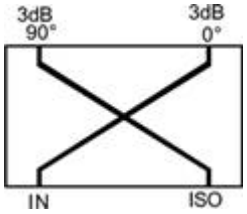
IQ combiner V3 guidelines

1.Circuit Description

Balanced Q signals and I are coming from the transceiver main board connector J4, and enters the combiner connector J1. The balanced signal between pin 5-6 and pin 4-3 has appx. 500 ohm impedance, according to the datasheet and this signal is combined and transformed to 50 ohm single ended with the components L1+C1+C5 for pin6 and c2+L2+C7 for pin 5, each of the components in this network has an impedance Z=163 Ohm at the center operating frequency =144.4 MHZ. On C9 and C10 we now have I and Q signals which are feed to the hybrid combiner. The hybrid combiner is a four-port device, which have two inputs (or output), 0 degree and 90 degree apart and two outputs (input), the sum and difference port. As it is completely symmetrical, I can be used both to combine but also to split signals.



In our application, Q and I are 90 degree from each other, and we use the hybrid to select either upper sideband or lover sideband from the mixing product generated by the mixer, so we either take the signal from the sum or the difference port, and terminate the unused port in 50ohm.

The hybrid combiner is a made from lumped components, c11+c12+l5+l6, and is designed for narrowband operation around 144.4MHz center frequency and 50ohm impedance.R1 and R2 are not mounted components , but pads are use as test points for the two input ports to the hybrid combiner.

Output is selected with PIN diode D2 and the unused port is selected with D1. For D1, R1+R6+C17 assures that the load impedance is 50Ohm and the bias current is kept at 5mA. For D2, R5+R7 +50ohm load at J4, assures the hybrid is loaded with 50ohm.

Pin diodes are switched with an external DPDT switch connected to J2. The bias in the pin diodes are controlled by R3. To minimize load of the hybrid I have used FB1...FB4, ferrite beds which hara high impedance at 144MHz.

2. Assembly of IQ board

First mount all R+C, they are all size 0603, but pads are large so 0805 will also fit. Then mount inductors FB's and diodes.

The hybrid coils L5 and L6 is a homemade bifilar wound coil. Take 2x 60mm 0,2mm ø copper wire, and twist the wires together. Then using a 3mm drill or other suitable form, make 5 turns. Now you need to find which coil ends of the wire belong together by ohming the wires (you could also have used different wire colors). You can now mount L5+L6. It should have a length of 3-4 mm.

Finally, you can mount the pin rows if **needed**. There are different solutions possible:

1. Use all pin rows and mount matching sockets on the transceiver board
2. Don't' use pin rows , hard wire all connections
3. Combination of above

What your choice is depends also on your mechanical build up.

IQ board J1 matches J4 on the transceiver board, but note that holes for J4 is very small, so standard pin rows will not fit here! In addition, one hole is blocked by C201, so it might be have to be moved.

3. Connection to transceiver board

From the transceiver board you need to connect J4 to IQ board J1, J4.1 to J1.1 ….J4.6 to J1.6

You also need to remove C3 on the transceiver board

IF output from J4.2 is connected to, IC4.6 (input) via either a short wire or a thin coax cable.

To switch sidebands, you need and external DPDT switch, which are wired according to the schematic and connected to IQ board J3. Alternatively, you can hardwire the wanted sideband, by putting a wire from J3.6 to J3.3+J3.4 (marked B) or a wire from J3.6 to J3.2+J3.5 (marked A).

4. Test

With the IQ board mounted, setup a FM duplex link with another transceiver. Try to change sideband with the DPDT switch; you should see 17-20dB change in signal level.

OZ2TG, Steen