NPL

National Physical Laboratory

Electromagnetic Measurement Capabilities and Facilities

We support UK technological innovation by providing state-of-the-art, accredited traceable electromagnetic measurements and related research and development

npl.co.uk/electromagnetics

Over-the-Air Measurements

- State-of-the-art antenna test facilities including a large extrapolation range
- Antenna gain and pattern measurements up to 220 GHz
- Power flux density testing of field probes up to 75 GHz

Typical devices we measure:

Antenna, wireless transceiver, radome and other over-the-air components

Communication Systems Testbeds

- State-of-the-art R&D testbeds:
- 5G beamforming testbed around 26GHz
- Terahertz channel sounder up to 750 GHz for measurement trials up to 600 metres
- Terahertz future communications testbed around 300 GHz
- Successfully transmitted 120 Gbps using 64 QAM over 3 metres

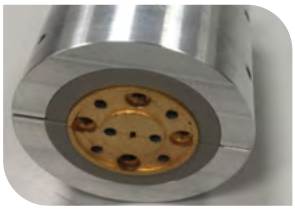
Typical devices/systems we measure:

Smart antennas, wireless transceiver and other over-the-air components

Connectorised Device Characterisation

- S-parameters measurements
  - Coaxial devices
    - 2-ports up to 90 GHz
    - 4-ports up to 67 GHz
    - Attenuation measurements up to 40 GHz
  - Waveguide devices
    - 2-port devices up to 750 GHz
    - Attenuation measurements up to 110 GHz
- Power measurements
  - Coaxial devices up to 67 GHz
  - Waveguide devices up to 170 GHz

- Development and supply of primary power measurement systems and transfer systems

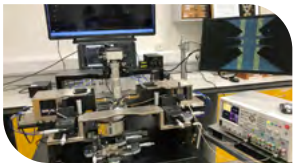


Typical devices we measure:

Passive and active coaxial and waveguide devices, calibration and verification standards

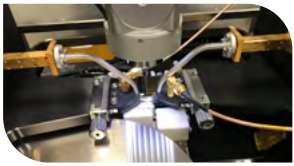
On-wafer Device Characterisation

- State-of-the-art probe station and probes enabling measurements up to 750 GHz
- Extensive knowledge and experience in de-embedding and calibration



Typical devices we measure:

GaAs / GaN transistors, MMIC interconnects, on-chip antenna, planar passive circuits



Cryogenic Device Characterisation

- State-of-the-art cryostats with NPL cryogenic calibration unit enabling measurements down to 15 milli-kelvin
- R&D activities on characterisation of on-wafer devices at 4 kelvin

Typical devices we measure:

Coaxial connectorized devices, on-chip devices and substrate materials

Active and Non-Linear Characterisation

- Power dependent S-parameter measurements
- Load-pull measurements
- X-parameter measurements
- Measurement uncertainties for active devices
- Non-linear microwave measurement and modelling
- Amplifier noise measurements

Typical devices we measure:

Field-effect transistors, packaged and connectorized amplifiers

Material Characterisation

- Characterisation of material properties such as permittivity and loss
  - high resolution measurements up to 750 GHz
  - 0.1 GHz resolution up to 2 THz
  - 5 GHz resolution up to 6 THz and 2D imaging with spatial resolution of 0.5 mm

Typical devices we measure:

Ceramics, composites, liquids, foodstuffs and magnetic materials

Meeting the requirements of…

- Semiconductor industry
- Telecommunications industry
- Quantum technologies
- Defence and space industry

Support for industry

- Measurement services (UKAS accredited to ISO 17025)
- UK businesses can access cutting-edge R&D expertise and work with scientists and research facilities at NPL through:
- Analysis for Innovation (A4I) programme
- Measurement for Quantum (M4Q) programme
- Measurement for Business (M4B) programme

For more info on any of our capabilities:
measurement_services@npl.co.uk

Support for academia

NPL is home to the EPSRC THz facility, serving the UK academic community. Through EPSRC funding, you can apply to use NPL's THz facilities and services.

For more info, please visit:
npl.co.uk/electromagnetics/terahertz-radiation/epsrc-facility