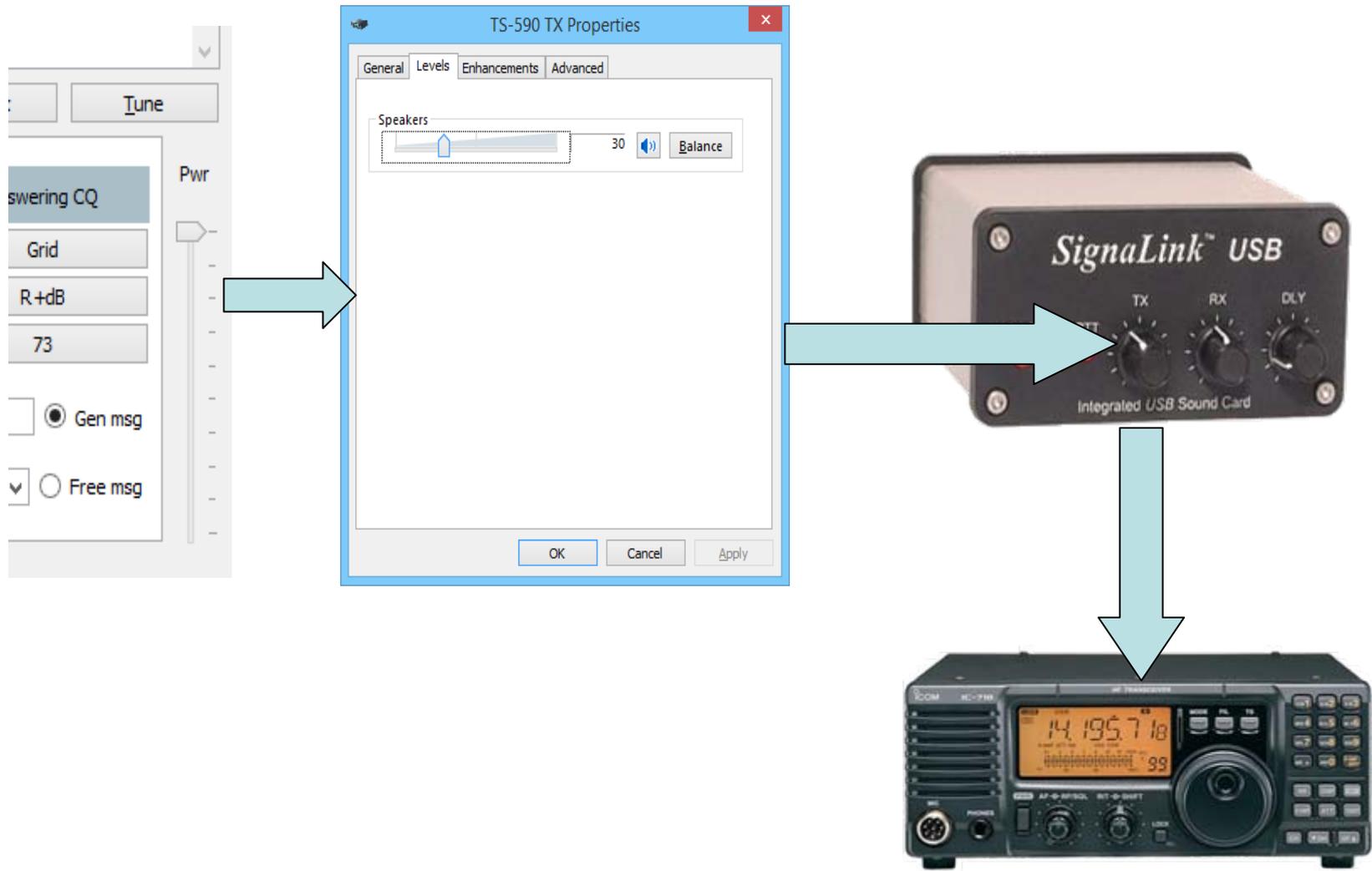
There are typically several places that the **audio drive level** can be adjusted:

- In the digital mode application
- Using the Windows “Playback Device” level slider
- Using a control on the digital mode interface
- Level control internal to the transmitter

Sometimes the digital app controls the Windows slider, sometimes it’s an independent adjustment.

Balance the gain distribution so a high output of one stage does not drive next stage non-linear.

# Adjusting Power



# Monitoring Digital Mode

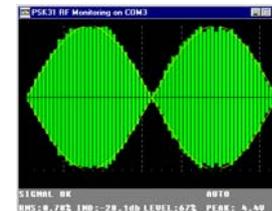


- It is very **easy to transmit a bad signal** with most, if not all, modes (not just digital)
- **The Choices**
  - **Don't monitor because you know your signal is perfect**  
**Congratulations...**
  - **Ask someone else to check your signal quality**  
**Can be a good choice for those new to a mode**
  - **Check you signal yourself**  
**Some methods are described**

# Self Monitoring of Transmissions



1. Use a separate receiver and PC with digital mode software to listen to, visually inspect, and decode your signal
2. Use the transmit monitor function of your transceiver to take a sample of your signal and listen, visually inspect, and decode it
3. Some digital mode programs provide a TX monitor function others require an independent monitor such as Spectrum Lab.
4. Note that TX monitors are not all the same. Some sample the actual RF signal, others sample the modulation audio.
5. Use a specialized analyzer such as **PSKMeter**
6. Monitors used for phone/CW modes may also show problems with digital modes (oscilloscope, spectrum analyzer etc)



# Typical Problems

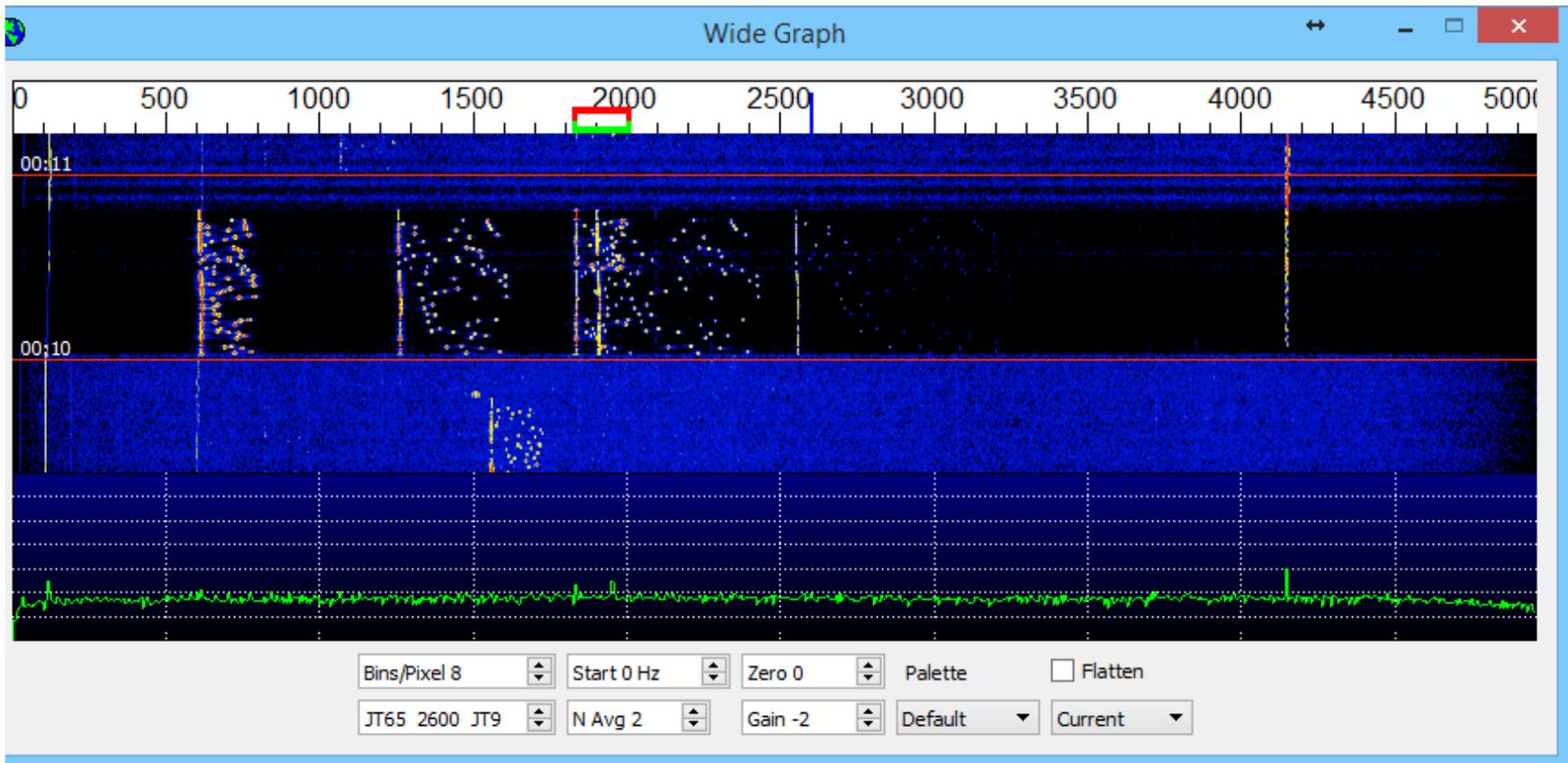


- **Over modulation – especially true for PSK modes**
- **Audio harmonics**
- **Spurious modulation by 60 Hz and its harmonics**
- **Spurious modulation by unintended PC audio**
- **Spurious modulation from microphone pickup**
- **Mark/space reversal (RTTY only)**

# Examples



- **JT65 second, third, and fourth audio harmonics**

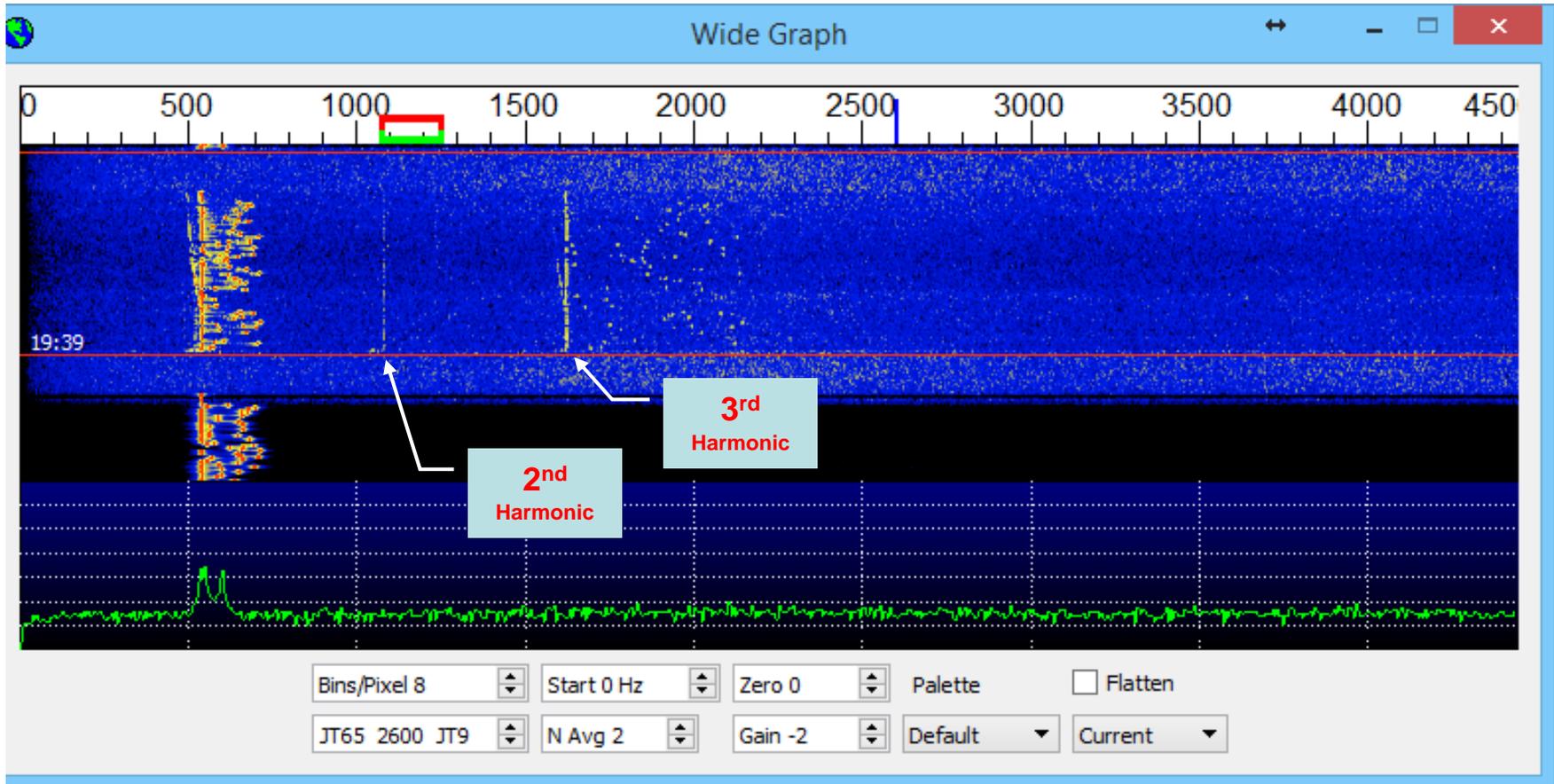


**Fundamental sync tone 620Hz, 2<sup>nd</sup> at 1240Hz, 3<sup>rd</sup> at 1860Hz, 4<sup>th</sup> at 2480Hz**  
**Note 2<sup>nd</sup> harmonic signal is twice as wide as fundamental, 3<sup>rd</sup> is 3 times, etc.**

# Examples



- JT65 weak 2<sup>nd</sup> harmonic with stronger 3<sup>rd</sup> harmonic



# Digital Mode Frequencies



- **JT65 & JT9**



Adobe Acrobat Document

- **Band Plan Recommendations**

<http://www.bandplans.com/?band=All>

BAND	OLIVIA 500 Center Frequency	OLIVIA 500 CQ: 500/16 DIAL Frequency USB kHz	OLIVIA 500 Audio Centre Marker
<u>20 meters</u>	14075.4	14074.65	750Hz
	14078.4	14077.65	750Hz
	14074.4	14073.65	750Hz

# Common PSK, RTTY Exchanges



- **Sending a CQ call**
- **Answering a CQ call**
- **Starting a QSO (<his/her-call> de <your-call>)**
- **Your station details (Name/Location/Grid Reference/Radio/Antenna etc...)**
- **Ending a QSO (SK)**

# JT65 QSO



**WSJT-X v1.6.0 by K1JT**

File View Mode Decode Save Help

Band Activity					Rx Frequency				
UTC	dB	DT	Freq	Message	UTC	dB	DT	Freq	Message
0452	-6	0.2	1638	# EU1FQ K6XJ R-14	0450	-11	1.2	1724	# CQ N8CDY EN90
0454	-11	0.3	1736	# W7TBC N8CDY RR73	0451	Tx		1724	# N8CDY W7TBC DM33
0454	-17	0.4	390	# ZL3TE VE7JDZ 73	0452	-13	0.4	1731	# W7TBC N8CDY -08
0454	-12	0.3	949	# K2GT ZP5YW -09	0453	Tx		1731	# N8CDY W7TBC R-13
0454	-3	0.4	1066	# KB1RIQ ZL1DFC R-06	0454	-11	0.3	1736	# W7TBC N8CDY RR73
0454	-14	-1.0	1151	# ZL1BDW K6RWM DM14	0455	Tx		1736	# N8CDY W7TBC 73
0454	-6	0.1	1638	# EU1FQ K6XJ RR73					

Log QSO Stop Monitor Erase Decode Enable Tx Halt Tx Tune

20m **14.076 000**

DX Call: N8CDY, DX Grid: RR73, Az: 352, 3786 mi

2016 Jul 24 04:55:53

Generate Std Msgs: N8CDY W7TBC DM33, N8CDY W7TBC -11, N8CDY W7TBC R-11, N8CDY W7TBC RRR, N8CDY W7TBC 73, CQ W7TBC DM33

Receiving JT65 A Last Tx: N8CDY W7TBC 73 Tx-Enable Disarmed 100%

**W7TBC Working N8CDY in JT65 Mode Using WSJT-X, 20m**

# JT65 QSO



File View Mode Decode Save Help

Band Activity

UTC	dB	DT	Freq	Message
0339	-21	1.0	1704	# CQ NOLWF EN10
0339	-1	0.9	1005	# KSXI KG5HTH EMO2
0341	-1	1.0	1005	# KSXI KG5HTH R-19
0342	-12	0.3	1281	# CQ NC7L DM33
0343	-1	0.9	1006	# KSXI KG5HTH 73
0345	-2	0.9	521	# CQ KG5HTH EMO2
0345	-11	0.5	1282	# NC7L K5WI EM12
0345	-16	1.5	1705	# AD7ND NOLWF -19
0347	-1	1.3	521	# WA6JBZ KG5HTH R-22
0347	-8	0.6	1282	# NC7L K5WI R-07
0347	-19	1.5	1705	# CQ NOLWF EN10

Rx Frequency

UTC	dB	DT	Freq	Message
0324	-1	0.2	1578	# CQ KG5WR EM12
0324	-5	0.2	1575	# CQ KG5WR EM12
0324	-6	1.0	588	# CQ KG5HTH EMO2
0326	-5	0.2	588	# AD7ND KG5HTH -23
0328	-3	0.1	589	# AD7ND KG5HTH RR73
0330	-1	0.2	590	# CQ KG5HTH EMO2
0332	-2	0.2	591	# CQ KG5HTH EMO2
0333	-18	1.6	1703	# CQ NOLWF EN10
0337	-17	1.6	1704	# CQ NOLWF EN10
0339	-21	1.6	1702	# CQ NOLWF EN10
0345	-16	1.5	1705	# AD7ND NOLWF -19

Log QSO Stop Monitor Erase Decode Enable Tx Halt Tx Tune

6m 50.276 000

DX Call: NOLWF, DX Grid: EN10, Tx JT65 #: Tx 1705 Hz, Tx even: , Tx < Rx: , Rx < Tx: , Lock Tx=Rx: , Report: -16

Az: 56, 961 mi

2016 Jul 13 03:49:09

Generate Std Msgs

Next	Now	Pwr
NOLWF AD7ND DM33	<input type="radio"/>	Tx 1
NOLWF AD7ND -16	<input type="radio"/>	Tx 2
NOLWF AD7ND R-16	<input checked="" type="radio"/>	Tx 3
NOLWF AD7ND RRR	<input type="radio"/>	Tx 4
NOLWF AD7ND 73	<input type="radio"/>	Tx 5
CQ AD7ND DM33	<input type="radio"/>	Tx 6

AD7ND: 07-13-16 03:49:09

Receiving JT65 A Last Tx: NOLWF AD7ND R-16 Tx-Enable Armed 18%

**AD7ND Working KG5HTH in JT65 Mode Using WSJT-X, 6m**

# JT9 QSO



The screenshot displays the WSJT-X software interface. At the top, there are two log windows: "Band Activity" and "Rx Frequency".

Band Activity					Rx Frequency				
UTC	dB	DT	Freq	Message	UTC	dB	DT	Freq	Message
2023	-23	0.1	701	TO3ONP N3DQZ FN20	2023	-19	0.0	1026	CQ K8OU0A EM17
2027	-11	0.5	874	RTU FRM WA 73	2023	-9	0.3	873	CQ K7YCH CN88
2027	-25	0.2	662	SQ7KGA PYSEJ 73	2025	-12	0.3	873	AD7ND K7YCH R-05
2027	-21	0.1	689	CQ N6TE DM12	2027	-11	0.5	874	RTU FRM WA 73
2027	-15	-0.6	922	CQ KSOUSA EM29	2029	-3	0.3	874	CQ K7YCH CN88
2027	-21	0.2	961	PA3FLA VA3MJR FN03					
2029	-3	0.3	874	CQ K7YCH CN88					
2029	-17	0.2	688	NE5RD N6TE -20					
2029	-10	0.2	922	CQ KSOUSA EM29					
2029	-16	0.2	962	PA3FLA VA3MJR FN03					
2029	-3	0.3	1075	RGSJVF VA3TX EN94					

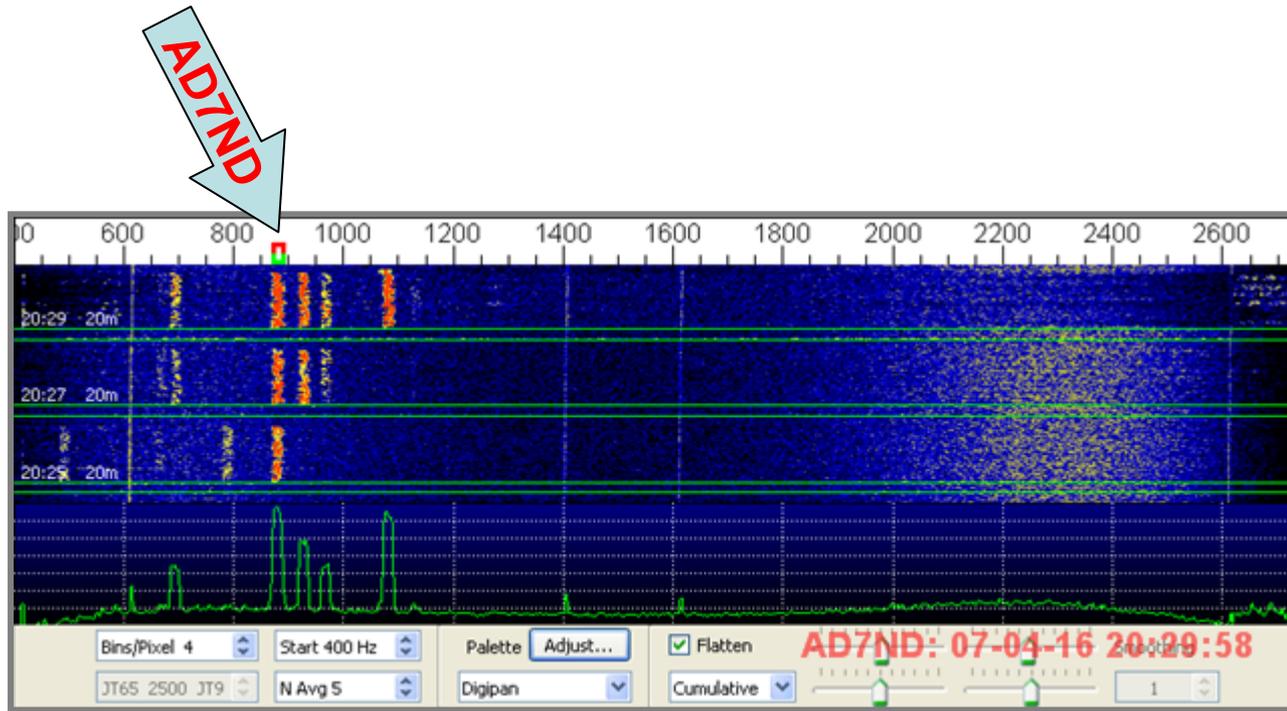
Below the logs are control buttons: Log QSO, Stop, Monitor (highlighted), Erase, Decode, Enable Tx, Halt Tx, and Tune.

The center of the interface shows the frequency 14.078 000. Below this are fields for DX Call (K7YCH), DX Grid (CN88), Az (335), and distance (1161 mi). There are also buttons for "Lookup" and "Add".

At the bottom, there is a date and time display: 2016 Jul 04 20:29:54. A red timestamp "AD7ND: 07-04-16 20:29:54" is overlaid on the interface. The status bar at the very bottom shows "Receiving", "JT9", "Last Tx: K7YCH AD7ND 73", "Tx-Enable Armed", and a 100% power indicator.

**AD7ND Working K7YCH in JT9 Mode Using WSJT-X in 20m**

# JT9 QSO



**AD7ND Working K7YCH in JT9 Mode Using WSJT-X in 20m**

# PSK Calling CQ



The screenshot shows the FLDIGI software interface. The title bar reads "fldigi / Hamlib IC-706MkIIG ver3.23.13-a06 - AD7ND". The main display area shows the frequency "14070.000" and the call "CQ AD7ND AD7ND CQ". The bottom panel shows a frequency scale from 14070.5 to 14073.5 kHz with a signal trace. The status bar at the bottom indicates "BPSK31", "s/n 38 dB", and "imd -14 dB".

## Calling CQ: PSK Mode Using FLDIGI

# RTTY Calling CQ



The screenshot shows the fldigi software interface in RTTY mode. The main window displays the frequency 14082.000 and the call sign AD7ND. The interface shows the transmission of CQ calls in RTTY mode, with a waterfall display at the bottom showing the signal's frequency spectrum. The text in the main window reads:

```
CQ CQ CQ DE AD7ND AD7ND AD7ND  
CQ CQ CQ DE AD7ND AD  
  
CQ CQ CQ de AD7ND AD7ND AD7ND  
CQ CQ CQ de AD7ND AD7ND AD7ND pse k  
^1
```

The interface also shows various controls and status indicators, including a timer at 00:12, a spot button, and a TUNE button. The bottom status bar shows the mode as RTTY, the baud rate as 45.45/170, and the signal-to-noise ratio as s/n -21 dB.

## Calling CQ: RTTY Mode Using FLDIGI

# Olivia Calling CQ



fldigi / Hamlib IC-706MkIIG ver3.23.13-a06 - AD7ND

File Op Mode Configure View Logbook Help 00:42 Spot RxID TxID TUNE

14082.000 Frq 14083.642 On Off 0520 In Out

Call Op Az

USB Qth St Pr Loc

CQ CQ CQ DE AD7ND AD7ND AD7ND PSE K

FTLCH  
CQ CQ CQ de AD7ND AD7ND AD7ND  
CQ CQ CQ de AD7ND AD7ND AD7N

CQ CQ CQ de AD7ND AD7ND AD7ND  
CQ CQ CQ de AD7ND AD7ND AD7ND pse k  
^I

CQ -6.4 Clear

CQ ANS QSO KN SK Me/Qth Brag T/R Tx Rx TX 1

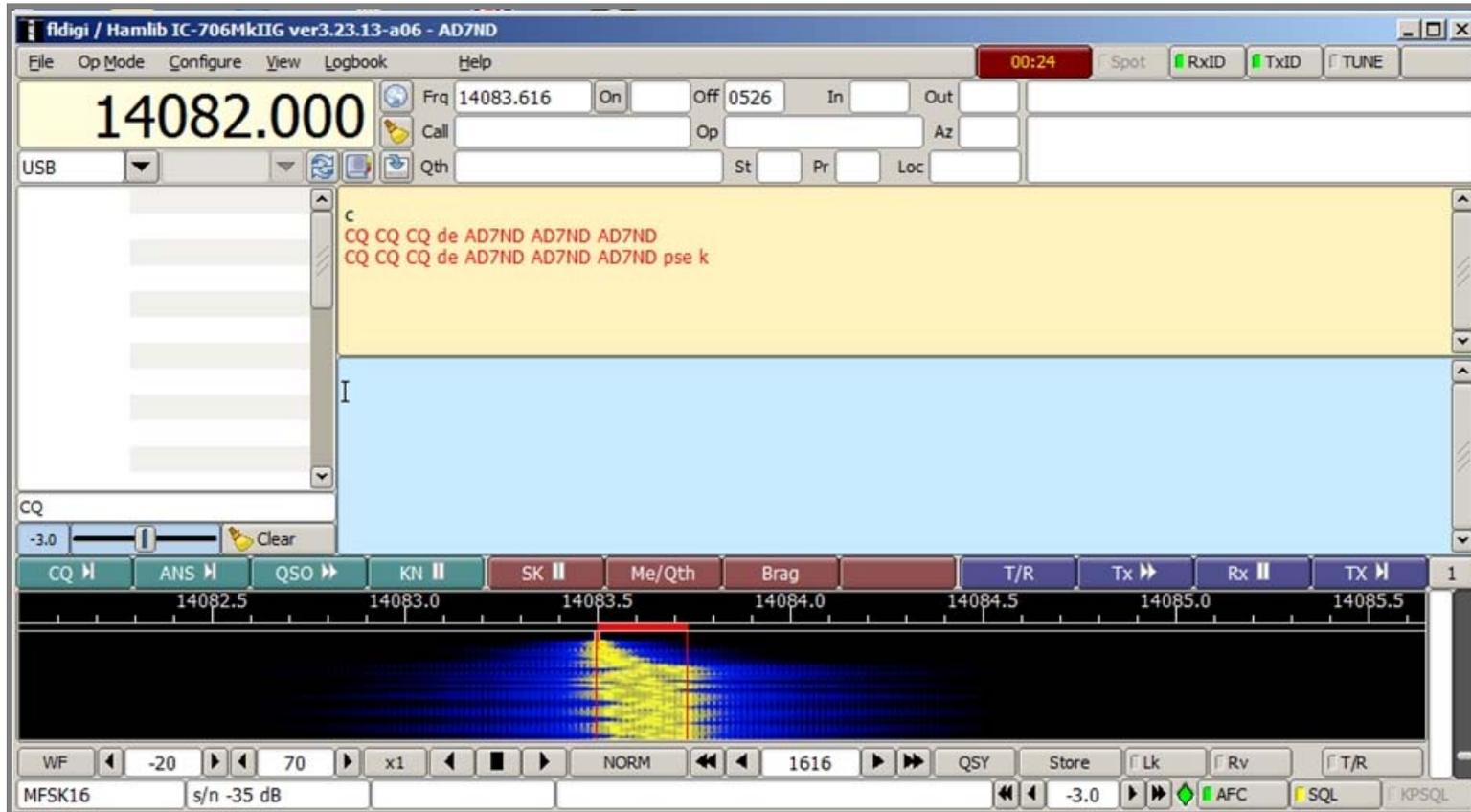
14082.5 14083.0 14083.5 14084.0 14084.5 14085.0 14085.5

WF -20 70 x1 NORM 1642 QSY Store Lk Rv T/R

Olivia-8-250 -3.0 AFC SQL KPSQL

**Calling CQ: Olivia 8-250 Mode Using FLDIGI**

# MFSK Calling CQ



## Calling CQ: MFSK-16 Mode Using FLDIGI

# PSK Calling CQ



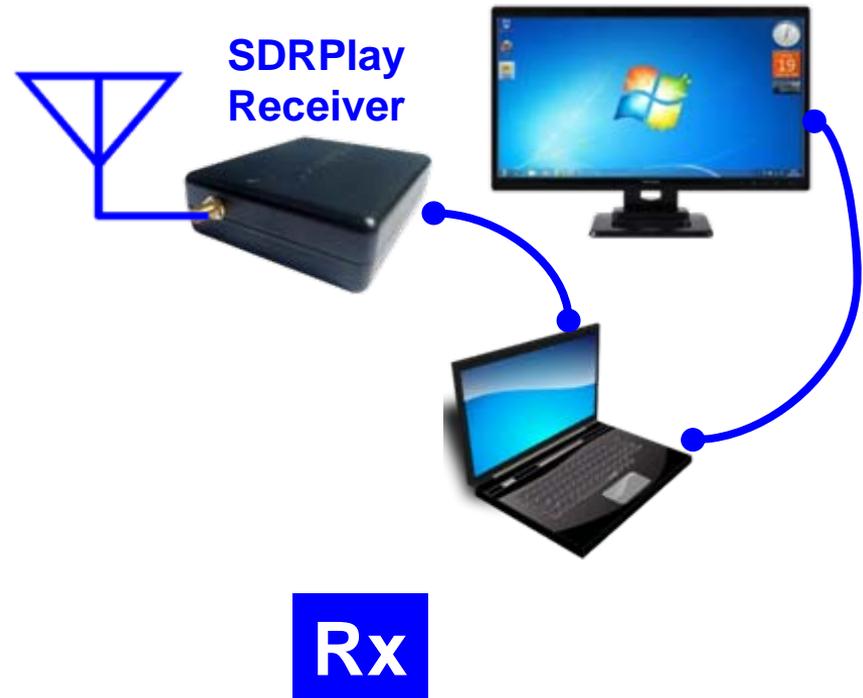
The screenshot shows the FLDIGI software interface for Hamlib IC-706MkIIG ver3.23.13-a06 - AD7ND. The main window displays the frequency 14070.000 and the call sequence 'CQ AD7ND AD7ND CQ'. The bottom panel shows a frequency scale from 14070.5 to 14073.5 kHz with a signal trace. The status bar at the bottom indicates 'BPSK31', 's/n 38 dB', and 'imd -14 dB'.

**Example of Calling CQ in PSK Mode Using FLDIGI**

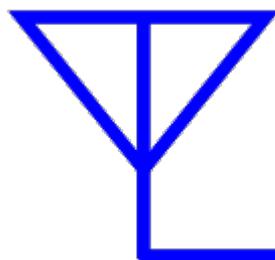
# Transmitting & Receiving



## Demonstration



# Simple Way to Decode PSK, RTTY...



Ant

HF Rcvr



Microphone



Most laptops have built in microphones



PC+Digipan

No excuses, you can try PSK today...

# Link References



- Digi Modes – Sight & Sound: <http://www.w1hkj.com/FldigiHelp-3.21/Modes/>
- Digital Modes Information Page WB8NUT: <http://wb8nut.com/digital/>
- ARRL Digital Mode Page: <http://www.arrl.org/digital-modes>
- Wireless Society of Southern Maind: <http://www.qsl.net/ws1sm/digital.html>
- Jim Brown K9YC: <http://k9yc.com/publish.htm>
- HF Path Simulation Project: <http://www.moetronix.com/ae4jy/pathsim.htm>
- WM2U Soundcard Interfacing: <http://www.qsl.net/wm2u/interface.html>
- K7AGE PSK: <http://www.hamblog.co.uk/top-10-psk31-tips-for-beginners/>
- Guide to RTTY Operation: <http://www.plicht.de/ekki/rtty/dxguide.html>
- Ham Radio Glossary: <http://noji.com/hamradio/glossary.php>

# Q&A



# Q&A