Overview

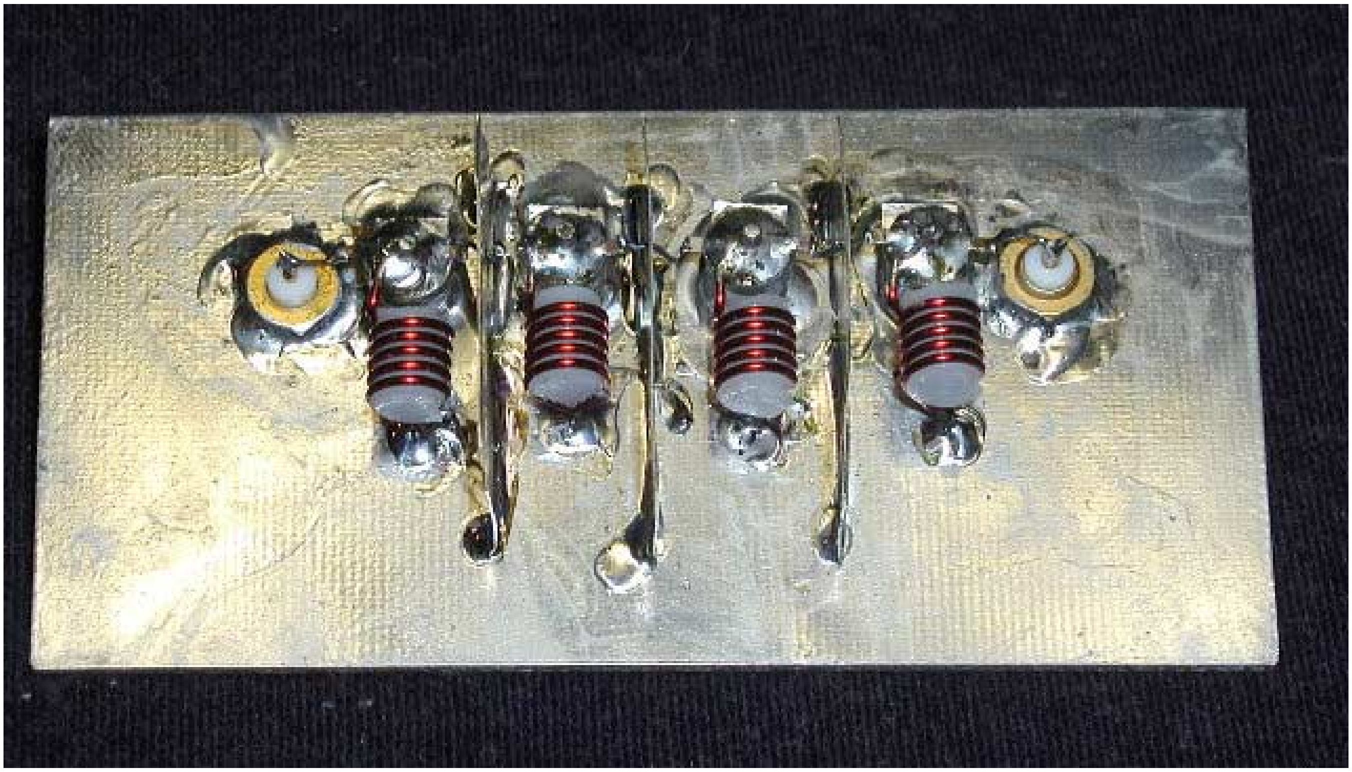
See the schematic on the following page that shows a simple "medium" performance VNA transverter. This transverter, or something similar, should be adequate for most reflection measurements and many transmission measurements.

As you can see, this version requires an external LO that, in my case, was provided by an HP signal generator. A suitable substitute that is sufficiently clean for harmonics and other spurii and also provides about +17 dBm can certainly be used.

The general concept of the VNA transverter is that the basic 0.05-60 MHz frequency range of the N2PK VNA is up-converted by an external LO, filtered to some desired narrow VHF/UHF frequency range, passed thru or reflected from a DUT, and that transmitted or reflected signal is then down-converted back to the 0.05-60 MHz range by the same external LO for input to the VNA detector for normal processing. Phase coherence at the DDS frequency is maintained, so the frequency conversions are transparent to the VNA.

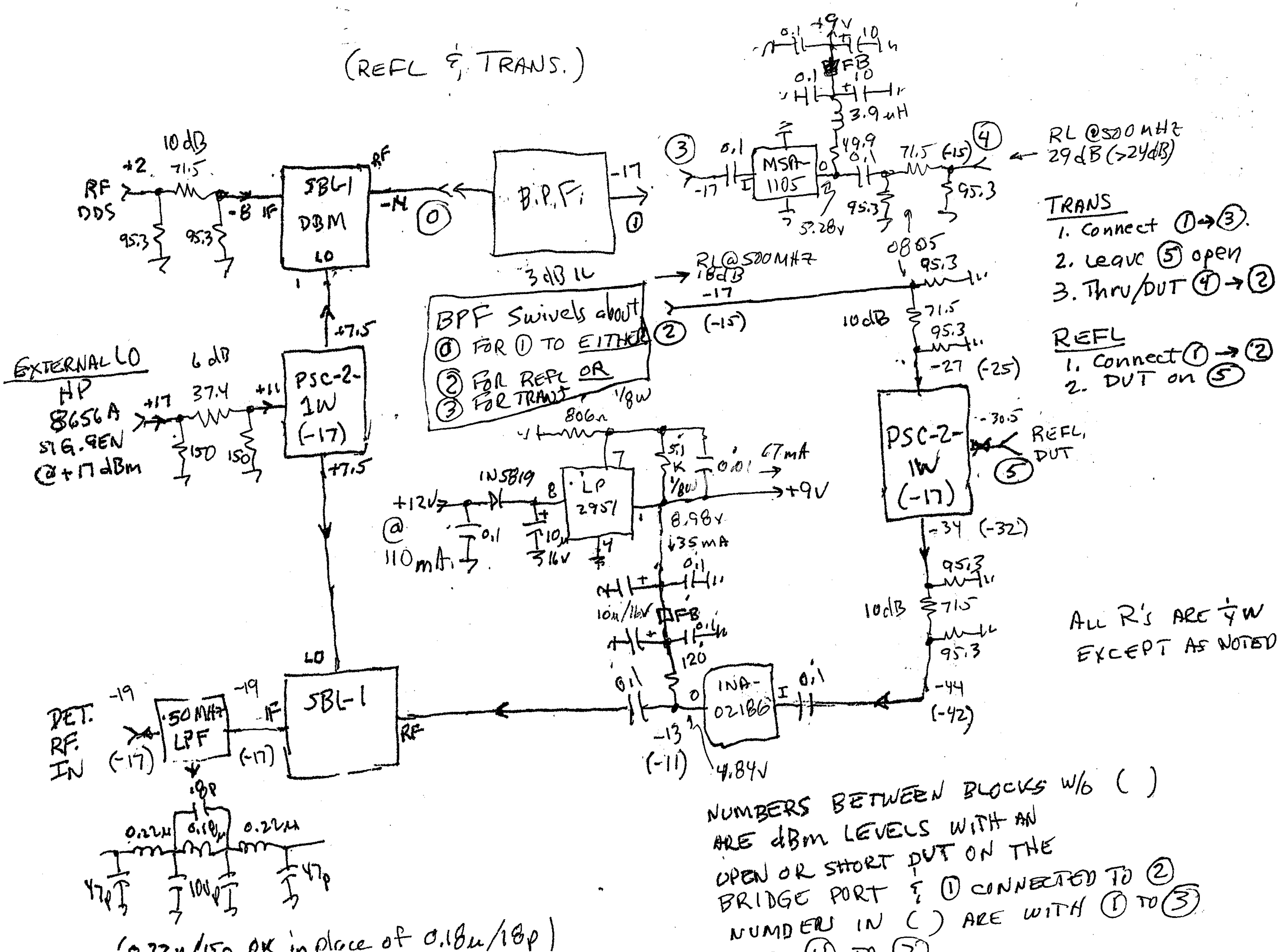
Practical considerations of images and harmonics typically require that the LO be "several" MHz (10+) removed from the desired VHF/UHF frequency range either low or high. My software allows the user to specify the external LO frequency when used in this mode.

A critical element of this concept is the BPF – the bandpass filter. An example design for 2m is shown here:



The inductors were wound 5.25T of #20 on a (US) 1/4-20 nylon (I think) screw. Measured Q=144.

VER. 3 SBL-1 BASED VNA TRANVERTER 02/11/04



(0.22u/15p OK in place of 0.18u/18p)

TRANS
1. Connect 1 → 3.
2. Leave 5 open
3. Thru/DUT 4 → 2

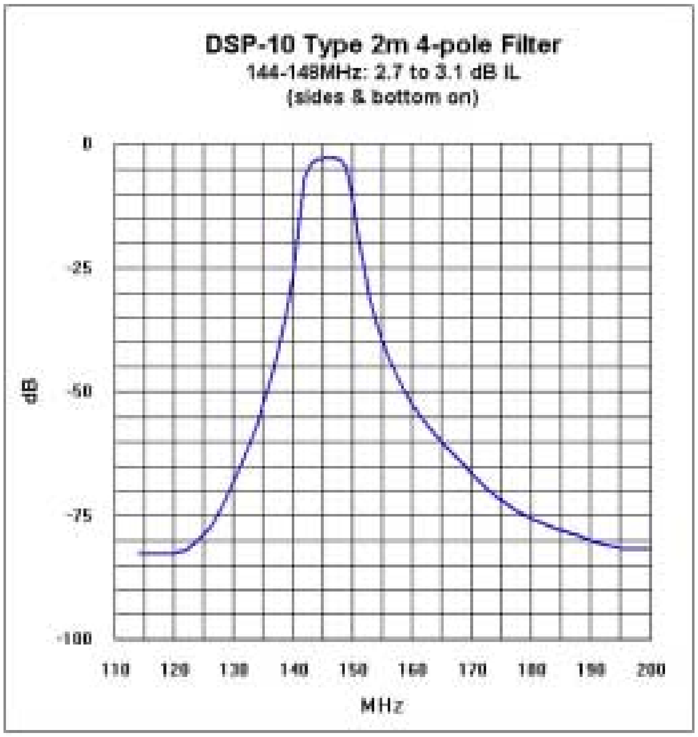
REFL
1. Connect 1 → 2
2. DUT on 5

ALL R's ARE 1/4 W EXCEPT AS NOTED

NUMBERS BETWEEN BLOCKS W/O ( ) ARE dBm LEVELS WITH AN OPEN OR SHORT DUT ON THE BRIDGE PORT & 1 CONNECTED TO 2. NUMBERS IN ( ) ARE WITH 1 TO 3 AND 4 TO 2.

It's hard to see, but the interstage coupling used a chip cap on each piston and tied them together with a wire thru the partition. I also had a problem with 3 pF chip caps on in & out so I swapped in some leaded 2.7 pF NPOs. The interstage coupling caps overall for this filter are very small, on the order of 0.3-0.4 pF, . The "Y" capacitor arrangement might also be used to increase the smallest coupling capacitor values to "nicer" values.

This filter was patterned after a filter in the DSP-10 rig, featured in QST I think. The measured response of my filter using a signal generator and an AD8307 log amp is shown here:



The transverter is necessarily narrow-band and the BPF is required to reduce images, harmonics, and other spurii to acceptable levels.

By making the BPF pluggable and with frequency agility in the LO, the transverter frequency range can be shifted about, if desired, limited only by the frequency range of mixers, power splitters, and MMIC amplifiers actually used.

There is also a concern about stray coupling paths - the primary one starting from the up-convert mixer, thru the LO power splitter, and finally thru the down-convert mixer to the VNA detector input. This stray path provides an input to the VNA detector at the RF DDS frequency whose level is largely independent of any downstream VHF/UHF DUT that may or may not be present.

Useful dynamic range of the "transverted" VNA will be limited by the strength of these spurii and stray coupling paths.

A "higher" performance transverter might take advantage of high reverse isolation MMIC amps in the LO power splitter paths to reduce this stray coupling path. Improved terminations on all mixers ports may also aid in reducing the stray coupling path. The pads shown in the PDF provide both signal level changes and impedance control and shouldn't be eliminated without consideration to both for possible impacts.

As before, substitutions of available components can be made. Ensure that nothing is overdriven, generating excessive spurii, or aggravating stray coupling paths.