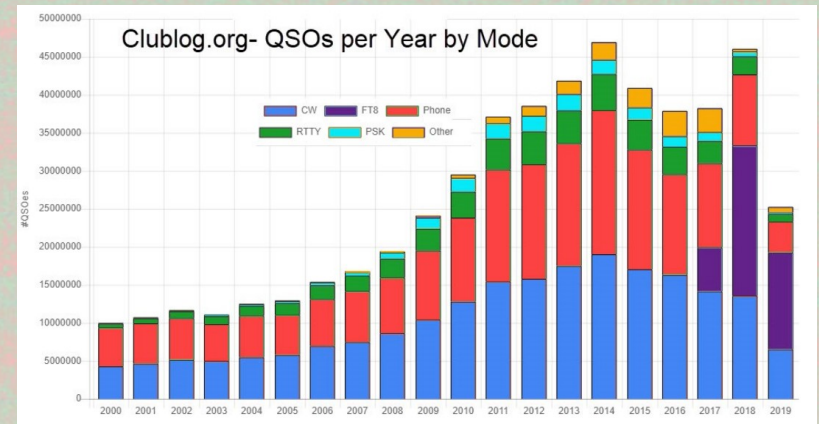


# Digital Data Communications in Amateur Radio

Keith Lindsay, KI5US  
geek4096@gmail.com

# History of Digital Communications in Amateur Radio

- David Casler (KE0OG) provides an excellent, in-depth overview of Amateur Radio digital data communications on YouTube at <https://www.youtube.com/watch?v=tXLXe9C7JX8>
- Morse Code to FT8
- Evolution over the decades: from RTTY to modern digital modes (up to 2019)





# Digital Data Modes

- Introduction to what constitutes a digital mode
- Highlighted Common HF Modes:
  - PSK (Phase Shift Keying) - PSK31, PSK63, etc.
  - RTTY (Radio Teletype)
  - Olivia, Contestia, Thor
  - Many more.....

Op Mode Configure View Logbook

CW

Contestia

DominoEX

FSQ

Hell

IFKP

MFSK

MT63

OFDM

**Olivia**

PSK

QPSK

8PSK

PSKR

RTTY

THOR

Throb

WEFAX

Navtex/SitorB

WWV

Freq Analysis

Frequency Measurement Test

NULL

SSB

OL 4-125

OL 4-250

OL 4-500

OL 4-1K

OL 4-2K

OL 8-125

**OL 8-250**

OL 8-500

OL 8-1K

OL 8-2K

OL 16-500

OL 16-1K

OL 16-2K

OL 32-1K

OL 32-2K

OL 64-500

OL 64-1K

OL 64-2K

Custom...

14070.85 ee

14070.73 re

# Typical PSK31 QSO

fldigi ver4.2.00 / FTdx101MP - K15US

14070.000

File Op Mode Configure View Logbook Help

14071.211 On 2007 Off 2008 In 599 Out 599 Cnty/Cntry Notes

Call W8VYM Op John Az 351

Qth EASTMAN St GA Pr L EM82je United States

CQ	ANS	QSO	CotheNetMsg	Sweet Spot	Log Incr	Clear	CQ TEST	My Info	Gear Brag	Weather	Home Brag
BTU	BTU/Name	SK Short	SK Long	CheckIn-Reg	73	Counter	ANS TEST	INTRO	Soft Ver		Testing SK
K15US	AGAIN?	QSL?	QSL73	CheckIn-Short	73-QRZ?	Counter --	EXCH				Sweet Spot
CQ Contest	Report	TU CQ	Log/Incr	TU	VIDEO-ID	Counter ++	NR?	SIGNAL REPORT	SigChk Request	DTG	

14072.38 ss

14072.20 etrt~

14071.92 =

14071.73

14071.63 T

14071.53 rCn

14070.21 today. How copy? BTU Christophe, F4GTB de V

14070.80 o the (xt te 73 and thanks 31 Qe W5BIL e=E3C

14070.60 tea6ee

14070.53

14070.04

FTB NF4GIB F4GTB de W8VYM W8VYM pse k ..=W8VYM de F4GTB...

Hi Dr OM .. tor 599 599..

Op = Chris = Ccris .. kth NR PAOIS .. JN18nt

o^ey btu WPVYM de F4GTB KNF4G de W8VYM

Hello Christophe

Your signal report : 599 599

Name : John John

State : Georgia

Grid : EM82je EM82je

Sunny 82 F here today.

How copy? BTU Christophe, F4GTB de W8VYM ps

500 1000 1500 2000 2500 3000

WF -20 70 x2 NORM 1211 QSY Store Lk Rv T/R

BPSK31 S/N 27 dB IMD -19 dB

ftrig FTdx101MP

File Config Memory Keyer Help

14070.000 7000.085

S3 S6 S8 -20 +40 +60 vfoA vfoB A/B Split

3000 DATA-U

Vol 25 RF 100 Pwr 5

ATT IPO AN Tune PTT

7 new alerts 20:07:36 UTC 22 Oct 2023

Enter Que by Callsign Search Database News Forums Store Swapmeet Resources Contact K15US

## W8VYM

USA

**JOHN M FICKLER**  
531 EVERGREEN  
CIRCLE  
EASTMAN, GA 31023  
USA

QSL: eQSL, LoTW or Direct

Email: Use mouse to view..

XML Subscriber Lookups:  
11649 Label

Biography Detail Logbook Web 201 Awards 7 Log a NEW contact with: W8VYM

Hello! I'm a recently (2016) licensed HAM but not new to electronics. I built a CB base station (Heathkit GW-22A) and some other kits when I was 16 years old (1967). I modified the CB kit so it had 9 channels instead of just 5. I remember talking with folks in and around my town after sundown, but nothing like the distances I'm seeing with this HF rig. I'm currently using a barefoot Yaesu FT-450D connected to an LNR EF Quad end fed wire antenna installed as a sloper going from about 15 foot at the matchbox up to about 25

VARA FM



# Olivia 8/250 CQ

fldigi ver4.2.00 / FTdx101MP - K1SUS

File Op Mode Configure View Logbook Help Spot RxID TxID TUNE

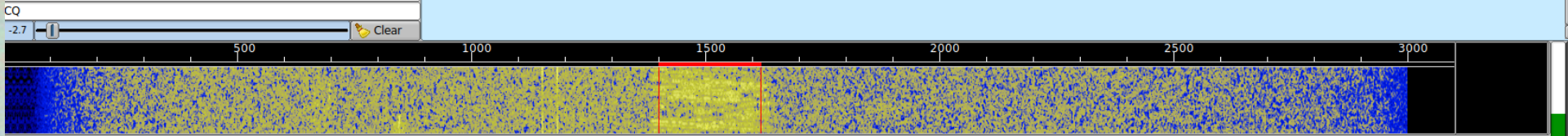
## 14070.000

Freq 14071.510 On 2016 Off 2017 In 599 Out 599 Cnty/Cntry Notes  
Call VE3HEQ Op Clive Az 004  
DATA-U 3000 Qth WOODSTOCK St Pr ON L EN930d Canada

CQ	ANS	QSO	CQtheNetMsg	Sweet Spot	Log Incr Clear	CQ TEST	My Info	Gear Brag	Weather	Home Brag
BTU	BTU/Name	SK Short	SK Long	CheckIn-Reg	73	Counter	ANS TEST	INTRO	Soft Ver	Testing SK
K1SUS	AGAIN?	QSL?	QSL?	CheckIn-Short	73-QRZ?	Counter --	EXCH	EXCH		Sweet Spot
CQ Contest	Report	TU CQ	Log/Incr	TU	VIDEO-ID	Counter ++	NR?	SIGNAL REPORT	SigChk Request	DTG

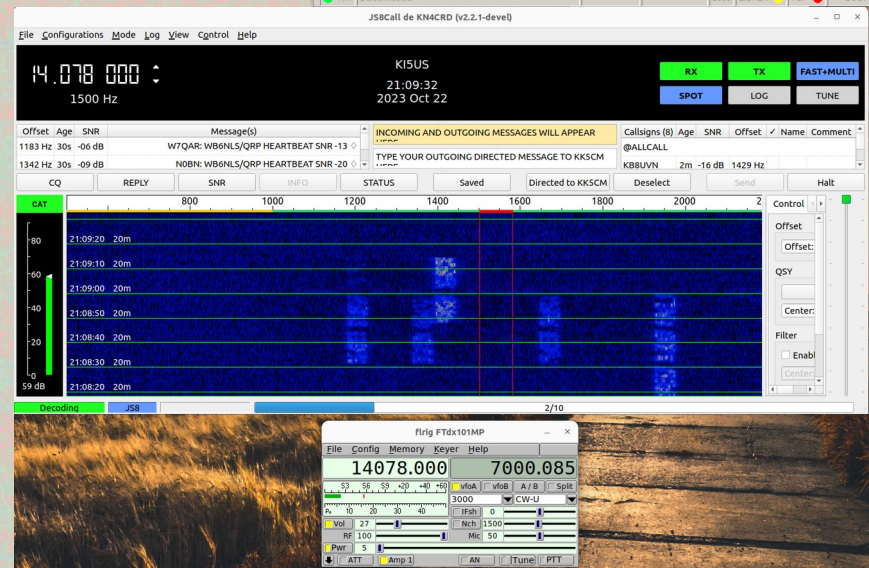
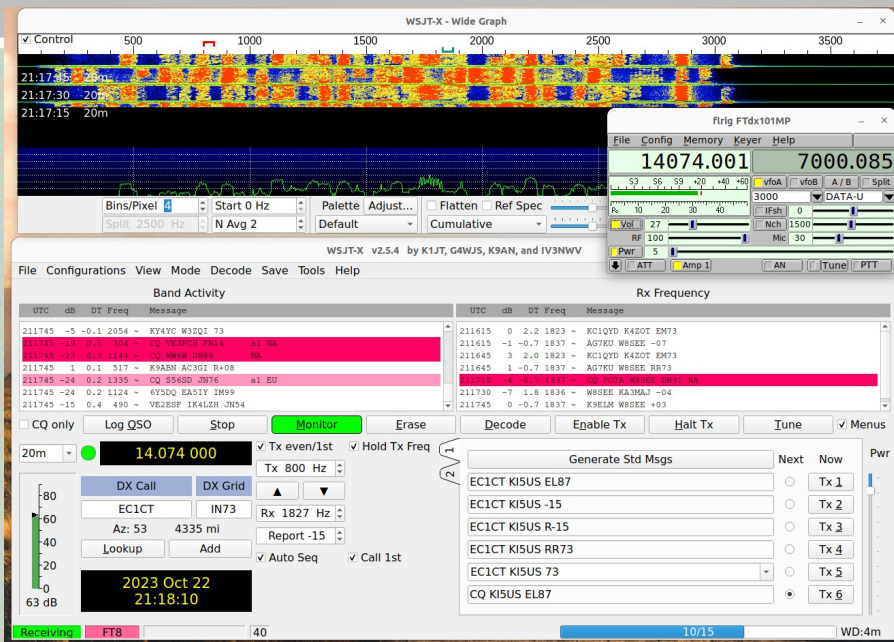
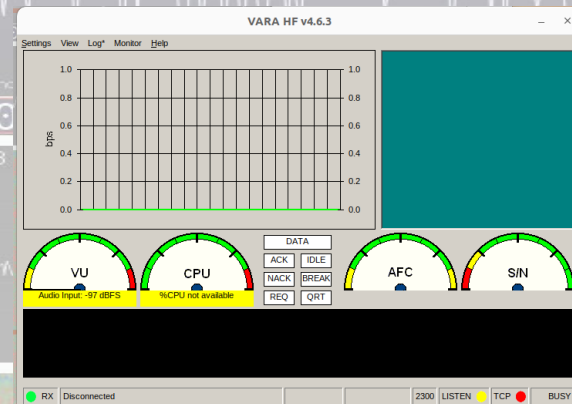
14072.71 t  
14071.62 .ert e  
14071.53 w ta r  
14071.40 e r e  
14071.31 oto ee  
14070.83 cet trt  
14070.80 SE K CQ CQ de VE300Z VE300Z CQ CQ de VE3  
14070.50 it  
14070.44 o  
14070.34

eeanytnx for PSK31 zSO f[ happy to coactaii you My u OK via EQSL(AG) / DIRECT / LOTr / BUREAU  
info + mictures www.enrz.com  
Bst i3 from france to cou & yours  
Bye Bye<ear John :) ged bles emerica  
QSO LOPGED 22/10/2023 at 20:1  
:57 UTC  
  
W8VYM de FTB F4  
de W8VYM  
73 Chris and thanks for this BPSK-31 QSO on 20m, Good to meet  
you on tQ  
CQ CQ de VE3HEQ VE3HEQ  
CQ CQ de VE3HEQ VE3HEQ  
PSE K [ ] P[ ]YCQ CQ de VE3HEQ VE3HEQ  
CQ CQ de VE3HEQ VE3HEQ  
PSE K HX-d"lheq de n4jhb n4jhb [ ]/v+[ ] CQ CQ de VE3HEQ VE3HEQ  
CQ CQ de VE3H



# Digital Data Modes - cont'd

- VARA
- Others (e.g., FT8, JT65, JS8Call, WSPR, Packet, APRS and more)





# Worth Mentioning: SSTV

- MMSSTV (Windows)
- QSSTV (linux)
- Generally use the same hardware configuration as the digital modes
- Also worth mentioning: ALL of these Digital Data Modes work on VHF & UHF (just not as far!)





# Applications Implementing Digital Modes

- Software overview:

- Winlink (RMS) Express [1-to-1 / email]
- WSJT-X, JS8Call, GridTracker
- FLDIGI, FLRIG, FLAMP, FLARQ, FLMSG [1-to-Many]
- Ham Radio Deluxe

- Hardware interfaces:

- Modern radio that supports CAT control (internal sound card)
- DigiRig
- Signalink
- RigBlaster, etc.





# Why Digital Data Communications in Amateur Radio? - Part 1

- Enhanced communication in weak signal environments
- Efficient bandwidth usage
- Ability to transmit text, data, images, and more

GridTracker 1.23.0402 [Band: 20m Mode: FT8 Layer: Grids]

GridTracker  
14,074,000 Hz (20m) FT8  
Sun 22 Oct 2023 22:07:29 UTC  
EC1CT IN73 -15  
Spain 4325mi 52°

DECODE

Rx Calls 129 QSO 1631  
Rx DXCC 19 QSL 1171  
(Clear Live) (Clear Log)

Map View Filters  
Band Auto  
Mode FT8  
Prop Mixed  
Data Live

State	County	Cont	dB ▲	Azim	CQz	ITUz	PX	OAMS
TX	Johnson +1	NA	-23	294	04	07	WB5	
		EU	-22	45	14	27	M0	
CA	Riverside	NA	-20	292	04	07	K5	
		EU	-15	58	14	37	CT2	
		SA	-14	166	09	12	HK4	
ME	Cumberland	NA	-12	27	05	08	KA1	
TX	Dallas	NA	-11	298	05	08	K3	
IL	Kankakee	NA	-10	346	04	08	K9	
IA	Woodbury	NA	-10	325	04	07	KD0	
		EU	-8	56	14	37	EA4	
CO	Cheyenne +1	NA	-9	310	04	07	W5	
		EU	-8	56	14	37	EA4	
		NA	-8		05	08		

Legend QSO QSL  
QSQ CQ CQ DX  
QRZ QTH WSPR  
CQ RU

ITUz	PX	OAMS	Age	POTA	UTC
27	M0		45s		22:06:30
07	W5		1m 59s		22:05:15
08	WV8		1m 30s		22:05:45



# Why Digital Data Communications in Amateur Radio? - Part 2

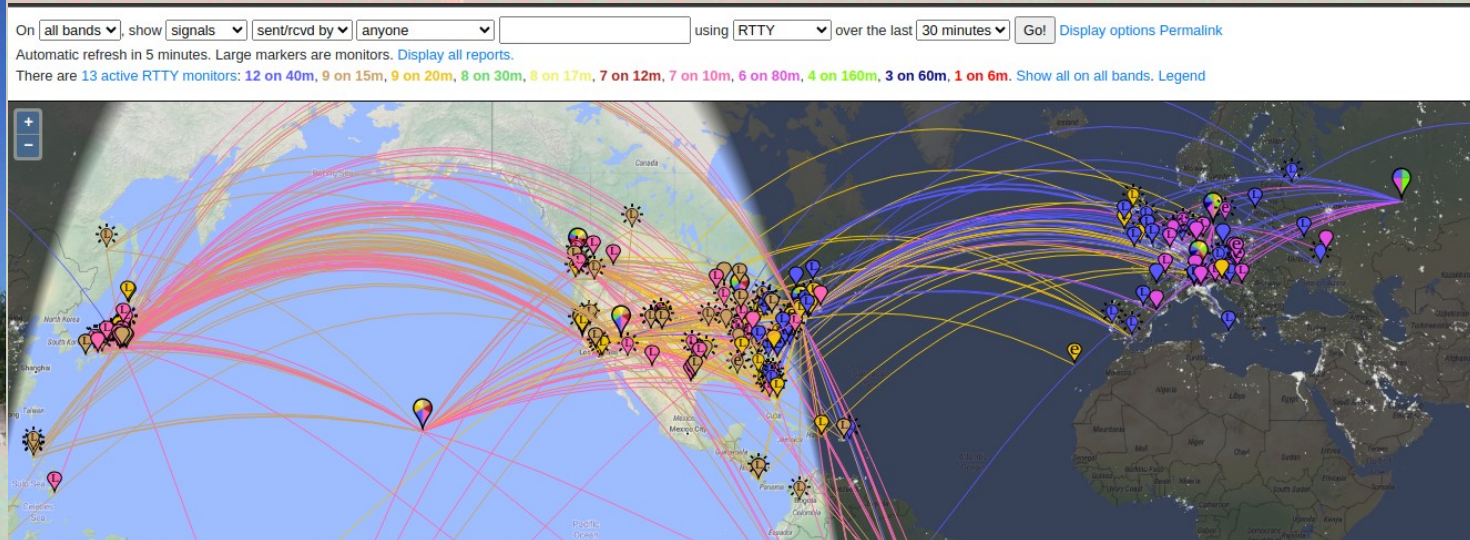
- ARES (Amateur Radio Emergency Service) applications
  - Disaster communications
  - Relay of critical information
- RACES (Radio Amateur Civil Emergency Service) applications
  - Civil defense purposes
  - Backup communications for governmental entities





# Real-world Applications & Examples

- Digital modes in DXing (long distance communication)
- Moonbounce (EME) and Meteor Scatter
- Remote telemetry and control





# On-The-Air Opportunities

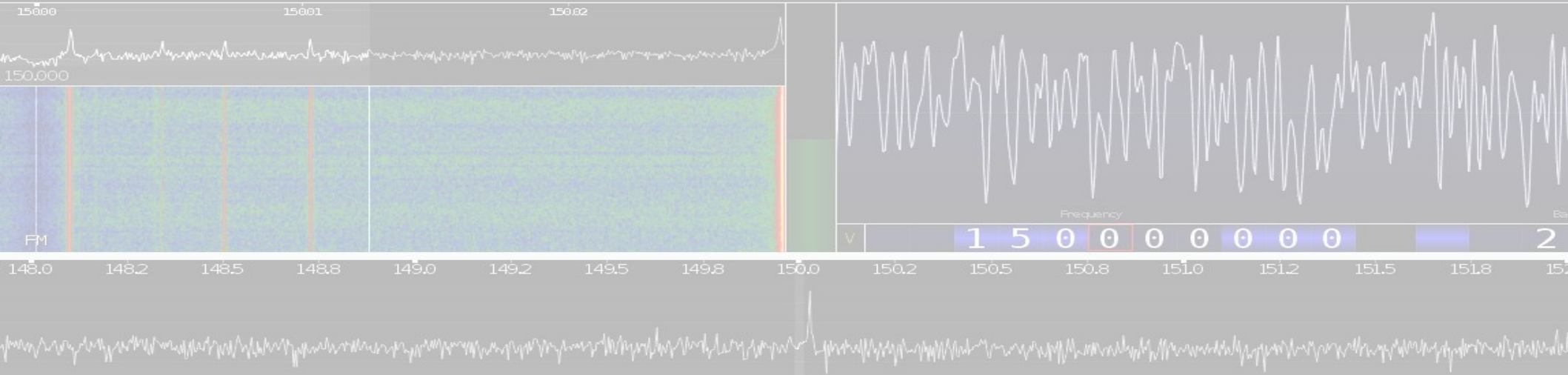
- W1AW ([www.arrl.org/w1aw](http://www.arrl.org/w1aw))
  - Receive-only digital bulletins
  - Weekdays at 6pm & 9pm [RTTY/PSK31/MFSK16]
- HF Digital Bands
  - FT8 is hard to miss when the band is up (ex: 14.074 MHz)
  - Free-form QSOs within designated digital bands
    - <https://www.bandplans.com/>
  - Winlink nodes (HF/VHF/UHF)





# Challenges & Considerations

- Balancing mode efficiency vs. bandwidth
- Ethical operating practices
- Future trends and emerging modes
  - Starlink, Network-based methods
- Attracting new, and mentoring junior, Hams



Questions?

