FT8
Presented by N1UGK

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What is FT8?

- FT8 (Franke-Taylor design, 8-FSK modulation) was introduced in July 2017 with version 1.8 of the software package WSJT-X, Joe Taylor, K1JT, and Steve Franke, K9AN.

- Weak Signal Digital Mode, -24dB! Using only 50 Hz Bandwidth (CW is 150 - 300 Hz, SSB Phone ~ 2400 – 3000 Hz)

- Similar to FST4, FST4W, FT4, JT4, JT9, JT65, Q65, MSK144, JS8Call and WSPR, built on the almost 20 year history of JT4, JT9, JT65.

- Provides a digital method of 2-way acknowledged radio contact (call signs, signal reports, maidenhead).

- Valid for contests, other awards including DXCC

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Timeline of Popular Digital Modes

- 1949 – RTTY (late) – 170 Hz Bandwidth
- 1984 – AX.25 v2.0 – 730 Hz Bandwidth
- 1998 – PSK31 (December) – 60 Hz Bandwidth
- 2003 – JT65 (Late) – 180 to 710 Hz Bandwidth
- 2008 – WSPR* – 6 Hz Bandwidth
- 2017 – FT8 (July) – 50 Hz Bandwidth
- 2019 – FT4 – 90 Hz Bandwidth

*Not a 2-way communication protocol

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Why FT8?

- You're a technician without HF privileges (except on the digital portion of the 10 meter band) and you don't know CW.

- You're aspiring toward obtaining the ARRL DXCC award, Worked All States, or any other award or contest that recognizes a digital contact.

- You're testing an antenna, want to compare configurations, propagation, or confirm radiation pattern, to check the results on PSK Reporter.

- You're looking for quick contacts that are not "conversational" like other digital modes can be, such as RTTY, PSK31.

- FT8 contacts are widely recognized because they include call sign exchange, grid square, and reception report. **An FT8 contact can be made in as little as 90 seconds and even shorter in "contest" mode**.

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FT8 Criticisms

- Contacts are almost entirely automated
  - Sequence is automated
  - Coding/Decoding is automated
  - Signal Report is automated
- Non-conversational mode (except JS8Call)
- Most HF Bands now have a permanent 3000 Hz slot taken up by FT8 24/7/365 (which might have been used for CW or other modes)
- FT8 encompasses no new innovation compared to previous modes

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What do I need to do FT8?

- Minimum Requirements
  - HF Transceiver (or a 2-meter SSB capable rig)
- Computer*
  - Windows
  - Mac
  - Linux
  - Raspberry Pi
  - Android Tablet or Phone
- Interface between computer and rig (audio in/out and PTT)
  - "Sound Card" interface is a bonus

* Accurate time sync required.

Table 1
**Conventional Dial Frequencies for FT8, JT65, JT9, and WSPR on the HF Bands**

Band (m)	Frequencies (MHz)			
	FT8	JT65	JT9	WSPR
160	1.840	1.838	1.839	1.8366
80	3.573	3.570	3.572	3.5686*
40	7.074	7.076	7.078	7.0386
30	10.136	10.138	10.140	10.1387
20	14.074	14.076	14.078	14.0956
17	18.100	18.102	18.104	18.1046
15	21.074	21.076	21.078	21.0946
12	24.915	24.917	24.919	24.9246
10	28.074	28.076	28.078	28.1246
6	50.313	50.310†	50.312	50.293

*Pending change from 3.5926, †Pending change from 50.276

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Sample FT8 Exchange

191700	Tx		710	~	CQ N1UGK FN20
191715	-24	0.2	705	~	4S7KKG I2VGW JN45
191715	-13	0.1	1985	~	N1UGK DJ0MAB JN49
191732	Tx		710	~	DJ0MAB N1UGK -13
191745	-9	0.1	1985	~	N1UGK DJ0MAB R-06
191800	Tx		710	~	DJ0MAB N1UGK RR73
191815	-12	0.1	1986	~	N1UGK DJ0MAB 73

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3000 Hz Slice of FT8
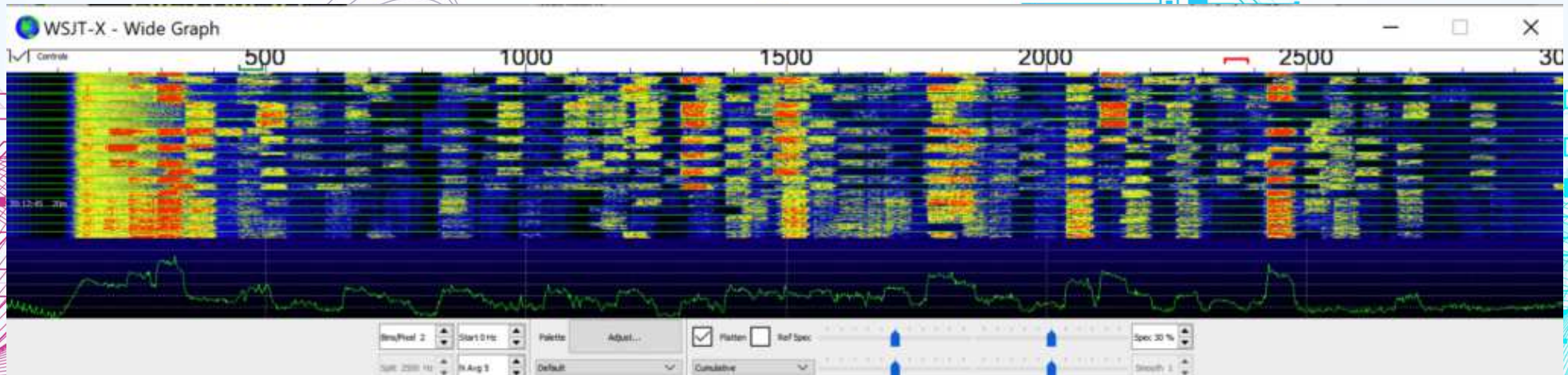
- Some HF rigs' SSB "Voice" mode might be limited to 300 - 2400 Hz.
- Modern rigs can cover almost all of the 3000 Hz window.
- Up to 60 'slots' at once
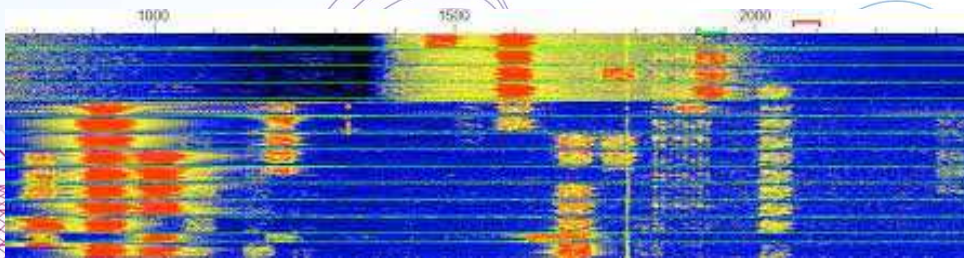
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GridTracker
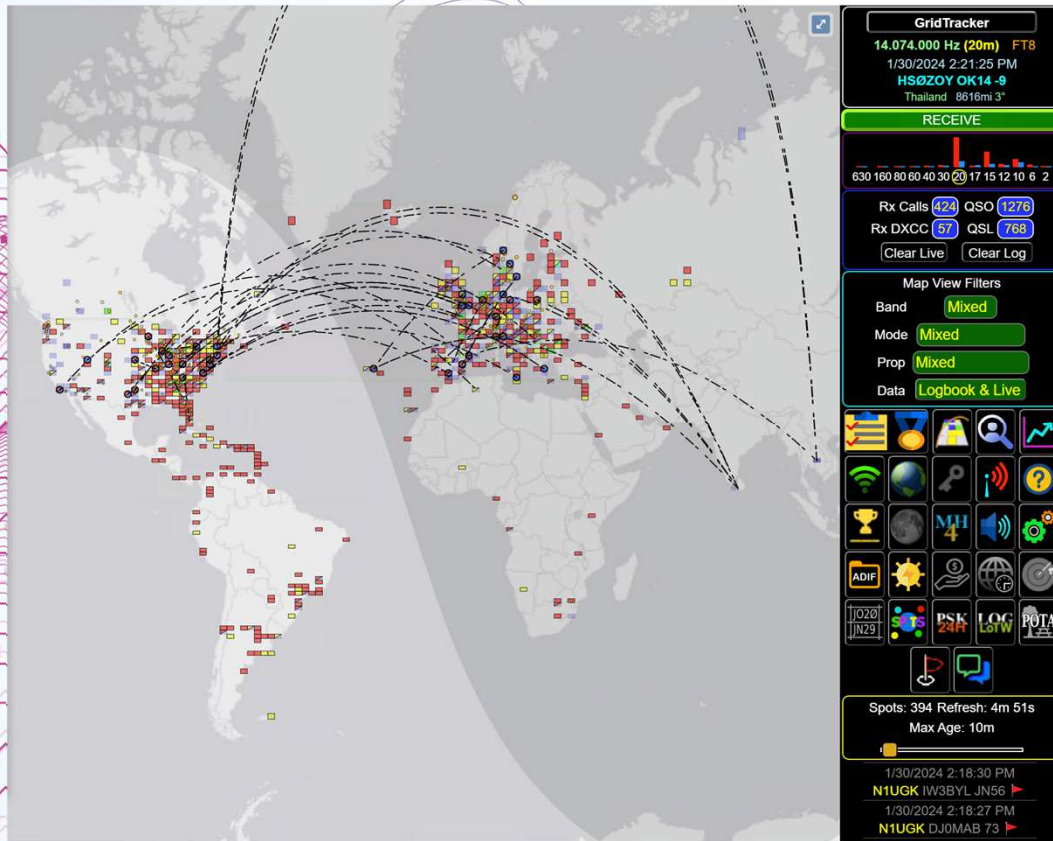
- Maidenhead Mapping
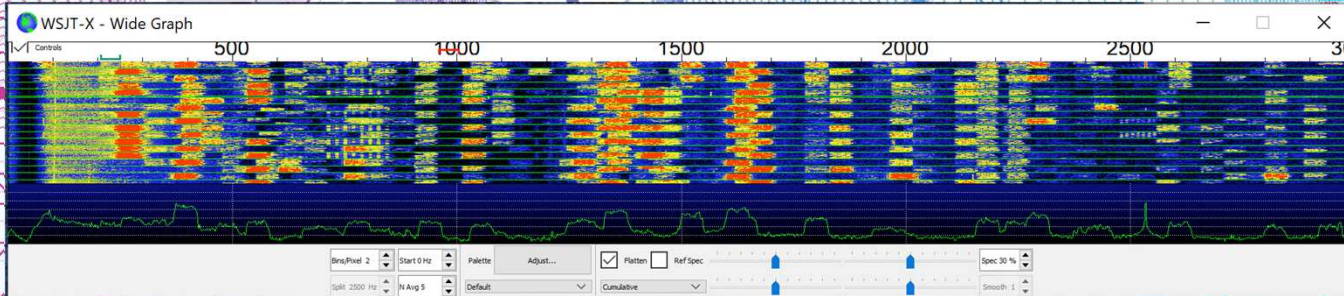- QSOs
- Automated Logging
- Spots
- Band Activity
- Logged Maidenheads

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Splatter Example

Watch your ALC!

FT8 Message Details

- 174 bits transmitted in approximately 15 seconds.
  - 77 message bits (source encoded)
  - 14 CRC bits
  - 83 FEC bits
- 3 "source type" bits provide up to 8 message types
- 8-tone (6.25 Hz apart) continuous-phase frequency shift keying (CPFSK) in USB mode using only 50 Hz bandwidth

Table 1 - Defined message types for the 77-bit payloads of FT4, FT8, and MSK144.

Type i3.n3	Purpose	Example message	Bit-field tags
0.0	Free Text	TNX BOB 73 GL	f71
0.1	DXpedition	K1ABC RR73; W9XYZ <KH1/KH7Z> -08	c28 c28 h10 r5
0.3	Field Day	K1ABC W9XYZ 6A WI	c28 c28 R1 n4 k3 S7
0.4	Field Day	W9XYZ K1ABC R 17B EMA	c28 c28 R1 n4 k3 S7
0.5	Telemetry	123456789ABCDEF012	t71
1.	Std Msg	K1ABC/R W9XYZ/R R EN37	c28 r1 c28 r1 R1 g15
2.	EU VHF	G4ABC/P PA9XYZ JO22	c28 p1 c28 p1 R1 g15
3.	RTTY RU	K1ABC W9XYZ 579 WI	t1 c28 c28 R1 r3 s13
4.	NonStd Call	<W9XYZ> PJ4/K1ABC RRR	h12 c58 h1 r2 c1
5.	EU VHF	<G4ABC> <PA9XYZ> R 570007 JO22DB	h12 h22 R1 r3 s11 g25

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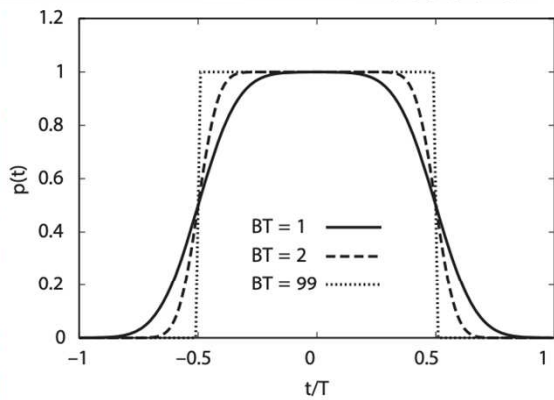
Modulation Examples

Figure 1 — Gaussian-smoothed frequency deviation pulses. The pulses labeled BT=1 and BT=2 are used to generate the FT4 and FT8 frequency-deviation waveforms, respectively. The case BT=99 is essentially the same as the unfiltered rectangular pulse that is used to generate standard, unsmoothed FSK in JT65, JT9, and other modes in *WSJT-X*.
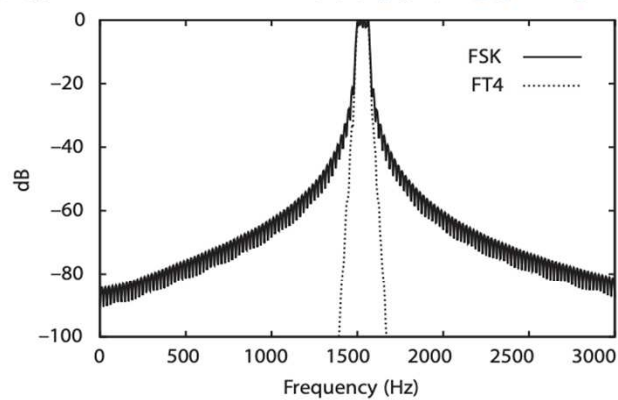
Figure 3 — Average spectrum of an FT4 signal (GFSK, BT=1.0: dotted line) and the spectrum of an otherwise equivalent standard FSK waveform (solid line).
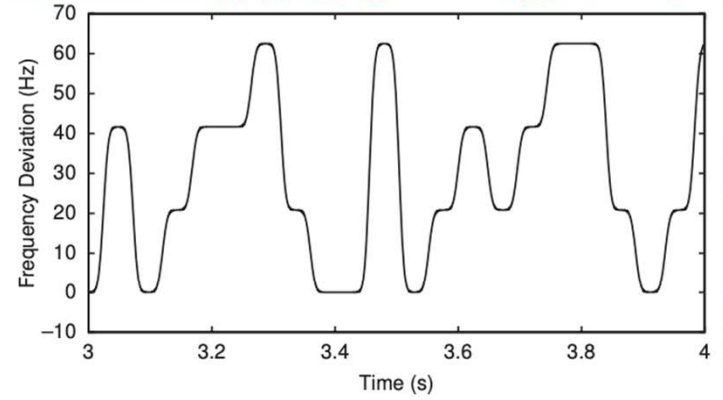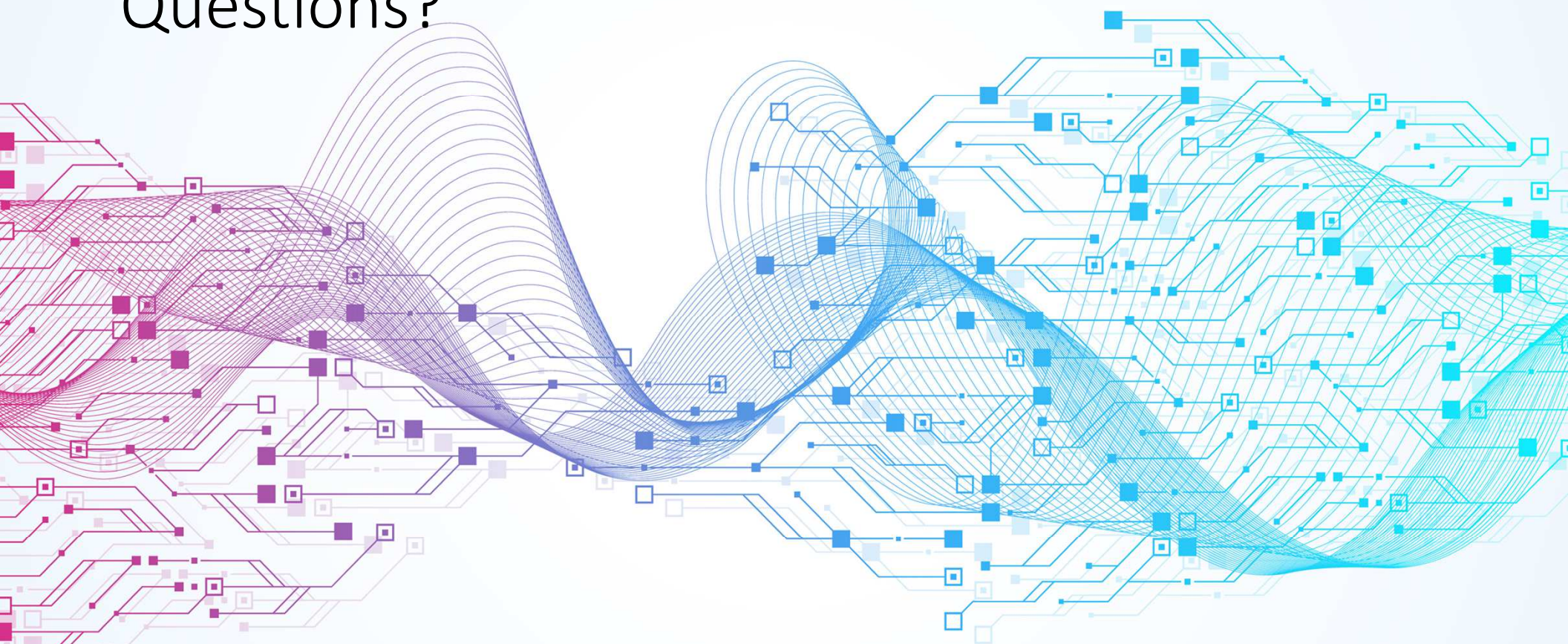
Figure 2 — A segment of an FT4 frequency deviation waveform generated using the Gaussian-smoothed frequency deviation pulse with BT=1.0.

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Questions?

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References

1. "The FT4 and FT8 Communication Protocols", (QEX, July/August 2020. pp. 3-13)

2. "Work the World with WSJT-X, Part 1: Operating Capabilities", (QST, October 2017, pp. 30-36)

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