**KiwiSAT Antenna Switch**

The antenna switch is a 3dB Coupler:

A 3dB, 90 degree hybrid coupler is a four-port device that is used to split an input signal into two equal parts with a 90 degree phase shift between the outputs or to combine two signals while maintaining high isolation between the two input ports.

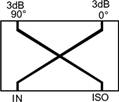


Figure 1.

The basic configuration of a hybrid coupler is shown in Figure 1 which illustrates two cross-over transmission lines, one quarter of a wavelength long at the centre frequency of operation. When power is fed in at the “IN” port, half the power (3dB) flows to the “0” degree port and the other half of the power is coupled (in the opposite direction) to the “90” degree port. Reflected power from output ports flows back to the “ISO” port or cancel at the “IN” port.

3dB, 90 degree hybrids are also known as quadrature hybrids because a signal applied to any input will result in two equal amplitude signals that are 90 degrees apart (quadrature). It also makes no difference which port is the input because the relationship between the outputs remains the same as these devices are electrically and mechanically symmetrical. This configuration ensures a high degree of isolation between the two input ports and the two output ports.

If we connect the Linear Transmitter to the “IN” port from figure 1 above, then we get 2 equal outputs 90 degrees apart. We need this 90 degree phase difference to obtain circular polarisation of the transmitted signal. Similarly if we feed the FM Transmitter into the “ISO” port (Figure 1) then we obtain 2 equal outputs but phased opposite to the Linear Transmitter outputs.

When the outputs are applied to the 2M antenna, we obtain circular polarisation of both signals but in opposing senses, Left Hand circular and Right Hand Circular.

Now a quarter wavelength at 2M is 500mms so we need to construct a short version of this coupler. To do this the lines consist of two wires twisted together and wound into a small coil. The coil is resonated at 146MHz by means of additional capacitors between the wires. The line is then matched to 50 Ohms by capacitors across each port. This technique was widely used by BCL engineers in the old analogue TV network. The disadvantage of this technique is that it requires access to a Network Analyser and very careful adjustment including adjusting for the detuning effects of the lid.

The KiwiSAT 3dB Coupler has good split between ports and good return loss. See screen shots SCRN01 and SCRN02. The Isolation between inputs was measured at 20dB but the plot has been lost.

References: <http://www.e-meca.com/rf-microwave-blog/hybrid-coupler-basics>