

Vara Digital on Winlink Express



WHAT WINLINK OFFERS FOR EMCOMM

Flexibility:

- Internet-only (Telnet) direct connections to Winlink.
- Radio link bridge to Internet e-mail.
- Radio-only store and forward messaging.
- Peer-to-peer connections between radio end-users.
- Familiar and simple e-mail client interface.

Interoperability: Connect different types of systems

- Bridge different radio capabilities (VHF/UHF/HF).
- Seamless integration with Internet e-mail.

Geographical dispersion and redundancy for reliability

WHAT WINLINK OFFERS FOR EMCOMM (MORE)

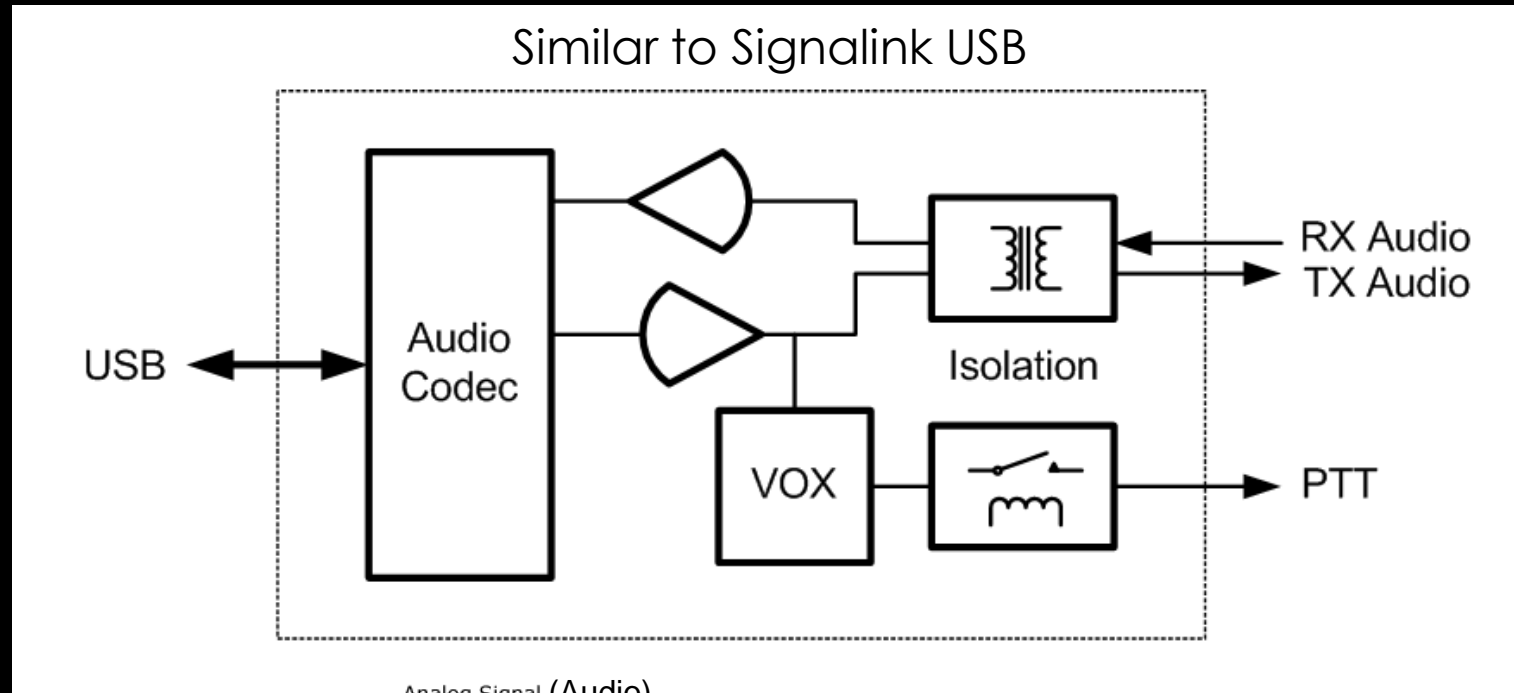
- Standard e-mail format with many features.
 - Binary file attachments (pictures, pdf, spreadsheets).
 - Automatic message compression/decompression.
 - White listing used to prevent spam.
- Time independence.
- Ability to collect messages while unattended.
- Good operation at most power levels.
- Not limited by station-to-station propagation.
- Message logging, and ICS report generation.
- Forms and template support.
- Wide adoption by EmComm related agencies.

WHY SOUND CARD DIGITAL?

Flexibility and Performance:

- Most Winlink modes are available using only a sound card interface (Packet, ARDOP, Winmor, Vara, Vara FM)
- Less expensive hardware options
- Superior decode performance over hardware devices
- Not limited to just Winlink, other weak signal and experimental modes require a sound card interface (WSJT, WSPR, FT8, etc.)

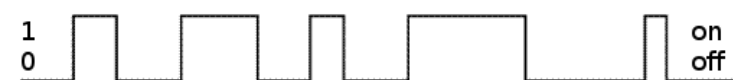
SOUND CARD INTERFACE BLOCK DIAGRAM



Analog Signal (Audio)



Digital Signal (USB)



SOUND CARD OPERATION

Interface:

- Basically a simple signal interface, it is not a TNC
- Provides ground isolation between radio and computer
- Provides Push To Talk (PTT) signal
- Does not process the modem signals
- Signal processing is done by software running on the host
- May include additional ports for rig control

Host Software:

- Does signal processing (modulation/demodulation)
- Provides timing of data and control signals
- Implements the data protocol

SOUND CARD OPERATION

WINLINK EXPRESS MODES

Mode	Speed	Application
Winmor (HF)	Up to 1300bps	Included
ARDOP (HF)	Up to 4,000bps	Included
Vara (HF)	Up to 7,000bps	External
Packet (V/UHF)	1200/9600bps ¹	External
Vara FM (V/UHF)	Up to 25,210bps	External

- Both Winmor and ARDOP were developed by the WDT and are included with Winlink Express
- Vara and Packet modes are provided by separate applications:
 - Vara (HF) and Vara FM (V/UHF)
 - UZ7HO Soundmodem (V/UHF Packet)
 - Direwolf (V/UHF Packet)

1. Both Soundmodem and Direwolf provide additional PSK modes between 1200 and 9600

SIGNALINK SOUND CARD INTERFACE

- Simple device powered by USB connection.
- Cost is about \$100 including radio-specific cable.
- Radio needs to have a data (sound) port or use microphone and speaker connections.
- Transformers in the Signalink limit audio bandwidth, and therefore maximum data speed



OTHER SOUND CARD INTERFACES



RIM Lite

Various interfaces designed around USB codec chips (C-Media or others). Some are kits, pre-built, or DIY. Many AllStar interfaces can be found and work fine for digital (may be PTT issues).



Masters Communications DRA-30



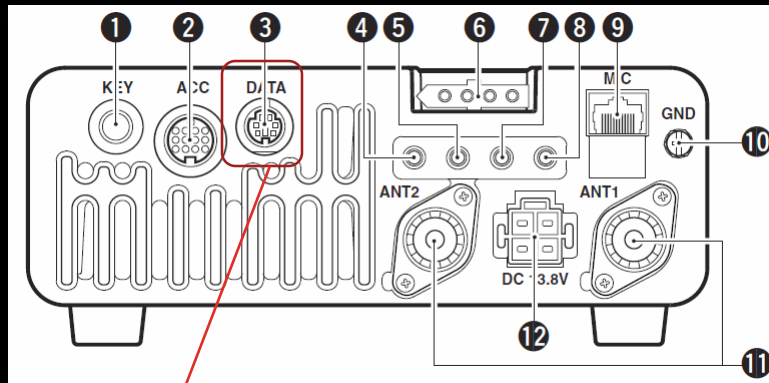
NS7C Homebrew Modified USB fob

RESOURCES NEEDED FOR WINLINK EXPRESS

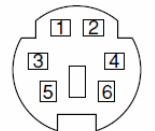
- Windows computer, Windows 10
- Winlink Express
- Transceiver with data (analog) port or speaker and mic jack
- Signalink or similar USB soundcard interface or transceiver with built-in sound card
- Appropriate cables to connect interface to transceiver
- External application, Vara and/or Vara FM
- Winlink software is free, but donation is suggested
- Vara registration is \$69/call or \$50/call for groups of 10 or more

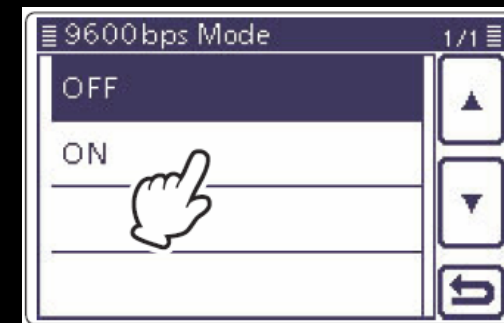
Vara can be tested without registration, but will have speed restrictions

HARDWARE CONNECTIONS



- Data Jack, poor name, but standard
- ACC jack varies by manufacturer
- 1200/9600bps doesn't really mean that
- CI-V, Cat varies by manufacturer
- Switching between 1200 and 9600 operation also requires rig menu changes

DATA	PIN No.	NAME	DESCRIPTION
 <p>Rear panel view</p>	1	DATA IN	Input terminal for data transmit. (1200 bps: AFSK/9600 bps: G3RUH, GMSK)
	2	GND	Common ground for DATA IN, DATA OUT and AF OUT.
	3	PTT P	PTT terminal for packet operation. Connect to ground to activate the transmitter. When grounded, microphone input (pin 6) of [MIC] connector will be disconnected.
	4	DATA OUT	Data out terminal for 9600 bps operation only.
	5	AF OUT	Data out terminal for 1200 bps operation only.
	6	SQL	Squelch out terminal. This pin is grounded when the transceiver receives a signal which opens the squelch. <ul style="list-style-type: none"> •To avoid interfering transmissions, connect squelch to the TNC to inhibit transmission when squelch is open. •Keep RF gain at a normal level, otherwise a "SQL" signal will not be output.

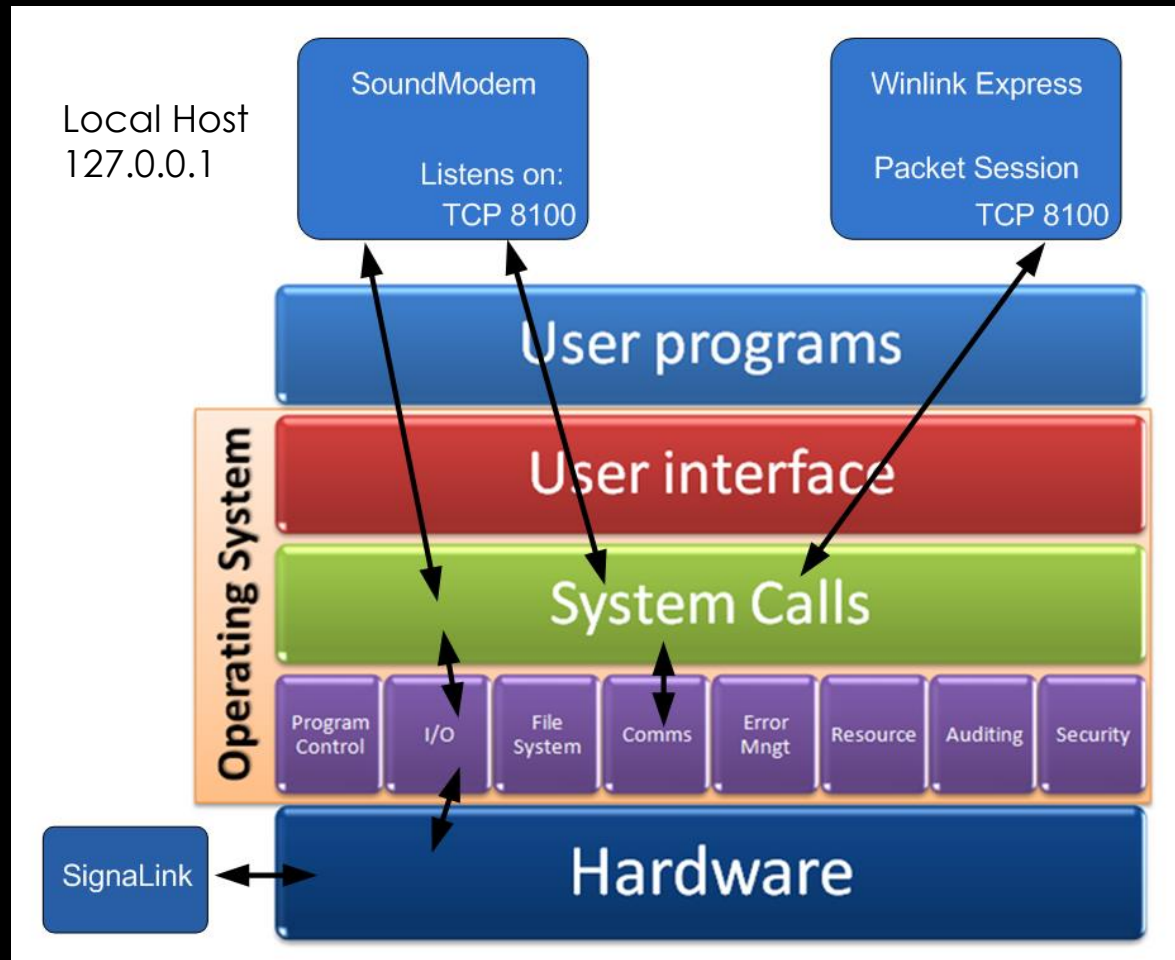


HARDWARE CONNECTIONS

Data Jack (6-Pin DIN connector) explained:

- Used for analog signals, not true digital data
- Not really related to 1200 or 9600 bps data speed
- 1200 connections go through the regular “voice” path in the radio, including pre/de-emphasis. Audio Bandwidth is limited to about 3kHz
- 9600 connections go direct to the modulator and discriminator. Greater audio bandwidth is possible, maybe up to 6kHz (in theory)
- Pin assignments are standard between manufacturers; however, impedance and voltage levels are not! Some manufacturers do not even document what signals are expected or provided at this jack

SOFTWARE CONNECTIONS



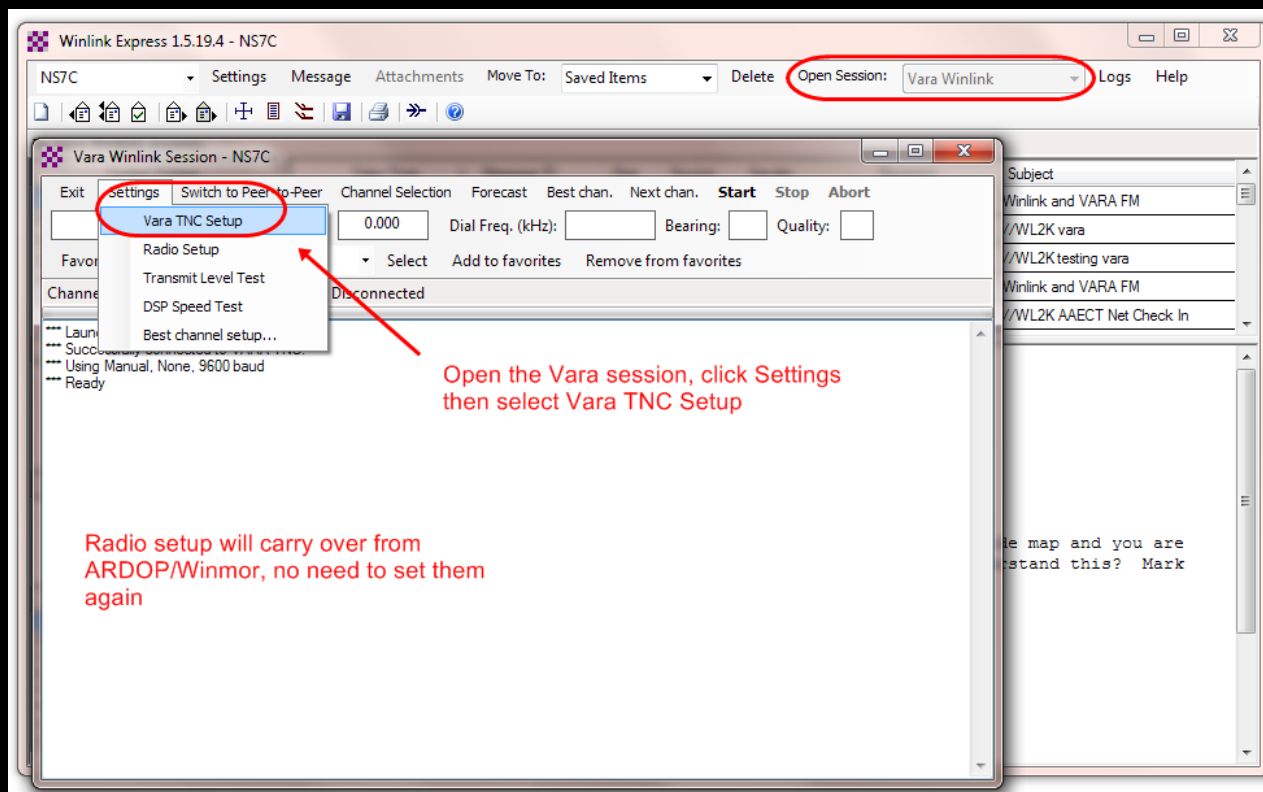
Programs communicate using the OS (Windows) network stack via TCP addresses and ports.

Communication stays within the system (local host) and does not go out on the LAN or the Internet.

Port numbers must match and must not conflict with other running programs.

SOFTWARE SETUP

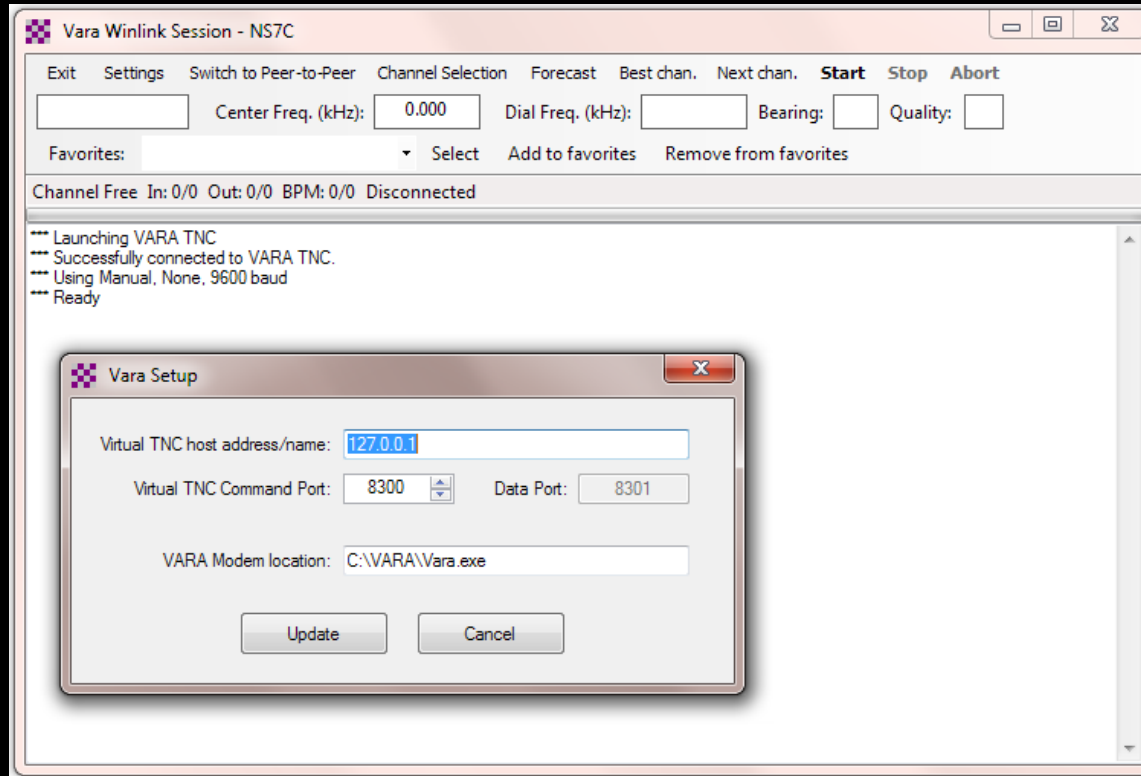
VARA HF



Open a Vara session, then select Settings and Vara TNC Setup. If Vara is not found on the computer in the default location, you will be given a link to the download page for Vara. The radio setup will carry over from ARDOP or Winmor if you have already setup those modes.

SOFTWARE SETUP

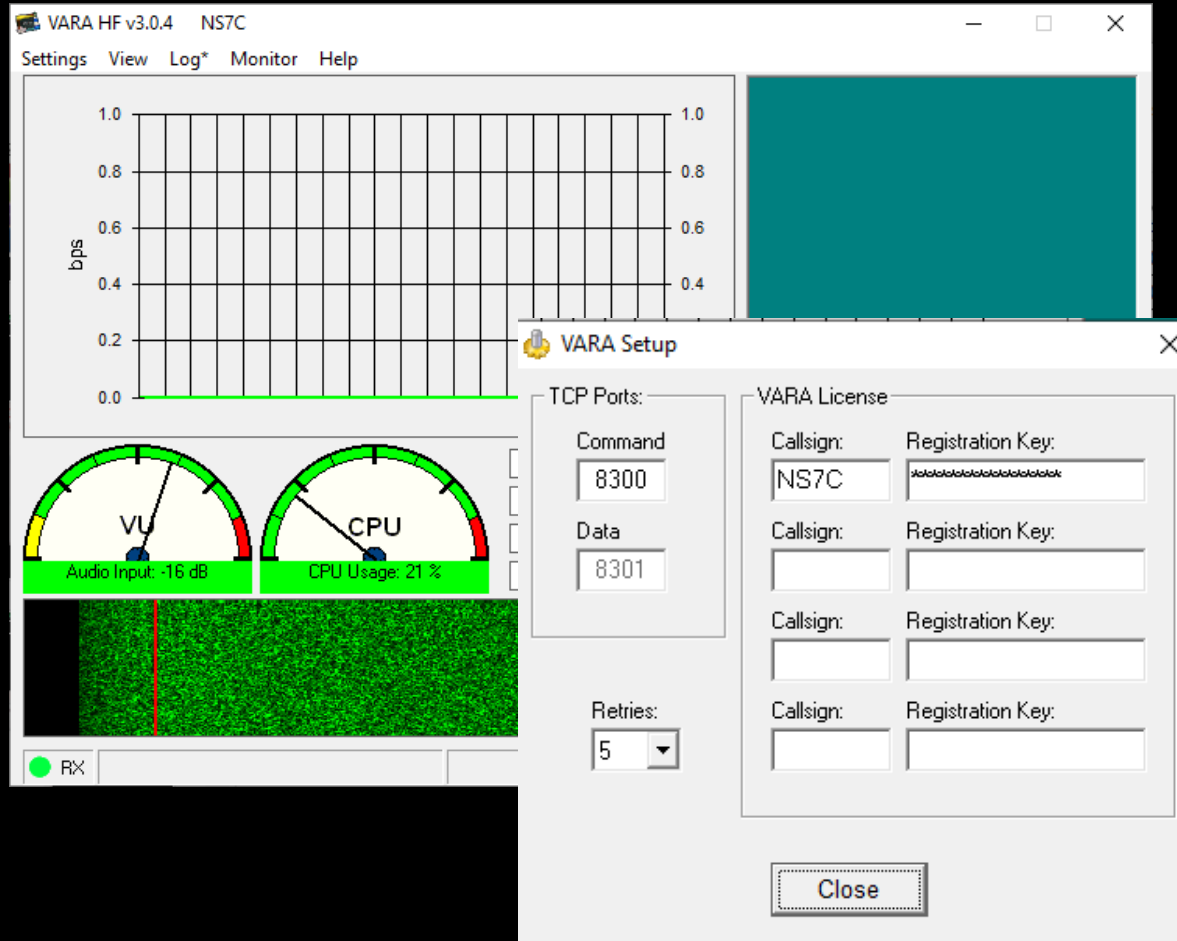
VARA HF



Accept the defaults of local host and ports 8300/8301 unless you need to make a change to prevent conflicts with other software applications that are running.

SOFTWARE SETUP

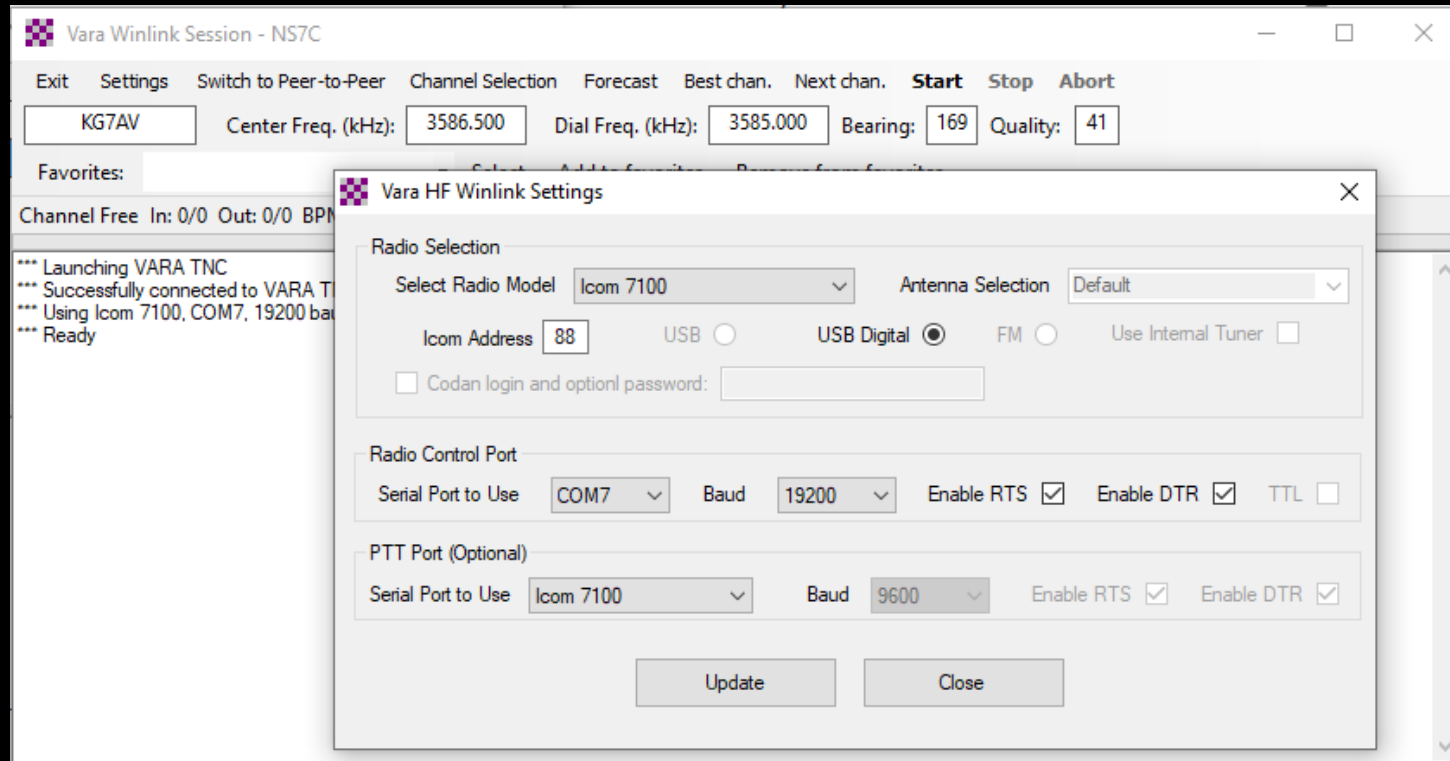
VARA HF



Bring up the Vara TNC (it starts minimized), select settings and Vara Setup. Make sure the TCP ports match the Winlink Session. Add your registration key and set retries to at least 5.

SOFTWARE SETUP

VARA HF



Adjust your radio selections to match your HF Rig Settings (CAT/CI-V). There are different options for PTT depending on what your rig supports.

SOFTWARE SETUP

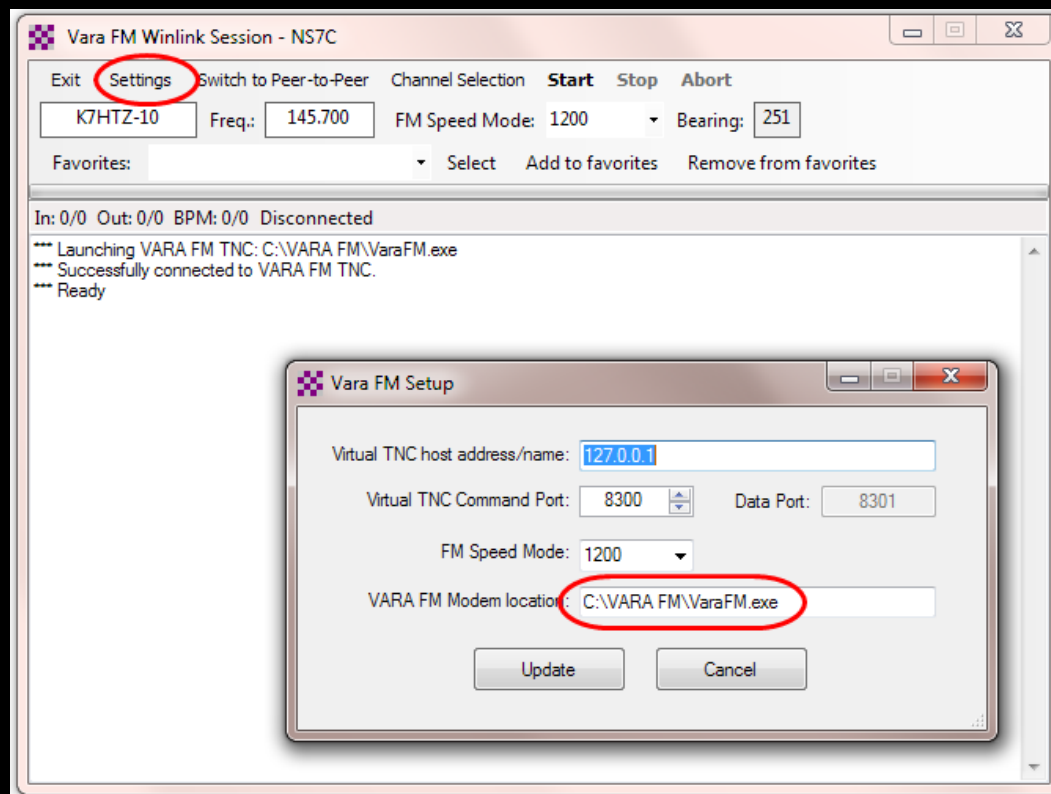
VARA HF

The screenshot displays the VARA HF v3.0.4 software interface. The main window has a menu bar with 'Settings', 'View', 'Log*', 'Monitor', and 'Help'. On the left, there is a grid showing signal strength in bps (0.0 to 1.0) and two analog meters for VU and CPU usage. Below these are 'Audio Input: -16 dB' and 'CPU Usage' indicators. A 'SoundCard' dialog box is open, showing 'Device Input' and 'Device Output' both set to 'IC-7100 (USB Audio CODEC)'. A 'Drive level' slider is set to -10 dB, with a 'Tune' button and a tip: 'Press Tune and set the Drive Level for ALC=1/3'. An inset image shows the IC-7300 radio display with the ALC meter highlighted by a red circle. The radio display shows '14.076.00' and 'ALC' at approximately 1/3 scale. A 'Close' button is visible at the bottom of the inset.

Select settings again, then Sound Card. Here you will select the sound card interface, and check/adjust the drive level. Note the tip on adjusting drive for about 1/3 scale on the ALC meter.

SOFTWARE SETUP

VARA FM V/UHF



Open a Vara FM session and select Settings. If Vara FM is not found on the computer in the default location, you will be given a link to the download page for Vara FM. Check the host and port settings. Vara FM can run in two speed modes, 1200 and 9600. These correspond to the 1200 and 9600 options on the radio. Choose the appropriate setting based on the radio capabilities.

SOFTWARE SETUP

VARA FM V/UHF

The image displays three overlapping windows from the VARA FM v3.0.5 software. The main window, titled 'VARA FM v3.0.5 NS7C', has a menu bar with 'Settings' circled in red. Below the menu is a signal strength meter and a 'VARA Setup' section with fields for 'Command' (8300) and 'Data' (8301). To the right is a 'VARA License' section with three rows of 'Callsign' and 'Registration Key' fields. The 'PTT' window is open, showing 'PTT Via' options: 'CAT', 'COM', 'RA-Board' (selected), and 'VOX'. The 'SoundCard' window is also open, showing 'Device Input' and 'Device Output' both set to 'RA-35 (USB PnP Sound Device)'. A 'Drive level' slider is set to -6 dB, with 'Tune' and 'Auto Tune' buttons on either side. A diagram of a sound card connector is visible in the background of the SoundCard window, with labels for SQL, DATA OUT (9600bps), GND, DATA, and PTT. A red arrow points from the 'Compatible with Signalink USB' text to the PTT pin on the diagram.

On the Vara FM modem, select Settings and Vara setup. Like Vara HF, check the TCP ports, and enter the registration key. TX Delay is now automatic. Select settings then Sound Card and select the sound card interface input and output, click on Tune and adjust the drive as needed. Select Settings, PTT and select the appropriate method for your configuration.

SOFTWARE SETUP

VARA FM V/UHF

VARA Setup

TCP Ports:

Command: 8300

Data: 8301

VARA License:

Callsign: NS7C Registration Key: [REDACTED]

Callsign: WA7AUB Registration Key: [REDACTED]

Callsign: [REDACTED] Registration Key: [REDACTED]

Callsign: [REDACTED] Registration Key: [REDACTED]

FM System: **NARROW**

Retries: 2

Compatible with Signalink USB

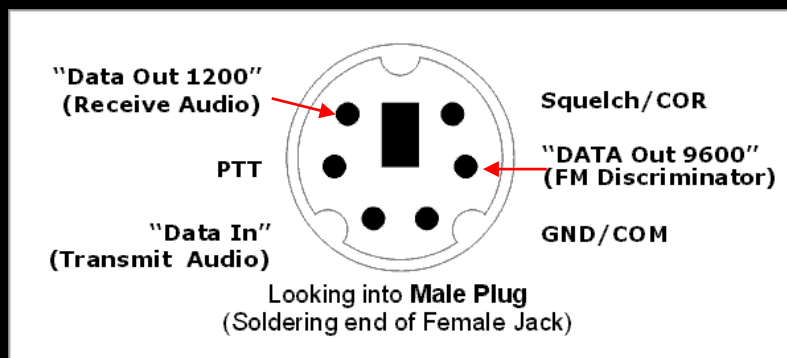
SQL, DATA OUT 9600bps, GND, DATA, PTT, DATA OUT 1200bps

to PC input, from PC output

FT-897D pins

* Narrow Mode is compatible with Signalink USB Interface

Vara FM has two speed modes that are selectable in the settings. Narrow mode can be used with limited bandwidth radio connections like speaker and microphone, or the "1200" connections on the data connector. Wide mode requires more bandwidth and must use the "9600" connections on the data connector. "9600" will also need to be set in the radio menus.

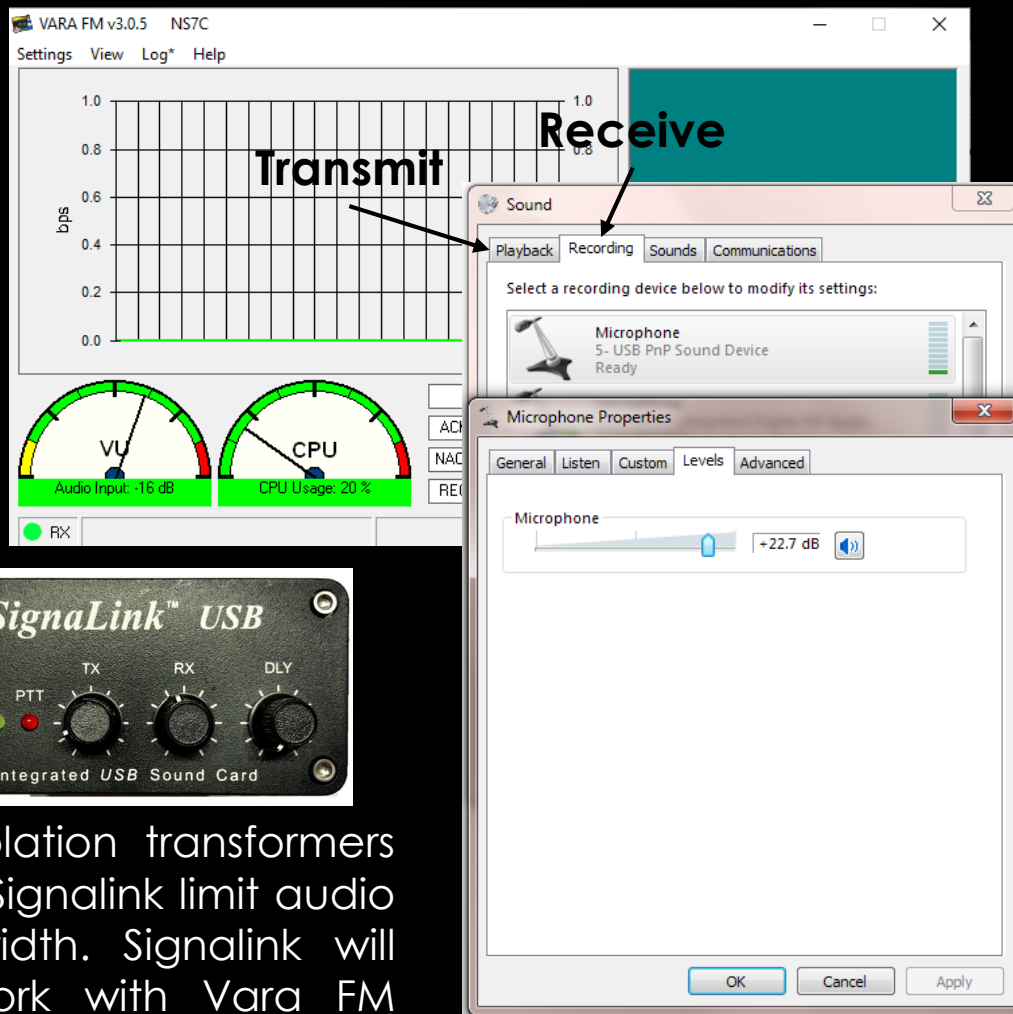


Top speed on Narrow is 12,098bps

Top speed on Wide is 25,210bps

SOFTWARE SETUP

VARA FM V/UHF



The screenshot shows the VARA FM v3.0.5 software interface. The main window displays a graph with 'Transmit' and 'Receive' levels. The 'Transmit' level is indicated by a green bar at the bottom of the graph, and the 'Receive' level is indicated by a blue bar at the top. Below the graph are two gauges: 'VU' (Audio Input: -16 dB) and 'CPU' (CPU Usage: 20%). The 'Settings' menu is visible at the top. Overlaid on the software window are two Windows system windows: 'Sound' and 'Microphone Properties'. The 'Sound' window shows the 'Recording' tab with 'Microphone' selected as the recording device. The 'Microphone Properties' window shows the 'Levels' tab with the microphone volume set to +22.7 dB.

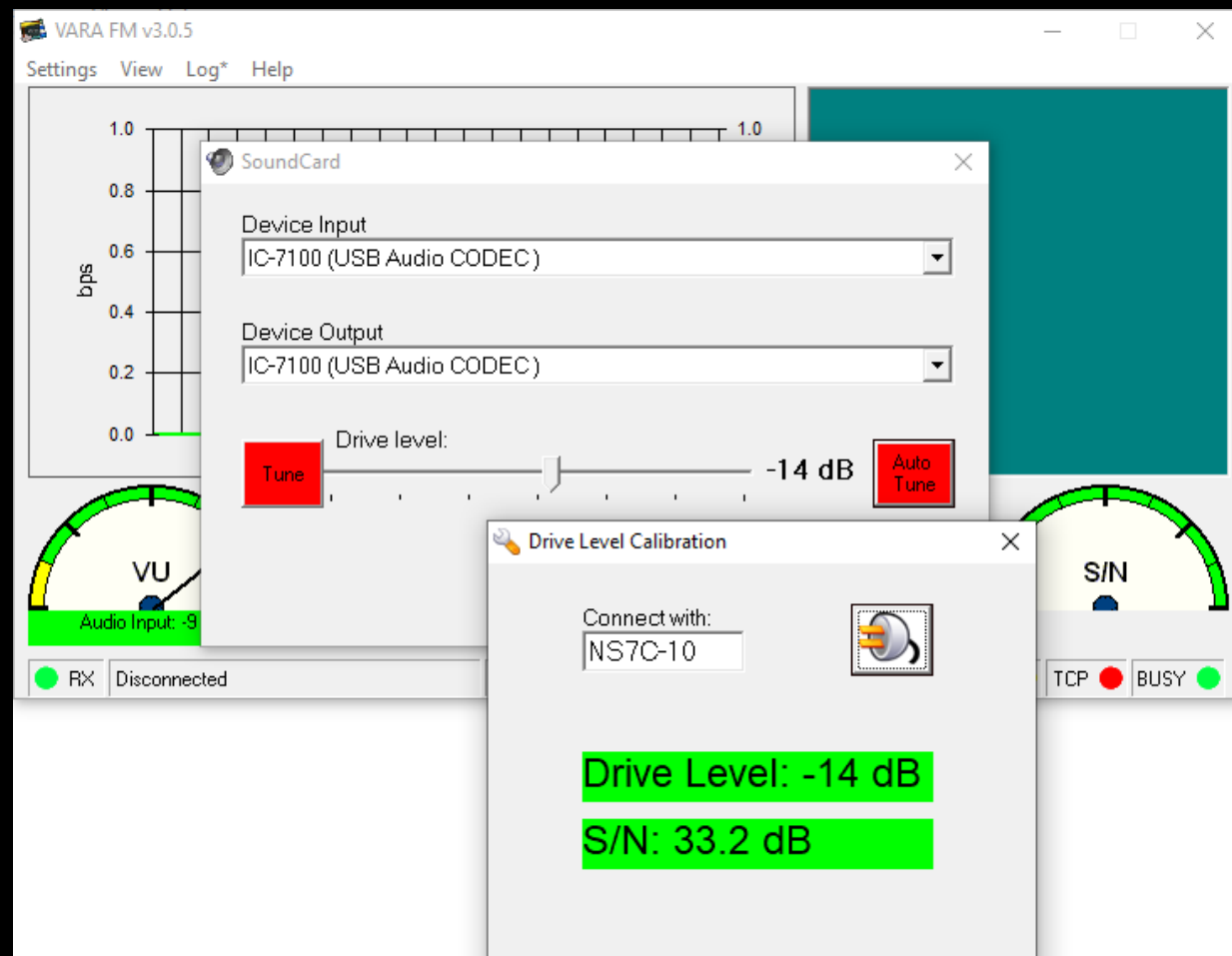


The isolation transformers in the Signalink limit audio bandwidth. Signalink will not work with Vara FM Wide mode

The Vara FM input level should be in the 50-75% range. Transmit audio should be 2.5kHz (much more drive is needed for Wide "9600" connections). Adjust the TX and RX levels on the Signalink, and/or the Windows mixer to achieve these levels. Some experimenting will be needed to achieve top performance. Document these settings for future reference or for resetting them after changing modes.

SOFTWARE SETUP

VARA FM V/UHF



The Vara FM AutoTune function assists in setting up the transmit drive level. Select AutoTune, enter the call sign of an available station to test with, and press the “plug” button. Vara FM will send a series of test transmissions, adjusting the level with each transmission. The remote station will then respond with the setting that had the best S/N ratio. Vara will adjust drive to that level. If the level is way too high, or way too low, Vara will instruct you to adjust the level on the Windows mixer or the Signalink TX control. Green results are good!

SOFTWARE SETUP

VARA FM V/UHF

VARA FM v3.0.5

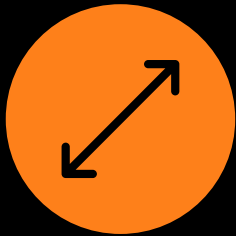
Level	VARA FM WIDE				VARA FM NARROW			
	Symbol Rate	Carriers	Mod.	Net Rate (bps)	Symbol Rate	Carriers	Mod.	Net Rate (bps)
1	42	55	4PSK	1098	42	55	4PSK	1098
2	42	55	4PSK	2253	42	55	4PSK	2253
3	42	98	4PSK	4040	42	55	4PSK	3022
4	42	98	4PSK	5387	42	55	16QAM	4032
5	42	98	16QAM	7185	42	55	16QAM	5375
6	42	98	16QAM	9580	42	55	32QAM	6720
7	42	116	16QAM	11340	42	55	64QAM	8065
8	42	116	32QAM	14144	42	55	64QAM	9072
9	42	116	64QAM	16932	42	55	128QAM	10585
10	42	116	64QAM	19003	42	55	256QAM	12091
11	42	116	128QAM	22102				
12	42	116	256QAM	25210				

Vara FM uses a very efficient FEC/ARQ protocol, resulting in a significant speed improvement over traditional Packet Radio (over 2X 9600 packet). It will shift to the different speed levels automatically based on the receive signal quality.

Vara FM Narrow can also be used over regular voice repeaters or cross-band repeaters (at somewhat slower rates).

Unlike Packet, Vara FM does not support store-and-forward systems like digipeaters and nodes. It will be used for point-to-point links to gateways or peer-to-peer partners.

CONCLUSION



WINLINK USE CONTINUES
TO GROW, ESPECIALLY
FOR EMCOMM USE



THE WINLINK
DEVELOPMENT TEAM
CONTINUES TO ENHANCE
CAPABILITIES TO ADAPT TO
CHANGING NEEDS



STEADY IMPROVEMENTS
ARE BEING IMPLEMENTED



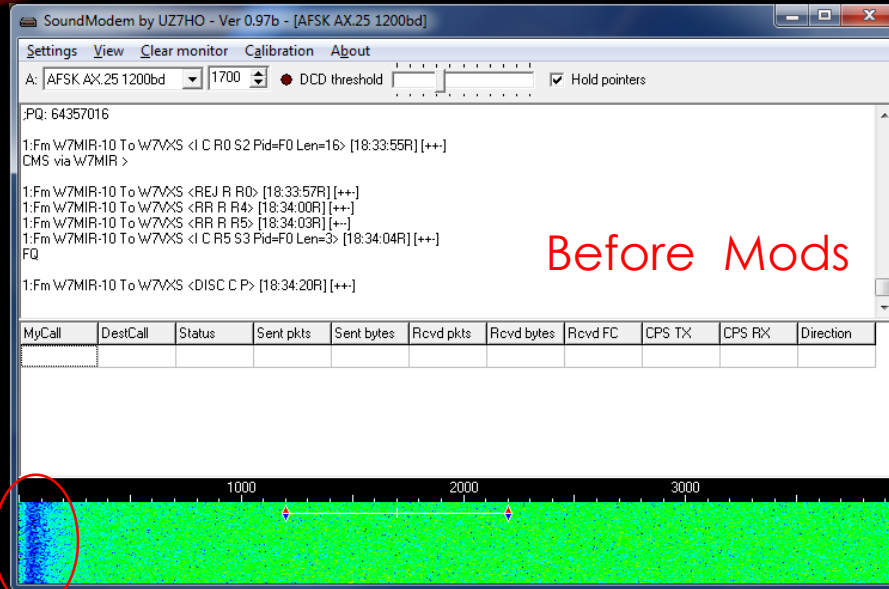
SOUND CARD INTERFACES
AND MODES PROVIDE
LOW COST AND HIGH
PERFORMANCE
SOLUTIONS TO DATA
TRANSFER OVER RF

BONUS

Signalink Modifications to improve performance:

- New Transformers
- Change OpAmp BIAS
- Filter USB power bus
- Fix power switch

http://www.frenning.dk/OZ1PIF_HOMEPAGE/SignalinkUSB-mods.html



Before Mods



After Mods

CONTACT



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