



Amateur Radio Digital Modes JT65, JT9 and FT8

W. Kent Larsen, AD7HK
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Bridgerland Amateur Radio Club

What is Digital Mode?

- Digital modes use a computer to generate and decode the transmitted signals.
- Some examples would be:
 - CW on/off (no longer the best or most reliable mode).
 - Packet Radio/Winlink/WINMOR for messaging.
 - PSK31 used for sending keyboard text.
 - JT65 in the last few years for Moon Bounce & HF.
 - JT9 beefed-up JT65
 - FT8 came out in 2017—very popular

What do you need to go digital?

- **Stuff you probably already have!**
 - Radio – SSB for HF (10-160 meters)
 - Radio – 6 meters is optional
 - Computer with sound card
- **Stuff you may need to get:**
 - Computer to radio interface (build/buy for Press-to-Talk, Data & Frequency Control)
 - Software – most is free!

AD7HK Pactor and Sound Card Modes in RV



Computer-Radio Interfaces



\$119.95



\$129.95

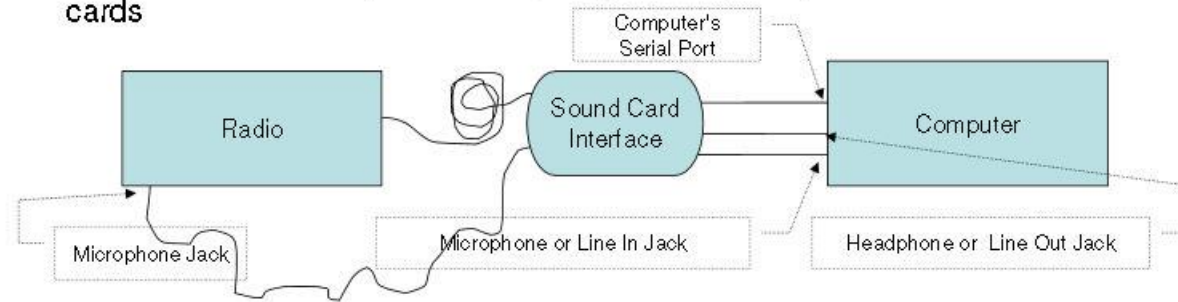


\$2.00



\$199.00

But more current computers have plenty of computer power and have sound cards



JT65

- Originally developed for moon bounce by K1JT
- Extremely low signal levels
- Excellent weak signal, detect ~28 dB below RX noise
- Each tone is a character
- Very slow, uses almost one minute to send each call & exchange.
- Requires accurate clocks at both stations
- Structured QSO sequence
- Was also extensively used on HF for DXing

JT65 - JT65 HF

JT65-HF Version 1.0.9.3 [RB Enabled, logged in. QRG = 28076 KHz] [G4UCJ QRV]

Setup Rig Control Raw Decoder Transmit Log About JT65-HF

Audio Input Levels: L 0, R 0
Optimum input level is 0 with only background noise present.
Digital Audio Gain: L: 0, R: 0

2011-Dec-20 11:20:53
Dial QRG KHz: 28076

Current Operation: Idle

Color-map: Blue, Brightness: [slider], Contrast: [slider], Speed: 5, Gain: 0, Smooth:

Message To TX: No message entered.
TX OFF
TX Text (13 Characters): [input]
TX Generated: TX Even, TX Odd

Call CQ and answer callers: Call CQ, Answer Caller, Send RRR, Send 73
Answering CQ: Answer CQ, Send Report

TX DF: -16, RX DF: -16, TX DF = RX DF:
AFC:
Noise Blank:
Single BW: 50, Multi BW: 20, Enable Multi:
Enable RB:
Enable PSKR:
RB/PSKR Counts: 7, 7

Sound In: 04-Line-In/Mic-In (3- Sound Blaste)
Sound Out: 09-Speakers / Headphones (IDT High)

Clear Decodes Decode Again 0 DT Offset Restore Defaults

Double click an entry in list to begin a QSO. Right click copies to clipboard.

UTC	Sync	dB	DT	DF	Exchange
11:20	2	-23	-0.2	401	K 20W IV TU 73
11:20	7	-13	-0.1	-307	B DL1AIW UA9CR MO06

11:18	3	-20	-0.2	401	K DC6MY PY8ELO R-07
11:17	7	-12	-0.1	-86	B PY8ELO PA1FR JO22
11:15	1	-24	-0.3	-86	K PY8ELO MOHYE IO94
11:14	3	-19	-0.4	-89	B CQ PY8ELO GI25
11:12	4	-21	-0.1	-86	B CQ PY8ELO GI25
11:06	4	-20	-0.2	-86	B 20W IV TU 73
11:04	4	-17	-0.4	-83	B DH6KOS PY8ELO -16

JT65 - Moon bounce program

The screenshot displays the WSJT-X software interface for moon bounce operations. The main window title is "WSJT 7 by K1JT". The menu bar includes File, Setup, View, Mode, Decode, Save, Band, and Help.

The top section features a waterfall plot with a prominent signal peak. To the right of the plot, a cyan box displays moon-related data:

- Moon
- Az: 104.89
- E1: -20.67
- Dop: 58
- Dgrd: -5.9

Below the plot, a status bar shows "3.7" and "Time (s)" next to the call sign "DK1CO_100124_214800".

The central area contains a table of decoded messages:

FileID	Sync	dB	DT	DF	WV	Message	1	10
214800	6	-23	2.3	118	3 *	W9XT DK1CO J063	1	10
214800	1	1/1				W9XT DK1CO J063	1	0

Below the table is a control panel with buttons for Log QSO, Stop, Monitor, Save, Decode, Erase, Clear Avg, Include, Exclude, and TxStp.

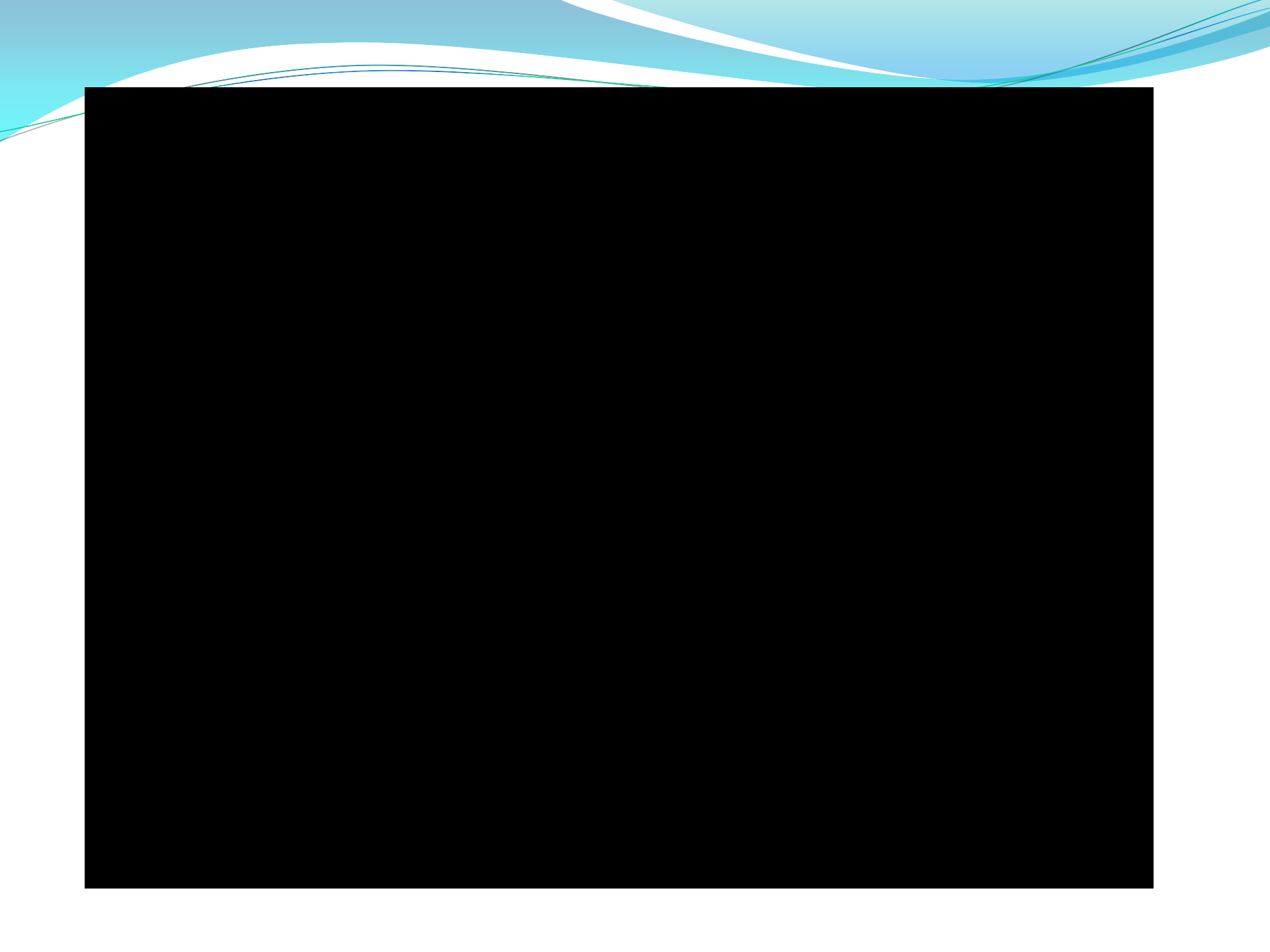
The bottom section contains various settings and a digital clock:

- To radio: DK1CO (Lookup)
- Grid: J063sx (Add)
- Az: 41, 4307 mi
- Digital clock: 2010 Oct 11 14:42:00
- Sync: 1, Zap, Clip: 0, NB, Tol: 400, Freeze, Defaults, AFC, Dsec: 0.0, Shift: 0.0
- Tx First: DK1CO W9XT EN53 (Tx1 selected)
- Rpt: 26, DK1CO W9XT EN53 OOO (Tx2)
- Sh Msg: RO (Tx3)
- TxDF = 0: RRR (Tx4)
- GenStdMsgs: 73 (Tx5)
- Auto is Off: CQ W9XT EN53 (Tx6)

The bottom status bar shows "1.0000 1.0001 JT65B Freeze DF: 0 Rx noise: 0 dB TR Period: 60 s" and a green "Receiving" indicator.

JT9 (included with WSJT-X)

- JT9 is a beefed-up improvement to JT65
- Detects even weaker signal levels (2db better)
- 10 Percent of the bandwidth
- Use 1 to 5 watts output
- Still slow, uses almost one minute to send each call & exchange.
- Still requires accurate clocks at both stations
- Structured QSO sequence
- Is also used on HF for DXing



FT8: The basics explained

- **In 2017, FT8 started to become the most popular of the various data modes because of a number of reasons:**
 - It's fairly simple to set up (uses same hookups)
 - It's significantly faster than the similar JT65
 - It works very well even with a lot of noise
 - It's popular, so there's lot of activity
 - It's semi-automated, making for easy contacts
 - It's a great way of racking up the countries, without too much hassle (easy DXCC)

FT8 The basics explained

- You still interface your HF rig to a computer, and send out text.
- With FT8, you're restricted to very small messages, with a limit of 13 characters per message.
- FT8 is made to listen to everything, and decode a pile-up (un-layers identical signals with multiple scans).
- FT8 sorts traffic on screen by color and purpose.
- FT8 developed for contesting & DX-expeditions.

FT8 The basics explained

- **Here is a typical conversation over FT8:**

“CQ AD7HK DN41” → (CQ call from AD7HK)

“AD7HK G3QQ IO81” → (G3QQ replies w/location)

“G3QQ AD7HK -12” → (AD7HK sends sig report)

“AD7HK G3QQ R-08” → (G3QQ confirms & replies with his report for AD7HK)

“G3QQ AD7HK RRR” → (AD7HK confirms receipt of his signal report.)

“AD7HK G3QQ 73” → (G3QQ says 73*)

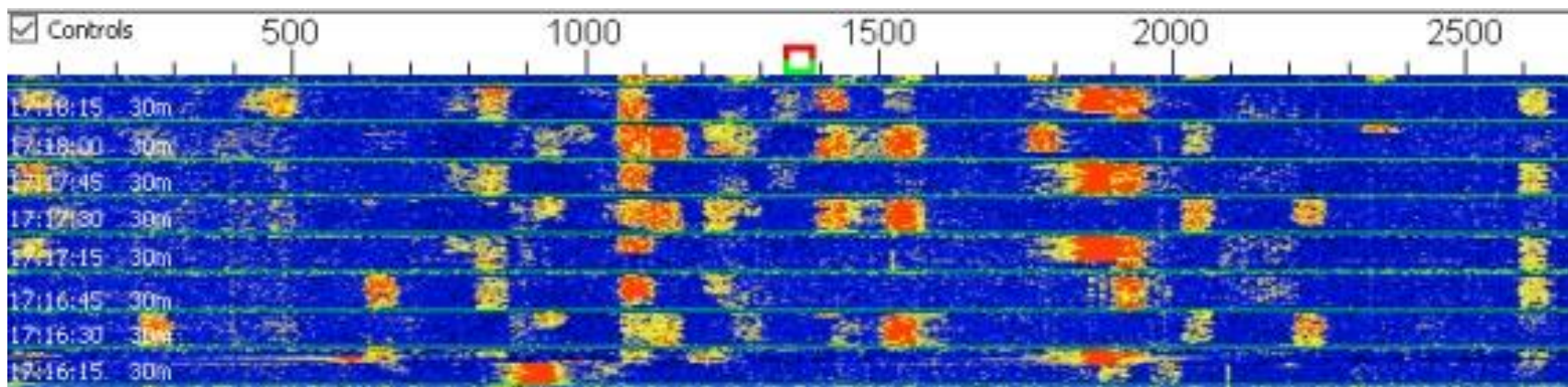
“G3QQ AD7HK 73” → (AD7HK says 73*)

FT8 The basics explained

- Each message of up to 13 characters takes only 13 seconds to send.
- There are 4 automatic exchanges per minute in 15 second transmit/receive blocks.
- The exchange in last slide would therefore take about 90 seconds (compared with seven minutes on JT65).

FT8 The basics explained

- The application WSJT-X is one of the most common used for FT8 (as well as JT65/JT9), and was written by the inventor of these modes, Joe Taylor K1JT. Here is what FT8 signals look like, displayed in the WSJT-X waterfall view 14.074:



FT8 The basics explained

- New “chunks” of messages arrive every 15 seconds, and are decoded by the WSJT-X software, which displays the messages like this:

Band Activity					
UTC	dB	DT	Freq	Message	
171345	-18	0.1	1705 ~	IZ4TOA WA2HIP RRR	^
----- 20m					
171415	9	-1.0	899 ~	CQ IT9RZR JM76	
171415	-20	0.1	1001 ~	W8TRN N8HMG +01	
171415	-9	-1.2	1510 ~	VE9FI SV1NZJ KM17	
171415	-17	0.1	2583 ~	CQ K3LU FM19	
171415	-11	0.3	2692 ~	XP3A WF7B FM16	
171415	-18	0.4	2752 ~	CQ W9KXQ EM58	
171415	-9	0.0	871 ~	KOKP SV5BYP RR73	v

FT8 The basics explained

The screenshot displays the WSJT-X software interface. The top section is a waterfall plot showing frequency activity from 500 to 3000 Hz. A vertical yellow and green signal is visible around 1649 Hz. Below the plot are various control options like 'Bins/Pixel 5', 'Start 200 Hz', and 'Flatten'.

The middle section shows the 'Band Activity' and 'Rx Frequency' logs. The 'Band Activity' log contains the following entries:

UTC	dB	DI	Freq	Message
000315	-14	-0.0	1603	~ CQ K9AN EN50
000345	-13	-0.0	1603	~ CQ K9AN EN50
000345	-12	-0.0	1664	~ CQ G4WJS IO91
000415	-13	-0.0	1603	~ CQ K9AN EN50
000415	-7	-0.0	1664	~ CQ G4WJS IO91
000445	-13	-0.0	1603	~ CQ K9AN EN50
000515	-9	-0.0	1649	~ K1JT G4WJS -11
000515	-14	-0.0	1603	~ CQ K9AN EN50
000545	-4	-0.0	1649	~ K1JT G4WJS RRR
000545	-14	-0.0	1603	~ CQ K9AN EN50
000615	-6	-0.0	1649	~ K1JT G4WJS 73
000615	-14	-0.0	1603	~ CQ K9AN EN50

The 'Rx Frequency' log contains the following entries:

UTC	dB	DI	Freq	Message
000515	-9	-0.0	1649	~ K1JT G4WJS -11
000545	-4	-0.0	1649	~ K1JT G4WJS RRR
000615	-6	-0.0	1649	~ K1JT G4WJS 73

The bottom section shows the 'Log QSO' button, a frequency display of 50.301 004, and a list of messages to be transmitted:

- G4WJS K1JT FM20
- G4WJS K1JT -06
- G4WJS K1JT R-06
- G4WJS K1JT RRR
- G4WJS K1JT 73
- CQ K1JT FM20

The interface also shows a date and time display: 2017 Jun 29 14:54:45.

Getting Started - Frequencies

FT8

160m	1.840
80m	3.573
40m	7.074
30m	10.136
20m	14.074
17m	18.100
15m	21.074
12m	24.915
10m	28.074
6m	50.313

FT8 Selling Points

- It lowers the bar for power and antenna requirements
- Low power 10-25 watts barefoot
- Software allows advanced customization of format
- There are additional modes in WSJT-X software not covered here (moon bounce, meteor bounce, etc.)
- Most people work split (but you don't tune the radio)
- Technician Class can use very popular 6 meters
- You can see 6-160 meters all in use at the same time!
- Many worldwide contacts are possible
- It has significantly cut into other modes of operation
- Lots of people find it FUN!!!