

# VarAC for HF / FM Digital Chat

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This article will start with some perspective on the history of digital (or data) modes and then discuss the recent development of a new digital mode based on the Vara software modems in more detail. Digital modes have been used by hams in many different forms for a very long time. My working definition of a digital mode is one where the information is encoded by an electromechanical or electronic processing device before combining with RF (modulation) for transmission. At the receiver, the information is extracted from the RF (demodulation) and processed to a form understandable by the receiving operator. This excludes traditional CW which is “modulated” and “demodulated” by the operators themselves.

The first widely used digital mode was RTTY (radioteletype). This method evolved from landline teleprinters and was pioneered by the US Navy in 1922. After WWII, obsolete surplus equipment became available to ham radio operators and, in 1946, the first amateur RTTY transmission occurred on 2 meters. (Frequency-shift keying (FSK) was not authorized for amateurs on the HF bands until 1953.) The electromechanical teleprinting equipment used in early systems have been replaced today by digital signal processors, computers and digital displays. RTTY remains a very popular mode today, especially for contesting. The first RTTY contest occurred 6 months after the FCC authorized FSK on HF.

Further development of digital modes focused on reducing the bandwidth and adding error correction to make communications more efficient and robust. This resulted in many new “keyboard-to-keyboard” modes such as PSK31 based on phase-shift keying and various MFSK (multiple frequency-shift keying) modes such as Olivia, Domino, Contessa, etc. Essentially the same setup is used for all RTTY and these modes, just the software algorithms change to encode and decode the various signals.

When hearing the term digital mode, most hams today would think of FT8 (Franke & Taylor, 8-FSK modulation). FT8 is undoubtedly the most popular amateur radio operating mode currently in use. Before the development of FT8, PSK31 was the most common digital mode in amateur use. The primary reasons for FT8’s popularity are its narrow bandwidth (although wider than PSK31), near automated QSO operation (this can start a lively discussion), error correction and ability to make contacts under very poor signal to noise ratio (SNR) conditions. Thus, even modest stations and QRP operators can make contacts under conditions and over distances that would not be possible with SSB or even CW in some cases. Typical SNR sensitivities (2500 Hz bandwidth) for those modes are:

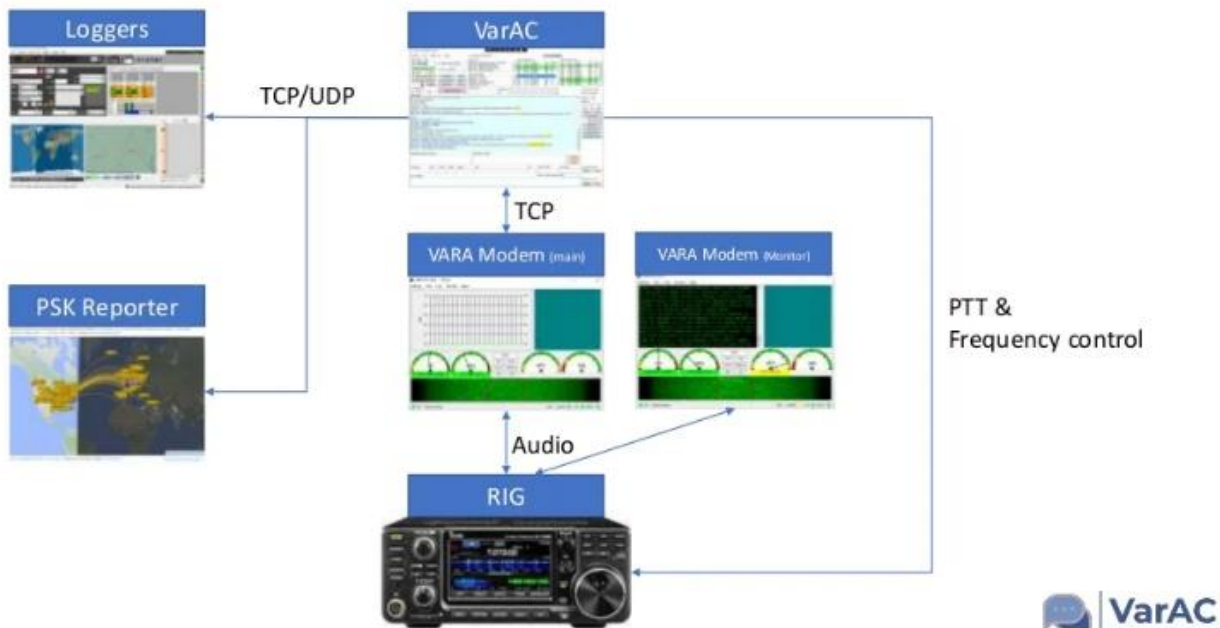
SSB	+10dB
CW	0 to -10dB typical, -15dB at best
FT8	-21 dB

The primary disadvantages of FT8 are the slow symbol rate (~5wpm), rigidly structured timing and minimalist QSO content where only callsigns, grids and signal reports are exchanged. While most previous digital modes were free-form keyboard-to-keyboard “rag-chew” modes, FT8 is not. An attempt to fix this was the development of JS8 Call which a derivative work based on the WSJT-X software. Directed calling, beaconing and message box system makes it more amenable to rag chewing and other amateur uses, but it is very slow and rigidly-timed like FT8.

VarAC is the latest digital communications mode for amateur radio. Irad Deutsch, 4Z1AC, released VarAC V1.9 Beta (the last beta version) for public use in October 2021. In exactly one year, he has released 18 updates and greatly expanded the capabilities of the application. VarAC is a point-to-point digital chat mode using the Vara software modem which provides good speed even under poor SNR conditions. Irad claims that it is ideal for QRP, portable and EmComm operations and can be used on HF, VHF, UHF and satellite (QQ-100) frequencies.

VarAC is free software that is only available for Windows operating systems (version 8.1 and above) with the .NET framework (version 4.x or above). Installation consists of creating a VarAC folder and extracting the downloaded files into it. For upgrades, you simply extract the newer Varac.exe file and copy it over the previous version in your VarAC folder. Links to the VarAC home page (with download tab) and the user manual are provided below along with an excellent presentation by Mike Richards, G4WNV, to the Radio Society of Great Britain (RSGB). There are many other internet resources to find out more about VarAC.

VarAC is the graphical user interface, CAT control and modem control software which links the Vara modem (HF or FM) and your rig. The figure below illustrates the data and audio paths for a typical HF setup.



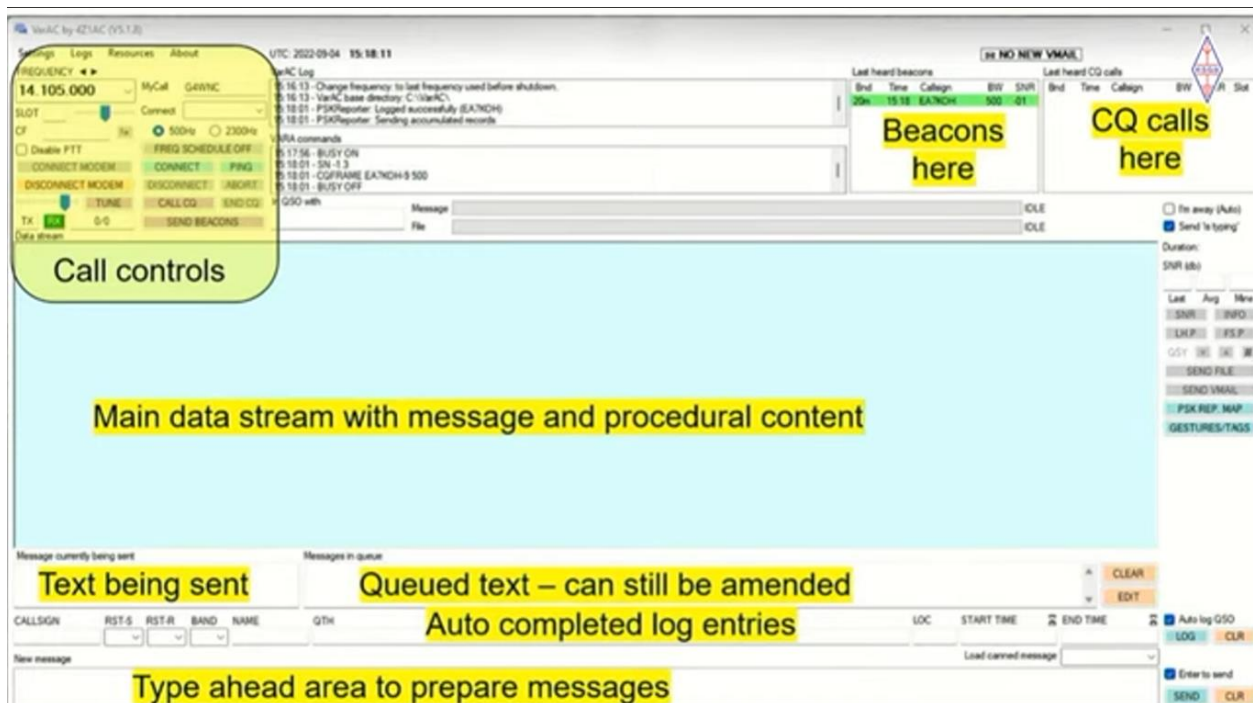
Note: Graphic is from the “VarAC Overview” presentation by Irad Deutsch, 4Z1AC and Gary Mitchelson, NC3Z linked below

If you use Vara for Winlink Express email, you only need to install VarAC, point it to the Vara installations and establish rig CAT control to get started. The Vara modem creates an error-free connection to the other station and varies the modulation method to optimize data speed for the current SNR conditions. VarAC uses a 500 Hz bandwidth, so the free version of Vara is sufficient and that provides data speeds of 18 to 180 bps (~27 to 270 wpm) – much faster than RTTY, PSK31, FT8, JS8 Call and most other ham radio digital modes. (Keep in mind, that data rates can be slowed by the need to resend data for error correction.) Under good conditions, file transfers are also possible. As shown above, a second instance

of the Vara modem can be used as a monitor to decode signals being received from QSOs that you are not a part of.

Establishing CAT control is straightforward if you have used other digital modes. An extensive list of rigs from the major and some minor manufacturers is provided by a dropdown list for both PTT and frequency control. VarAC can also use OmniRig or VOX to connect to your rig. If you have more than one rig, you can create profiles to easily start VarAC with the correct settings.

The graphical user interface is shown below. While it looks quite complicated, it is very logically laid out and easy to use with a little practice. I will describe some of the key features, but please see the linked resources for more complete information on using VarAC.



Note: Graphic is from the “RSGB Tonight@8” presentation by Mike Richards, G4WNV linked below

The “Call Controls” allow you to select the calling frequency for the band you want to operate on (80M through 6M built-in for HF). 20M and 40M seem to be the most used as you might expect. VarAC uses a channelized arrangement of frequency “slots” to reduce interference among ongoing QSOs. These 500 Hz wide slots are spaced 750 Hz apart with 5 below and 5 above the calling frequency.

When you initiate a CQ call, a popup box appears allowing you to choose among the 10 slots and calling frequency to make your call. Operators who receive your CQ call will see it in the box at the upper right corner. Along with the CQ caller’s callsign are the band, time, bandwidth, SNR and slot number. Answering a CQ is as easy as double-clicking on the line in the CQ Box. VarAC automatically routes CQ replies to the correct slot without operator intervention. Right-clicking on a line in the CQ Box allows you to ping the operator, send a Vmail to them or do lookups on QRZ, PSK Reporter or in the VarAC callsign history.

Pinging allows you to make a connection to another station to exchange signal reports. This is very useful before attempting a QSO to make sure that the quality and speed of the connection will allow a good connection. Again, VarAC automatically uses the correct slot to contact the other station. Beaconing is another feature in the Call Controls area. This allows you to indicate that you are online and available for a QSO. Beacons transmit by default every 15 minutes and are automatically stopped after 24 hours. Beacons appear in the box to the right of the CQ calls. Right-clicking on a Beacon Call provides the same options listed above for CQ Calls. In both boxes, your previous contacts on the current band are unhighlighted (white in light mode or black in dark mode) your previous contacts on a different band are highlighted in orange, while potential new contacts are highlighted in green.

To conduct a QSO, either answer a CQ or double-click a callsign in the Beacon or CQ boxes. Normally a QSO will start with several “Canned Messages” which are similar to macros in other digital modes. There is a dropdown to select “Load canned message” in the bottom right of the VarAC main window just above the “New message” box. These will typically include your name, QTH, working conditions, etc. For a rag chew QSO, you type messages in the New message box. This can be done at any time during a QSO. Pressing enter in that box moves the text to the “Messages in queue” box. Messages there can still be edited until they move into the “Message currently being sent” box. VarAC alerts you when the other operator is typing a message, but this does not affect your ability to type or edit messages. One of the canned messages is usually a “73 message” used to end the QSO.

VarAC will auto-log your QSOs to several common logging programs including N3FJP, HRD and N1MM. The ADIF committee recently created new modes and sub-modes to log VarAC QSOs and you can select which mode and sub-mode you want to log under. Also, users can report the stations that they hear to PSK Reporter. This allows you to determine how well you are receiving and how well your signal is getting out. Clicking the button labelled “PSK REP MAP” opens PSK Reporter preset to show sent and received stations for your callsign over the past 6 hours on all bands.

Other features include sending and receiving “Vmail” to one or multiple recipients. This is useful for short communications where the other operator is not “on-line”. The next time they open VarAC, they will be alerted to new messages in their mailbox. You can also draft messages off-line to be sent the next time that you on-line with VarAC. The system also has a relay feature. These are a potential new method for EmComm situations.

I recommend that you checkout VarAC, the newest digital mode. There is quite an active group using the 500 Hz protocol around the calling frequencies on 20M in the daytime and 40M at night. The mode can also be used on other legal amateur frequencies using either the free (170 bps) or non-speed limited (up to 7050 bps on HF), paid version of Vara. The latter would be especially useful for transferring large amounts of data.

[Home | VarAC \(varac-hamradio.com\)](http://varac-hamradio.com)

[VarAC \(usrfiles.com\)](http://usrfiles.com)

[VarAC Overview \(slideshare.net\)](http://slideshare.net)

[RSGB Tonight@8 - Back to the keyboard! by Mike Richards, G4WNC - YouTube](https://www.youtube.com/watch?v=...)