Identifying the Useful Frequency Range of an Unknown Double Balanced Mixer

by
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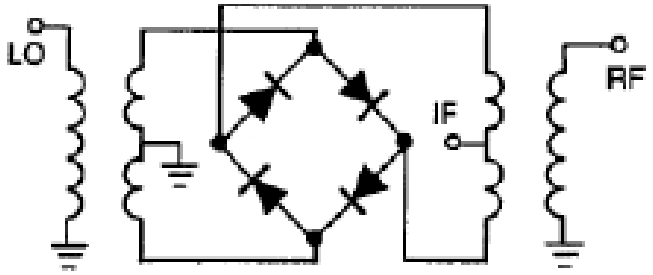
Many times a mixer turns up surplus and frequency range data can't be found. I have one the maker would not admit the rated frequency range because it was specifically made for a military product. They did admit it would work at 10368 MHz and it does.

When the mixer uses a ring of diodes and direct connection for the IF port it can be used as a modulator or a switch. By turning it on through the IF port if there is a DC connection to the diode ring, a signal generator and detector can be used to measure the overlapping frequency range of the LO and the RF ports. Often they overlap fully, but that is not guaranteed. The typical double balance mixer schematic is:



Ring-Diode Double Balanced Mixer

There are some circuits with a transformer on the IF port and this technique will not work with that transformer blocking DC from the diodes.

The first test is to apply a milliamp or so current to the IF port and look for the forward drop of a Schottky diode, between 0.4 and 0.55 volts. If the voltage on the port never gets above 0.1 volts, there is a transformer preventing this scheme from working. A very high power mixer might use two diodes in series for each side of the ring and show twice that voltage drop.

To have my mixer tested on the VNA at MUD 2013 I connected a single AAA cell to a 220 ohm series resistor. That limited the diode current to about 5 milliamps. The VNA practically instantly showed the overlapping

RF and LO passband. It would be a slower test with a manual signal generator and detector providing the detector can work with about 1 mw level driving the LO port with +7 or +10 dBm and the detector on the RF port.

If the mixer is made for half frequency LO, this scheme won't work with a VNA unless it can be set to expect the output from the RF port at twice the input frequency at the LO port. Without identifying the output frequency on the RF port manual measurement will be misleading too.

Determining the optimum LO power can probably start presuming 5 to 10 mw is appropriate, +7 to + 10 dBm. Then set the mixer up as a mixer and measure the conversion loss variation with LO drive. Typically if the mixer is designed for +7 dBm the loss will be a little less with +10 dBM LO and noticebly greater with 0 dBm LO drive. The signal conversion loss should be 5 to 8 dB and most rules of thumb set the double balanced mixer noise figure the same as the insertion loss.

A mixer with two diodes per side of the ring will probably require twice the LO voltage, so 6 dB more LO power than the single diode per side mixer.

73, KØCQ

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