What is VarAC and the VARA Software Suite?

Capabilities, Use Cases and Comparisons

Rick Fletcher, W7YP

Flathead Valley Amateur Radio Club

January 20, 2026

TOPICS

- What is the VARA Software Suite?

- Core Components

- Key Capabilities

- Comparison: VARA vs. FT8

- Comparison: VARA vs. JS8Call

- Real World Use Cases

- Future Outlook

- Q&A

# What is the VARA Software Suite?

- Developed by Ricardo M0HZH/EA5HVK (rosmodem.com) for the Windows platform
  – Macs can use it, too, with Windows emulation (e.g, Wine)
- High-performance HF/VHF/UHF modems using OFDM modulation (military-grade tech)
  – Uses error-free Automatic Repeat reQuest (ARQ) protocol
- Focus: Weak-signal digital modes for reliable, fast data over radio
- User Base: 80,000+ operators in 100+ countries (as of 2026)
- Latest: Active development; VarAC nets booming in 2025 (e.g., scheduled EmComm shifts)
- VARA isn't just a modem—it's a full ecosystem for keyboard-to-radio messaging, outpacing legacy modes in speed and features.

Core Components

- VARA HF
  - Core OFDM Modem
    - HF (160m-6m)
    - Up to 1,543 bps at 500 Hz BW
    - Up to 7,000+ bps at 2300 Hz BW
- VarAC
  - Free P2P chat app
  - Integrates with Winlink
- VARA FM
  - VHF/UHF Narrowband > 12,750 bps
  - Wideband > 25,210 bps
- VARA SAT
  - Satellite transponder modem adds additional latency handling and Doppler tuning
    - LEOs and HEOs
- VARA Terminal
  - Basic terminal for raw data/scripts
    - All bands

Core Components of the VARA Suite
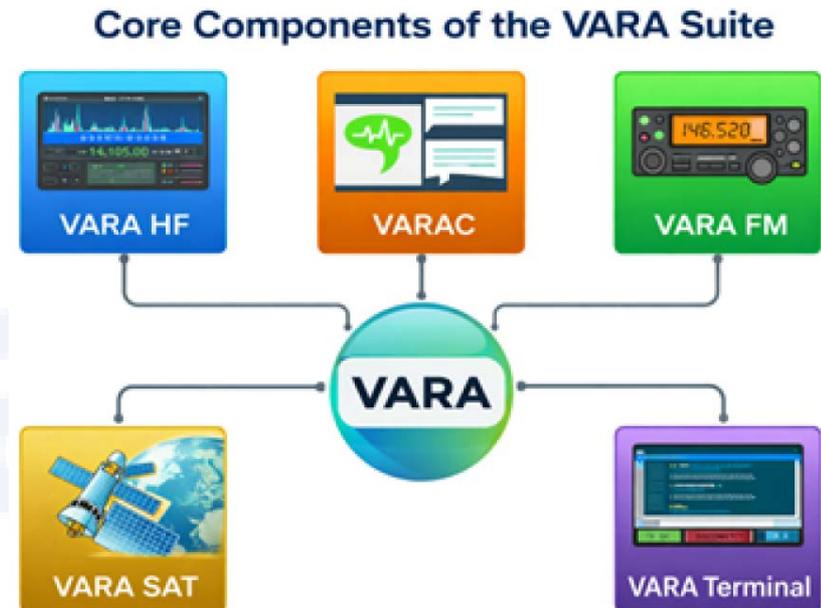
VARA HF
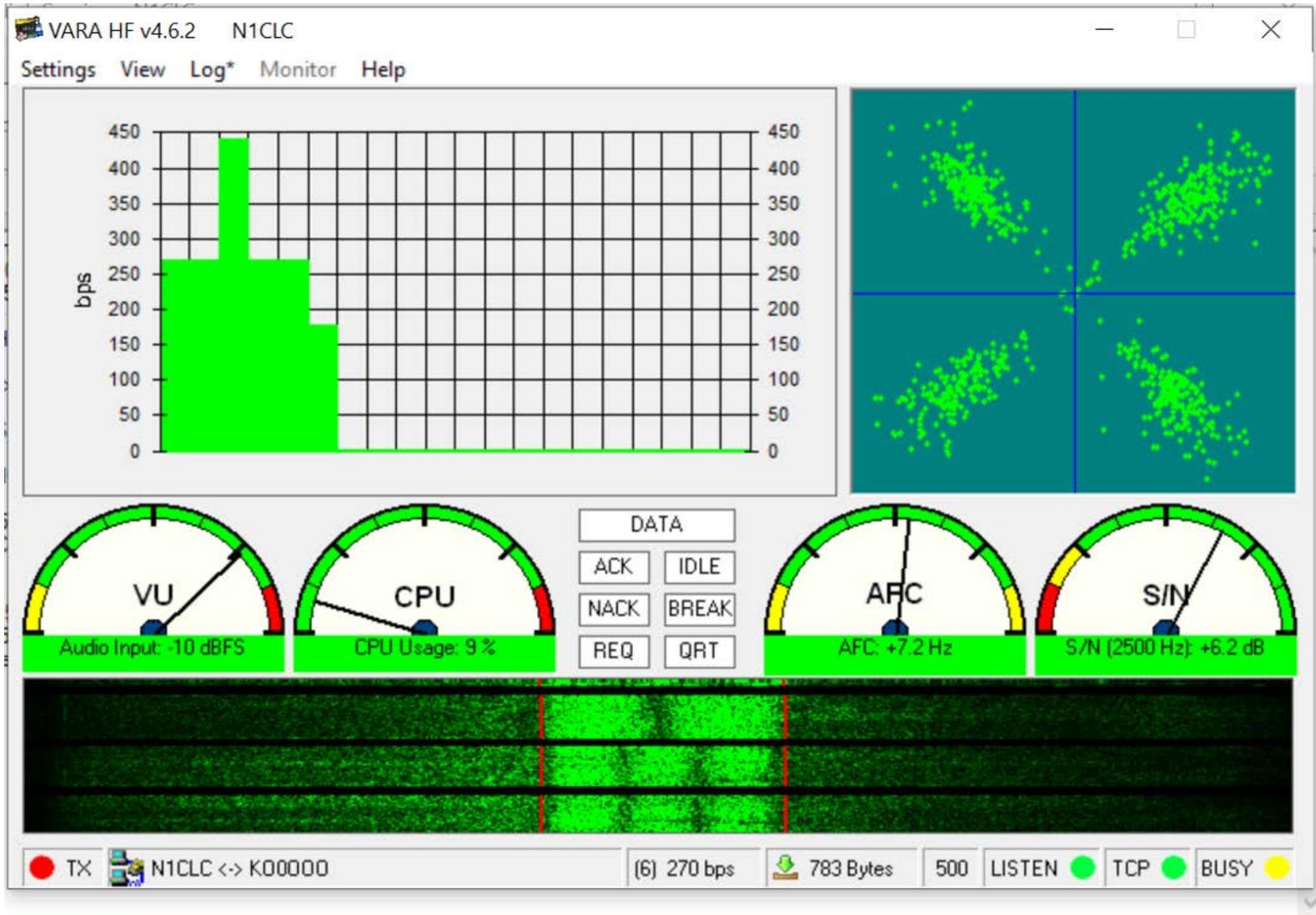
VarAC

VarAC by 4Z1AC (V13.0.1)

Settings Tools Logs Resources About   UTC: 2026-01-18 **22:45:37**   Mode Simple

FREQUENCY **BUSY**

14.105.000

SLOT [ ] ──●── AA5IT

CONNECT MODEM | CONNECT

DISCONNECT MODEM | DISCONNECT | ABORT

──●── TUNE | CALL CQ | END CQ

NEXT BEACON: 00:06:48

Beacons

Bnd	TΔ	Callsign	Tag	LOC		SNR
20m	00:...	N4WFF		EM61...	⚡	-14
20m	00:...	N9HMA		EN53...	⚡	-12
20m	00:...	KN4IIG		EM88JL	⚡	-16
20m	00:...	N1ZZZ				-10
20m	00:...	AE5JO				-14
20m	00:...	WJ9H		EN42...	⚡	-12
20m	00:...	K7QB		EM69...	⚡	-13
20m	00:...	KJ7BS		DM33...	⚡	-13

CQ calls

Bnd	TΔ	Callsign	LOC	Type	SNR	Slot
20m	00:11	KQ4QCJ			-12	11
20m	00:31	KB0US			-15	3
20m	00:34	KQ4QWH			-17	2
20m	01:01	WB7SWW			-12	1
20m	01:07	AA5IT			-11	5
20m	02:55	KQ6K			-17	3
20m	02:55	VE3RIA			-20	1
20m	03:38	KD2WNY			-19	4

In QSO with   Duration: 00:00:25

SNR: Last Avg Mine
dB -15

☐ I'm away
☑ Unattended links

Bnd	Time	From	To	SNR	Broadcast message
20m	17:41	K9JAJ	ALL	-15	Any Superstations out there?
20m	18:29	KB9FFR	CQ	-20	1
20m	20:00	N1DOU	ALL	-15	Go Patriots beat Texans

QSY ▽ △ #

SEND VMAIL
BROADCAST
PSK REP. MAP

Time	Callsign	Datastream message	Reply
20:28:25		CONNECTED TO AA5IT (BANDWIDTH: 500 FREQUENCY: 14.105.000) (INCOMING PING)	
20:28:39	W7YP	<R-15>	
20:28:51		QSO SUMMARY: Frequency: 14.105.000 (20m) Duration: 00:00:25	
20:28:51		DISCONNECTED FROM AA5IT	
20:42:51		<SENDING STANDARD BEACON ON 20m - 14.105.000> DE W7YP	
20:58:25		<SENDING STANDARD BEACON ON 20m - 14.105.000> DE W7YP	
21:13:28		<SENDING STANDARD BEACON ON 20m - 14.105.000> DE W7YP	
21:28:39		<SENDING STANDARD BEACON ON 20m - 14.105.000> DE W7YP	
21:51:34		<SENDING STANDARD BEACON ON 20m - 14.105.000> DE W7YP	
22:06:34		<SENDING STANDARD BEACON ON 20m - 14.105.000> DE W7YP	
22:21:48		<SENDING STANDARD BEACON ON 20m - 14.105.000> DE W7YP	
22:37:25		<SENDING STANDARD BEACON ON 20m - 14.105.000> DE W7YP	

CALLSIGN	SNR-S	SNR-R	BAND	NAME	LOC	QTH	MyPWR	START TIME	END TIME	
AA5IT	-15		20m		EM20VD		100	2026-01-18 20:28:25	2026-01-18 20:28:51	

☑ Auto log QSO
LOG

New message   Gestures/Tags   Load canned message:

☑ Enter to send
SEND

TX **RX** [ ] IDLE W7YP DN28WK   EMAIL GATE ALERT ✉ NO NEW VMAIL RELAY

Net Bit Rates in 2300 Hz Bandwidth

- Uses Orthogonal Frequency-Division Multiplexing (OFDM) with many sub-carriers
- Adapts, based on
  - SNR
  - Doppler and fading
  - Channel quality
- Low/very weak link: ~100-500 bps
- Medium strength link: ~500-2,000 bps
- Strong Link: ~2,000-5,000 bps
- Very strong link: ~5,000-8,490 bps (7k bps typical)
- NOTE: Free version of VARA HF limits speed to 180 bps (500 Hz) or 270 bps (2300 Hz)
  - Permanent license costs $69 to unlock speed limit

VARA HF SNR vs Speed (approximate)
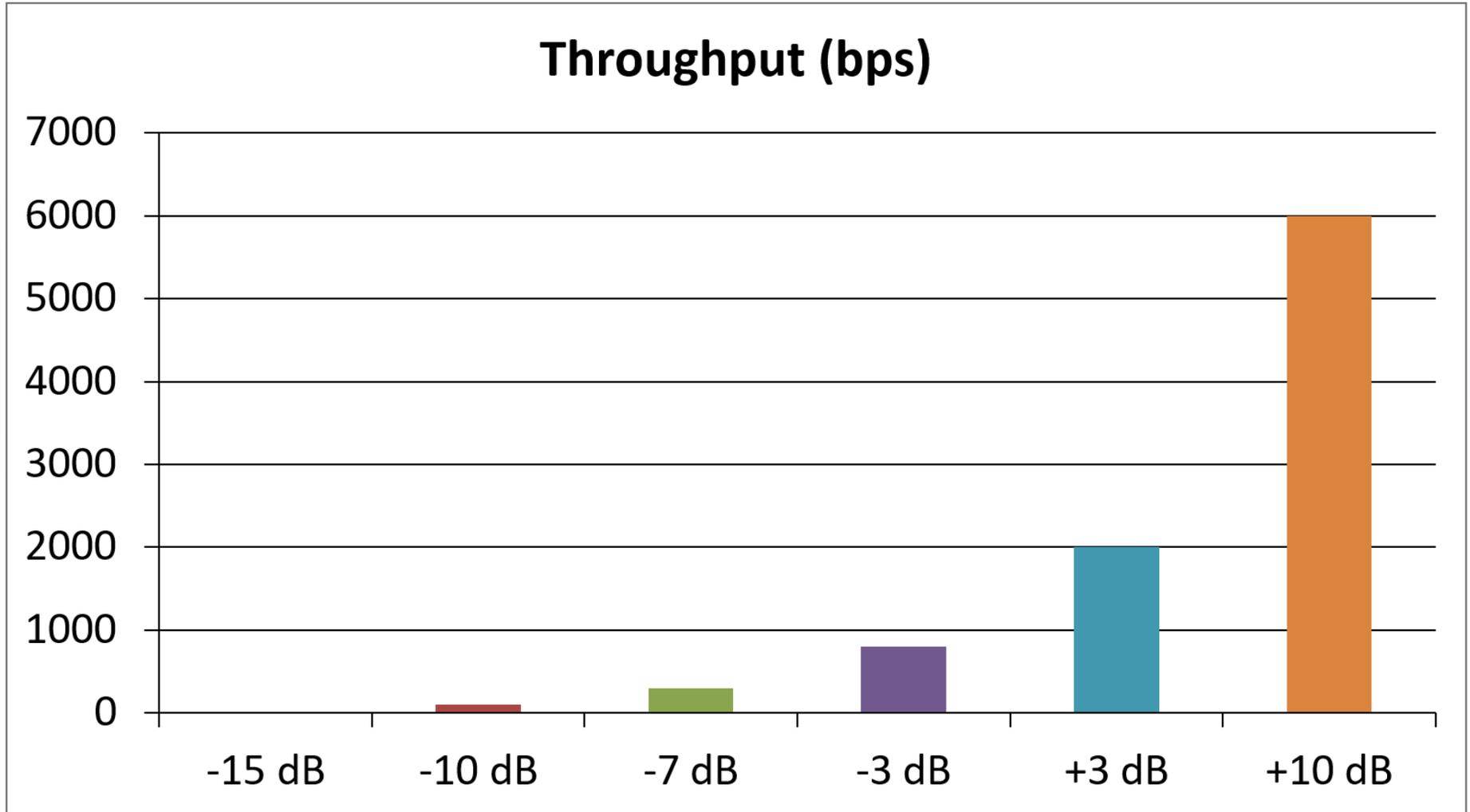
Comparison: VARA vs. FT8

Feature	FT8	VARA HF
Modulation family	8-FSK	PSK + QAM
Adaptive modulation	❌ No	✅ Yes
Uses phase	❌ No	✅ Yes
Uses amplitude	❌ No	✅ Yes (QAM)
Bandwidth	~50 Hz	500 Hz / ~2300 Hz
Typical throughput	~10–15 WPM	~500 bps → ~7 kbps
Link type	Broadcast-style	ARQ, two-way
Latency	Fixed 15 s cycles	Low, interactive
Amp linearity needed	No	Yes

FT8 uses fixed 8-FSK for ultra-weak-signal decoding, while VARA HF uses adaptive PSK and QAM over OFDM to trade robustness for much higher data throughput.

Comparison: VARA vs. JS8Call

🔬 **JS8Call vs VARA HF**

Feature	JS8Call	VARA HF
Modulation family	8-FSK only	PSK + QAM
Adaptive modulation	❌ No	✅ Yes
Uses phase	❌ No	✅ Yes
Uses amplitude	❌ No	✅ Yes
Bandwidth	~50 Hz	500 Hz / ~2300 Hz
Typical throughput	~20–300 bps	~500 bps → ~7 kbps
Weak-signal ability	Excellent	Moderate
Latency	High (frame-based)	Low
Two-way ARQ	Limited	Full
Interactive use	Text-centric	File transfer, chat, email

Practical SNR Equivalence Table

FT8 decode SNR (dB)	What it means in practice	VARA HF outcome
−24 to −20 dB	Barely detectable tones	❌ No VARA link possible
−20 to −15 dB	Solid FT8 decodes	❌ VARA cannot lock
−15 to −10 dB	Strong FT8, weak JS8	❌ VARA handshake usually fails *****
−10 to −7 dB	Good JS8Call	⚠️ VARA may connect at **very low speed**
−7 to −3 dB	Comfortable JS8	✅ VARA BPSK / low QPSK
−3 to +3 dB	Excellent JS8	✅ VARA QPSK
+3 to +10 dB	"Loud" signals	✅ VARA 8PSK
+10 dB and up	Very strong	✅ VARA QAM, multi-kbps

* I have seen successful decodes down to -22 SNR (500 Hz BW), but handshakes aren't fully reliable. VARA HF does support non-ARQ exchanges which lack acknowledgment and error correction.

Key Capabilities

- High-Speed Data: Up to 7,000+ bps (HF wideband); ARQ error correction for 100% delivery
  - ARQ ensures no lost messages in noisy bands like 80m and 40m
  - Weak-Signal Resilience: -18 dB SNR threshold; auto-reconnect on fades
- Multi-Mode Support: Chat, file/image sharing, beacons, CQ calls, RIG control (CAT/OmniRig)
- EmComm Tools: Message queuing, VMail-Box (store-forward), ADIF logging, spell-check
- Monitoring & Extras: Signal scanning, "typing" indicators, emojis, dark mode; multilingual
- Bandwidth Options: 500 Hz narrow or 2,300 Hz wide

VARA HF's Vector Signal Analyzer

- VARA HF's window includes a built-in VSA
  - Located in the top right corner
- While sampling the derived incoming digital signal, it plots a symbol as a point in the I/Q (In-phase and Quadrature) plane
  - Shows aspects such as:
    - Signal quality
    - Phase/Amplitude errors
    - Modulation type
  - "Constellation" pattern
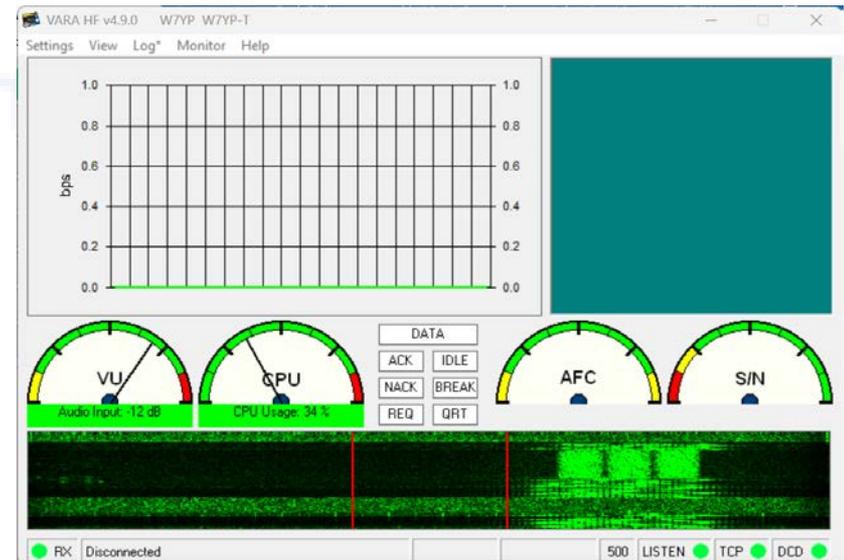
Binary Phase-Shift Keying - BPSK

- 2 symbol states 180° apart
- HF smearing is caused by
  - Fading
  - Residual phase noise
  - Doppler spread
- This is VARA's most robust mode
  - Channel SNR is low/unstable, but still usable
  - Used early in a connection
  - Used before a speed increase or a disconnect
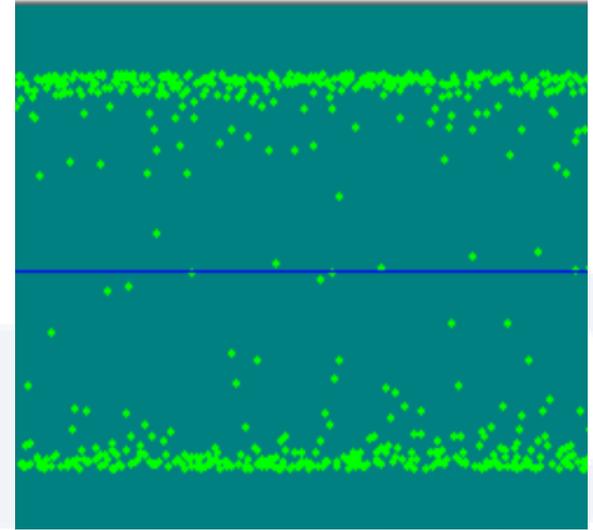
Also BPSK

- Still only 2 symbol states (1 bit per symbol)

- Points have collapsed into a single diagonal smear when:
  - The phase reference is rotating
    - Doppler spread (time-varying frequency offset)
      - Rapid phase rotation produced this constellation
  - The PLL can't fully lock
    - The bright central ridge indicates that the PLL is almost tracking
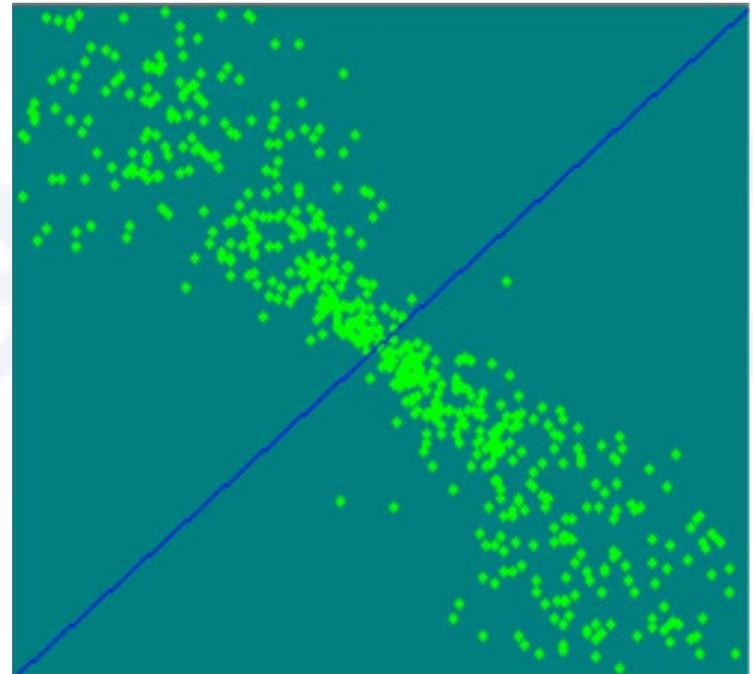
Quadrature Phase Shift Keying (QPSK)

- One distinct cluster in each quadrant

- 2 bits per symbol

- Clusters are elongated diagonally by:
  - Ionospheric phase noise
  - Doppler spread
  - Multipath

- This is QPSK under real HF channel conditions at moderate SNR
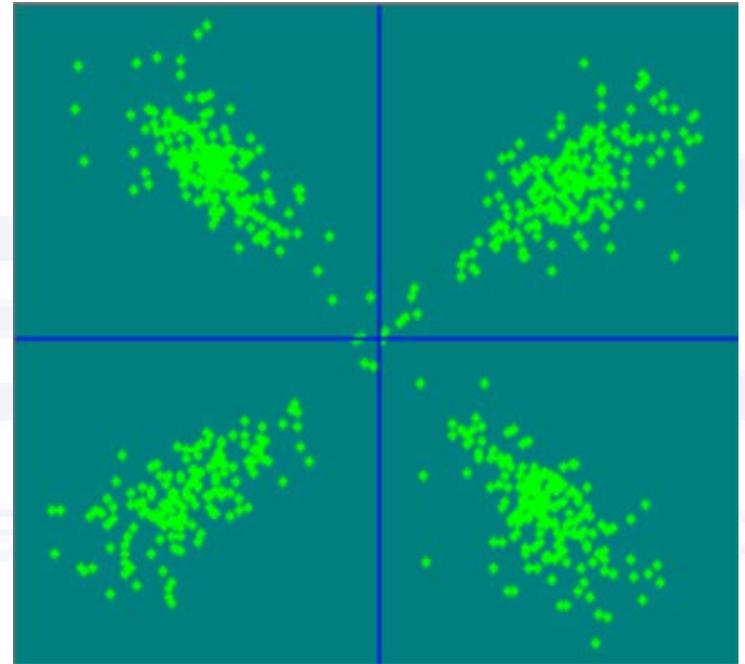
Octal PSK – 8PSK

- 3 bits per symbol
- Used on good HF paths
  - Less commonly selected
  - High SNR
  - Low Doppler spread
- 8 points around a circle
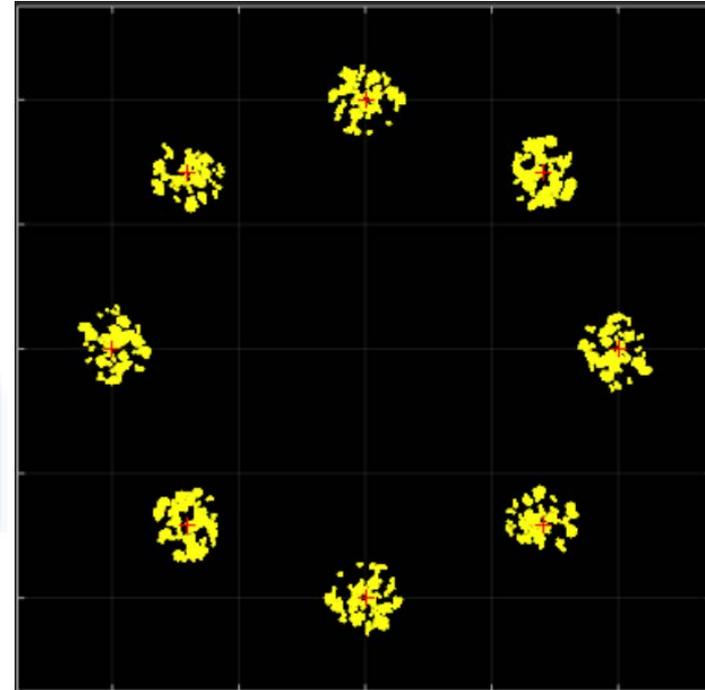
Quadrature Amplitude Modulation - QAM

- 16-QAM
  - ~2,000 to 5,000 bps
  - 4x4 grid pattern
- 32-QAM
  - ~5,000 to 7,000 bps
- Shows up at higher speed levels
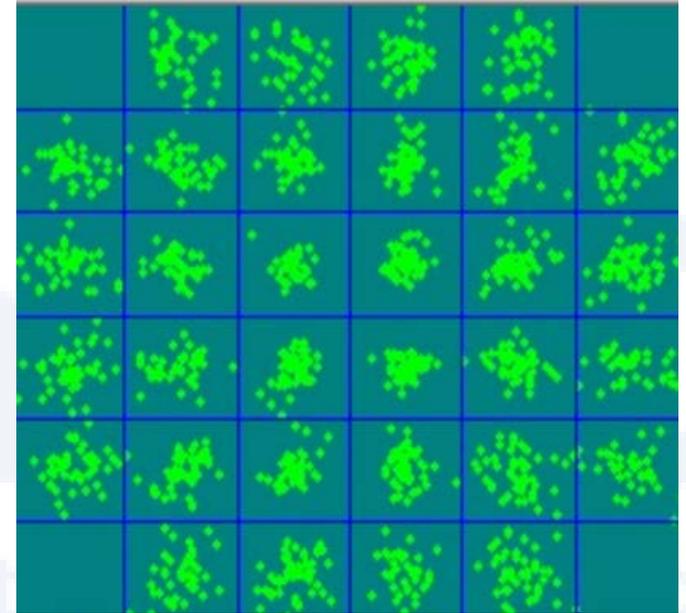
32-QAM

Getting Started

- Download:
  - https://www.varac-hamradio.com/ (VarAC free)
  - OmniRig: https://www.hb9ryz.ch/omnirig/
    - Creates virtual serial ports for CAT control of transceivers
- Documents:
  - VarAC Quick Start Guide:
    - https://www.varac-hamradio.com/forum/manuals-troubleshooting/varac-quick-start-guide
  - VarAC User Manuals:
    - https://www.varac-hamradio.com/post/varac-user-manuals
  - VARA-Winlink integration:
    - https://winlink.org/
  - Communities:
    - VARA-MODEM Groups.io
    - Facebook: https://www.facebook.com/groups/varahf/
    - VarAC Community on Telegram

VARA HF Setup

- ## Under "Settings"
  - VARA Setup
  - Soundcard Setup

- ## Very simple
  - Select the proper Audio sources for:
    - RX audio stream
    - TX audio stream
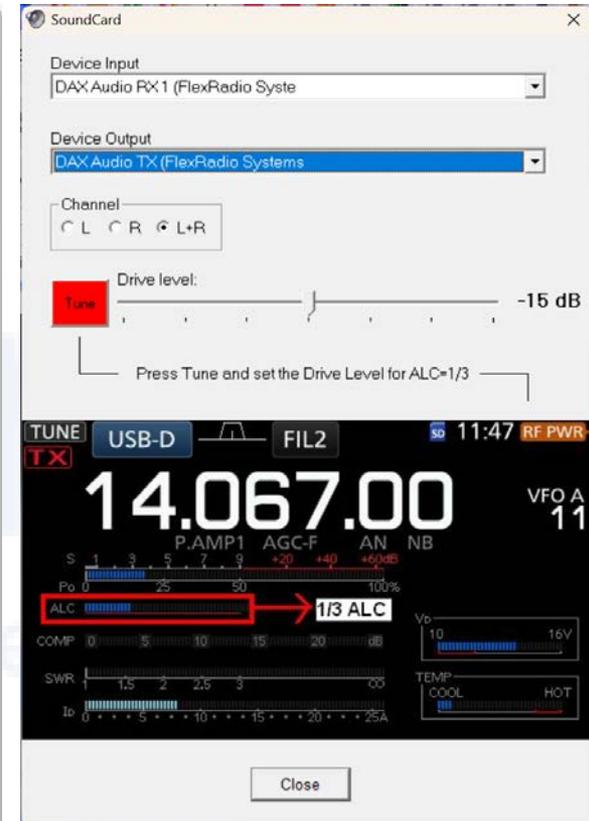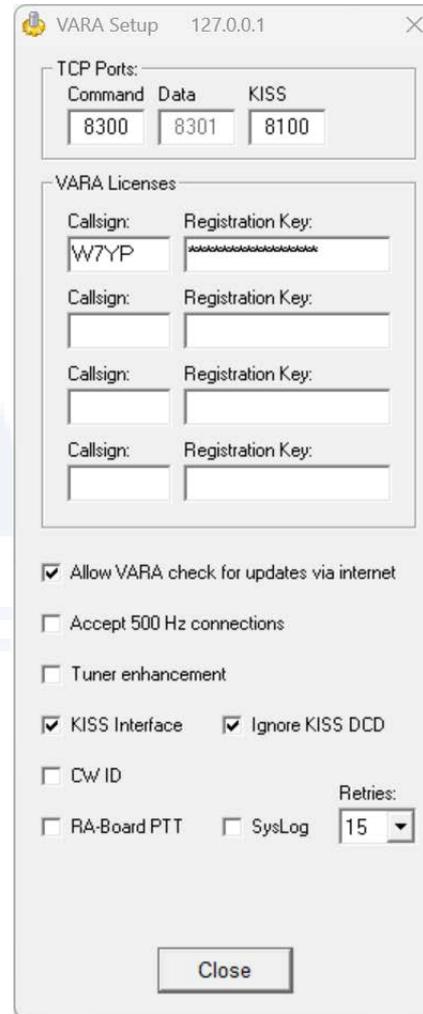
VarAC Setup

- RIG control is the only critical setup requirement
  - PTT configuration
  - CAT configuration
  - Frequency control
- VarAC has configuration files for almost all HF transceivers
- Call sign, location and station information under "My Information"

Conducting a QSO

- "IS TYPING" indicator
- Multilingual support
- Emoji support
- Incoming message unfolds as it is being received
  - Status bar shows message send/receive progress
- Tags and Gestures show symbols and play sounds
- Chat history is stored in a log file
  - Viewed in "call sign history" screen
  - Spotted Beacons and CQs can also be viewed
- Bidirectional SNR exchange
- Auto-QSO logging
- Message queue
- And much more!

CQ and the Slot System

- Single calling frequency (CF) per band
- 10 slots, 5 above and 5 below the CF
  - 750 Hz steps
- CQ Flow:
  - Pick a slot
  - Make sure it's free (slot sniffer)
  - Call CQ on the CF
  - VarAC will auto-QSY to the selected slot
  - Double-clicking a CQ auto-QSYs to the slot and connects
  - No answer? Your rig will QSY back to the CF

VarAC QSO

https://www.youtube.com/watch?v=0yJ-GGBEFQU
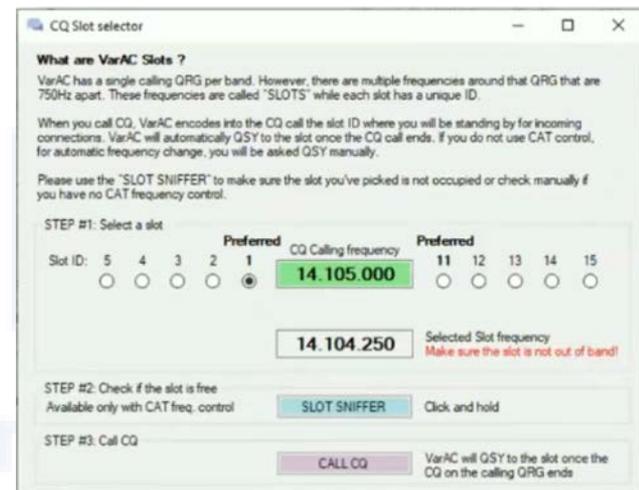
Video produced by K2MO

Other Useful VarAC Tools

- Upon completion of a QSO, logs to an ADIF file
  - Mode is reported as "Dynamic"
    - Sub-mode as "VARA HF/FM/SAT as appropriate
  - Can export via TCP or UDP to many other logging programs
  - LOTW can import its ADIF file
- Beacons – great for propagation analysis and announcing your presence
  - Minimum beacon interval: 15 minutes
  - Beacon is sent only if the CF is clear for at least 30 seconds
- Every CQ and Beacon is reported to PSKReporter
  - Roughly 50,000 spots per day
  - See how you're being heard
- Notifications (e.g., broadcast messages and CQs) can be spoken
- PING – Link validation
  - Confirms reachability to another station and bidirectional SNR of the link
- Vmail – VarAC's own internal mailbox system
  - Connecting to an "AWAY" station will ask you to leave a Vmail
  - Relay a message to a 3rd party through a mediator
  - Queue Vmails in your Outbox which will be forwarded once you're connected
- File Transfer (you can limit incoming file size)
  - Images (PNG/JPG/GIF) are shown in the chat stream
  - Supports binary files of any kind

Real World Use Cases

- Casual QSOs (P2P Chat)
  - Real-time texting like WhatsApp over HF
  - Share pics from a POTA/SOTA activation
- EmComm Drills
  - Queue messages for nets
  - Integrate with Winlink for email during blackouts
- File Transfer
  - Send maps/positions via PinPoint APRS integration
- Broadcasting messages
- Satellite Ops
  - Doppler-corrected QSOs via VARA SAT for global reach without HF propagation
- Local Nets (VARA FM)
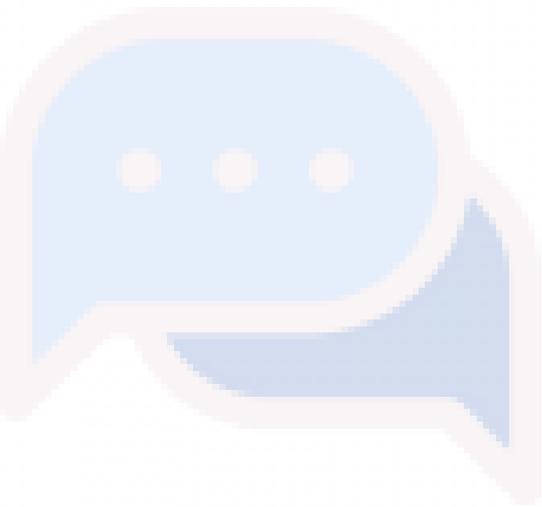 - VHF repeaters for regional alerts

What's Next for VARA?

- Continued growth: More nets adopting VarAC
- Native store-forward in VarAC
- Deeper Winlink/SAT integrations
- Community
  - Active forums (varac-hamradio.com)
  - Reddit (praises stability)
- Multi-band enhancements?
  - Monitoring multiple bands simultaneously
  - Cross-band communication

References

- VarAC User Manuals:
  - https://www.varac-hamradio.com/post/varac-user-manuals
- VarAC Website:
  - https://www.varac-hamradio.com/
- VarAC Wednesday:
  - https://www.varacwednesday.net/home
- VarAC Tutorials:
  - https://www.youtube.com/playlist?list=PLBDk9lmKMHPSbxoT4mAQgEWmSfTq_PE9D
- Winlink Email using VARA HF:
  - https://www.n1clc.com/2022/06/winlink-email-using-vara-hf.html
- VarAC Quick Start Guide:
  - https://www.varac-hamradio.com/forum/manuals-troubleshooting/varac-quick-start-guide
- VarAC for EmComm:
  - https://eugeneemcomm.org/wp-content/uploads/2025/12/VarAC_for_EmComm_tactical_guide.pdf
- VarAC EmComm Handout:
  - https://eugeneemcomm.org/wp-content/uploads/2025/12/VarAC-EmComm-One-Pager.pdf
- VARA Operators Facebook Page:
  - https://www.facebook.com/groups/varahf/
- Winlink:
  - https://winlink.org/

Q&A

VarAC

HF Chat reinvented