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Report No.: SZEM140300130802

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FCC SAR TEST REPORT

Application No.: SZEM1403001308RF
Applicant: Lexibook America
Manufacturer: Jungletac Interactive Co., Ltd.
Factory: Jungletac Interactive Co., Ltd.
Product Name: Lexibook Pocket Master – 4.3”
Model No.(EUT): MFC144
Add Model No.: MFC143
FCC ID: UU8-MFC11
Standards: IEEE Std C95(1991)
IEEE1528(2003)
Date of Receipt: 2014-04-25
Date of Test: 2014-04-26 to 2014-04-26
Date of Issue: 2014-07-31
Test Result : **PASS ***

* In the configuration tested, the EUT detailed in this report complied with the standards specified above.

Authorized Signature:



Jack Zhang
EMC Laboratory Manager

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS International Electrical Approvals or testing done by SGS International Electrical Approvals in connection with, distribution or use of the product described in this report must be approved by SGS International Electrical Approvals in writing.

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2 Version

| Revision Record | | | | |
|-----------------|---------|------------|----------|----------|
| Version | Chapter | Date | Modifier | Remark |
| 00 | | 2014-07-31 | | Original |
| | | | | |
| | | | | |

| | | | | |
|--------------------------|--|---|--|------------|
| Authorized for issue by: | | | | |
| Tested By | |  _____ (Owen Zhou) /Project Engineer | | 2014-04-26 |
| | | | | Date |
| Prepared By | |  _____ (Sade Luo) /Clerk | | 2014-07-31 |
| | | | | Date |
| Checked By | |  _____ (Evan Mi) /Reviewer | | 2014-08-12 |
| | | | | Date |



3 Test Summary

| Frequency Band | Test position | Test Ch. /Freq. | Max average SAR1-g(W/kg) | Conduct ed power (dBm) | Tune up Limit (dBm) | Scaling Factor | Scaled SAR (W/kg) | SAR limit (W/kg) | verdict |
|----------------|---------------|-----------------|--------------------------|------------------------|---------------------|----------------|-------------------|------------------|---------|
| WIFI (2.4GHz) | Body | 1/2412 | 0.577 | 14.78 | 15.00 | 1.052 | 0.607 | 1.6 | PASS |

Remark: The maximum scaled SAR value of **Body** is **0.607W/kg**.



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5 General Information

5.1 Details of Applicant

| | |
|----------|--|
| Name: | Lexibook America |
| Address: | C/O NATXIS PRAMEX INTERNATIONAL – NORTH AMERICA 1251 avenue of the Americas 34 th floor |

5.2 Details of Manufacturer

| | |
|----------|--|
| Name: | Jungletac Interactive Co., Ltd. |
| Address: | Rm 17-18, 16/F., Parklane Centre, 25 Kin Wing Street, Tuen Mun, New Territories, Hong Kong |

5.3 Details of Factory

| | |
|----------|--|
| Name: | Jungletac Interactive Co., Ltd. |
| Address: | Rm 17-18, 16/F., Parklane Centre, 25 Kin Wing Street, Tuen Mun, New Territories, Hong Kong |

5.4 General Description of EUT

| | | | |
|---------------------|--|-----------|-----------|
| Product Name: | Lexibook Pocket Master – 4.3” | | |
| Model No.: | MFC144, MFC143 | | |
| Device Type : | portable device | | |
| Product Phase: | production unit | | |
| Exposure Category: | uncontrolled environment / general population | | |
| Hardware Version: | MFC144_RK3026_VO | | |
| Software Version: | Android 4.4 | | |
| FCC ID: | UU8-MFC11 | | |
| Battery Information | Normal Voltage :3.7V | | |
| | Charging Voltage :5V | | |
| | Rated capacity :1000mAh | | |
| | Battery Type :Rechargeable Li-ion Battery | | |
| | Model:N/A | | |
| Antenna Type: | Inner Antenna | | |
| Frequency Bands: | Band | Tx (MHz) | Rx (MHz) |
| | WIFI | 2412-2462 | 2412-2462 |
| Modulation Mode: | WIFI: IEEE for 802.11b: DSSS(CCK,DQPSK,DBPSK) IEEE for 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE for 802.11n(T20 and T40) : OFDM (64QAM, 16QAM, QPSK,BPSK) | | |
| Serial Number: | NA | | |
| IMEI: | NA | | |
| Remark: | Model No.: MFC144, MFC143 Only the Model MFC144 was tested, since the electrical circuit design, layout, components used and internal wiring were identical for all above models, with difference being item number, casing color and cosmetic. | | |



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5.5 Description of Support Units

The EUT has been tested independently.

5.6 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch E&E Lab

No. 1 Workshop, M-10, Middle section, Science & Technology Park, Shenzhen, Guangdong, China
518057

Telephone: +86 (0) 755 2601 2053 Fax: +86 (0) 755 2671 0594

No tests were sub-contracted.

5.7 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **CNAS (No. CNAS L2929)**

CNAS has accredited SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

- **VCCI**

The 3m Semi-anechoic chamber, Full-anechoic Chamber and Shielded Room (7.5m x 4.0m x 3.0m) of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-2197, G-416, T-1153 and C-2383 respectively.

- **FCC – Registration No.: 556682**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration No.: 556682.

- **Industry Canada (IC)**

Two 3m Semi-anechoic chambers of SGS-CSTC Standards Technical Services Co., Ltd. have been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 4620C-1 & 4620C-2.

5.8 Deviation from Standards

None

5.9 Abnormalities from Standard Conditions

None

5.10 Other Information Requested by the Customer

None



5.11 Test Standards

| Identity | Document Title |
|------------------------|---|
| IEEE Std C95.1 – 1991 | IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz – 300 GHz. |
| IEEE 1528-2003 | Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques |
| Canada's Safety Code 6 | Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz (99-EHD-237) |
| RSS-102 | Radio Frequency Exposure Compliance of Radio communication Apparatus (All Frequency Bands (Issue 4 of March 2010) |
| KDB447498 D01 | General RF Exposure Guidance v05r02 |
| KDB447498 D03 | Supplement C Cross-Reference v01 |
| KDB616217 D04 | SAR for laptop and tablets v01r01 |
| KDB 248227 D01 | SAR meas for 802 11 a b g v01r02 |
| KDB 865664 D01 | SAR Measurement 100 MHz to 6 GHz v01r03 |

5.12 RF exposure limits

| Human Exposure | Uncontrolled Environment General Population | Controlled Environment Occupational |
|--|--|--|
| Spatial Peak SAR* (Brain) | 1.60 mW/g | 8.00 mW/g |
| Spatial Average SAR** (Whole Body) | 0.08 mW/g | 0.40 mW/g |
| Spatial Peak SAR*** (Hands/Feet/Ankle/Wrist) | 4.00 mW/g | 20.00 mW/g |

Notes:

* The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time

** The Spatial Average value of the SAR averaged over the whole body.

*** The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation.)

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5.13 Measurement Uncertainty

Measurements and results are all in compliance with the standards listed in section 12 of this report. All measurements and results are recorded and maintained at the laboratory performing the tests and measurement uncertainties are taken into account when comparing measurements to pass/ fail criteria. The Expanded uncertainty(95% CONFIDENCE INTERVAL) is **21.36%**.

| A | b1 | c | d | e = f(d,k) | g | i = C*g/e | k |
|--|---------------------|------------|-----------------|---------------|-------------------|--------------|--------------|
| Uncertainty Component | Section in P1528 | Tol (%) | Prob . Dist. | Div. | Ci (1g) | 1g ui (%) | Vi (Veff) |
| Probe calibration | E.2.1 | 6.3 | N | 1 | 1 | 6.30 | ∞ |
| Axial isotropy | E.2.2 | 0.5 | R | $\sqrt{3}$ | $(1 - C_p)^{1/2}$ | 0.20 | ∞ |
| hemispherical isotropy | E.2.2 | 2.6 | R | $\sqrt{3}$ | $\sqrt{C_p}$ | 1.06 | ∞ |
| Boundary effect | E.2.3 | 1.0 | R | $\sqrt{3}$ | 1 | 0.58 | ∞ |
| Linearity | E.2.4 | 0.6 | R | $\sqrt{3}$ | 1 | 0.35 | ∞ |
| System detection limit | E.2.5 | 0.25 | R | $\sqrt{3}$ | 1 | 0.14 | ∞ |
| Readout electronics | E.2.6 | 0.3 | N | 1 | 1 | 0.30 | ∞ |
| Response time | E.2.7 | 0 | R | $\sqrt{3}$ | 1 | 0.00 | ∞ |
| Integration time | E.2.8 | 2.6 | R | $\sqrt{3}$ | 1 | 1.50 | ∞ |
| RF ambient Condition –Noise | E.6.1 | 3 | R | $\sqrt{3}$ | 1 | 1.73 | ∞ |
| RF ambient Condition - reflections | E.6.1 | 3 | R | $\sqrt{3}$ | 1 | 1.73 | ∞ |
| Probe positioning- mechanical tolerance | E.6.2 | 1.5 | R | $\sqrt{3}$ | 1 | 0.87 | ∞ |
| Probe positioning- with respect to phantom | E.6.3 | 2.9 | R | $\sqrt{3}$ | 1 | 1.67 | ∞ |
| Max. SAR evaluation | E.5.2 | 1 | R | $\sqrt{3}$ | 1 | 0.58 | ∞ |
| Test sample positioning | E.4.2 | 3.7 | N | 1 | 1 | 3.70 | 9 |
| Device holder uncertainty | E.4.1 | 3.6 | N | 1 | 1 | 3.60 | ∞ |
| Output power variation –SAR drift measurement | 6.6.2 | 5 | R | $\sqrt{3}$ | 1 | 2.89 | ∞ |
| Phantom uncertainty (shape and thickness tolerances) | E.3.1 | 4 | R | $\sqrt{3}$ | 1 | 2.31 | ∞ |
| Liquid conductivity - deviation from target values | E.3.2 | 5 | R | $\sqrt{3}$ | 0.64 | 1.85 | ∞ |
| Liquid conductivity | E.3.2 | 5.78 | N | 1 | 0.64 | 3.68 | 5 |

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| | | | | | | | |
|---|-------|------|---|------------|-----|--------------|----------|
| - measurement uncertainty | | | | | | | |
| Liquid permittivity - deviation from target values | E.3.3 | 5 | R | $\sqrt{3}$ | 0.6 | 1.73 | ∞ |
| Liquid permittivity - measurement uncertainty | E.3.3 | 0.62 | N | 1 | 0.6 | 0.372 | 5 |
| Combined standard uncertainty | | | | RSS | | 10.68 | 430 |
| Expanded uncertainty (95% CONFIDENCE INTERVAL) | | | | K=2 | | 21.36 | |

Table 1 : Measurement Uncertainty

6 Equipments Used during Test

6.1 SPEAG DASY4

| Test Platform | | SPEAG DASY4 Professional | | | |
|-------------------------------------|--|--|----------------|------------------|-------------------------|
| Location | | SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch E&E Lab | | | |
| Description | | SAR Test System (Frequency range 300MHz-3GHz) 835, 900, 1800, 1900, 2000, 2450 frequency band | | | |
| Software Reference | | DASY4: V4.7 Build 80 SEMCAD: V1.8 Build 186 | | | |
| Hardware Reference | | | | | |
| | Model | Equipment | Serial Number | Calibration Date | Due date of calibration |
| <input checked="" type="checkbox"/> | Robot | RX90L | F03/5V32A1/A01 | NA | NA |
| <input checked="" type="checkbox"/> | Twin Phantom | SAM 1 | TP-1283 | NA | NA |
| <input type="checkbox"/> | Flat Phantom | ELI 5.0 | 1128 | NA | NA |
| <input checked="" type="checkbox"/> | DAE | DAE3 | 569 | 2013-11-22 | 2014-11-21 |
| <input checked="" type="checkbox"/> | E-Field Probe | EX3DV4 | 3962 | 2013-12-10 | 2014-12-09 |
| <input type="checkbox"/> | Validation Kits | D835V2 | 4d015 | 2013-11-25 | 2014-11-24 |
| <input type="checkbox"/> | Validation Kits | D1900V2 | 184 | 2013-11-27 | 2014-11-26 |
| <input checked="" type="checkbox"/> | Validation Kits | D2450V2 | 733 | 2013-11-26 | 2014-11-25 |
| <input checked="" type="checkbox"/> | Agilent Network Analyzer | E5071B | MY42100549 | 2014-04-11 | 2015-04-11 |
| <input checked="" type="checkbox"/> | Dielectric Probe Kit | 85070D | US01440210 | NA | NA |
| <input checked="" type="checkbox"/> | R&S Universal Radio Communication Tester | CMU200 | 103633 | 2014-04-11 | 2015-04-10 |
| <input checked="" type="checkbox"/> | RF Bi-Directional Coupler | ZABDC20-252H-N+ | N989900825 | 2014-04-11 | 2015-04-10 |
| <input checked="" type="checkbox"/> | Agilent Signal Generator | E4438C | MY42082326 | 2014-04-11 | 2015-04-10 |
| <input checked="" type="checkbox"/> | Mini-Circuits Preamplifier | ZHL-42 | QA0827002 | 2014-04-11 | 2015-04-10 |
| <input checked="" type="checkbox"/> | Agilent Power Meter | E4416A | GB41292095 | 2014-04-11 | 2015-04-10 |
| <input checked="" type="checkbox"/> | Agilent Power Sensor | 8481H | MY41091234 | 2014-04-15 | 2015-04-14 |
| <input checked="" type="checkbox"/> | R&S Power Sensor | NRP-Z92 | 100025 | 2014-04-15 | 2015-04-14 |
| <input checked="" type="checkbox"/> | Attenuator | TS2-3dB | 30704 | 2014-04-11 | 2015-04-10 |
| <input checked="" type="checkbox"/> | Coaxial low pass filter | VLF-2500(+) | NA | 2014-04-11 | 2015-04-10 |
| <input checked="" type="checkbox"/> | 50 Ω coaxial load | KARN-50+ | 00850 | 2014-04-11 | 2015-04-10 |
| <input checked="" type="checkbox"/> | DC POWER SUPPLY | SK1730SL5A | NA | 2014-04-14 | 2015-04-13 |

Note: All the test equipments are calibrated once a year.

6.2 The SAR Measurement System

A photograph of the SAR measurement System is given in F-1.

This SAR Measurement System uses a Computer-controlled 3-D stepper motor system (Speag Dasy 4 professional system). A Model EX3DV4 3962 E-field probe is used to determine the internal electric fields. The SAR can be obtained from the equation $SAR = \sigma (|E|^2) / \rho$ where σ and ρ are the conductivity and mass density of the tissue-Simulate.

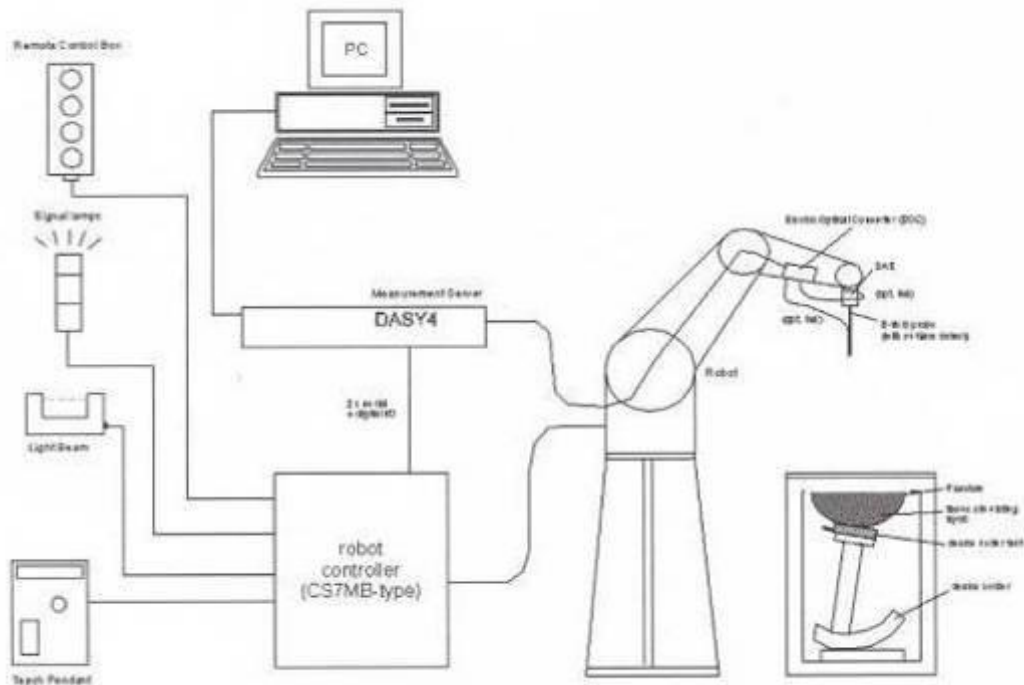
The DASY4 system for performing compliance tests consists of the following items:

A standard high precision 6-axis robot (Stabile RX family) with controller, teach pendant and software. An arm extension for accommodation the data acquisition electronics (DAE).

A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.

A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.

The Electro-optical converter (EOC) performs the conversion between optical and electrical of the signals for the digital communication to DAE and for the analog signal from the optical surface detection. The EOC is connected to the measurement server.




F-1. SAR System Configuration

- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- A computer operating Windows XP.
- DASY4 software.
- Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom enabling testing left-hand, right-hand and Body Worn usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- Validation dipole kits allowing to validating the proper functioning of the system.


6.3 Isotropic E-field Probe EX3DV4

| | |
|--|--|
|  | <p>Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)</p> |
| <p>Calibration</p> | <p>ISO/IEC 17025 calibration service available.</p> |
| <p>Frequency</p> | <p>10 MHz to > 6 GHz Linearity: ± 0.2 dB (30 MHz to 6 GHz)</p> |
| <p>Directivity</p> | <p>± 0.3 dB in TSL (rotation around probe axis) ± 0.5 dB in TSL (rotation normal to probe axis)</p> |
| <p>Dynamic Range</p> | <p>10 μW/g to > 100 mW/g Linearity: ± 0.2 dB (noise: typically < 1 μW/g)</p> |
| <p>Dimensions</p> | <p>Overall length: 337 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm</p> |
| <p>Application</p> | <p>High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields); the only probe that enables compliance testing for frequencies up to 6 GHz with precision of better 30%.</p> |
| <p>Compatibility</p> | <p>DASY3, DASY4, DASY52 SAR and higher, EASY4/MRI</p> |

6.4 Data Acquisition Electronics (DAE)

| | | |
|-----------------------------|--|---|
| Model | DAE3,DAE4 |  |
| Construction | Signal amplifier, multiplexer, A/D converter and control logic. Serial optical link for communication with DASY4/5 embedded system (fully remote controlled). Two step probe touch detector for mechanical surface detection and emergency robot stop. | |
| Measurement Range | -100 to +300 mV (16 bit resolution and two range settings: 4mV,400mV) | |
| Input Offset Voltage | < 5µV (with auto zero) | |
| Input Bias Current | < 50 f A | |
| Dimensions | 60 x 60 x 68 mm | |


6.5 SAM Twin Phantom

| | | |
|--|---|--|
| Material | Vinylester, glass fiber reinforced (VE-GF) |  |
| Liquid Compatibility | Compatible with all SPEAG tissue simulating liquids (incl. DGBE type) | |
| Shell Thickness | 2 ± 0.2 mm (6 ± 0.2 mm at ear point) | |
| Dimensions (incl. Wooden Support) | Length: 1000 mm Width: 500 mm Height: adjustable feet | |
| Filling Volume | approx. 25 liters | |
| Wooden Support | SPEAG standard phantom table | |

The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528 and IEC 62209-1. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by teaching three points with the robot.

Twin SAM V5.0 has the same shell geometry and is manufactured from the same material as Twin SAM V4.0, but has reinforced top structure.

6.6 ELI Phantom

| | | |
|--|---|---|
| Material | Vinylester, glass fiber reinforced (VE-GF) |  |
| Liquid Compatibility | Compatible with all SPEAG tissue simulating liquids (incl. DGBE type) | |
| Shell Thickness | 2.0 ± 0.2 mm (bottom plate) | |
| Dimensions | Major axis: 600 mm Minor axis: 400 mm | |
| Filling Volume | approx. 30 liters | |
| Wooden Support | SPEAG standard phantom table | |
| <p>Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles.</p> <p>ELI V5.0 has the same shell geometry and is manufactured from the same material as ELI4, but has reinforced top structure.</p> | | |

6.7 Device Holder for Transmitters



F-2. Device Holder for Transmitters

- The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source in 5mm distance, a positioning uncertainty of $\pm 0.5\text{mm}$ would produce a SAR uncertainty of $\pm 20\%$. An accurate device positioning is therefore crucial for accurate and repeatable measurements. The positions, in which the devices must be measured, are defined by the standards.
- The DASY device holder is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation centres for both scales are the ear reference point (ERP). Thus the device needs no repositioning when changing the angles.
- The DASY device holder has been made out of low-loss POM material having the following dielectric parameters: relative permittivity $\epsilon=3$ and loss tangent $\delta=0.02$. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.

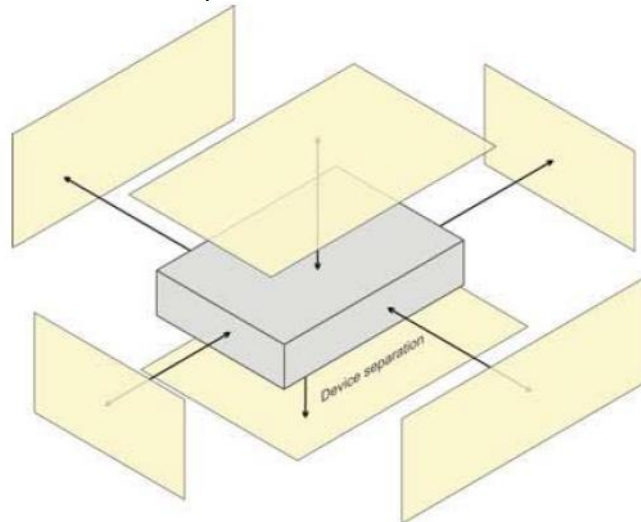


7 Description of Test Position

7.1 The Body Test Position

The SAR evaluation shall be performed for all surfaces of the DUT that are accessible during intended use, as indicated in Figure 3. The separation distance in testing shall correspond to the intended use distance as specified in the user instructions provided by the manufacturer. If the intended use is not specified, all surfaces of the DUT shall be tested directly against the flat phantom.

The surface of the generic device (or the surface of the carry accessory holding the DUT) pointing towards the flat phantom shall be parallel to the surface of the phantom.



F-3. Test positions for a generic device

8 SAR System Verification Procedure

8.1 Tissue Simulate Liquid

8.1.1 Recipes for Tissue Simulate Liquid

The following tables give the recipes for tissue simulating liquids to be used in different frequency bands:

| Ingredients (% by weight) | Frequency (MHz) | | | | | | | | | |
|--|-----------------|-------|-------|-------|-----------------------------|-------|-----------|-------|-------|-------|
| | 450 | | 835 | | 900 | | 1800-2000 | | 2450 | |
| Tissue Type | Head | Body | Head | Body | Head | Body | Head | Body | Head | Body |
| Water | 38.56 | 51.16 | 40.30 | 50.75 | 40.30 | 50.75 | 55.24 | 70.17 | 55.00 | 68.53 |
| Salt (NaCl) | 3.95 | 1.49 | 1.38 | 0.94 | 1.38 | 0.94 | 0.31 | 0.39 | 0.2 | 0.1 |
| Sucrose | 56.32 | 46.78 | 57.90 | 48.21 | 57.90 | 48.21 | 0 | 0 | 0 | 0 |
| HEC | 0.98 | 0.52 | 0.24 | 0 | 0.24 | 0 | 0 | 0 | 0 | 0 |
| Bactericide | 0.19 | 0.05 | 0.18 | 0.10 | 0.18 | 0.10 | 0 | 0 | 0 | 0 |
| DGBE | 0 | 0 | 0 | 0 | 0 | 0 | 44.45 | 29.44 | 44.80 | 31.37 |
| Salt: 99% Pure Sodium Chloride | | | | | Sucrose: 98% Pure Sucrose | | | | | |
| Water: De-ionized, 16 MΩ ⁺ resistivity | | | | | HEC: Hydroxyethyl Cellulose | | | | | |
| DGBE: 99% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol] | | | | | | | | | | |

Table 2 : Recipe of Tissue Simulate Liquid

8.1.2 Measurement for Tissue Simulate Liquid

The dielectric properties for this Tissue Simulate Liquids were measured by using the Agilent Model 85070D Dielectric Probe (rates frequency band 200 MHz to 20 GHz) in conjunction with Agilent E5071B Network Analyzer (300 KHz-8500 MHz). The Conductivity (σ) and Permittivity (ρ) are listed in Table 1. For the SAR measurement given in this report. The temperature variation of the Tissue Simulate Liquids was $22 \pm 2^\circ\text{C}$.

| Tissue Type | Measured Frequency (MHz) | Target Tissue Body($\pm 5\%$) | | Measured Tissue Body | | Liquid Temp. ($^\circ\text{C}$) | Measured Date |
|-------------|--------------------------|---------------------------------|----------------------|----------------------|----------------------|-----------------------------------|---------------|
| | | ϵ_r | $\sigma(\text{S/m})$ | ϵ_r | $\sigma(\text{S/m})$ | | |
| 2450 | 2450 | 52.70 (50.07~55.34) | 1.95 (1.85~2.05) | 51.59 | 1.933 | 22.3 | 2014/4/26 |

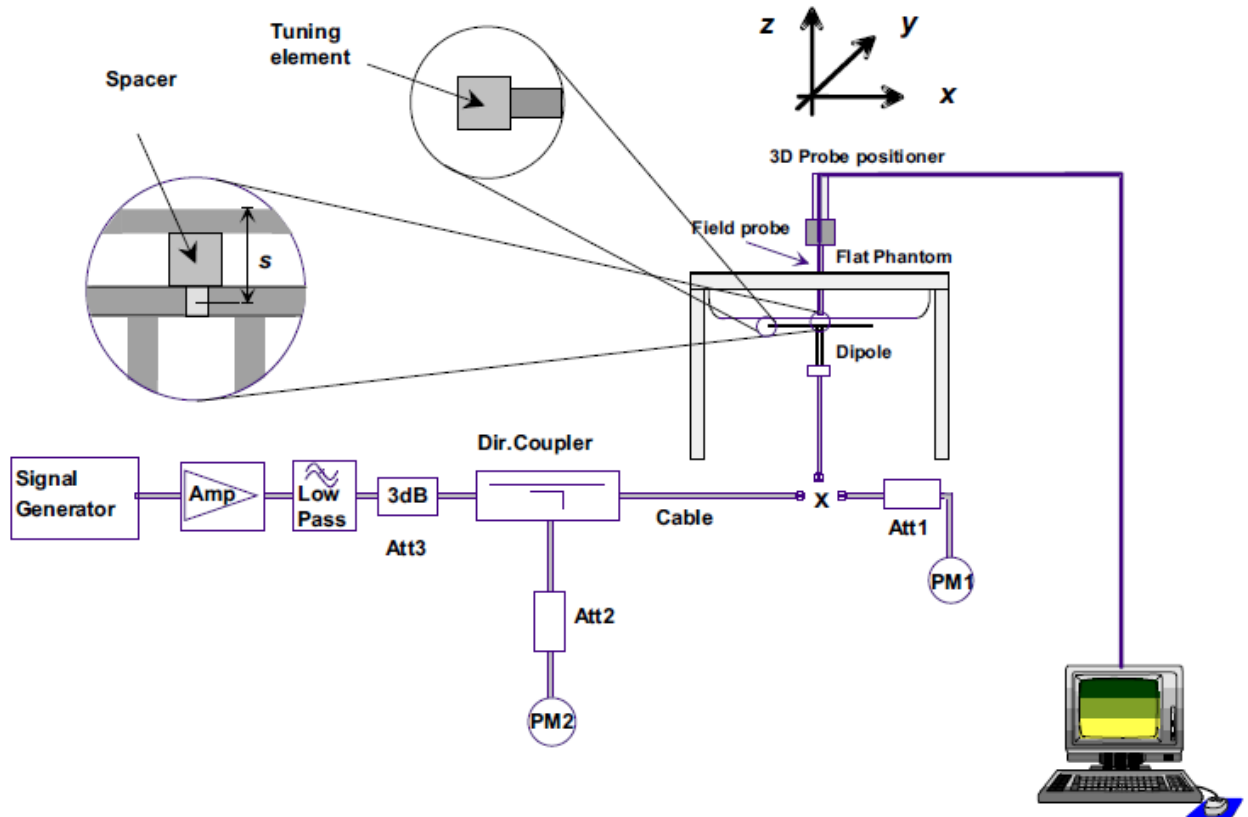
Table 3 : Measurement result of Tissue electric parameters

| Channel | Measured Frequency (MHz) | Target Tissue Body($\pm 5\%$) | | Measured Tissue Body | | Liquid Temp. ($^\circ\text{C}$) | Measured Date |
|---------|--------------------------|---------------------------------|----------------------|----------------------|----------------------|-----------------------------------|---------------|
| | | ϵ_r | $\sigma(\text{S/m})$ | ϵ_r | $\sigma(\text{S/m})$ | | |
| 1 | 2412 | 52.75 (50.11~55.39) | 1.91 (1.81~2.01) | 51.74 | 1.887 | 22.3 | 2014/4/26 |
| 6 | 2437 | 52.72 (50.08~55.35) | 1.94 (1.84~2.04) | 51.66 | 1.917 | | |
| 11 | 2462 | 52.68 (50.05~55.31) | 1.97 (1.87~2.07) | 51.51 | 1.948 | | |

Table 4 : Measurement result of Tissue electric parameters for Low/Mid/High Channel.

8.2 SAR System Validation

The microwave circuit arrangement for system verification is sketched in F-4. The daily system accuracy verification occurs within the flat section of the SAM phantom. A SAR measurement was performed to see if the measured SAR was within +/- 10% from the target SAR values. The tests were conducted on the same days as the measurement of the EUT. The obtained results from the system accuracy verification are displayed in the table 5 (A power level of 250mw was input to the dipole antenna). During the tests, the ambient temperature of the laboratory was in the range 22°C, the relative humidity was in the range 60% and the liquid depth above the ear reference points was above 15 cm in all the cases. It is seen that the system is operating within its specification, as the results are within acceptable tolerance of the reference values.



F-1. the microwave circuit arrangement used for SAR system verification

PM1. Power Sensor NRP-Z92

PM2. Agilent Model E4416A Power Meter



8.2.1 Summary System Validation Result(s)

| Validation Kit | | Target SAR (normalized to 1w) (±10%) | | Measured SAR (normalized to 1w) | | Liquid Temp. (°C) | Measured date |
|----------------|------|---|---------------------|------------------------------------|------------|-------------------------|------------------|
| | | 1-g(W/kg) | 10-g(W/kg) | 1-g(W/kg) | 10-g(W/kg) | | |
| D2450V2 | Body | 49.4 (44.46~54.34) | 23.0 (20.7~25.3) | 50.8 | 22.8 | 22.3 | 2014/4/26 |

Table 5 : SAR System Validation Result

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8.2.2 Detailed System Validation Results

Please see the Appendix A

9 Test results and Measurement Data

9.1 Operation Configurations

9.1.1 WiFi Test Configuration

For the 802.11b/g/n SAR tests, a communication link is set up with the test mode software for Wi-Fi mode test. The Absolute Radio Frequency Channel Number (ARFCN) is allocated to 1, 6 and 11 respectively in the case of 2450 MHz during the test at the each test frequency channel .the EUT is operated at the RF continuous emission mode. Each channel should be tested at the lowest data rate. 802.11b/g/n operating modes are tested independently according to the service requirements in each frequency band. 802.11b/g modes are tested on channel 1, 6, 11; however if output power reduction is necessary for channels 1 and/or 11 to meet restricted band requirements the highest output channel closest to each of these channels must be tested instead.

SAR is not required for 802.11g/n channels when the maximum average output power is less than 0.25dB higher than that measured on the corresponding 802.11b channels.

| Mode | GHz | Channel | Turbo Channel | “Default Test Channels” | | UNII | |
|------------|-------|-----------------|---------------|-------------------------|---------|------|--|
| | | | | §15.247 | | | |
| | | | | 802.11b | 802.11g | | |
| 802.11 b/g | 2.412 | 1 [#] | | √ | ∇ | | |
| | 2.437 | 6 | 6 | √ | ∇ | | |
| | 2.462 | 11 [#] | | √ | ∇ | | |

9.2 Measurement procedure

9.2.1 Scanning procedure

Step 1: Power reference measurement

The SAR measurement was taken at a selected spatial reference point to monitor power variations during testing. This fixed location point was measured and used as a reference value.

Step 2: Area scan

The SAR distribution at the exposed side of the head was measured at a distance of 4mm from the inner surface of the shell. The area covered the entire dimension of the head and the horizontal grid spacing was 15mm*15mm or 10mm*10mm. Based on the area scan data, the area of the maximum absorption was determined by spline interpolation.

Step 3: Zoom scan

Around this point, a volume of 30mm*30mm*30mm (fine resolution volume scan, zoom scan) was assessed by measuring 7*7*7 points. On this basis of this data set, the spatial peak SAR value was evaluated with the following procedure:

The data at the surface was extrapolated, since the centre of the dipoles is 2.0mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.2mm. (This can be variable. Refer to the probe specification). The extrapolation was based on a least square algorithm. A polynomial of the fourth order was calculated through the points in z-axes. This polynomial was then used to evaluate the points between the surface and the probe tip. The maximum interpolated value was searched with a straight-forward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1g or 10g) were computed using the 3D-Spline interpolation algorithm. The volume was integrated with the trapezoidal algorithm. One

thousand points (10*10*10) were interpolated to calculate the average. All neighbouring volumes were evaluated until no neighboring volume with a higher average value was found.

Step 4: Power reference measurement (drift)

The SAR value at the same location as in step 1 was again measured. (If the value changed by more than 5%, the evaluation should be done repeatedly)

9.2.2 Data Storage

The DASY4 software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension “.DAE3”. The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated. The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [m W/g], [m W/cm²], [dBrel], etc.). Some of these units are not available in certain situations or show meaningless results, e.g., a SAR output in a lossless media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

9.2.3 Data Evaluation by SEMCAD

The SEMCAD software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

| | | |
|--------------------|---------------------------|----------------------|
| Probe parameters: | - Sensitivity | Normi, ai0, ai1, ai2 |
| | - Conversion factor | ConvFi |
| | - Diode compression point | Dcpi |
| Device parameters: | - Frequency | f |
| | - Crest factor | cf |
| Media parameters: | - Conductivity | ε |
| | - Density | ρ |

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY4 components. In the direct measuring mode of the multimeter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics.

If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \cdot c f / d c p_i$$

With V_i = compensated signal of channel i (i = x, y, z)

U_i = input signal of channel i ($i = x, y, z$)

cf = crest factor of exciting field (DASY parameter)

dcp_i = diode compression point (DASY parameter)

From the compensated input signals the primary field data for each channel can be evaluated:

E-field probes: $E_i = (V_i / Norm_i \cdot ConvF)^{1/2}$
H-field probes: $H_i = (V_i)^{1/2} \cdot (a_{i0} + a_{i1}f + a_{i2}f^2) / f$
With V_i = compensated signal of channel i ($i = x, y, z$)
 $Norm_i$ = sensor sensitivity of channel i ($i = x, y, z$)
[mV/(V/m)²] for E-field Probes
 $ConvF$ = sensitivity enhancement in solution
 a_{ij} = sensor sensitivity factors for H-field probes
 f = carrier frequency [GHz]
 E_i = electric field strength of channel i in V/m
 H_i = magnetic field strength of channel i in A/m

The RSS value of the field components gives the total field strength (Hermitian magnitude):

$$E_{tot} = (E_x^2 + E_y^2 + E_z^2)^{1/2}$$

The primary field data are used to calculate the derived field units.

$$SAR = (E_{tot}^2 \cdot \sigma) / (\epsilon \cdot 1000)$$

with **SAR** = local specific absorption rate in mW/g
 E_{tot} = total field strength in V/m
 σ = conductivity in [mho/m] or [Siemens/m]
 ϵ = equivalent tissue density in g/cm³

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid. The power flow density is calculated assuming the excitation field to be a free space field.

$$P_{pwe} = E_{tot}^2 / 3770 \quad \text{or} \quad P_{pwe} = H_{tot}^2 \cdot 37.7$$

with **P_{pwe}** = equivalent power density of a plane wave in mW/cm²
 E_{tot} = total electric field strength in V/m
 H_{tot} = total magnetic field strength in A/m

9.3 Measurement of RF conducted Power

9.3.1 Conducted Power Of WIFI

| Wi-Fi | Average Power (dBm) for Data Rates (Mbps) | | | | | | | | |
|-------------------|---|--------------|-------|-------|-------|-------|-------|-------|-------|
| 2450MHz | Channel | 1 | 2 | 5.5 | 11 | / | / | / | / |
| 802.11b | 1 | 14.78 | 13.73 | 13.68 | 13.51 | / | / | / | / |
| | 6 | 14.66 | 13.52 | 13.49 | 13.36 | / | / | / | / |
| | 11 | 14.15 | 13.38 | 13.29 | 13.22 | / | / | / | / |
| 802.11g | Channel | 6 | 9 | 12 | 18 | 24 | 36 | 48 | 54 |
| | 1 | 12.31 | 12.43 | 12.59 | 11.99 | 12.84 | 12.47 | 12.52 | 12.73 |
| | 6 | 12.15 | 12.23 | 12.32 | 11.72 | 12.55 | 12.14 | 12.22 | 12.44 |
| | 11 | 11.96 | 12.06 | 12.11 | 11.5 | 12.37 | 11.93 | 12.09 | 12.15 |
| 802.11n (HT20) | Channel | 6.5 | 13 | 19.5 | 26 | 39 | 52 | 58.5 | 65 |
| | 1 | 12.43 | 12.21 | 12.17 | 12.11 | 12.24 | 12.37 | 12.39 | 12.42 |
| | 6 | 12.19 | 11.93 | 11.95 | 11.9 | 12.06 | 12.13 | 12.09 | 12.19 |
| | 11 | 11.94 | 11.66 | 11.77 | 11.66 | 11.83 | 11.95 | 11.86 | 11.83 |
| 802.11n (HT40) | Channel | 13.5 | 27 | 40.5 | 54 | 81 | 108 | 121.5 | 135 |
| | 3 | 11.79 | 11.61 | 11.65 | 11.77 | 11.93 | 12.25 | 12.14 | 11.95 |
| | 6 | 11.64 | 11.49 | 11.44 | 11.53 | 11.73 | 12.04 | 11.83 | 11.76 |
| | 9 | 11.39 | 11.18 | 11.23 | 11.22 | 11.51 | 11.91 | 11.57 | 11.56 |

Table 6: Conducted Power Of WIFI

Note:

- 1) Indicates default channels per KDB Publication 248227 D01v01r02. When the adjacent channels are higher in power than the default channels, these “required channels” are considered for SAR testing instead of the default channels.
- 2) For each frequency band, testing at higher data rates and higher order modulations is not required when the maximum average output power for each of these configurations is less than 0.25dB higher than those measured at the lowest data rate.
- 3) SAR is not required for 802.11g/n channels when the maximum average output power is less than 0.25dB higher than that measured on the corresponding 802.11b channels.



9.4 Measurement of SAR average value

9.4.1 SAR Result Of WIFI

| Test position | Test mode | Test Ch./Fre q | SAR (W/kg) | | Power drift (dB) | Scaled SAR (1-g) | SAR limit (W/kg) | Liquid Temp. (°C) | |
|---------------|-----------------|----------------|------------|-------|------------------|------------------|------------------|-------------------|----|
| | | | 1-g | 10-g | | | | | |
| Body | Front side 0mm | 802.11b | 1/2412 | 0.577 | 0.250 | 0.028 | 0.607 | 1.6 | 22 |
| | Back side 0mm | 802.11b | 1/2412 | 0.116 | 0.059 | -0.190 | 0.122 | 1.6 | 22 |
| | Right side 0mm | 802.11b | 1/2412 | 0.011 | 0.00751 | 0.129 | 0.012 | 1.6 | 22 |
| | Bottom side 0mm | 802.11b | 1/2412 | 0.035 | 0.020 | -0.114 | 0.037 | 1.6 | 22 |
| | Front side 0mm | 802.11b | 6/2437 | 0.532 | 0.232 | -0.13 | 0.575 | 1.6 | 22 |
| | Front side 0mm | 802.11b | 11/2462 | 0.487 | 0.201 | -0.11 | 0.592 | 1.6 | 22 |

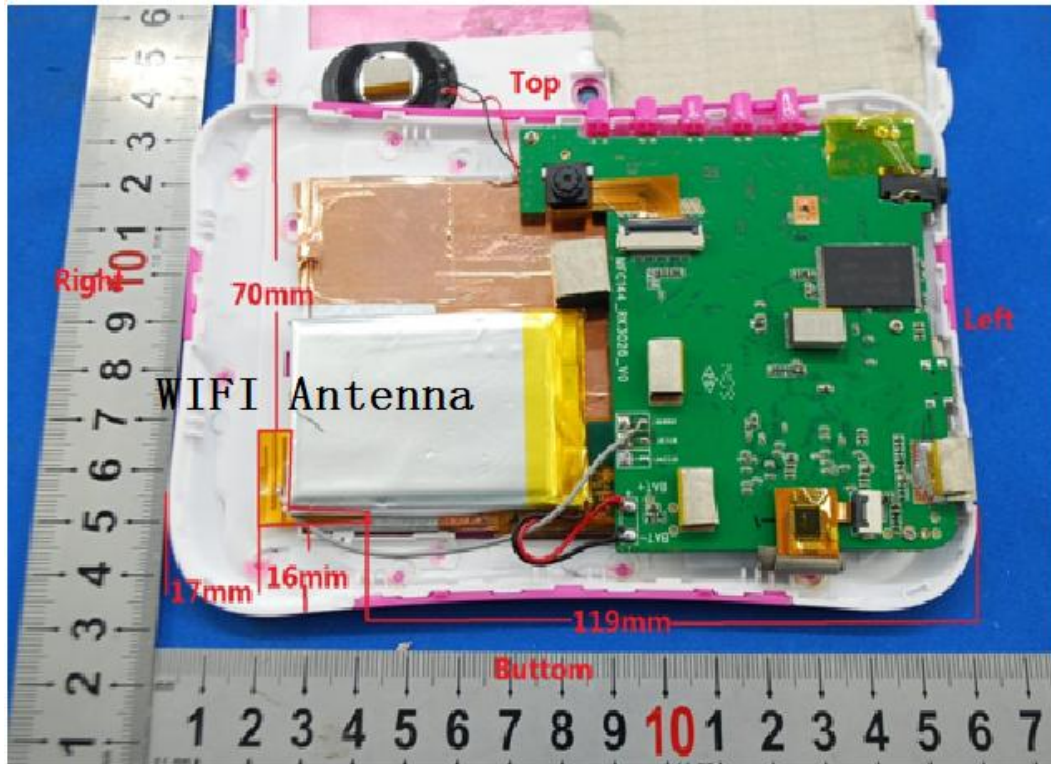
Table 7: SAR of WIFI for Body

Note:

- 1) Test positions of EUT(the distance between the EUT and the phantom is 0mm for all sides)
- 2) The maximum Scaled SAR value is marked in **bold**
- 3) Per FCC KDB Publication 447498 D01v05r02, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s).
- 4) Each channel was tested at the lowest data rate.

9.5 Multiple (single) Transmitter Evaluation

9.5.1 DUT Antenna Locations



The location of the antennas inside MFC144 is shown as above picture, for it we can have some conclusion (s) :

9.5.2 EUT side for SAR Testing

Per KDB 447498 D01v05r02, According to the distance between Wi-Fi antenna and the sides of MFC144 we can draw the conclusion that:

| EUT Sides for SAR Testing | | | | | | |
|---------------------------|-------|------|------|-------|-----|--------|
| Mode | Front | Back | Left | Right | Top | Bottom |
| Wi-Fi (2.4GHz) | Yes | Yes | No | Yes | No | Yes |

Table 8: EUT Sides for SAR Testing

Note: Per FCC KDB 616217, the back surface and edges of the tablet should be tested for SAR compliance with the tablet touching the phantom. The SAR Exclusion Threshold in KDB 447498D01 v05r02 can be applied to determine SAR test exclusion for adjacent edge configurations. The closest distance from the antenna to an adjacent tablet edge is used to determine if SAR testing is required for the adjacent edges, with the adjacent edge positioned against the phantom and the edge containing the antenna positioned perpendicular to the phantom.

9.5.3 Stand-alone SAR

Per FCC KDB 447498 D01 v05r02, the SAR exclusion threshold for distances <50mm is defined by the following equation:

$$\frac{\text{Max Power of Channel(mW)}}{\text{Test Separation Dist(mm)}} * \sqrt{\text{Frequency(GHz)}} \leq 3.0$$

Note:

When the minimum *test separation distance* is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

- 1) Based on the maximum conducted power of Wi-Fi and the antenna to use separation distance, Stand-alone SAR evaluation is required for Wi-Fi; $[(31.6228/5) * \sqrt{2.462}] = 9.9 > 3.0$.

9.5.4 Simultaneous SAR

Simultaneous Transmission SAR evaluation is not required for MFC144, because it has Wi-Fi unlicensed transmitter only.



9.6 Detailed Test Results

Please see the Appendix B

10 Photographs

10.1 EUT Test Setup



Photo 1: SAR measurement System


10.2 Photographs of EUT

Photo 2: Front View







Photo 3: Back View



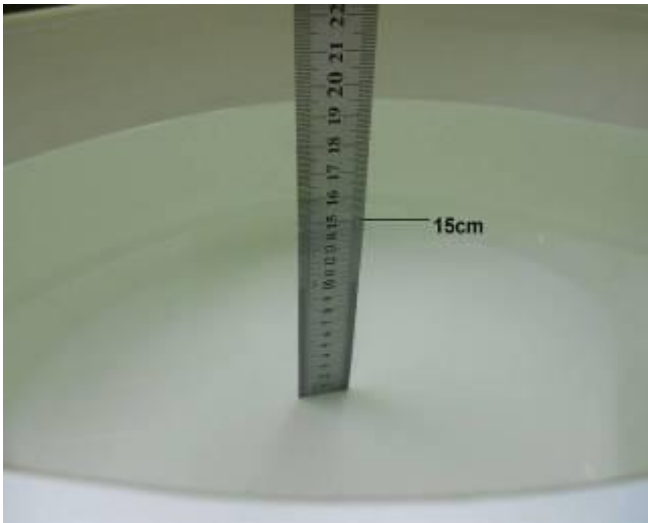
| | |
|---|------------|
| <p>Photo 4: Accessory</p> | <p>N/A</p> |
|  | <p>N/A</p> |

10.3 Photographs of EUT test position

| | |
|---|--|
| <p>Photo 5: Front side 0mm</p> | <p>Photo 6: Back side 0mm</p> |
|  |  |

| Photo 7: Bottom side 0mm | Photo 8: Right side 0mm |
|---|--|
|  |  |

10.4 Photographs of Tissue Simulate Liquid

| Photo 9: Tissue Simulate Liquid for Body 2450 | NA |
|---|-----------|
|  | <p>NA</p> |

10.5 EUT Constructional Details

Refer to Report No. SZEM140300130801 for EUT external and internal photos.

11 Calibration certificate

Please see the Appendix C



Appendix A : Detailed System Validation Results

Appendix B: Detailed Test Results

Appendix C: Calibration certificate

---END---



Appendix A

Detailed System Validation Results

| |
|---------------------------------------|
| System Performance Check 2450MHz Body |
|---------------------------------------|

Test Laboratory: SGS-SAR Lab

System Performance Check 2450MHz Body

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 733

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: MSL2450 Medium parameters used: $f = 2450$ MHz; $\sigma = 1.93$ mho/m; $\epsilon_r = 51.6$;

$\rho = 1000$ kg/m³

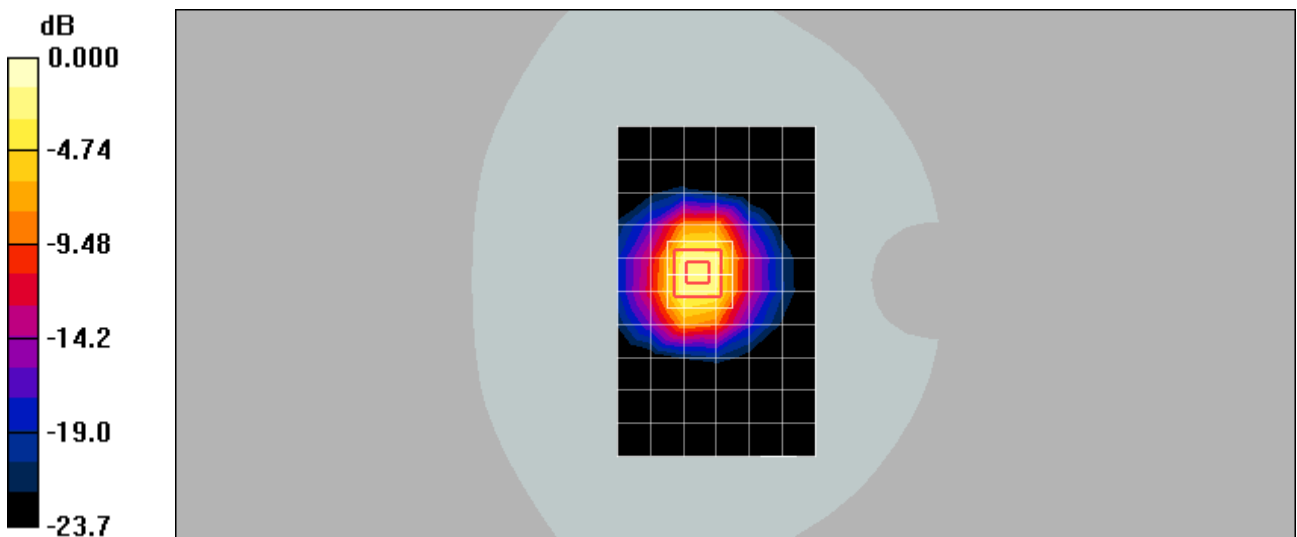
Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV4 - SN3962; ConvF(7.13, 7.13, 7.13); Calibrated: 2013-12-10
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2013-11-22
- Phantom: SAM 1; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d=10mm, Pin=250mW/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 17.8 mW/g

d=10mm, Pin=250mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 113.4 V/m; Power Drift = -0.171 dB
Peak SAR (extrapolated) = 58.5 W/kg
SAR(1 g) = 12.7 mW/g; SAR(10 g) = 5.7 mW/g
Maximum value of SAR (measured) = 26.6 mW/g



0 dB = 26.6mW/g



Appendix B

Detailed Test Results

| |
|---------------|
| WIFI for Body |
|---------------|

Test Laboratory: SGS-SAR Lab

MFC144 WiFi 802.11b 1CH Front Side 0mm

DUT: MFC144; Type: Lexibook Master Pocket-4.3"; Serial: NA

Communication System: 802.11b/g; Frequency: 2412 MHz; Duty Cycle: 1:1
Medium: MSL2450 Medium parameters used: $f = 2412 \text{ MHz}$; $\sigma = 1.89 \text{ mho/m}$; $\epsilon_r = 51.7$;

$\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV4 - SN3962; ConvF(7.13, 7.13, 7.13); Calibrated: 2013-12-10
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2013-11-22
- Phantom: SAM 1; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Body/Area Scan (8x11x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (measured) = 0.503 mW/g

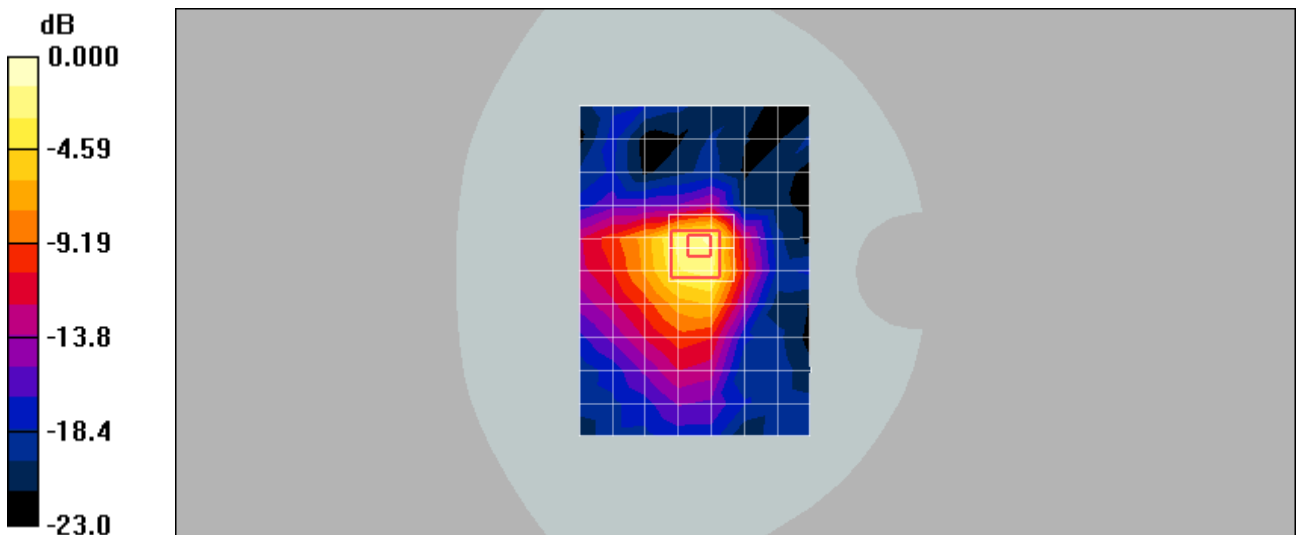
Body/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 15.3 V/m; Power Drift = 0.028 dB

Peak SAR (extrapolated) = 1.45 W/kg

SAR(1 g) = 0.577 mW/g; SAR(10 g) = 0.250 mW/g

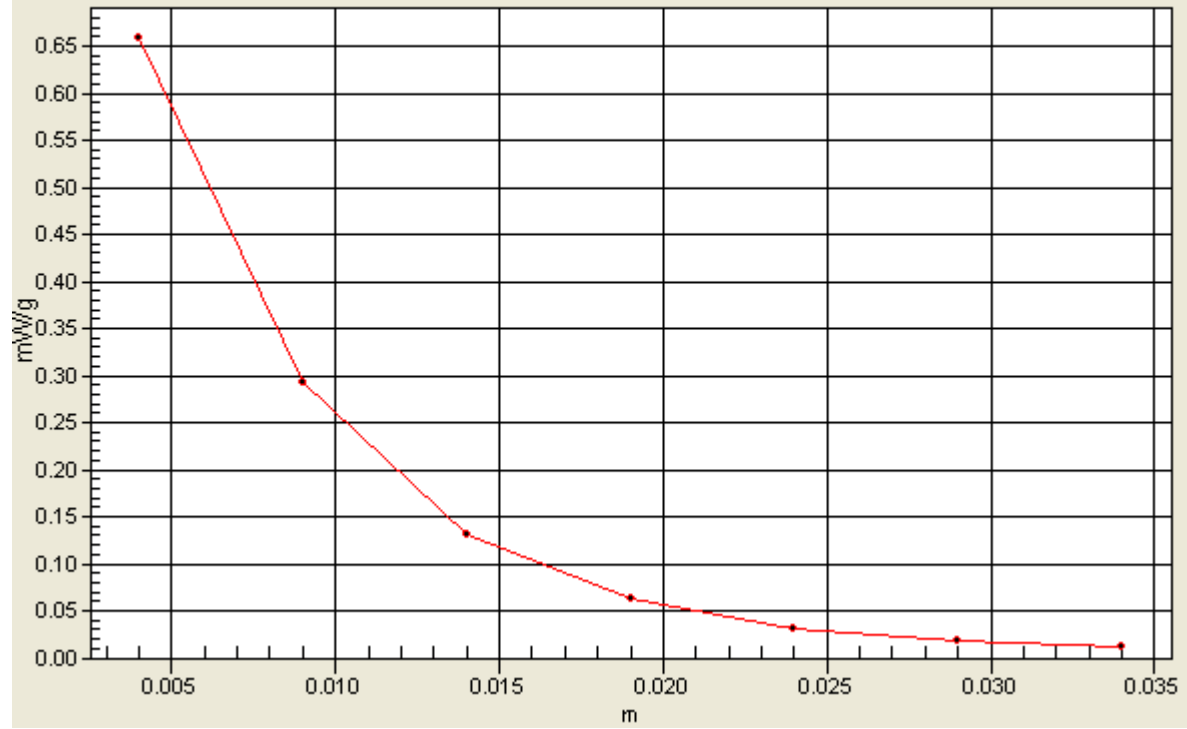
Maximum value of SAR (measured) = 0.659 mW/g



0 dB = 0.659mW/g

1g/10g Averaged SAR

SAR; Zoom Scan: Value Along Z, X=3, Y=3



Test Laboratory: SGS-SAR Lab

MFC144 WiFi 802.11b 1CH Back Side 0mm

DUT: MFC144; Type: Lexibook Master Pocket-4.3"; Serial: NA

Communication System: 802.11b/g; Frequency: 2412 MHz; Duty Cycle: 1:1
Medium: MSL2450 Medium parameters used: $f = 2412$ MHz; $\sigma = 1.89$ mho/m; $\epsilon_r = 51.7$;

$\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV4 - SN3962; ConvF(7.13, 7.13, 7.13); Calibrated: 2013-12-10
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2013-11-22
- Phantom: SAM 1; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Body/Area Scan (8x11x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.122 mW/g

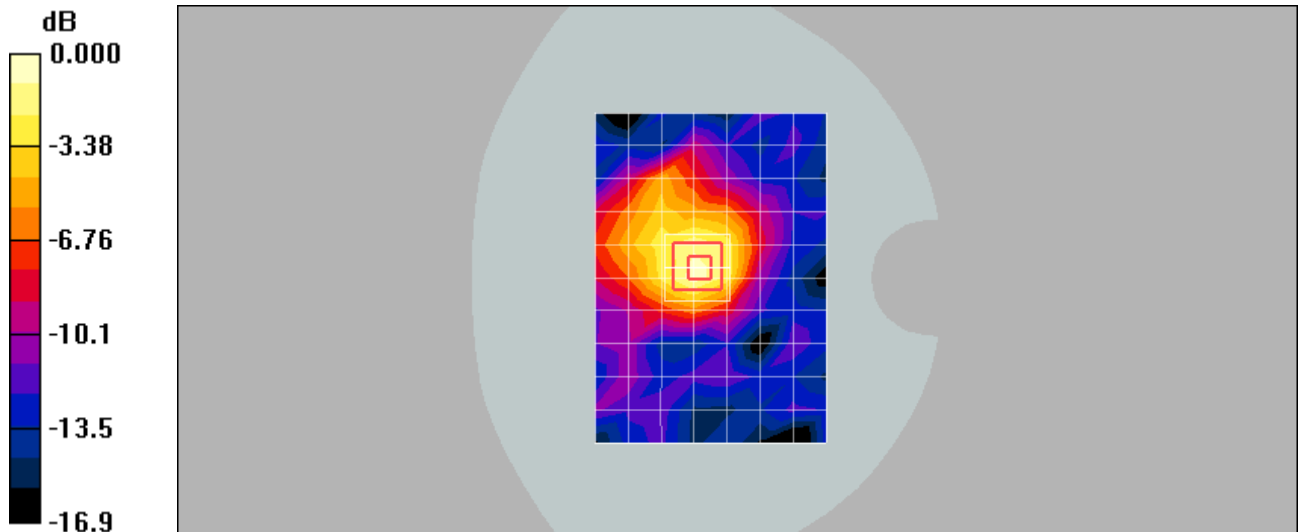
Body/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 8.09 V/m; Power Drift = -0.190 dB

Peak SAR (extrapolated) = 0.255 W/kg

SAR(1 g) = 0.116 mW/g; SAR(10 g) = 0.059 mW/g

Maximum value of SAR (measured) = 0.131 mW/g



0 dB = 0.131mW/g

Test Laboratory: SGS-SAR Lab

MFC144 WiFi 802.11b 1CH Right Side 0mm

DUT: MFC144; Type: Lexibook Master Pocket-4.3"; Serial: NA

Communication System: 802.11b/g; Frequency: 2412 MHz; Duty Cycle: 1:1
Medium: MSL2450 Medium parameters used: $f = 2412$ MHz; $\sigma = 1.89$ mho/m; $\epsilon_r = 51.7$;

$\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV4 - SN3962; ConvF(7.13, 7.13, 7.13); Calibrated: 2013-12-10
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2013-11-22
- Phantom: SAM 1; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Body/Area Scan (8x11x1): Measurement grid: dx=15mm, dy=15mm

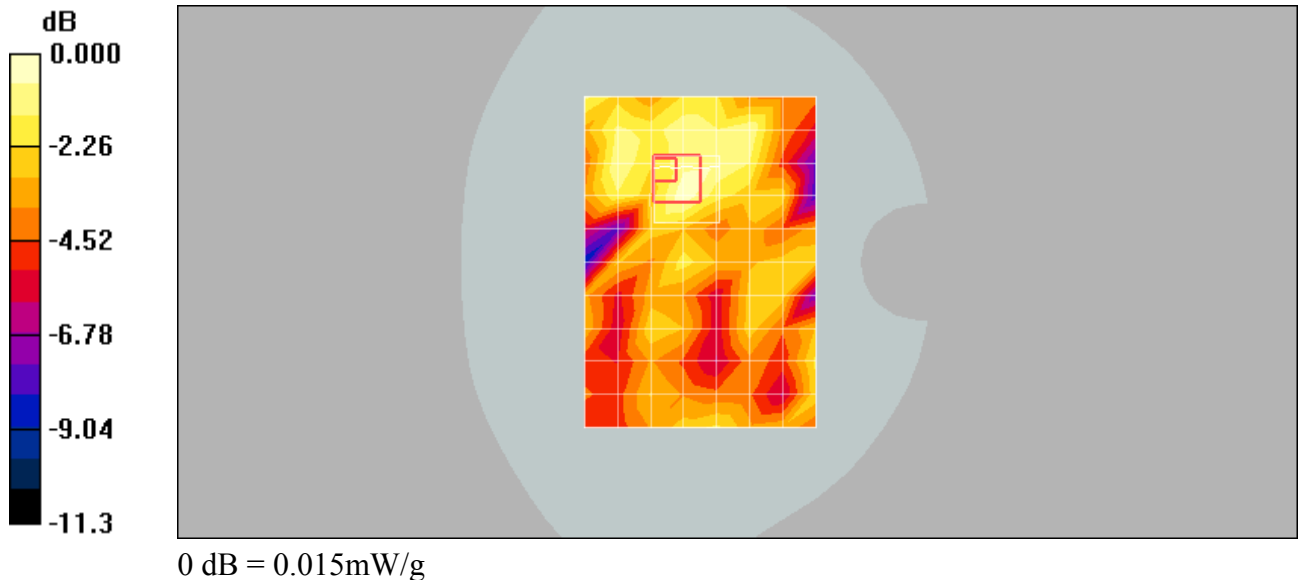
Maximum value of SAR (measured) = 0.015 mW/g

Body/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 1.90 V/m; Power Drift = 0.129 dB

Peak SAR (extrapolated) = 0.030 W/kg

SAR(1 g) = 0.011 mW/g; SAR(10 g) = 0.00751 mW/g



Test Laboratory: SGS-SAR Lab

MFC144 WiFi 802.11b 1CH Bottom Side 0mm

DUT: MFC144; Type: Lexibook Master Pocket-4.3"; Serial: NA

Communication System: 802.11b/g; Frequency: 2412 MHz; Duty Cycle: 1:1
Medium: MSL2450 Medium parameters used: $f = 2412$ MHz; $\sigma = 1.89$ mho/m; $\epsilon_r = 51.7$;

$\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV4 - SN3962; ConvF(7.13, 7.13, 7.13); Calibrated: 2013-12-10
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2013-11-22
- Phantom: SAM 1; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Body/Area Scan (8x11x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.029 mW/g

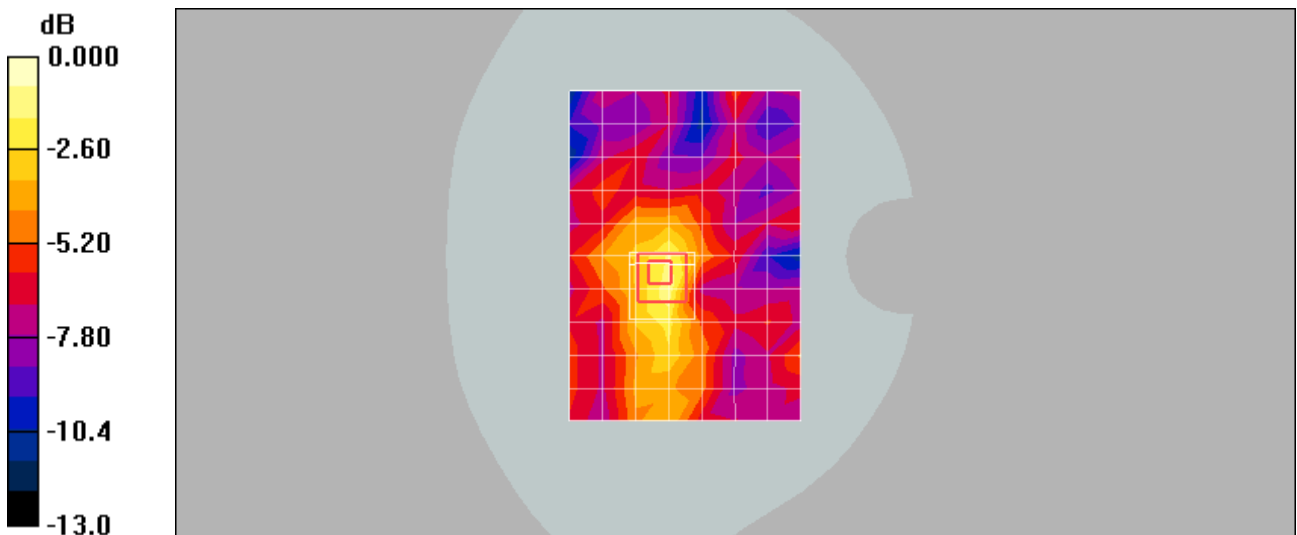
Body/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 2.98 V/m; Power Drift = -0.114 dB

Peak SAR (extrapolated) = 0.071 W/kg

SAR(1 g) = 0.035 mW/g; SAR(10 g) = 0.020 mW/g

Maximum value of SAR (measured) = 0.037 mW/g



Test Laboratory: SGS-SAR Lab

MFC144 WiFi 802.11b 6CH Front Side 0mm

DUT: MFC144; Type: Lexibook Master Pocket-4.3"; Serial: NA

Communication System: 802.11b/g; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: MSL2450 Medium parameters used: $f = 2437$ MHz; $\sigma = 1.917$ mho/m; $\epsilon_r = 51.66$;

$\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV4 - SN3962; ConvF(7.13, 7.13, 7.13); Calibrated: 2013-12-10
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2013-11-22
- Phantom: SAM 1; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Body/Area Scan (8x11x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.478 mW/g

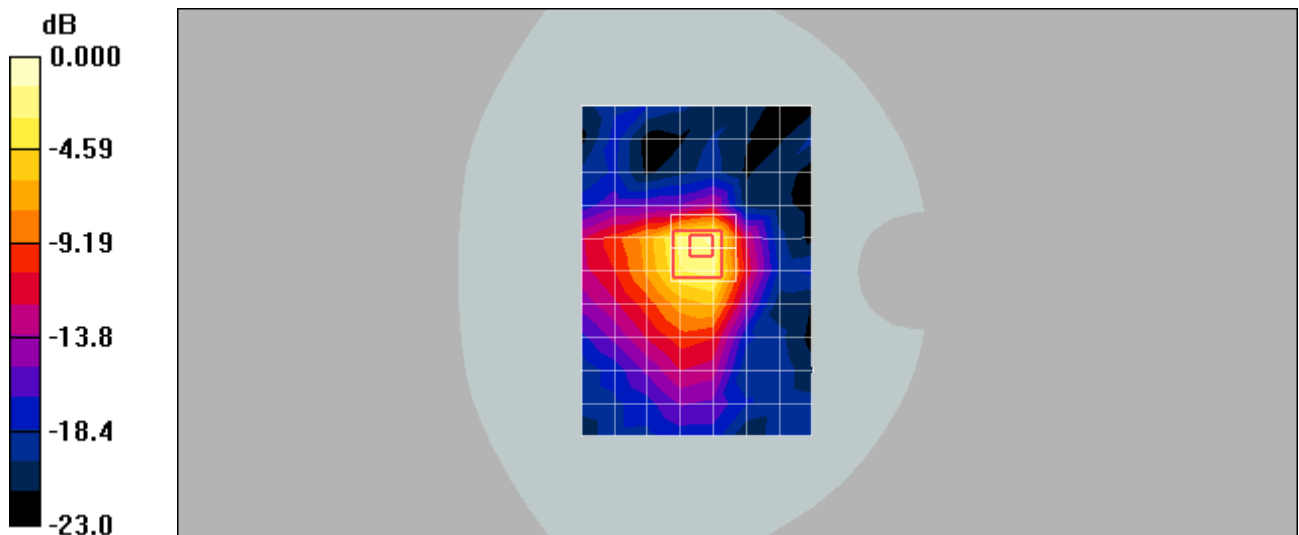
Body/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 14.8 V/m; Power Drift = -0.13dB

Peak SAR (extrapolated) = 1.38 W/kg

SAR(1 g) = 0.532 mW/g; SAR(10 g) = 0.232 mW/g

Maximum value of SAR (measured) = 0.621 mW/g



0 dB = 0.621mW/g

Test Laboratory: SGS-SAR Lab

MFC144 WiFi 802.11b 11CH Front Side 0mm

DUT: MFC144; Type: Lexibook Master Pocket-4.3"; Serial: NA

Communication System: 802.11b/g; Frequency: 2462 MHz; Duty Cycle: 1:1

Medium: MSL2450 Medium parameters used: $f = 2462$ MHz; $\sigma = 1.948$ mho/m; $\epsilon_r = 51.51$;

$\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV4 - SN3962; ConvF(7.13, 7.13, 7.13); Calibrated: 2013-12-10
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn569; Calibrated: 2013-11-22
- Phantom: SAM 1; Type: SAM V4.0; Serial: TP-1283
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Body/Area Scan (8x11x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.465 mW/g

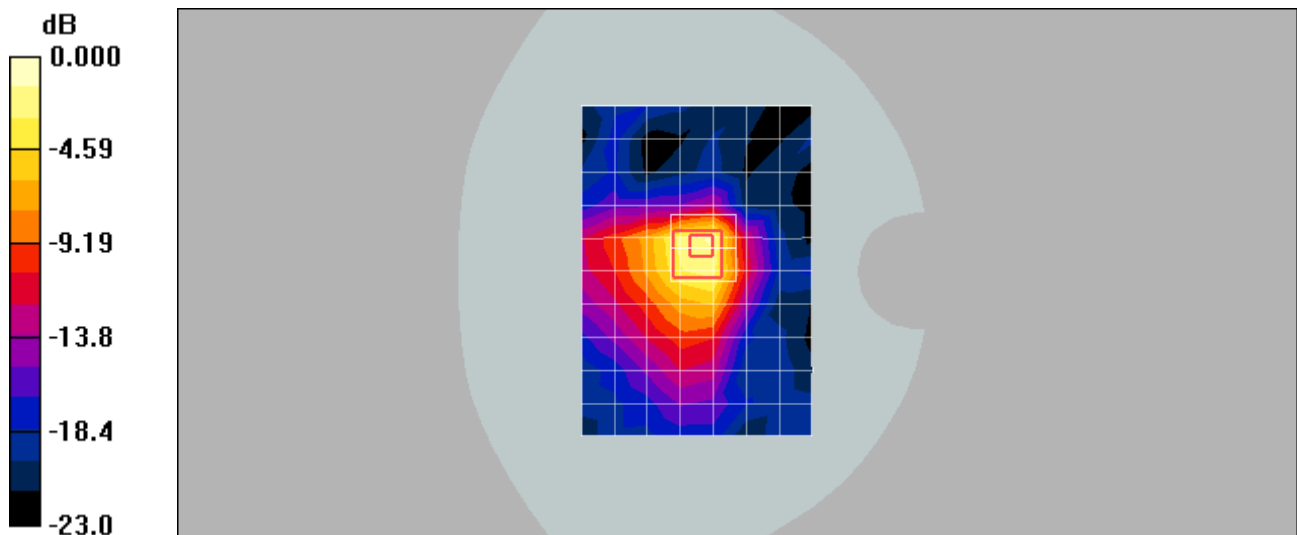
Body/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 14.1 V/m; Power Drift = -0.11 dB

Peak SAR (extrapolated) = 1.05 W/kg

SAR(1 g) = 0.487 mW/g; SAR(10 g) = 0.201 mW/g

Maximum value of SAR (measured) = 0.549 mW/g



0 dB = 0.549mW/g



Appendix C

Calibration certificate

| |
|----------------------------|
| D2450V2-SN 733(2013-11-26) |
| DAE3-SN 569(2013-11-22) |
| EX3DV4-SN 3962(2013-12-10) |



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Client **SGS-SZ (Auden)**

Certificate No: **D2450V2-733_Nov13**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 733**

Calibration procedure(s) **QA CAL-05.v9
Calibration procedure for dipole validation kits above 700 MHz**

Calibration date: **November 26, 2013**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date (Certificate No.) | Scheduled Calibration |
|-----------------------------|--------------------|--------------------------------|-----------------------|
| Power meter EPM-442A | GB37480704 | 09-Oct-13 (No. 217-01827) | Oct-14 |
| Power sensor HP 8481A | US37292783 | 09-Oct-13 (No. 217-01827) | Oct-14 |
| Power sensor HP 8481A | MY41092317 | 09-Oct-13 (No. 217-01828) | Oct-14 |
| Reference 20 dB Attenuator | SN: 5058 (20k) | 04-Apr-13 (No. 217-01736) | Apr-14 |
| Type-N mismatch combination | SN: 5047.3 / 06327 | 04-Apr-13 (No. 217-01739) | Apr-14 |
| Reference Probe ES3DV3 | SN: 3205 | 28-Dec-12 (No. ES3-3205_Dec12) | Dec-13 |
| DAE4 | SN: 601 | 25-Apr-13 (No. DAE4-601_Apr13) | Apr-14 |

| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
|---------------------------|------------------|-----------------------------------|------------------------|
| RF generator R&S SMT-06 | 100005 | 04-Aug-99 (in house check Oct-13) | In house check: Oct-15 |
| Network Analyzer HP 8753E | US37390585 S4206 | 18-Oct-01 (in house check Oct-13) | In house check: Oct-14 |

Calibrated by: **Claudio Leubler** Name: Claudio Leubler Function: Laboratory Technician

Signature 

Approved by: **Katja Pokovic** Name: Katja Pokovic Function: Technical Manager

Issued: November 26, 2013

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



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Accreditation No.: **SCS 108**

Glossary:

| | |
|-------|---------------------------------|
| TSL | tissue simulating liquid |
| ConvF | sensitivity in TSL / NORM x,y,z |
| N/A | not applicable or not measured |

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- c) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

| | | |
|------------------------------|------------------------|-------------|
| DASY Version | DASY5 | V52.8.7 |
| Extrapolation | Advanced Extrapolation | |
| Phantom | Modular Flat Phantom | |
| Distance Dipole Center - TSL | 10 mm | with Spacer |
| Zoom Scan Resolution | dx, dy, dz = 5 mm | |
| Frequency | 2450 MHz \pm 1 MHz | |

Head TSL parameters

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|---|---------------------|----------------|----------------------|
| Nominal Head TSL parameters | 22.0 °C | 39.2 | 1.80 mho/m |
| Measured Head TSL parameters | (22.0 \pm 0.2) °C | 39.7 \pm 6 % | 1.84 mho/m \pm 6 % |
| Head TSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with Head TSL

| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
|---|--------------------|--|
| SAR measured | 250 mW input power | 13.2 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 52.4 W/kg \pm 17.0 % (k=2) |

| SAR averaged over 10 cm ³ (10 g) of Head TSL | condition | |
|---|--------------------|--|
| SAR measured | 250 mW input power | 6.10 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 24.3 W/kg \pm 16.5 % (k=2) |

Body TSL parameters

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|---|---------------------|----------------|----------------------|
| Nominal Body TSL parameters | 22.0 °C | 52.7 | 1.95 mho/m |
| Measured Body TSL parameters | (22.0 \pm 0.2) °C | 52.1 \pm 6 % | 2.02 mho/m \pm 6 % |
| Body TSL temperature change during test | < 0.5 °C | ---- | ---- |

SAR result with Body TSL

| SAR averaged over 1 cm ³ (1 g) of Body TSL | Condition | |
|---|--------------------|--|
| SAR measured | 250 mW input power | 12.6 W/kg |
| SAR for nominal Body TSL parameters | normalized to 1W | 49.4 W/kg \pm 17.0 % (k=2) |

| SAR averaged over 10 cm ³ (10 g) of Body TSL | condition | |
|---|--------------------|--|
| SAR measured | 250 mW input power | 5.81 W/kg |
| SAR for nominal Body TSL parameters | normalized to 1W | 23.0 W/kg \pm 16.5 % (k=2) |

Appendix

Antenna Parameters with Head TSL

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 54.2 Ω + 2.5 j Ω |
| Return Loss | - 26.6 dB |

Antenna Parameters with Body TSL

| | |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 51.0 Ω + 4.2 j Ω |
| Return Loss | - 27.5 dB |

General Antenna Parameters and Design

| | |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.149 ns |
|----------------------------------|----------|

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

| | |
|-----------------|--------------|
| Manufactured by | SPEAG |
| Manufactured on | May 07, 2003 |

DASY5 Validation Report for Head TSL

Date: 26.11.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 733

Communication System: UID 0 - CW ; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.84$ S/m; $\epsilon_r = 39.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.52, 4.52, 4.52); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Dipole Calibration for Head Tissue/ $P_{in}=250$ mW, $d=10$ mm/Zoom Scan (8x7x7)/Cube 0:

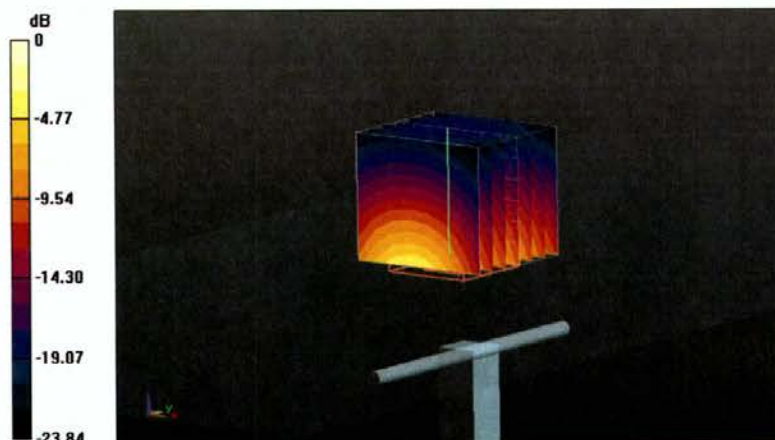
Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 93.010 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 27.4 W/kg

SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.1 W/kg

Maximum value of SAR (measured) = 17.4 W/kg

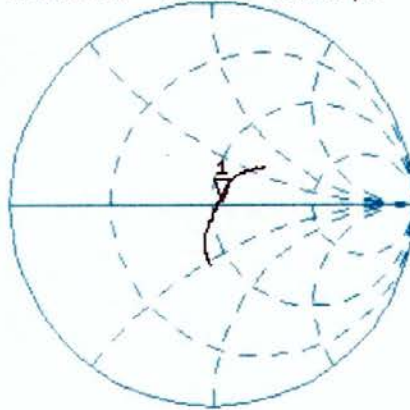


0 dB = 17.4 W/kg = 12.41 dBW/kg

Impedance Measurement Plot for Head TSL

26 Nov 2013 12:23:30
CH1 S11 1 U FS 1: 54.160 Ω 2.5000 Ω 162.40 pF 2 450.000 000 MHz

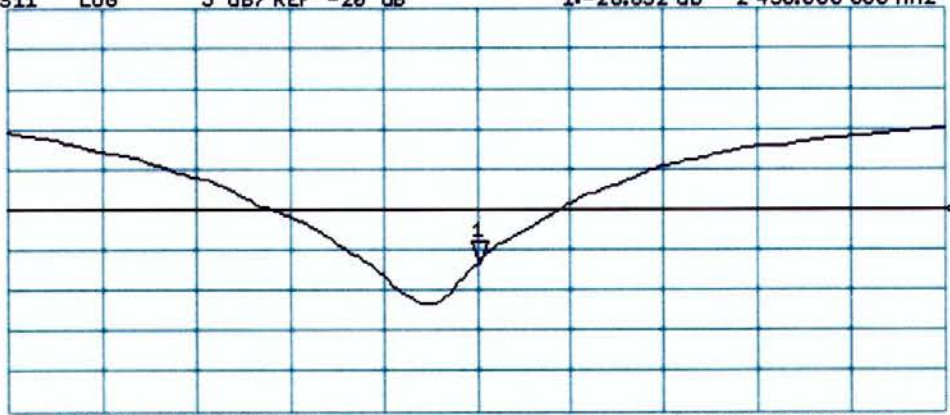
*
De1
CA



Avg
13
H1d

CH2 S11 LOG 5 dB/REF -20 dB 1: -26.632 dB 2 450.000 000 MHz

CA
Avg
13
H1d



START 2 250.000 000 MHz

STOP 2 650.000 000 MHz

DASY5 Validation Report for Body TSL

Date: 26.11.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 733

Communication System: UID 0 - CW ; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 2.02$ S/m; $\epsilon_r = 52.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.42, 4.42, 4.42); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

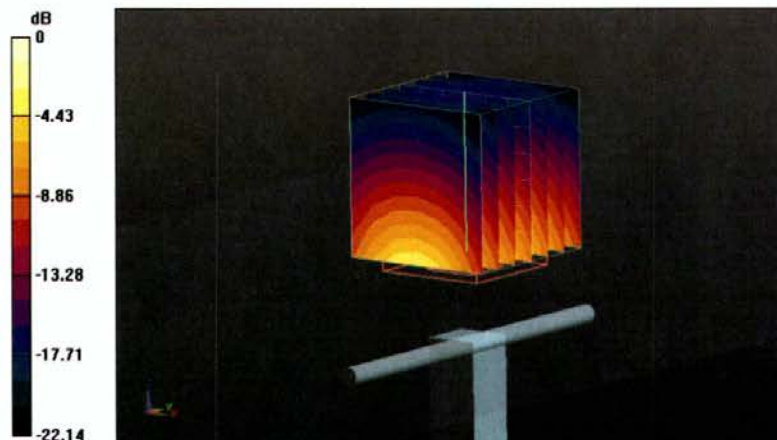
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 93.010 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 26.1 W/kg

SAR(1 g) = 12.6 W/kg; SAR(10 g) = 5.81 W/kg

Maximum value of SAR (measured) = 16.4 W/kg



0 dB = 16.4 W/kg = 12.15 dBW/kg

Impedance Measurement Plot for Body TSL

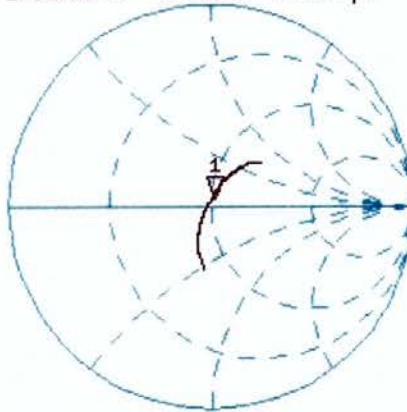
26 Nov 2013 12:21:35

CH1 S11 1 U FS

1: 51.002 Ω 4.1621 Ω 270.38 μ H

2 450.000 000 MHz

*
De1
CA



Avg
6

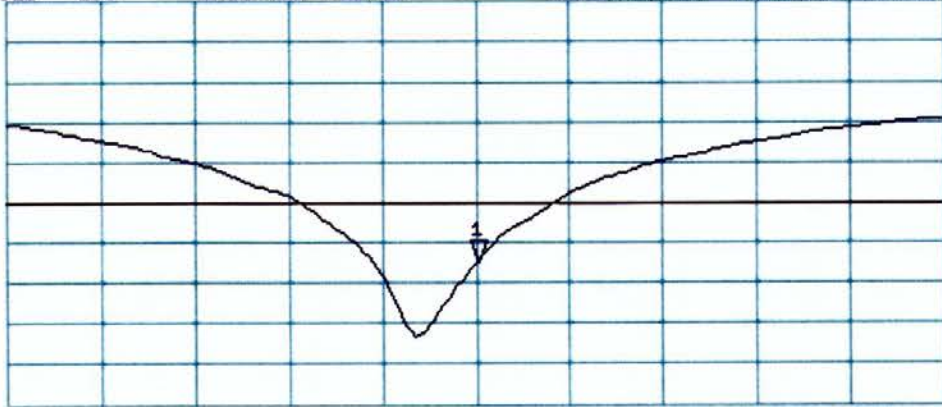
H1d

CH2 S11 LOG 5 dB/REF -20 dB 1:-27.463 dB 2 450.000 000 MHz

CA

Avg
6

H1d



START 2 250.000 000 MHz

STOP 2 650.000 000 MHz

IMPORTANT NOTICE

USAGE OF THE DAE 3

The DAE unit is a delicate, high precision instrument and requires careful treatment by the user. There are no serviceable parts inside the DAE. Special attention shall be given to the following points:

Battery Exchange: The battery cover of the DAE3 unit is connected to a fragile 3-pin battery connector. Customer is responsible to apply utmost caution not to bend or damage the connector when changing batteries.

Shipping of the DAE: Before shipping the DAE to SPEAG for calibration the customer shall remove the batteries and pack the DAE in an antistatic bag. This antistatic bag shall then be packed into a larger box or container which protects the DAE from impacts transportation. The package shall be marked to indicate that a fragile instrument is inside.

E-Stop Failures: Touch detection may be malfunctioning due to broken magnets in the E-stop. Rough handling of the E-stop may lead to damage of these magnets. Touch and collision errors are often caused by dust and dirt accumulated in the E-stop. To prevent E-stop failure, Customer shall always mount the probe to the DAE carefully and keep the DAE unit in a non-dusty environment if not used for measurements.

Repair: Minor repairs are performed at no extra cost during the annual calibration. However, SPEAG reserves the right to charge for any repair especially if rough unprofessional handling caused the defect.

DASY Configuration Files: Since the exact values of the DAE input resistances, as measured during the calibration procedure of a DAE unit, are not used by the DASY software, a nominal value of 200 MOhm is given in the corresponding configuration file.

Important Note:

Warranty and calibration is void if the DAE unit is disassembled partly or fully by the Customer.

Important Note:

Never attempt to grease or oil the E-stop assembly. Cleaning and readjusting of the E-stop assembly is allowed by certified SPEAG personnel only and is part of the annual calibration procedure.

Important Note:

To prevent damage of the DAE probe connector pins, use great care when installing the probe to the DAE. Carefully connect the probe with the connector notch oriented in the mating position. Avoid any rotational movement of the probe body versus the DAE while turning the locking nut of the connector. The same care shall be used when disconnecting the probe from the DAE.



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 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **SGS - ZH (Auden)**

Certificate No: **DAE3-569_Nov13**

CALIBRATION CERTIFICATE

Object **DAE3 - SD 000 D03 AA - SN: 569**

Calibration procedure(s) **QA CAL-06.v26
 Calibration procedure for the data acquisition electronics (DAE)**

Calibration date: **November 22, 2013**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
 The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date (Certificate No.) | Scheduled Calibration |
|-------------------------------|--------------------|----------------------------|------------------------|
| Keithley Multimeter Type 2001 | SN: 0810278 | 01-Oct-13 (No:13976) | Oct-14 |
| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
| Auto DAE Calibration Unit | SE UWS 053 AA 1001 | 07-Jan-13 (in house check) | In house check: Jan-14 |
| Calibrator Box V2.1 | SE UMS 006 AA 1002 | 07-Jan-13 (in house check) | In house check: Jan-14 |

| | | | |
|----------------|----------------------|---------------------------------|------------------|
| | Name | Function | Signature |
| Calibrated by: | Eric Hainfeld | Technician | |
| Approved by: | Fin Bomholt | Deputy Technical Manager | |

Issued: November 22, 2013

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Accreditation No.: **SCS 108**

Glossary

| | |
|-----------------|---|
| DAE | data acquisition electronics |
| Connector angle | information used in DASY system to align probe sensor X to the robot coordinate system. |

Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle:* The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
 - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
 - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.
 - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.
 - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage
 - *Input Offset Measurement:* Output voltage and statistical results over a large number of zero voltage measurements.
 - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.
 - *Input resistance:* Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
 - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.
 - *Power consumption:* Typical value for information. Supply currents in various operating modes.

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1 μ V, full range = -100...+300 mV

Low Range: 1LSB = 61nV, full range = -1.....+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| Calibration Factors | X | Y | Z |
|---------------------|---------------------------|---------------------------|---------------------------|
| High Range | 403.044 \pm 0.02% (k=2) | 403.443 \pm 0.02% (k=2) | 403.617 \pm 0.02% (k=2) |
| Low Range | 3.94201 \pm 1.50% (k=2) | 3.95604 \pm 1.50% (k=2) | 3.94389 \pm 1.50% (k=2) |

Connector Angle

| | |
|---|--------------------------|
| Connector Angle to be used in DASY system | 262.5 \pm 1 $^{\circ}$ |
|---|--------------------------|

Appendix

1. DC Voltage Linearity

| High Range | Reading (μV) | Difference (μV) | Error (%) |
|-------------------|---------------------------|------------------------------|-----------|
| Channel X + Input | 199993.93 | -2.78 | -0.00 |
| Channel X + Input | 19998.22 | -2.12 | -0.01 |
| Channel X - Input | -20001.42 | -0.25 | 0.00 |
| Channel Y + Input | 199997.32 | 0.36 | 0.00 |
| Channel Y + Input | 20002.20 | 1.55 | 0.01 |
| Channel Y - Input | -20000.21 | 0.87 | -0.00 |
| Channel Z + Input | 199997.05 | -0.02 | -0.00 |
| Channel Z + Input | 19996.57 | -3.95 | -0.02 |
| Channel Z - Input | -20001.04 | 0.17 | -0.00 |

| Low Range | Reading (μV) | Difference (μV) | Error (%) |
|-------------------|---------------------------|------------------------------|-----------|
| Channel X + Input | 2001.02 | 0.39 | 0.02 |
| Channel X + Input | 201.44 | 0.42 | 0.21 |
| Channel X - Input | -197.34 | 1.32 | -0.67 |
| Channel Y + Input | 2000.80 | 0.19 | 0.01 |
| Channel Y + Input | 201.17 | 0.07 | 0.03 |
| Channel Y - Input | -199.58 | -0.75 | 0.38 |
| Channel Z + Input | 2000.93 | 0.26 | 0.01 |
| Channel Z + Input | 200.10 | -0.84 | -0.42 |
| Channel Z - Input | -199.73 | -0.91 | 0.46 |

2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| | Common mode Input Voltage (mV) | High Range Average Reading (μV) | Low Range Average Reading (μV) |
|-----------|--------------------------------|--|---|
| Channel X | 200 | -0.24 | -2.04 |
| | - 200 | 2.76 | 1.27 |
| Channel Y | 200 | 4.80 | 4.90 |
| | - 200 | -6.14 | -6.55 |
| Channel Z | 200 | -13.76 | -13.77 |
| | - 200 | 11.04 | 11.29 |

3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| | Input Voltage (mV) | Channel X (μV) | Channel Y (μV) | Channel Z (μV) |
|-----------|--------------------|-----------------------------|-----------------------------|-----------------------------|
| Channel X | 200 | - | 2.83 | -2.47 |
| Channel Y | 200 | 9.46 | - | 3.54 |
| Channel Z | 200 | 7.51 | 7.74 | - |

4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| | High Range (LSB) | Low Range (LSB) |
|-----------|------------------|-----------------|
| Channel X | 16190 | 16754 |
| Channel Y | 16540 | 16468 |
| Channel Z | 15791 | 17162 |

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Input 10M Ω

| | Average (μ V) | min. Offset (μ V) | max. Offset (μ V) | Std. Deviation (μ V) |
|-----------|--------------------|------------------------|------------------------|---------------------------|
| Channel X | 0.60 | -1.47 | 2.64 | 0.79 |
| Channel Y | -0.27 | -1.99 | 2.05 | 0.72 |
| Channel Z | -1.01 | -3.56 | 0.67 | 0.63 |

6. Input Offset Current

Nominal input circuitry offset current on all channels: <25fA

7. Input Resistance (Typical values for information)

| | Zeroing (kOhm) | Measuring (MOhm) |
|-----------|----------------|------------------|
| Channel X | 200 | 200 |
| Channel Y | 200 | 200 |
| Channel Z | 200 | 200 |

8. Low Battery Alarm Voltage (Typical values for information)

| Typical values | Alarm Level (VDC) |
|----------------|-------------------|
| Supply (+ Vcc) | +7.9 |
| Supply (- Vcc) | -7.6 |

9. Power Consumption (Typical values for information)

| Typical values | Switched off (mA) | Stand by (mA) | Transmitting (mA) |
|----------------|-------------------|---------------|-------------------|
| Supply (+ Vcc) | +0.01 | +6 | +14 |
| Supply (- Vcc) | -0.01 | -8 | -9 |



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **SGS-SZ (Auden)**

Certificate No: **EX3-3962_Dec13**

CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3962**

Calibration procedure(s) **QA CAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6
Calibration procedure for dosimetric E-field probes**

Calibration date: **December 10, 2013**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID | Cal Date (Certificate No.) | Scheduled Calibration |
|----------------------------|-----------------|-----------------------------------|------------------------|
| Power meter E4419B | GB41293874 | 04-Apr-13 (No. 217-01733) | Apr-14 |
| Power sensor E4412A | MY41498087 | 04-Apr-13 (No. 217-01733) | Apr-14 |
| Reference 3 dB Attenuator | SN: S5054 (3c) | 04-Apr-13 (No. 217-01737) | Apr-14 |
| Reference 20 dB Attenuator | SN: S5277 (20x) | 04-Apr-13 (No. 217-01735) | Apr-14 |
| Reference 30 dB Attenuator | SN: S5129 (30b) | 04-Apr-13 (No. 217-01738) | Apr-14 |
| Reference Probe ES3DV2 | SN: 3013 | 28-Dec-12 (No. ES3-3013_Dec12) | Dec-13 |
| DAE4 | SN: 660 | 4-Sep-13 (No. DAE4-660_Sep13) | Sep-14 |
| Secondary Standards | ID | Check Date (in house) | Scheduled Check |
| RF generator HP 8648C | US3642U01700 | 4-Aug-99 (in house check Apr-13) | In house check: Apr-15 |
| Network Analyzer HP 8753E | US37390585 | 18-Oct-01 (in house check Oct-13) | In house check: Oct-14 |

| | | | |
|----------------|--------------------------------|--|---------------|
| Calibrated by: | Name Claudio Leubler | Function Laboratory Technician | Signature |
| Approved by: | Katja Pokovic | Technical Manager | |

Issued: December 11, 2013

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



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Accreditation No.: **SCS 108**

The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Glossary:

| | |
|--------------------------|---|
| TSL | tissue simulating liquid |
| NORM _{x,y,z} | sensitivity in free space |
| ConvF | sensitivity in TSL / NORM _{x,y,z} |
| DCP | diode compression point |
| CF | crest factor (1/duty_cycle) of the RF signal |
| A, B, C, D | modulation dependent linearization parameters |
| Polarization φ | φ rotation around probe axis |
| Polarization ϑ | ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis |
| Connector Angle | information used in DASY system to align probe sensor X to the robot coordinate system |

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}:** Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E²-field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z} = NORM_{x,y,z} * frequency_response** (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCP_{x,y,z}:** DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR:** PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; D_{x,y,z}; VR_{x,y,z}:** A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters:** Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM_{x,y,z} * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy):** in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset:** The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle:** The angle is assessed using the information gained by determining the NORM_x (no uncertainty required).

Probe EX3DV4

SN:3962

Manufactured: September 30, 2013
Calibrated: December 10, 2013

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3962

Basic Calibration Parameters

| | Sensor X | Sensor Y | Sensor Z | Unc (k=2) |
|---|----------|----------|----------|---------------|
| Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A | 0.39 | 0.48 | 0.43 | $\pm 10.1 \%$ |
| DCP (mV) ^B | 98.5 | 93.1 | 90.7 | |

Modulation Calibration Parameters

| UID | Communication System Name | | A dB | B dB/ μV | C | D dB | VR mV | Unc ^E (k=2) |
|-----|---------------------------|---|---------|------------------------|-----|---------|----------|---------------------------|
| 0 | CW | X | 0.0 | 0.0 | 1.0 | 0.00 | 134.3 | $\pm 3.3 \%$ |
| | | Y | 0.0 | 0.0 | 1.0 | | 163.4 | |
| | | Z | 0.0 | 0.0 | 1.0 | | 146.1 | |

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

^A The uncertainties of NormX,Y,Z do not affect the E^2 -field uncertainty inside TSL (see Pages 5 and 6).

^B Numerical linearization parameter: uncertainty not required.

^E Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3962

Calibration Parameter Determined in Head Tissue Simulating Media

| f (MHz) ^C | Relative Permittivity ^F | Conductivity (S/m) ^F | ConvF X | ConvF Y | ConvF Z | Alpha ^G | Depth ^G (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|--------------------|-------------------------|-------------|
| 850 | 41.5 | 0.92 | 10.14 | 10.14 | 10.14 | 0.32 | 0.97 | ± 12.0 % |
| 1810 | 40.0 | 1.40 | 8.14 | 8.14 | 8.14 | 0.65 | 0.64 | ± 12.0 % |
| 1900 | 40.0 | 1.40 | 8.07 | 8.07 | 8.07 | 0.62 | 0.62 | ± 12.0 % |
| 2000 | 40.0 | 1.40 | 8.11 | 8.11 | 8.11 | 0.50 | 0.69 | ± 12.0 % |
| 2450 | 39.2 | 1.80 | 7.33 | 7.33 | 7.33 | 0.28 | 0.93 | ± 12.0 % |
| 5200 | 36.0 | 4.66 | 5.25 | 5.25 | 5.25 | 0.30 | 1.80 | ± 13.1 % |
| 5300 | 35.9 | 4.76 | 5.00 | 5.00 | 5.00 | 0.30 | 1.80 | ± 13.1 % |
| 5500 | 35.6 | 4.96 | 4.80 | 4.80 | 4.80 | 0.35 | 1.80 | ± 13.1 % |
| 5600 | 35.5 | 5.07 | 4.71 | 4.71 | 4.71 | 0.30 | 1.80 | ± 13.1 % |
| 5800 | 35.3 | 5.27 | 4.65 | 4.65 | 4.65 | 0.40 | 1.80 | ± 13.1 % |

^C Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

^G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3962

Calibration Parameter Determined in Body Tissue Simulating Media

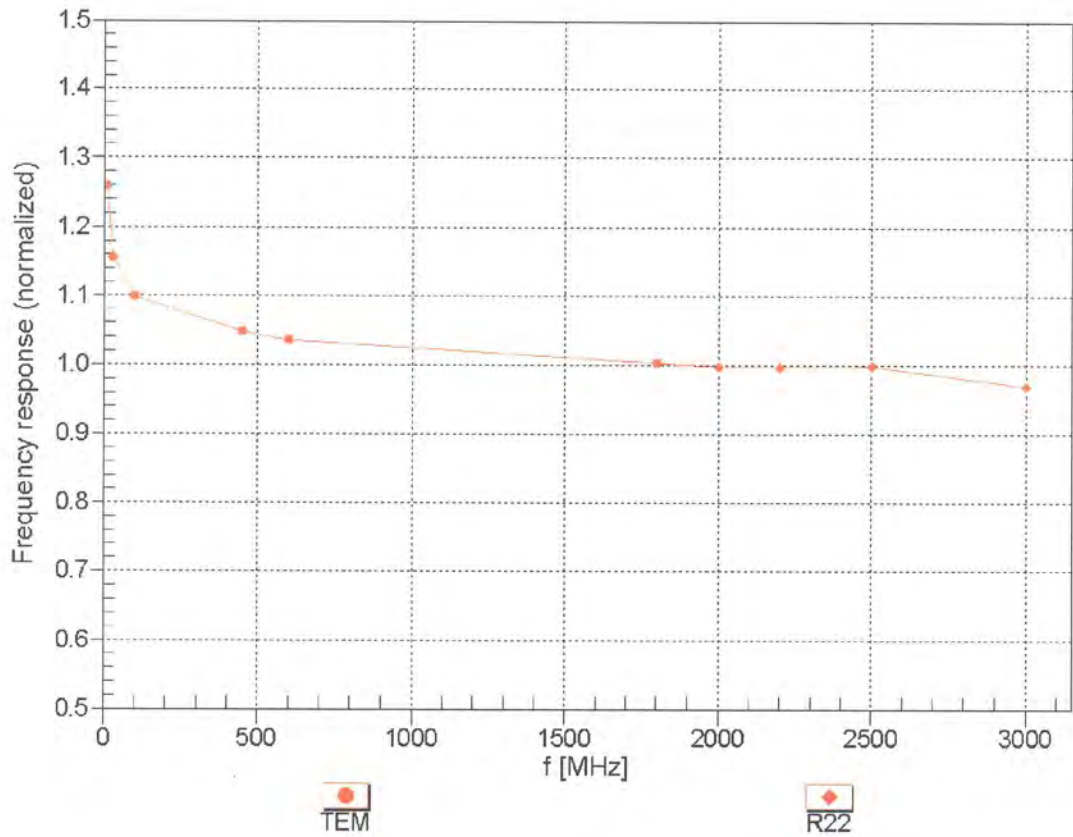
| f (MHz) ^C | Relative Permittivity ^F | Conductivity (S/m) ^F | ConvF X | ConvF Y | ConvF Z | Alpha ^G | Depth ^G (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|--------------------|-------------------------|-------------|
| 850 | 55.2 | 0.99 | 9.75 | 9.75 | 9.75 | 0.33 | 1.01 | ± 12.0 % |
| 1810 | 53.3 | 1.52 | 8.01 | 8.01 | 8.01 | 0.36 | 0.84 | ± 12.0 % |
| 1900 | 53.3 | 1.52 | 7.68 | 7.68 | 7.68 | 0.59 | 0.65 | ± 12.0 % |
| 2450 | 52.7 | 1.95 | 7.13 | 7.13 | 7.13 | 0.65 | 0.50 | ± 12.0 % |
| 5200 | 49.0 | 5.30 | 4.18 | 4.18 | 4.18 | 0.45 | 1.90 | ± 13.1 % |
| 5300 | 48.9 | 5.42 | 4.09 | 4.09 | 4.09 | 0.45 | 1.90 | ± 13.1 % |
| 5500 | 48.6 | 5.65 | 3.91 | 3.91 | 3.91 | 0.45 | 1.90 | ± 13.1 % |
| 5600 | 48.5 | 5.77 | 3.60 | 3.60 | 3.60 | 0.55 | 1.90 | ± 13.1 % |
| 5800 | 48.2 | 6.00 | 3.96 | 3.96 | 3.96 | 0.50 | 1.90 | ± 13.1 % |

^C Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

^G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

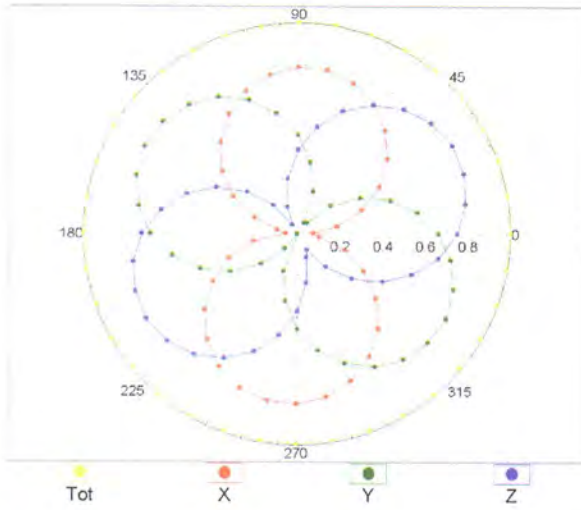
Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)



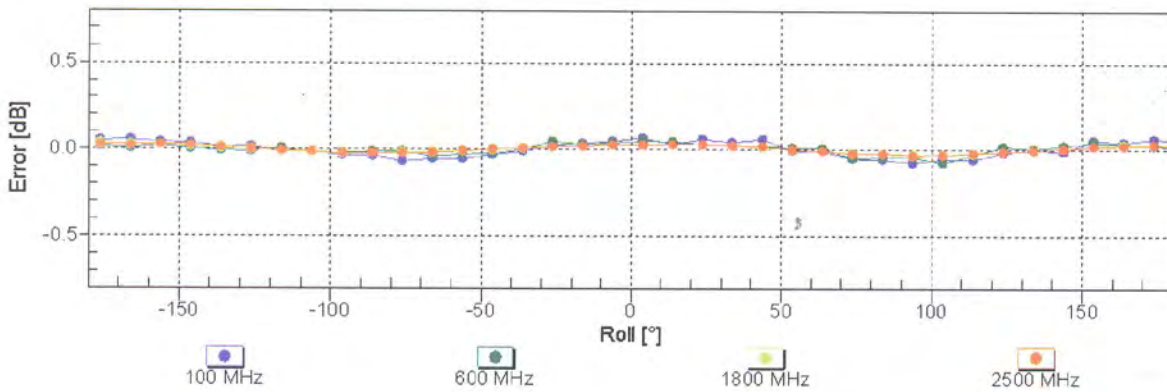
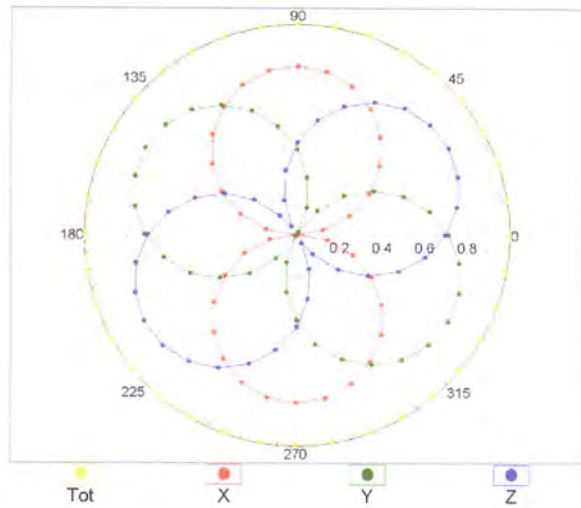
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ (k=2)

Receiving Pattern (ϕ), $\theta = 0^\circ$

f=600 MHz, TEM

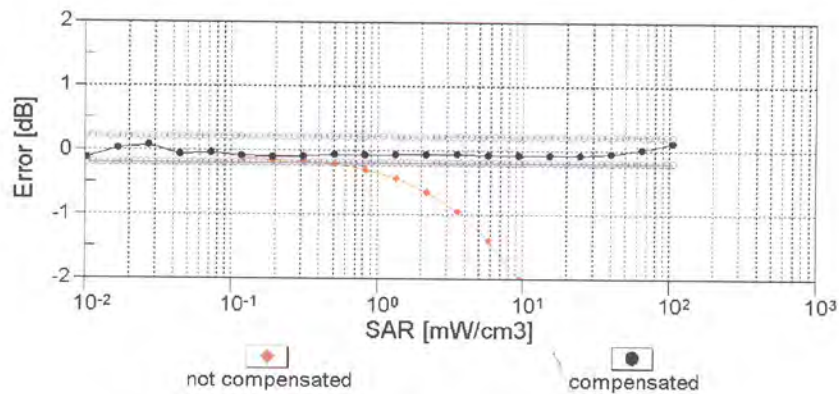
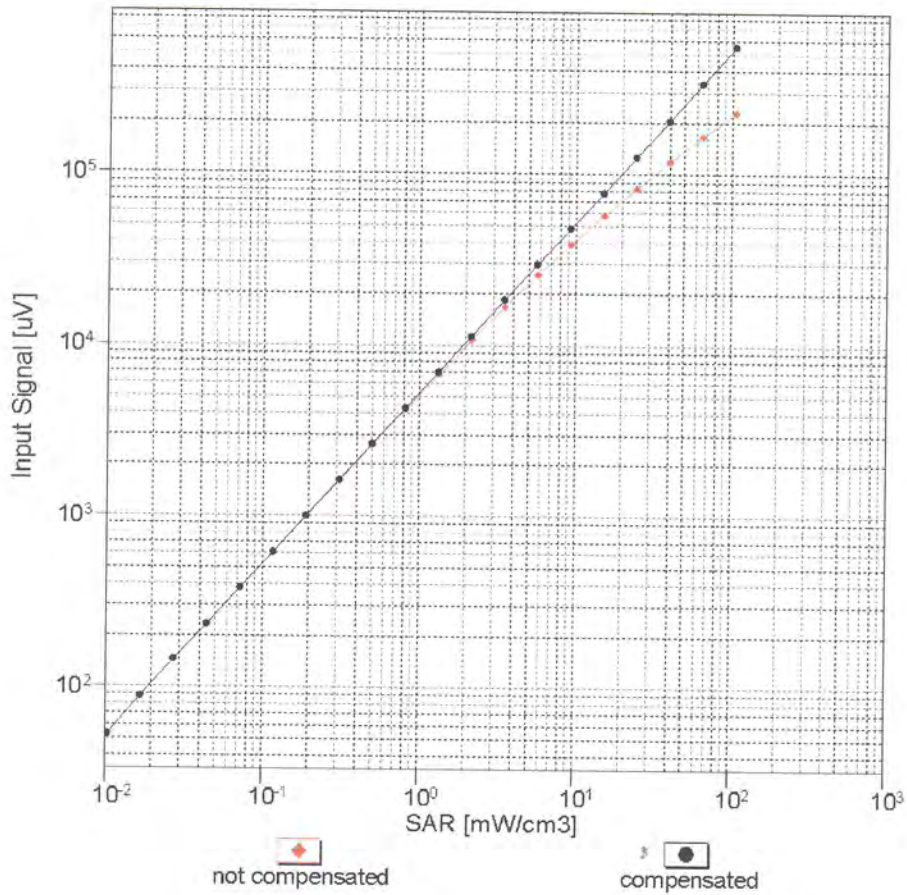


f=1800 MHz, R22



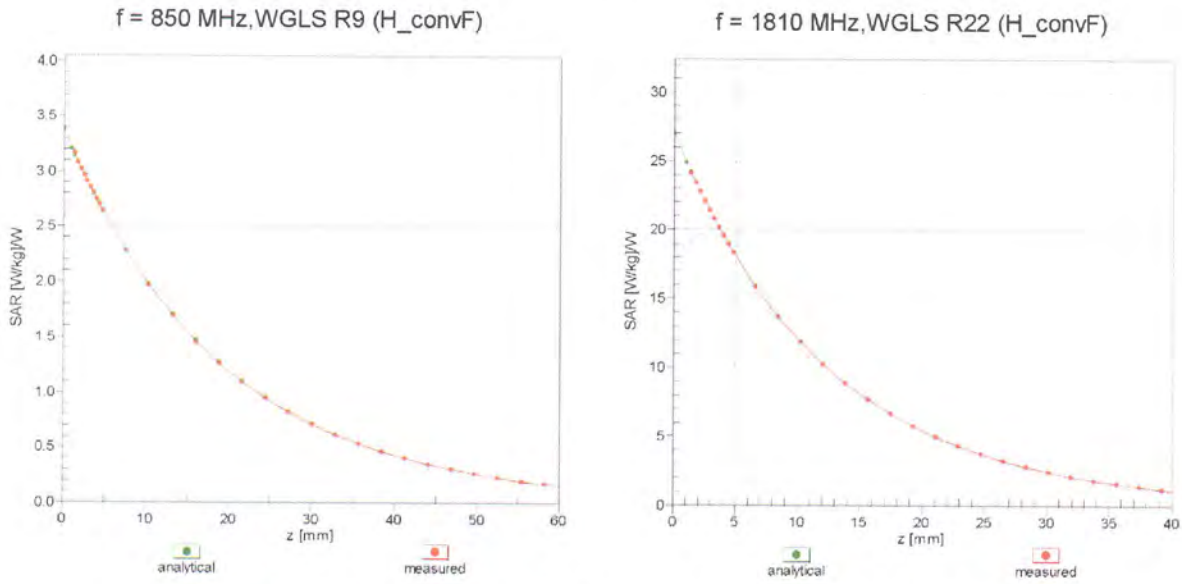
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ (k=2)

Dynamic Range $f(SAR_{head})$ (TEM cell , $f = 900$ MHz)

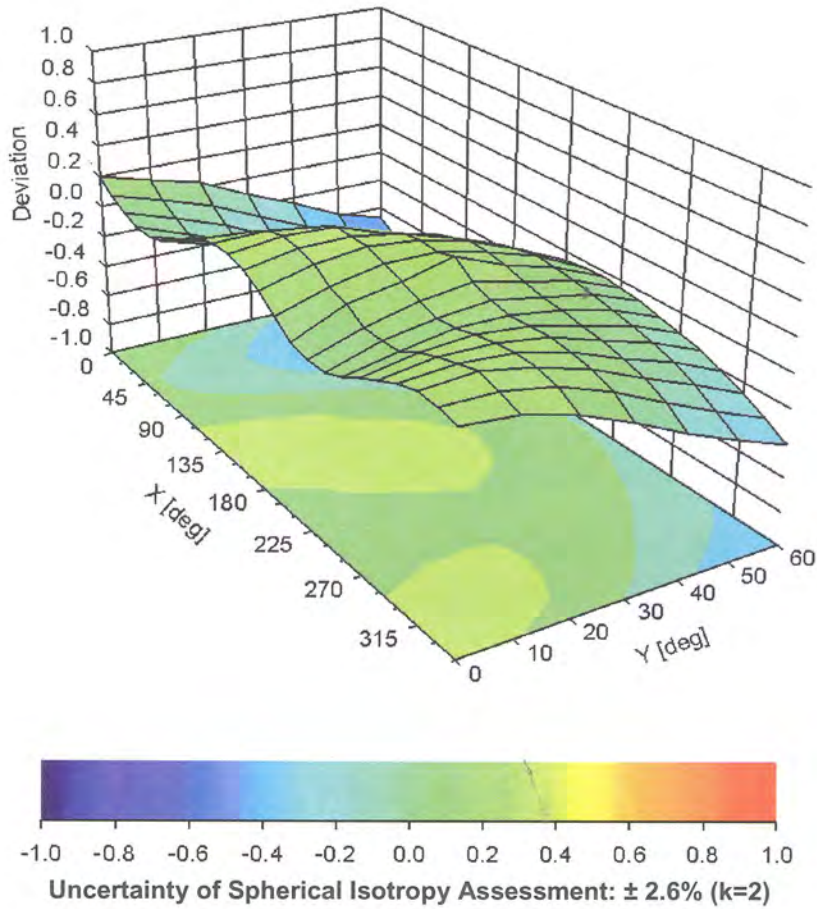


Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

Conversion Factor Assessment



Deviation from Isotropy in Liquid Error (ϕ, θ), f = 900 MHz



DASY/EASY - Parameters of Probe: EX3DV4 - SN:3962

Other Probe Parameters

| | |
|---|------------|
| Sensor Arrangement | Triangular |
| Connector Angle (°) | -26.3 |
| Mechanical Surface Detection Mode | enabled |
| Optical Surface Detection Mode | disabled |
| Probe Overall Length | 337 mm |
| Probe Body Diameter | 10 mm |
| Tip Length | 9 mm |
| Tip Diameter | 2.5 mm |
| Probe Tip to Sensor X Calibration Point | 1 mm |
| Probe Tip to Sensor Y Calibration Point | 1 mm |
| Probe Tip to Sensor Z Calibration Point | 1 mm |
| Recommended Measurement Distance from Surface | 2 mm |