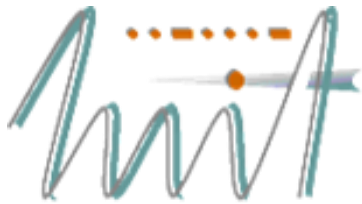


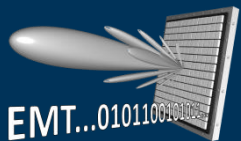
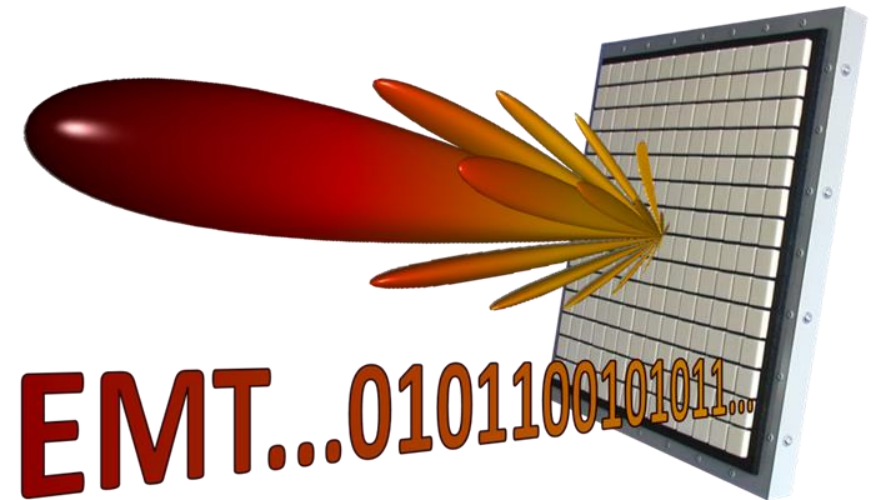
# Ilmenau University of Technology

Germany

## Institute of Information Technology



Reiner S. Thomä



Electronic Measurement  
Research Lab

# Multidimensional MIMO Sounding

- Full MIMO: joint Tx/Rx, azimuth&elevation, delay and Doppler, polarization
- High resolution DoA, DoD, ToA, Doppler parameter estimation
- Big arrays (massive MIMO, real-time and synthetic aperture)
- Realistic scenarios (e.g. cellular, C2X time variant)
- Frequencies up to 6 GHz, bandwidth 100 MHz, up to 40 W Tx power, long sustained recording

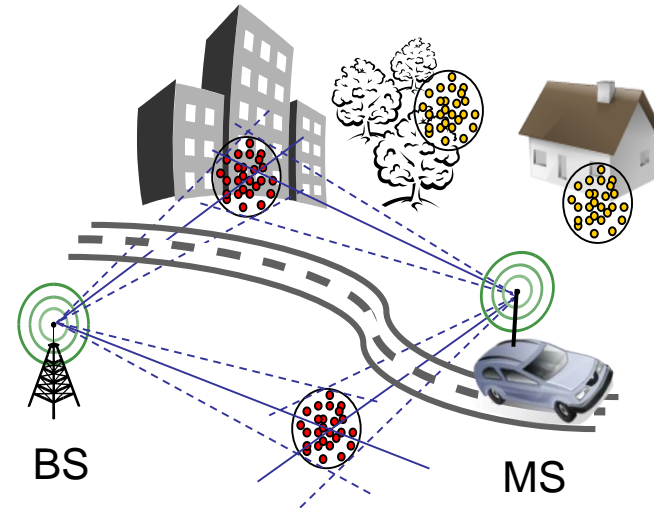
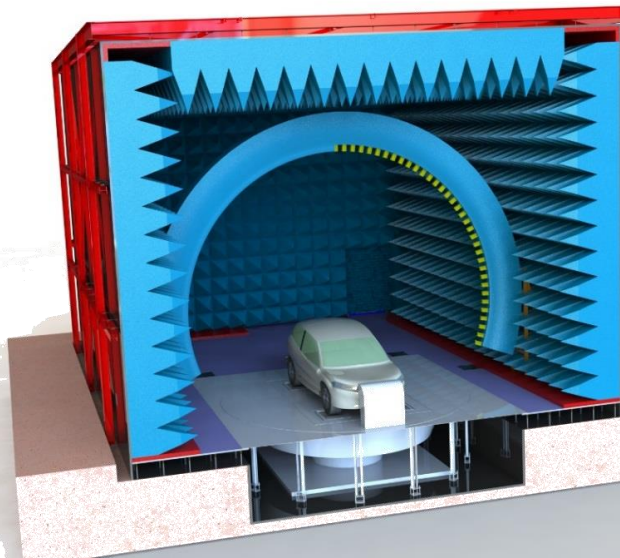


2013



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# Real-life Testing of C2X in Virtual Electromagnetic Environments




## OTA testing of installed performance in Virtual Electromagnetic Environments

- authentic test environment for C2C and C2X
- repeatable emulation of multipath and multiuser environments
- realistic traffic scenarios (“car and driver in the loop”)
- chamber size 16x12x9 m<sup>3</sup>, roller dynamometer

## Real-time channel emulator

- Frequency range: 700...3000 (6000) MHz
- Bandwidth: 80 MHz, 12 x 32 Channels
- up- and downlink, interference

Applicable also for cognitive radio testing

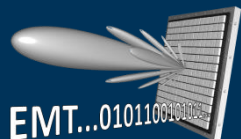
  
*Over-The-Air  
in a Virtual  
Electromagnetic Environment*

THÜRINGER  
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MOBILITÄT

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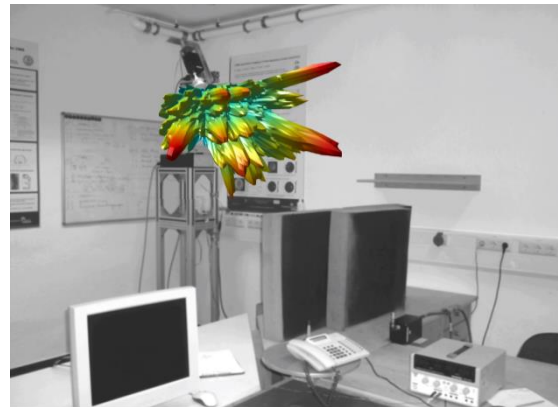
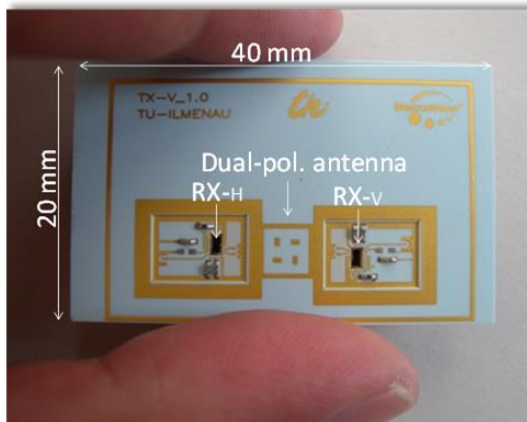
  
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# mm-Wave Sounding and Mixed RF Signal Processing

- Usage of huge bandwidth at mm-wave frequencies between ca. 10 and 80 GHz
- Backhauling, access in dense environments, public hot spots, public transport, industrial M2M
- Shadowing and path loss mitigation, huge arrays, polarization matching
- Low energy mixed signal polarimetric-space-time signal processing

Experience with RF packageing (SiGe-chips, LTCC, antenna arrays)



Experience with 60 GHz (directional&polarimetric measurement, real-time shadowing, macro diversity)

