



## RESEARCH ENVIRONMENT

### FACILITY

#### Microwave/Millimeter-wave Circuits Lab (R506 ~ R507)

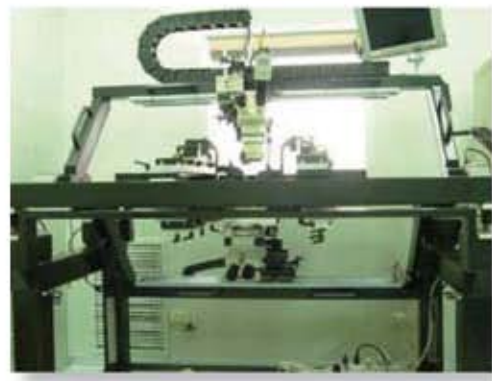
The facilities for microwave and millimeter-wave circuit measurements are available in a clean room. The probe stations in this laboratory are used for the on-wafer chip testing. Agilent 50-GHz vector network analyzer which can be extended up to 170 GHz by the millimeter-wave modules and Anritsu 40 MHz to 65 GHz four-port vector analyzer are available for S-parameter measurements. Noise figure analyzer, spectrum analyzers, signal generators, load-pull systems, and oscilloscopes are also provided in this laboratory. In addition, we have Agilent precision semiconductor parameter analyzer and Auriga pulsed-IV system for the transistor dc characteristics testing. This laboratory provides the world-class measurement capability for the microwave and millimeter-wave circuits.



Agilent vector network analyzer

#### Packaging Lab (R505)

The facilities for microwave and millimeter-wave circuit measurements are available in a temperature, moisture and dust controlled room. The probe stations in this laboratory are used for packaging substrate and PCB board testing. An Agilent 4 port network analyzer up to 20GHz and two 2-port VNA up to 67 GHz can make scattering matrix measurement with probe stations. RF impedance/material analyzer, oscilloscopes, spectrum analyzer, and signal generator are supplied in this laboratory. One Cascade Summit 9000 probe station is used for packaging substrate measurement. A two-sided probe station is designed for dual-side probing of PCB board and packaging



Dual-side probe station

substrate. This lab has a wire bonder and a flip-chip bonder to provide two most common level one interconnect between die and substrate. The wire bonder can do either ball bond or wedge bond and the

flip-chip bonder can provide thermal compressing flip-chip bonding.

### Electromagnetic Design for Advanced Packaging Lab (R533)

The facilities for signal integrity (SI), power integrity (PI), and electromagnetic compatibility (EMC) research are all included in this Lab. A Tektronix Time-domain Reflectometry (TDR) Analyzer with two 12ps/9ns rise time signal source modules is available for signal integrity measurement. A turn-key measurement solution for far field electromagnetic interference (EMI) and susceptibility (EMS) measurement is established based on a GTEM cell chamber environment and near field EM measurement solution is established based on Hitachi EMV-200 test system. They mainly include a spectrum analyzer (R&S FSP40) covering from 800MHz to 40GHz, 20W power amplifier (AR 20ST) covering from 800MHz to 18GHz, arbitrary waveform generator (Tektronix AWG7122B) up to 12GS/s, and other accessories such as power meter, preamplifier, calibration probes, and cables. These facilities provide an excellent environment for the electromagnetic design and integration research of advanced package and system on package (SoP).

### Anechoic Chamber and Antenna Lab (R527)

The Group has two anechoic chambers: the main chamber is for general purpose with operating frequency range 1-18 GHz, while the millimeter wave chamber is for 40-65 GHz operation. The main chamber is equipped with a vector analyzer Agilent 8722ES and a PC-based 3-axis motion controller that may position the antenna under test in an arbitrary direction for the 3D antenna patterns measurement. In addition, the position controller may also precisely control the source antenna for two orthogonal components enabling the system for the circular polarization measurement. The millimeter wave chamber is equipped with an Agilent PNA E8361A (10MHz to 67GHz) and a 4-axis position controller. Besides the aforementioned 3-axis control for 3D and CP measurements, the 4-th axis is for varying the distance between the antennas empowering the system for the precise calibration on the antenna gain at millimeter wave frequencies where the errors due to the phase center uncertainty is significant.



GTEM 500



(top to bottom)  
Probe Laser Interface, Boonton 4231,  
ROHDE&SCHWARZ FSP40,  
DC Power Supply AR Model 20ST 1G18A



Main chamber (6x6x10 m<sup>3</sup>)



Millimeter-wave chamber (1.3x1.3x1.5 m<sup>3</sup>)