UNIVERSITY OF NOTRE DAME | RESEARCH

University of Notre Dame Wideband Test Facility



The Wideband Test Facility (WBTF), funded by the Microelectronics Commons program through the Silicon Crossroads Microelectronics Commons Hub, provides capabilities to enable advancements in satellite communications, radar, directed energy, and wireless communications through advanced measurement capabilities for high-frequency transistors, circuits, and antennas. Opened in the summer of 2025, the facility builds on Notre Dame's existing expertise in high-frequency device and circuit testing to empower and advance the development of state-of-the-art wideband electronic systems and antennas.

Component-level electrical analysis up to 220 GHz

High-frequency device testing assesses the performance of nanometer-scale semiconductor devices, which are essential elements of everything from high-end computer chips, to wireless communication systems, to radar and sensing systems. At the WBTF, on-wafer testing of high-speed transistors and circuits can be conducted at frequencies up to 220 Gigahertz (GHz). The ability to test chips at such high frequencies allows for the development of more efficient and reliable device components with unmatched performance.

Learn More

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Key Measurement	Frequencies	Testing Outcome
Small-signal characterization	9 kHz - 220 GHz	▪ Device speed, frequency response, and gain ▪ Data for model development and circuit design
Large-signal characterization: passive, active, and hybrid-active load pull configurations	Ka-band: 18-40 GHz W-band: 75-110 GHz D-band: 110-170 GHz G-band: 140-220 GHz	▪ Maximum output power, gain compression, intermodulation distortion ▪ Impedance tuning conditions to optimize device efficiency, minimize distortion, or maximize output power
Noise characterization	Ka-band: 18-40 GHz Q-band: 33-50 GHz W-band: 75-110 GHz D-band: 110-170 GHz G-band: 140-220 GHz	▪ Device-level noise contributions to circuit performance ▪ Impedance tuning conditions to reach noise, gain, and distortion goals

WIDEBAND TESTING AT NOTRE DAME

Antenna characterization up to 220 GHz

Advanced over-the-air antenna measurements are enabled by the facility's spherical near field scanning capabilities, supporting both on-chip and antenna-in-package testing. This, coupled with a test area surrounded by anechoic foam to minimize external interferences, allows for the accurate measurement of the sending and receiving of signals by antennas, especially small ones, at frequencies from 4 GHz up to 220 GHz.

Key Operation	System Configuration	Frequncies	Key Measurements
Antenna-on-chip testing	Hemispherical scan on a custom open-top probe station	▪ 4 to 220 GHz* *Support for testing at such high frequencies is a distinguishing characteristic of the facility.	**Frequency domain** ▪ Radiation patterns: spherical, near-field, and far-field ▪ Effective isotropic radiated power (EIRP) ▪ Frequency converters (IF-to-RF, RF-to-RF) **Time domain** ▪ Error-vector magnitude (EVM) ▪ Coexistence: 5G NR, 6G-candidate, radar, and SATCOM waveforms
Antenna-in-package testing	All-around spherical scan		

Impact

By enriching the nation's research infrastructure through both collaborations and technical capabilities, the Wideband Test Facility is an important asset to the nation's security through the development, testing, and advancement of new communication technologies.





