



MIC MRA WORKSHOP 2015

Fast SAR Trends, Standardization & Regulatory Status

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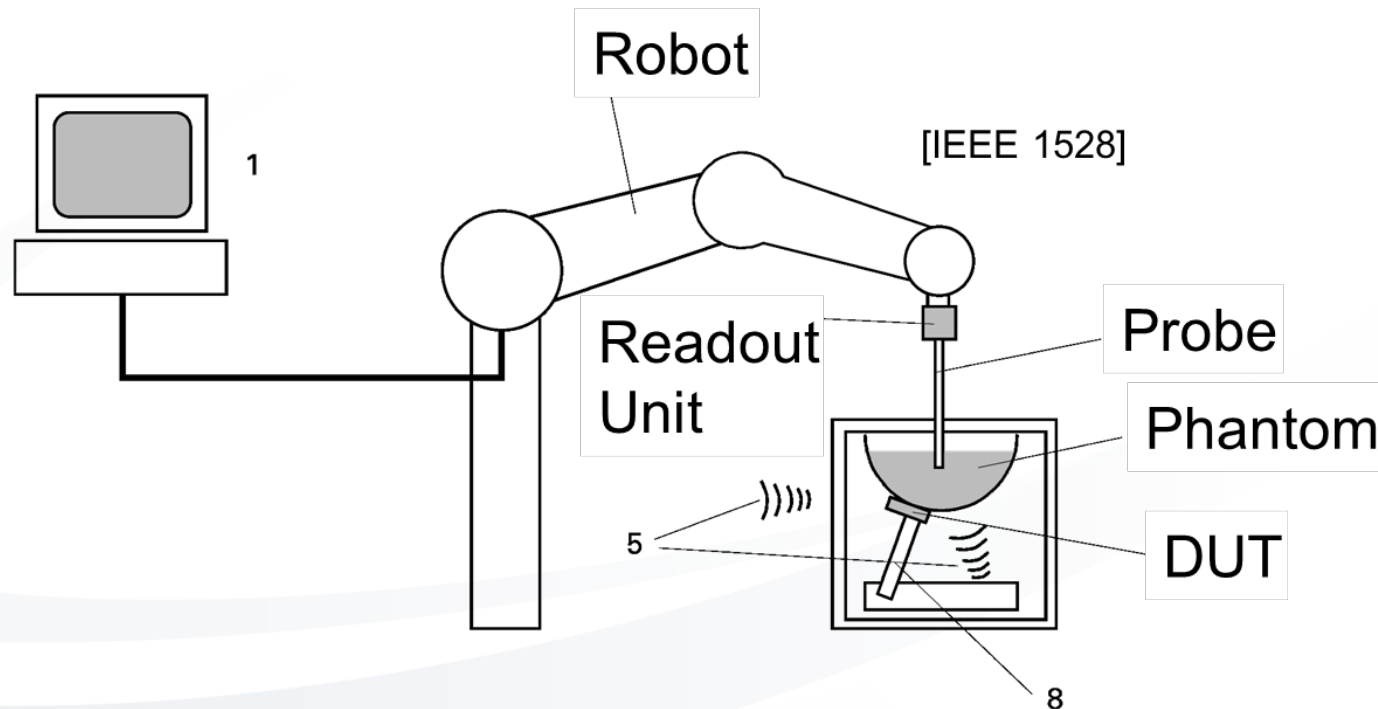


> New Wireless Technologies & Increase in SAR Testing Matrix

- **Wireless devices with more complex and integrated design:** multiple bands, LTE, dynamic antenna tuning, AsDiv, proximity sensors, simultaneous multi-frequency, MIMO
- **Increase in the SAR test matrix in the past 15 years:** 5x more bands, 4x more communication systems, 2x as many antennas
- **40-fold increase in SAR test conditions wrt older dual-band handsets**

> No Progress in Legacy SAR Systems

- Based on technology from roughly twenty years ago, one test takes 20 minutes
- Too slow to keep up with new mobile designs

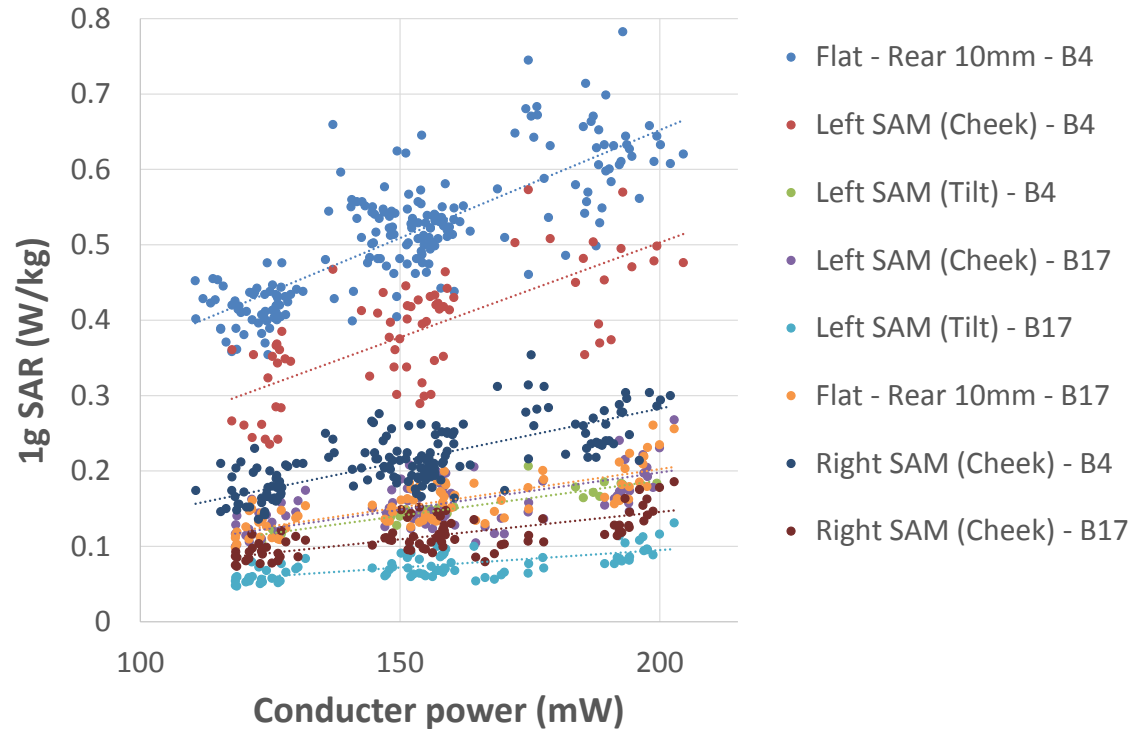


- Decrease number of test conditions based on a priori information

- IEEE 1528 – Clause 6.8 and Annex I
 - Transmission modes operating at the same frequency
 - Tilt position and bottom internal antenna with cheek position below 3dB from limit
 - Zoom scan not executed when SAR below threshold
 - Low-power exclusion

> Approach 1: Test Reduction

→ IEC LTE PAS – draft: reduction of LTE SAR test conditions based on conducted power assessment



- Accelerate SAR compliance testing using faster measurement methods; checkpoints with traditional approach
- IEEE 1528 – Clause 6.7 describes fast SAR screening procedure based on traditional hardware – different processing
- IEEE 1528 – Annex H (informative) extends to different measurement system hardware, incl. array systems

- With robot systems, still takes about 5 minutes per test condition
- Based on amplitude-only measurements and rough a priori assumptions on field propagation (exponential decay / Motorola Fast SAR)
- Diode-based arrays are not accurate because probes must be extremely close to phantom surface (3–4 mm)

→ IEC 62209-3 standard – vector measurement-based systems

- Totally different concept based on **amplitude and phase measurements**
- Uses Maxwellian behavior of the electric field
- Third field component is determined by the two others
- Vector field (magnitude and phase) in 3-D is accurately obtained from 2-D measurements

→ A direct assessment of the field exactly in the region of peak SAR is not necessary: the field at 20 mm depth in phantom contains as much information as at 1mm

→ Suitable for accurate measurements with array-based systems

→ Measurement system specifications, protocol for SAR assessment, system verification and uncertainty sections already drafted

→ Full draft in May / June

→ CDV: Summer 2015

→ Target publication date: Q1 2016



→ Traditional fast SAR approaches, e.g. based on Motorola algorithm, are authorized by the FCC, IC or in Europe

- **FCC** has agreed to review reports including SAR screening made with ART-MAN for dynamic antenna tuner systems on a case-by-case basis
- **Europe:** The manufacturer may choose any test solution to demonstrate compliance with the R&TTE Directive Harmonized standards are preferable but not mandatory
- **IC** is running experiments on IEEE 1528 Annex H procedure to authorize second generation array systems for screening
- **RRA** authorizes array systems for screening multiple transmission cases

→ Many SAR patterns are extremely similar

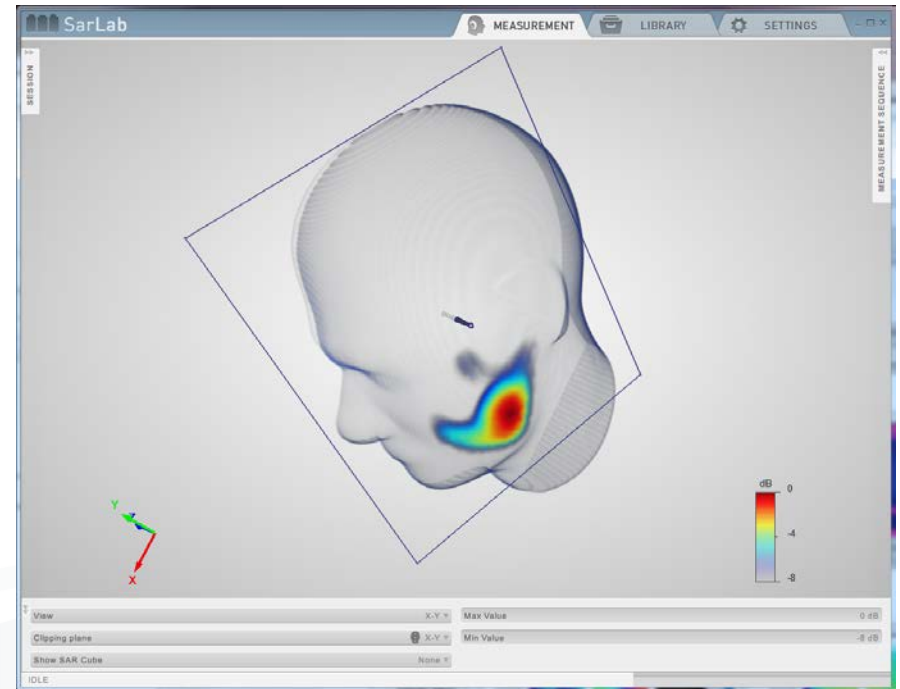
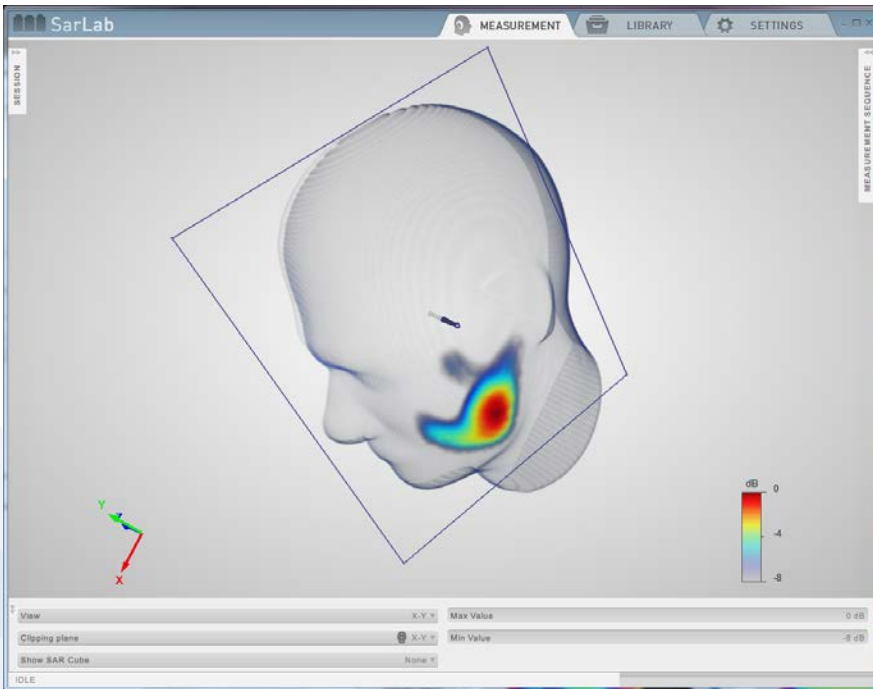
- Communication systems transmitting at the same frequency
- Antenna tuners states
- LTE modes within the same band

→ A power meter which reproduces head or body loading conditions would be enough

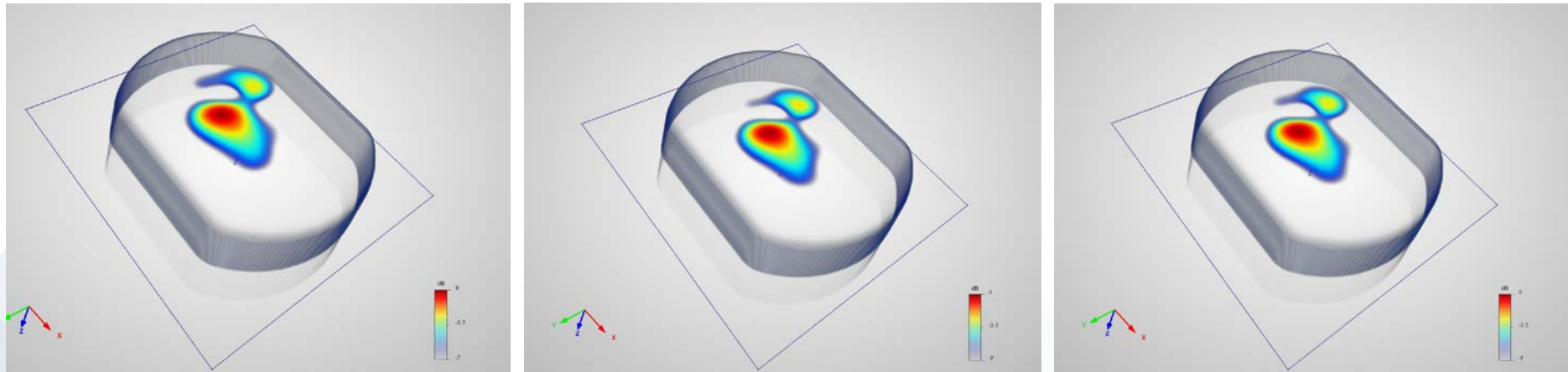
→ It is efficient and extremely safe to use array systems for screening those cases

> Similar pattern cases

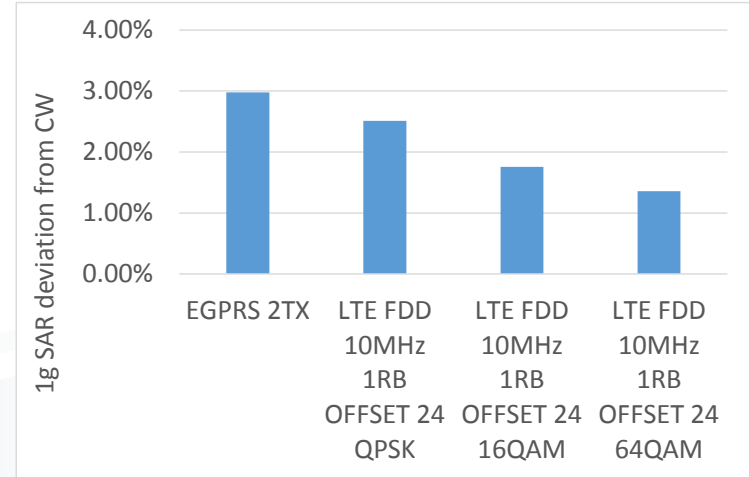
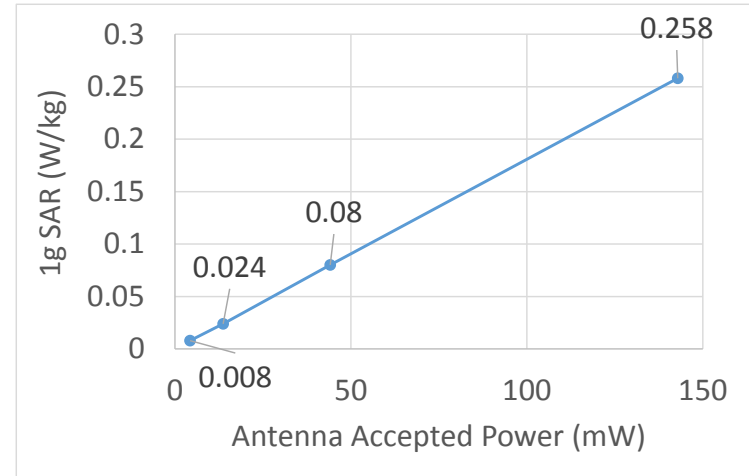
→ Smartphone at SAM left cheek 1880 MHz: GSM 1900 and WCDMA band 2



→ Smartphone in front 15mm position at flat phantom: WCDMA band 8, mid-channel, 3 antenna tuner states



> Key Characteristics for Screening Linearity and modulation response



- The complexity of modern wireless devices makes it impossible to go through the SAR test matrix with traditional test approaches
- Screening approaches combined with IEC 62209–3 amplitude and phase generation 2 SAR measurement systems solve a large part of the SAR test time issues
- Standardization and regulatory acceptance for IEC 62209–3 compliant array systems is under progress and shows the way to the future of EMF exposure conformity assessment