Update on Fast SAR Techniques and IEC 62209 V3

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> ART-Fi Company Profile

- Mission: developing radiofrequency solutions for efficient design and regulatory compliance demonstration of wireless products
- Created in 2010 - founders: B. Derat (CEO), S. Pannetrat (COO), A. Cozza (Scientific Advisor), M. Dembinski (Principal SW Engineer)
- Advisory Board chaired by Mr. Matthias Meier, former chair of IEC PT62209 and former board member of Mobile Manufacturers Forum
- Headquarters: Orsay, France
- Quality management and certifications:
  - **HQ and R&D:** ISO 9001
  - **Production center:** ISO 9001, ISO/IEC 17025, ISO 14001
- 10 years of active participation to international IEEE and IEC SAR measurement and computational standards development

> Fast SAR

Fast SAR methods use special techniques, methods or algorithms, in order to decrease the measurement time.

> Fast SAR Approach in 62209

- → Fast SAR methods do not comply with all of the normative requirements
- → Fast SAR methods are based on approximations and optimizations that are specific to each implementation
- → Fast SAR methods are used to reduce measurement time, with less accuracy or higher measurement tolerances
- → Measurement systems that fully comply with the measurement requirements are "full SAR" measurement systems

> SAR 2.0

Fast SAR methods using vector probes for the measurement of the peak spatial-average SAR that fully comply with the requirements for "full SAR" measurements.

> The Approach of SAR 2.0

- → A 2-D electric field scan of components tangential to a surface contains enough information
- → Solution of Maxwell‘s equations with the equivalence principle
- → 3-D distribution can be accurately reconstructed using propagation functions (Huygens principle)

> Historical Background

- → SAR measurement technologies based on assessment of vector fields (amplitude & phase) were first described by Merckel and Bolomey in 2002
- → The idea to use such technology for SAR measurement was presented in 2006 by Teruo ONISHI et al.

> Rationale

- → Vector measurement-based method enable a more advanced application of array systems
- → Accurate reconstruction of 3-D field distributions from 2-D scans without a priori assumption on field propagation
- → Field reconstruction can be performed using a variety of techniques

New Specifications needed

- → Vector measurement-based techniques require specific considerations not covered in IEC 62209-1/IEEE 1528 or IEC 62209-2
- → IEC 62209-3 is intended to specify the requirements for such methods

IEC 62209

Part 3: Vector probe systems (Frequency range of 100 MHz to 6 GHz)

> Process

→ New proposal was submitted for vote
→ 27 national committees and 8 observing committees
→ Proposal was approved by 19 of 23 voting members
→ 9 of 27 members will participate

> Participating Members

- → Australia
- → Germany
- → Finland
- → France
- → Italy
- → Japan
- → Korea
- → Sweden
- → USA

> Comments

- → Austria: increased overall uncertainty of SAR testing results
- → Canada: Frequency Range; Patents
- → Switzerland: consistent results; fragmentation of the standard; merge IEC 62209-1, IEC 62209-2 and IEEE 1528
- → Spain: several standards are developed in parallel

> Comments cont.

- → UK: Include vector probe specifications in the existing 62209-1 and 62209-2
- → Korea: Replace “with vector probe” by “with electric field probe or with vector probe arrays”
- → USA: Separate clauses for probe positioner, array implementation, probe or array boundary effect, and positioner mechanical constraints

> Patents

- → Any party participating should, from the outset, draw their attention to any known Patent, either its own or that of other organizations
- → The words “from the outset” imply that such information should be disclosed as early as possible during the development of the standard. This might not be possible when the first draft text appears since at this time, the text might be still too vague or subject to subsequent major modifications.

Structure of the IEC 62209-3 draft

> Structure

- → 1 Scope
- → 2 Normative references
- → 3 Terms and definitions
- → 4 Symbols and abbreviated terms
- → 5 Measurement system specifications
- → 6 Protocol for SAR assessment
- → 7 Uncertainty estimation
- → 8 Measurement report
- → Annex A - SAR measurement system verification

> Traditional SAR vs. SAR 2.0

- → Current standard requirements: single probe specifications, measurements at several test points
- → Current standard method: determination of combined uncertainty of interpolation, extrapolation, averaging and maximum finding
- → This approach cannot be directly transposed to vector-field based methods: physical phase profile is needed

> System specifications

- → Use existing phantom requirements
- → Use existing tissue requirements
- → Use existing device holder requirements
- → Specify requirements for array of vector probes

> Protocol for SAR assessment

→ Use existing requirements for DUT positioning
→ Use existing requirements for accessories
→ Use existing requirements for frequencies and modes
→ Develop requirements for tests to be performed
→ Amend requirements for data processing

> Uncertainty Estimation

- → Use existing uncertainty requirements for phantom shell and tissue, device holder and positioning, ambient conditions
- → Develop requirements for vector probe array and vector probe measurements

> System verification

→ Develop calibration requirements
→ Develop system validation requirements
→ Develop system check requirements

> Conclusions

- → The idea to use vector probes for SAR measurements was presented in 2006
- → A 2-D scan of 2 field components contains enough information to know the 3-D distribution of the field
- → Standard being developed to account for vector probes in “Full SAR” measurement procedures

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