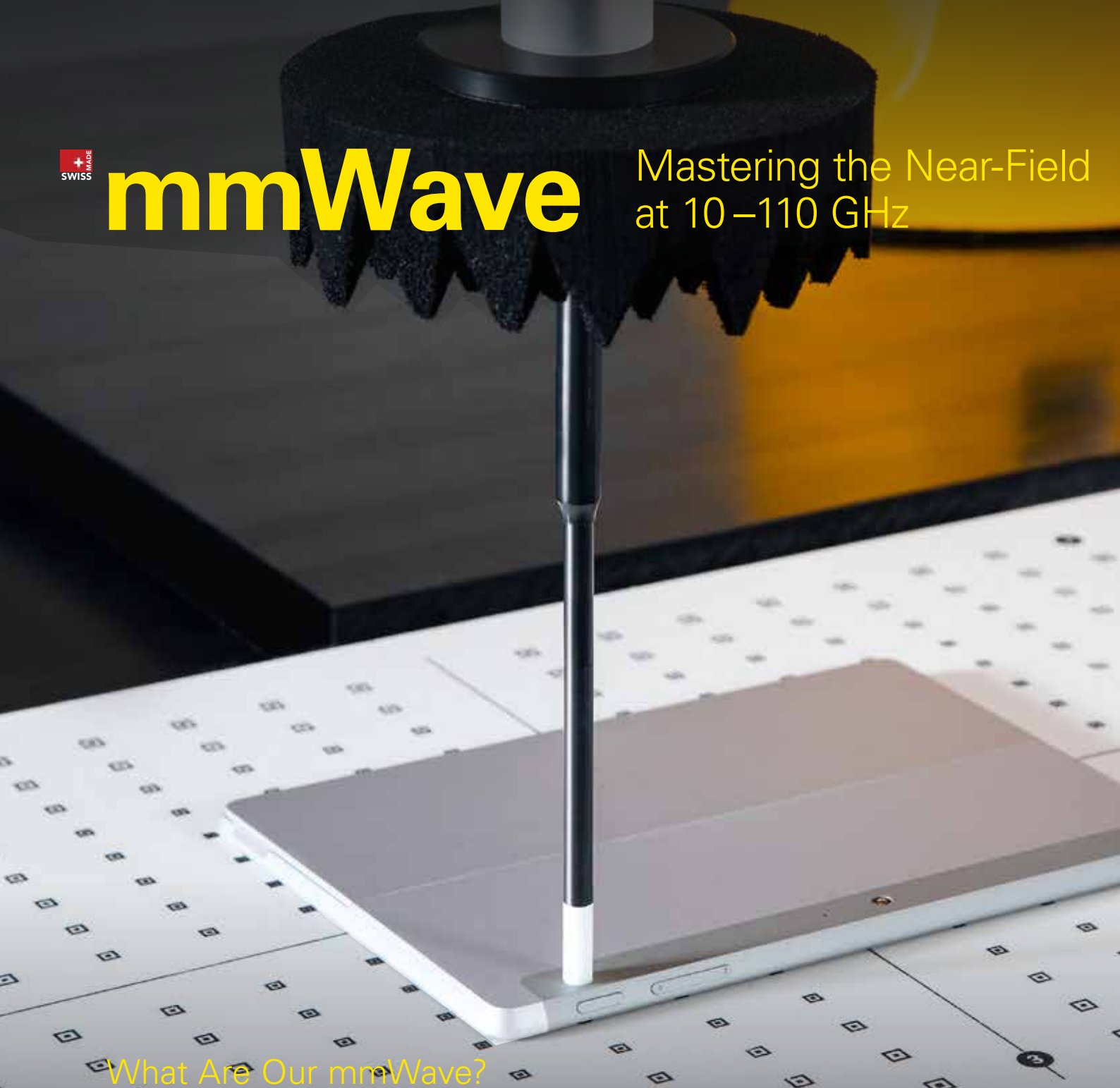

mmWave

Mastering the Near-Field at 10 – 110 GHz

What Are Our mmWave?

SPEAG's comprehensive portfolio of solutions supports the wireless industry in design, optimization, performance, and regulatory compliance testing of emerging transmitters operating in the mmWave frequency range from 6 – 110 GHz. Our DASY6 and ICEy systems are the most advanced high-resolution, high-precision near-field measurement instruments worldwide.

The 5G Toolkit and powerful evaluators and postprocessors of SEMCAD X and Sim4Life provide many unique R&D features for development and analysis of body-mounted 5G transmitters.
In addition, SPEAG's research partner, the IT'IS Foundation, offers customized research from design to safety validation of mmWave devices.

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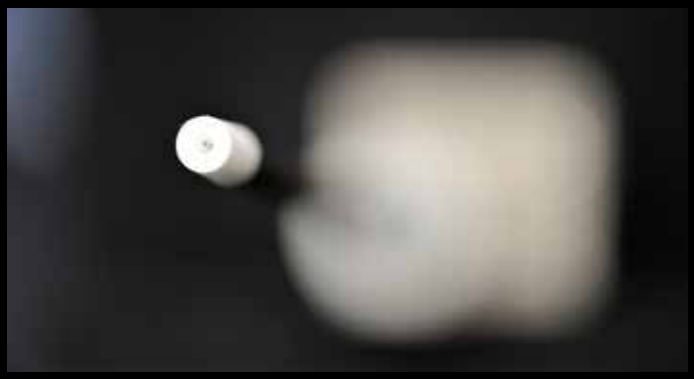
mmWave Mastering the Near-Field at 10 – 110 GHz

EUmmWVx Probe

The EUmmWVx probe is designed for precise interference-free measurement of the close near-field in the mmWave-range. The two high precision diode-loaded sensors printed on a glass substrate (0.9 × 0.18 × 20 mm) are protected by high density foam. The specifications are:

- Frequency range: 750 MHz – 110 GHz
- Dynamic range: < 20 – 3,000 V/m (with PRE-10 to 10,000 V/m)
- Deviation from hemispherical isotropy: < 0.5 dB at 60 GHz
- Linearity: < 0.2 dB
- Compatibility: DASY6 Module mmWave V2.0+ and ICEy V2.0+
- ISO17025 accredited calibration

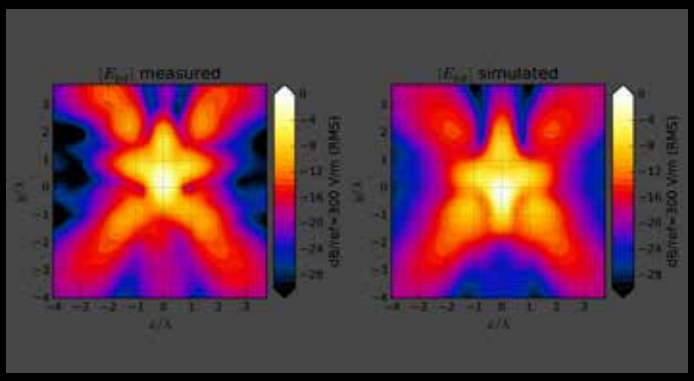


Close-up of the novel EUmmWV2 probe tip, revealing the sensors atop a glass substrate and surrounded by high-density foam.

cDASY6 Module mmWave / ICEy mmWave

The cDASY6 Module mmWave / ICEy mmWave for near-field evaluations (> 6 GHz) are fully compatible with IEC/IEEE 63195 and other national / international regulations. The modules offer the following features:

- Novel and powerful algorithms for total field reconstruction
- Power density averaging areas (square, circular, cubical, and spherical) according to IEC/IEEE 63195
- Small, well-characterized, and validated uncertainty
- User-friendly graphical user interface
- Flexible and automated scans
- Visualization of vector fields, time-/spatially averaged values
- Automatic device-under-test (DUT) 3D surface reconstruction with field overlay on the 3D DUT model (ICEy only)
- Option FTE: evaluation on any surface at any distance with an advanced forward transformation method
- Option MEO: automated evaluation of the maximum exposure anywhere for beam-forming antenna structure (MIMO)
- Option API: automation of measurement workflow (DASY6 only)

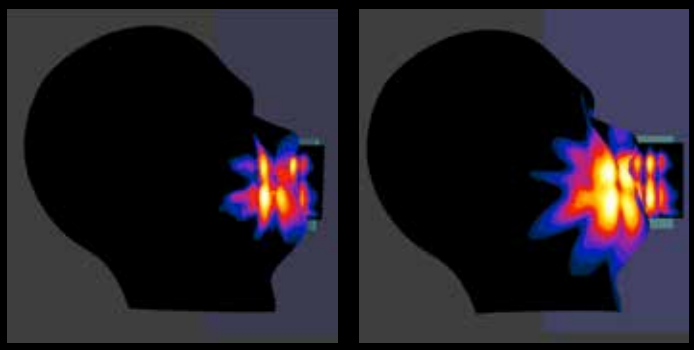


Measured E-field (left) compared to the simulations (right) at 30 GHz.

5G Toolkit of SEMCAD X / Sim4Life

The 5G Toolkit of SEMCAD X / Sim4Life offers

- Shared post-processing and full interoperability with cDASY6 Module mmWave, for straightforward and reliable comparisons
- Dedicated, intuitive modelling tools to create or import CAD-models of phased arrays and to setup HPC-empowered finite-difference time-domain method (FDTD) simulations
- Efficient array-factor far-field evaluators for fast prototyping
- Predefined phase/amplitude excitation patterns to simulate arrays operating under various conditions
- Latest surface-averaged power density evaluators, fully compatible with IEC/IEEE 63195 (shared with DASY/ICEY)
- Maximum exposure evaluator for beam-forming antenna arrays, implementing Annex C of IEC/IEEE 63195-2
- Compatible with circuit design software tools for analysis and further optimization of feeding network effects
- Parameter sweeps, optimizer to automate design workflows
- Generalized Huygens approach (multi-scale, micro-macro)
- MIMO module to analyze diversity performance
- Fastest, most robust FDTD, FEM, and MM solvers; CPU-GPU, AXE/CUDA, latest NVIDIA VOLTA/TURING architectures

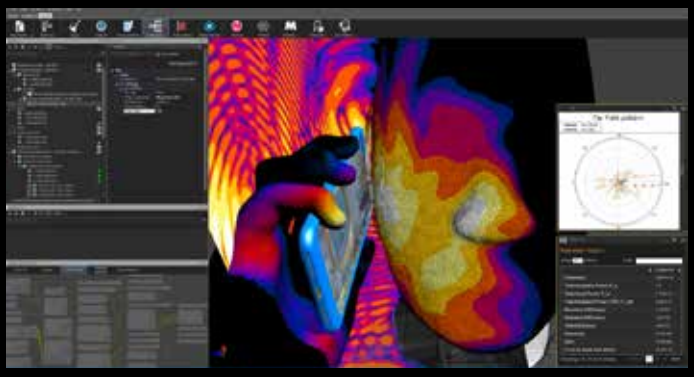


Reconstructed power density on the surface of the SAM head using Option FTE for touch and tilt device position.

5G Customized Research

Our research partner, the IT'IS Foundation, provides customized research for advanced transmitter design, exposure assessments, and regulatory submissions.

For further information, contact customized@itis.swiss.



Powerful 5G simulation toolbox in Sim4Life: Design, optimization, and analysis of a complex MIMO antennas embedded in the phone case.

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