

# Using a “Brick” CPU to Run RMS Packet and VARA FM (rev 1.2)

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## 1.0 Overview

This writeup summarizes a simple setup using a modern miniature low-cost “brick” Win 11 computer to run Winlink RMS Packet and VARA FM. This is a reliable, low-cost approach to creating a simpler software and computer configuration that can run reliably unattended. A similar approach can be used to run programs like Winlink RMS Trimode, RMS Express or other Ham programs. This writeup is not a detailed step by step instruction guide...those details are normally covered in the specific setup instructions for the computer and associated software programs.

## 2.0 The Computer

Brick computers are becoming popular for many cost-sensitive applications and unattended, stand-alone systems. These brick computers are often found in office settings where the brick computer is mounted on the back of the monitor. The computer is small (typically 5”x5”x2”) and can be quite suitable in many environments. Typically these run between \$150 to \$250 depending on OS, “Hard Drive” size (usually implemented with internal flash memory chips), and dynamic RAM. This article covers an implementation using Windows 11 but the same brick computers can normally be used on



Windows 10, Linux or other Operating systems. The computer selected for this project was a KAMRUI Mini PC with Intel processor, Windows 11 Pro with 8GB DDR4 RAM and a 256 GB SSD. The KAMRUI various versions of this or similar computers are usually available with more or less RAM or SSD storage and sometimes different processor speed or core options. These are available from AMAZON or other retailers. The KAMRUI Mini PC comes complete with 1 DC (12 V) power supply, 2 USB 3.0, and 2 USB 2.0 connectors, a RJ45 Ethernet port, 2 HDMI ports and 1 Audio in/out port. There is fan cooling that is virtually inaudible.

Windows 11 Pro 64 bit was pre-installed but needs to be configured (personalized, login password etc.) prior to Installing operational software. There is some but minimal documentation on this that is included with the computer. Do this setup and registration before trying to load or configure any VARA or Winlink code. The Windows 11 comes with a basic Internet browser and utility programs that should be sufficient. These of course can be customized to your choice but keep in mind you are going to be supporting time-critical communications protocols, software, and hardware (e.g. Sound card based modems). One important setting for Windows 11 running unattended is the System/Power setting which should be set for “Best Performance” which will keep the OS from going to sleep or timing out. The cornerstone of reliable high-performance operation is keeping any other “real time” or heavy CPU/Memory demanding applications to a minimum. You will also need to provide some basic operator/setup interface consisting of a keyboard, mouse, and monitor. These can range from conventional full size to smaller, cheaper or older accessories. The normal graphics demands of most ham radio protocol software is modest so a smaller display and keyboard is probably fine.

### 3.0 The Modem

The modem for most ham radio digital applications can either be a true dedicated HF/VHF modem like an SCS Packet or Pactor modem or it can be a higher performance sound card with support software to do the modulation, encoding/decoding and timing with software. The preferred and more reliable approach is to use dedicated “sound card with keying” hardware such as the DRA series available from Masters Communications. <http://www.masterscommunications.com/products/radio-adapter/dra/>

In the example in this writeup a MC DRA-36 “high performance” sound card with keying was used with the VARA FM software to implement the sound generating and receiving tasks along with accurately



timed radio PTT keying. This USB sound card provides flat response, wide bandwidth audio, and manual audio level adjustments for transmit and receive along with software controlled non-relay transmitter PTT keying. To reach full performance with VARA FM or 9600 baud AX.25 packet it is necessary to use the higher baud rates and

bandwidths permitted on VHF/UHF frequencies. There are other similar MC modems which may have different connectors or adjustments.

There are other popular “sound card” modems like the Signalink pictured below that are also useable. One caution here is that often these “sound card” interfaces use the audio input with filtering to generate the internal PTT relay (transmitter keying) function. While this approach can be used on many ARQ protocols it requires careful adjustment of the PTT “hold” or “DLY” time to insure part of the transmitted or received packet is not delayed or truncated. Also, because these products often contain audio isolation transformers they may not have adequate flat frequency response required by some higher baud rate protocols (e.g. 9600 baud packet and VARA FM wide).



Trying to share one “sound card” across multiple *concurrent* running protocols is **NOT** recommended especially for unattended operation. The “sound card” should be a dedicated resource for each protocol supported to avoid timing or resource conflicts. Keep in mind that while Windows may report fairly low *average* CPU utilization (e.g. < 20%) to maintain accurate timing requirements of the protocol may require timing precision that will be degraded when the CPU is heavily loaded with other real-time applications. In the RMS Packet/VARA 9600 baud setup my KAMRUI Mini PC utilization reported (by VARA) was typically under 2% with occasional higher peaks. Running too many high CPU demanding applications is probably the most common mistake in setting up and maintaining reliable *unattended* sound card -based modems and protocols. Tracking down the causes of such transient problems is a difficult or to-often impossible debugging task.

## 4.0 The Radio

The Radio is of course an important part of the system and must be designed for and configured for reliable stand-alone operation. For this project a 2 meter Alinco DR-135T was selected to provide 50 watts of output on 2 meters and supports a wide bandwidth 9600 baud capability. Accessing the high bandwidth audio in/out and PTT keying is set up with the radio's packet menus and uses the 9 pin "D" connector at the back of the radio. This and the radio's 9600 bps packet mode supports the bandwidth for VARA FM Wide. The D connector is wired directly to the ground, audio out, audio in, and PTT connections of the DRA-36 modem. The radio is set up for Wide band data transfer.



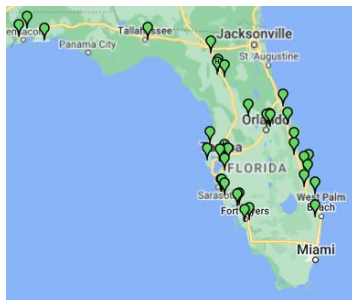
The similar models for the Alinco 220 MHz or 440 MHz radios can be used for other bands. I also had good success with the TH-9000D radio which *may* be made in the same factory as the DR-135T. The TH-9000D will require adding the connections for a radio rear panel mounted 9 Pin D connector wired into a small header in the radio. Make sure the radio's 12 volt power supply is rated with some reserve to handle long sessions. Extended operation at full power may require a small fan for the radio. Lowering the output power of the radio will improve reliability but of course reduces S:N (which can lower data throughput...see section 6) at the receiving end.

## 5.0 Setting Up the Software:

Once the basic OS is configured and the support hardware obtained the required software can be installed. For this project this consisted of two software modules that create a Winlink VHF/VARA FM network node that can accept user connections and handle messages to/from the Winlink system. The VARA software also allows the (licensed) VARA FM station to perform as a "digi" to relay connections (at the expense of message throughput) to other similar nodes. This is one way to obtain message forwarding when a station loses internet connectivity. The two modules used are RMS Packet and VARA FM. These two modules should be configured as per the setup instructions first with RMS Packet and then VARA FM. The fairly simple setup instructions for the software (which may vary with software version) are contained in the software downloads and are not included here.

The Winlink RMS Channels utility

( [https://winlink.org/RMSChannels?qtlive\\_winlink\\_information=1#qt-live\\_winlink\\_information](https://winlink.org/RMSChannels?qtlive_winlink_information=1#qt-live_winlink_information) )

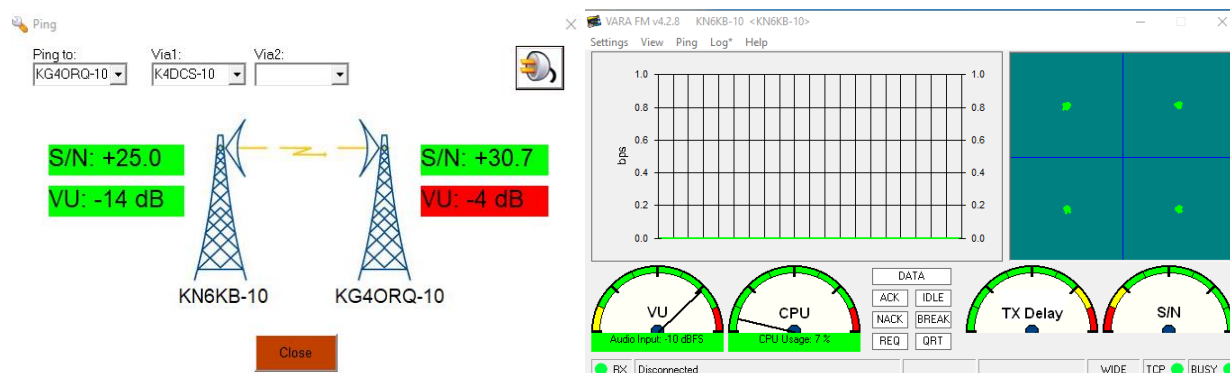


shows similar nearby Winlink/VARA FM stations operating in the Winlink network. Clicking on a specific location provides details (at right) on the station (callsign, frequency, gridsquare, antenna, modes, operating hours and operational status).

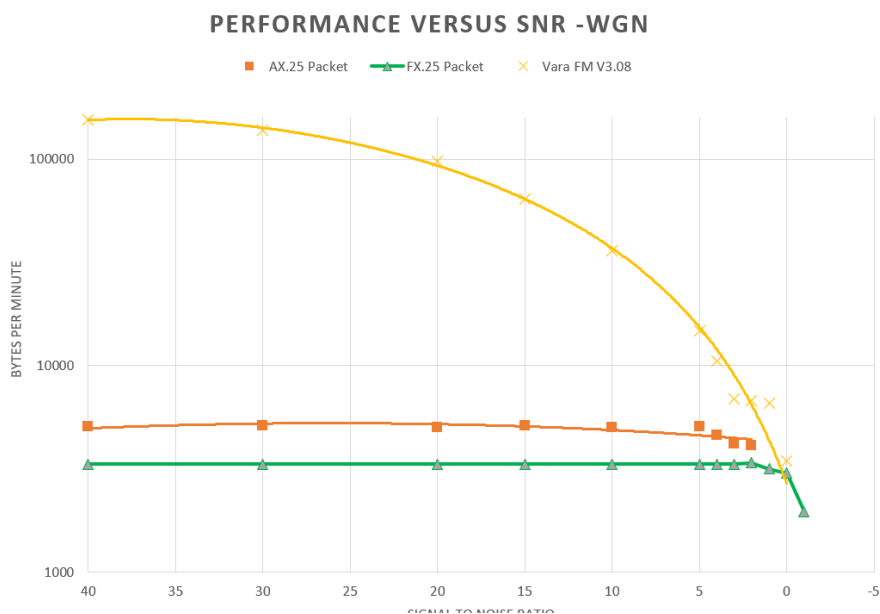
### Gateway Channel Information

Callsign: KN6KB-10  
Frequency: 144.990 MHz  
Gridsquare: EL98PF  
Antenna: Omni  
Operating Mode: VARAFM / VARA FM WIDE  
Operating Hours: 00-23  
Last Status Received: 2023-03-19 11:25 -04:00  
Comments: Connect direct or Digi through K4DCS-10

The VARA FM operation requires a VARA license code for full speed performance and use as a digi. The VARA FM setup and “PING” features provide a good mechanism for adjusting drive levels for the radio and audio levels for the received audio for the sound card. Below are a couple of screen shots showing readouts from a VARA FM Ping through a connecting DIGI through 2 stations within the Florida East coast VARA FM network. The tight grouping of the 4 PSK constellation confirms good signal strength and proper audio levels at the sending and receiving stations.



## 6.0 Simulated Performance VARA FM vs AX.25 Packet



Evaluating the throughput of a protocol as a function of radio path (S:N or multipath) requires the consistent duplication of path or using a propagation simulator. As part of an article in the Mar/April 2022 issue of QEX that described a self-contained Teensy CPU HF and VHF channel simulator we ran extensive performance simulations (courtesy of Tom Whiteside N5TW) of VARA FM compared to

AX.25 Packet and FX.25 packet showing net throughput of large files through a White Gaussian Noise channel at various S:N Ratios (0-40dB). The Chart above shows the throughput (averaged over several large file transfers) of VARA FM Wide substantially outperformed conventional AX.25 or FX.25 packet at all useable WGN S:N environments.

Feel free to contact me via email with any questions or results of your “Brick Computer”, Winlink /VARA Setup, or the use of the open source IONOS HF/VHF simulator.