

**JOINT DCKTN & CAMBRIDGE WIRELESS's TESTING SIG
EXCLUSIVE NPL's TOURS
25th February 2010**

Tour 1 – The Traditional Areas:

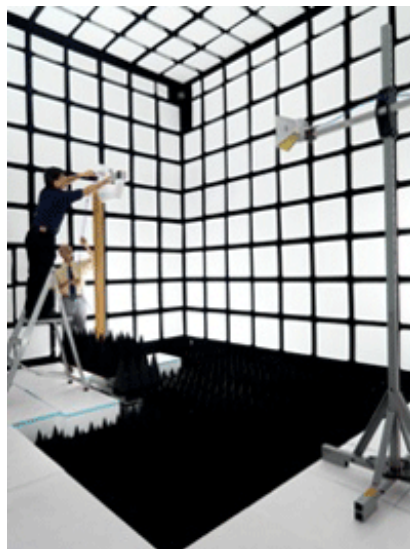
- Anechoic Chamber (OEFS)
This wedge-lined room provides a simulated free-field environment, suitable for testing of instruments and artefacts where such conditions are required. Typically measurements can be performed from 125 Hz up to 20 kHz
- Resonant Microwave Chamber
- Waveforms & Primary Standards
- Interference

Tour 2 - Applications and Support:

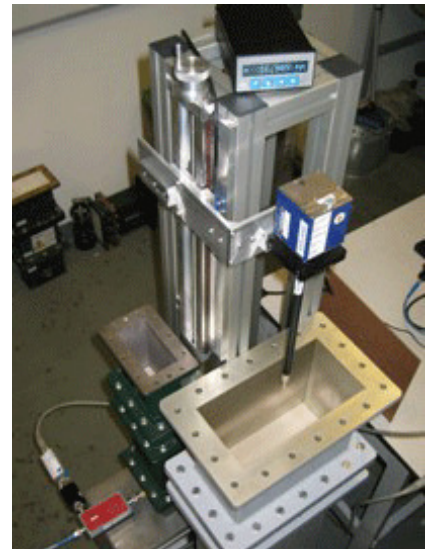
- Wireless Sensors for Structural Health Monitoring
- Time Standards and Time Signals
- Earth Observation
- Primary Temperature Standard Development



SAR Measurement system
for body mounted devices



Small Antenna Radiated Testing
SMART chamber



SAR probe calibration
system

The National Physical Laboratory Company Profile

About NPL – UK's National Measurement Institute

The National Physical Laboratory (NPL) is one of the UK's leading science and research facilities and a centre of excellence in developing and applying the most accurate measurement standards. These standards underpin an infrastructure of traceability throughout the UK and the world that ensures accuracy and consistency, which:

- improves productivity and quality;
- underpins consumer confidence and trade;
- and is vital to innovation.

Part of NPL's remit is to maintain one of the world's most comprehensive national capabilities for measuring electromagnetic quantities across the spectrum from DC via RF and microwave up to terahertz frequencies and beyond. NPL's national electromagnetic standards form the basis of a UK traceability chain that ensures all companies, institutions and research labs in the UK can have access to accurate reliable standards that are constantly updated to ensure their continued relevance.

As part of NPL's role to support UK technological innovation, the laboratory provides consultancy on electromagnetic measurement and supports R & D in areas that are important for the national economy. At RF and microwave frequencies the laboratory has excellent research facilities for complex waveform measurement and for developing new capability in wireless communications. The laboratory is one of only a few in the world with expertise in metrology to support exposure standards of field strength and specific absorption rate.

<http://www.npl.co.uk/about/>

Wireless Communications

NPL's wireless communications research group aims to develop new metrology for emerging applications in the communication markets covering a range of topics grouped into four main research areas:

- accurate measurement and characterisation of communications waveforms, traceable to primary standards;
- measurements of small and smart antennas;
- research into wireless propagation and interference effects;
- characterisation of wireless sensor networks and the associated uncertainty of system measurands.

NPL's wireless communications research covers both theoretical and experimental aspects of wireless, optical and antenna systems. Research generally covers either:

- measurements relating to individual components or subsystems of the physical layer of a communications system; or
- whole system performance of a system or sensor network.

Particular areas of interest include:

- quantification of the resilience and reliability of wireless networks in a dense radio environment;
- signal propagation and interference;
- characterisation of small and smart antennas;
- measurements of waveforms and parameters such as jitter and EVM.

<http://www.npl.co.uk/electromagnetics/wireless-communications/>

RF & Microwave

NPL runs one of the world's most comprehensive capabilities for traceable measurement of basic electromagnetic parameters at RF and Microwave frequencies. This is centred on the frequency range from 1 MHz to 110 GHz, but with many extensions at either end, e.g. up to THz frequencies. The national standards and measurement capability are maintained specifically to support UK industry, engineers and scientists.

<http://www.npl.co.uk/electromagnetics/rf-microwave/>

Electromagnetic materials

Electromagnetic (EM) industries rely heavily upon high performance materials that are designed to support, direct, condition or absorb EM fields. In a wide range of applications, EM fields also come into contact with other natural substances, for example: earth, water, and biological tissues. Full characterization of all of these material interactions is essential for optimal design of instrumentation. This can only be achieved with a knowledge of the intrinsic dielectric and magnetic properties of the materials involved: typically their complex dielectric permittivity and magnetic permeability, but also related parameters such as anisotropy, susceptibility and coercivity. NPL has a long history of successful EM material metrology and is actively developing its capabilities here to ensure that they meet the requirements of modern technology. Measurement research is being tackled on a broad front:

- provision of materials measurement solutions in key bands across the whole spectrum: DC to THz and above. Special measurement techniques are being developed for active functional materials, including piezoelectric, ferroelectric and multiferroic materials;
- measurements are required at ever smaller scales to allow faster, lighter, more compact and more energy efficient solutions to be developed in the electronics industries: traceable methods for probing of EM material properties at micro to nano-scales are being developed to meet this need and to characterise the properties of thin films;
- there are growing requirements for measurements to be undertaken in situ in harsh environments: for example high temperature and high pressure measurements on magnetic materials are needed to improve electrical power generation and similar measurements on dielectric materials are required to improve efficacy of microwave processing.

Public concern over increasing exposure to broadcast RF and microwave signals has prompted widespread research and a requirement for traceable standards to quantify exposure. NPL has an ongoing research activity in this field. Dielectric measurement solutions are essential here as human tissues have their own dielectric response to EM fields.

<http://www.npl.co.uk/electromagnetics/electromagnetic-materials/>

Technology Transfer

RF and Microwave metrologists at NPL have unique knowledge that can be invaluable when working with industrial collaborators and end-users to help remove measurement barriers to innovation. This experience is passed on in many ways, e.g. through collaborations, workshops, Electromagnetic Measurement Network activities and consultancies.

Measurement for Innovators

NPL has a long and successful history of working with industry and academia on a variety of problems relating to wireless communications. In addition to project collaborations there is currently a Measurement For Innovators (MFI) scheme for encouraging innovation, which provides a link between industry and the expertise of the UK's NMIs at shared cost.

<http://www.npl.co.uk/working-with-npl/measurement-for-innovators/measurement-for-innovators>

NPL facilities

We maintain a number of major facilities that can be accessed by industry and academia. These include:

- Spherical Near-field Range housed in a temperature controlled 7.5 m by 7.5 m by 15 m anechoic chamber;
- 6.55 x 5.85 x 3.50 m Reverberation Chamber;
- 60 x 30 m Open Area Test Site;
- EMC antenna calibration range, GTEM cells and several other anechoic chambers;
- fully and partially screened rooms housing unique guided wave standards and equipment;
- a comprehensive range of network analysers (to 110 GHz);
- digital sampling oscilloscopes (to 80 GHz) traceable to an electro-optic sampling system (one of three worldwide);
- an electro-optic system for precise EM field mapping and measurements of small antenna characteristics;
- an automated probe station for on-wafer measurements.

Knowledge and Innovation Centre

NPL's Knowledge and Innovation Centre provides business accommodation for companies who rely on measurement for competitive advantage. Located at NPL, near to Heathrow in south-west London, it gives managed access to NPL's expertise, laboratories and capital equipment.

http://projects.npl.co.uk/innovation_centre/

SMART Chamber

SMART anechoic chamber 7.15 m long, 6.25 m high & 6.25 m wide for measuring electrically small antennas non-invasively in the frequency range from 400 MHz to 40 GHz.