Nonlinear Microwave Power and Noise measurement and Analysis facility

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Under the support of this funding, UCLA are able to setup a complete high quality microwave power measurement system. Currently, this is the only system available in UCLA to perform on wafer automatic load pull measurement. Measurable frequency covers from 4GHz to 18GHz, driven power up to 20 Watts. By adding the noise equipment and sharing some equipment in this system, the system can perform low noise measurement. About ten technique papers have been published relating to this system so far.

Microwave power, Load Pull measurements

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Abstract: under the support of this funding, UCLA are able to setup a complete high quality microwave power measurement system. Currently, this is the only system available in UCLA to perform on wafer automatic load pull measurement. Measurable frequency covers from 4GHz to 18GHz, driven power up to 20 Watts. By adding the noise equipment and sharing some equipment in this system, the system can perform low noise measurement. About ten technique papers have been published relating to this system so far.

After carefully calibration, the facility is capable of measuring microwave devices with a frequency ranging from 6 GHz to 18GHz. Power up to 100 watts (for 7db gain device). Load pulling is automatic, computer controlled. Wafer chuck temperature controlled by a high efficiency heating exchanger, which can increase the temperature from 0°C to 200°C in seconds, and vice versa. This system facilitates BMDO GAMPA project research. System picture and some measurement results are attached as Fig1 to Fig. 5.

A complete System list:
Loadpull system:
1. HP83640B swept signal generator (10MHz – 40GHz) $53,743.96
2. LogiMetrics Amplifier; (6GHz to 18GHz, 20Watts) $15,978.78
3. Maury automatic tuner system: 0.8GHz – 18GHz) $2,598.00
4. HP8722ES vector spectrum analyzer (50MHz – 40GHz) $76,622.60
5. HP E4419B microwave power meter (50Mhz – 50GHz) $7,301.46
6. HP6654A system DC power supply (9A, 60V) $2,598.00
7. HP6653A system DC power supply (18A, 35V) $2,598.00
8. Karl Suss probe station: PA200 (8") $86,600.00
9. TRIO-TECH TC1000 temperature controller and recirculation system $52,652.80

Noise measurement system:
1. HP8970B noise figure meter $9,501.60
2. HP8971C noise figure test set $9,501.60
3. HP83711B (1-20GHz) synthesized CW generator $9,501.60

Supplies: $307,597.20

Please be noticed that two items listed above, Maury automatic tuner system: 0.8GHz – 18GHz) and HP83711B (1-20GHz) synthesized CW generator were purchased under another funding in order to complete this system, which cost another roughly $120,000.
Published publications related to this facility are listed below:


Fig1. Picture of the Nonlinear Microwave Power and Noise measurement system: Chuck temperature controlling range: 0C to 200C. Auto tuning frequency range up to 18 GHz, limited by Maury automatic tuner. Vector spectrum analyzer frequency ranges from 50Mhz to 40 GHz. Input power can be up to 20 Watts from 5 GHz to 18 GHz. Noise equipment are not shown above. Whole system is put on a N2 pressure gas floating optical table for vibration protection.

Measurement results examples:
Fig 2. Microwave nonlinear power measurement system

Fig 3. Source and Load S parameters change as frequency sweeping

Fig 4. Load pull results to search for optimum loading point to get maximum output power

Fig 5. Power sweep after source and load pull. Gain, efficiency and other interested parameters are also plotted