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Case Study

Supply and Installation of a Millimetre-Wave Measurement Facility to the University of Birmingham

Working in partnership with

ANTENNA SYSTEMS SOLUTIONS

UNIVERSITY OF BIRMINGHAM

Introduction

The University of Birmingham recently completed construction of a new building for the School of Engineering which includes an Anechoic Chamber located on the third floor for use by the Communication and Sensing Research Group. The chamber lacked the hardware (e.g. mechanical stages, RF cables, rotary joints, masts/pedestals etc) and control software required to carry out antenna measurements.

The measurement facility was required to support three primary modes of measurement across the frequency range 1 GHz to 330 GHz:

- Far-field (FF) measurement
- Spherical near-field (SNF) measurement
- Monostatic and bistatic electromagnetic scattering measurement

Solution

Working closely with the University of Birmingham and ASYSOL, APC Technology Group provided a customised antenna measurement solution to meet the research requirements. Leveraging ASYSOL's expertise in antenna measurement system design and equipment integration, we supplied a range of mechanical positioners, control components, antennas and RF equipment that enabled the university to perform the following measurements:

- Direct FF measurements of all main antenna parameters across a broad frequency range (1 GHz - 330 GHz). This included a 4-axis positioner for an antenna under test (AUT) and a stationary probe mast with polarisation positioner, corresponding control and RF components, and system operation computer university's with data acquisition and processing software. Most of the provided components were customised to ensure compatibility with the existing anechoic chamber and providing the precision and automation necessary for the research carried by the university.
- The above setup can easily be reconfigured to perform SNF measurements, by adjusting the distance between the AUT and probe, and using specially designed SNF probes, ASYSOL series ASY-CWG-S/D Corrugated Waveguide Feeds covering 1-18 GHz, and series ASY-CHA-S Conical Horn Antennas covering 18-330 GHz. SNF-FF transformation module was also provided as part of the data processing software.
- Electromagnetic Bistatic Scattering Measurement setup included a custom-designed high-accuracy curved circular track with 190 degrees travel range and 4m radius, which carried another probe mast with polarization positioner. An accurate azimuth positioner holding a foam column for the device under test (DUT), and the stationary probe mast from the FF/SNF setup complement the setup, which also includes a set of pyramidal horn pairs covering 1-330 GHz.

Software solution provided

The university's measurement processes were streamlined with ASYSOL's user-friendly software. Featuring an intuitive Graphical User Interface, this software package includes all main functionalities required for antenna tests and scattering tests defining various measurement configurations, parameter specification, data acquisition, and advanced processing (including near-field to far-field transformations), while offering data export in several formats and integration with other data processing software packages.

Results

All equipment was integrated with the university's existing anechoic chamber, providing a comprehensive and efficient testing environment. As a result, the university now possesses a 3-in-1 state-of-the-art integrated measurement environment enabling:

- Fully automated antenna characterisation through far-field and spherical near-field measurements.
- Characterisation of bistatic scattering from EM structures (metasurfaces, drones, etc.) and materials.
- Simultaneous measurement of antennas and intelligent reflecting surfaces, where meaningful de-embedding is not feasible.

The expanded frequency range now allows the university to test antennas up to 330 GHz, opening up new research opportunities in areas such as 5G/6G and satellite communications.

This comprehensive solution fully addressed Birmingham University's need for enhancing its ability to provide an advanced versatile Electromagnetic Characterisation Suite used in industrial and academic research, as well as in development projects, focusing on the issues of accuracy, stability, repeatability and reproducibility of measurements.

"We are delighted with the unique, state-of-the-art multi-modal anechoic chamber which ASYSOL and APC have delivered to the Communications and Sensing research groups at the University of Birmingham. Both companies engaged with the academic team to convert our outline design to a fully customised specification, and worked seamlessly with us to ensure the smooth delivery of a complex and ambitious project, culminating in an outstanding facility."

Costas Constantinou | Professor of Communication Electrodynamics, University of Birmingham

"We are pleased to highlight the successful collaboration between ASYSOL and APC, our esteemed representative. APC played a crucial role in managing and facilitating communication between ASYSOL and the end client, the University of Birmingham. This partnership proved to be highly effective, leading to the successful execution of the project. The University is now deeply proud and satisfied with the system we provided, which has exceeded their expectations. This achievement underscores the strength of our cooperation and the commitment of both teams to deliver exceptional results."

Javi Portilla | Business Development Director, Antenna Systems Solutions (ASYSOL)

To find out more about our turnkey project management and how we can support with the design, installation and setup of bespoke test systems and environments, start a conversation with an APC test expert

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