MOONEER SALEM, K6AQ

WINLINK GATEWAYS ON THE CHEAP

ABOUT ME

- Winlink Elmer for SDGARES
  - Currently run the K6AQ-10 (new as of 2021) VARA FM gateway
  - Net Control for the weekly Winlink net (conducted fully over Winlink)
- Various radio related and other open source projects in my spare time
  - e.g. FreeDV, Arduino/ESP8266 based Wi-Fi controlled magloop tuner

COMPONENTS OF A GATEWAY

- A way to transmit/receive signals to/from client stations
  - Radio, antenna, coax, soundcard interface, etc.
- A way to forward messages to/from clients
  - Internet, HF radio, etc.
- A device to perform the interfacing
  - PC running Winlink gateway software

GATEWAY CONSIDERATIONS

- Must remain up as long/frequently as possible
  - How will that be done in an emergency situation?
  - What emergencies are most probable in your immediate area? (e.g. power outages, wildfires, etc.)
- What coverage do you expect to provide?
  - Where will the gateway reside? (own QTH, EOC, hilltop, etc.)

GATEWAY CONSIDERATIONS

- What modes are you going to support?
  - VARA is quickly becoming the “go to” mode in Winlink
- What band(s) should you use?
  - K6AQ-10 is on 70cm (as an example)
- What resources do you have and/or can obtain to achieve the above objectives?

STEP 1: YOUR RADIO SETUP

- The easier that it is to interface with your PC, the better
  - Prefer 9600 capable radios if possible to expand options (e.g. to support VARA FM Wide mode)
- Radios with a good reputation for use with packet gateways will improve reliability
- There's nothing wrong with the used market!
  - K6AQ-10 uses an Alinco DR-435 purchased from QTH classifieds

STEP 2: YOUR GATEWAY'S ANTENNA SYSTEM

- Should be an antenna separate from your main station's if possible
  - There are options if this isn't possible (e.g. restricted space)
- Adequate separation to avoid interference with main/other stations
- As high as required to produce the desired coverage
  - Programs such as SPLAT! can map out predicted coverage before installation

STEP 2: YOUR GATEWAY'S ANTENNA SYSTEM

- You may not need as big of an antenna as you think
  - Antenna pattern matters as much/more than advertised gain
  - Too wide of a coverage area could be detrimental for certain modes (e.g. VARA)
  - Consider antennas designed for "mobile" use (e.g. Comet SBB-5)
    - Warning: untested in very high wind environments (e.g. mountaintops)

STEP 2: YOUR GATEWAY'S ANTENNA SYSTEM

- What if my space is restricted and I can't install another antenna/can't get enough separation?
  - Duplexers and/or cavity filtering are required to avoid desense/frying radios
  - Reasonable options from China on eBay that take up little space (especially for 70cm)
  - Still more expensive than a second antenna + coax, but if you have to, you have to

STEP 2: YOUR GATEWAY'S ANTENNA SYSTEM

- Install appropriate coax for the band(s) it'll be on
  - LMR-400 for VHF/UHF
  - RG-8X for HF
- Keep runs as short as possible
  - Reduces loss as well as cost
- Coax-Seal, etc. saves time and money on replacing stuff later

STEP 3: INTERFACING YOUR RADIO TO YOUR PC

- The same devices clients use are also in use on gateways
  - Separate TNCs are likely unnecessary for most modes now
- Recommend DRA series interfaces from Masters Communications
  - Building it yourself (vs. buying preassembled) saves ~$30
- Caution: older Signalinks aren't capable of VARA FM Wide mode

STEP 4: OUTSIDE CONNECTIVITY FOR YOUR GATEWAY

- Winlink gateways use internet whenever possible
  - All connections go out from gateway to CMS, so likely no special router setup required
- Software can be set up in various modes in case of connectivity loss

STEP 5: SETTING UP THE GATEWAY

- Winlink team highly recommends a dedicated PC
  - Easier to ensure it's not accidentally powered off, etc.
- Required software has a low footprint
  - 4GB of RAM/64GB disk is sufficient if nothing else is running
  - $100-150 PCs for sale on Amazon that meet those requirements—even cheaper used on Craigslist, etc.
  - Software also runs fine on Raspberry Pi 4Bs running Windows 10!

STEP 5: SETTING UP THE GATEWAY

- Determine how your gateway will be powered
  - Usually via AC power, but what if it goes out?
- UPSes are the recommended minimum
  - Typical home models only provide enough runtime to safely power everything down
- Good experience with DC UPSes (such as Epic PWRgate) + LiFePO4 batteries
  - Generators, etc. also possibilities

STEP 5: SETTING UP THE GATEWAY

- Winlink gateway software components:
  - RMS Packet: Responsible for Packet/VARA FM gateway duties
  - RMS Trimode: Responsible for HF gateway duties (ARDOP, VARA HF, PACTOR)
  - RMS Relay: Enables forwarding during network outages
  - The required modems (VARA HF/FM, UZ7HO for Packet, etc.)
- Recommend: installing RMS Relay + either Packet or Trimode at minimum

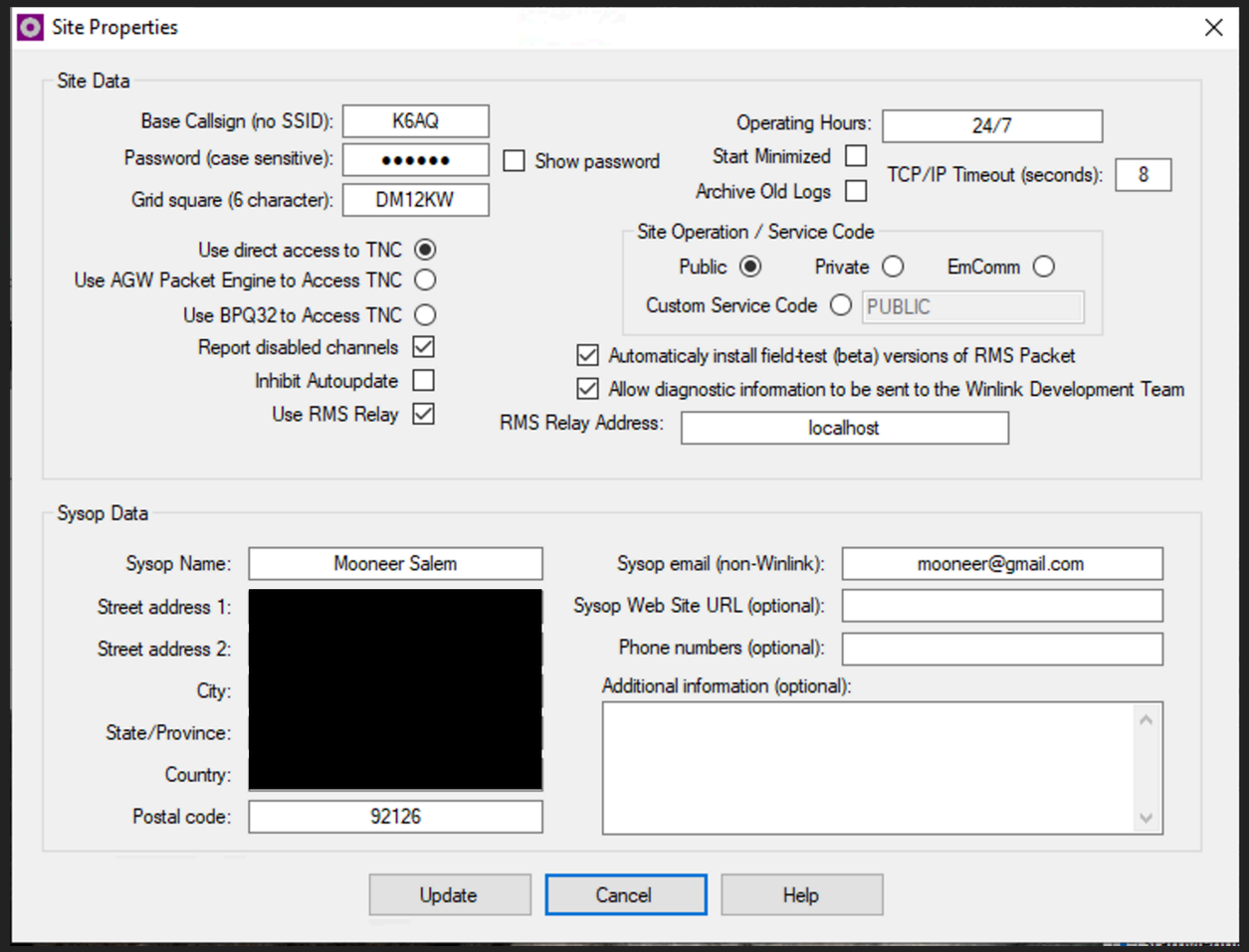
STEP 5: SETTING UP THE GATEWAY

- The gateway programs will not permit setup without authorization from the Winlink team
  - Send request via email to Steve Waterman, K4CJX
  - Once you receive the acknowledgement, you can proceed with setup
- While you're waiting, a good way to test coverage, etc. is to run VARA FM in digipeater mode and use Winlink P2P

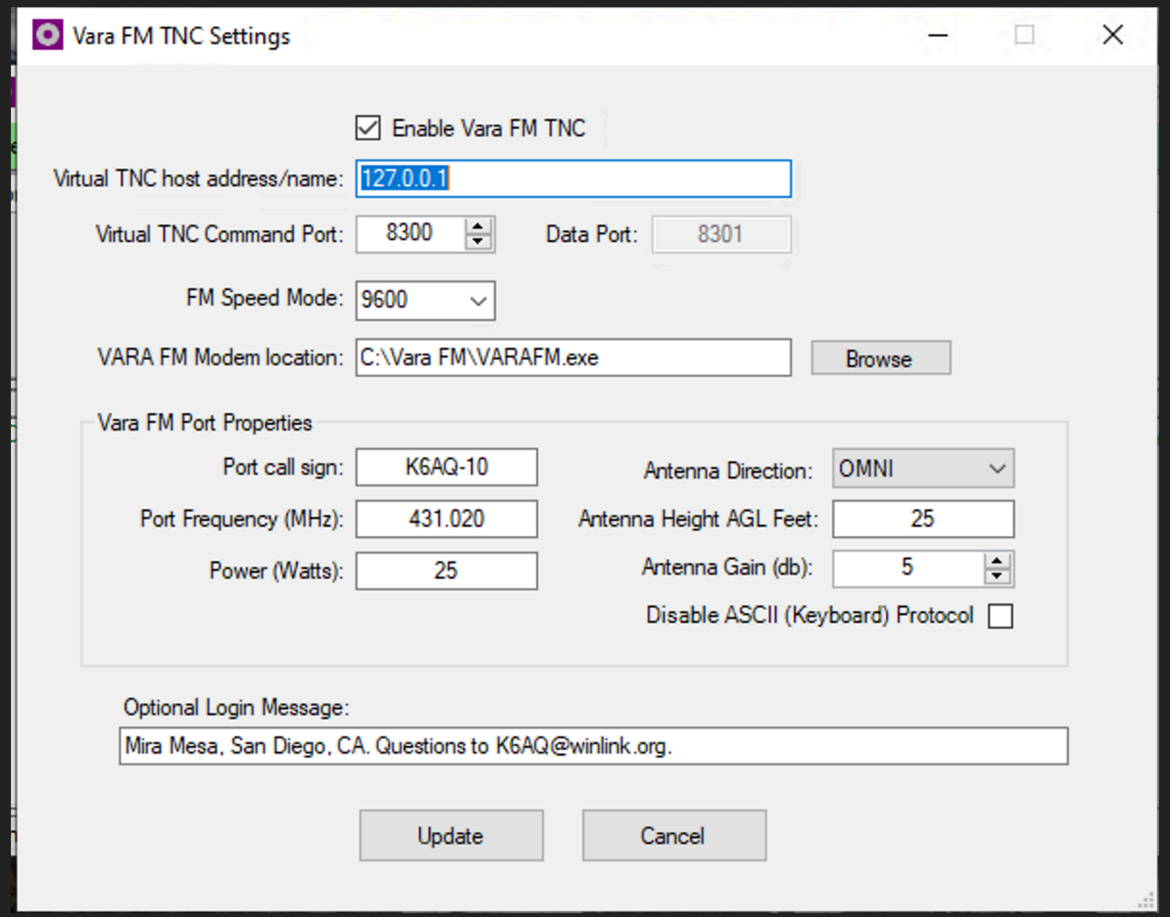
STEP 5: SETTING UP THE GATEWAY

- RMS Packet/Trimode produce a dialog box on first start similar to the next slide
  - You can go back to it later by going to Settings->Site Properties
- For RMS Packet, you also need to set up channels (VARA FM, Packet) for your gateway to become “live”
  - Settings->VARA FM Settings, etc.

STEP 5: SETTING UP THE GATEWAY



STEP 5: SETTING UP THE GATEWAY



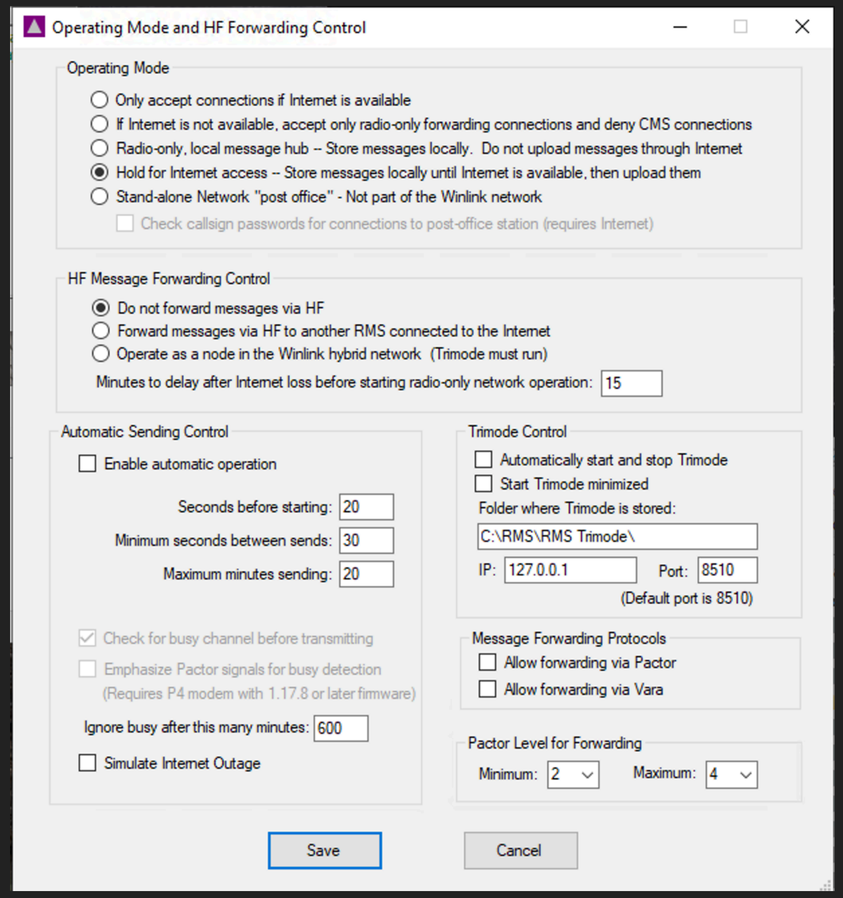
STEP 5: SETTING UP THE GATEWAY

- VARA FM settings
  - Aim for ~ -13dB RX volume while squelch is open and no signal
  - TX volume adjustment:
    - Tune HT to same frequency as gateway
    - Adjust TX volume until it stops getting louder in the HT
    - Back off a bit (or use auto-tune with another station)

STEP 5: SETTING UP THE GATEWAY

- Available operating modes during outages:
  - “Internet only”: reject all connections
  - Radio-only: only accept “radio only” connections
  - Local message hub: don’t connect to the wider network (even if internet is available)
  - Store + forward
- Settings->Operating Mode & HF Forwarding in RMS Relay

STEP 5: SETTING UP THE GATEWAY



STEP 6: MAKING SURE EVERYTHING WORKS

- Have others use the gateway to verify that they can connect
  - Coordinate via reflector and/or repeaters
- Use your own gateway yourself on occasion
- Double-check all connections and software setup if issues

STEP 7: HARDENING

- Disable automatic Windows updates to ensure the gateway doesn't reboot on its own
  - You should still install updates ASAP to fix security holes, etc.
- Add shortcuts to the RMS applications to your gateway's Startup folder
  - C:\Users\[username]\AppData\Roaming\Microsoft\Windows\Start Menu\Programs\Startup
  - AKA Windows+R -> "shell:startup".

STEP 7: HARDENING

- Ensure that your emergency power solution works
  - Tip: Disconnect power occasionally to make sure it stays running
- Occasionally trigger network outages to test forwarding functionality
  - Tip: RMS Relay can simulate outages without needing to unplug your router
- Schedule drills that exercise all likely possibilities

THANKS EVERYONE!

Any questions?

APPENDIX

- Examples of 9600 capable radios (that I know of):
  - Most/all? with a Mini-DIN 6 connector (e.g. Kenwood TM-D700/710, Yaesu FT-817)
  - Alinco DR-135/235?/435
  - Many radios with built-in USB sound cards (e.g. most modern Icoms)

APPENDIX

- Antenna separation charts
  - http://www.repeater-builder.com/antenna/separation.html
- eBay duplexers/bandpass filter examples
  - https://www.ebay.com/itm/New-50W-UHF-400-520Mhz-Bandpass-3-Cavity-Filter-for-Radio-Repeater-N-Connector/272964554499
  - https://www.ebay.com/itm/50W-UHF-6-Cavity-Duplexer-N-Connector-FREE-tune-radio-repeat-380-520Mhz/272546290581

APPENDIX

- SPLAT! RF propagation mapping software
  - https://www.qsl.net/kd2bd/splat.html
- Coax loss calculator
  - https://kv5r.com/ham-radio/coax-loss-calculator/
- UZ7HO packet modem
  - http://uz7.ho.ua/packetradio.htm
- VARA HF/FM: https://rosmodem.wordpress.com/

APPENDIX

- Cheap mini-PC
  - https://www.amazon.com/gp/product/B07QY8LDGX/ref=ppx_yo_dt_b_asin_title_o09_s00
- Winlink gateway programs download area
  - https://downloads.winlink.org/Sysop%20Programs/
- Winlink sysop guidelines
  - https://winlink.org/content/join_gateway_sysop_team_sysop_guidelines

APPENDIX

- Masters Communications DRA series
  - http://www.masterscommunications.com/products/radio-adapter/dra/dra-features.html
- Epic PWRgate
  - http://www.westmountainradio.com/product_info.php?products_id=epic-pwrgate