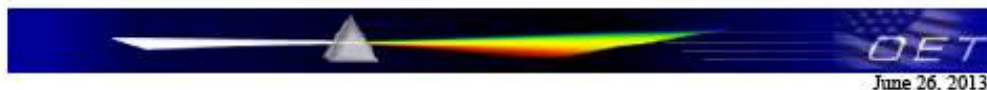


Acceptable Conditions for SAR Measurements Using Probes and Dipoles Calibrated under the SPEAG-TMC Dual-Logo Calibration Program to Support FCC Equipment Certification

The acceptable conditions for SAR measurements using probes, dipoles and DAEs calibrated by TMC (*Telecommunication Metrology Center of MITT in Beijing, China*), under the Dual-Logo Calibration Certificate program and quality assurance (QA) protocols established between SPEAG (*Schmid & Partner Engineering AG, Switzerland*) and TMC, to support FCC (*U.S. Federal Communications Commission*) equipment certification are defined and described in the following.

- 1) The agreement established between SPEAG and TMC is only applicable to calibration services performed by TMC where its clients (companies and divisions of such companies) are headquartered in the Greater China Region, including Taiwan and Hong Kong. This agreement is subject to renewal at the end of each calendar year between SPEAG and TMC. TMC shall inform the FCC of any changes or early termination to the agreement.
- 2) Only a subset of the calibration services specified in the SPEAG-TMC agreement, while it remains valid, are applicable to SAR measurements performed using such equipment for supporting FCC equipment certification. These are identified in the following.
 - a) Calibration of dosimetric (SAR) probes EX3DVx, ET3DVx and ES3DVx.
 - i) Free-space E-field and H-field probes, including those used for HAC (hearing aid compatibility) evaluation, temperature probes, other probes or equipment not identified in this document, when calibrated by TMC, are excluded and cannot be used for measurements to support FCC equipment certification.
 - ii) Signal specific and bundled probe calibrations based on PMR (probe modulation response) characteristics are handled according to the requirements of KDB 865664; that is, "Until standardized procedures are available to make such determination, the applicability of a signal specific probe calibration for testing specific wireless modes and technologies is determined on a case-by-case basis through KDB inquiries, including SAR system verification requirements."
 - b) Calibration of SAR system validation dipoles, excluding HAC dipoles.
 - c) Calibration of data acquisition electronics DAE3Vx, DAE4Vx and DAEasyVx.
 - d) For FCC equipment certification purposes, the frequency range of SAR probe and dipole calibrations is limited to 700 MHz - 6 GHz and provided it is supported by the equipment identified in the TMC QA protocol (a separate attachment to this document).
 - e) The identical system and equipment setup, measurement configurations, hardware, evaluation algorithms, calibration and QA protocols, including the format of calibration certificates and reports used by SPEAG shall be applied by TMC.
 - f) The calibrated items are only applicable to SPEAG DASY 4 and DASY 5 or higher version systems.



June 26, 2013

- 3) The SPEAG-TMC agreement includes specific protocols identified in the following to ensure the quality of calibration services provided by TMC under this SPEAG-TMC Dual-Logo calibration agreement are equivalent to the calibration services provided by SPEAG. TMC shall, upon request, provide copies of documentation to the FCC to substantiate program implementation.
 - a) The Inter-laboratory Calibration Evaluation (ILCE) stated in the TMC QA protocol shall be performed between SPEAG and TMC at least once every 12 months. The ILCE acceptance criteria defined in the TMC QA protocol shall be satisfied for the TMC, SPEAG and FCC agreements to remain valid.
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 - c) The calibration equipment and measurement system used by TMC shall be verified before each calibration service according to the specific reference SAR probes, dipoles, and DAE calibrated by SPEAG. The results shall be reproducible and within the defined acceptance criteria specified in the TMC QA protocol before each actual calibration can commence. TMC shall maintain records of the measurement and calibration system verification results for all calibrations.
 - d) Quality Check of Calibration (QCC) certificates shall be performed by SPEAG at least once every 12 months. SPEAG shall visit TMC facilities to verify the laboratory, equipment, applied procedures and plausibility of randomly selected certificates.
- 4) A copy of this document, to be updated annually, shall be provided to TMC clients that accept calibration services according to the SPEAG-TMC Dual-Logo calibration program, which should be presented to a TCB (*Telecommunication Certification Body*), to facilitate FCC equipment approval.
- 5) TMC shall address any questions raised by its clients or TCBs relating to the SPEAG-TMC Dual-Logo calibration program and inform the FCC and SPEAG of any critical issues.

Change Note: Revised on June 26 to clarify the applicability of PMR and Bundled probe calibrations according to the requirements of KDB 865664.



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CALIBRATION
No. L0570

Client

Tejet

Certificate No: Z14-97078

CALIBRATION CERTIFICATE

Object

EX3DV4 - SN:3717

Calibration Procedure(s)

TMC-OS-E-02-195

Calibration Procedures for Dosimetric E-field Probes

Calibration date:

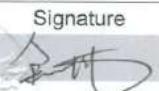
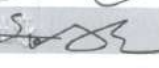
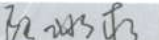
September 02, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
|-------------------------|------------|--|-----------------------|
| Power Meter NRP2 | 101919 | 01-Jul-14 (CTTL, No.J14X02146) | Jun-15 |
| Power sensor NRP-Z91 | 101547 | 01-Jul-14 (CTTL, No.J14X02146) | Jun-15 |
| Power sensor NRP-Z91 | 101548 | 01-Jul-14 (CTTL, No.J14X02146) | Jun-15 |
| Reference10dBAttenuator | BT0520 | 12-Dec-12(TMC,No.JZ12-867) | Dec-14 |
| Reference20dBAttenuator | BT0267 | 12-Dec-12(TMC,No.JZ12-866) | Dec-14 |
| Reference Probe EX3DV4 | SN 3846 | 03-Sep-13(SPEAG,No.EX3-3846_Sep13) | Sep-14 |
| DAE4 | SN 1331 | 23-Jan-14 (SPEAG, DAE4-1331_Jan14) | Jan -15 |
| Secondary Standards | ID # | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
| SignalGeneratorMG3700A | 6201052605 | 01-Jul-14 (CTTL, No.J14X02145) | Jun-15 |
| Network Analyzer E5071C | MY46110673 | 15-Feb-14 (TMC, No.JZ14-781) | Feb-15 |

| | Name | Function | Signature |
|----------------|-------------|-----------------------------------|---|
| Calibrated by: | Yu Zongying | SAR Test Engineer |  |
| Reviewed by: | Qi Dianyuan | SAR Project Leader |  |
| Approved by: | Lu Bingsong | Deputy Director of the laboratory |  |

Issued: September 05, 2014

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

Certificate No: Z14-97078

Page 1 of 11



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Glossary:

| | |
|-----------------------|--|
| TSL | tissue simulating liquid |
| NORM _{x,y,z} | sensitivity in free space |
| ConvF | sensitivity in TSL / NORM _{x,y,z} |
| DCP | diode compression point |
| CF | crest factor (1/duty_cycle) of the RF signal |
| A,B,C,D | modulation dependent linearization parameters |
| Polarization Φ | Φ rotation around probe axis |
| Polarization θ | θ rotation around an axis that is in the plane normal to probe axis (at measurement center), $\theta=0$ is normal to probe axis |

Connector Angle information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}: Assessed for E-field polarization $\theta=0$ ($f \leq 900\text{MHz}$ in TEM-cell; $f > 1800\text{MHz}$: waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not effect the E^2 -field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z} = NORM_{x,y,z} * frequency_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCP_{x,y,z}: DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.
- PAR: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics.
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; VR_{x,y,z}; A,B,C are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800\text{MHz}$) and inside waveguide using analytical field distributions based on power measurements for $f > 800\text{MHz}$. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty valued are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM_{x,y,z} * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from $\pm 50\text{MHz}$ to $\pm 100\text{MHz}$.
- Spherical isotropy (3D deviation from isotropy): in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle: The angle is assessed using the information gained by determining the NORM_x (no uncertainty required).



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Probe EX3DV4

SN: 3717

Calibrated: September 02, 2014

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)



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DASY – Parameters of Probe: EX3DV4 - SN: 3717

Basic Calibration Parameters

| | Sensor X | Sensor Y | Sensor Z | Unc (k=2) |
|--|----------|----------|----------|-----------|
| Norm($\mu\text{V}/(\text{V}/\text{m})^2$) ^A | 0.49 | 0.45 | 0.54 | ±10.8% |
| DCP(mV) ^B | 100.6 | 103.6 | 101.4 | |

Modulation Calibration Parameters

| UID | Communication System Name | | A dB | B dB/μV | C | D dB | VR mV | Unc ^E (k=2) |
|-----|---------------------------|---|------|---------|-----|------|-------|------------------------|
| 0 | CW | X | 0.0 | 0.0 | 1.0 | 0.00 | 197.6 | ±2.1% |
| | | Y | 0.0 | 0.0 | 1.0 | | 191.9 | |
| | | Z | 0.0 | 0.0 | 1.0 | | 205.7 | |

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

^A The uncertainties of Norm X, Y, Z do not affect the E²-field uncertainty inside TSL (see Page 5 and Page 6).

^B Numerical linearization parameter: uncertainty not required.

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



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DASY – Parameters of Probe: EX3DV4 - SN: 3717

Calibration Parameter Determined in Head Tissue Simulating Media

| f [MHz] ^C | Relative Permittivity ^F | Conductivity (S/m) ^F | ConvF X | ConvF Y | ConvF Z | Alpha ^G | Depth ^G (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|--------------------|-------------------------|-------------|
| 850 | 41.5 | 0.92 | 9.08 | 9.08 | 9.08 | 0.12 | 2.08 | ± 12% |
| 900 | 41.5 | 0.97 | 8.89 | 8.89 | 8.89 | 0.16 | 1.25 | ± 12% |
| 1750 | 40.1 | 1.37 | 7.98 | 7.98 | 7.98 | 0.18 | 1.36 | ± 12% |
| 1900 | 40.0 | 1.40 | 7.74 | 7.74 | 7.74 | 0.22 | 1.12 | ± 12% |
| 2300 | 39.5 | 1.67 | 7.53 | 7.53 | 7.53 | 0.50 | 0.77 | ± 12% |
| 2450 | 39.2 | 1.80 | 7.24 | 7.24 | 7.24 | 0.55 | 0.75 | ± 12% |
| 2600 | 39.0 | 1.96 | 7.01 | 7.01 | 7.01 | 0.53 | 0.77 | ± 12% |
| 5200 | 36.0 | 4.66 | 5.49 | 5.49 | 5.49 | 0.41 | 0.97 | ± 13% |
| 5300 | 35.9 | 4.76 | 5.27 | 5.27 | 5.27 | 0.38 | 1.04 | ± 13% |
| 5600 | 35.5 | 5.07 | 4.58 | 4.58 | 4.58 | 0.25 | 2.31 | ± 13% |
| 5800 | 35.3 | 5.27 | 4.58 | 4.58 | 4.58 | 0.36 | 1.13 | ± 13% |

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

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

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



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DASY – Parameters of Probe: EX3DV4 - SN: 3717

Calibration Parameter Determined in Body Tissue Simulating Media

| f [MHz] ^C | Relative Permittivity ^F | Conductivity (S/m) ^F | ConvF X | ConvF Y | ConvF Z | Alpha ^G | Depth ^G (mm) | Unct. (k=2) |
|----------------------|------------------------------------|---------------------------------|---------|---------|---------|--------------------|-------------------------|-------------|
| 2300 | 52.9 | 1.81 | 7.35 | 7.35 | 7.35 | 0.33 | 1.13 | ± 12% |
| 2450 | 52.7 | 1.95 | 7.11 | 7.11 | 7.11 | 0.39 | 1.01 | ± 12% |
| 2600 | 52.5 | 2.16 | 6.99 | 6.99 | 6.99 | 0.41 | 0.93 | ± 12% |
| 5200 | 49.0 | 5.30 | 4.49 | 4.49 | 4.49 | 0.38 | 1.52 | ± 13% |
| 5300 | 48.9 | 5.42 | 4.32 | 4.32 | 4.32 | 0.36 | 1.61 | ± 13% |
| 5600 | 48.5 | 5.77 | 3.89 | 3.89 | 3.89 | 0.39 | 1.64 | ± 13% |
| 5800 | 48.2 | 6.00 | 4.05 | 4.05 | 4.05 | 0.40 | 1.68 | ± 13% |

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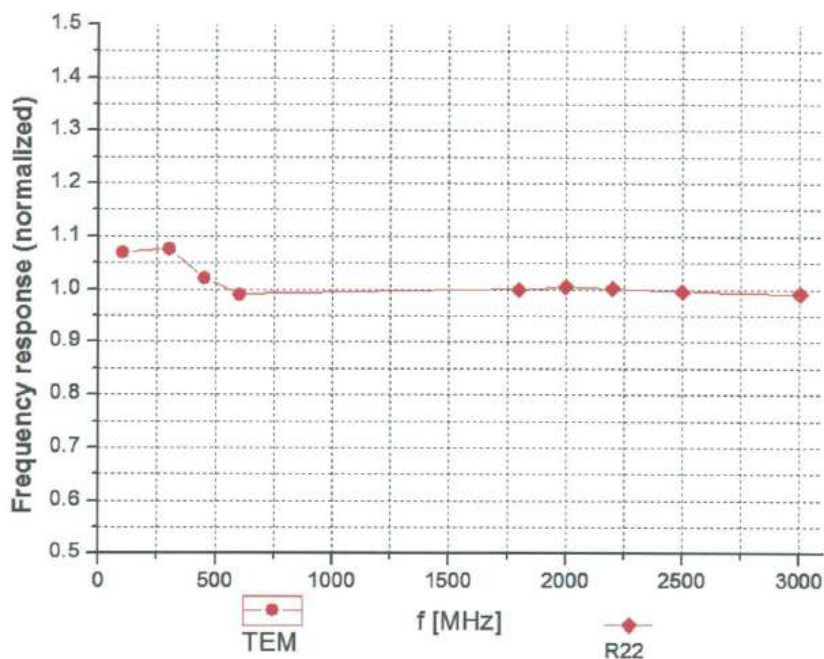
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Frequency Response of E-Field (TEM-Cell: ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field: $\pm 7.5\%$ ($k=2$)

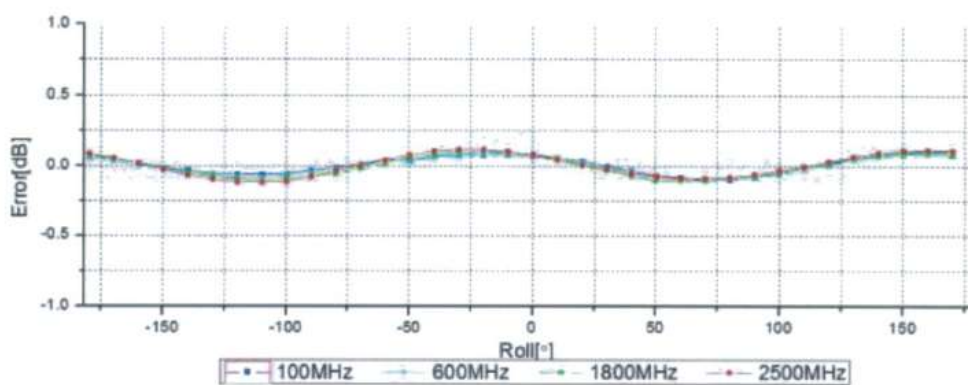
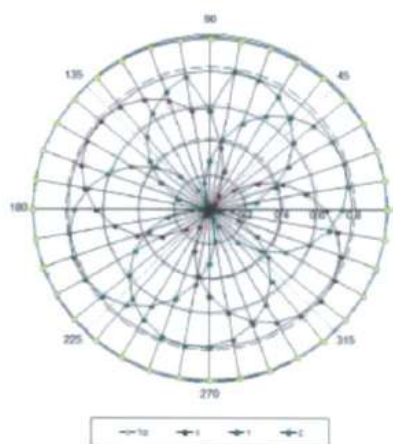
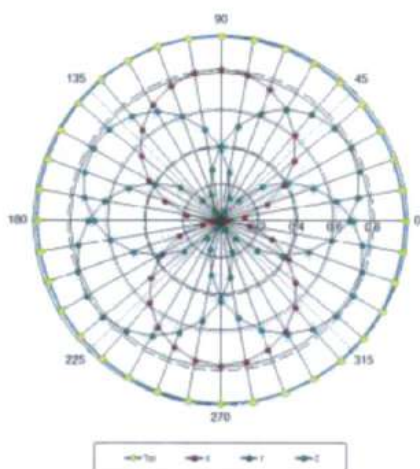


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Receiving Pattern (Φ), $\theta=0^\circ$

f=600 MHz, TEM

f=1800 MHz, R22

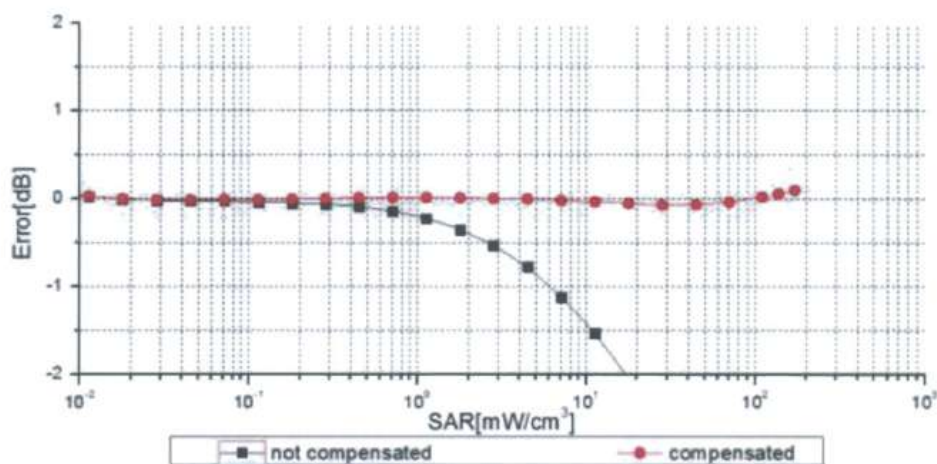
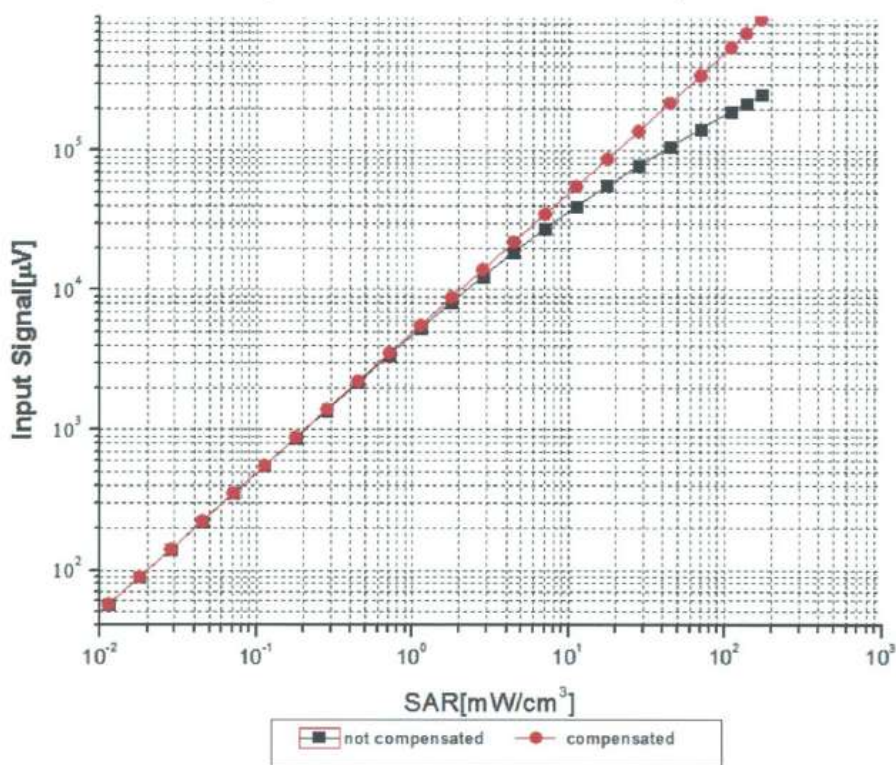


Uncertainty of Axial Isotropy Assessment: $\pm 0.9\%$ ($k=2$)



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Dynamic Range $f(\text{SAR}_{\text{head}})$ (TEM cell, $f = 900 \text{ MHz}$)



Uncertainty of Linearity Assessment: $\pm 0.9\%$ ($k=2$)

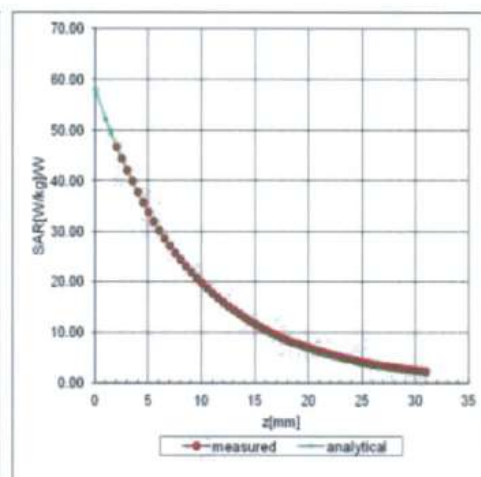
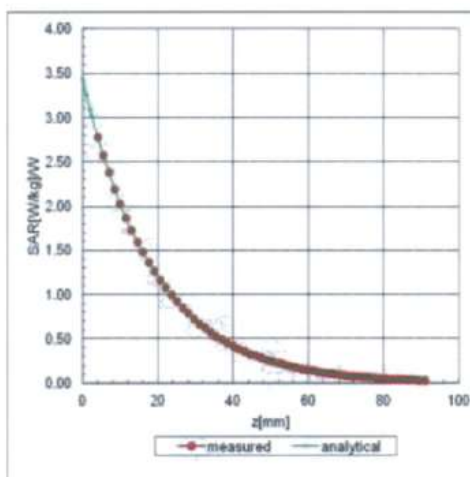


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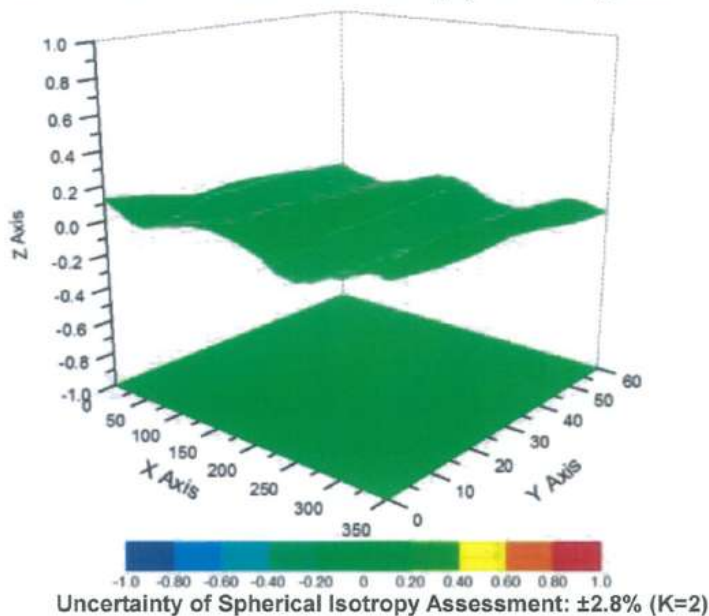
Conversion Factor Assessment

f=850 MHz, WGLS R9(H_convF)

f=2450 MHz, WGLS R26(H_convF)



Deviation from Isotropy in Liquid



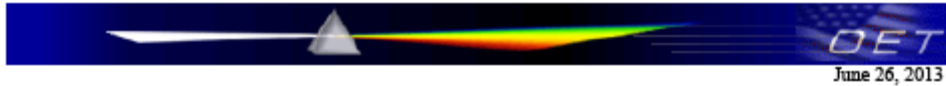


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DASY - Parameters of Probe: EX3DV4 - SN: 3717

Other Probe Parameters

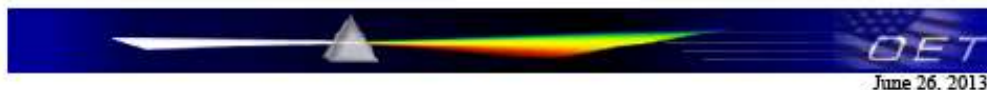
| | |
|---|------------|
| Sensor Arrangement | Triangular |
| Connector Angle (°) | 155.2 |
| Mechanical Surface Detection Mode | enabled |
| Optical Surface Detection Mode | disable |
| Probe Overall Length | 337mm |
| Probe Body Diameter | 10mm |
| Tip Length | 9mm |
| Tip Diameter | 2.5mm |
| Probe Tip to Sensor X Calibration Point | 1mm |
| Probe Tip to Sensor Y Calibration Point | 1mm |
| Probe Tip to Sensor Z Calibration Point | 1mm |
| Recommended Measurement Distance from Surface | 2mm |



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Calibrated under the SPEAG-TMC Dual-Logo Calibration Program to
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June 26, 2013

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Change Note: Revised on June 26 to clarify the applicability of PMR and Bundled probe calibrations according to the requirements of KDB 865664.

Annex B.2 DAE4 Calibration Certificate



In Collaboration with
s p e a g
CALIBRATION LABORATORY

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Client : **Tejet**

Certificate No: **Z14-97086**

CALIBRATION CERTIFICATE

Object: **DAE4 - SN: 1226**

Calibration Procedure(s): **TMC-OS-E-01-198**
Calibration Procedure for the Data Acquisition Electronics (DAEx)


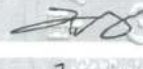
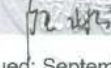
Calibration date: **September 15, 2014**

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
|------------------------|---------|--|-----------------------|
| Process Calibrator 753 | 1971018 | 01-July-14 (CTTL, No:J14X02147) | July-15 |

| | Name | Function | Signature |
|----------------|-------------|-----------------------------------|---|
| Calibrated by: | Yu Zongying | SAR Test Engineer |  |
| Reviewed by: | Qi Dianyuan | SAR Project Leader |  |
| Approved by: | Lu Bingsong | Deputy Director of the laboratory |  |

Issued: September 17, 2014

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Glossary:

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

Methods Applied and Interpretation of Parameters:

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle:* The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The report provide only calibration results for DAE, it does not contain other performance test results.



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DC Voltage Measurement

A/D - Converter Resolution nominal

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

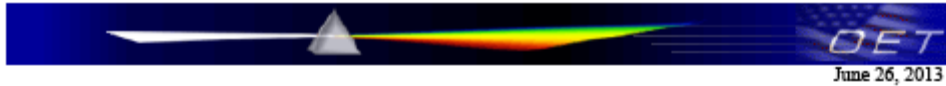
Low Range: 1LSB = 61nV, full range = -1.....+3mV

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

| Calibration Factors | X | Y | Z |
|---------------------|---------------------------|---------------------------|---------------------------|
| High Range | 404.607 \pm 0.15% (k=2) | 404.376 \pm 0.15% (k=2) | 404.104 \pm 0.15% (k=2) |
| Low Range | 3.97906 \pm 0.7% (k=2) | 4.00337 \pm 0.7% (k=2) | 3.98461 \pm 0.7% (k=2) |

Connector Angle

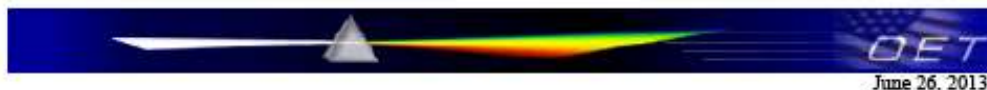
| | |
|---|------------------|
| Connector Angle to be used in DASY system | 114.5° \pm 1 ° |
|---|------------------|



**Acceptable Conditions for SAR Measurements Using Probes and Dipoles
Calibrated under the SPEAG-TMC Dual-Logo Calibration Program to
Support FCC Equipment Certification**

The acceptable conditions for SAR measurements using probes, dipoles and DAEs calibrated by TMC (*Telecommunication Metrology Center of MITT in Beijing, China*), under the Dual-Logo Calibration Certificate program and quality assurance (QA) protocols established between SPEAG (*Schmid & Partner Engineering AG, Switzerland*) and TMC, to support FCC (*U.S. Federal Communications Commission*) equipment certification are defined and described in the following.

- 1) The agreement established between SPEAG and TMC is only applicable to calibration services performed by TMC where its clients (companies and divisions of such companies) are headquartered in the Greater China Region, including Taiwan and Hong Kong. This agreement is subject to renewal at the end of each calendar year between SPEAG and TMC. TMC shall inform the FCC of any changes or early termination to the agreement.
- 2) Only a subset of the calibration services specified in the SPEAG-TMC agreement, while it remains valid, are applicable to SAR measurements performed using such equipment for supporting FCC equipment certification. These are identified in the following.
 - a) Calibration of dosimetric (SAR) probes EX3DVx, ET3DVx and ES3DVx.
 - i) Free-space E-field and H-field probes, including those used for HAC (hearing aid compatibility) evaluation, temperature probes, other probes or equipment not identified in this document, when calibrated by TMC, are excluded and cannot be used for measurements to support FCC equipment certification.
 - ii) Signal specific and bundled probe calibrations based on PMR (probe modulation response) characteristics are handled according to the requirements of KDB 865664; that is, "Until standardized procedures are available to make such determination, the applicability of a signal specific probe calibration for testing specific wireless modes and technologies is determined on a case-by-case basis through KDB inquiries, including SAR system verification requirements."
 - b) Calibration of SAR system validation dipoles, excluding HAC dipoles.
 - c) Calibration of data acquisition electronics DAE3Vx, DAE4Vx and DAEasyVx.
 - d) For FCC equipment certification purposes, the frequency range of SAR probe and dipole calibrations is limited to 700 MHz - 6 GHz and provided it is supported by the equipment identified in the TMC QA protocol (a separate attachment to this document).
 - e) The identical system and equipment setup, measurement configurations, hardware, evaluation algorithms, calibration and QA protocols, including the format of calibration certificates and reports used by SPEAG shall be applied by TMC.
 - f) The calibrated items are only applicable to SPEAG DASY 4 and DASY 5 or higher version systems.



- 3) The SPEAG-TMC agreement includes specific protocols identified in the following to ensure the quality of calibration services provided by TMC under this SPEAG-TMC Dual-Logo calibration agreement are equivalent to the calibration services provided by SPEAG. TMC shall, upon request, provide copies of documentation to the FCC to substantiate program implementation.
 - a) The Inter-laboratory Calibration Evaluation (ILCE) stated in the TMC QA protocol shall be performed between SPEAG and TMC at least once every 12 months. The ILCE acceptance criteria defined in the TMC QA protocol shall be satisfied for the TMC, SPEAG and FCC agreements to remain valid.
 - b) Check of Calibration Certificate (CCC) shall be performed by SPEAG for all calibrations performed by TMC. Written confirmation from SPEAG is required for TMC to issue calibration certificates under the SPEAG-TMC Dual-Logo calibration program. Quarterly reports for all calibrations performed by TMC under the program are also issued by SPEAG.
 - c) The calibration equipment and measurement system used by TMC shall be verified before each calibration service according to the specific reference SAR probes, dipoles, and DAE calibrated by SPEAG. The results shall be reproducible and within the defined acceptance criteria specified in the TMC QA protocol before each actual calibration can commence. TMC shall maintain records of the measurement and calibration system verification results for all calibrations.
 - d) Quality Check of Calibration (QCC) certificates shall be performed by SPEAG at least once every 12 months. SPEAG shall visit TMC facilities to verify the laboratory, equipment, applied procedures and plausibility of randomly selected certificates.
- 4) A copy of this document, to be updated annually, shall be provided to TMC clients that accept calibration services according to the SPEAG-TMC Dual-Logo calibration program, which should be presented to a TCB (*Telecommunication Certification Body*), to facilitate FCC equipment approval.
- 5) TMC shall address any questions raised by its clients or TCBs relating to the SPEAG-TMC Dual-Logo calibration program and inform the FCC and SPEAG of any critical issues.

Change Note: Revised on June 26 to clarify the applicability of PMR and Bundled probe calibrations according to the requirements of KDB 865664.

Calibration Laboratory of
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Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland



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

Accreditation No.: **SCS 108**

Client **Tejet (Auden)**

Certificate No: **DAE4-1327_May14**

CALIBRATION CERTIFICATE

Object **DAE4 - SD 000 D04 BJ - SN: 1327**

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

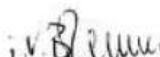
Calibration date: **May 05, 2014**

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

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date (Certificate No.) | Scheduled Calibration |
|-------------------------------|--------------------|----------------------------|------------------------|
| Keithley Multimeter Type 2001 | SN: 0810278 | 01-Oct-13 (No:13976) | Oct-14 |
| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
| Auto DAE Calibration Unit | SE UWS 053 AA 1001 | 07-Jan-14 (in house check) | In house check: Jan-15 |
| Calibrator Box V2.1 | SE UMS 006 AA 1002 | 07-Jan-14 (in house check) | In house check: Jan-15 |

| | | | |
|----------------|-----------------------------|--------------------------|--|
| Calibrated by: | Name R.Mayoraz | Function Technician | Signature  |
| Approved by: | Name Fin Bornholt | Deputy Technical Manager | Signature  |

Issued: May 5, 2014

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Certificate No: DAE4-1327_May14

Page 1 of 5

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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

Accreditation No.: **SCS 108**

Glossary

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

Methods Applied and Interpretation of Parameters

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

DC Voltage Measurement

A/D - Converter Resolution nominal

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

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

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

| Calibration Factors | X | Y | Z |
|---------------------|-----------------------|-----------------------|-----------------------|
| High Range | 404.896 ± 0.02% (k=2) | 404.741 ± 0.02% (k=2) | 404.940 ± 0.02% (k=2) |
| Low Range | 3.99218 ± 1.50% (k=2) | 3.99097 ± 1.50% (k=2) | 3.99813 ± 1.50% (k=2) |

Connector Angle

| | |
|---|---------------|
| Connector Angle to be used in DASY system | 187.0 ° ± 1 ° |
|---|---------------|

Appendix

1. DC Voltage Linearity

| High Range | Reading (μV) | Difference (μV) | Error (%) |
|-------------------|---------------------------|------------------------------|-----------|
| Channel X + Input | 200036.27 | 0.51 | 0.00 |
| Channel X + Input | 20005.01 | 1.05 | 0.01 |
| Channel X - Input | -20004.10 | 1.80 | -0.01 |
| Channel Y + Input | 200033.33 | -2.28 | -0.00 |
| Channel Y + Input | 20003.31 | -0.48 | -0.00 |
| Channel Y - Input | -20006.17 | -0.06 | 0.00 |
| Channel Z + Input | 200033.50 | -2.00 | -0.00 |
| Channel Z + Input | 20002.83 | -0.90 | -0.00 |
| Channel Z - Input | -20008.51 | -2.38 | 0.01 |

| Low Range | Reading (μV) | Difference (μV) | Error (%) |
|-------------------|---------------------------|------------------------------|-----------|
| Channel X + Input | 2000.09 | -0.19 | -0.01 |
| Channel X + Input | 200.72 | 0.41 | 0.20 |
| Channel X - Input | -199.42 | 0.24 | -0.12 |
| Channel Y + Input | 2000.87 | 0.57 | 0.03 |
| Channel Y + Input | 200.02 | -0.13 | -0.06 |
| Channel Y - Input | -198.35 | 1.42 | -0.71 |
| Channel Z + Input | 2000.46 | 0.16 | 0.01 |
| Channel Z + Input | 199.68 | -0.59 | -0.29 |
| Channel Z - Input | -201.15 | -1.34 | 0.67 |

2. Common mode sensitivity

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

| | Common mode Input Voltage (mV) | High Range Average Reading (μV) | Low Range Average Reading (μV) |
|-----------|--------------------------------|--|---|
| Channel X | 200 | -1.49 | -2.80 |
| | - 200 | 4.58 | 3.19 |
| Channel Y | 200 | 15.02 | 14.91 |
| | - 200 | -16.06 | -16.06 |
| Channel Z | 200 | -9.51 | -9.74 |
| | - 200 | 8.51 | 8.58 |

3. Channel separation

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

| | Input Voltage (mV) | Channel X (μV) | Channel Y (μV) | Channel Z (μV) |
|-----------|--------------------|-----------------------------|-----------------------------|-----------------------------|
| Channel X | 200 | - | -0.85 | -2.41 |
| Channel Y | 200 | 6.24 | - | 0.57 |
| Channel Z | 200 | 9.93 | 4.38 | - |

4. AD-Converter Values with inputs shorted

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

| | High Range (LSB) | Low Range (LSB) |
|-----------|------------------|-----------------|
| Channel X | 16000 | 14679 |
| Channel Y | 16291 | 17597 |
| Channel Z | 15620 | 15519 |

5. Input Offset Measurement

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

Input 10M Ω

| | Average (μ V) | min. Offset (μ V) | max. Offset (μ V) | Std. Deviation (μ V) |
|-----------|--------------------|------------------------|------------------------|---------------------------|
| Channel X | 0.55 | -0.77 | 1.82 | 0.52 |
| Channel Y | 0.60 | -0.77 | 2.34 | 0.63 |
| Channel Z | -0.49 | -2.84 | 1.48 | 0.79 |

6. Input Offset Current

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

7. Input Resistance (Typical values for information)

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

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

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

9. Power Consumption (Typical values for information)




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

Annex B.3 D835V2 Calibration Certificate



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| | | | | |
|---|---|--|---|---------------------------|
| Client | Tejet | | | Certificate No: Z14-97088 |
| CALIBRATION CERTIFICATE | | | | |
| Object | D835V2 - SN: 4d100 | | | |
| Calibration Procedure(s) | TMC-OS-E-02-194 Calibration procedure for dipole validation kits | | | |
| Calibration date: | September 23, 2014 | | | |
| <p>This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements(SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.</p> <p>All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)℃ and humidity<70%.</p> <p>Calibration Equipment used (M&TE critical for calibration)</p> | | | | |
| Primary Standards | ID # | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration | |
| Power Meter NRVD | 102196 | 14-Mar-14 (CTTL, No.JZ14-896) | Mar-15 | |
| Power sensor NRV-Z5 | 100596 | 14-Mar-14 (CTTL, No. JZ14-896) | Mar -15 | |
| Reference Probe ES3DV3 | SN 3142 | 1- Sep-14 (CTTL-SPEAG, No.JZ14-97079) | Aug-15 | |
| DAE3 | SN 536 | 23-Jan-14 (SPEAG, DAE3-536_Jan14) | Jan -15 | |
| Signal Generator E4438C | MY49070393 | 13-Nov-13 (TMC, No.JZ13-394) | Nov-14 | |
| Network Analyzer E8362B | MY43021135 | 19-Oct-13 (TMC, No.JZ13-278) | Oct-14 | |
| Calibrated by: | Name | Function | Signature | |
| | Zhao Jing | SAR Test Engineer |  | |
| Reviewed by: | Qi Dianyuan | SAR Project Leader |  | |
| Approved by: | Lu Bingsong | Deputy Director of the laboratory |  | |
| <p>Issued: September 30, 2014</p> <p>This calibration certificate shall not be reproduced except in full without written approval of the laboratory.</p> | | | | |



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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
- 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 300MHz to 3GHz)", February 2005
- KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

- 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 | DASY52 | 52.8.8.1222 |
| Extrapolation | Advanced Extrapolation | |
| Phantom | Triple Flat Phantom 5.1C | |
| Distance Dipole Center - TSL | 15 mm | with Spacer |
| Zoom Scan Resolution | dx, dy, dz = 5 mm | |
| Frequency | 835 MHz \pm 1 MHz | |

Head TSL parameters

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|---|---------------------|----------------|----------------------|
| Nominal Head TSL parameters | 22.0 °C | 41.5 | 0.90 mho/m |
| Measured Head TSL parameters | (22.0 \pm 0.2) °C | 40.4 \pm 6 % | 0.93 mho/m \pm 6 % |
| Head TSL temperature change during test | <1.0 °C | ---- | ---- |

SAR result with Head TSL

| | | |
|---|--------------------|--------------------------------|
| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
| SAR measured | 250 mW input power | 2.44 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 9.51 mW / g \pm 20.8 % (k=2) |
| SAR averaged over 10 cm ³ (10 g) of Head TSL | Condition | |
| SAR measured | 250 mW input power | 1.60 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 6.27 mW / g \pm 20.4 % (k=2) |

Body TSL parameters

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|---|---------------------|----------------|----------------------|
| Nominal Body TSL parameters | 22.0 °C | 55.2 | 0.97 mho/m |
| Measured Body TSL parameters | (22.0 \pm 0.2) °C | 54.4 \pm 6 % | 0.98 mho/m \pm 6 % |
| Body TSL temperature change during test | <1.0 °C | ---- | ---- |

SAR result with Body TSL

| | | |
|---|--------------------|--------------------------------|
| SAR averaged over 1 cm ³ (1 g) of Body TSL | Condition | |
| SAR measured | 250 mW input power | 2.41 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 9.52 mW / g \pm 20.8 % (k=2) |
| SAR averaged over 10 cm ³ (10 g) of Body TSL | Condition | |
| SAR measured | 250 mW input power | 1.60 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 6.34 mW / g \pm 20.4 % (k=2) |



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Appendix

Antenna Parameters with Head TSL

| | |
|--------------------------------------|----------------|
| Impedance, transformed to feed point | 52.7Ω + 0.73jΩ |
| Return Loss | - 31.3dB |

Antenna Parameters with Body TSL

| | |
|--------------------------------------|----------------|
| Impedance, transformed to feed point | 48.2Ω - 1.47jΩ |
| Return Loss | - 32.4dB |

General Antenna Parameters and Design

| | |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.327 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 |
|-----------------|-------|



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DASY5 Validation Report for Head TSL

Date: 22.09.2014

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d100

Communication System: UID 0, CW (0); Frequency: 835 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 835$ MHz; $\sigma = 0.925$ S/m; $\epsilon_r = 40.43$; $\rho = 1000$ kg/m³

Phantom section: Left Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3142; ConvF(5.89, 5.89, 5.89); Calibrated: 2014-09-01;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn536; Calibrated: 2014-01-23
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

System Performance Check at Frequencies below 1 GHz/d=15mm, Pin=250 mW, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:

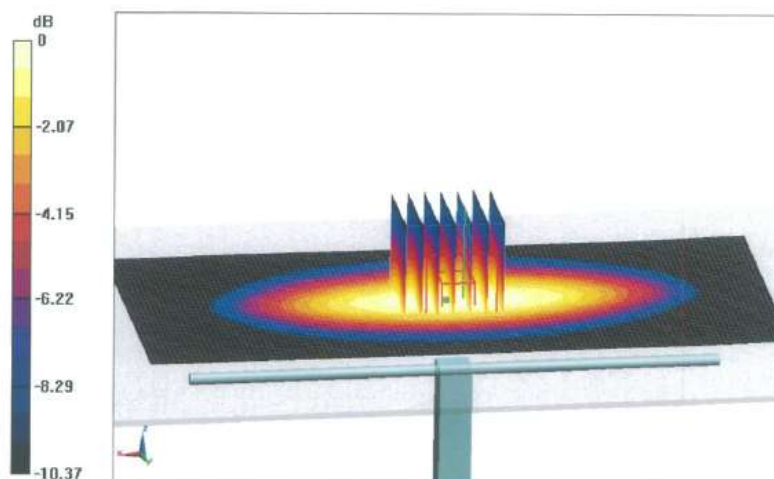
dx=5mm, dy=5mm, dz=5mm

Reference Value = 55.51 V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 3.63 W/kg

SAR(1 g) = 2.44 W/kg; SAR(10 g) = 1.6 W/kg

Maximum value of SAR (measured) = 2.85 W/kg



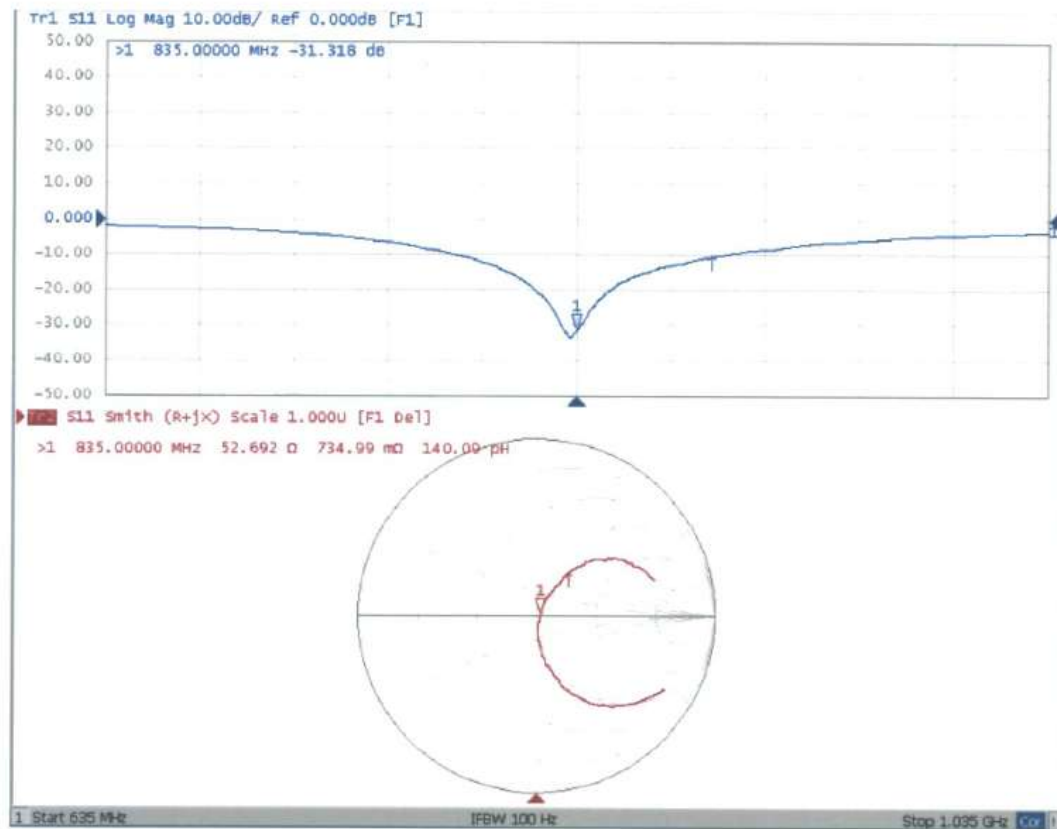
0 dB = 2.85 W/kg = 4.55 dBW/kg



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Impedance Measurement Plot for Head TSL





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DASY5 Validation Report for Body TSL

Date: 23.09.2014

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d100

Communication System: UID 0, CW (0); Frequency: 835 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.982 \text{ S/m}$; $\epsilon_r = 54.36$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Center Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3142; ConvF(6.01, 6.01, 6.01); Calibrated: 2014-09-01;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn536; Calibrated: 2014-01-23
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/2
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

System Performance Check at Frequencies below 1 GHz/d=15mm, Pin=250

mW, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement

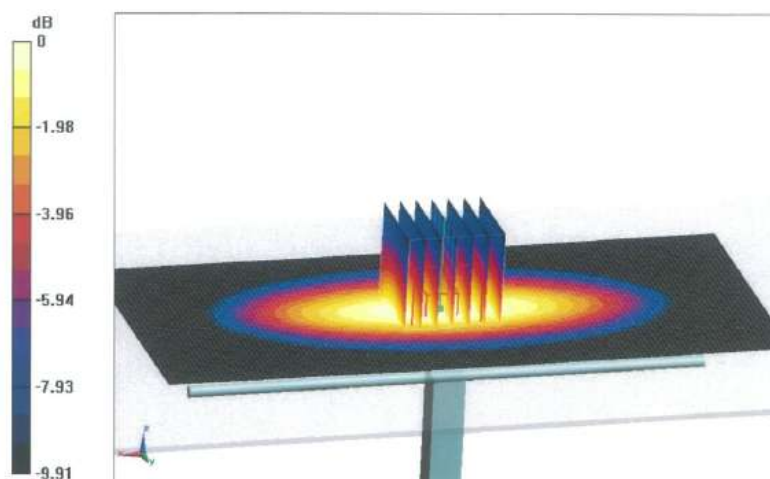
grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 53.51 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 3.52 W/kg

SAR(1 g) = 2.41 W/kg; SAR(10 g) = 1.6 W/kg

Maximum value of SAR (measured) = 2.79 W/kg



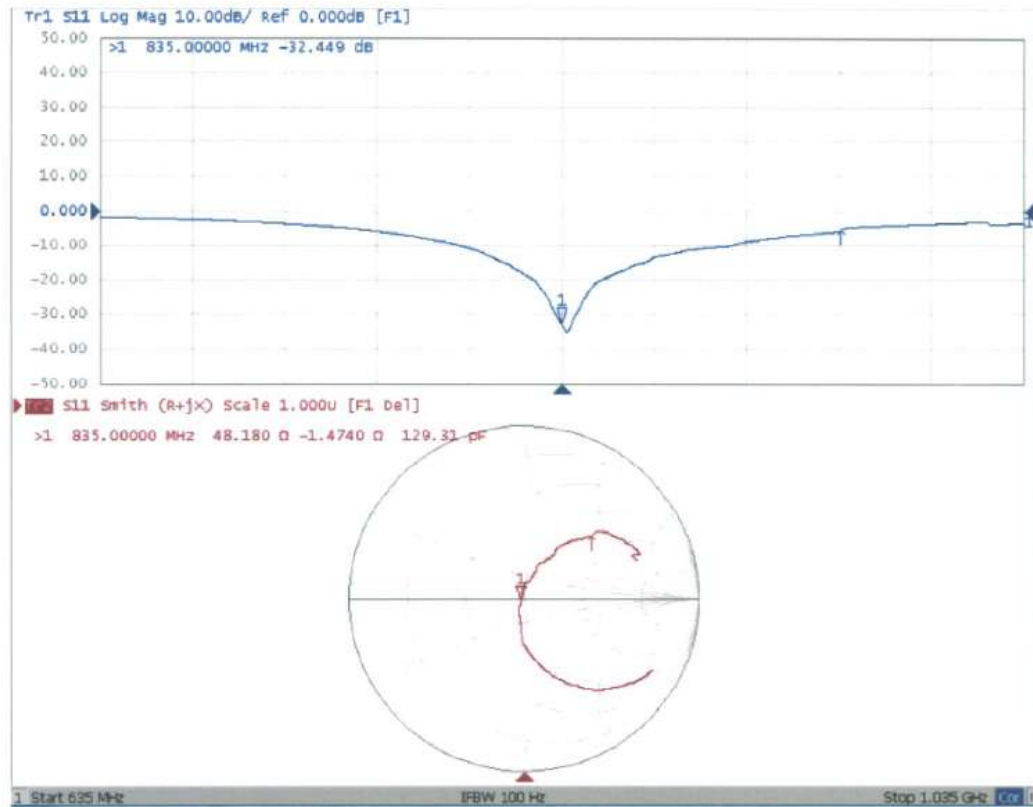
0 dB = 2.79 W/kg = 4.46 dBW/kg

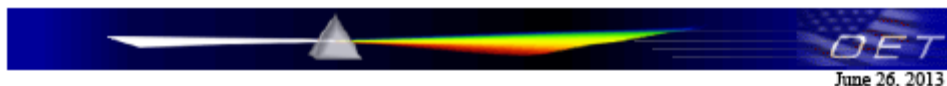


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Impedance Measurement Plot for Body TSL

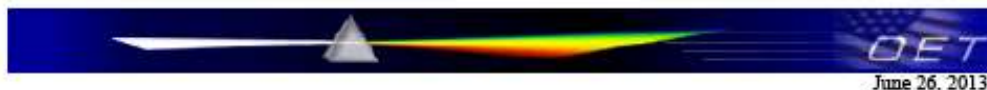




**Acceptable Conditions for SAR Measurements Using Probes and Dipoles
Calibrated under the SPEAG-TMC Dual-Logo Calibration Program to
Support FCC Equipment Certification**

The acceptable conditions for SAR measurements using probes, dipoles and DAEs calibrated by TMC (*Telecommunication Metrology Center of MITT in Beijing, China*), under the Dual-Logo Calibration Certificate program and quality assurance (QA) protocols established between SPEAG (*Schmid & Partner Engineering AG, Switzerland*) and TMC, to support FCC (*U.S. Federal Communications Commission*) equipment certification are defined and described in the following.

- 1) The agreement established between SPEAG and TMC is only applicable to calibration services performed by TMC where its clients (companies and divisions of such companies) are headquartered in the Greater China Region, including Taiwan and Hong Kong. This agreement is subject to renewal at the end of each calendar year between SPEAG and TMC. TMC shall inform the FCC of any changes or early termination to the agreement.
- 2) Only a subset of the calibration services specified in the SPEAG-TMC agreement, while it remains valid, are applicable to SAR measurements performed using such equipment for supporting FCC equipment certification. These are identified in the following.
 - a) Calibration of dosimetric (SAR) probes EX3DVx, ET3DVx and ES3DVx.
 - i) Free-space E-field and H-field probes, including those used for HAC (hearing aid compatibility) evaluation, temperature probes, other probes or equipment not identified in this document, when calibrated by TMC, are excluded and cannot be used for measurements to support FCC equipment certification.
 - ii) Signal specific and bundled probe calibrations based on PMR (probe modulation response) characteristics are handled according to the requirements of KDB 865664; that is, "Until standardized procedures are available to make such determination, the applicability of a signal specific probe calibration for testing specific wireless modes and technologies is determined on a case-by-case basis through KDB inquiries, including SAR system verification requirements."
 - b) Calibration of SAR system validation dipoles, excluding HAC dipoles.
 - c) Calibration of data acquisition electronics DAE3Vx, DAE4Vx and DAEasyVx.
 - d) For FCC equipment certification purposes, the frequency range of SAR probe and dipole calibrations is limited to 700 MHz - 6 GHz and provided it is supported by the equipment identified in the TMC QA protocol (a separate attachment to this document).
 - e) The identical system and equipment setup, measurement configurations, hardware, evaluation algorithms, calibration and QA protocols, including the format of calibration certificates and reports used by SPEAG shall be applied by TMC.
 - f) The calibrated items are only applicable to SPEAG DASY 4 and DASY 5 or higher version systems.



- 3) The SPEAG-TMC agreement includes specific protocols identified in the following to ensure the quality of calibration services provided by TMC under this SPEAG-TMC Dual-Logo calibration agreement are equivalent to the calibration services provided by SPEAG. TMC shall, upon request, provide copies of documentation to the FCC to substantiate program implementation.
 - a) The Inter-laboratory Calibration Evaluation (ILCE) stated in the TMC QA protocol shall be performed between SPEAG and TMC at least once every 12 months. The ILCE acceptance criteria defined in the TMC QA protocol shall be satisfied for the TMC, SPEAG and FCC agreements to remain valid.
 - b) Check of Calibration Certificate (CCC) shall be performed by SPEAG for all calibrations performed by TMC. Written confirmation from SPEAG is required for TMC to issue calibration certificates under the SPEAG-TMC Dual-Logo calibration program. Quarterly reports for all calibrations performed by TMC under the program are also issued by SPEAG.
 - c) The calibration equipment and measurement system used by TMC shall be verified before each calibration service according to the specific reference SAR probes, dipoles, and DAE calibrated by SPEAG. The results shall be reproducible and within the defined acceptance criteria specified in the TMC QA protocol before each actual calibration can commence. TMC shall maintain records of the measurement and calibration system verification results for all calibrations.
 - d) Quality Check of Calibration (QCC) certificates shall be performed by SPEAG at least once every 12 months. SPEAG shall visit TMC facilities to verify the laboratory, equipment, applied procedures and plausibility of randomly selected certificates.
- 4) A copy of this document, to be updated annually, shall be provided to TMC clients that accept calibration services according to the SPEAG-TMC Dual-Logo calibration program, which should be presented to a TCB (*Telecommunication Certification Body*), to facilitate FCC equipment approval.
- 5) TMC shall address any questions raised by its clients or TCBs relating to the SPEAG-TMC Dual-Logo calibration program and inform the FCC and SPEAG of any critical issues.

Change Note: Revised on June 26 to clarify the applicability of PMR and Bundled probe calibrations according to the requirements of KDB 865664.

Annex B.4 D1900V2 Calibration Certificate



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校准
CNAS L0442

Client **TEJET**

Certificate No: **Z14-97044**

CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 5d155**

Calibration Procedure(s) **TMC-OS-E-02-194**
Calibration procedure for dipole validation kits

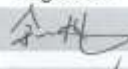
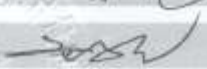
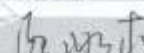
Calibration date: **May 23, 2014**

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
|-------------------------|------------|--|-----------------------|
| Power Meter NRVD | 102083 | 11-Sep-13 (TMC, No.JZ13-443) | Sep-14 |
| Power sensor NRV-Z5 | 100595 | 11-Sep-13 (TMC, No. JZ13-443) | Sep -14 |
| Reference Probe EX3DV4 | SN 3846 | 3- Sep-13 (SPEAG, No.EX3-3846_Sep13) | Sep-14 |
| DAE4 | SN 1331 | 23-Jan-14 (SPEAG, DAE4-1331_Jan14) | Jan -15 |
| Signal Generator E4438C | MY49070393 | 13-Nov-13 (TMC, No.JZ13-394) | Nov-14 |
| Network Analyzer E8362B | MY43021135 | 19-Oct-13 (TMC, No.JZ13-278) | Oct-14 |

| | Name | Function | Signature |
|----------------|-------------|-----------------------------------|---|
| Calibrated by: | Yu Zongying | SAR Test Engineer |  |
| Reviewed by: | Qi Dianyuan | SAR Project Leader |  |
| Approved by: | Lu Bingsong | Deputy Director of the laboratory |  |

Issued: January 24, 2014

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

Certificate No: Z14-97044

Page 1 of 8



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Glossary:

| | |
|-------|--------------------------------|
| TSL | tissue simulating liquid |
| ConvF | sensitivity in TSL / NORMx,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
- 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 300MHz to 3GHz)", February 2005
- KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

- 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 | DASY52 | 52.8.7.1137 |
| Extrapolation | Advanced Extrapolation | |
| Phantom | Twin Phantom | |
| Distance Dipole Center - TSL | 10 mm | with Spacer |
| Zoom Scan Resolution | dx, dy, dz = 5 mm | |
| Frequency | 1900 MHz \pm 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 \pm 0.2) °C | 40.3 \pm 6 % | 1.37 mho/m \pm 6 % |
| Head TSL temperature change during test | <1.0 °C | --- | --- |

SAR result with Head TSL

| | | |
|--|--------------------|--------------------------------|
| SAR averaged over 1 cm^3 (1 g) of Head TSL | Condition | |
| SAR measured | 250 mW input power | 9.69 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 39.3 mW / g \pm 20.8 % (k=2) |
| SAR averaged over 10 cm^3 (10 g) of Head TSL | Condition | |
| SAR measured | 250 mW input power | 5.21 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 21.0 mW / g \pm 20.4 % (k=2) |

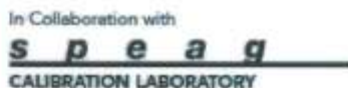
Body TSL parameters

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 \pm 0.2) °C | 52.7 \pm 6 % | 1.48 mho/m \pm 6 % |
| Body TSL temperature change during test | <1.0 °C | --- | --- |

SAR result with Body TSL

| | | |
|--|--------------------|--------------------------------|
| SAR averaged over 1 cm^3 (1 g) of Body TSL | Condition | |
| SAR measured | 250 mW input power | 10.1 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 40.9 mW / g \pm 20.8 % (k=2) |
| SAR averaged over 10 cm^3 (10 g) of Body TSL | Condition | |
| SAR measured | 250 mW input power | 5.29 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 21.3 mW / g \pm 20.4 % (k=2) |



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Appendix

Antenna Parameters with Head TSL

| | |
|--------------------------------------|---------------|
| Impedance, transformed to feed point | 48.7Ω- 7.35jΩ |
| Return Loss | - 22.3dB |

Antenna Parameters with Body TSL

| | |
|--------------------------------------|---------------|
| Impedance, transformed to feed point | 52.0Ω- 6.48jΩ |
| Return Loss | - 23.6dB |

General Antenna Parameters and Design

| | |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.211 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 |
|-----------------|-------|



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DASY5 Validation Report for Head TSL

Date: 21.05.2014

Test Laboratory: TMC, Beijing, China

DUT: Dipole 1900 MHz D1900V2; Type: D1900V2; Serial: D1900V2 - SN: 5d155

Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.372$ S/m; $\epsilon_r = 40.27$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3846; ConvF(7.57, 7.57, 7.57); Calibrated: 2013-09-03;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2014-01-23
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: xxxx
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

System Performance Check at Frequencies above 1 GHz/d=10mm, Pin=xx mW,

dist=2.0mm (EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0; Measurement grid:

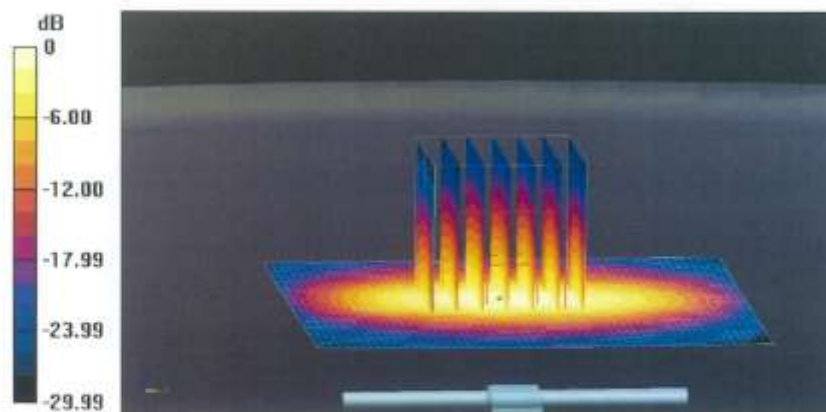
dx=5mm, dy=5mm, dz=5mm

Reference Value = 103.2 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 18.0 W/kg

SAR(1 g) = 9.69 W/kg; SAR(10 g) = 5.21 W/kg

Maximum value of SAR (measured) = 14.0 W/kg



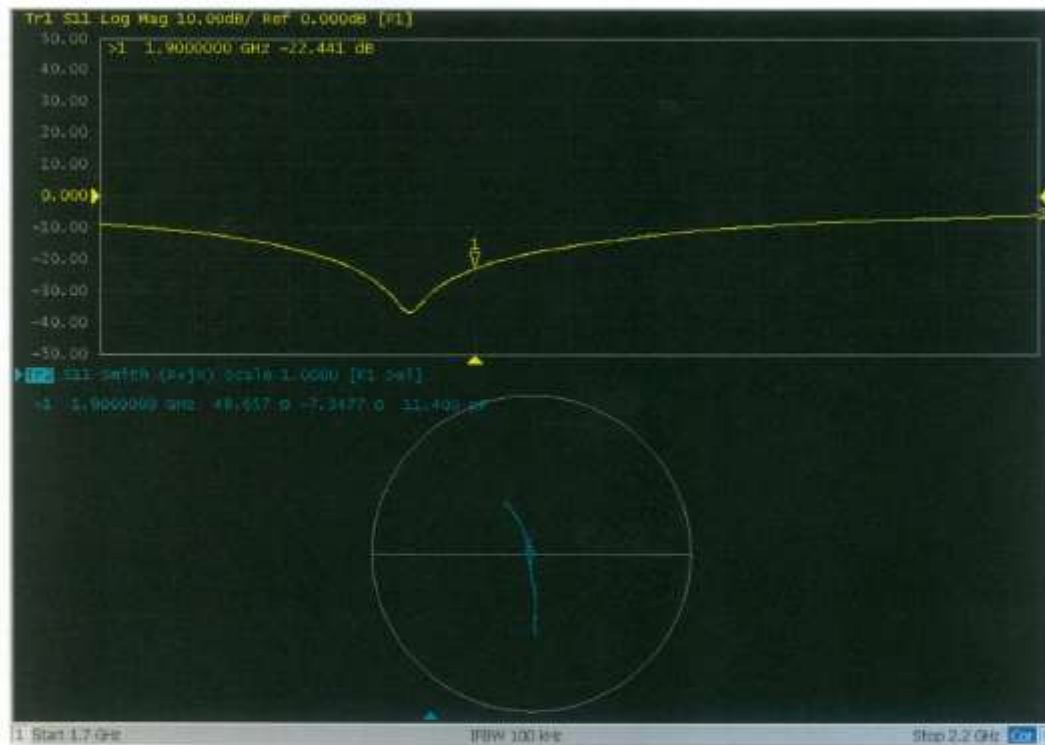
0 dB = 14.0 W/kg = 11.46 dBW/kg



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Impedance Measurement Plot for Head TSL





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E-mail: info@emcile.com <http://www.emcile.com>

DASY5 Validation Report for Body TSL

Date: 22.05.2014

Test Laboratory: TMC, Beijing, China

DUT: Dipole 1900 MHz D1900V2; Type: D1900V2; Serial: D1900V2 - SN: 5d155

Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1900 \text{ MHz}$; $\sigma = 1.48 \text{ S/m}$; $\epsilon_r = 52.72$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3846; ConvF(7.03, 7.03, 7.03); Calibrated: 2013-09-03;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2014-01-23
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: xxxx
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

System Performance Check at Frequencies above 1 GHz/d=10mm, Pin=xx mW,

dist=2.0mm (EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:

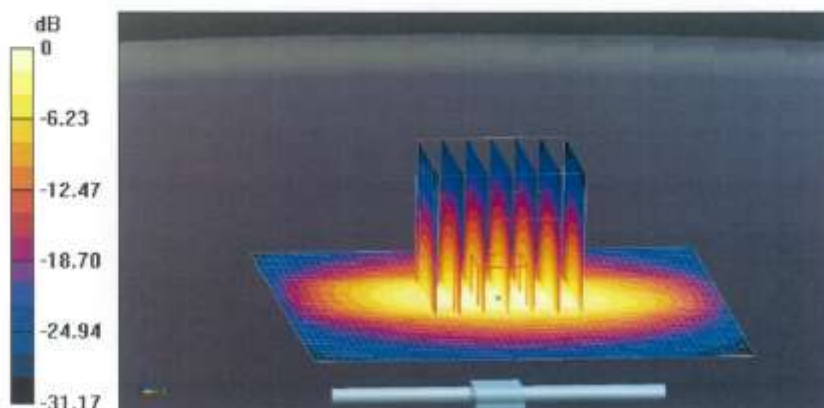
dx=5mm, dy=5mm, dz=5mm

Reference Value = 100.2 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 18.0 W/kg

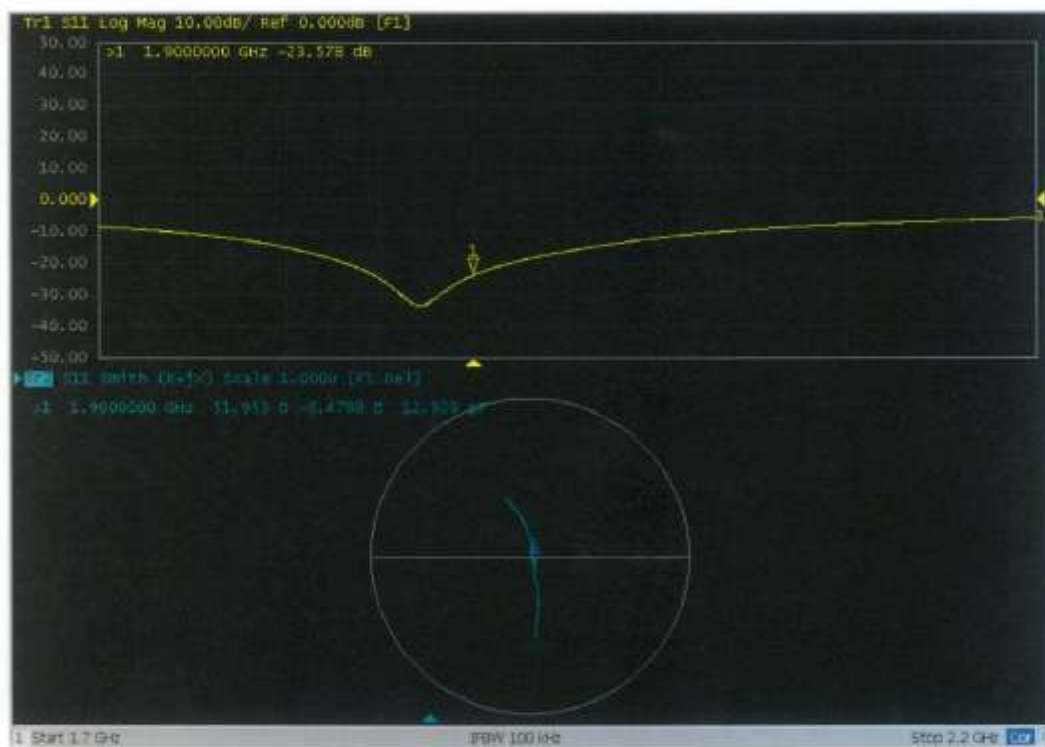
SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.29 W/kg

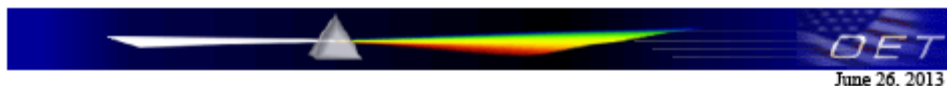
Maximum value of SAR (measured) = 14.3 W/kg



0 dB = 14.1 W/kg = 11.49 dBW/kg

Impedance Measurement Plot for Body TSL

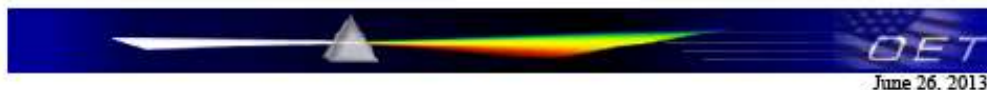




**Acceptable Conditions for SAR Measurements Using Probes and Dipoles
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 - a) Calibration of dosimetric (SAR) probes EX3DVx, ET3DVx and ES3DVx.
 - i) Free-space E-field and H-field probes, including those used for HAC (hearing aid compatibility) evaluation, temperature probes, other probes or equipment not identified in this document, when calibrated by TMC, are excluded and cannot be used for measurements to support FCC equipment certification.
 - ii) Signal specific and bundled probe calibrations based on PMR (probe modulation response) characteristics are handled according to the requirements of KDB 865664; that is, "Until standardized procedures are available to make such determination, the applicability of a signal specific probe calibration for testing specific wireless modes and technologies is determined on a case-by-case basis through KDB inquiries, including SAR system verification requirements."
 - b) Calibration of SAR system validation dipoles, excluding HAC dipoles.
 - c) Calibration of data acquisition electronics DAE3Vx, DAE4Vx and DAEasyVx.
 - d) For FCC equipment certification purposes, the frequency range of SAR probe and dipole calibrations is limited to 700 MHz - 6 GHz and provided it is supported by the equipment identified in the TMC QA protocol (a separate attachment to this document).
 - e) The identical system and equipment setup, measurement configurations, hardware, evaluation algorithms, calibration and QA protocols, including the format of calibration certificates and reports used by SPEAG shall be applied by TMC.
 - f) The calibrated items are only applicable to SPEAG DASY 4 and DASY 5 or higher version systems.



- 3) The SPEAG-TMC agreement includes specific protocols identified in the following to ensure the quality of calibration services provided by TMC under this SPEAG-TMC Dual-Logo calibration agreement are equivalent to the calibration services provided by SPEAG. TMC shall, upon request, provide copies of documentation to the FCC to substantiate program implementation.
 - a) The Inter-laboratory Calibration Evaluation (ILCE) stated in the TMC QA protocol shall be performed between SPEAG and TMC at least once every 12 months. The ILCE acceptance criteria defined in the TMC QA protocol shall be satisfied for the TMC, SPEAG and FCC agreements to remain valid.
 - b) Check of Calibration Certificate (CCC) shall be performed by SPEAG for all calibrations performed by TMC. Written confirmation from SPEAG is required for TMC to issue calibration certificates under the SPEAG-TMC Dual-Logo calibration program. Quarterly reports for all calibrations performed by TMC under the program are also issued by SPEAG.
 - c) The calibration equipment and measurement system used by TMC shall be verified before each calibration service according to the specific reference SAR probes, dipoles, and DAE calibrated by SPEAG. The results shall be reproducible and within the defined acceptance criteria specified in the TMC QA protocol before each actual calibration can commence. TMC shall maintain records of the measurement and calibration system verification results for all calibrations.
 - d) Quality Check of Calibration (QCC) certificates shall be performed by SPEAG at least once every 12 months. SPEAG shall visit TMC facilities to verify the laboratory, equipment, applied procedures and plausibility of randomly selected certificates.
- 4) A copy of this document, to be updated annually, shall be provided to TMC clients that accept calibration services according to the SPEAG-TMC Dual-Logo calibration program, which should be presented to a TCB (*Telecommunication Certification Body*), to facilitate FCC equipment approval.
- 5) TMC shall address any questions raised by its clients or TCBs relating to the SPEAG-TMC Dual-Logo calibration program and inform the FCC and SPEAG of any critical issues.

Change Note: Revised on June 26 to clarify the applicability of PMR and Bundled probe calibrations according to the requirements of KDB 865664.

Annex B.5 D2450V2 Calibration Certificate



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Client **Tejet** Certificate No: **Z14-97092**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 845**

Calibration Procedure(s) **TMC-OS-E-02-194**
Calibration procedure for dipole validation kits


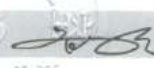
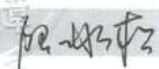
Calibration date: **September 17, 2014**

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
|-------------------------|------------|--|-----------------------|
| Power Meter NRVD | 102196 | 14-Mar-14 (CTTL, No.JZ14-896) | Mar-15 |
| Power sensor NRV-Z5 | 100596 | 14-Mar-14 (CTTL, No. JZ14-896) | Mar -15 |
| Reference Probe ES3DV3 | SN 3142 | 1- Sep-14 (CTTL-SPEAG, No.JZ14-97079) | Aug-15 |
| DAE3 | SN 536 | 23-Jan-14 (SPEAG, DAE3-536_Jan14) | Jan -15 |
| Signal Generator E4438C | MY49070393 | 13-Nov-13 (TMC, No.JZ13-394) | Nov-14 |
| Network Analyzer E8362B | MY43021135 | 19-Oct-13 (TMC, No.JZ13-278) | Oct-14 |

| | Name | Function | Signature |
|----------------|-------------|-----------------------------------|---|
| Calibrated by: | Zhao Jing | SAR Test Engineer |  |
| Reviewed by: | Qi Dianyuan | SAR Project Leader |  |
| Approved by: | Lu Bingsong | Deputy Director of the laboratory |  |

Issued: September 30, 2014

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



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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
- 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 300MHz to 3GHz)", February 2005
- KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

- 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 | DASY52 | 52.8.8.1222 |
| Extrapolation | Advanced Extrapolation | |
| Phantom | Triple Flat Phantom 5.1C | |
| Distance Dipole Center - TSL | 10 mm | with Spacer |
| Zoom Scan Resolution | dx, dy, dz = 5 mm | |
| Frequency | 2450 MHz \pm 1 MHz | |

Head TSL parameters

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|---|---------------------|----------------|----------------------|
| Nominal Head TSL parameters | 22.0 °C | 39.2 | 1.80 mho/m |
| Measured Head TSL parameters | (22.0 \pm 0.2) °C | 39.8 \pm 6 % | 1.85 mho/m \pm 6 % |
| Head TSL temperature change during test | <1.0 °C | ---- | ---- |

SAR result with Head TSL

| | | |
|---|--------------------|--------------------------------|
| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
| SAR measured | 250 mW input power | 12.9 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 51.1 mW / g \pm 20.8 % (k=2) |
| SAR averaged over 10 cm ³ (10 g) of Head TSL | Condition | |
| SAR measured | 250 mW input power | 6.01 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 23.9 mW / g \pm 20.4 % (k=2) |

Body TSL parameters

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|---|---------------------|----------------|----------------------|
| Nominal Body TSL parameters | 22.0 °C | 52.7 | 1.95 mho/m |
| Measured Body TSL parameters | (22.0 \pm 0.2) °C | 51.2 \pm 6 % | 1.97 mho/m \pm 6 % |
| Body TSL temperature change during test | <1.0 °C | ---- | ---- |

SAR result with Body TSL

| | | |
|---|--------------------|--------------------------------|
| SAR averaged over 1 cm ³ (1 g) of Body TSL | Condition | |
| SAR measured | 250 mW input power | 12.7 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 50.3 mW / g \pm 20.8 % (k=2) |
| SAR averaged over 10 cm ³ (10 g) of Body TSL | Condition | |
| SAR measured | 250 mW input power | 5.95 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 23.6 mW / g \pm 20.4 % (k=2) |



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Appendix

Antenna Parameters with Head TSL

| | |
|--------------------------------------|---------------|
| Impedance, transformed to feed point | 51.8Ω+ 7.29jΩ |
| Return Loss | - 22.7dB |

Antenna Parameters with Body TSL

| | |
|--------------------------------------|---------------|
| Impedance, transformed to feed point | 48.7Ω+ 8.02jΩ |
| Return Loss | - 21.7dB |

General Antenna Parameters and Design

| | |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.255 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 |
|-----------------|-------|



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DASY5 Validation Report for Head TSL

Date: 17.09.2014

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 845

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.852$ S/m; $\epsilon_r = 39.76$; $\rho = 1000$ kg/m³

Phantom section: Center Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3142; ConvF(4.58, 4.58, 4.58); Calibrated: 2014-09-01;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn536; Calibrated: 2014-01-23
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/2
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

System Performance Check /d=10mm, Pin=250 mW, dist=3.0mm

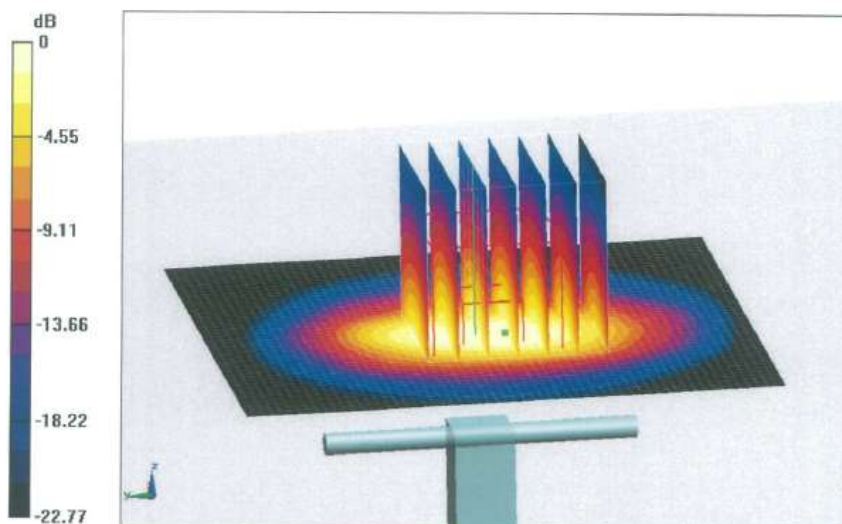
(ES-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 98.59 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 27.4 W/kg

SAR(1 g) = 12.9 W/kg; SAR(10 g) = 6.01 W/kg

Maximum value of SAR (measured) = 16.9 W/kg



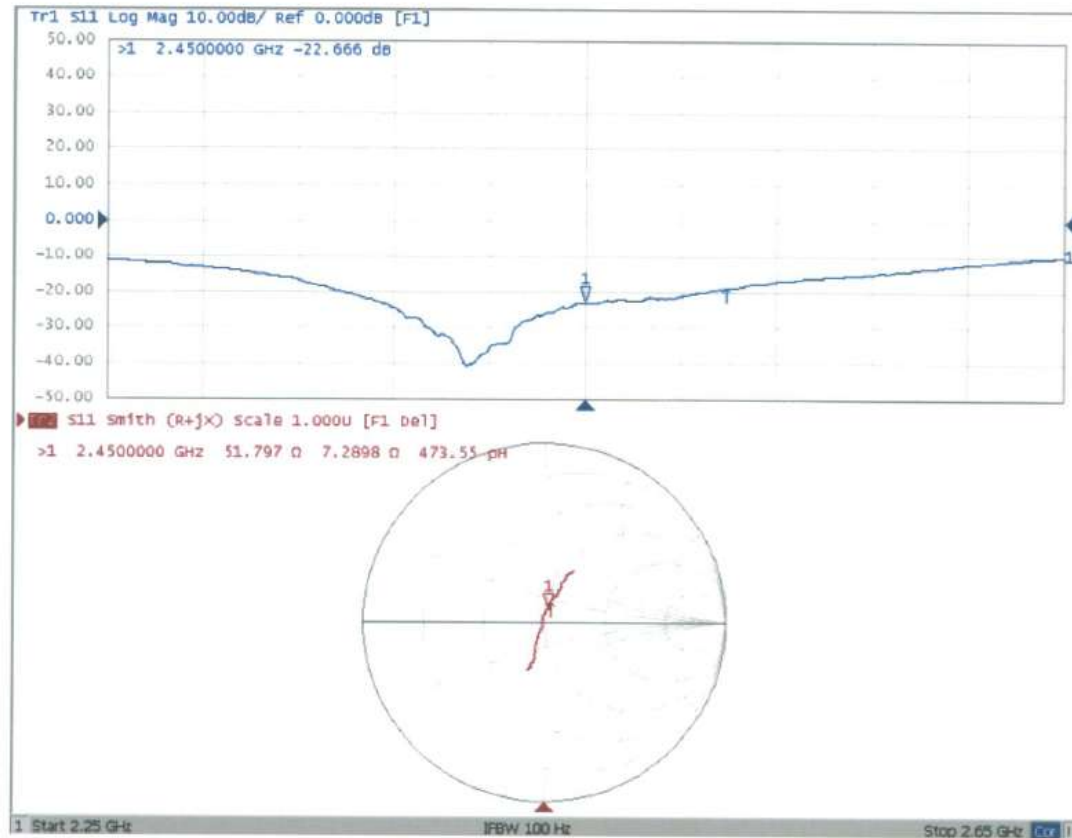
0 dB = 16.9 W/kg = 12.28 dBW/kg



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Impedance Measurement Plot for Head TSL





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DASY5 Validation Report for Body TSL

Date: 17.09.2014

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 845

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.966$ S/m; $\epsilon_r = 51.18$; $\rho = 1000$ kg/m³

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3142; ConvF(4.29, 4.29, 4.29); Calibrated: 2014-09-01;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn536; Calibrated: 2014-01-23
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/3
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

System Performance Check /d=10mm, Pin=250 mW, dist=3.0mm

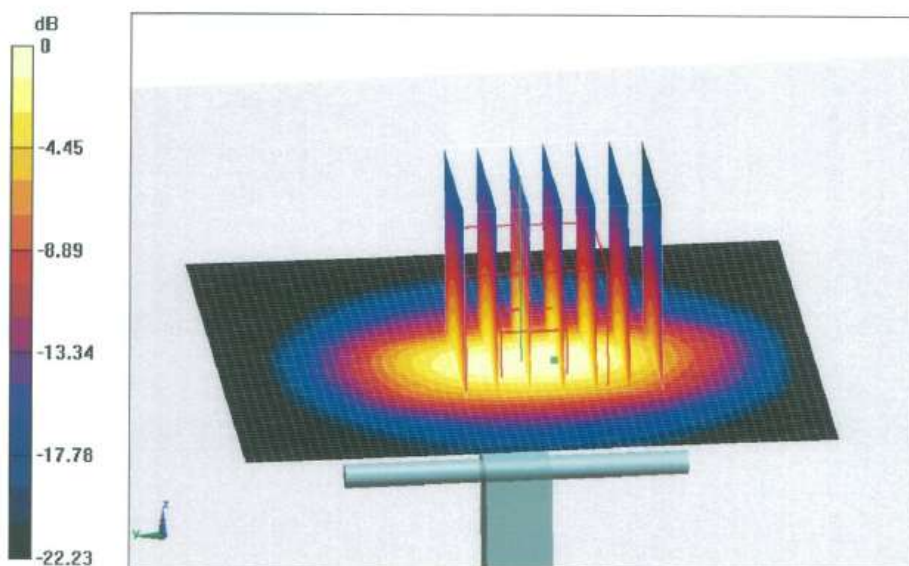
(ES-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 94.82 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 25.7 W/kg

SAR(1 g) = 12.7 W/kg; SAR(10 g) = 5.95 W/kg

Maximum value of SAR (measured) = 16.5 W/kg

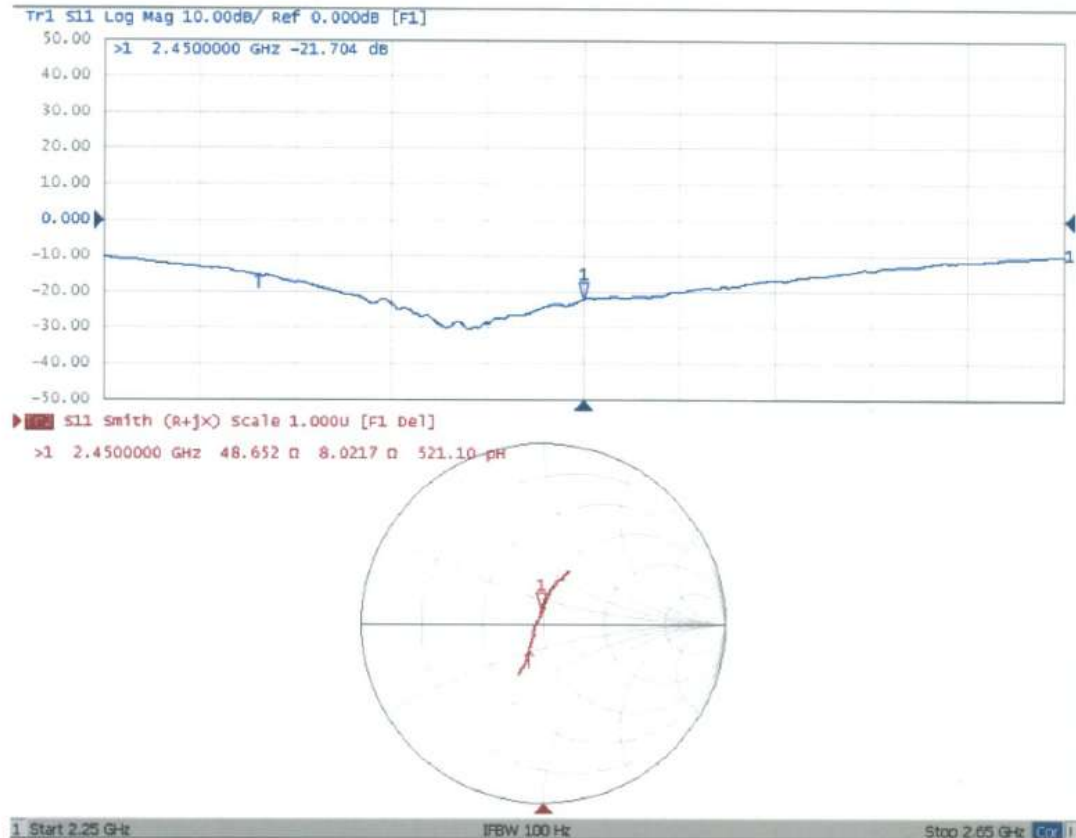


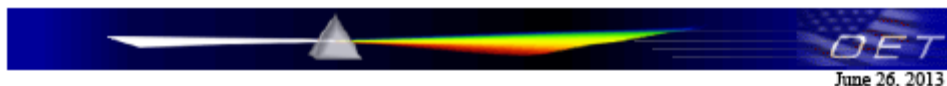


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Impedance Measurement Plot for Body TSL

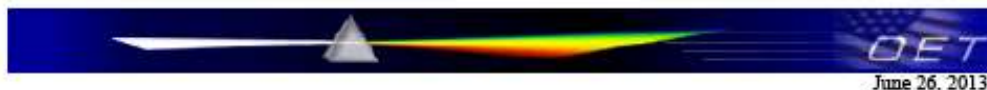




**Acceptable Conditions for SAR Measurements Using Probes and Dipoles
Calibrated under the SPEAG-TMC Dual-Logo Calibration Program to
Support FCC Equipment Certification**

The acceptable conditions for SAR measurements using probes, dipoles and DAEs calibrated by TMC (*Telecommunication Metrology Center of MITT in Beijing, China*), under the Dual-Logo Calibration Certificate program and quality assurance (QA) protocols established between SPEAG (*Schmid & Partner Engineering AG, Switzerland*) and TMC, to support FCC (*U.S. Federal Communications Commission*) equipment certification are defined and described in the following.

- 1) The agreement established between SPEAG and TMC is only applicable to calibration services performed by TMC where its clients (companies and divisions of such companies) are headquartered in the Greater China Region, including Taiwan and Hong Kong. This agreement is subject to renewal at the end of each calendar year between SPEAG and TMC. TMC shall inform the FCC of any changes or early termination to the agreement.
- 2) Only a subset of the calibration services specified in the SPEAG-TMC agreement, while it remains valid, are applicable to SAR measurements performed using such equipment for supporting FCC equipment certification. These are identified in the following.
 - a) Calibration of dosimetric (SAR) probes EX3DVx, ET3DVx and ES3DVx.
 - i) Free-space E-field and H-field probes, including those used for HAC (hearing aid compatibility) evaluation, temperature probes, other probes or equipment not identified in this document, when calibrated by TMC, are excluded and cannot be used for measurements to support FCC equipment certification.
 - ii) Signal specific and bundled probe calibrations based on PMR (probe modulation response) characteristics are handled according to the requirements of KDB 865664; that is, "Until standardized procedures are available to make such determination, the applicability of a signal specific probe calibration for testing specific wireless modes and technologies is determined on a case-by-case basis through KDB inquiries, including SAR system verification requirements."
 - b) Calibration of SAR system validation dipoles, excluding HAC dipoles.
 - c) Calibration of data acquisition electronics DAE3Vx, DAE4Vx and DAEasyVx.
 - d) For FCC equipment certification purposes, the frequency range of SAR probe and dipole calibrations is limited to 700 MHz - 6 GHz and provided it is supported by the equipment identified in the TMC QA protocol (a separate attachment to this document).
 - e) The identical system and equipment setup, measurement configurations, hardware, evaluation algorithms, calibration and QA protocols, including the format of calibration certificates and reports used by SPEAG shall be applied by TMC.
 - f) The calibrated items are only applicable to SPEAG DASY 4 and DASY 5 or higher version systems.



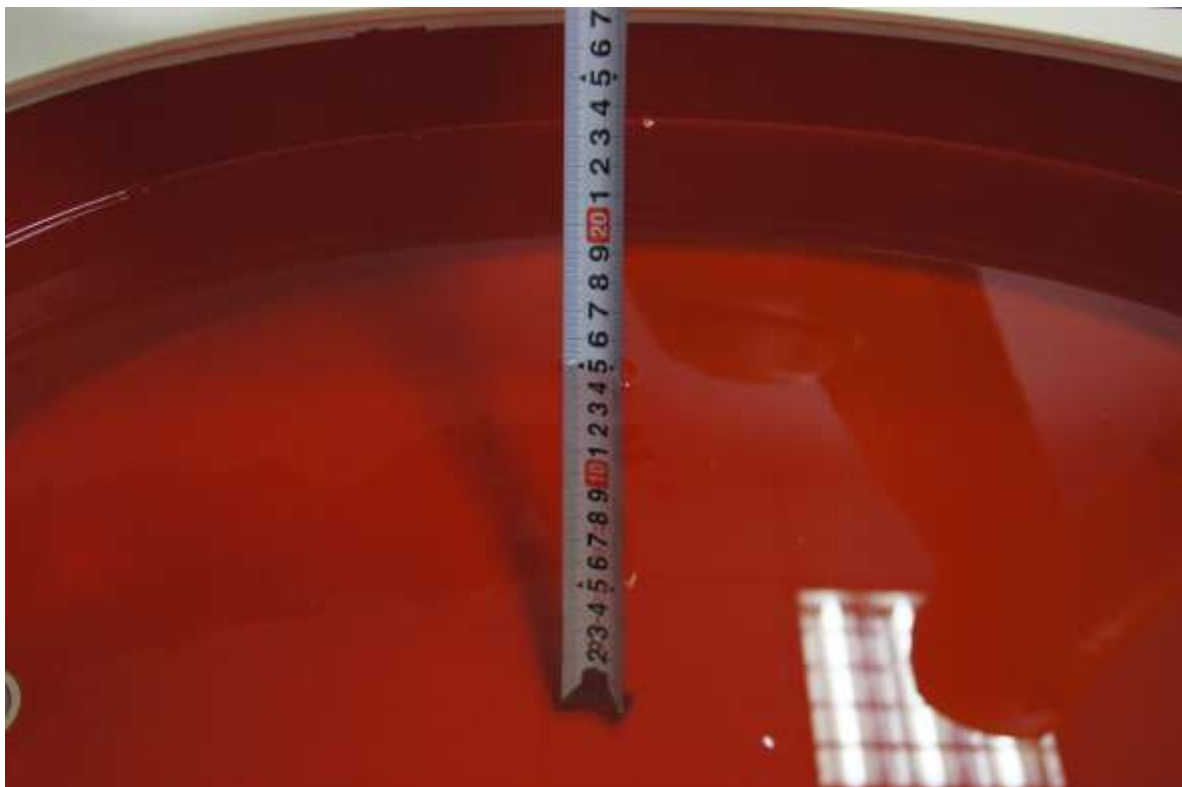
- 3) The SPEAG-TMC agreement includes specific protocols identified in the following to ensure the quality of calibration services provided by TMC under this SPEAG-TMC Dual-Logo calibration agreement are equivalent to the calibration services provided by SPEAG. TMC shall, upon request, provide copies of documentation to the FCC to substantiate program implementation.
 - a) The Inter-laboratory Calibration Evaluation (ILCE) stated in the TMC QA protocol shall be performed between SPEAG and TMC at least once every 12 months. The ILCE acceptance criteria defined in the TMC QA protocol shall be satisfied for the TMC, SPEAG and FCC agreements to remain valid.
 - b) Check of Calibration Certificate (CCC) shall be performed by SPEAG for all calibrations performed by TMC. Written confirmation from SPEAG is required for TMC to issue calibration certificates under the SPEAG-TMC Dual-Logo calibration program. Quarterly reports for all calibrations performed by TMC under the program are also issued by SPEAG.
 - c) The calibration equipment and measurement system used by TMC shall be verified before each calibration service according to the specific reference SAR probes, dipoles, and DAE calibrated by SPEAG. The results shall be reproducible and within the defined acceptance criteria specified in the TMC QA protocol before each actual calibration can commence. TMC shall maintain records of the measurement and calibration system verification results for all calibrations.
 - d) Quality Check of Calibration (QCC) certificates shall be performed by SPEAG at least once every 12 months. SPEAG shall visit TMC facilities to verify the laboratory, equipment, applied procedures and plausibility of randomly selected certificates.
- 4) A copy of this document, to be updated annually, shall be provided to TMC clients that accept calibration services according to the SPEAG-TMC Dual-Logo calibration program, which should be presented to a TCB (*Telecommunication Certification Body*), to facilitate FCC equipment approval.
- 5) TMC shall address any questions raised by its clients or TCBs relating to the SPEAG-TMC Dual-Logo calibration program and inform the FCC and SPEAG of any critical issues.

Change Note: Revised on June 26 to clarify the applicability of PMR and Bundled probe calibrations according to the requirements of KDB 865664.

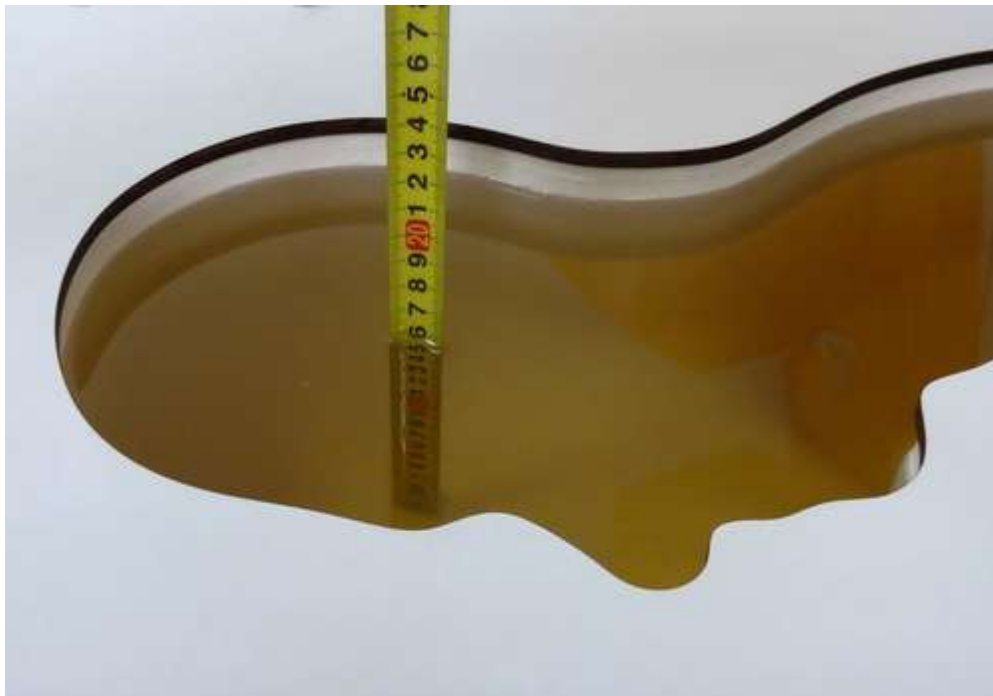
ANNEX C: Test Layout



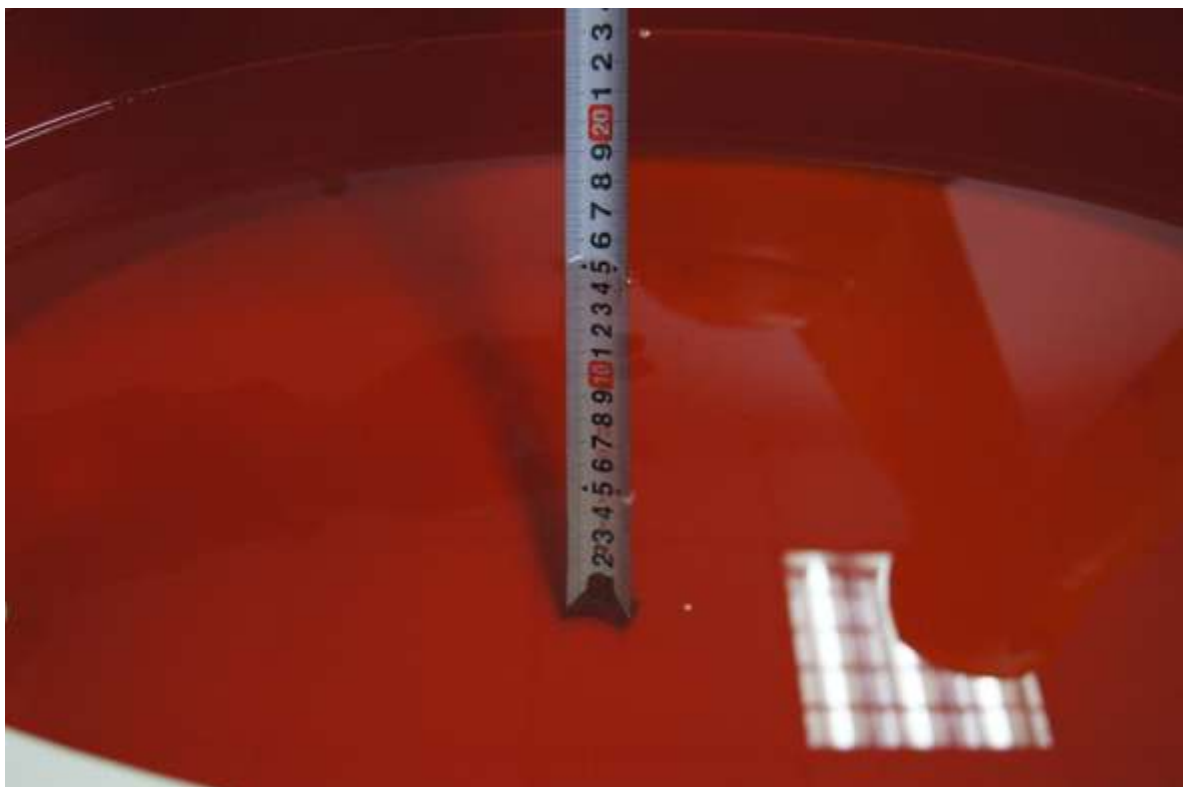
Picture C.1: Specific Absorption Rate Test Layout



Picture C.2: Liquid depth in the flat Phantom (835MHz) (15.1cm deep)



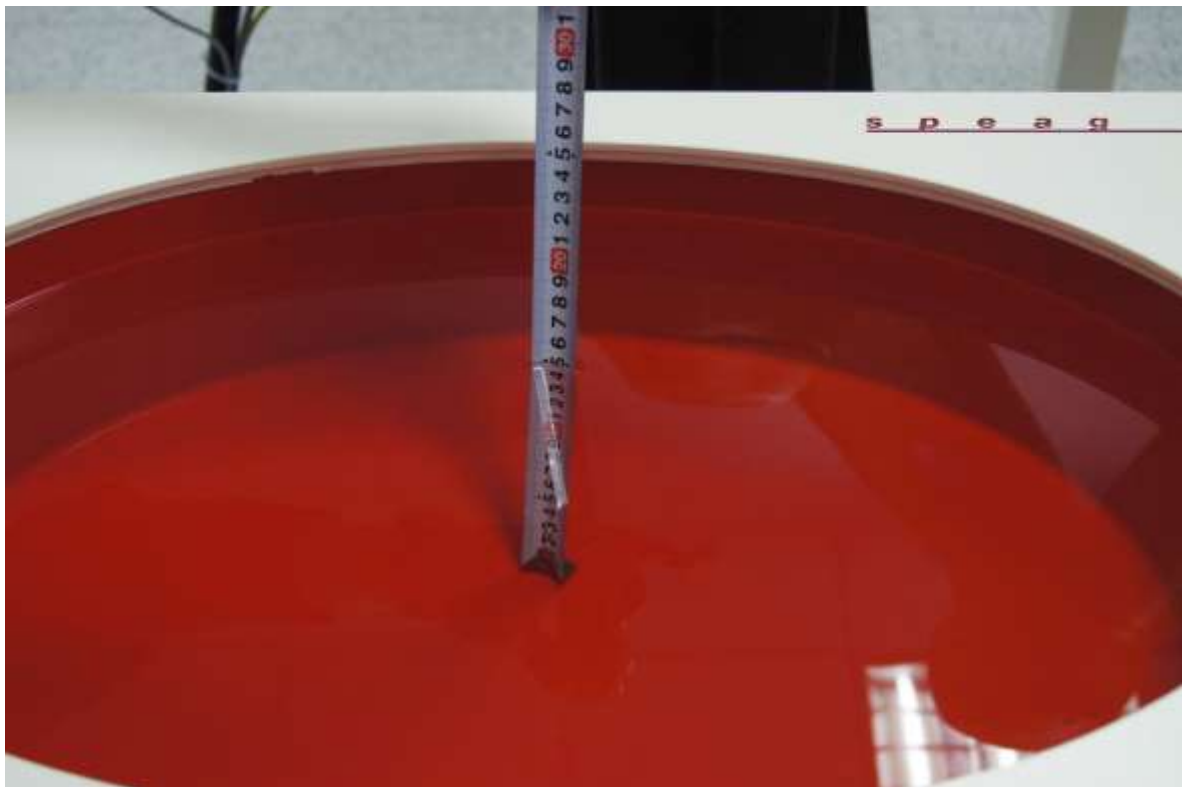
Picture C.3: Liquid depth in the head Phantom (835MHz) (15.4cm deep)



Picture C.4: Liquid depth in the flat Phantom (1900 MHz) (15.3cm deep)



Picture C.5: liquid depth in the head Phantom (1900 MHz) (15.2cm deep)



Picture C.6: Liquid depth in the flat Phantom (2450 MHz) (15.1cm deep)



Picture C.7: liquid depth in the head Phantom (2450 MHz) (15.2cm deep)

-----END OF REPORT-----