# Application Note 1

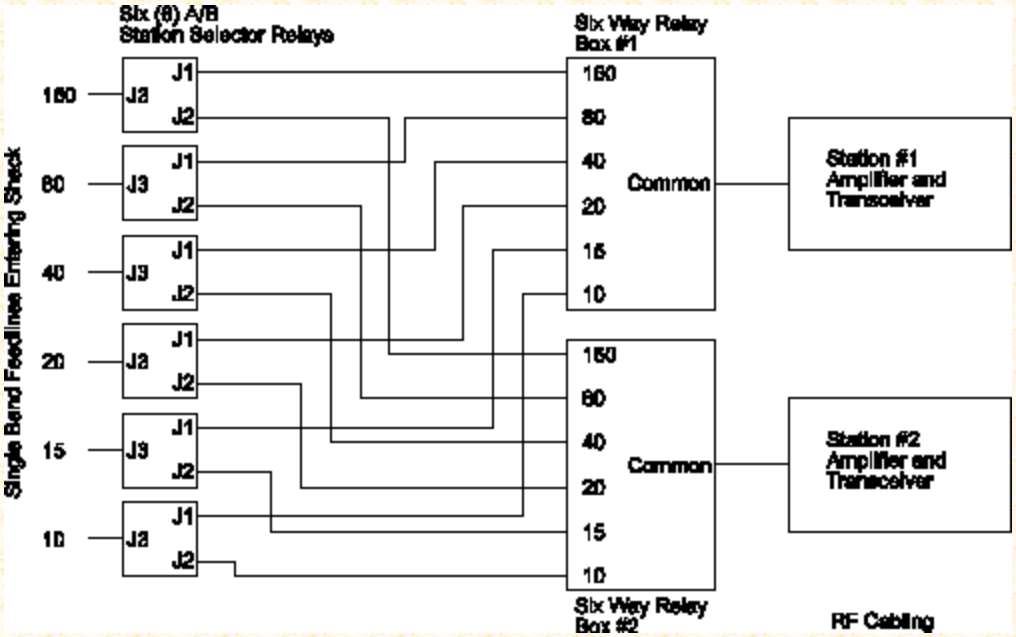
## Subject: Stacking Six A/B Station Selector Relays

**Background:**

The A/BSS relay was designed for the two-rig contest station where any antenna not in use by the first station should be available to the second station. Initial implementations of this concept used Band Decoders and Six Way Relay Boxes on both stations, with the switching of the antennas themselves between the two stations being done manually.

Typically, a bank of six SP2T coax switches, commonly available from MFJ and Daiwa, would be used for this purpose. Although all the other switching could be accomplished automatically by the Band Decoders and Six Ways, the operator had to manually adjust the proper SP2T switch before transmitting (or at least glance at the switch to verify that it was in the correct position).

The A/BSS relays replace the manual switches, allowing the operators to freely roam the various bands with all antenna switching being automatic. The recommended configuration looks like this:




**Possibility to Eliminate the Six Ways:**

You can see from the above diagram that the array of two Six Ways and six A/BSS relays form a switching system which is (looking from the antenna side) "Six In/Two Out." This same functionality can be obtained by eliminating the Six Ways, and bussing the A/BSS A ("J1") Outputs together and bussing the A/BSS B ("J2") outputs together.

This is accomplished using standard coaxial adapters (male-male, Tee, and elbow). Be sure to use good quality fittings. We tried some inexpensive imported connectors with disastrous results due to many of them being so "loose" that no rf connection was made.

Build the stack in the following manner. Install Tees on Outputs A and B on Boxes 1 through 5. Install elbows on Outputs A and B on Box 6. Join Boxes 1 and 2 with male-male adapters. Repeat for all the boxes until you have a stack of six A/BSS relays joined by the adapter fittings making busses for Outputs A and B. These outputs now appear on the unoccupied end of the Tee fittings on Box 1.

As far as mechanical mounting is concerned, you are left to you own devices. Although the stack is relatively rigid inherently, we recommend that stress relief on the fittings be considered in any mounting arrangement. One way that comes to mind is to clamp the busses to the underside of a table or other surface, allowing the A/BSS relays and their attached antenna leads to hang in the downward direction.

**Performance of the "Two by Six Stack"**

VSWR was measured at 14 and 28 MHz with a 50 ohm dummy load attached to the input (antenna) connector of each of the six boxes. The appropriate relay was energized and rf applied to Port B, with results as follows:

| | Box 1 | Box 2 | Box 3 | Box 4 | Box 5 | Box 6 |
|---|---|---|---|---|---|---|
| 14 MHz | 1.15 | 1.09 | 1.05 | 1.02 | 1.0 | 1.07 |
| 28 MHz | 1.65 | 1.45 | 1.2 | 1.15 | 1.15 | 1.2 |

The total capacitance looking into an open Port A or Port B is about 85 pF. The calculated VSWR with 85 pF across 50 ohms is 1.67 at 10 meters, which correlates nicely with the measured data. This capacitance can be eliminated by installing a 0.38 µH compensating inductor across the 10 meter output. If flat VSWR is not all that important to you, merely use Box 1 for 160, Box 2 for 80, etc., ending up with Box 6 on 10 meters.

Port to port isolation tests were run at 28 MHz and 14 MHz. 100 watts was inserted at Port A or B, and readings taken at the other Port, for each of the six possible cases per band. Due to the vagaries of stray capacitance, results are not precisely repeatable. However, the Port A to Port B isolation is typically greater than 85 dB at 28 MHz and 95 dB at 14 MHz. This is far in excess of the typical 60 dB required to prevent receiver front end damage when running 1500 watts through one of the ports.

**Comments:**

1. Using this approach, you can save the cost of two Six Way Relay Boxes, and twelve coax jumper cables, each with a PL-259 connector. However, if your junk box is sparse, you will have to acquire the necessary 10 Tees, 10 male-males, and 2 elbows. Using prices from the Newark Electronics catalog, these adapters would cost in excess of $250! A little shopping reveals The R.F. Connection ( http://www.therfc.com ) where you can pick up all 22 connectors for $121.50. The point is that the approximately $225 saving realized by eliminating the Six Ways and attendant cables can be very quickly eroded in adapter costs.
2. VSWR characteristics are certainly acceptable on the stack. However, better performance can be expected from the full implementation using the additional Six Ways, in that 50 ohm impedance paths are maintained throughout.
3. Port to port isolation is also very good at 85 dB or greater. However, the full implementation will display significantly more isolation due to the additional open relay contacts in the circuit.

4. Reliability of the "switching system" would be expected to be greater with the stack due to fewer components. (The very same relays are used in both the Six Way and the A/BSS.) However, "on-line repairability" of the stack is virtually non-existent, due to the way the boxes are electrically and mechanically coupled. On the other hand, the full implementation with two Six Ways allows access to either a failed Six Way or a failed A/BSS while the other station continues on the air. For example, if the 40 meter A/BSS fails, it can be easily removed from the switching system by disconnecting the coax jumpers. The two stations continue to operate normally on all bands EXCEPT 40 meters. If Station 1's Six Way fails, Station 2 continues to operate normally while the repair is being made.

   Please note that the reliability of our rf switching products when installed properly and operated within ratings has proved to be exceptionally high.