## PROBE CALIBRATION CERTIFICATES

| Accredited by the Swiss Accredi<br>The Swiss Accreditation Servi  |  | Act   | Swiss Calibration Service   |
|---|--|---|---|
| Client BACL China (   | recognition of calibration of  | ertificates   | : EX3-7329_Feb15  |
| CALIBRATION   | CERTIFICATE  |   |   |
| Object  | EX3DV4 - SN:73   |   |   |
| Calibration procedure(s)  |  | A CAL-23.v5, QA CAL-25.v6<br>dure for dosimetric E-field probes   |   |
|   |  |   |   |
| The measurements and the un   | sertainties with confidence pr   | nal standards, which realize the physical unit<br>obability are given on the following pages and<br>y facility: environment temperature (22 ± 3)°C  | d are part of the certificate.  |
| This calibration certificate docu<br>The measurements and the un  | ments the traceability to natio<br>sertainties with confidence pr<br>ucted in the closed laborator   |   | d are part of the certificate.  |
| This calibration certificate docu<br>The measurements and the unit<br>All calibrations have been cond   | ments the traceability to natio<br>sertainties with confidence pr<br>ucted in the closed laborator   | obability are given on the following pages and  | d are part of the contribute.<br>and humidity < 70%,<br>Scheduled Calibration   |
| This calibration certificate docu<br>The measurements and the unit<br>All calibrations have been cond<br>Calibration Equipment used (M<br>Primary Standards<br>Power meter E44198   | ments the traceability to natio<br>sertainties with confidence pr<br>ucted in the closed laborator<br>&TE critical for calibration)                                    | bability are given on the following pages and<br>/ facility: renvironment temperature (22 ± 3)*C<br>Cal Date (Certificate No.)<br>03-Apr-14 (No. 217-01911)   | d are part of the contificate.<br>and humidity < 70%.<br>Scheduled Calibration<br>Apr-15  |
| This calibration certificate docu<br>The measurements and the unit<br>All calibrations have been cond<br>Calibration Equipment used (M<br>Primary Standards<br>Power meter E44198<br>Power sensor E4412A  | Ments the baceability to natio<br>pertainties with confidence pro-<br>ucted in the closed laborator<br>&TE critical for calibration)<br>ID<br>GB41293874<br>MY41498087 | Cal Date (Certificate No.)<br>03-Apr-14 (No. 217-01911)<br>03-Apr-14 (No. 217-01911)  | d are part of the contificate.<br>and humidity < 70%.<br>Scheduled Calibration<br>Apr-15<br>Apr-15  |
| This calibration certificate docu<br>The measurements and the unit<br>All calibrations have been cond<br>Calibration Equipment used (M<br>Primary Standards<br>Power meter E44198<br>Power sensor E4412A<br>Reference 3 dB Attenuator   | ID<br>GB41293874<br>MY41498087<br>SN: S5054 (3c)   | Cal Date (Certificate No.)<br>03-Apr-14 (No. 217-01911)<br>03-Apr-14 (No. 217-01911)<br>03-Apr-14 (No. 217-01915)   | d are part of the contificate.<br>and humidity < 70%.<br>Scheduled Calibration<br>Apr-15<br>Apr-15<br>Apr-15  |
| This calibration certificate docu<br>The measurements and the unit<br>All calibrations have been cond<br>Calibration Equipment used (M<br>Primary Standards<br>Power meter E44198<br>Power sensor E4412A<br>Reference 3 dB Attenuator<br>Reference 20 dB Attenuator   | ID<br>GB41293874<br>MY41498087<br>SN: S5054 (3c)<br>SN: S5277 (20x)  | cbability are given on the following pages and           y facility: xervironment temperature (22 ± 3)*C           Cal Date (Certificate No.)           03-Apr-14 (No. 217-01911)           03-Apr-14 (No. 217-01911)           03-Apr-14 (No. 217-01915)           03-Apr-14 (No. 217-01919)   | d are part of the contificate.<br>and humidity < 70%.<br>Scheduled Calibration<br>Apr-15<br>Apr-15<br>Apr-15<br>Apr-15  |
| This calibration certificate docu<br>The measurements and the unit<br>All calibrations have been cond<br>Calibration Equipment used (M<br>Primary Standards<br>Power meter E44198<br>Power sensor E44198<br>Power sensor E4412A<br>Reference 3 dB Attenuator<br>Reference 30 dB Attenuator  | ATE critical for calibration)<br>ID<br>GB41293874<br>MY41498087<br>SN: S5054 (3c)<br>SN: S5129 (30b)   | cbability are given on the following pages and           y facility: xervironment temperature (22 ± 3)*C           Cal Date (Certificate No.)           03-Apr-14 (No. 217-01911)           03-Apr-14 (No. 217-01911)           03-Apr-14 (No. 217-01915)           03-Apr-14 (No. 217-01919)           03-Apr-14 (No. 217-01919)           03-Apr-14 (No. 217-01919)           03-Apr-14 (No. 217-01919)   | d are part of the certificate.<br>and humidity < 70%.<br>Scheduled Calibration<br>Apr-15<br>Apr-15<br>Apr-15<br>Apr-15<br>Apr-15<br>Apr-15  |
| This calibration certificate docu<br>The measurements and the unit<br>All calibrations have been cond<br>Calibration Equipment used (M<br>Primary Standards<br>Power meter E44198<br>Power sensor E4412A<br>Reference 3 dB Attenuator<br>Reference 20 dB Attenuator   | ID<br>GB41293874<br>MY41498087<br>SN: S5054 (3c)<br>SN: S5277 (20x)  | cbability are given on the following pages and           y facility: xervironment temperature (22 ± 3)*C           Cal Date (Certificate No.)           03-Apr-14 (No. 217-01911)           03-Apr-14 (No. 217-01911)           03-Apr-14 (No. 217-01915)           03-Apr-14 (No. 217-01919)   | d are part of the contificate.<br>and humidity < 70%.<br>Scheduled Calibration<br>Apr-15<br>Apr-15<br>Apr-15<br>Apr-15  |
| This calibration certificate docu<br>The measurements and the unit<br>All calibrations have been cond<br>Calibration Equipment used (M<br>Primary Standards<br>Power meter E44198<br>Power sensor E44198<br>Reference 3 dB Attenuator<br>Reference 30 dB Attenuator<br>Reference Probe E\$30V2<br>DAE4  | ID<br>GB41293874<br>MY41498087<br>SN: S5054 (30)<br>SN: S5129 (306)<br>SN: 660   | Cal Date (Certificate No.)<br>Cal Date (Certificate No.)<br>03-Apr-14 (No. 217-01911)<br>03-Apr-14 (No. 217-01911)<br>03-Apr-14 (No. 217-01915)<br>03-Apr-14 (No. 217-01915)<br>03-Apr-14 (No. 217-01919)<br>03-Apr-14 (No. 217-01919)<br>03-Apr-14 (No. 217-01920)<br>30-Dec-14 (No. ES3-3013_Dec14)<br>14-Jan-15 (No. DAE4-680_Jan15)   | d are part of the contribute.<br>and humidity < 70%.<br>Scheduled Calibration<br>Apr-15<br>Apr-15<br>Apr-15<br>Apr-15<br>Apr-15<br>Dec-15   |
| This calibration certificate docu<br>The measurements and the unit<br>All calibrations have been cond<br>Calibration Equipment used (M<br>Primary Standards<br>Power meter E44198<br>Power sensor E44198<br>Power sensor E4412A<br>Reference 3 dB Attenuator<br>Reference 30 dB Attenuator<br>Reference 30 dB Attenuator  | ID<br>GB41293874<br>MY1498087<br>SN: S5054 (3c)<br>SN: S5129 (30b)<br>SN: 3013   | Cal Date (Certificate No.)           03-Apr-14 (No. 217-01911)           03-Apr-14 (No. 217-01911)           03-Apr-14 (No. 217-01911)           03-Apr-14 (No. 217-01911)           03-Apr-14 (No. 217-01915)           03-Apr-14 (No. 217-01915)           03-Apr-14 (No. 217-01915)           03-Apr-14 (No. 217-01915)           03-Apr-14 (No. 217-01916)           03-Apr-14 (No. 217-01917)           03-Apr-14 (No. 217-01916)           03-Apr-14 (No. 217-01917)  | d are part of the contificate.<br>and humidity < 70%.<br>Scheduled Calibration<br>Apr.15<br>Apr.15<br>Apr.15<br>Apr.15<br>Apr.15<br>Doc.15<br>Jao.16  |
| This calibration certificate docu<br>The measurements and the unit<br>All calibrations have been cond<br>Calibration Equipment used (M<br>Primary Standards<br>Power meter E44198<br>Power sensor E44198<br>Power sensor E44198<br>Reference 3 dB Attenuator<br>Reference 3 dB Attenuator<br>Reference 30 dB Attenuator | ID<br>GB41293874<br>MY41498087<br>SN: S5054 (3c)<br>SN: S5054 (3c)<br>SN: S5129 (30b)<br>SN: 3013<br>SN: 660<br>ID   | Cal Date (Certificate No.)<br>Cal Date (Certificate No.)<br>03-Apr-14 (No. 217-01911)<br>03-Apr-14 (No. 217-01911)<br>03-Apr-14 (No. 217-01915)<br>03-Apr-14 (No. 217-01915)<br>03-Apr-14 (No. 217-01919)<br>03-Apr-14 (No. 217-01919)<br>03-Apr-14 (No. 217-01919)<br>14-Jan-15 (No. DAE4-660_Jan15)<br>Check Date (in house)  | d are part of the contificate.<br>and humidity < 70%.<br>Scheduled Calibration<br>Apr-15<br>Apr-15<br>Apr-15<br>Apr-15<br>Apr-15<br>Dec-15<br>Jan-16<br>Scheduled Check   |
| This calibration certificate docu<br>The measurements and the unit<br>All calibrations have been cond<br>Calibration Equipment used (M<br>Primary Standards<br>Power sensor E44128<br>Power sensor E44128<br>Reference 3 dB Attenuator<br>Reference 30 dB Attenuator<br>Reference 30 dB Attenuator<br>Reference 30 dB Attenuator<br>Reference Probe ES30V2<br>DAE4<br>Secondary Standards<br>RF generator HP 8648C  | ID<br>GB41293874<br>MY41498087<br>SN: S5054 (3c)<br>SN: S5054 (3c)<br>SN: S5129 (30b)<br>SN: 3013<br>SN: 660<br>ID<br>US3642U01700                                     | Cal Date (Certificate No.)<br>Cal Date (Certificate No.)<br>03-Apr-14 (No. 217-01911)<br>03-Apr-14 (No. 217-01911)<br>03-Apr-14 (No. 217-01915)<br>03-Apr-14 (No. 217-01919)<br>03-Apr-14 (No. 217-01919)<br>03-Apr-14 (No. 217-01920)<br>30-Dec-14 (No. ES3-3013_Dec14)<br>14-Jan-15 (No. DAE4-660_Jan15)<br>Check Date (in house)<br>4-Aug-99 (in house check Apr-13)   | d are part of the contificate.<br>and humidity < 70%.<br>Scheduled Calibration<br>Apr-15<br>Apr-15<br>Apr-15<br>Apr-15<br>Apr-15<br>Dec-15<br>Jan-16<br>Scheduled Check<br>In house check: Apr-16                 |
| This calibration certificate docu<br>The measurements and the unit<br>All calibrations have been cond<br>Calibration Equipment used (M<br>Primary Standards<br>Power sensor E44128<br>Power sensor E44128<br>Reference 3 dB Attenuator<br>Reference 30 dB Attenuator<br>Reference 30 dB Attenuator<br>Reference 30 dB Attenuator<br>Reference Probe ES30V2<br>DAE4<br>Secondary Standards<br>RF generator HP 8648C  | ID<br>ID<br>ID<br>ID<br>ID<br>ID<br>ID<br>ID<br>ID<br>ID   | Cal Date (Certificate No.)           03-Apr-14 (No. 217-01911)           03-Apr-14 (No. 217-01911)           03-Apr-14 (No. 217-01911)           03-Apr-14 (No. 217-01911)           03-Apr-14 (No. 217-01913)           03-Apr-14 (No. 217-01919)           03-Apr-14 (No. 217-01919)           03-Apr-14 (No. 217-01920)           30-Dec-14 (No. 217-01920) <td>d are part of the contificate.<br/>and humidity &lt; 70%.<br/>Scheduled Calibration<br/>Apr-15<br/>Apr-15<br/>Apr-15<br/>Apr-15<br/>Dec-15<br/>Jan-16<br/>Scheduled Check<br/>In house check: Apr-16<br/>In house check: Oct-15</td> | d are part of the contificate.<br>and humidity < 70%.<br>Scheduled Calibration<br>Apr-15<br>Apr-15<br>Apr-15<br>Apr-15<br>Dec-15<br>Jan-16<br>Scheduled Check<br>In house check: Apr-16<br>In house check: Oct-15 |

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Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



S Schweizerischer Kalibrierdlienst

- C Service suisse d'étalonnage Servizio svizzero di taratura
- S Swiss Calibration Service
- Swiss Calibration aervice

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

#### Glossary:

| corocoury.      |  |
|-----------------|--|
| TSL             | tissue simulating liquid   |
| NORMx,y,z       | sensitivity in free space  |
| ConvF           | sensitivity in TSL / NORMx,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 o  | o rotation around probe axis   |
| Polarization 3  | 9 rotation around an axis that is in the plane normal to probe axis (at measurement center), |
|                 | i.e., 9 = 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:

- 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
- 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

#### Methods Applied and Interpretation of Parameters:

- NORMx, y,z: Assessed for E-field polarization 9 = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx, y,z are only intermediate values, i.e., the uncertainties of NORMx, y,z does not affect the E<sup>2</sup>-field uncertainty inside TSL (see below ConvF).
- NORM(f)x,y,z = NORMx,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.
- DCPx,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
- Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,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 ≤ 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 NORMx,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 NORMx (no uncertainty required).

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# Probe EX3DV4

## SN:7329

Manufactured: Calibrated: December 11, 2014 February 5, 2015

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

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### DASY/EASY - Parameters of Probe: EX3DV4 - SN:7329

#### **Basic Calibration Parameters**

|                                | Sensor X | Sensor Y | Sensor Z | Unc (k=2) |
|--------------------------------|----------|----------|----------|-----------|
| Norm (µV/(V/m) <sup>2</sup> )^ | 0.48     | 0.43     | 0.46     | ± 10.1 %  |
| DCP (mV) <sup>e</sup>          | 96.7     | 97.6     | 94.2     |           |

#### Modulation Calibration Parameters

| UID | Communication System Name |   | A   | B            | с   | DdB  | VR<br>mV | Unc <sup>E</sup><br>(k=2) |
|-----|---------------------------|---|-----|--------------|-----|------|----------|---------------------------|
| 0   | CW                        | × | 0.0 | dB√μV<br>0.0 | 1.0 | 0.00 | 137.9    | ±3.0 %                    |
|     |                           | Ŷ | 0.0 | 0.0          | 1.0 |      | 147.0    |                           |
|     |                           | Z | 0.0 | 0.0          | 1.0 |      | 150.5    |                           |

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%.

<sup>4</sup> The uncertainties of NormX,Y,Z do not affect the E<sup>2</sup>-field uncertainty inside TSL (see Pages 5 and 6).
<sup>9</sup> Numerical linearization parameter: uncertainty not required.
<sup>4</sup> Uncertainty is determined using the max, deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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#### EX3DV4- SN:7329

### DASY/EASY - Parameters of Probe: EX3DV4 - SN:7329

| f (MHz) <sup>c</sup> | Relative<br>Permittivity | Conductivity<br>(S/m) <sup>F</sup> | ConvF X | ConvF Y | ConvF Z | Alpha <sup>G</sup> | Depth <sup>o</sup><br>(mm) | Unct.<br>(k=2) |
|----------------------|--------------------------|------------------------------------|---------|---------|---------|--------------------|----------------------------|----------------|
| 900                  | 41.5                     | 0.97                               | 9.52    | 9.52    | 9.52    | 0.40               | 0.86                       | ± 12.0 %       |
| 1750                 | 40.1                     | 1.37                               | 8.12    | 8.12    | 8.12    | 0.29               | 0.90                       | ± 12.0 %       |
| 1900                 | 40.0                     | 1.40                               | 7.88    | 7.88    | 7.88    | 0.68               | 0.61                       | ± 12.0 %       |
| 2450                 | 39.2                     | 1.80                               | 7.06    | 7.06    | 7.06    | 0.33               | 0.84                       | ± 12.0 %       |

### Calibration Parameter Determined in Head Tissue Simulating Media

<sup>C</sup> Frequency validity above 300 MHz 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 RISS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.
<sup>\*</sup> At frequencies below 3 GHz, the validity of tissue parameters (c and c) 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 (c and c) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
<sup>©</sup> AphaDepth 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.

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### DASY/EASY - Parameters of Probe: EX3DV4 - SN:7329

| Calibration Paramete | r Determined in Bod | y Tissue Simulating Media |
|----------------------|---------------------|---------------------------|
|----------------------|---------------------|---------------------------|

| f (MHz) <sup>C</sup> | Relative<br>Permittivity <sup>F</sup> | Conductivity<br>(S/m) <sup>F</sup> | ConvF X | ConvF Y | ConvF Z | Alpha <sup>G</sup> | Depth <sup>6</sup><br>(mm) | Unct.<br>(k=2) |
|----------------------|---------------------------------------|------------------------------------|---------|---------|---------|--------------------|----------------------------|----------------|
| 900                  | 55.0                                  | 1.05                               | 9.17    | 9.17    | 9.17    | 0.41               | 0.90                       | ± 12.0 %       |
| 1750                 | 53.4                                  | 1.49                               | 7.85    | 7.85    | 7.85    | 0.70               | 0.64                       | ± 12.0 %       |
| 1900                 | 53.3                                  | 1.52                               | 7.58    | 7.56    | 7.56    | 0.56               | 0.70                       | ± 12.0 %       |
| 2450                 | 52.7                                  | 1.95                               | 7.20    | 7.20    | 7.20    | 0.78               | 0.59                       | ± 12.0 %       |

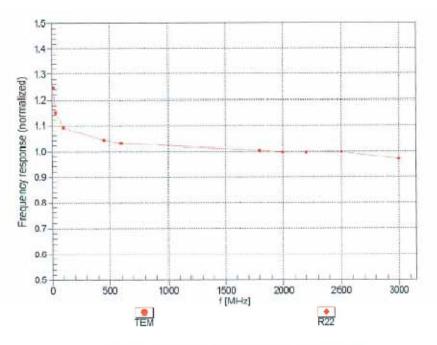
<sup>C</sup> Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF essessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity on be extended to ± 110 MHz.
<sup>6</sup> At frequencies below 3 GHz, the validity of tissue parameters (*c* and *a*) can be relaxed to ± 10% if liquid compensation formula is applied to measured SRR values. At frequencies above 3 GHz, the validity of tissue parameters (*c* and *a*) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
<sup>6</sup> Alpha/Depth are determined during calibration. SIPEAG 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.

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

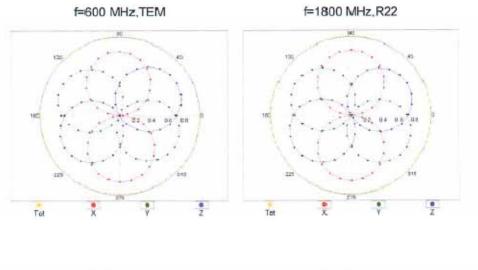


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

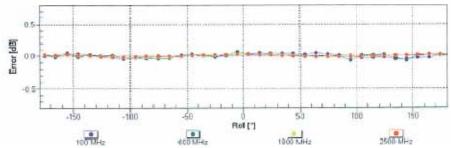
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## Receiving Pattern ( $\phi$ ), $\vartheta = 0^{\circ}$

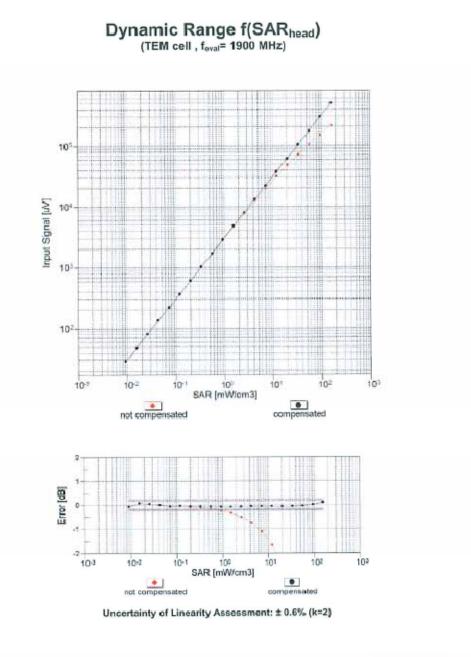


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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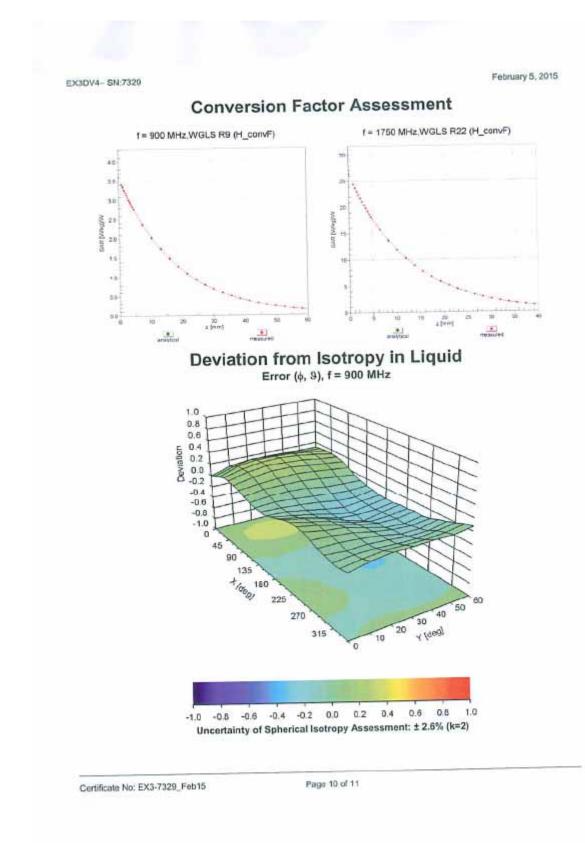
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## DASY/EASY - Parameters of Probe: EX3DV4 - SN:7329

| Sensor Arrangement                            | Triangular |
|---|------------|
| Connector Angle (*)                           | 24.5       |
| 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 | 1.4 mm     |

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### **DIPOLE CALIBRATION CERTIFICATES**

**Calibration Laboratory of** Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



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S Swiss Calibration Service

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Client BACL

Certificate No: D900V2-1d183\_Jul15

| CALIBRATION                           | CERTIFICAT                       | E   |                                  |
|---------------------------------------|----------------------------------|---|----------------------------------|
| Object                                | D900V2 - SN: 1                   | d183  |                                  |
| Calibration procedure(s)              | QA CAL-05.v9<br>Calibration proc | edure for dipole validation kits at   | pove 700 MHz                     |
|                                       |                                  |   |                                  |
| Calibration date:                     | July 14, 2015                    |   |                                  |
| The measurements and the unce         | artainties with confidence p     | tional standards, which realize the physical u<br>probability are given on the following pages a<br>my facility: environment temperature $(22 \pm 3)$ | and are part of the certificate. |
| Primary Standards                     | ID #                             | Cal Date (Certificate No.)  | Scheduled Calibration            |
| Power meter EPM-442A                  | GB37480704                       | 07-Oct-14 (No. 217-02020)   | Oct-15                           |
| Power sensor HP 8481A                 | US37292783                       | 07-Oct-14 (No. 217-02020)   | Oct-15                           |
| Power sensor HP 8481A                 | MY41092317                       | 07-Oct-14 (No. 217-02021)   | Oct-15                           |
| Reference 20 dB Attenuator            | SN: 5058 (20k)                   | 01-Apr-15 (No. 217-02131)   | Mar-16                           |
| Type-N mismatch combination           | SN: 5047.2 / 06327               | 01-Apr-15 (No. 217-02134)   | Mar-16                           |
| Reference Probe ES3DV3                | SN: 3205                         | 30-Dec-14 (No. ES3-3205_Dec14)  | Dec-15                           |
| DAE4                                  | SN: 601                          | 18-Aug-14 (No. DAE4-601_Aug14)  | Aug-15                           |
| 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-16           |
| Network Analyzer HP 8753E             | US37390585 S4206                 | 18-Oct-01 (in house check Oct-14)   | In house check: Oct-15           |
|                                       | Name                             | Function  | Signature                        |
| Calibrated by:                        | Leif Klysner                     | Laboratory Technician   | Sel Them                         |
| Approved by:                          | Katja Pokovic                    | Technical Manager   | C.C.U.G.                         |
|                                       |                                  |   | Issued: July 14, 2015            |
| inis calibration certificate shall no | t be reproduced except in        | full without written approval of the laboratory   |                                  |

Certificate No: D900V2-1d183\_Jul15

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#### Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





- Schweizerischer Kalibrierdienst
- Service suisse d'étalonnage
- Servizio svizzero di taratura Swiss Calibration Service

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS)

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        |
|-------|---------------------------------|
| 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) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

#### Additional Documentation:

e) 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%.

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#### **Measurement Conditions**

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

| DASY Version                 | DASY5                  | V52.8.8     |
|------------------------------|------------------------|-------------|
| Extrapolation                | Advanced Extrapolation |             |
| Phantom                      | Modular Flat Phantom   |             |
| Distance Dipole Center - TSL | 15 mm                  | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm      |             |
| Frequency                    | 900 MHz ± 1 MHz        |             |

#### Head TSL parameters

The following parameters and calculations were applied.

|   | Temperature     | Permittivity | Conductivity     |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters             | 22.0 °C         | 41.5         | 0.97 mho/m       |
| Measured Head TSL parameters            | (22.0 ± 0.2) °C | 42.2 ± 6 %   | 0.95 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C        |              |                  |

#### SAR result with Head TSL

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL                   | Condition                       |                          |
|---|---------------------------------|--------------------------|
| SAR measured  | 250 mW input power              | 2.61 W/kg                |
| SAR for nominal Head TSL parameters                                     | normalized to 1W                | 10.6 W/kg ± 17.0 % (k=2) |
|   |                                 |                          |
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL                 | condition                       |                          |
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL<br>SAR measured | condition<br>250 mW input power | 1.68 W/kg                |

Body TSL parameters The following parameters and calculations were applied.

|   | Temperature     | Permittivity | Conductivity     |
|---|-----------------|--------------|------------------|
| Nominal Body TSL parameters             | 22.0 °C         | 55.0         | 1.05 mho/m       |
| Measured Body TSL parameters            | (22.0 ± 0.2) °C | 54.8 ± 6 %   | 1.03 mho/m ± 6 % |
| Body TSL temperature change during test | < 0.5 °C        |              |                  |

#### SAR result with Body TSL

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL | Condition          |                          |
|---|--------------------|--------------------------|
| SAR measured  | 250 mW input power | 2.61 W/kg                |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | 10.6 W/kg ± 17.0 % (k=2) |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL | condition          |                          |
|---|--------------------|--------------------------|
| SAR measured  | 250 mW input power | 1.69 W/kg                |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 6.83 W/kg ± 16.5 % (k=2) |

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#### Appendix (Additional assessments outside the scope of SCS 0108)

#### Antenna Parameters with Head TSL

| Impedance, transformed to feed point | 52.3 Ω - 1.5 jΩ |
|--------------------------------------|-----------------|
| Return Loss                          | - 31.6 dB       |

#### Antenna Parameters with Body TSL

| Impedance, transformed to feed point | 47.6 Ω - 2.4 jΩ |
|--------------------------------------|-----------------|
| Return Loss                          | - 29.2 dB       |

#### **General Antenna Parameters and Design**

| Electrical Delay (one direction) | 1.411 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 | January 31, 2014 |

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#### **DASY5 Validation Report for Head TSL**

Date: 14.07.2015

Test Laboratory: SPEAG, Zurich, Switzerland

### DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN: 1d183

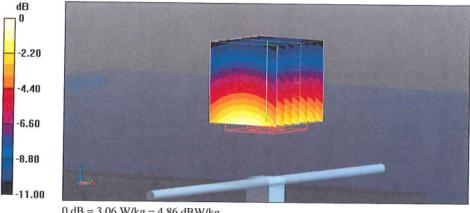
Communication System: UID 0 - CW; Frequency: 900 MHz Medium parameters used: f = 900 MHz;  $\sigma$  = 0.95 S/m;  $\epsilon_r$  = 42.2;  $\rho$  = 1000 kg/m^3 Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 SN3205; ConvF(5.94, 5.94, 5.94); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection) .
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014 •
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001 •
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331) •

### Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 58.62 V/m; Power Drift = 0.01 dB Peak SAR (extrapolated) = 3.89 W/kg SAR(1 g) = 2.61 W/kg; SAR(10 g) = 1.68 W/kg Maximum value of SAR (measured) = 3.06 W/kg

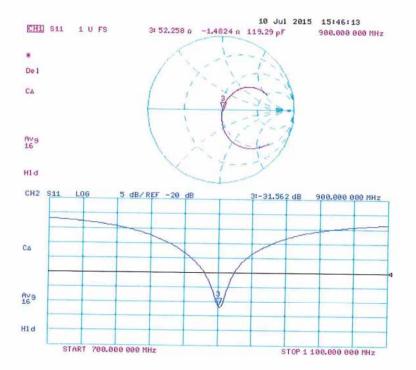


0 dB = 3.06 W/kg = 4.86 dBW/kg

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Impedance Measurement Plot for Head TSL



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#### **DASY5 Validation Report for Body TSL**

Date: 10.07.2015

Test Laboratory: SPEAG, Zurich, Switzerland

### DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN: 1d183

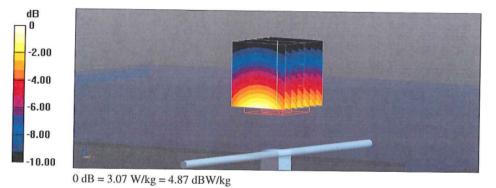
Communication System: UID 0 - CW; Frequency: 900 MHz Medium parameters used: f = 900 MHz;  $\sigma = 1.03$  S/m;  $\varepsilon_r = 54.8$ ;  $\rho = 1000$  kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 SN3205; ConvF(5.95, 5.95, 5.95); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

## Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

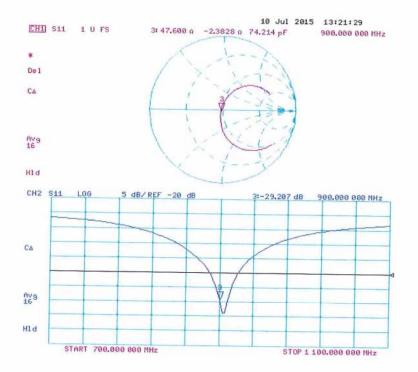
Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 56.48 V/m; Power Drift = -0.02 dB Peak SAR (extrapolated) = 3.86 W/kg SAR(1 g) = 2.61 W/kg; SAR(10 g) = 1.69 W/kg Maximum value of SAR (measured) = 3.07 W/kg



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Impedance Measurement Plot for Body TSL



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Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



S Schweizerlacher Kalibrierdienst Service suisse d'étalonnage Servizio svizzero di taratura S Swiss Calibration Service

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS) The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Client BACL

Certificate No: D1750V2-1141\_Jul15

| Object  | D1750V2 - SN:1  | 141   |   |
|---|---|---|---|
| Calibration procedure(s)  | QA CAL-05.v9<br>Calibration proce   | dure for dipole validation kits abo   | ove 700 MHz   |
| Calibration date:   | July 09, 2015   |   |   |
| The measurements and the unce   | rtainties with confidence p   | ional standards, which realize the physical un<br>robability are given on the following pages ar<br>ny facility: environment temperature $(22 \pm 3)^{\circ}$   | d are part of the certificate.  |
|   |   |   |   |
| himary Standards  | ID.#  | Cal Date (Certificate No.)  | Scheduled Calibration   |
| the second s  | ID #<br>GB37480704  | Cal Date (Certificate No.)<br>07-Oct-14 (No. 217-02020)   | Scheduled Calibration<br>Oct-15   |
| ower meter EPM-442A   | the second se                                     |   |   |
| ower meter EPM-442A<br>ower sensor HP 8481A   | GB37480704  | 07-Oct-14 (No. 217-02020)   | Oct-15  |
| Yower meter EPM-442A<br>Yower sensor HP 8481A<br>Yower sensor HP 8481A<br>leference 20 dB Attenuator  | GB37480704<br>US37292783<br>MY41092317<br>SN: 5058 (20k)  | 07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02020)  | Oct-15<br>Oct-15  |
| Power meter EPM-442A<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>Reference 20 dB Attenuator<br>Type-N mismatch combination   | GB37480704<br>US37292783<br>MY41092317<br>SN: 5058 (20k)<br>SN: 5047.2 / 06327  | 07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02021)<br>01-Apr-15 (No. 217-02131)<br>01-Apr-15 (No. 217-02134)   | Oct-15<br>Oct-15<br>Oct-15<br>Mar-16<br>Mar-16  |
| Power meter EPM-442A<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe ES3DV3   | GB37480704<br>US37292783<br>MY41092317<br>SN: 5058 (20k)<br>SN: 5047.2 / 06327<br>SN: 3205  | 07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02021)<br>01-Apr-15 (No. 217-02131)<br>01-Apr-15 (No. 217-02134)<br>30-Doc-14 (No. ES3-3205_Doc14)   | Oct-15<br>Oct-15<br>Oct-15<br>Mar-16<br>Mar-16<br>Dec-15  |
| Power meter EPM-442A<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>Reference 20 dB Attenuator<br>Fype-N mismatch combination<br>Reference Probe ES3DV3   | GB37480704<br>US37292783<br>MY41092317<br>SN: 5058 (20k)<br>SN: 5047.2 / 06327  | 07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02021)<br>01-Apr-15 (No. 217-02131)<br>01-Apr-15 (No. 217-02134)   | Oct-15<br>Oct-15<br>Oct-15<br>Mar-16<br>Mar-16  |
| Power meter EPM-442A<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>Reference 20 dB Attenuator<br>Fype-N mismatch combination<br>Reference Probe ES3DV3<br>DAE4   | GB37480704<br>US37292783<br>MY41092317<br>SN: 5058 (20k)<br>SN: 5047.2 / 06327<br>SN: 3205  | 07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02021)<br>01-Apr-15 (No. 217-02131)<br>01-Apr-15 (No. 217-02134)<br>30-Dec-14 (No. ES3-3205_Dec14)<br>18-Aug-14 (No. D:AE4-601_Aug14)  | Oct-15<br>Oct-15<br>Oct-15<br>Mar-16<br>Mar-16<br>Dec-15<br>Aug-15  |
| Power meter EPM-442A<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe ES3DV3<br>DAE4<br>Secondary Standards  | GB37480704<br>US37292783<br>MY41092317<br>SN: 5058 (20k)<br>SN: 5047.2 / 06327<br>SN: 3205<br>SN: 601   | 07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02021)<br>01-Apr-15 (No. 217-02131)<br>01-Apr-15 (No. 217-02131)<br>01-Apr-15 (No. 217-02134)<br>30-Dec-14 (No. E S3-3205_Dec14)<br>18-Aug-14 (No. D:AE4-601_Aug14)<br>Check Date (in house)   | Oct-15<br>Oct-15<br>Oct-15<br>Mar-16<br>Mar-16<br>Dec-15<br>Aug-15<br>Scheduled Check   |
| Power meter EPM-442A<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>Reference 20 dB Attenuator<br>Fype-N mismatch combination<br>Reference Probe ES3DV3<br>DAE4<br>Secondary Standards<br>RF generator R&S SMT-06   | GB37480704<br>US37292783<br>MY41092317<br>SN: 5058 (20k)<br>SN: 5047.2 / 06327<br>SN: 3205<br>SN: 601<br>ID #                                       | 07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02021)<br>01-Apr-15 (No. 217-02131)<br>01-Apr-15 (No. 217-02134)<br>30-Dec-14 (No. ES3-3205_Dec14)<br>18-Aug-14 (No. D:AE4-601_Aug14)  | Oct-15<br>Oct-15<br>Oct-15<br>Mar-16<br>Mar-16<br>Dec-15<br>Aug-15  |
| Primary Standards<br>Power meter EPM-442A<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe ES3DV3<br>DAE4<br>Secondary Standards<br>RF generator R&S SMT-06<br>Network Analyzer HP 8753E | GB37460704<br>US37292783<br>MY41092317<br>SN: 5058 (20k)<br>SN: 5047.2 / 06327<br>SN: 3205<br>SN: 601<br>ID-#<br>100005<br>US37390585 S4206         | 07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02021)<br>01-Apr-15 (No. 217-02131)<br>01-Apr-15 (No. 217-02134)<br>30-Dec-14 (No. E33-3205_Dec14)<br>18-Aug-14 (No. D:AE4-601_Aug14)<br>Check Date (in house)<br>04-Aug-99 (in house check Oct-13)<br>18-Oct-01 (in house check Oct-14)             | Oct-15<br>Oct-15<br>Oct-15<br>Mar-16<br>Mar-16<br>Dec-15<br>Aug-15<br>Scheduled Check<br>In house check: Oct-16<br>In house check: Oct-15 |
| Power meter EPM-442A<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe ES3DV3<br>DAE4<br>Secondary Standards<br>RF generator R&S SMT-06<br>Vetwork Analyzer HP 8753E                      | GB37460704<br>US37292783<br>MY41092317<br>SN: 5058 (20k)<br>SN: 5047.2 / 06327<br>SN: 3205<br>SN: 601<br>ID #<br>100005<br>US37390585 S4206<br>Name | 07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02021)<br>01-Apr-15 (No. 217-02131)<br>01-Apr-15 (No. 217-02134)<br>30-Dec-14 (No. ES3-3205 Dec14)<br>18-Aug-14 (No. DAE4-601_Aug14)<br>Check Date (in house)<br>04-Aug-99 (in house check Oct-13)<br>18-Oct-01 (in house check Oct-14)<br>Function  | Oct-15<br>Oct-15<br>Oct-15<br>Mar-16<br>Mar-16<br>Dec-15<br>Aug-15<br>Scheduled Check<br>In house check: Oct-16                           |
| Power meter EPM-442A<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe ES3DV3<br>DAE4<br>Secondary Standards<br>RF generator R&S SMT-06<br>Vetwork Analyzer HP 8753E                      | GB37460704<br>US37292783<br>MY41092317<br>SN: 5058 (20k)<br>SN: 5047.2 / 06327<br>SN: 3205<br>SN: 601<br>ID-#<br>100005<br>US37390585 S4206         | 07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02021)<br>01-Apr-15 (No. 217-02131)<br>01-Apr-15 (No. 217-02134)<br>30-Dec-14 (No. E33-3205_Dec14)<br>18-Aug-14 (No. D:AE4-601_Aug14)<br>Check Date (in house)<br>04-Aug-99 (in house check Oct-13)<br>18-Oct-01 (in house check Oct-14)             | Oct-15<br>Oct-15<br>Oct-15<br>Mar-16<br>Mar-16<br>Dec-15<br>Aug-15<br>Scheduled Check<br>In house check: Oct-16<br>In house check: Oct-15 |
| Power meter EPM-442A<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe ES3DV3<br>DAE4<br>Secondary Standards<br>RF generator R&S SMT-06   | GB37460704<br>US37292783<br>MY41092317<br>SN: 5058 (20k)<br>SN: 5047.2 / 06327<br>SN: 3205<br>SN: 601<br>ID #<br>100005<br>US37390585 S4206<br>Name | 07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02021)<br>01-Apr-15 (No. 217-02131)<br>01-Apr-15 (No. 217-02134)<br>30-Dec-14 (No. ES3-3205, Dec14)<br>18-Aug-14 (No. DAE4-601_Aug14)<br>Check Date (in house)<br>04-Aug-99 (in house check Oct-13)<br>18-Oct-01 (in house check Oct-14)<br>Function | Oct-15<br>Oct-15<br>Oct-15<br>Mar-16<br>Mar-16<br>Dec-15<br>Aug-15<br>Scheduled Check<br>In house check: Oct-16<br>In house check: Oct-15 |

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#### Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



Schweizerischer Kalibrierdienst s Service suisse d'étalonnage С Servizio svizzero di taratura S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)

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        |
|-------|---------------------------------|
| 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) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

#### Additional Documentation:

e) 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%.

Certificate No: D1750V2-1141\_Jul15

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Accreditation No.: SCS 0108

#### Measurement Conditions

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

| DASY Version                 | DASY5                  | V52.8.8     |
|------------------------------|------------------------|-------------|
| Extrapolation                | Advanced Extrapolation |             |
| Phantom                      | Modular Flat Phantom   |             |
| Distance Dipole Center - TSL | 10 mm                  | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm      |             |
| Frequency                    | 1750 MHz ± 1 MHz       |             |

#### Head TSL parameters

The following parameters and calculations were applied.

|   | Temperature     | Permittivity | Conductivity     |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters             | 22.0 °C         | 40.1         | 1.37 mho/m       |
| Measured Head TSL parameters            | (22.0 ± 0.2) °C | 38.8 ± 6 %   | 1.38 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C        |              |                  |

#### SAR result with Head TSL

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL                   | Condition                       |                          |
|---|---------------------------------|--------------------------|
| SAR measured  | 250 mW input power              | 9.31 W/kg                |
| SAR for nominal Head TSL parameters                                     | normalized to 1W                | 36.8 W/kg ± 17.0 % (k=2) |
|   |                                 |                          |
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL                 | condition                       |                          |
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL<br>SAR measured | condition<br>250 mW input power | 4.97 W/kg                |

Body TSL parameters The following parameters and calculations were applied.

|   | Temperature     | Permittivity | Conductivity     |
|---|-----------------|--------------|------------------|
| Nominal Body TSL parameters             | 22.0 °C         | 53.4         | 1.49 mho/m       |
| Measured Body TSL parameters            | (22.0 ± 0.2) °C | 52.2 ± 6 %   | 1.48 mho/m ± 6 % |
| Body TSL temperature change during test | < 0.5 °C        |              |                  |

#### SAR result with Body TSL

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL   | Condition          |                          |
|---|--------------------|--------------------------|
| SAR measured  | 250 mW input power | 9.37 W/kg                |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 37.4 W/kg ± 17.0 % (k=2) |
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL | condition          |                          |
| that a relation age a star to said (ite g) of body its  | condition          |                          |
| SAR measured  | 250 mW input power | 5.07 W/kg                |

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#### Appendix (Additional assessments outside the scope of SCS 0108)

#### Antenna Parameters with Head TSL

| Impedance, transformed to feed point | 51.1 Ω - 0.1 jΩ |
|--------------------------------------|-----------------|
| Return Loss                          | - 39.5 dB       |

#### Antenna Parameters with Body TSL

| Impedance, transformed to feed point | 46.6 Ω + 0.3 jΩ |
|--------------------------------------|-----------------|
| Return Loss                          | - 29.0 dB       |

#### **General Antenna Parameters and Design**

| Electrical Delay (one direction) | 1.225 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 feading 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 | September 30, 2014 |

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#### **DASY5 Validation Report for Head TSL**

Date: 09.07.2015

Test Laboratory: SPEAG, Zurich, Switzerland

#### DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1141

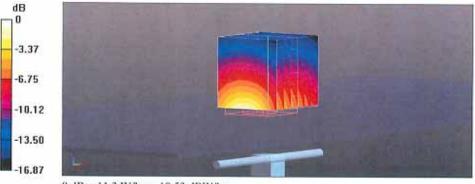
Communication System: UID 0 - CW; Frequency: 1750 MHz Medium parameters used: f = 1750 MHz;  $\sigma = 1.38$  S/m;  $\epsilon_r = 38.8$ ;  $\rho = 1000$  kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 SN3205; ConvF(5.2, 5.2, 5.2); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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

Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 93.34 V/m; Power Drift = 0.04 dB Peak SAR (extrapolated) = 16.6 W/kg SAR(1 g) = 9.31 W/kg; SAR(10 g) = 4.97 W/kg Maximum value of SAR (measured) = 11.3 W/kg

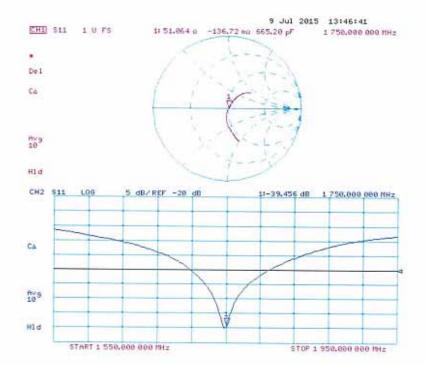


0 dB = 11.3 W/kg = 10.53 dBW/kg

Certificate No: D1750V2-1141\_Jul15

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Impedance Measurement Plot for Head TSL



Certificate No: D1750V2-1141\_Jul15

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#### **DASY5 Validation Report for Body TSL**

Date: 09.07.2015

Test Laboratory: SPEAG, Zurich, Switzerland

#### DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1141

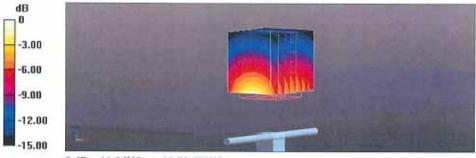
Communication System: UID 0 - CW; Frequency: 1750 MHz Medium parameters used: f = 1750 MHz;  $\sigma$  = 1.48 S/m;  $\epsilon_r$  = 52.2;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 SN3205; ConvF(4.88, 4.88, 4.88); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

#### 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 = 92.95 V/m; Power Drift = 0.02 dB Peak SAR (extrapolated) = 15.9 W/kg SAR(1 g) = 9.37 W/kg; SAR(10 g) = 5.07 W/kg Maximum value of SAR (measured) = 11.8 W/kg

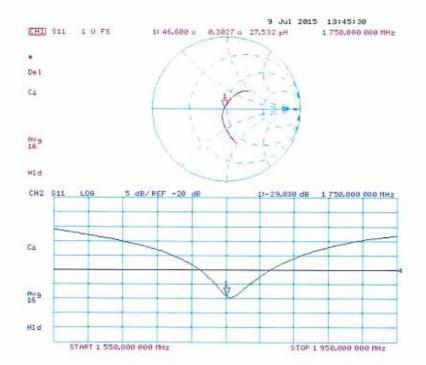


0 dB = 11.8 W/kg = 10.72 dBW/kg

Certificate No: D1750V2-1141\_Jul15

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Impedance Measurement Plot for Body TSL



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| Engineering AG<br>Zeughausstrasse 43, 8004 Zuri  | ch, Switzerland   |  | Convinio evigence di territure  |
|--|---|--|---|
| Accredited by the Swise Accredit   |   |  | Servizio svizzero di taratura<br>Swiss Calibration Service  |
| According by the Swiss According   |   | "Indulated   |   |
| The Swiss Accreditation Servi  |   | es to the EA   | Accreditation No.: SCS 0108   |
| Multilateral Agreement for the<br>Client BACL  | recognition of calibration  |  |   |
|  |   |  | lo: D1900V2-5d206_Jul15   |
| CALIBRATION  | CERTIFICATI   |  |   |
| Object   | D1900V2 - SN:5  | d206   |   |
|  |   |  |   |
| Calibration procedure(s)   | QA CAL-05.v9<br>Calibration proce   | dure for dipole validation kits ab   | ava 700 MHz   |
|  | Calibration proce   | dure for upple valuation kits ab   | ove 700 MHz   |
| Calibration date:  | hill did posts  |  |   |
|  | JUIV 14, 2015   |  |   |
| This calibration certificate docum   | July 14, 2015   | ional standards, which realize the physical ur<br>robability are given on the following pages a  | tits of measurements (SI).  |
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| This calibration certificate docum<br>The measurements and the unc   | nents the traceability to nati<br>ertainties with confidence p<br>ucted in the closed laborator   | robability are given on the following pages a  | nd are part of the certificate.   |
| This calibration certificate docum<br>The measurements and the unc<br>All calibrations have been condu<br>Calibration Equipment used (M&<br>Primary Standards  | nents the traceability to nati<br>ertainties with confidence p<br>ucted in the closed laborator   | robability are given on the following pages a  | nd are part of the certificate.   |
| This calibration certificate docum<br>The measurements and the unc<br>All calibrations have been condu<br>Calibration Equipment used (M&<br>Primary Standards<br>Power meter EPM-442A  | nents the traceability to nati<br>ertainties with confidence p<br>inced in the closed laborato<br>TE critical for calibration)<br>ID #<br>GB37480704  | robability are given on the following pages a<br>ry facility: environment temperature (22 ± 3) <sup>4</sup><br>Cal Date (Certificate No.)<br>07-Oct-14 (No. 217-02020)   | nd are part of the certificate.<br>'C and humidity < 70%.<br>Scheduled Calibration<br>Oct-15  |
| This calibration certificate docum<br>The measurements and the unc<br>All calibrations have been condu<br>Calibration Equipment used (M8<br>Primary Standards<br>Power meter EPM-442A<br>Power sensor HP 8481A   | nents the traceability to nati<br>ertainties with confidence p<br>inced in the closed laborator<br>TE critical for calibration)<br>ID #<br>GB37480704<br>US37292783   | robability are given on the following pages a<br>ry facility: environment temperature (22 ± 3) <sup>4</sup><br>Cal Date (Certificate No.)<br>07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02020)  | nd are part of the certificate.<br>'C and humidity < 70%.<br>Scheduled Calibration<br>Oct-15<br>Oct-15  |
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| This calibration certificate docum<br>The measurements and the unc<br>All calibrations have been condu<br>Calibration Equipment used (M&<br>Primary Standards<br>Power meter EPM-442A<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>Reference 20 dB Attenuator<br>Type-N mismatch combination   | nents the traceability to nati<br>ertainties with confidence p<br>ucted in the closed laborato<br>TE critical for calibration)<br>ID #<br>GB37480704<br>US37292783<br>MY41092317<br>SN: 5058 (20k)<br>SN: 5057.2 / 06327  | robability are given on the following pages a<br>ry facility: environment temperature (22 ± 3)*<br>Cal Date (Certificate No.)<br>07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02021)<br>01-Apr-15 (No. 217-02131)<br>01-Apr-15 (No. 217-02134)   | nd are part of the certificate.<br>'C and humidity < 70%.<br>Scheduled Calibration<br>Oct-15<br>Oct-15<br>Oct-15<br>Oct-15<br>Mar-16<br>Mar-16  |
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| This calibration certificate docum<br>The measurements and the unc<br>All calibrations have been condu<br>Calibration Equipment used (M8<br>Primary Standards<br>Power meter EPM-442A<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe ES3DV3<br>DAE4<br>Secondary Standards<br>RF generator R&S SMT-06 | nents the traceability to nati<br>ertainties with confidence p<br>incred in the closed laborator<br>.TE critical for calibration)<br>ID #<br>GB374B0704<br>US37292783<br>MY41092317<br>SN: 5058 (20k)<br>SN: 5058 (20k)<br>SN: 5057.2 / 06327<br>SN: 3205<br>SN: 3205<br>SN: 3601<br>ID #<br>100005 | robability are given on the following pages a<br>ry facility: environment temperature (22 ± 3)*<br>Cal Date (Certificate No.)<br>07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02021)<br>01-Apr-15 (No. 217-02131)<br>01-Apr-15 (No. 217-02134)<br>30-Dec-14 (No. ES3-3205_Dec14)<br>18-Aug-14 (No. DAE4-601_Aug14)<br>Check Date (in house)<br>04-Aug-99 (in house check Oct-13)   | nd are part of the certificate.<br>'C and humidity < 70%.<br>Scheduled Calibration<br>Oct-15<br>Oct-15<br>Oct-15<br>Mar-16<br>Mar-16<br>Dec-15<br>Aug-15  |
| This calibration certificate docum<br>The measurements and the unc<br>All calibrations have been condu<br>Calibration Equipment used (M8<br>Primary Standards<br>Power meter EPM-442A<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe ES3DV3<br>DAE4<br>Secondary Standards<br>RF generator R&S SMT-06 | nents the traceability to nati<br>ertainties with confidence p<br>inced in the closed laborator<br>TE critical for calibration)<br>ID #<br>GB37480704<br>US37292783<br>MY41092317<br>SN: 5058 (20k)<br>SN: 5058 (20k)<br>SN: 50547.2 / 06327<br>SN: 3205<br>SN: 601<br>ID #                         | robability are given on the following pages a<br>ry facility: environment temperature (22 ± 3)*<br>Cal Date (Certificate No.)<br>07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02021)<br>01-Apr-15 (No. 217-02131)<br>01-Apr-15 (No. 217-02131)<br>30-Dec-14 (No. ES3-3205_Dec14)<br>18-Aug-14 (No. DAE4-601_Aug14)<br>Check Date (in house)  | nd are part of the certificate.<br>'C and humidity < 70%.<br>Scheduled Calibration<br>Oct-15<br>Oct-15<br>Oct-15<br>Mar-16<br>Mar-16<br>Dec-15<br>Aug-15<br>Scheduled Check   |
| This calibration certificate docum<br>The measurements and the unc<br>All calibrations have been condu<br>Calibration Equipment used (M8<br>Primary Standards<br>Power meter EPM-442A<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe ES3DV3<br>DAE4<br>Secondary Standards<br>RF generator R&S SMT-06 | nents the traceability to nati<br>ertainties with confidence p<br>incred in the closed laborator<br>.TE critical for calibration)<br>ID #<br>GB374B0704<br>US37292783<br>MY41092317<br>SN: 5058 (20k)<br>SN: 5058 (20k)<br>SN: 5057.2 / 06327<br>SN: 3205<br>SN: 3205<br>SN: 3601<br>ID #<br>100005 | Cal Date (Certificate No.)           07-Oct-14 (No. 217-02020)           07-Oct-14 (No. 217-02020)           07-Oct-14 (No. 217-02020)           07-Oct-14 (No. 217-02020)           07-Oct-14 (No. 217-02021)           01-Apr-15 (No. 217-02131)           01-Apr-15 (No. 217-02134)           30-Dec-14 (No. ES3-3205_Dec14)           18-Aug-14 (No. DAE4-601_Aug14)           Check Date (in house)           04-Aug-99 (in house check Oct-13)           18-Oct-01 (in house check Oct-14) | nd are part of the certificate.<br>'C and humidity < 70%.<br>Scheduled Calibration<br>Oct-15<br>Oct-15<br>Oct-15<br>Mar-16<br>Dec-15<br>Aug-15<br>Scheduled Check<br>In house check: Oct-16<br>In house check: Oct-15 |
| This calibration certificate docum<br>The measurements and the unc<br>All calibrations have been condu<br>Calibration Equipment used (M&<br>Primary Standards<br>Power meter EPM-442A<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe ES3DV3<br>DAE4<br>Secondary Standards                            | nents the traceability to nati<br>ertainties with confidence p<br>incted in the closed laborator<br>ID #<br>GB37480704<br>US37292783<br>MY41092317<br>SN: 5058 (20k)<br>SN: 5047.2 / 06327<br>SN: 3205<br>SN: 601<br>ID #<br>100005<br>US37390585 S4206   | robability are given on the following pages a<br>ry facility: environment temperature (22 ± 3)*<br>Cal Date (Certificate No.)<br>07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02021)<br>01-Apr-15 (No. 217-02131)<br>01-Apr-15 (No. 217-02134)<br>30-Dec-14 (No. ES3-3205_Dec14)<br>18-Aug-14 (No. DAE4-601_Aug14)<br>Check Date (in house)<br>04-Aug-99 (in house check Oct-13)   | nd are part of the certificate.<br>C and humidity < 70%.<br>Scheduled Calibration<br>Oct-15<br>Oct-15<br>Oct-15<br>Mar-16<br>Mar-16<br>Dec-15<br>Aug-15<br>Scheduled Check<br>In house check: Oct-16                  |

Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



S Schweizerischer Kalibrierdienst Service suisse d'étalonnage Servizio svizzero di taratura S swiss Calibration Service

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS)

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        |
|-------|---------------------------------|
| 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) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

#### Additional Documentation:

e) 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%.

Certificate No: D1900V2-5d206\_Jul15

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#### **Measurement Conditions**

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

| DASY Version                 | DASY5                  | V52.8.8     |
|------------------------------|------------------------|-------------|
| Extrapolation                | Advanced Extrapolation |             |
| Phantom                      | Modular Flat Phantom   |             |
| Distance Dipole Center - TSL | 10 mm                  | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm      |             |
| Frequency                    | 1900 MHz ± 1 MHz       |             |

Head TSL parameters The following parameters and calculations were applied.

|   | Temperature     | Permittivity | Conductivity     |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters             | 22.0 °C         | 40.0         | 1.40 mho/m       |
| Measured Head TSL parameters            | (22.0 ± 0.2) °C | 39.7 ± 6 %   | 1.38 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C        |              |                  |

#### SAR result with Head TSL

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL                   | Condition                       |                          |
|---|---------------------------------|--------------------------|
| SAR measured  | 250 mW input power              | 10.1 W/kg                |
| SAR for nominal Head TSL parameters                                     | normalized to 1W                | 40.7 W/kg ± 17.0 % (k=2) |
|   |                                 |                          |
| CAB avaraged even 10 cm <sup>3</sup> (10 c) of local TO                 |                                 |                          |
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL                 | condition                       |                          |
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL<br>SAR measured | condition<br>250 mW input power | 5.35 W/kg                |

#### Body TSL parameters

The following parameters and calculations were applied.

|   | Temperature     | Permittivity | Conductivity     |
|---|-----------------|--------------|------------------|
| Nominal Body TSL parameters             | 22.0 °C         | 53.3         | 1.52 mho/m       |
| Measured Body TSL parameters            | (22.0 ± 0.2) °C | 52.7 ± 6 %   | 1.54 mho/m ± 6 % |
| Body TSL temperature change during test | < 0.5 °C        |              |                  |

#### SAR result with Body TSL

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL                   | Condition                       |                          |
|---|---------------------------------|--------------------------|
| SAR measured  | 250 mW input power              | 10.3 W/kg                |
| SAR for nominal Body TSL parameters                                     | normalized to 1W                | 40.8 W/kg ± 17.0 % (k=2) |
|   |                                 |                          |
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL                 | condition                       |                          |
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL<br>SAR measured | condition<br>250 mW input power | 5.51 W/kg                |

Certificate No: D1900V2-5d206\_Jul15

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#### Appendix (Additional assessments outside the scope of SCS 0108)

#### Antenna Parameters with Head TSL

| Impedance, transformed to feed point | 52.5 Ω + 6.5 jΩ |
|--------------------------------------|-----------------|
| Return Loss                          | - 23.3 dB       |

#### Antenna Parameters with Body TSL

| Impedance, transformed to feed point | 48.6 Ω + 7.1 jΩ |
|--------------------------------------|-----------------|
| Return Loss                          | - 22.8 dB       |

#### **General Antenna Parameters and Design**

|  | Electrical Delay (one direction) | 1.203 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 | October 21, 2014 |

Certificate No: D1900V2-5d206\_Jul15

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#### **DASY5 Validation Report for Head TSL**

Date: 14.07.2015

Test Laboratory: SPEAG, Zurich, Switzerland

#### DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d206

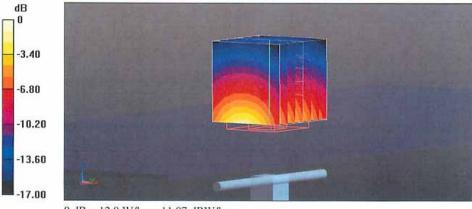
Communication System: UID 0 - CW; Frequency: 1900 MHz Medium parameters used: f = 1900 MHz;  $\sigma = 1.38$  S/m;  $\epsilon_r = 39.7$ ;  $\rho = 1000$  kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 SN3205; ConvF(5, 5, 5); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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

Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 99.02 V/m; Power Drift = 0.02 dB Peak SAR (extrapolated) = 18.4 W/kg SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.35 W/kg Maximum value of SAR (measured) = 12.8 W/kg

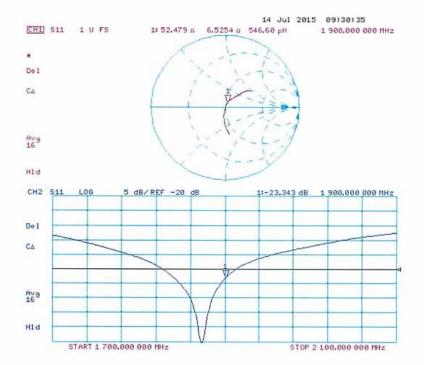


0 dB = 12.8 W/kg = 11.07 dBW/kg

Certificate No: D1900V2-5d206\_Jul15

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Certificate No: D1900V2-5d206\_Jul15

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#### **DASY5 Validation Report for Body TSL**

Date: 14.07.2015

Test Laboratory: SPEAG, Zurich, Switzerland

#### DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d206

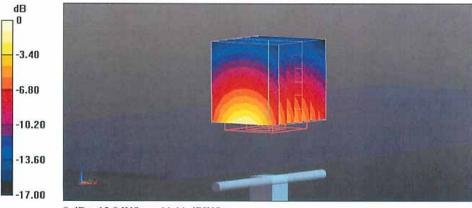
Communication System: UID 0 - CW; Frequency: 1900 MHz Medium parameters used: f = 1900 MHz;  $\sigma$  = 1.54 S/m;  $\varepsilon_r$  = 52.7;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 SN3205; ConvF(4.65, 4.65, 4.65); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

#### **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 = 95.62 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 17.3 W/kgSAR(1 g) = 10.3 W/kg; SAR(10 g) = 5.51 W/kgMaximum value of SAR (measured) = 12.9 W/kg

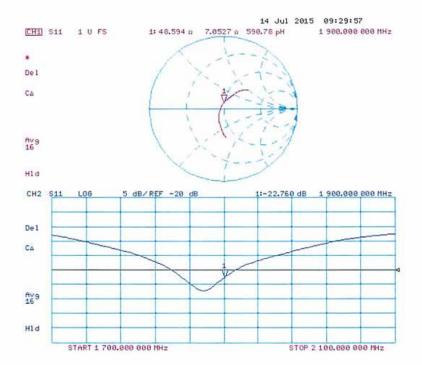


0 dB = 12.9 W/kg = 11.11 dBW/kg

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#### **Calibration Laboratory of** Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



S Schweizerischer Kalibrierdienst Service suisse d'étalonnage Servizio svizzero di taratura S Swiss Calibration Service

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS)

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

BACL Client

#### Certificate No: D2450V2-971\_Jul15

С

| Object   | D2450V2 - SN:97  | 1  |   |
|--|--|--|---|
| Calibration procedure(s)   | QA CAL-05.v9<br>Calibration proce  | dure for dipole validation kits abo  | ove 700 MHz   |
| Calibration date:  | July 08, 2015  |  |   |
| The measurements and the unco  | rtainties with confidence p<br>ted in the closed laborator   | onal standards, which realize the physical un<br>robability are given on the following pages an<br>$\gamma$ facility: environment temperature (22 ± 3) <sup>o</sup>  | nd are part of the certificate.   |
| and the second se  |  |  |   |
| Brimboy Chandarde  | line   | Cal Data (Cartilizata No.)   | Schoolded Collimation   |
| and the second sec | ID #   | Cal Date (Certificate No.)   | Scheduled Calibration   |
| ower moter EPM-442A  | GB37480704   | 07-Oct-14 (No. 217-02020)  | Oct-15  |
| ower meter EPM-442A<br>ower sensor HP 8481A  | GB37480704<br>US37292783   | 07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02020)   | Oct-15<br>Oct-15  |
| ower meter EPM-442A<br>ower sensor HP 8481A<br>ower sensor HP 8481A  | GB37480704<br>US37292783<br>MY41092317   | 07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02021)  | Oct-15  |
| ower meter EPM-442A<br>ower sensor HP 8481A<br>ower sensor HP 8481A<br>eference 20 dB Attenuator   | GB37480704<br>US37292783<br>MY41092317<br>SN: 5058 (20k)   | 07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02021)<br>01-Apr-15 (No. 217-02131)   | Oct-15<br>Oct-15<br>Oct-15  |
| Yower meter EPM-442A<br>Yower sensor HP 8481A<br>Yower sensor HP 8481A<br>Reference 20 dB Attenuator<br>Ype-N mismatch combination   | GB37480704<br>US37292783<br>MY41092317<br>SN: 5058 (20k)<br>SN: 5047.2 / 06327   | 07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02021)<br>01-Apr-15 (No. 217-02131)<br>01-Apr-15 (No. 217-02134)  | Oct-15<br>Oct-15<br>Oct-15<br>Mar-16<br>Mar-16  |
| rower meter EPM-442A<br>fower sensor HP 8481A<br>fower sensor HP 8481A<br>Reference 20 dB Attenuator<br>ype-N mismatch combination<br>Reference Probe ES3DV3   | GB37480704<br>US37292783<br>MY41092317<br>SN: 5058 (20k)   | 07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02021)<br>01-Apr-15 (No. 217-02131)   | Oct-15<br>Oct-15<br>Oct-15<br>Mar-16  |
| Power meter EPM-442A<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>lafeforance Probe ES3DV3<br>DAE4  | GB37480704<br>US37292783<br>MY41092317<br>SN: 5058 (20k)<br>SN: 5058 (20k)<br>SN: 5047.2 / 06327<br>SN: 3205   | 07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02021)<br>01-Apr-15 (No. 217-02131)<br>01-Apr-15 (No. 217-02134)<br>30-Dec-14 (No. ES3-3205_Dec14)  | Oct-15<br>Oct-15<br>Oct-15<br>Mar-16<br>Mar-16<br>Dec-15  |
| Power meter EPM-442A<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>Reference 20 dB Attenuator<br>(ype-N mismatch combination<br>Reference Probe ES3DV3<br>DAE4<br>Secondary Standards   | GB37480704<br>US37292783<br>MY41092317<br>SN: 5058 (20k)<br>SN: 5047.2 / 06327<br>SN: 3205<br>SN: 601  | 07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02021)<br>01-Apr-15 (No. 217-02131)<br>01-Apr-15 (No. 217-02134)<br>30-Dec-14 (No. ES3-3205_Dec14)<br>18-Aug-14 (No. DAE4-601_Aug14)  | Oct-15<br>Oct-15<br>Oct-15<br>Mar-16<br>Mar-16<br>Dec-15<br>Aug-15  |
| Power meter EPM-442A<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>Reference 20 dB Attenuator<br>(ype-N mismatch combination<br>Reference Probe ES3DV3<br>DAE4<br>Secondary Standards<br>RF generator R&S SMT-05  | GB37480704<br>US37292783<br>MY41092317<br>SN: 5058 (20k)<br>SN: 5047.2 / 06327<br>SN: 5047.2 / 06327<br>SN: 601<br>ID #  | 07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02021)<br>01-Apr-15 (No. 217-02131)<br>01-Apr-15 (No. 217-02134)<br>30-Dec-14 (No. ES3-3205_Dec14)<br>18-Aug-14 (No. DAE4-601_Aug14)<br>Check Date (in house)   | Oct-15<br>Oct-15<br>Oct-15<br>Mar-16<br>Mar-16<br>Dec-15<br>Aug-15<br>Scheduled Check   |
| Power meter EPM-442A<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>Reference 20 dB Attenuator<br>(ype-N mismatch combination<br>Reference Probe ES3DV3<br>DAE4<br>Secondary Standards<br>RF generator R&S SMT-05  | GB37480704<br>US37292783<br>MY41092317<br>SN: 5058 (20k)<br>SN: 5047.2 / 06327<br>SN: 3205<br>SN: 601<br>ID #<br>100005  | 07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02021)<br>01-Apr-15 (No. 217-02131)<br>01-Apr-15 (No. 217-02134)<br>30-Dec-14 (No. 217-02134)<br>30-Dec-14 (No. 217-02134)<br>18-Aug-14 (No. DAE4-601_Aug14)<br>Check Date (in house)<br>04-Aug-99 (in house check Oct-13)                          | Oct-15<br>Oct-15<br>Oct-15<br>Mar-16<br>Dec-15<br>Aug-15<br>Scheduled Check<br>In house check: Oct-16<br>In house check: Oct-15 |
| Power moter EPM-442A<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe ES3DV3<br>DAE4<br>Secondary Standards<br>RF generator R&S SMT-06<br>Network Analyzer HP 8753E   | GB37480704<br>US37292783<br>MY41092317<br>SN: 5058 (20k)<br>SN: 5047.2 / 06327<br>SN: 3205<br>SN: 601<br>ID #<br>100005<br>US37390585 S4206<br>Name  | 07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02021)<br>01-Apr-15 (No. 217-02131)<br>01-Apr-15 (No. 217-02134)<br>30-Dec-14 (No. ES3-3205_Dec14)<br>18-Aug-14 (No. DAE4-601_Aug14)<br>Check Date (in house)<br>04-Aug-99 (in house check Oct-13)<br>18-Oct-01 (in house check Oct-14)<br>Function | Oct-15<br>Oct-15<br>Oct-15<br>Mar-16<br>Mar-16<br>Dec-15<br>Aug-15<br>Scheduled Check<br>In house check: Oct-16                 |
| Power moter EPM-442A<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe ES3DV3<br>DAE4<br>Secondary Standards<br>RF generator R&S SMT-06<br>Network Analyzer HP 8753E   | GB37480704           US37292783           MY41092317           SN: 5058 (20k)           SN: 6047.2 / 06327           SN: 3205           SN: 601           ID #           100005           US37390585 S4206 | 07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02021)<br>01-Apr-15 (No. 217-02131)<br>01-Apr-15 (No. 217-02134)<br>30-Dec-14 (No. ES3-3205_Dec14)<br>18-Aug-14 (No. DAE4-601_Aug14)<br>Check Date (in house)<br>04-Aug-99 (in house check Oct-13)<br>18-Oct-01 (in house check Oct-14)             | Oct-15<br>Oct-15<br>Oct-15<br>Mar-16<br>Dec-15<br>Aug-15<br>Scheduled Check<br>In house check: Oct-16<br>In house check: Oct-15 |
| Primary Standards<br>Power moter EPM-442A<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe ES3DV3<br>DAE4<br>Secondary Standards<br>RF generator R&S SMT-06<br>Network Analyzer HP 8753E<br>Calibrated by:<br>Approved by:  | GB37480704<br>US37292783<br>MY41092317<br>SN: 5058 (20k)<br>SN: 5047.2 / 06327<br>SN: 3205<br>SN: 601<br>ID #<br>100005<br>US37390585 S4206<br>Name  | 07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02020)<br>07-Oct-14 (No. 217-02021)<br>01-Apr-15 (No. 217-02131)<br>01-Apr-15 (No. 217-02134)<br>30-Dec-14 (No. ES3-3205_Dec14)<br>18-Aug-14 (No. DAE4-601_Aug14)<br>Check Date (in house)<br>04-Aug-99 (in house check Oct-13)<br>18-Oct-01 (in house check Oct-14)<br>Function | Oct-15<br>Oct-15<br>Oct-15<br>Mar-16<br>Dec-15<br>Aug-15<br>Scheduled Check<br>In house check: Oct-16<br>In house check: Oct-15 |

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#### Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



S Schweizerischer Kalibrierdienat Service suisse d'étalonnage Servizio svizzero di taratura S Swiss Calibration Service

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS)

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

#### 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
- 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) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

#### Additional Documentation:

e) 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%.

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#### **Measurement Conditions**

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

| DASY Version                 | DASY5                  | V52.8.8     |
|------------------------------|------------------------|-------------|
| 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 ± 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 ± 0.2) °C | 37.9 ± 6 %   | 1.88 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C        |              |                  |

#### SAR result with Head TSL

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL | Condition          |                          |
|---|--------------------|--------------------------|
| SAR measured  | 250 mW input power | 13.7 W/kg                |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 53.3 W/kg ± 17.0 % (k=2) |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                          |
|---|--------------------|--------------------------|
| SAR measured  | 250 mW input power | 6.40 W/kg                |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 25.2 W/kg ± 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 ± 0.2) °C | 52.4 ± 6 %   | 2.03 mho/m ± 6 % |
| Body TSL temperature change during test | < 0.5 °C        |              |                  |

#### SAR result with Body TSL

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL   | Condition          |                          |
|---|--------------------|--------------------------|
| SAR measured  | 250 mW input power | 12.9 W/kg                |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 50.6 W/kg ± 17.0 % (k=2) |
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL | condition          |                          |
| SAR measured  | 250 mW input power | 6.05 W/kg                |

normalized to 1W

23.9 W/kg ± 16.5 % (k=2)

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SAR for nominal Body TSL parameters

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#### Appendix (Additional assessments outside the scope of SCS 0108)

#### Antenna Parameters with Head TSL

| Impedance, transformed to feed point | 53.5 Ω + 1.9 jΩ |
|--------------------------------------|-----------------|
| Return Loss                          | - 28.3 dB       |

#### Antenna Parameters with Body TSL

| Impedance, transformed to feed point | 50.5 Ω + 3.6 jΩ |
|--------------------------------------|-----------------|
| Return Loss                          | - 28.8 dB       |

#### **General Antenna Parameters and Design**

| Electrical Delay (one direction) | 1.155 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 | December 30, 2014 |

Certificate No: D2450V2-971\_Jul15

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#### **DASY5 Validation Report for Head TSL**

Date: 08.07.2015

Test Laboratory: SPEAG, Zurich, Switzerland

#### DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:971

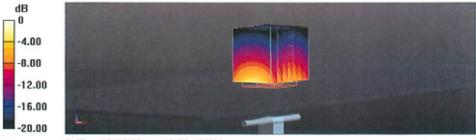
Communication System: UID 0 - CW; Frequency: 2450 MHz Medium parameters used: f = 2450 MHz;  $\sigma = 1.88$  S/m;  $\epsilon_r = 37.9$ ;  $\rho = 1000$  kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 SN3205; ConvF(4.54, 4.54, 4.54); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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

Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 101.3 V/m; Power Drift = 0.03 dB Peak SAR (extrapolated) = 28.1 W/kg SAR(1 g) = 13.7 W/kg; SAR(10 g) = 6.4 W/kg Maximum value of SAR (measured) = 18.0 W/kg

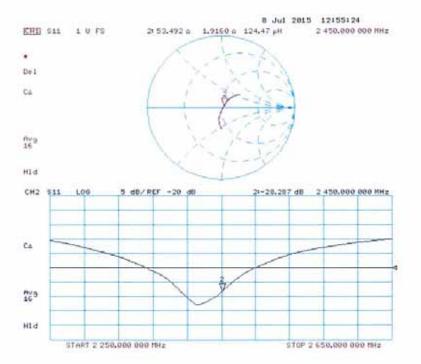


0 dB = 18.0 W/kg = 12.55 dBW/kg

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#### **DASY5 Validation Report for Body TSL**

Date: 08.07.2015

Test Laboratory: SPEAG, Zurich, Switzerland

#### DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:971

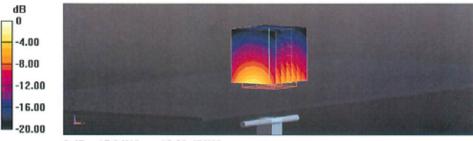
Communication System: UID 0 - CW; Frequency: 2450 MHz Medium parameters used: f = 2450 MHz;  $\sigma = 2.03$  S/m;  $v_{\tau} = 52.4$ ;  $\rho = 1000$  kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 SN3205; ConvF(4.32, 4.32, 4.32); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

#### 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 = 94.67 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 26.4 W/kg SAR(1 g) = 12.9 W/kg; SAR(10 g) = 6.05 W/kg Maximum value of SAR (measured) = 17.0 W/kg

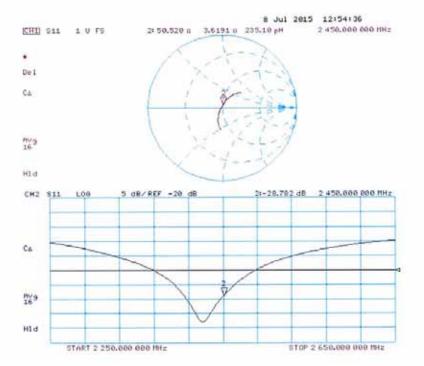


0 dB = 17.0 W/kg = 12.30 dBW/kg

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