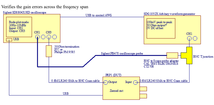
Measurements done on the PRP1 Power rail probe

This documents lists all the measurements that are done on the PRP1 for design characterization.
The measurements were done on TBD (at least two) separate units, results are published in folders.

1) Bode plot 10MHz

Verifies the gain errors across the frequency span



Equipment used:

- Siglent SDS6062X HD Oscilloscope
- Siglent SDG1032X HDD Generator

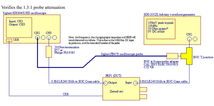
Settings:

- 10Hz to 10MHz
- C21 point
- 100mV peak to peak
- 0V offset
- Frequency mode: Linear
- DUT input C21
- DUT output C31
- Load 50 Ohm

Pass criteria: ±4B maximum deviation between minimum and maximum of the gain plot Note: Crossover frequency is ~100 KHz
Note: 1.3 x 6.577 or ~2dB

2) AC gain @ 10 MHz

Verifies the 1.5:1 probe attenuation



Equipment used:

- Siglent SDS6062X HD Oscilloscope
- Siglent SDG1032X HDD Generator

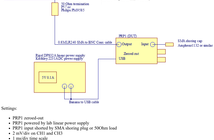
Settings on generator:

- 10MHz sine wave
- 100mV peak to peak
- 0V offset
- Load 50 Ohm

Pass criteria: 5% maximum deviation between RMS and Peak to peak value of CH1 and CH3

3) Noise measurement 20MHz BW 12 bit Scope

Verifies the noise figure of the PRP1



$$ENB_{Scope} = \sqrt{BANE^2 - BANE^2}$$

$$ENB\ total = CH\ measured\ ENB\ value$$

$$ENB\ 1 = Scope\ at\ PRP1\ pin\ setting$$

$$ENB\ 2 = Scope\ at\ oscilloscope\ +CH1\ measured\ ENB\ value$$

$$ENB_1 = \sqrt{ENB_{total}^2 - ENB_2^2}$$

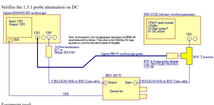
Settings:

- PRP1 zeroed-out
- PRP1 powered by lab linear power supply
- PRP1 input shorted by SMA shorting plug or 50Ohm load
- 2 mV/div on CH1 and CH3
- 1 microSec time scale
- 20MHz bandwidth limit

Pass criteria: (Noise = sqrt(CH3^2 - CH1^2)) < 5nV

4) DC gain

Verifies the 1.5:1 probe attenuation on DC



Equipment used:

- Siglent SDS6062X HD Oscilloscope
- Siglent SDG1032X HDD Generator

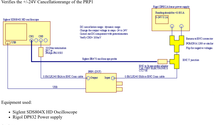
Settings:

- PRP1 zeroed out on Oscilloscope with 0V input
- 0.1 Hz square wave
- 100mV peak to peak
- 0V offset

Pass criteria: Measured 100mV peak to peak on the oscilloscopes CH1 and CH3
Two measurements are 3% within each other

5) Cancellation range +24V and -24V

Verifies the +/-24V Cancellationrange of the PRP1



Equipment used:

- Siglent SDS6062X HD Oscilloscope
- Rigol DP832 Power supply

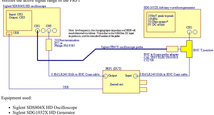
Settings:

- PRP1 zeroed out after each change of the voltage on power supply
- Set up 5V, 12V, 24V with 0.1A current limit on power supply
- Flip BNC to banana adapter and repeat measurement

Pass criteria: PRP1 can be adjusted to less than 100mV measured on the oscilloscope Output current of the power supply is less than 1mA

6) 500mV dynamic range

Verifies the active signal range of the PRP1



Equipment used:

- Siglent SDS6062X HD Oscilloscope
- Siglent SDG1032X HDD Generator

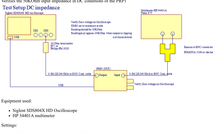
Settings:

- PRP1 zeroed out on Oscilloscope with 0V input
- 0.1 Hz square wave
- 500mV peak to peak
- 0V offset

Pass criteria: Measured 500mV peak to peak on the oscilloscope

7) DC input 50KOhm

Verifies the 50KOhm input impedance in DC conditions of the PRP1



Equipment used:

- Siglent SDS6062X HD Oscilloscope
- HP 34401A multimeter

Settings:

- PRP1 zeroed out on Oscilloscope with 0V input
- resistance measurement auto range

Pass criteria: 50KOhm +/- 2% measured on DMM

8)a VNA bandwidth 10MHz-3 GHz

Verifies the minimum 2 GHz bandwidth of the PRP1

Equipment used:

- LinVNA
- Rigol DP832 Power supply
- MegaQ VNA calibration kit
- LinVNA S0401 Coax cables

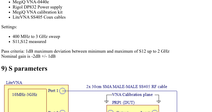
Settings:

- 10 MHz to 3 GHz sweep

Pass criteria: 1dB maximum deviation between minimum and maximum of S12 up to 2 GHz
Nominal gain is -2dB +/- 1dB
Note: 1.13 x 6.577 or -2dB

8)b VNA bandwidth 400MHz-3 GHz 2nd setup

Verifies the minimum 2 GHz bandwidth of the PRP1 with a more accurate VNA



Note: Minimum frequency setting of the VNA is 400 MHz
Equipment used:

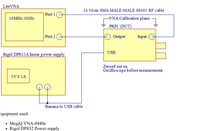
- MegaQ VNA S4401
- Rigol DP832 Power supply
- MegaQ VNA calibration kit
- LinVNA S0401 Coax cables

Settings:

- 400 MHz to 3 GHz sweep
- S11,S12 measured

Pass criteria: 1dB maximum deviation between minimum and maximum of S12 up to 2 GHz
Nominal gain is -2dB +/- 1dB

9) S parameters

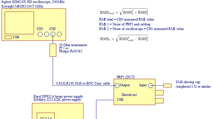


Equipment used:

- LinVNA
- Rigol DP832 Power supply
- MegaQ VNA calibration kit
- LinVNA S0401 Coax cables Settings:
- 10 MHz to 3 GHz sweep

Pass criteria: None S parameters provided for reference

10) 50 Ohm loading at high frequncy, VSWR



Equipment used:

- MegaQ VNA 4b
- Rigol DP832 Power supply
- MegaQ VNA calibration kit
- LinVNA S0401 Coax cables

Pass criteria: VSWR < 1.2 up to 2 GHz
This is equivalent to Return loss < -13dB
Or capacitive loading of ~ 0.5pF

11) Noise measurement 1GHz BW 8 bit scope

Verifies the high enqency noise content of the PRP1

$$ENB_{Scope} = \sqrt{BANE^2 - BANE^2}$$

$$ENB\ total = CH\ measured\ ENB\ value$$

$$ENB\ 1 = Scope\ at\ PRP1\ pin\ setting$$

$$ENB\ 2 = Scope\ at\ oscilloscope\ +CH1\ measured\ ENB\ value$$

$$ENB_1 = \sqrt{ENB_{total}^2 - ENB_2^2}$$

2 GHz scope should be used for ideal conditions, but I don't have access to one
Equipment used:

- Keysight MSOX 3104T Oscilloscope
- Keithley 2231A Power supply Settings:
- PRP1 zeroed-out
- PRP1 powered by lab linear power supply
- PRP1 input shorted by SMA shorting plug or 50Ohm load
- 2 mV/div on CH1 and CH3
- 1 microSec time scale
- 50 Ohm input on scope

Pass criteria: TBD

12) Power consumption

Equipment used:

- Siglent SDS6062X HD Oscilloscope
- Rigol DP832 Power supply

Settings:

- 5V, 0.1A
- PRP1 zeroed-out

Pass criteria: Power consumption less than 20mA