

# Introduction to Digital Modes

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# Digital Modes

- What is a “Digital Mode”?
- Examples
- Where can I find them?
- How do I use them?

# What is a “Digital Mode”?

- CW was the first digital mode
- Frequency or Phase Shift Keying
- Encodes data as signals
- Decodes signals to text

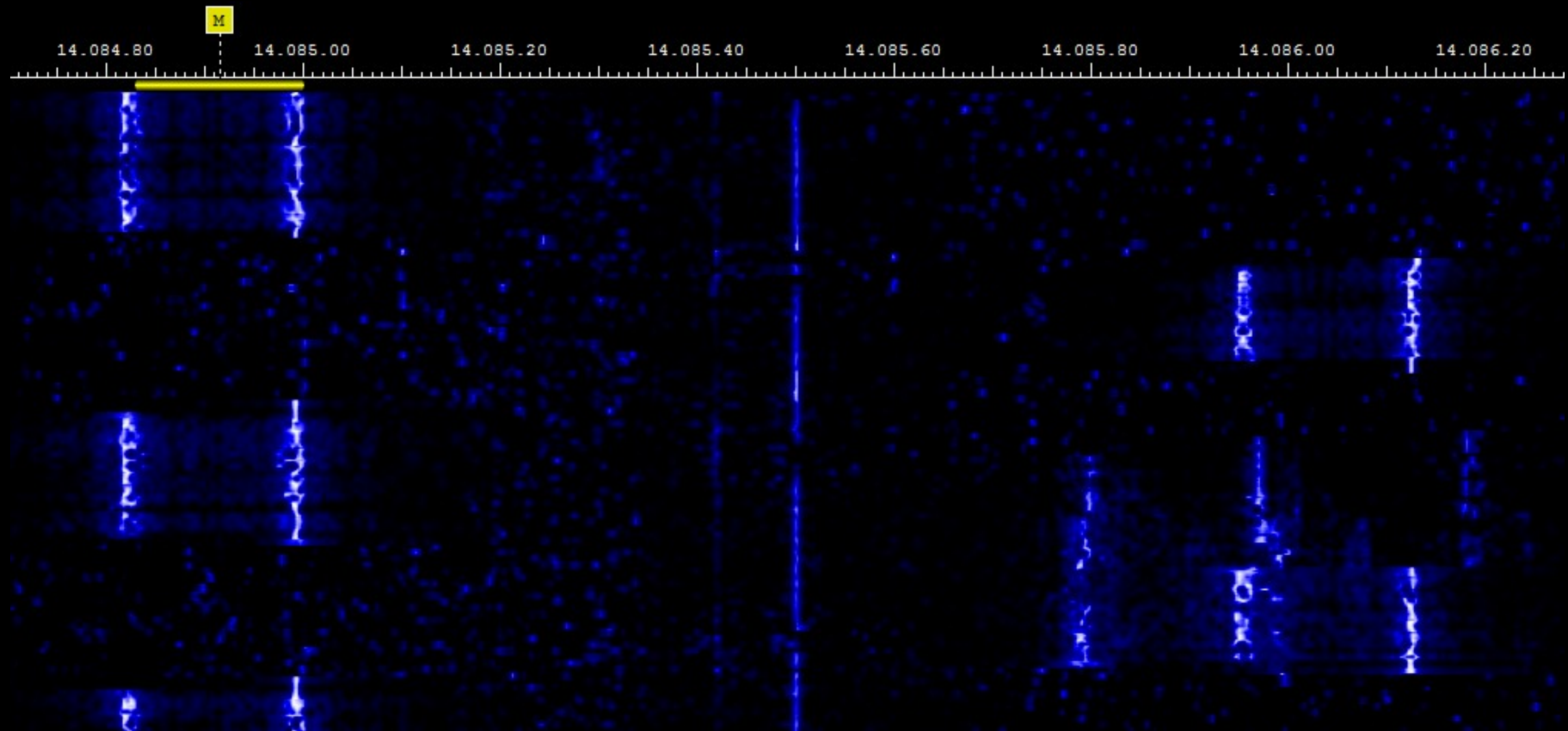
# Popular Examples on HF

- RTTY
- PSK (31/63/125)
- JT65/JT9
- Olivia
- Contestia

# RTTY

- RadioTeleTYpe
- FSK and AFSK
  - Frequency Shift Keying
- Based on Baudot coding
- Low spectral efficiency
- No error correction
- 170 Hz bandwidth

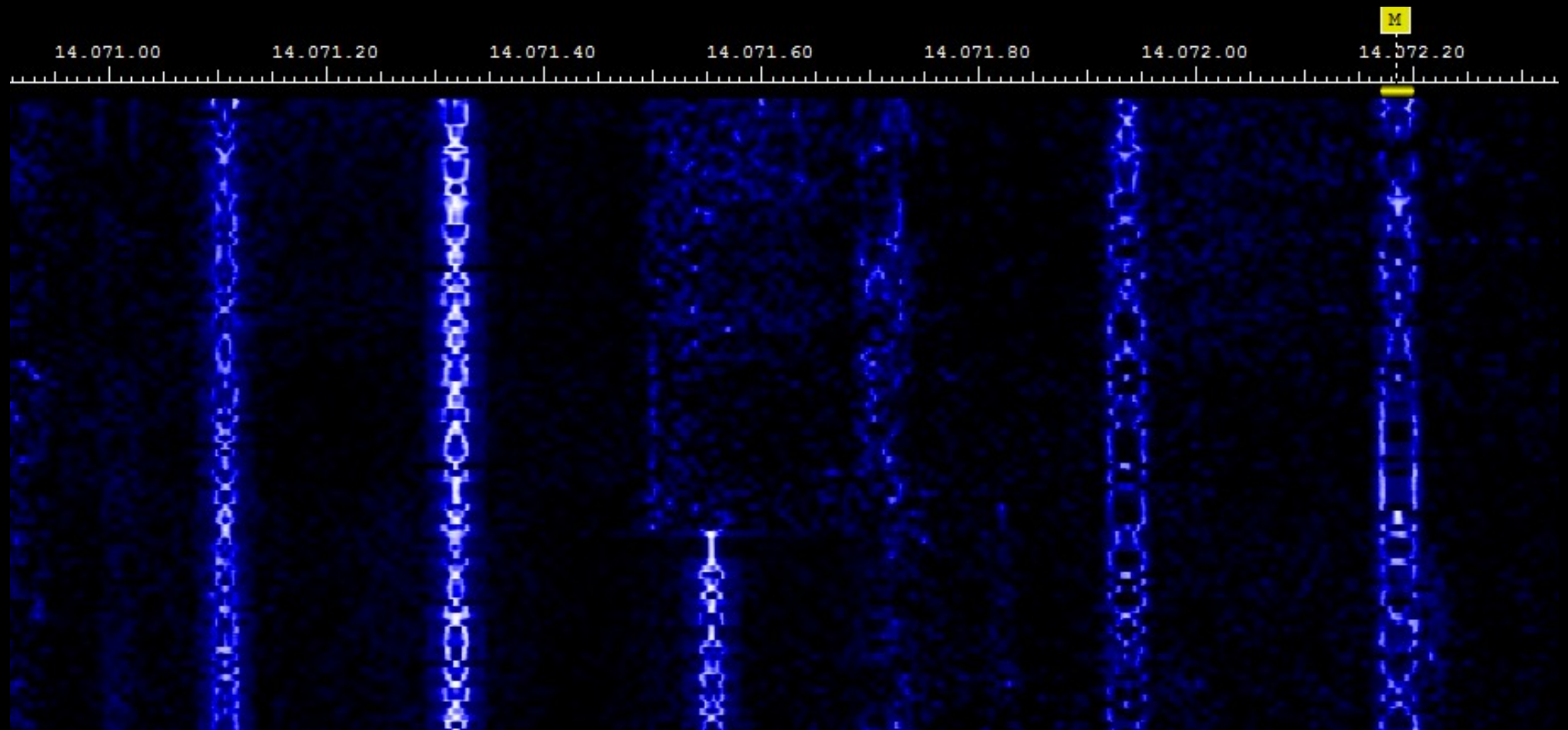
# RTTY



# PSK

- Phase Shift Keying
- Binary and Quadrature PSK
- Common Baud Rates for BPSK
  - 31
  - 63
  - 125
- No error correction
- 30-130 Hz bandwidth
- QPSK faster in same bandwidth

# PSK

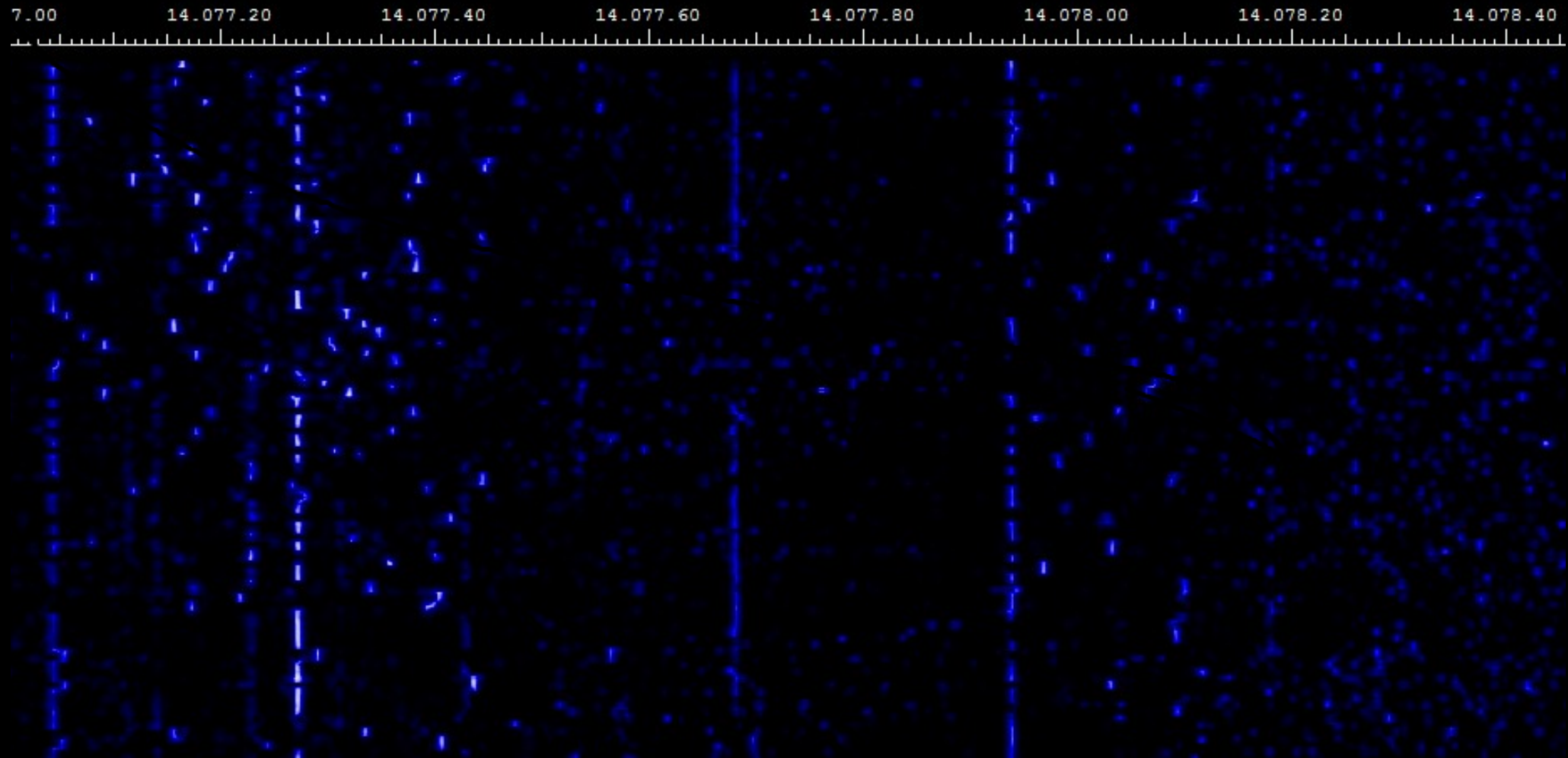




# JT65

- Multiple Frequency Shift Keying (MFSK)
- Weak signal mode
- Intended for EME or Troposcatter
- Highly synchronized in minute intervals
- No error correction

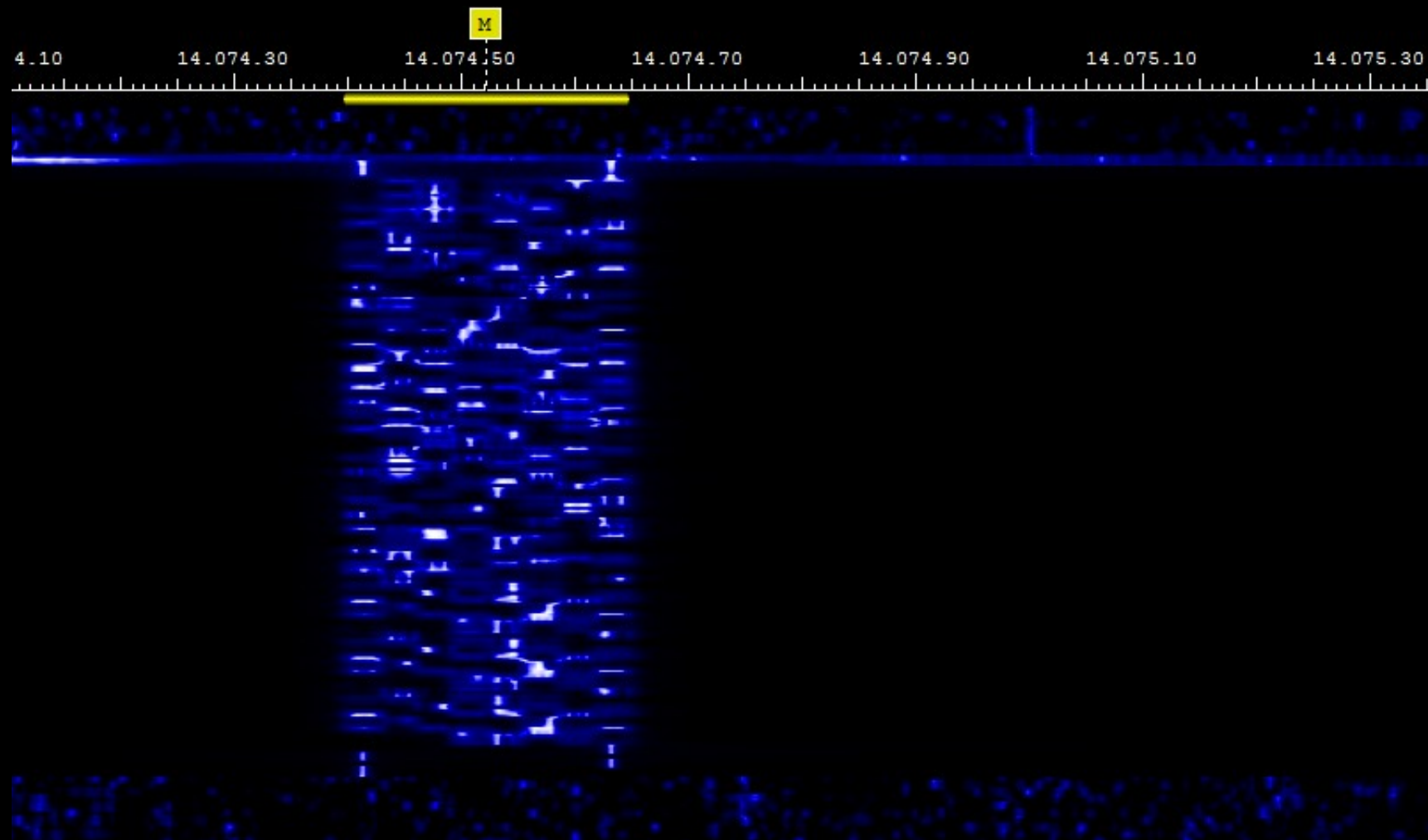
# JT65



# Olivia

- Multiple Frequency Shift Keying (MFSK)
- # of tones/bandwidth
  - ex Olivia 16/500 or 8/250
  - more tones == more redundancy
  - more tones == slower transmission
- Great in difficult conditions
  - 10-14dB below NF
- Error Correcting

# Olivia 8/250



# Other modes

- Pactor/Winlink
- Hellschreiber (Hell)
- Throb
- Domino
- Thor
- WSPR
- APRS

# Where can I find them?

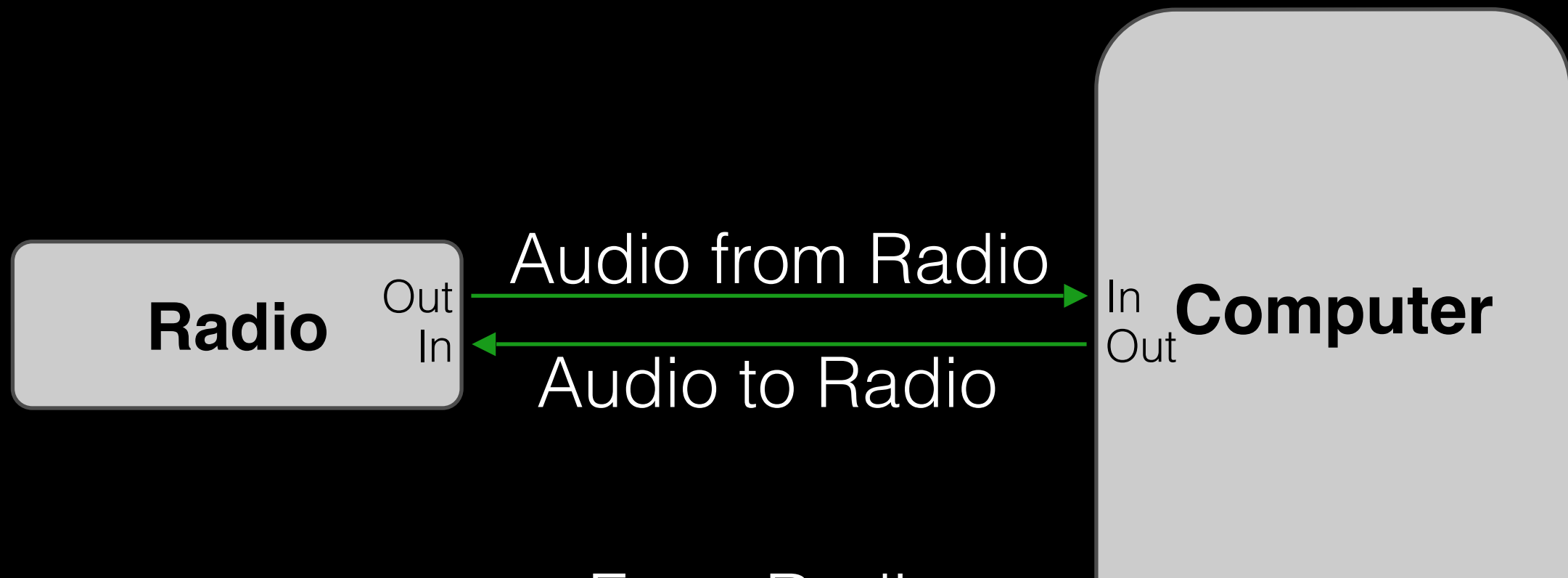
- Look at the ARRL band plans.
- Digital Modes fall in Data/RTTY space

Example for 3 bands			
Band	PSK	RTTY	JT65
10 m	28.070	28.070-28.150	28.076
15 m	21.070	21.070-21.100	21.076
20 m	14.070	14.070-14.095	14.076

# How do I use them?

- You need:
  - Radio
  - Computer with sound card
  - Digital Mode Software
- Optional:
  - external sound card or Signalink

# Basic Setup



From Radio

Audio Out == Data Out

Audio In == Data In



# Software

- Ham Radio Deluxe
  - v6+ \$99
  - v5 Free
- FLDigi
  - OpenSource aka Free
- DXLab
  - Freeware

# Ham Radio Deluxe

- Ham radio software package includes:
  - Radio control app
  - Digital modes app
  - Logging app
  - Satellite tracking app
  - Rotator control app
  - <http://www.ham-radio-deluxe.com/>

# Ham Radio Deluxe

The screenshot displays the Ham Radio Deluxe software interface during a PSK-63 QSO session. The top menu bar includes File, Edit, View, QSO, Browser, Logbook, SSTV, SuperSweeper, World Map, Tools, Window, and Help. The top toolbar contains icons for QSO, SuperSweeper, Radio, Soundcard, Waterfall, Rig Control, Logbook, Rotator, Configure, and Program Options. The top status bar shows the time 01:34:40 and the frequency 14.070.000.

The left sidebar shows the 'Default' tab with fields for (F2) Start, (F3) End, (F5) Call, Name, QTH, Locator, Country, Frequency, Band, Mode, Sent, Rcvd, and Remark. The 'Add Log Entry' button is visible. The 'Add' button is also present at the bottom of the sidebar.

The main window displays the QSO log entry for BTU XE3VDK de KF5WAY pse kn. The log entry includes the name JAVIER JIVIER, QTH Merida In The Peninla Of Yucatan Mexico, Locator EL51EA [134.8° 821.4mi], and a QSL Card Only Direct, o My Qth u& B4REAH°lease. The log entry also includes the text 'Infoá el: www.qe z.nom' and 'BTU Sco Me KF5WA oVDbe'. The log entry is dated 01:34:29 and is labeled 'Main'. The log entry is also labeled 'XE3VDK de KF5WAY' and '73 Javier and thanks for the PSK63 QSO 18 on 20m. be safe and good luck out there!'.

The bottom status bar shows the frequency 14.071.677 MHz, 30 secs, and S/N: 22dB. The bottom status bar also shows the CPU usage (1%), Audio (0%), and Soundcard TX: 7999.60Hz. The bottom status bar also shows the HRD Logbook: My Logbook, RSID, OVR, CAP, NUM, SCRL, and the time 01:34.

# JT65 Software

- wsjtx
  - <http://physics.princeton.edu/pulsar/K1JT/wsjtx.html>
- JT65-HF
  - <http://jt65-hf.sourceforge.net/>

# wsjtx

WSJT-X v1.3, r3673 by K1JT

File Setup View Mode Decode Save Help

Band Activity					Rx Frequency				
UTC	dB	DT	Freq	Message	UTC	dB	DT	Freq	Message
0139	-1	0.1	523	# CQ WA9THI EM69					
0139	-1	0.5	746	# KA4HOT NOMHL -08					
0139	-6	0.5	933	# N4OVQ KE7XE R-13					
0139	-5	0.2	1227	# KG4VMF K4SHQ R-04					
0139	-14	1.2	1375	# WL7CG KK4JSJ EM78					
0139	-15	0.4	1514	# PP1ER KD8HHG 73					
0139	-5	-0.8	1936	# CQ KI6CYT CM87					
0139	-19	0.6	2614	@ CQ HC6PE FI08					
0139	-3	0.4	2672	@ KM4BWU WB0N 73					
0139	2	0.2	2916	@ CQ WB7CTI DN06					
0139	-11	0.2	3034	@ KG4OXA N6TE DM12					

Log QSO Stop Monitor Erase Decode Enable Tx Halt Tx Tune

20 m 14.076 000

☐ +2 kHz ☒ DX Call ☐ DX Grid

50  
40  
30  
20  
10  
21 dB

Lookup Add

2014 Sep 03  
01:39:53

☐ Tx even

Tx JT65 #

Tx 1626 Hz

Rx 1624 Hz

☐ Tx=Rx ☐ Rx=Tx

☐ Lock Tx=Rx

Report -15

Generate Std Msgs

Next Now

☐ Tx 1

☐ Tx 2

☐ Tx 3

☐ Tx 4

☐ Tx 5

☒ Tx 6

CQ KF5WAY EL09

Pwr

Receiving JT9+JT65

# Useful Links

- Digital Modes, sound and pictures ([http://hfradio.org.uk/html/digital\\_modes.html](http://hfradio.org.uk/html/digital_modes.html))
- ARRL Digital Modes (<http://www.arrl.org/digital-modes>)
- Digital Modes audio samples (<http://www.kb9ukd.com/digital/>)
- PSKReporter (<http://pskreporter.info>)

# More Links

- Passband Modulation (<http://en.wikipedia.org/wiki/Modulation>)
- FLDigi (<http://www.w1hkj.com>)
- DX Lab Suite (<http://www.dxlabsuite.com>)
- Tigertronics, Signalink (<http://www.tigertronics.com>)