MOAS Server – Dayton 2013

This is a demonstration of the MOAS Server, which works with the MOAS II antenna switch controller. It requires a PC running Windows XP, Vista, 7, or 8.

The optional Android client requires an Android tablet or phone running Android 2.1 or newer.

The optional knob client requires a Phidgets 1052 encoder, preferably with a CTS 288V232R161B2. See www.phidgets.com for details.

The optional MOAS II emulator requires virtual COM port software.

Quick Start

1. Extract everything from the .ZIP file into a folder.
2. If you want to use N1MM Logger to control the frequencies you must edit N1MM Logger.ini (in the folder where you installed N1MM Logger). Add the following:

   ```
   [ExternalBroadcast]
   DestinationIPs=127.0.0.1
   DestinationPort=12060
   IsBroadcastRadio=True
   ```

   Start N1MM Logger. Configure it for SO2R.

   If your copy of N1MM Logger is old (pre-2013) you should download a newer one.
3. Start MOAS Server. Select Open in the File menu. Pick one of the configuration files. You can ignore the error about failing to open a COM port.
4. Start the OASP Windows Client. Click OK on the Server Information dialog.
5. If you are not using N1MM Logger to control the frequencies click on the icon at the upper left. Select Frequency from the menu. Type in a frequency and click OK.
6. You should now see buttons for various antennas and functions on the left, and antenna rotators on the right. Click on whatever you'd like. If you do not see antennas and functions then the server does not have a frequency for the station. If you are using N1MM Logger try typing a frequency into the entry window for radio 1.
7. Start another copy of the OASP Windows Client. In the Server Information dialog change the radio number to 2 and click OK. Set a frequency if necessary, then click on whatever you'd like.

Android Client

1. The client is AS.apk. Install it on your Android tablet or phone. The easiest way to do this might be to copy the file to a web server and then open it using the Browser.

   You may have to change the security settings for your Android tablet or phone. In settings, under Security, select "Unknown sources". You can deselect this after the client is installed.

2. If the server is not running start it and select a configuration file and frequencies as described in Quick Start above.

3. Start the Antenna Switch application on the Android tablet or phone. Click the settings icon (upper right corner). Choose the server address and set the name or IP address of the server. You may need to use a numeric address such as 192.168.1.2 or 10.0.1.4.

4. Tap the back icon (usually at the lower left).

The number and size of the buttons may not be appropriate for your tablet or phone. You can change the button size, text, and number of columns. Different sizes work best for different station configurations and portrait versus landscape mode.

The Android client can handle antennas for two radios (for SO2R). Select the "Two radios" preference.

If you are using a phone you may prefer to be able to swipe between separate antenna selection and rotator control panels. Select the "Swipe" preference.

You can also change quite a few other preferences. Try them!

Knob Client

1. If the server is not running start it and select a configuration file and frequencies as described in Quick Start above.

2. Connect a knob and install the appropriate software. Currently the only supported knob is the Phidgets 1052. The encoder shipped with this unit is not a good choice for antenna selection. The instruction manual mentions a replacement, the CTS 288V232R161B2. This encoder is a better choice.

3. Start the Knob Client program. Click OK on the Server Information dialog.

Turning the knob will select both transmit and receive antennas. Pressing and turning the knob will select receive antennas only. Pressing and releasing the knob without turning it will set the receive antenna to the transmit antenna.

The antenna selections available by turning the knob are not necessarily the same as available using a client with buttons. This is controlled by the server configuration.

Emulator

The actual MOAS hardware looks like a serial port. The emulator uses a pair of virtual COM ports to provide this function.

By default the emulator uses COM port 25. The configuration files are set up to use COM port 24.

1. Install virtual COM port software if it is not already installed. Create a COM port pair for COM24 and COM25. If these ports are not available on the PC edit the configuration files and change them to specify a COM port that is available.
2. Start the emulator before starting the server. Set the COM port to the port you are using. Then press Start.
3. Start the server and set frequencies as described in Quick Start above.

The emulator accepts timer commands but does not have any actual timers. This is OK because there are also no actual relays to protect from hot-switching. The emulator will display which relays are selected. A station can also be set to transmit.

The MOAS II hardware and the emulator can accommodate six radios. All of the supplied configurations are for two radios.

Clients

There is no practical limit on the number of clients the server can handle, or on the number of clients that are controlling antennas for the same radio. It is possible to have a logging program, a knob control, and a tablet all working together.. You can demonstrate this by starting several copies of the Windows client program for the same radio – any change made by one is seen by all.

The Windows client was written to test the server and is admittedly ugly. It has some limitations, such as 15 antenna or function buttons. It can control antennas for only one radio (but you can run two copies for two radios). It does not need to be run on the same PC as the server – just set the remote server name or address in the startup dialog.

The Android client was designed to work with inexpensive 7 inch tablets. The least expensive of these costs around $55.00 and has a 480x800 pixel screen. For about $10 more it is often possible to buy a tablet with a 600x1024 pixel screen. It can also work with Android phones.

The knob client works with the only commercially available knob that I know of that has detents. If the knob client becomes important it is possible to design a better one.

A single client can handle multiple radios. The Android client has two sets of antenna and function buttons and one set of rotators – everything needed for SO2R antenna control.

Hardware

The MOAS II hardware which works with the server is a box which communicates with a PC using USB and can control up to 64 relays. It is relatively simple – it doesn't have RS-485 or wireless capability. It is being built as a YCCC club project. It is also possible to build one from scratch using the schematic or starting with Arduino hardware. K1GQ and WC1M have written software which also works with the MOAS II.

The MOAS II has too many features to describe here. See http://moas.k1xm.org/ for more information.

The schematic is already on the website. The protocol is also available under a Creative Commons license. Firmware .HEX files will be posted on the website. Firmware source code will probably not be made available publicly but is available for the asking.

Rotators

The server does not yet have the ability to control external rotators – that's the next part of the software project. For now it has a built-in rotator emulator that turns at ten degrees per second.

Comments Wanted

I welcome your comments!

If you find a bug, particularly if you can describe how to reproduce it, please let me know. The server is new and has not seen much testing.

If you have suggestions for how to improve the interface, or for functions it should implement, I'm interested. What I have seems to work but I always have the feeling it could be better.

And if you are interested in helping, I definitely want to hear from you.

Technical Information

The protocol used between the clients and server is an open protocol. The protocol document is under a Creative Commons license. I have not sent it to many people yet because I've been using this server implementation to test it. If you would like to read it and perhaps to review it just ask me for a copy.

The configuration file is only documented in a Server Topics document which I update as I develop the server. I can send you a copy but understand that I do not keep it under any sort of revision control and I change it frequently as I implement the server. I expect further changes to the configuration file as I add features to the server.

Configuration Files

The server depends on the configuration file for just about everything. It can't do anything until it reads one, and once it has one it cannot read another unless you stop and restart it.

Unfortunately the configuration files can be quite large. Gerry, W1VE, is working on a utility to help with creating and modifying them. Check the website for availability.

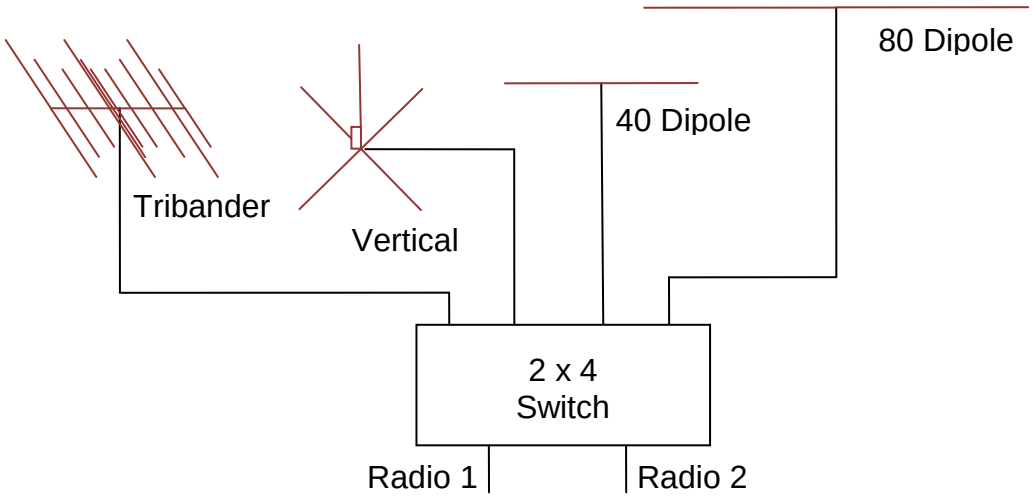
There are five configuration files provided with this demo – a small station, a large station, a complex stack of tribanders, a big 20 meter station, and a complex stack of tribanders with a triplexer.

Small Station Configuration

This station has four antennas:

- Triband Yagi for 10, 15, 20
- All-band vertical
- 40 meter dipole (also usable on 15)
- 80 meter dipole

The antennas are connected to a 2x4 switch and it has bandpass filters. It is capable of SO2R operation.



If you play with this configuration you will notice that if one station is using the tribander or vertical they become unavailable to the other station.

You will also notice that if two antennas are available on a band you can set the station to transmit on one antenna and receive on the other. This is a feature of the MOAS II hardware and it can be configured for each antenna pair. It isn't terribly useful with this station.

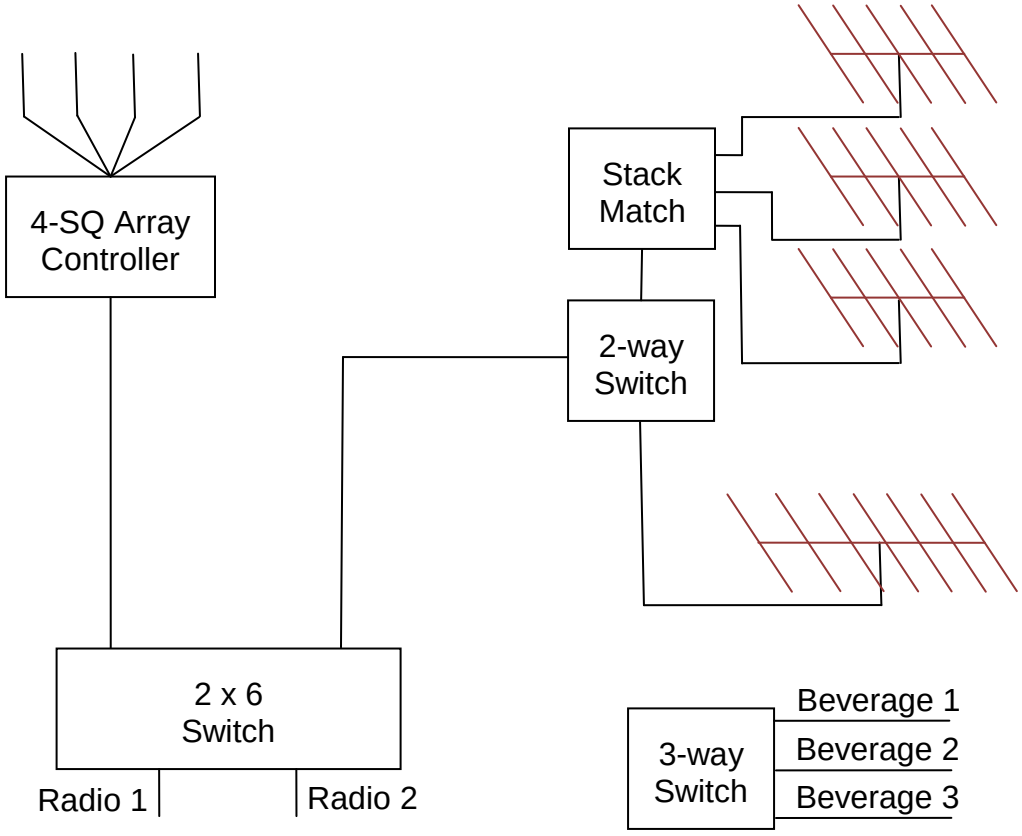
The Swap function has also been configured for this station. When selected on either station it will swap the antennas. It is only available if the antennas can actually be swapped. It is useful if one station is using the beam and one is using the vertical and you find a pile-up on the vertical that you need the beam to break.

Big Station Configuration

This station has three 4-squares, thirteen yagis, and three beverages:

- 160 – 4-square
- 80 – 4-square
- 40 – 3 element rotatable yagi, 4-square
- 20 – 4/4/4 yagi stack (top rotatable), 5 element rotatable yagi
- 15 – 6/4/4 yagi stack (top rotatable), 4 element rotatable yagi
- 10 – 5/5/5 yagi stack (all rotatable), 7 element rotatable yagi

There are also NE, S, and W beverages usable on 160 and 80 meters.



The illustration shows the 160 and 10 meter antenna systems and the beverages. Other antennas are similar.

The beverages show antennas which are receive-only. It is not necessary to press the RX button before selecting one.

The beverages are connected to a single coax, so only one is available at a time. They can be shared between the stations. When antennas are shared changing the antenna for one station also changes it for the other. A station which is not using a shared antenna cannot change which antenna the other station is using – it must first start using the

antenna and then it can change it. This behavior is a bit weird but the other choice would be that starting to use an antenna would also change it for the existing user and that is also weird.

This example shows the Store and Recall functions which will remember an antenna and return to it. For example, when running Europe the NE 4-square / NE beverage combination would likely be stored so it can be quickly recalled after picking off a Caribbean multiplier.

The stacks on 20, 15, and 10 show additive antenna selection. A stack of three yagis can be described in two ways:

One way is as an exclusive selection of one of seven choices: Top, Middle, Bottom, Top+Middle, Top+Bottom, Middle+Bottom, and Top+Middle+Bottom. This would require seven buttons.

The other is as an addition of Top, Middle, and Bottom. This requires three buttons, which are pressed to add the antenna or to remove it.

The server can be configured for either exclusive or additive or any combination of the two. In this example it is configured as a hybrid – there is an exclusive All button and additive buttons for Top, Middle, and Bottom.

An additive button can be used to exclusively select an antenna by double-clicking it. For example, if all of the antennas in a stack are selected double-clicking Top will result in only the top antenna being selected.

It is not possible to turn off all of the antennas in the stack. Attempts to do so will be ignored.

It is possible to use different antennas on the stack for transmit and receive. For example if it is raining and static is a problem the station can transmit on the entire stack but receive only on the bottom antenna.

There is no way to select additive antennas with the knob client. So it has all seven combinations of antennas for the stack.

By default the first time a station goes to a band the server will pick a suitable antenna, which will be the first available antenna in the configuration which covers the frequency. However when a station goes to a band which has been used before the server will select the last antenna used on that band if it is available.

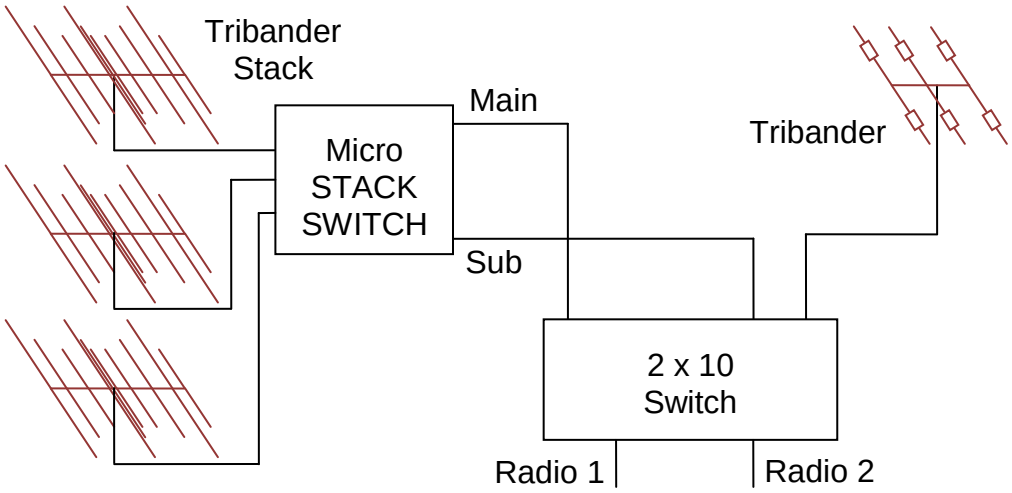
This example also shows electrical rotators for the 4-squares on 160, 40, and 80. These do not have to be configured. The thought is that some logging programs know how to rotate antennas and they would be able to control a 4-square in this way.

Tribander Stack Configuration

This is a part of a station (antennas for 40, 80, and 160 are not in the configuration):

- A stack of three tribanders (top rotatable)
- A separate tribander (rotatable)

The tribanders are connected to a microHam micro STACK SWITCH™.



This switch is different than the common stack match because it has two feeds. The main feed has an impedance matching transformer and can connect to one, two, or all three tribanders. The sub feed has no matching network and can connect to one antenna at a time.

Either radio can be connected to the main or sub feed through the 2x10 switch.

If each radio is using one tribander it does not matter which is using the main and which is using the sub feeds. However if one station uses two tribanders it must have the main feed. This may require swapping which radio has which feed. The server does this automatically. This can be observed by watching the server's log window when switching which station has two tribanders.

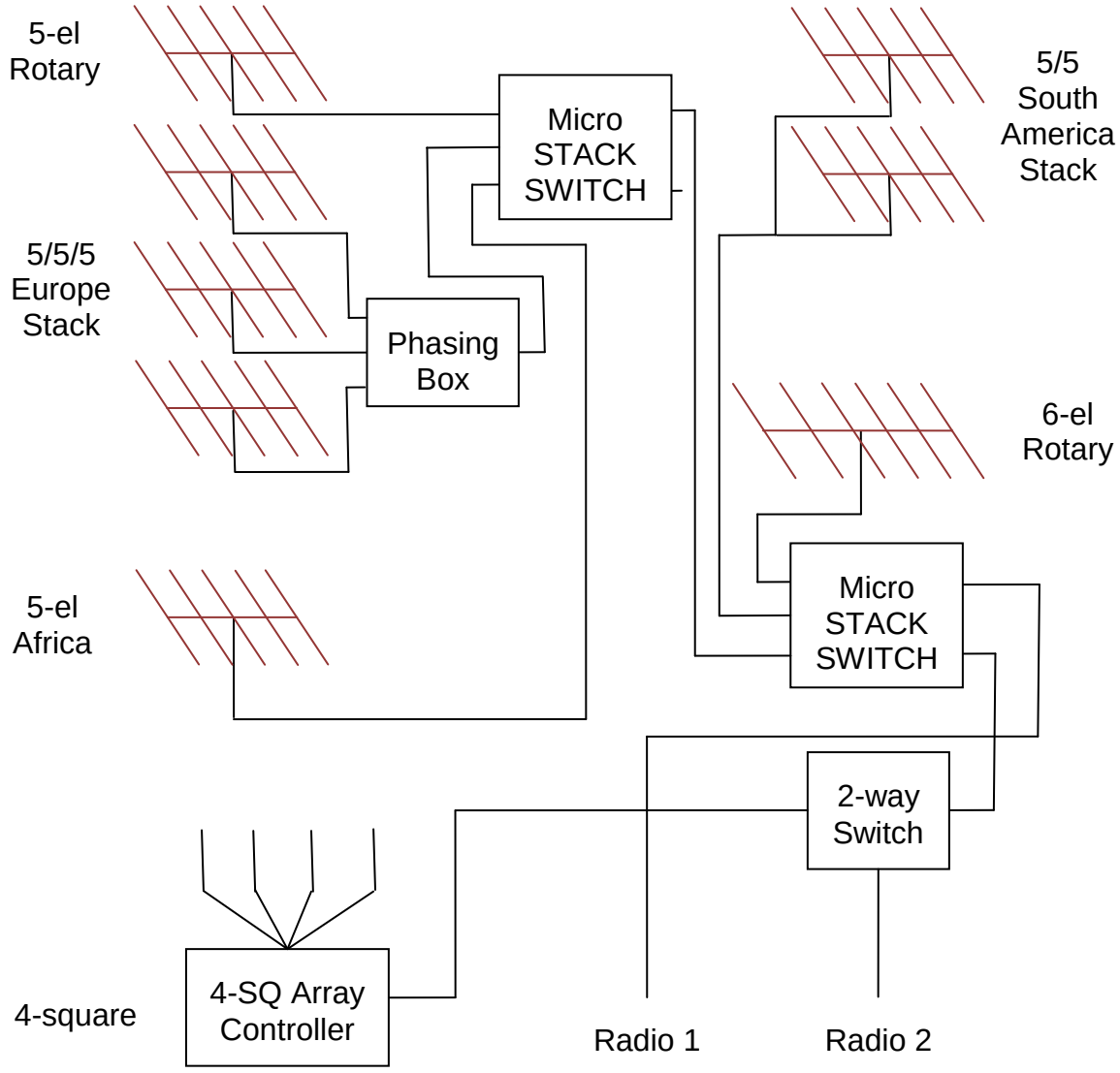
Note that there are several relay combinations which will connect an antenna to a feed with this switch. microHam provides a chart showing which have the lowest SWR. The issue is apparently not with impedance matching but with RF paths within the switch. This configuration uses combinations which avoid switching relays which affect the other radio. These combinations may not have the lowest SWR in all cases.

Multi-Multi 20 Configuration

This station has eight yagis and a 4-square on 20 meters:

- 5/5/5 Europe stack – switchable angles 7°, 17°, 24°, 34°
- 5 element rotatable above Europe stack, can be phased with stack
- 6 element rotatable
- 5 element fixed on Africa
- 5/5 stack fixed on South America, both antennas fed in phase
- 4-square

The switching arrangement is complicated:



Normally there would be two stations. It is configured as one station with two radios to make it possible to run the demo using one copy of N1MM Logger.

Set both stations to 14 MHz to try this configuration.

The stack switches are used to combine antenna systems. The station can transmit in several directions at once. The ability to select so many antennas creates a large number of choices – station 1 can select one of 78 combinations.

The two stations do not have the same antenna capabilities. Station 1 is connected to the main feed of the switch and can combine antennas that station 2, which is connected to the sub feed cannot. The result of this is that the 6-el and Africa antennas are additive on station 1 but exclusive on station 2. And only station 2 has access to the 4-square array.

There is no visible difference between an additive and an exclusive button. This is a compromise between showing everything the operator might want to know and showing so much information that the operator cannot quickly figure out what to do.

The ability to double-click an antenna to select it exclusively is valuable with this system.

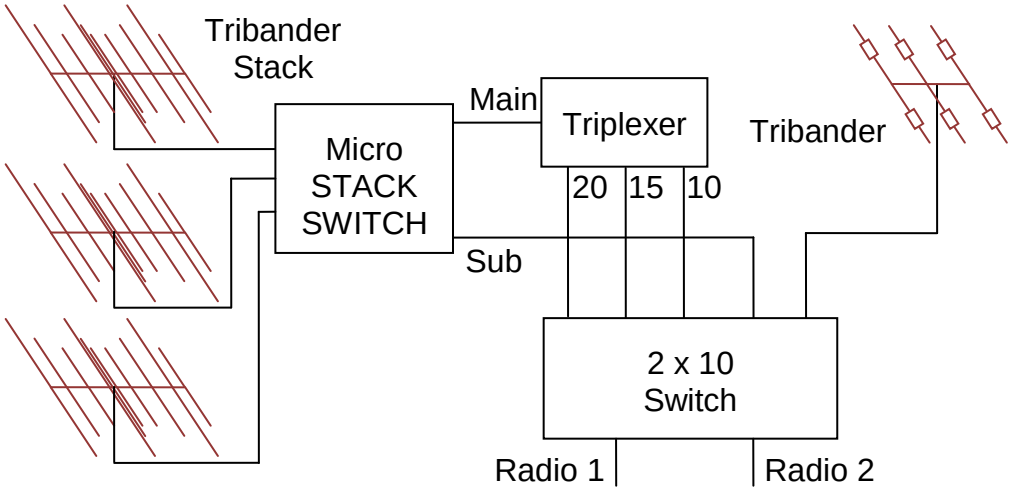
The Europe stack has four exclusive selections but the antenna system itself is additive because it can be combined with the 5 element yagi and the Africa antenna. Therefore the Europe stack buttons have a slight additive capability – if the Europe stack is selected and another antenna is also selected pressing the selected Europe stack button will deselect the Europe stack.

The Swap function is only available on station 1 because station 2 has more antenna buttons. If this is a significant problem the configuration could be changed.

The knob client cannot select all of the antenna combinations – it would be insane to have all 78 choices available. The configuration gives it a limited set.

Triplexer Configuration

This is a expansion of the Tribander Stack Configuration. The difference is that a triplexer was added to the main coax:



The triplexer allows both stations to use the same antennas.

The server handles this system by having two modes. In the unshared mode it behaves just like the Tribander Stack configuration above.

In shared mode both stations are connected through the triplexer to the main feed on the stack switch. This requires that neither station can be transmitting when the stack configuration is changed. It also means that a station cannot transmit on one stack configuration and receive on another.

The two modes cover all useful stack configurations. Non-modal solutions were considered but they seemed to be too complicated in actual use.

The Share button is an example of an on/off function.