

Universal NanoVNA Test Fixture

This project was inspired by a need for, a more or less, universal platform, to replace an older simpler design, to measure toroid inductance & resonance for several band pass and low pass filter system components that are to be constructed. The circuit embodies concepts from Sam Wetterlin's old web pages <https://web.archive.org/web/20181206052548/http://www.wetterlin.org/sam/> and from Lex Bolkesteijn, PH2LB's QRP-Labs filter adapter for NanoVNA

<https://www.ph2lb.nl/blog/index.php?page=qrp-labs-filter-adapter-for-nanovna#adapter4nanovnah4>

[Manual - <https://www.ph2lb.nl/blog/uploads/QRP-Labs%20filter%20adapter%20V2%20for%20NanoVNA%20manual.pdf>.]

The adapter has been designed to connect directly to the NanoVNA-H4 with male edge mount SMA connectors or cables and female edge mount SMA connectors. There are provisions for input and output attenuators and S-O-L-T loads and jumpers for calibration to the on board reference plane. With proper attention to the attenuators, load values and on board jumpers the fixture can be used for either series or shunt measurements with 50 ohm or custom loads. The fixture also can be used directly for measuring QRP Labs filters or any pin compatible devices.

There are two basic methods of measurement, series and shunt. In the series configuration individual parts can be measured in series or an inductor and capacitor can be placed in parallel and the hi-Z parallel resonance can be detected. With the shunt method individual components can be measured and LC series resonance is detected as a deep notch. Sam Wetterlin describes these circuits and I have used his values in the schematic for this fixture. Please refer to the short form descriptions in the document "Excerpts from some of Sam Wetterlins' Documents".

<http://www.k9ivb.net/NanoVNA/Excerpts%20from%20some%20of%20Sam%20Wetterlins%20Documents.pdf>

If you wish to stick to 50 Ohm loads a 8.25 dB π pad can be made with two 113 ohm 0.1% and one 54.9 Ohm 0.1% on each side, as indicated on the schematic and at the bottom of this page.

When the fixture is used in the series configuration JP1 may be open or closed and the DUT is connected [after calibration] to pins 1 & 3 of J5 [DUT]. A series connection of two components can be connected using J5 pin2 if JP1 is open or a π configuration if JP1 is installed.

When the fixture is used in a shunt configuration JP1 MUST be installed. After calibration the JP7 "Through" connector MUST BE INSTALLED, as well, for shunt to function. In Sam's circuit [Figure 13 Improved 50 ohm test fixture], the resistors R3 and R4 are in parallel and cannot be separated. This fixture separates the 100.5 Ohm resistors so that fixture reference plane calibration can be performed.

Resistor part numbers and Mouser ordering # [These are 0805 SMT parts, PCB is designed for 1206]

Series configuration "Hi Z Fixture"

Ref Des	Description	Mouser Part #
R1a, R6a	Thin Film Resistors - SMD 0805 1/8W 91 ohms 0.1% 25ppm	667-ERA-6AEB910V
R2a, R5a	Thin Film Resistors - SMD 0805 1/8W 49.9 ohm 0.1% 25ppm	667-ERA-6AEB49R9V
R3a, R4a	Thin Film Resistors - SMD 0805 1/8W 127 ohm 0.1% 25ppm	667-ERA-6AEB1270V

Shunt configuration ["Improved 50 ohm test fixture"] R3 || R4 = 50.25 Ohms & R3 = R4 = 100.5 Ohms

R1a, R6a	Thin Film Resistors - SMD 0805 1/8W 150 ohms 0.1% 25ppm	667-ERA-6AEB151V
R2a, R5a	Thin Film Resistors - SMD 0805 1/8W 61.9 ohm 0.1% 25ppm	667-ERA-6AEB61R9V
R3a,R4a	Thin Film Resistors - SMD 0805 1/8W 102 ohm 0.1% 25ppm	667-ERA-6AEB1020V
R3b,R4b	Thin Film Resistors - SMD 0805 1/8W 6.98 Kohm 0.1% 25ppm	667-ERA-6AEB6981V

All 50 Ohm Fixtures

R7a, R7b, R8a, R8b	Thin Film Resistors - SMD 0805 1/8W 100 ohm 0.1% 25ppm	667-ERA-6AEB101V
Or R7a, R8a	Thin Film Resistors - SMD 0805 1/8W 49.9 ohm 0.1% 25ppm	667-ERA-6AEB49R9V

If you prefer other attenuator values please feel free to substitute those parts for R1 to R8.

8.25 dB Attenuator parts

R1a,R3a,R4a,R6a	Thin Film Resistors - SMD 0805 1/8W 113 ohm 0.1% 25ppm	667-ERA-6AEB1130V
R2a,R5a	Thin Film Resistors - SMD 0805 1/8W 54.9 ohm 0.1% 25ppm	667-ERA-6AEB54R9V