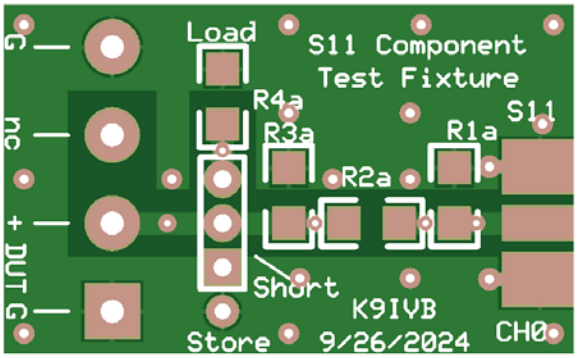
S11 Component Fixture – Shunt Measurements

This fixture was inspired by Rusty, KJ6AMR's NanoVNA 101 Class [copies at https://bit.ly/KJ6AMR].
The primary purpose is to make component measurements in the S11 mode with a NanoVNA.



The circuit schematic is very simple and includes an attenuator with a screw terminal block, in addition to a load and short configuration for calibration. The open is just the fixture with nothing connected. The user can connect the fixture to the NanoVNA through a male or female Edge Mount SMA connector. A male SMA allows direct connection to the S11 port.

There are many attenuator configurations that can be used, including none or 0 dB with a 0 Ohm resistor for R2. The most familiar would be a symmetrical 50 Ohm = Z_0 in / out with only two values. The parts list below provides an 8.2 dB configuration. Note the PCB was designed with 1206 pads but 0805 parts will fit and are more reasonably priced in 0.1% values.

8.25 dB Attenuator Symmetrical - 50 Ω = Z_0 in / out

Ref Des	Description	Mouser Part #
R1a,R3a	Thin Film Resistors - SMD 0805 1/8W 113 ohm 0.1% 25ppm	667-ERA-6AEB1130V
R2a	Thin Film Resistors - SMD 0805 1/8W 54.9 ohm 0.1% 25ppm	667-ERA-6AEB54R9V

All 50 Ohm Fixtures where DUT R_0 = 50 Ohms

R4a, R4b,	Thin Film Resistors - SMD 0805 1/8W 100 ohm 0.1% 25ppm	667-ERA-6AEB101V
Or R4a	Thin Film Resistors - SMD 0805 1/8W 49.9 ohm 0.1% 25ppm	667-ERA-6AEB49R9V

Note; If you are using a non 50 Ohm R_0 customized attenuator you will need to use off board S-O-L Calibration. If you know the R_0, then the value of R4 = R_0 and on board calibration S-O-L can be used.

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

When looking for resistor values for attenuators three web sites provide very easy to use on line calculators.

For two series or parallel resistors to achieve a specific value
http://mustcalculate.com/electronics/resistorfinder.php?r=50.25&es=E96

A Matching Pi Attenuator Calculator that handles Unsymmetrical Pi Attenuators and provides data and equations. https://chemandy.com/calculators/matching-pi-attenuator-calculator.htm

A useful alternative with multiple configurations. https://k7mem.com/Res_Attenuator.html

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