Winlink 2000 - Configurations for Basic, Field and Emergency Communications use

With configuration drawings

N5TIM

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With the continued upgrade and enhancements of the Winlink suite of programs the content of this document is subject to change. Please review the Winlink.org site for information regarding changes and updates. The Winlink Yahoo group also announces changes and discusses issues related to operating with the Winlink programs.

Several of the Winlink equipment configurations shown are identified in the Communications Resource Function (CRF) documentation located elsewhere. (www.tinyurl.com/AR-EmComResources)

Thanks go to members of our response group and Tom Whiteside, N5TW for their input to this document.

Winlink Basic and EmComm Hardware/Software Configurations

Winlink is?

Winlink is a digital radio communications system that allows amateur radio operators to send and receive electronic mail (e-mail) and attachments without having a direct connection to the Internet. Winlink is a store and forward messaging system. Being able to send and receive e-mail without an internet connection is especially valuable during times of commercial communication outages. Visit www.winlink.org for additional information.
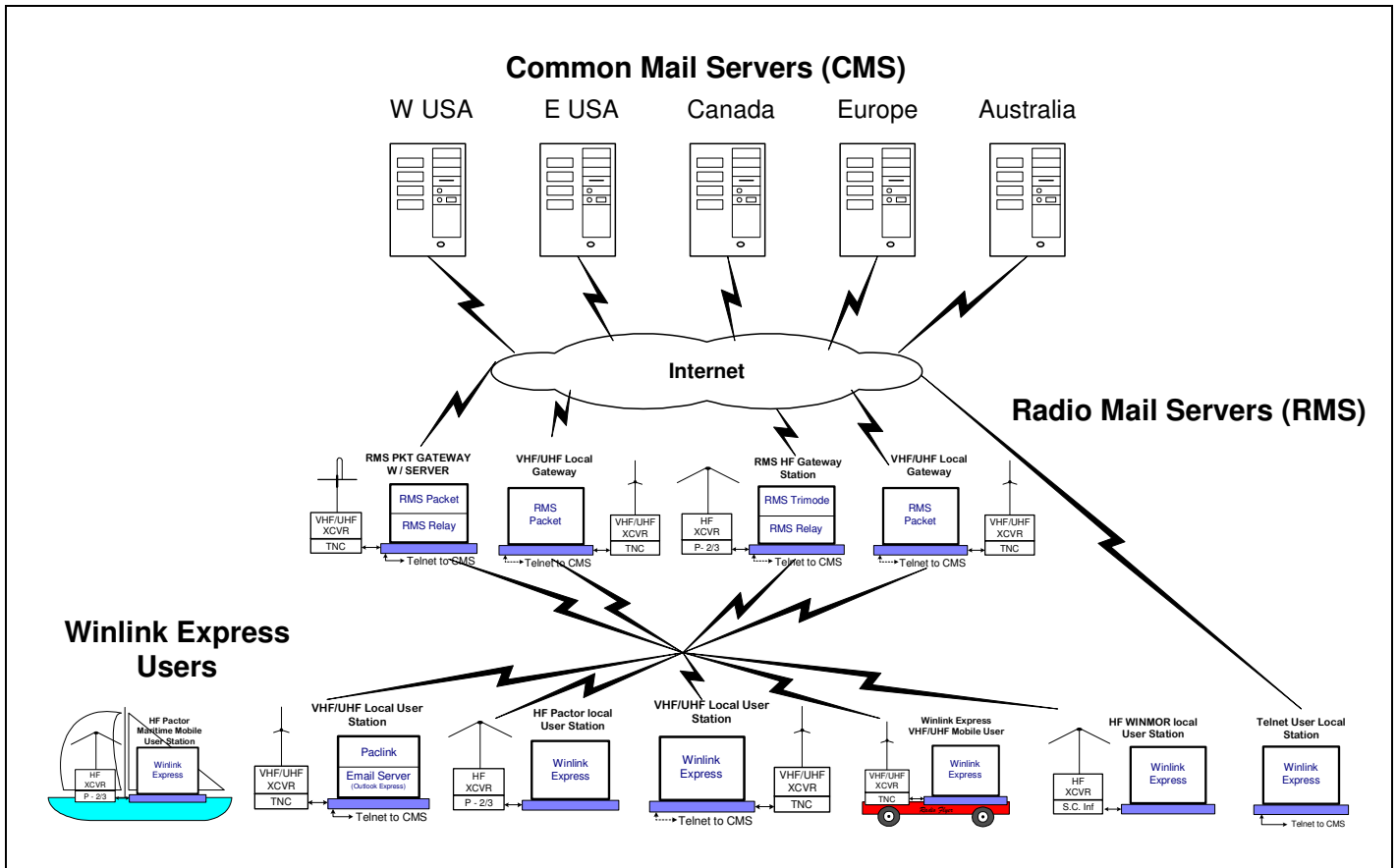

Figure 1 – A global view of the Winlink system. In times of Radio Only operation the message traffic never goes to the internet but is handled at the RMS level.

- Winlink 2000 (WL2K) is a worldwide system of volunteer resources supporting e-mail by radio, with non-commercial links to internet e-mail

- These volunteer resources come from Amateur Radio, the Military Affiliate Radio System (MARS), and other non-commercial organizations. The system provides a valuable service to emergency communicators

- This network provides truly inter-operable messaging to all agencies in the same format. Winlink mixes Internet technology and appropriate amateur radio, military, marine RF and commercial technologies

- Multiple digital modes are accommodated, and the system provides radio interconnection services including: email with attachments, position reporting, graphic and text weather bulletins, emergency / disaster relief communications, and message relay

- This network provides truly inter-operable messaging to all agencies in the same format
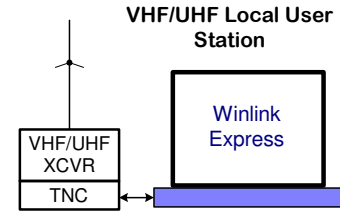
Basic Station Configurations

Home or Field Telnet Station

This station is a minimalist hardware and software setup for sending and receiving messages via Telnet (the Internet) with the Winlink system. A computer with an internet connection (LAN or WiFi) is required. This could be considered a Winlink Express user training setup. (Hardware = computer | Software = RMS* Express).
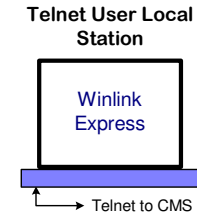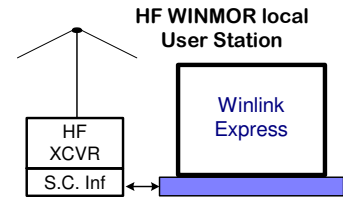
Home or Field VHF/UHF Station

The VHF/UHF station is one of three basic hardware and software setups for sending and receiving messages via RF with the Winlink system. This configuration could also be used mobile and for other packet systems. (Hardware = computer, TNC, VHF/UHF transceiver | Software = Winlink Express)

Home or Field HF Station (WINMOR)

The HF WINMOR Station is the second of three basic hardware and software setups for sending and receiving messages via HF with the Winlink system. This configuration uses Winlink Express with a sound card interface. (Hardware = computer, sound card interface, HF transceiver | Software = Winlink Express) * Radio Message Server (RMS)

Home or Field HF Station (Pactor)

The HF Pactor Station is the third of three basic hardware and software setups for sending and receiving messages via RF with the Winlink system. This configuration uses Winlink Express along with a Pactor modem. Due to the cost of Pactor modems this type of station is usually found In permanent installations such as EOC's. (Hardware = computer, Pactor modem, HF transceiver | Software = Winlink Express : RMS Pactor is being phased out)
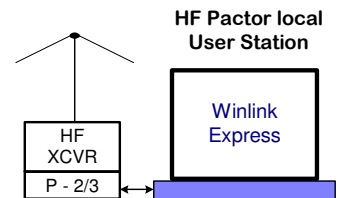
Advanced/Sysop Station Configurations

(Operators of Gateway stations require registration with and approval of the WL2K development team.)

RMS Packet Gateway

The RMS Packet Gateway Station is the radio link between a client VHF/UHF/WiFi/DD stations and a telnet/internet connection to a Common Message Server (CMS) or an RMS Relay module. The Gateway may be co-located at a client station or a separate secured site. Gateways operate 24/7/365 and require SysOp authorization. In the absence of the internet the Gateway becomes a server for local users if RMS Relay is used. RMS Packet also works with AGWPE (multiple TNC driver utility) to provide multiple radio channel connections. RMS Packet may be used without RMS Relay if the intent is to only provide CMS access with the Internet. These stations usually use a SSID of -10. (Hardware = computer, VHF/UHF transceiver, TNC | Software = RMS* Packet and RMS Relay)
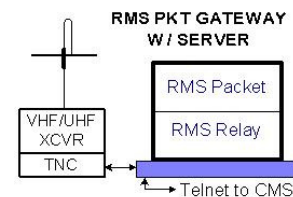
RMS Trimode HF Station

This is the latest in the Winlink evolution of user software/hardware for sending and receiving HF radio email. This station has the capability of running three types of configurations. WINMOR, Pactor and Robust Packet. It can be programmed to step through the different modes using a single HF radio and computer. This type of station is usually located at a fixed location and provides CMS access 24/7. (Hardware = computer, HF transceiver, Pactor modem and/or sound card interface | Software = RMS Trimode)
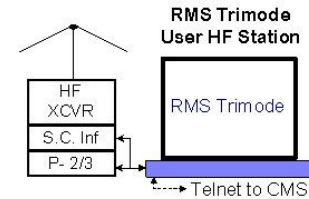
Unique Configurations (Radio Only or EMCOMM focused)

VHF Gateway / HF Forwarding Station

A portable station running RMS Packet, RMS Relay and RMS Trimode that can provide local server capability, send and receive email messages via VHF/UHF radio. Using RMS Trimode, the station HF radio can be used to forward messages outside the local area via Pactor or WINMOR. This function may be referred to as a Store and Forward station. By adding Winlink Express a local message capability is enabled. This setup is typically used by the Rapid Response Task Force Amateur Radio attachment, the Rapid Deploy Communications Assistance Group, a North Texas Section ARES Team (RRTF/RDCAG) and mutual assistance teams. (Hardware = computer, HF transceiver, Pactor modem, VHF/UHF transceiver, TNC | Software = RMS Packet, RMS Relay and RMS Trimode - optionally Winlink Express)
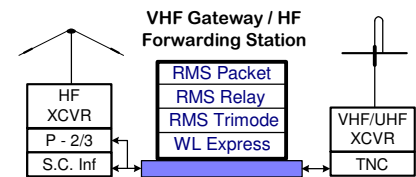
Designated Station

At times, generally during EMCOMM situations a station may be tagged with the term "Designated." This indicates that the station has been identified as a hubbing station for a local area, a specialty station serving a specific task or a station with unique capabilities. Designated stations are typically listed in the Action plan and the ICS-205A documentation. The use of designated stations is also a means to manage the bandwidth of a band typically used for EMCOMM communications.

Radio-Only or the Winlink Hybrid Network

Winlink also can be operated in a radio-only mode of operation called the "Hybrid Winlink Network" where messages are stored on RMS themselves without being transferred to a CMS. The radio-only system is designed primarily for use by agencies during an Internet outage, but it could be used at other times. Additional detail can be found in the help section of Winlink Express.

Radio Mail Server (RMS) Software

Winlink Express

Winlink Express is designed to be most easily used by single users with a single call sign but it may be used to access one or two preset tactical addresses or alternate callsigns. Winlink Express supports a wide selection of TNCs and multimode controllers, the new sound card mode WINMOR, as well as support for HF Pactor, SCS Robust Packet, VHF/UHF packet and direct telnet to WL2K CMS servers (for amateur radio High Speed Multimedia [HSMM], D-Star DD mode, or internet). This software supports the Basic Station configurations.
Winlink Express with built in email client supports attachments, multiple addresses and tactical addresses. With the WINMOR mode Winlink Express may be used peer-to-peer (connecting directly via HF to other Winlink Express clients).
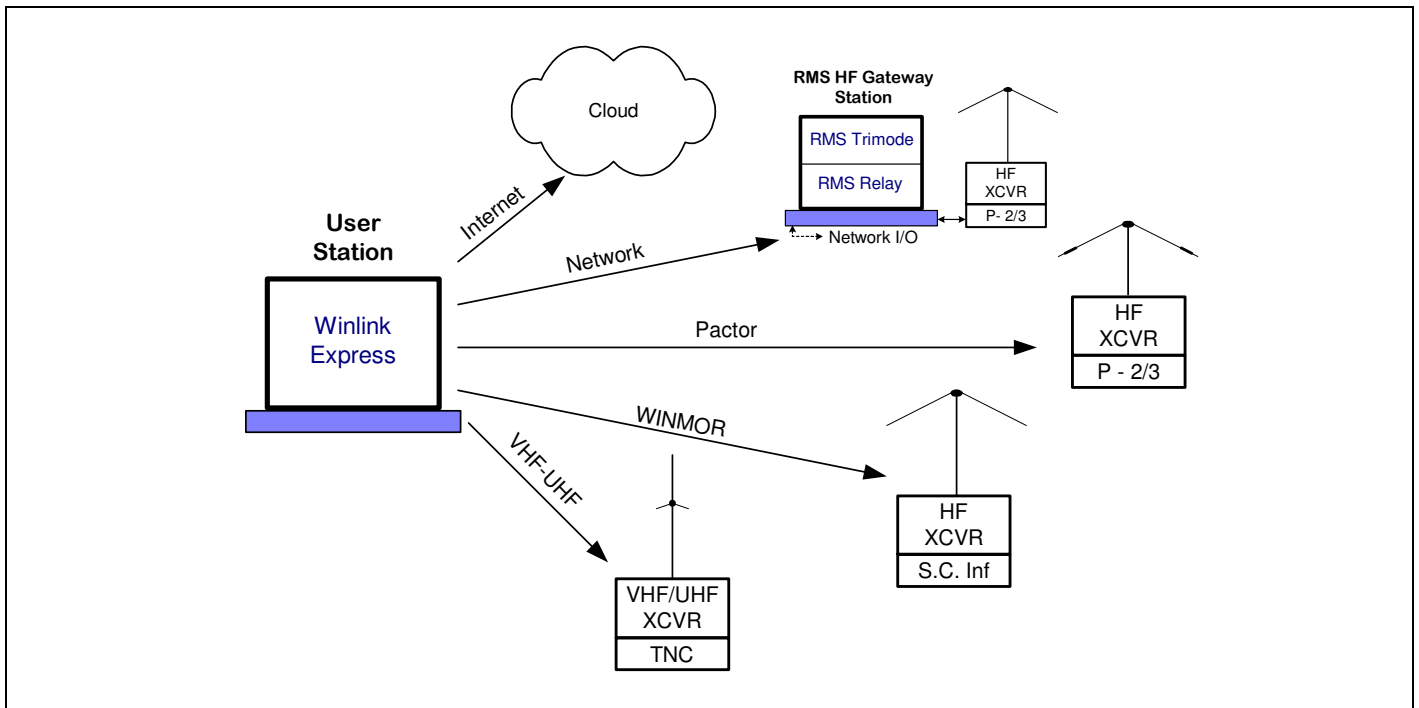
Figure 2 – The many ways Winlink Express can be interfaced to get the message through. Winlink Express is becoming the "*Swiss Army Knife*" for Winlink.

RMS-Packet

RMS Packet is software intended for WL2K sysops. This software supports a VHF/UHF packet radio gateway station to the WL2K system. RMS Packet stations are part of the network of participating stations, and they provide full automated messaging capability to the wireless amateur user using AX.25 packet radio in combination with the WL2K Common Message Servers. One or several RMS Packet stations may serve an area or group.

RMS Packet is simple to install and run, and requires a minimum of computer and radio equipment. It runs on virtually any WinXP and later computer with .NET extensions that has a permanent connection to the internet. It supports the most popular TNCs directly, and almost all others through the AGW Packet Engine or Packet Engine Pro software.

RMS Packet is ideal to provide a temporary emergency portal for radio e-mail users, or for fixed installation at unattended remote locations where it can provide wireless e-mail communications to the "last mile".

Note -Winlink system administrator's approval is required for this software.

RMS-Relay

RMS Relay software provides temporary storage of messages and local routing in the event internet access to the CMS sites is lost. It will normally only be used with co-located RMS Packet and Trimode programs. (Co-located means in the same computer, LAN, or short distance Ethernet links.) The relay program becomes active when links are lost to CMS sites. It will work in three modes:

• Normal -- If an Internet connection is available, RMS Relay acts as a conduit from the RMS program to the Internet and a CMS. If the Internet connection is down, RMS Relay refuses connections from the RMS program, so the program rejects connections with the message "No CMS available".

• Radio-only, local message hub -- When this mode is selected, RMS Relay does not forward messages through the Internet even if it is available. All messages are stored in a local database. The primary use of this option is to provide a store-and forward Radio Message Server that can serve as a message hub for a set of stations. If station A leaves a message for station B or C, the message can be retrieved by stations B and C if they connect to the hub. Since messages are not sent to a CMS, messages can be exchanged only between stations connecting to this hub.

- Hold for Internet access -- If an Internet connection is available; RMS Relay passes the message through the Internet to a CMS. If the Internet connection goes down, the RMS Relay stores messages in a local database until the Internet connection is restored. Once the Internet connection is restored stored messages are automatically uploaded with a CMS. Caution: since connecting stations do not know that the Internet connection is down, any messages they send through the node will be held and delayed until the Internet connection is reestablished. This can cause unexpected delays that might be unacceptable for emergency messages.

The program includes an optional feature that will exchange stored messages with a CMS using links to distant RMS HF gateways over HF. When there is no internet access in the latter two modes, the RMS Relay program will share the same controller and radio used by an RMS HF program running on the same computer. (RMS Relay-- just like RMS Pactor--could use any of the SCS models including the II, IIe, IIex, IIpro, IIusb and Dragon.) Note that any RMS Pactor inbound portal is deactivated when RMS Relay is active and no TCP/IP connection to a CMS is available, freeing the controller to serve in HF relay service for the local ports. In most countries, a control operator is required to initiate manual HF connections.

"Network Post Office" - This type of session is designed to facilitate connecting to RMS Relay on a MESH or LAN network, but it also works to connect through the Internet. You can add entries to a server address book providing the callsign and IP address of each network server you access. Once a server is selected, a Telnet connection is established to RMS Relay. See the program's revised Help file for additional information.

Note -Winlink system administrator's approval is required for this software.

RMS Trimode

RMS (Radio Mail Server) Trimode is software intended for WL2K sysops who operate High-Frequency gateway stations. These RMS stations are part of the controlled global network of WL2K participating stations.

RMS Trimode is a flexible HF Radio server for the Pactor (P1-P3), WINMOR (500Hz & 1600Hz bandwidths) and the Robust Packet HF protocols. RMS Trimode can be used for any one, two or all three of the above protocols simultaneously and can scan multiple frequencies adjusted by time of day. A single instance can support Amateur, MARS and EMCOMM applications.

The objective of RMS Trimode is to allow sysops to use one program that supports multiple user protocols using the same radio, antenna, and computer resources. This gives users more connectivity options and makes better use of limited spectrum. It is intended to replace RMS Pactor and RMS WINMOR.

Once a connection in one protocol is established RMS Trimode will block other connections on the remaining protocols until the session is completed. If desired a single instance and radio can support multiple call signs and service codes. RMS Trimode may optionally use the program RMS Relay with a local message database or to temporarily buffer messages if internet connectivity is lost. Sysop approval is required for this software.

Paclink is a streamlined radio e-mail client with a built-in POP/SMTP server. It is a single- or multi-user client. Paclink supports telnet, VHF/UHF packet radio, and HF Pactor radio connections to WL2K servers and the user interface is through any common e-mail client program (Microsoft Live Mail, Outlook Express and Mozilla Thunderbird). Paclink supports attachments, multiple addresses and tactical addresses. Paclink can be used to create tactical addresses for other Winlink clients. Currently, Paclink does not support the WINMOR sound card mode.

Note -Winlink system administrator's approval is required for this software.

Paclink (for reference only – program is minaminally supported)

Paclink is a radio e-mail client with a built-in POP/SMTP server. It is a single or multi user client. Paclink supports telnet, VHF/UHF packet radio, and HF Pactor radio connections to WL2K servers. The user interface is with many common e-mail client programs (Microsoft Live Mail, Outlook Express and Mozilla Thunderbird). Paclink supports attachments, multiple addresses and tactical addresses. Paclink also supports use of a sound card interface via AGWPE. Paclink does not support the WINMOR sound card mode.

VHF/UHF Local User Station

VHF/UHF XCVR

TNC

Paclink

Email Server
(Outlook Express)

Telnet to CMS
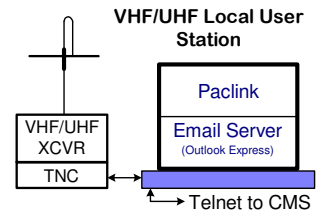
General Notes -

With the Winlink suite of software constantly changing there are bound to be inaccuracies in this document. The intent is to give an overview of configurations using Winlink programs with a home station and in the field for emergency communications.

- Winlink Express can be downloaded at this URL; <http://www.winlink.org/ClientSoftware>
- Setting up a user Winlink address account is automatically done when you connect to the Winlink 2000 system via radio or via a telnet session using a valid call sign using Winlink Express.
- Each RMS software program has an extensive help section to help getting started and setting up configurations and options. Searching the internet or asking a user are alternate ways of getting help with Winlink. Visit <www.winlink.org> for more info.
- A very good Winlink frequently asked questions document is located at this link; <http://www.felge.us/WL2K_FAQ.pdf>
- Sysop software requires a 24/7/365 commitment and Winlink team approval to download.
- Secure login began on April 15, 2016. The Winlink system will begin requiring the use of passwords and secure login for ALL users. This is being done to enhance the privacy and protection of the Winlink community. If you've already entered both a password and also turned on Secure Login, you don't have to make any other changes.

Information used in developing this document came from many sources, Internet, other documents and field experience. Thanks go out to those who developed Winlink software, continue to support and use Winlink programs for amateur radio digital communications and those who reviewed drafts.
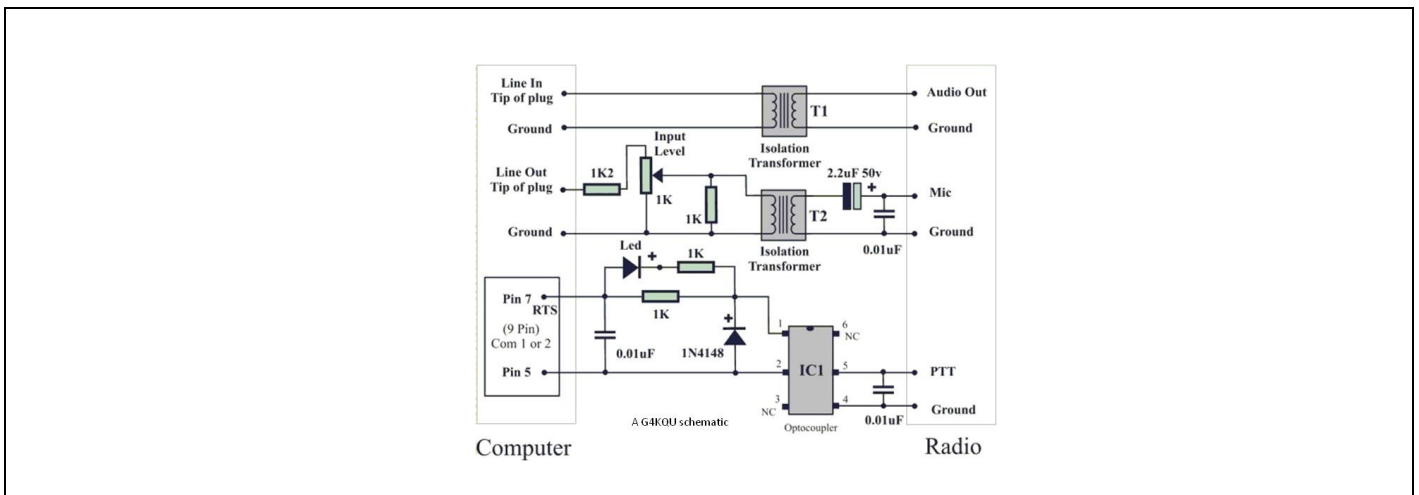

Figure 3 – Schematic showing a typical sound card interface circuit. It is also recommended that an external USB sound device be used. A circuit board similar in design to this is available from KF5INZ. Additional designs can be found by searching the internet. Soundmodem and DireWolf with additional software are programs that can be used as "soft" TNC's with Winlink Express and Paclink.

Note -A simple sound card interface can be constructed for as little as $25.00 or less.

Operational (Typical) and EMCOMM Configurations

The following figures and diagrams are a few representations of various ways basic stations can be put together to create systems for both normal and emergency digital communications.

**VHF/UHF Peer-to-Peer Operation**

HF WINMOR Peer-to-Peer Operation
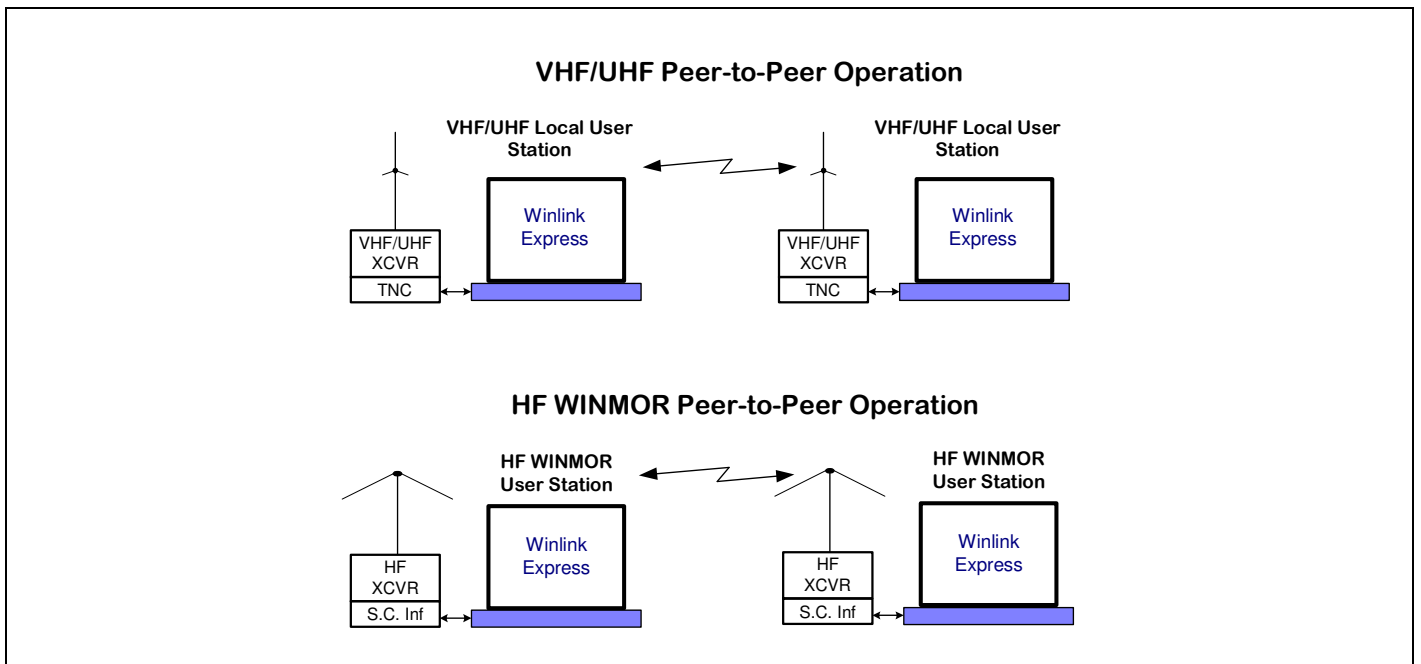
Figure 4 – The simplest configuration is the Peer-to-Peer messaging between two stations operating on the same frequency and at the same time. Timing and frequency for this type of exchange is generally planned over a voice frequency or with a standing plan. This same function can be implemented between HF WINMOR or Pactor stations using a voice frequency for coordination. This is a non-preferred set up for EmComm use due to the additional use of bandwidth to set up contacts.
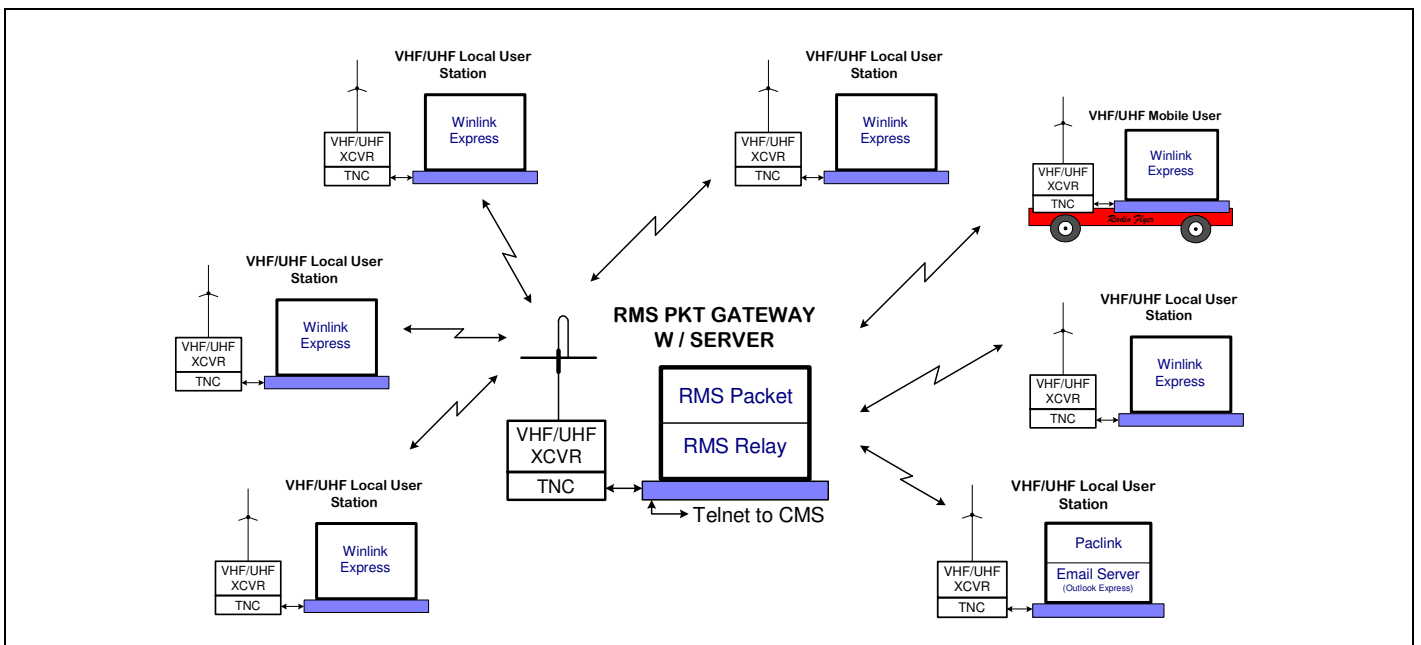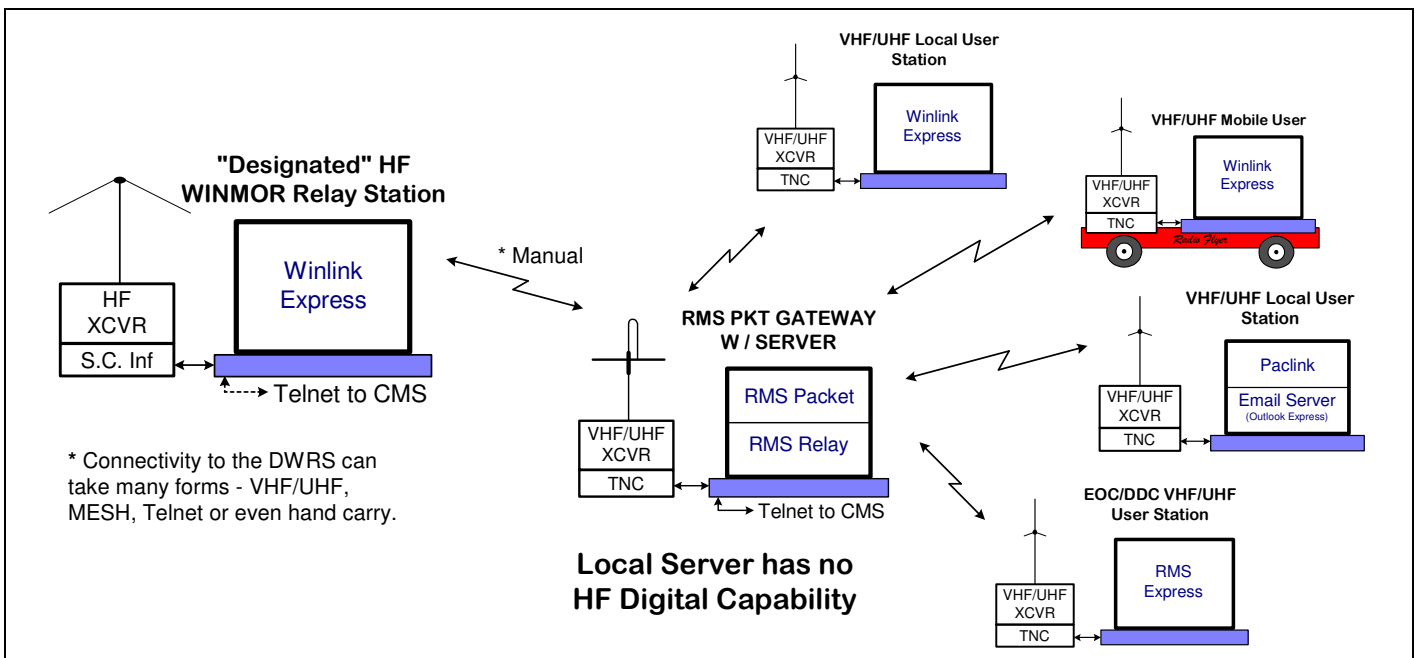

Figure 5 – A typical system configuration of a county or city level digital messaging set up used for normal routine digital operations from local user locations with only a single gateway available. In a situation where connection to the CMS (Internet) is lost, the Gateway becomes a local message hub or server using RMS Relay. This could also be viewed as a tactical digital deployment where all stations are portable in support of a local EOC or DDC.
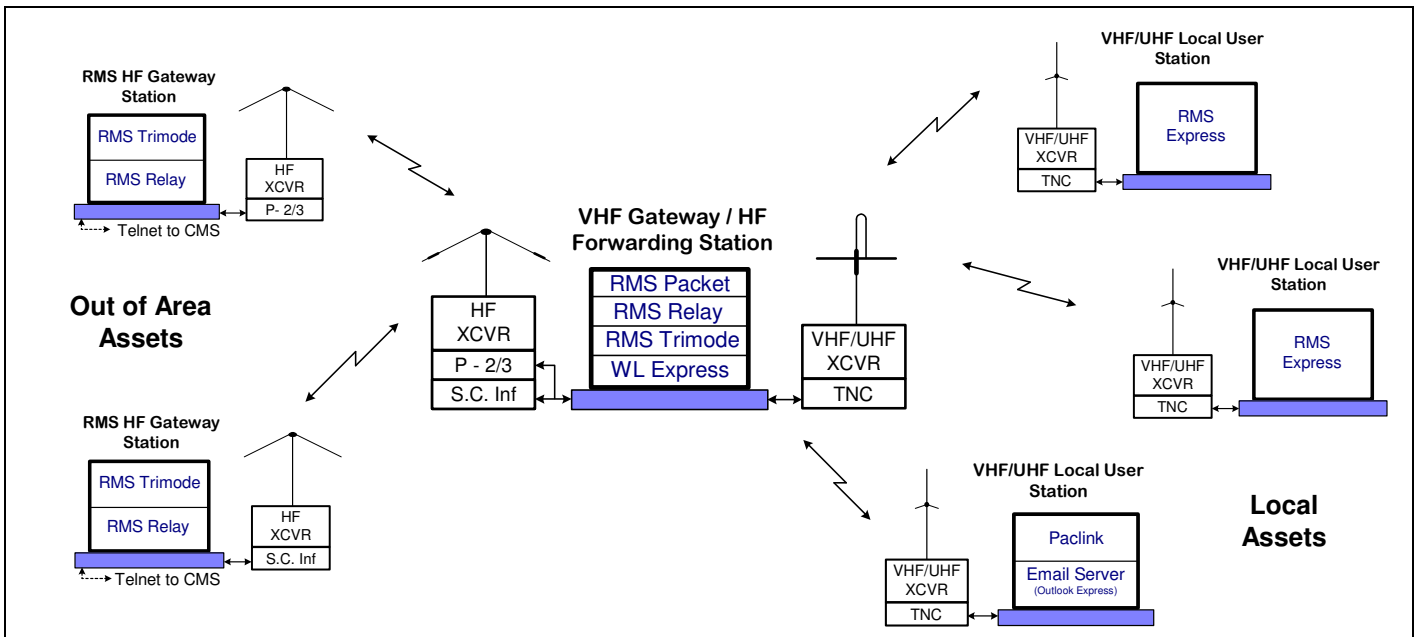
Figure 6– System configuration showing how a forwarding station plays into the overall communications plan. This is a typical down range or forward area deployment "Store-and-Forward" feature of the Gateway and Forwarding Station. RMS Trimode is used to manually initiate HF forwarding. The store-and-forward station may also run Winlink Express for local message receipt and transmission by the gateway operator.


Figure 7– Typical system configuration for a Designated HF WINMOR Relay Station. The station provides out of area connectivity for local systems that do not have HF Digital capability at the gateway server location. The connection between the gateway server and the relay station can take many forms. The station is "designated" by the local leadership and the station call is communicated on voice nets and in an ICS-217 and/or ICS-205A.
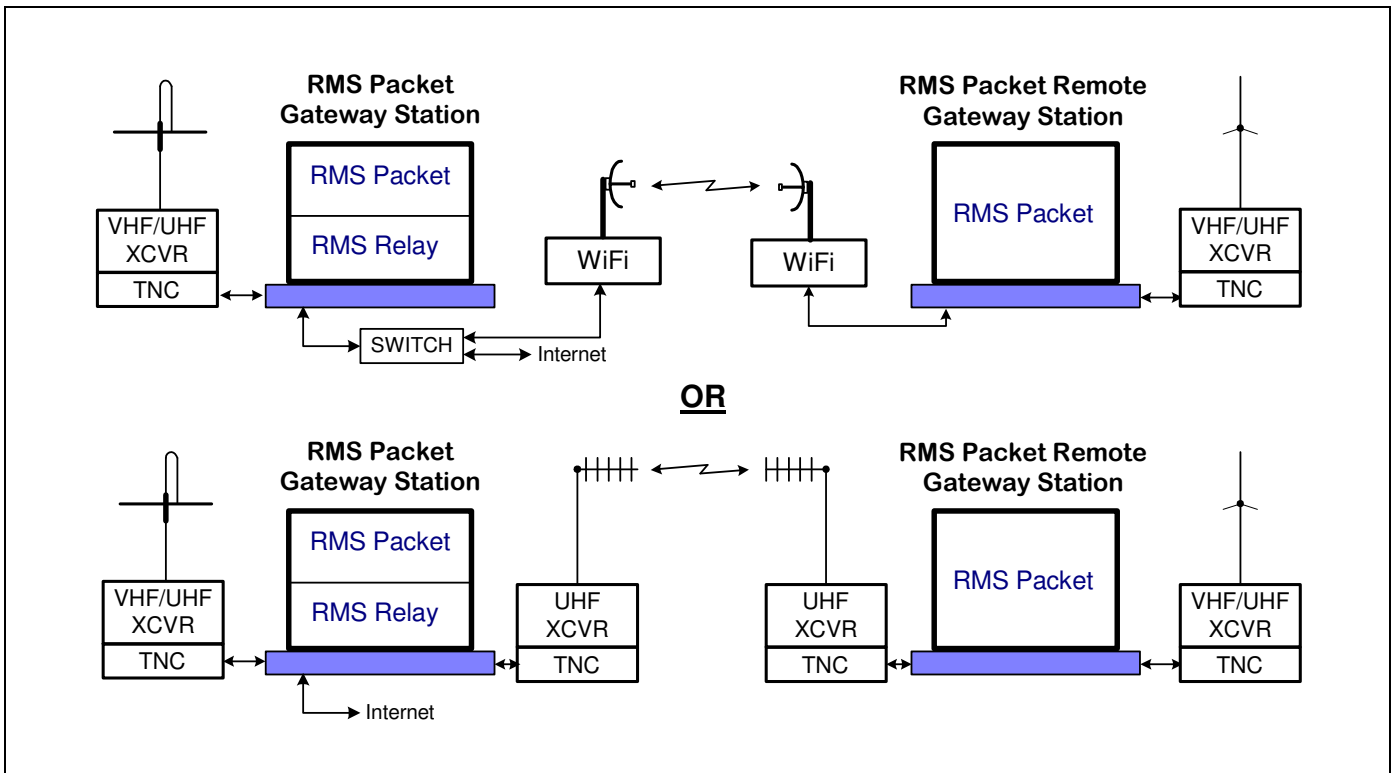
Figure 8– Using a WiFi or RF link you can set up remote Gateway stations at remote location without internet access that home in on a Gateway station with internet connectivity. This function works both with VHF/UHF and HF Gateways. Additional remote Gateway stations can be added by using the appropriate equipment.
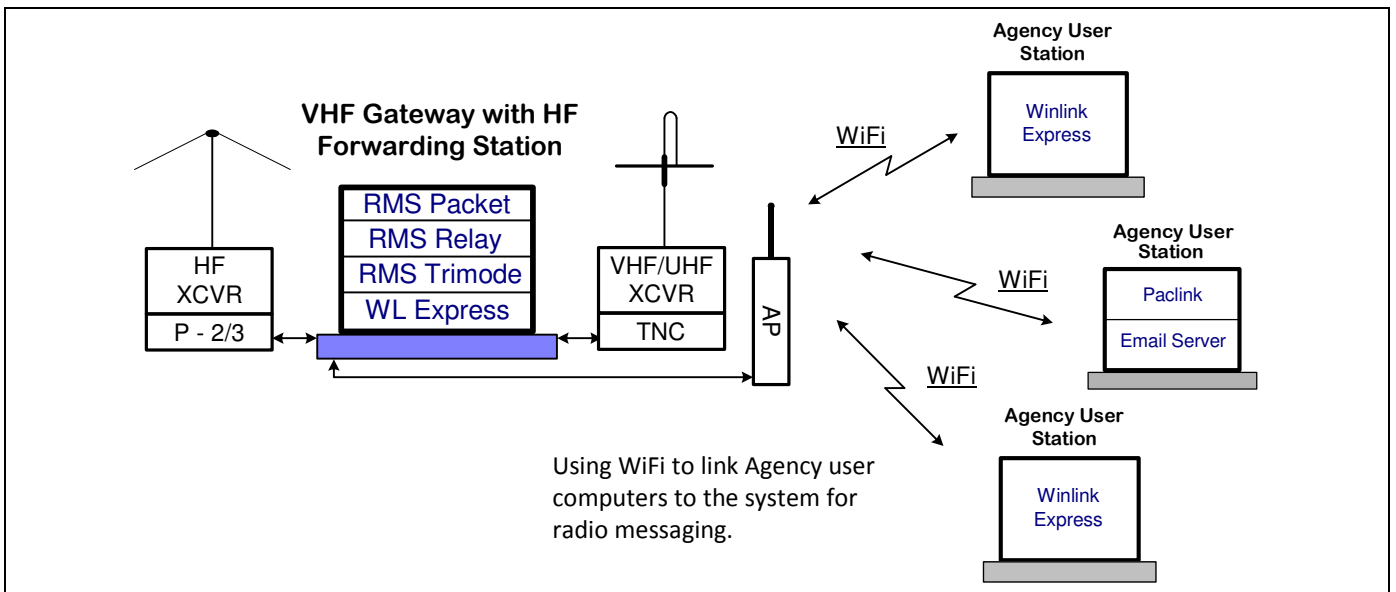
Figure 9 - A suggested way to add non radio equipped agency user stations to a designated HF Forwarding station using WiFi, a switch or similar networking equipment. WiFi would be best used for an open area command post location while a switch would be better for an EOC set-up. All agency user stations are running Winlink Express with "use RMS Relay checked" and are connected to the Gateway Station Access Point. In addition local VHF Winlink Express station operators can deposit and retrieve messages via the RMS Packet VHF equipment of the Forwarding Station.
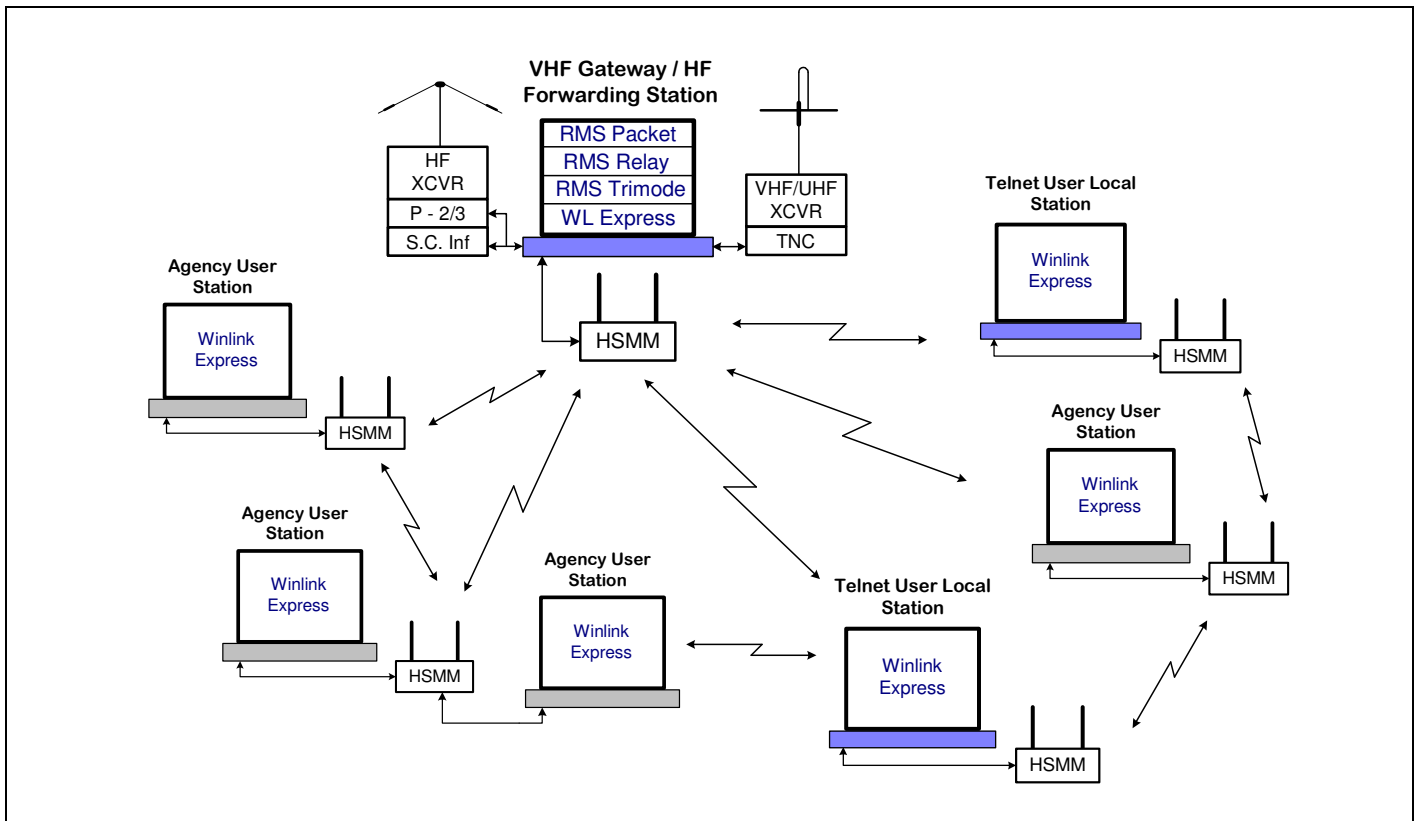
Figure 10 – Another suggested way to add non radio equipped agency and local user stations to a designated HF/VHF Forwarding station using a Broadband Multimedia MESH network. All user stations are running Winlink Express with "use RMS Relay" checked and are connected to a MESH node.

RMS Packet Frequency Coordination

RMS Packet frequencies should be coordinated over an area for both physical coverage and bandwidth. Local areas should have default RMS Packet coordination plans to maximize bandwidth and coverage. For example, an RMS Packet on a frequency with wide area coverage might be reserved as a key hubbing station.

A viable solution is the Quad plan as implemented by Bruce Dingman, N5BYL in Collin County, Texas. The proposal divides the county into four sections, NW, NE, SE and SW. A common RMS Packet frequency is assigned to each quad. Each County uses the same quad frequency plan. This should minimize "crashing" between RMS stations that are co-located within a multi county area. This may not work everywhere, but should help in most. The Quad frequencies are; A) 144.910, B) 144.930, C) 144.950, D) 144.970, E) 144.990, F) 145.030, G) 145.050 and H) 145.070. A, B, C and D are assigned to the four quads as shown below. A wide coverage centrally located or Hubbing RMS Packet station would use one of the remaining frequencies or one of their choosing. Adjacent Counties with wide coverage stations should coordinate the central station frequency to avoid interference with one another.
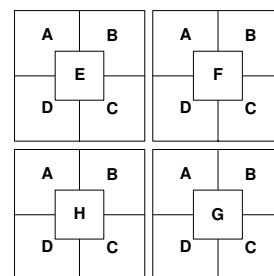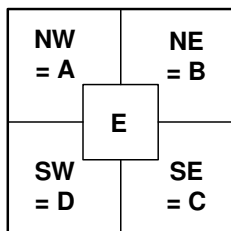
Figure 11 - Example of County sectioned per the Quad Plan. Central/Hubbing RMS optional.

Figure 12 - Example of four adjacent Counties each using the Quad Plan.