

## Appendix C for KSCR230200014201

### Calibration Certificate

Object	Apply	No	Model	SN	Calibration Date	Due date of calibration
Dipole	<input type="checkbox"/>	1	CLA150	4025	2021/04/26	2024/04/25
	<input type="checkbox"/>	2	D450V3	1103	2021/04/21	2024/04/20
	<input type="checkbox"/>	3	D750V3	1188	2022/03/29	2025/03/28
	<input type="checkbox"/>	4	D835V2	4d114	2022/03/31	2025/03/30
	<input type="checkbox"/>	5	D900V2	1d079	2022/06/07	2025/06/06
	<input type="checkbox"/>	6	D1800V2	2d170	2022/03/31	2025/03/30
	<input type="checkbox"/>	7	D1900V2	5d136	2022/06/07	2025/06/06
	<input type="checkbox"/>	8	D2000V2	1041	2022/06/06	2025/06/05
	<input type="checkbox"/>	9	D2300V2	1096	2022/03/31	2025/03/30
	<input checked="" type="checkbox"/>	10	D2450V2	817	2022/04/01	2025/03/31
	<input type="checkbox"/>	11	D2600V2	1158	2022/03/31	2025/03/30
	<input type="checkbox"/>	12	D5GHzV2	1095	2022/06/01	2025/05/31
DAE	<input checked="" type="checkbox"/>	13	DAE4	1245	2022/05/30	2023/05/29
Probe	<input checked="" type="checkbox"/>	14	EX3DV4	7767	2022/10/28	2023/10/27



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 中国·江苏·昆山市留学生创业园伟业路10号 邮编 215300      ☎(86-512)57355888      ☎(86-512)57370818      sgs.china@sgs.com

## 1 Dipole

### 1.1 CLA150 - SN 4025

<p><b>Calibration Laboratory of Schmid &amp; Partner Engineering AG</b> Zehrgassestrasse 43, 8004 Zurich, Switzerland</p> <p>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</p> <p>Client: <b>SGS-CN (Auden)</b>      Certificate No.: <b>CLA150-4025_Apr21</b></p> <p style="text-align: right;">Accreditation No.: <b>SCS 0108</b></p> <hr/> <p style="text-align: center;"><b>CALIBRATION CERTIFICATE</b></p> <p>Object: <b>CLA150 - SN: 4025</b></p> <p>Calibration procedure(s): <b>QA CAL-15.09 Calibration Procedure for SAR Validation Sources below 700 MHz</b></p> <p>Calibration date: <b>April 26, 2021</b></p> <p>The 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)°C and humidity &lt; 70%.</p> <p>Calibration Equipment used (MPE critical for calibration)</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Primary Standards</th> <th>ID #</th> <th>Cal Date (Certificate No.)</th> <th>Scheduled Calibration</th> </tr> </thead> <tbody> <tr> <td>Power meter NRP</td> <td>SN: 10475</td> <td>09-Apr-21 (No. 217-03201/02320)</td> <td>Apr-22</td> </tr> <tr> <td>Power sensor NRP Z91</td> <td>SN: 10364</td> <td>09-Apr-21 (No. 217-03201)</td> <td>Apr-22</td> </tr> <tr> <td>Power sensor NRP Z91</td> <td>SN: 10365</td> <td>09-Apr-21 (No. 217-03202)</td> <td>Apr-22</td> </tr> <tr> <td>Reference 20 dB Attenuator</td> <td>SN: C22662 (20)</td> <td>09-Apr-21 (No. 217-03343)</td> <td>Apr-22</td> </tr> <tr> <td>Type-N mismatch combination</td> <td>SN: 31085 / 0037</td> <td>09-Apr-21 (No. 217-03344)</td> <td>Apr-22</td> </tr> <tr> <td>Reference Probe EX30N4 (DIE4)</td> <td>SN: 3877</td> <td>30-Dec-20 (No. EX33877_Dec20)</td> <td>Dec-21</td> </tr> <tr> <td></td> <td>SN: 664</td> <td>26-Jun-20 (No. DMS4-656_Jun20)</td> <td>Jun-21</td> </tr> </tbody> </table> <table border="1" style="width: 100%; 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Partner Engineering AG</b> Zehrgassestrasse 43, 8004 Zurich, Switzerland</p> <p>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</p> <p>Accreditation No.: <b>SCS 0108</b></p> <hr/> <p><b>Glossary:</b></p> <p>TSL: Issue simulating liquid sensitivity in TSL / NORM x,y,z</p> <p>ConvF: not applicable or not measured</p> <p>N/A: not applicable or not measured</p> <p><b>Calibration is Performed According to the Following Standards:</b></p> <ol style="list-style-type: none"> <li>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</li> <li>IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016</li> <li>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</li> <li>KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"</li> </ol> <p><b>Additional Documentation:</b></p> <ol style="list-style-type: none"> <li>DASY4/5 System Handbook</li> </ol> <p><b>Methods Applied and Interpretation of Parameters:</b></p> <ul style="list-style-type: none"> <li><b>Measurement Conditions:</b> 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.</li> <li><b>Antenna Parameters with TSL:</b> The source is mounted in a touch configuration below the center marking of the flat phantom.</li> <li><b>Return Loss:</b> This parameter is measured with the source positioned under the liquid filled phantom (as described in the measurement condition clause). The Return Loss ensures low reflected power. No uncertainty required.</li> <li><b>SAR measured:</b> SAR measured at the stated antenna input power.</li> <li><b>SAR normalized:</b> SAR as measured, normalized to an input power of 1 W at the antenna connector.</li> <li><b>SAR for nominal TSL parameters:</b> The measured TSL parameters are used to calculate the nominal SAR result.</li> </ul> <p>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%.</p> <p>Certificate No: CLA150-4025_Apr21      Page 2 of 8</p>						
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<p><b>Measurement Conditions</b> DASY system configuration, as far as not given on page 1.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>DASY Version</th> <th>DASY5</th> <th>V32.10.4</th> </tr> </thead> <tbody> <tr> <td>Extrapolation</td> <td>Advanced Extrapolation</td> <td></td> </tr> <tr> <td>Phantom</td> <td>ELN Flat Phantom</td> <td>Shell thickness: 2 ± 0.2 mm</td> </tr> <tr> <td>EUT Positioning</td> <td>Touch Position</td> <td></td> </tr> <tr> <td>Zoom Scan Resolution</td> <td>dx, dy = 4.0 mm, dz = 1.4 mm</td> <td>Graded Ratio = 1.4 (Z direction)</td> </tr> <tr> <td>Frequency</td> <td>150 MHz ± 1 MHz</td> <td></td> </tr> </tbody> </table> <p><b>Head TSL parameters</b> The following parameters and calculations were applied.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Parameter</th> <th>Temperature</th> <th>Permittivity</th> <th>Conductivity</th> </tr> </thead> <tbody> <tr> <td>Nominal Head TSL parameters</td> <td>22.0 °C</td> <td>52.3</td> <td>0.75 mho/m</td> </tr> <tr> <td>Measured Head TSL parameters</td> <td>(22.0 ± 0.2) °C</td> <td>51.1 ± 6 %</td> <td>0.75 mho/m ± 6 %</td> </tr> <tr> <td>Head TSL temperature change during test</td> <td>&lt; 0.5 °C</td> <td>---</td> <td>---</td> </tr> </tbody> </table> <p><b>SAR result with Head TSL</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</th> <th>Condition</th> <th></th> </tr> </thead> <tbody> <tr> <td>SAR measured</td> <td>1 W input power</td> <td>3.90 W/kg</td> </tr> <tr> <td>SAR for nominal Head TSL parameters</td> <td>normalized to 1W</td> <td>3.88 W/kg ± 18.4 % (k=2)</td> </tr> </tbody> </table> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</th> <th>condition</th> <th></th> </tr> </thead> <tbody> <tr> <td>SAR measured</td> <td>1 W input power</td> <td>2.60 W/kg</td> </tr> <tr> <td>SAR for nominal Head TSL parameters</td> <td>normalized to 1W</td> <td>2.59 W/kg ± 18.0 % (k=2)</td> </tr> </tbody> </table> <p>Certificate No: CLA150-4025_Apr21      Page 3 of 8</p>	DASY Version	DASY5	V32.10.4	Extrapolation	Advanced Extrapolation		Phantom	ELN Flat Phantom	Shell thickness: 2 ± 0.2 mm	EUT Positioning	Touch Position		Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)	Frequency	150 MHz ± 1 MHz		Parameter	Temperature	Permittivity	Conductivity	Nominal Head TSL parameters	22.0 °C	52.3	0.75 mho/m	Measured Head TSL parameters	(22.0 ± 0.2) °C	51.1 ± 6 %	0.75 mho/m ± 6 %	Head TSL temperature change during test	< 0.5 °C	---	---	SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition		SAR measured	1 W input power	3.90 W/kg	SAR for nominal Head TSL parameters	normalized to 1W	3.88 W/kg ± 18.4 % (k=2)	SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition		SAR measured	1 W input power	2.60 W/kg	SAR for nominal Head TSL parameters	normalized to 1W	2.59 W/kg ± 18.0 % (k=2)	<p><b>Appendix (Additional assessments outside the scope of SCS 0108)</b></p> <p><b>Antenna Parameters with Head TSL</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Parameter</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>Impedance, transformed to feed point</td> <td>47.9 Ω ± 1.5 Ω</td> </tr> <tr> <td>Return Loss</td> <td>-31.4 dB</td> </tr> </tbody> </table> <p><b>Additional EUT Data</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Manufacturer by</th> <th>SPEAG</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> </tr> </tbody> </table> <p>Certificate No: CLA150-4025_Apr21      Page 4 of 8</p>	Parameter	Value	Impedance, transformed to feed point	47.9 Ω ± 1.5 Ω	Return Loss	-31.4 dB	Manufacturer by	SPEAG		
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 中国·江苏·昆山市留学生创业园伟业路10号 邮编 215300      t(86-512)57355888      f(86-512)57370818      sgs.china@sgs.com

**DASY5 Validation Report for Head TSL**

Date: 26.04.2021

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: CLA150; Type: CLA150; Serial: CLA150 - SN: 4025

Communication System: UID 0 - CW; Frequency: 150 MHz  
Medium parameters used:  $f = 150 \text{ MHz}$ ;  $\sigma = 0.76 \text{ S/m}$ ;  $\epsilon = 51.1$ ;  $\rho = 1000 \text{ kg/m}^3$   
Phantom section: Flat Section  
Measurement Standard: DASY5 (IEE/EC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3877; ConvF(12.51, 12.51, 12.51) @ 150 MHz; Calibrated: 30.12.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DA54 Sn654; Calibrated: 26.06.2020
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP.1003
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

**CLA Calibration for HSL-LF Tissue/CLA150, touch configuration, Pin=1W/Zoom Scan, dist=1.4mm (8x10x8)/Cube D:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm  
Reference Value = 85.93 W/m; Power Drift = -0.02 dB  
Peak SAR (extrapolated) = 7.36 W/kg  
**SAR(1 g) = 3.90 W/kg; SAR(10 g) = 2.60 W/kg**  
Smallest distance from peaks to all points 3 dB below: Larger than measurement grid (> 30mm)  
Ratio of SAR at M2 to SAR at M1 = 80.4%  
Maximum value of SAR (measured) = 5.48 W/kg

0 dB = 5.48 W/kg = 7.39 dBW/kg

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## 1.2 D450V3 - SN 1103

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

Accredited by the Swiss Accreditation Service (SAS)  
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Client: **SGS-CN (Aude)** Certificate No: **D450V3-1103\_Apr21**

**CALIBRATION CERTIFICATE**

Object: **D450V3 - SN: 1103**

Calibration procedure(s): **QA CAL-15\_v9**  
Calibration Procedure for SAR Validation Sources below 700 MHz

Calibration date: **April 21, 2021**

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 closest laboratory facility; environment temperature (22 ± 0.1) °C and humidity < 70%.

Calibration Equipment used (MTE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NP#	SN: 104778	09-Apr-21 (No. 217-03021/03030)	Apr-22
Power sensor NP#-Z91	SN: 102344	09-Apr-21 (No. 217-03021)	Apr-22
Power sensor NP#-Z91	SN: 102345	09-Apr-21 (No. 217-03025)	Apr-22
Reference 20 dB Attenuator	SN: C2552 (20)	09-Apr-21 (No. 217-03343)	Apr-22
Type-N immersion connection	SN: 310952 / 06327	09-Apr-21 (No. 217-03344)	Apr-22
Reference Probe E3039A	SN: 3077	30-Dec-20 (No. E30-3077_De20)	Dec-21
DAEA	SN: 654	05-Jan-20 (No. 0454-664_Jan20)	Jan-21

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4418B	SN: GB41200274	06-Apr-16 (in house check Jun-20)	In house check Jun-22
Power sensor E4412A	SN: MY41496027	06-Apr-16 (in house check Jun-20)	In house check Jun-22
Power sensor E4412A	SN: 00010010	06-Apr-16 (in house check Jun-20)	In house check Jun-22
RF generator HP 8648C	SN: US3496101700	06-Apr-19 (in house check Jun-20)	In house check Jun-22
Network Analyzer Agilent E8358A	SN: US41980477	31-Mar-14 (in house check Oct-20)	In house check Oct-21

Calibrated by: **Christoph Leuber** (Function: Laboratory Technician)

Approved by: **Katja Polovic** (Function: Technical Manager)

This calibration certificate shall not be reproduced except in full without written approval of the laboratory. Issued: April 23, 2021

Certificate No: D450V3-1103\_Apr21 Page 1 of 6

**Calibration Laboratory of Schmid & Partner Engineering AG**  
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Client: **SGS-CN (Aude)** Certificate No: **D450V3-1103\_Apr21**

**Glossary:**

TSL: Issue simulating liquid sensitivity in TSL / NORM x,y,z

ConvF: not applicable or not measured

N/A: not applicable or not measured

**Calibration is Performed According to the Following Standards:**

- IEE 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, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- 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
- KDB 665664, "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%.

Certificate No: D450V3-1103\_Apr21 Page 2 of 6



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

DASY Version	DASY5	V82.10.4
Extrapolation	Advanced Extrapolation	
Phantom	ELJ4 Flat Phantom	Shell thickness: 2 ± 0.2 mm
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	450 MHz ± 1 MHz	

**Head TSL parameters**  
The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	43.5	0.57 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	43.1 ± 0.6 %	0.57 mho/m ± 0 %
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	1.14 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	4.55 W/kg ± 18.1 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	0.757 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	3.06 W/kg ± 17.6 % (k=2)

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**Appendix (Additional assessments outside the scope of SCS 0106)**

**Antenna Parameters with Head TSL**

Impedance, transformed to feed point	57.1 Ω - 2.8 jΩ
Return Loss	-23.0 dB

**General Antenna Parameters and Design**

Electrical Delay (one direction)	1.346 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 straight 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 set 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**

Test Laboratory: SPEAG, Zurich, Switzerland Date: 21.04.2021

DUT: Dipole 450 MHz; Type: D450V3; Serial: D450V3 - SN:1103

Communication System: UID 0 - CW; Frequency: 450 MHz  
Medium parameters used: f = 450 MHz, α = 0.87 S/m; ε<sub>r</sub> = 43.1; ρ = 1000 kg/m<sup>3</sup>  
Phantom section: Flat Section  
Measurement Standard: DASY5 (IEE/IEC/ANSI C63.19-2011)

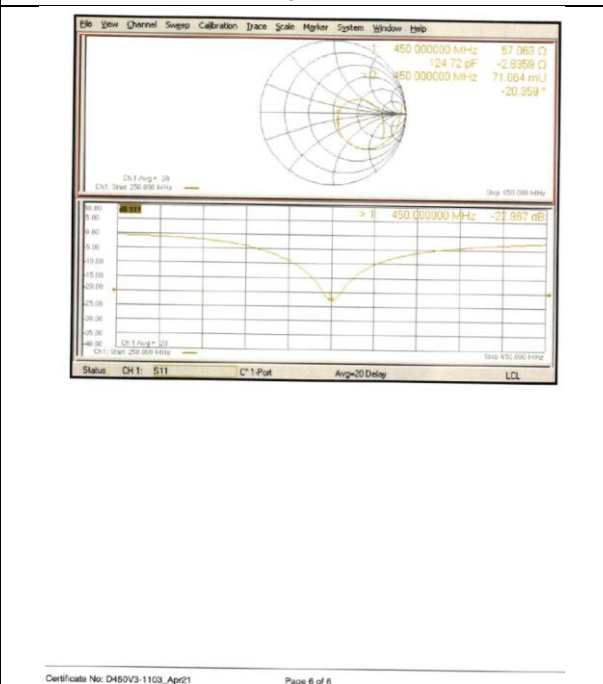
**DASY52 Configuration:**

- Probe: EX3DV4 - SN3877; ConvF(10.64, 10.64, 10.64) @ 450 MHz; Calibrated: 30.12.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 26.06.2020
- Phantom: ELJ v4.0; Type: QDOVA001BB; Serial: TP:1003
- DASY52.52.10.4(1527); SEMCAD X 14.6.14(7483)

**Dipole Calibration for Head Tissue/d=15mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0:**  
Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 39.18 V/m; Power Drift = -0.08 dB  
Peak SAR (extrapolated) = 1.76 W/kg  
SAR(1 g) = 1.14 W/kg; SAR(10 g) = 0.767 W/kg  
Smallest distance from peaks to all points 3 dB below: Larger than measurement grid  
Ratio of SAR at M2 to SAR at M1 = 64.9%  
Maximum value of SAR (measured) = 1.53 W/kg

0 dB = 1.53 W/kg = 1.85 dBW/kg

Certificate No: D450V3-1103\_Apr21 Page 5 of 6



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t(86-512)57355888 f(86-512)57370818 sgs.china@sgs.com

## 1.3 D750V3 - SN 1188

<div style="display: flex; justify-content: space-between;"> </div> <p>Address: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-6236633-2112 Fax: +86-10-6236633-2504 E-mail: cti@china-test.com http://www.china-test.cn</p> <p>Client: <b>SGS-CN</b> Certificate No: <b>Z22-60103</b></p> <h3>CALIBRATION CERTIFICATE</h3> <p>Object: D750V3 - SN: 1188</p> <p>Calibration Procedure(s): FF-Z11-003-01 Calibration Procedures for dipole validation kits</p> <p>Calibration date: March 28, 2022</p> <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)°C and humidity&lt;70%.</p> <p>Calibration Equipment used (M&amp;TE critical for calibration)</p> <table border="1"> <thead> <tr> <th>Primary Standards</th> <th>ID #</th> <th>Cal Date (Calibrated by, Certificate No.)</th> <th>Scheduled Calibration</th> </tr> </thead> <tbody> <tr> <td>Power Meter NRP2</td> <td>106277</td> <td>24-Sep-21 (CTTL No.J21X08326)</td> <td>Sep-22</td> </tr> <tr> <td>Power sensor NRP88</td> <td>104291</td> <td>24-Sep-21 (CTTL No.J21X08326)</td> <td>Sep-22</td> </tr> <tr> <td>Reference Probe EX30V4</td> <td>SN 7307</td> <td>26-May-21(SPEAG.No.EX3-7307_May21)</td> <td>May-22</td> </tr> <tr> <td>D4E4</td> <td>SN 1556</td> <td>12-Jan-22(CTTL-SPEAG.No.Z22-60007)</td> <td>Jan-23</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Secondary Standards</th> <th>ID #</th> <th>Cal Date (Calibrated by, Certificate No.)</th> <th>Scheduled Calibration</th> </tr> </thead> <tbody> <tr> <td>Signal Generator E4439C</td> <td>MY49671430</td> <td>13-Jan-22 (CTTL No.J22X00409)</td> <td>Jan-23</td> </tr> <tr> <td>Network Analyzer E5071C</td> <td>MY46110973</td> <td>14-Jan-22 (CTTL No.J22X00409)</td> <td>Jan-23</td> </tr> </tbody> </table> <p>Calibrated by: Zhao Jing (SAR Test Engineer) [Signature]</p> <p>Reviewed by: Lin Hao (SAR Test Engineer) [Signature]</p> <p>Approved by: Qi Dianyuan (SAR Project Leader) [Signature]</p> <p>Issued: April 3, 2022</p> <p>This calibration certificate shall not be reproduced except in full without written approval of the laboratory.</p> <p>Certificate No: Z22-60103 Page 1 of 6</p>	Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration	Power Meter NRP2	106277	24-Sep-21 (CTTL No.J21X08326)	Sep-22	Power sensor NRP88	104291	24-Sep-21 (CTTL No.J21X08326)	Sep-22	Reference Probe EX30V4	SN 7307	26-May-21(SPEAG.No.EX3-7307_May21)	May-22	D4E4	SN 1556	12-Jan-22(CTTL-SPEAG.No.Z22-60007)	Jan-23	Secondary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration	Signal Generator E4439C	MY49671430	13-Jan-22 (CTTL No.J22X00409)	Jan-23	Network Analyzer E5071C	MY46110973	14-Jan-22 (CTTL No.J22X00409)	Jan-23	<div style="display: flex; justify-content: space-between;"> </div> <p>Address: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-6236633-2079 Fax: +86-10-6236633-2504 E-mail: cti@china-test.com http://www.china-test.cn</p> <h3>Glossary:</h3> <p>TSL: tissue simulating liquid ConvF: sensitivity in TSL / NORMx.yz N/A: not applicable or not measured</p> <p><b>Calibration is Performed According to the Following Standards:</b></p> <ul style="list-style-type: none"> <li>IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices-Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020</li> <li>KDB 865684, "SAR Measurement Requirements for 100 MHz to 6 GHz"</li> </ul> <p><b>Additional Documentation:</b></p> <ul style="list-style-type: none"> <li>DASY4/5 System Handbook</li> </ul> <p><b>Methods Applied and Interpretation of Parameters:</b></p> <ul style="list-style-type: none"> <li>Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. 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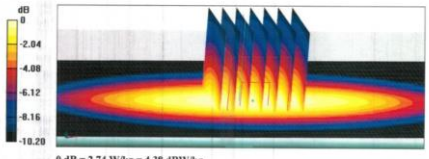
**TTL Speaq** Calibration Laboratory  
 In Collaboration with **CAICT**

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 Tel: +86-10-62504631-2079 Fax: +86-10-62504631-2504  
 E-mail: cti@china.ttl.com http://www.china.ttl.com

**DASY5 Validation Report for Head TSL** Date: 2022-03-29  
 Test Laboratory: CCTL, Beijing, China  
 DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1188  
 Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1  
 Medium parameters used:  $f = 750 \text{ MHz}$ ;  $\sigma = 0.888 \text{ S/m}$ ;  $\epsilon_r = 41.36$ ;  $\rho = 1000 \text{ kg/m}^3$   
 Phantom section: Right Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)  
 DASY5 Configuration:

- Probe: EX3DV4 - SN7307; ConvF(10.31, 10.31) @ 750 MHz; Calibrated: 2021-05-26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2022-01-12
- Phantom: MFP-V5.1C (20kg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- DASY52.52.10.4(1535); SEMCADX 14.6.14(7501)

**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7) Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
 Reference Value = 55.06 V/m; Power Drift = 0.00 dB  
 Peak SAR (extrapolated) = 2.07 W/kg  
 SAR(1 g) = 2.07 W/kg; SAR(10 g) = 1.37 W/kg  
 Smallest distance from peaks to all points 3 dB below = 18.9 mm  
 Ratio of SAR at M2 to SAR at M1 = 67.1%  
 Maximum value of SAR (measured) = 2.74 W/kg



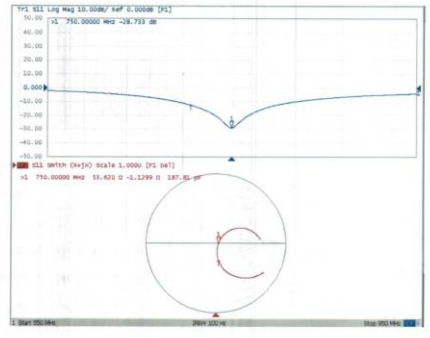
0 dB = 2.74 W/kg = 4.38 dBW/kg

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 In Collaboration with **CAICT**

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**Impedance Measurement Plot for Head TSL**



Certificate No: Z22-60103 Page 6 of 6

## 1.4 D835V2 - SN 4d114

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Client: **SGS-CN** Certificate No: **Z22-60104**

**CALIBRATION CERTIFICATE**

Object: D835V2 - SN: 4d114

Calibration Procedure(s): FF-Z11-003-01  
 Calibration Procedures for dipole validation kits

Calibration date: March 31, 2022

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	106277	24-Sep-21 (CCTL, No.J21X08326)	Sep-22
Power sensor NRPBS	104291	24-Sep-21 (CCTL, No.J21X08326)	Sep-22
Reference Probe EX3DV4	SN 7307	26-May-21(SPEAG.No.EX3-7307_May21)	May-22
DAE4	SN 1556	12-Jan-22(CCTL-SPEAG.No.Z22-60007)	Jan-23

Secondary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	13-Jan-22 (CCTL, No.J22X00409)	Jan-23
Network Analyzer E5071C	MY49110673	14-Jan-22 (CCTL, No.J22X00406)	Jan-23

Calibrated by: Zhao Jing, SAR Test Engineer

Reviewed by: Lin Hao, SAR Test Engineer

Approved by: Qi Dianyuan, SAR Project Leader

Signature: [Signatures]

Issued: April 6, 2022

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

Certificate No: Z22-60104 Page 1 of 6

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**Glossary:**

TSL: tissue simulating liquid  
 ConvF: sensitivity in TSL / NORMx.yz  
 N/A: not applicable or not measured

**Calibration is Performed According to the Following Standards:**

- IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices- Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020
- KDB 685864, "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	VS2 10.4
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 ± 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 ± 0.2) °C	41.0 ± 8 %	0.91 mho/m ± 8 %
Head TSL temperature change during test	<1.0 °C	---	---

**SAR result with Head TSL**

SAR averaged over 1 cm <sup>3</sup> (1g) of Head TSL	Condition	
SAR measured	250 mW input power	2.37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.40 W/kg ± 18.6 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10g) of Head TSL	Condition	
SAR measured	250 mW input power	1.54 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.12 W/kg ± 18.7 % (k=2)

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**Appendix (Additional assessments outside the scope of CNAS L0570)**

**Antenna Parameters with Head TSL**

Impedance, transformed to feed point	48.7Ω - j22Ω
Return Loss	-25.3dB

**General Antenna Parameters and Design**

Electrical Delay (one direction)	1.307 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point 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 feed-point may be damaged.

**Additional EUT Data**

Manufactured by	SPEAG
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**DASY5 Validation Report for Head TSL**  
 Test Laboratory: CTTL, Beijing, China Date: 2022-03-31  
 DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d114  
 Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1  
 Medium parameters used: f = 835 MHz; σ = 0.907 S/m; ε<sub>r</sub> = 40.98; ρ = 1000 kg/m<sup>3</sup>  
 Phantom section: Right Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)  
 DASY5 Configuration:

- Probe: EX3DV4 - SN7307; ConvF(10.13, 10.13, 10.13) @ 835 MHz; Calibrated: 2021-05-26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DA-E4 Sx1556; Calibrated: 2022-01-12
- Phantom: MFP\_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7) Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm**  
 Reference Value = 57.88 V/m; Power Drift = 0.04 dB  
 Peak SAR (extrapolated) = 3.56 W/kg  
 SAR(1g) = 2.37 W/kg; SAR(10g) = 1.54 W/kg  
 Smallest distance from peaks to all points 3 dB below = 15.8 mm  
 Ratio of SAR at M2 to SAR at M1 = 66.2%  
 Maximum value of SAR (measured) = 3.17 W/kg

0 dB = 3.17 W/kg = 5.01 dBW/kg

Certificate No: Z22-60104 Page 5 of 6

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**Impedance Measurement Plot for Head TSL**

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## 1.5 D900V2 - SN 1d079

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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 (23±3)°C and humidity &lt;70%.</p> <p>Calibration Equipment used (M&amp;TE critical for calibration)</p> <table border="1"> <thead> <tr> <th>Primary Standards</th> <th>ID #</th> <th>Cal Date (Calibrated by, Certificate No.)</th> <th>Scheduled Calibration</th> </tr> </thead> <tbody> <tr> <td>Power Meter NRP2</td> <td>106277</td> <td>24-Sep-21 (CTTL No. J21X08326)</td> <td>Sep-22</td> </tr> <tr> <td>Power sensor NRP8S</td> <td>104291</td> <td>24-Sep-21 (CTTL No. J21X08326)</td> <td>Sep-22</td> </tr> <tr> <td>Reference Probe EX3DV4</td> <td>SN 7464</td> <td>26-Jan-22 (SPEAG No. EX3-7464_Jan22)</td> <td>Jan-23</td> </tr> <tr> <td>DAE4</td> <td>SN 1556</td> <td>12-Jan-22 (CTTL-SPEAG No. Z22-60007)</td> <td>Jan-23</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Secondary Standards</th> <th>ID #</th> <th>Cal Date (Calibrated by, Certificate No.)</th> <th>Scheduled Calibration</th> </tr> </thead> <tbody> <tr> <td>Signal Generator E4438C</td> <td>MV42071430</td> <td>13-Jan-22 (CTTL No. J22X00409)</td> <td>Jan-23</td> </tr> <tr> <td>Network Analyzer E5071C</td> <td>MV48110673</td> <td>14-Jan-22 (CTTL No. J22X00409)</td> <td>Jan-23</td> </tr> </tbody> </table> <p>Calibrated by: <b>Zhao Jing</b> SAR Test Engineer</p> <p>Reviewed by: <b>Lin Hao</b> SAR Test Engineer</p> <p>Approved by: <b>Qi Dianyuan</b> SAR Project Leader</p> <p>Issued: June 13, 2022</p> <p>The calibration certificate shall not be reproduced except in full without written approval of the laboratory.</p> <p>Certificate No: Z22-60184 Page 1 of 6</p>	Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration	Power Meter NRP2	106277	24-Sep-21 (CTTL No. J21X08326)	Sep-22	Power sensor NRP8S	104291	24-Sep-21 (CTTL No. J21X08326)	Sep-22	Reference Probe EX3DV4	SN 7464	26-Jan-22 (SPEAG No. EX3-7464_Jan22)	Jan-23	DAE4	SN 1556	12-Jan-22 (CTTL-SPEAG No. Z22-60007)	Jan-23	Secondary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration	Signal Generator E4438C	MV42071430	13-Jan-22 (CTTL No. J22X00409)	Jan-23	Network Analyzer E5071C	MV48110673	14-Jan-22 (CTTL No. J22X00409)	Jan-23	<p>Address: No. 52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-4239633-2117 E-mail: cti@ttdi.com</p> <p>Client: <b>SGS-CN</b> Certificate No: <b>Z22-60184</b></p> <h3>CALIBRATION CERTIFICATE</h3> <p>Glossary: TSL: tissue simulating liquid ConvF: sensitivity in TSL / NORM<sub>x,y,z</sub> N/A: not applicable or not measured</p> <p>Calibration is Performed According to the Following Standards: a) IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices- Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020 b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz" c) DASY4/S System Handbook</p> <p>Additional Documentation: c) DASY4/S System Handbook</p> <p>Methods Applied and Interpretation of Parameters:</p> <ul style="list-style-type: none"> <li>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.</li> <li>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.</li> <li>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.</li> <li>Electrical Delay: One-way delay between the SMA connector and the antenna feed point. 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Extrapolation	Advanced Extrapolation	52.10.4																																																													
Phantom	Triple Flat Phantom 5.1C																																																														
Distance Dipole Center - TSL	15 mm	with Spacer																																																													
Zoom Scan Resolution	dk, dy, dz = 5 mm																																																														
Frequency	900 MHz ± 1 MHz																																																														
Nominal Head TSL parameters	Temperature	Permittivity	Conductivity																																																												
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.5	0.07 mho/m																																																												
Head TSL temperature change during test	<1.0 °C	---	---																																																												
SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	Value																																																													
SAR measured	250 mW input power	2.70 W/kg																																																													
SAR for nominal Head TSL parameters	normalized to 1W	11.0 W/kg ± 18.8 % (k=2)																																																													
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	Value																																																													
SAR measured	250 mW input power	1.73 W/kg																																																													
SAR for nominal Head TSL parameters	normalized to 1W	7.09 W/kg ± 18.7 % (k=2)																																																													
Parameter	Value																																																														
Impedance, transformed to feed point	48.10 - 8.48jΩ																																																														
Return Loss	-23.3 dB																																																														
Parameter	Value																																																														
Electrical Delay (one direction)	1.312 ns																																																														
Manufacturer by	SPEAG																																																														



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**DASY5 Validation Report for Head TSL** Date: 2022-06-07

Test Laboratory: CCTL, Beijing, China

DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN: 14079

Communication System: UTD 0, CW; Frequency: 900 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 900 \text{ MHz}$ ;  $\sigma = 0.98 \text{ S/m}$ ;  $\epsilon = 42.05$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7464; ConvF(9.72, 9.72) @ 900 MHz; Calibrated: 2022-01-26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronic: DA44 SN1556; Calibrated: 2022-01-12
- Phantom: MFP\_V5.1C (2ddeg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- DASY52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration/Zoom Scan (7x7) (7x7) Cube 0; Measurement grid:  $d_x=5\text{mm}$ ,  $d_y=5\text{mm}$ ,  $d_z=5\text{mm}$

Reference Value = 59.81 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 4.20 W/kg

SAR(1g) = 2.78 W/kg; SAR(10g) = 1.78 W/kg

Smallest distance from peaks to all points 3 dB below = 16 mm

Ratio of SAR at M2 to SAR at M1 = 65.8%

Maximum value of SAR (measured) = 3.71 W/kg

0 dB = 3.71 W/kg = 5.69 dBW/kg

Certificate No: Z22-60184 Page 3 of 6

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**Impedance Measurement Plot for Head TSL**

Certificate No: Z22-60184 Page 6 of 6

## 1.6 D1800V2 - SN 2d170

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Client: **SGS-CN** Certificate No: **Z22-60105**

**CALIBRATION CERTIFICATE**

Object: D1800V2 - SN: 2d170

Calibration Procedure(s): FF-Z11-003-01  
Calibration Procedures for dipole validation kits

Calibration date: March 31, 2022

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	106277	24-Sep-21 (CCTL No.J21X08326)	Sep-22
Power sensor NRP85	104291	24-Sep-21 (CCTL No.J21X08326)	Sep-22
Reference Probe EX3DV4	SN 7307	26-May-21 (SPEAG No.EX3-7307_May21)	May-22
DAE4	SN 1556	12-Jan-22 (CCTL-SPEAG No.Z22-60007)	Jan-23

Secondary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	13-Jan-22 (CCTL No.J22X00406)	Jan-23
Network Analyzer E5071C	MY46110973	14-Jan-22 (CCTL No.J22X00406)	Jan-23

Calibrated by: Zhao Jing, SAR Test Engineer

Reviewed by: Lin Hao, SAR Test Engineer

Approved by: Qi Diqiyuan, SAR Project Leader

Issued: April 6, 2022

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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:**

- IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices- Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020
- KDB 855664, "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%.

Certificate No: Z22-60105 Page 2 of 6



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**Measurement Conditions**  
 DASYS system configuration, as far as not given on page 1

DASY Version	DASY52	52.10.4
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	1800 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	40.8 ± 8 %	1.41 mho/m ± 8 %
Head TSL temperature change during test	<1.0 °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	9.73 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	38.9 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.11 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	20.4 W/kg ± 18.7 % (k=2)

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**Appendix (Additional assessments outside the scope of CNAS L0570)**

**Antenna Parameters with Head TSL**

Impedance, transformed to feed point	47.90-2.54jΩ
Return Loss	-29.4dB

**General Antenna Parameters and Design**

Electrical Delay (one direction)	1.116 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point 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 feed-point may be damaged.

**Additional EUT Data**

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**DASY5 Validation Report for Head TSL** Date: 2022-03-31  
 Test Laboratory: CTTL, Beijing, China  
 DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN: 2d170  
 Communication System: UID 0, CW; Frequency: 1800 MHz; Duty Cycle: 1:1  
 Medium parameters used: f = 1800 MHz; σ = 1.411 S/m; ε = 40.62; ρ = 1000 kg/m<sup>3</sup>  
 Phantom section: Right Section  
 Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2007)  
 DASYS Configuration:

- Probe: EX3DV4 - SN7307; ConvF(8.34, 8.34, 8.34) @ 1800 MHz; Calibrated: 2021-05-26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2022-01-12
- Phantom: MFP\_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7) Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm**  
 Reference Value = 98.14 V/m; Power Drift = 0.03 dB  
 Peak SAR (extrapolated) = 18.2 W/kg  
 SAR(1 g) = 9.73 W/kg; SAR(10 g) = 5.11 W/kg  
 Smallest distance from peaks to all points 3 dB below = 10 mm  
 Ratio of SAR at M2 to SAR at M1 = 54%  
 Maximum value of SAR (measured) = 15.2 W/kg

0 dB = 15.2 W/kg = 11.82 dBW/kg

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**Impedance Measurement Plot for Head TSL**

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## 1.7 D1900V2 - SN 5d136

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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 (23±)°C and humidity &lt;70%.</p> <p>Calibration Equipment used (M&amp;TE critical for calibration)</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Primary Standards</th> <th>ID #</th> <th>Cal Date (Calibrated by, Certificate No.)</th> <th>Scheduled Calibration</th> </tr> </thead> <tbody> <tr> <td>Power Meter NRP2</td> <td>106277</td> <td>24-Sep-21 (CTTL No. J21X08326)</td> <td>Sep-22</td> </tr> <tr> <td>Power Meter NRP6S</td> <td>104291</td> <td>24-Sep-21 (CTTL No. J21X08326)</td> <td>Sep-22</td> </tr> <tr> <td>Reference Probe EKSDV4</td> <td>SN 7484</td> <td>28-Jan-22 (SPEAG No. EX3-7484_Jan22)</td> <td>Jan-23</td> </tr> <tr> <td>DAE4</td> <td>SN 1656</td> <td>12-Jan-22 (CTTL-SPEAG No. Z22-60007)</td> <td>Jan-23</td> </tr> </tbody> </table> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Secondary Standards</th> <th>ID #</th> <th>Cal Date (Calibrated by, Certificate No.)</th> <th>Scheduled Calibration</th> </tr> </thead> <tbody> <tr> <td>Signal Generator E4438C</td> <td>MY48671430</td> <td>13-Jan-22 (CTTL No. J22X00409)</td> <td>Jan-23</td> </tr> <tr> <td>Network Analyser E5071C</td> <td>MY48110073</td> <td>14-Jan-22 (CTTL No. J22X00406)</td> <td>Jan-23</td> </tr> </tbody> </table> <p>Calibrated by: Zhao Jing, SAR Test Engineer, Signature: [Signature]</p> <p>Reviewed by: Lin Hao, SAR Test Engineer, Signature: [Signature]</p> <p>Approved by: Qi Diaryuan, SAR Project Leader, Signature: [Signature]</p> <p style="text-align: right;">Issued: June 13, 2022</p> <p>The calibration certificate shall not be reproduced except in full without written approval of the laboratory.</p> </div>	Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration	Power Meter NRP2	106277	24-Sep-21 (CTTL No. J21X08326)	Sep-22	Power Meter NRP6S	104291	24-Sep-21 (CTTL No. J21X08326)	Sep-22	Reference Probe EKSDV4	SN 7484	28-Jan-22 (SPEAG No. EX3-7484_Jan22)	Jan-23	DAE4	SN 1656	12-Jan-22 (CTTL-SPEAG No. Z22-60007)	Jan-23	Secondary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration	Signal Generator E4438C	MY48671430	13-Jan-22 (CTTL No. J22X00409)	Jan-23	Network Analyser E5071C	MY48110073	14-Jan-22 (CTTL No. J22X00406)	Jan-23	<div style="text-align: center;"> <p>Address: No. 52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-42204633-2117 E-mail: vt@china.ttl.com</p> </div> <div style="text-align: center;"> <p>中国合格评定国家认可委员会 CALIBRATION CNAS 10178</p> </div> <p style="text-align: center;">Client: <b>SGS-CN</b> Certificate No: <b>Z22-60185</b></p> <p><b>Glossary:</b></p> <p>TSL: tissue simulating liquid ConvF: sensitivity in TSL / NORMx.y.z NA: not applicable or not measured</p> <p><b>Calibration is Performed According to the Following Standards:</b></p> <p>a) IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices- Part 1526: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020 b) KDB 865984, "SAR Measurement Requirements for 100 MHz to 6 GHz"</p> <p><b>Additional Documentation:</b> c) DASY4/S System Handbook</p> <p><b>Methods Applied and Interpretation of Parameters:</b></p> <ul style="list-style-type: none"> <li><b>Measurement Conditions:</b> 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.</li> <li><b>Antenna Parameters with TSL:</b> 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.</li> <li><b>Feed Point Impedance and Return Loss:</b> 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.</li> <li><b>Electrical Delay:</b> One-way delay between the SMA connector and the antenna feed point. 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Certificate No: Z22-60185 Page 1 of 6	Certificate No: Z22-60185 Page 2 of 6																																																												
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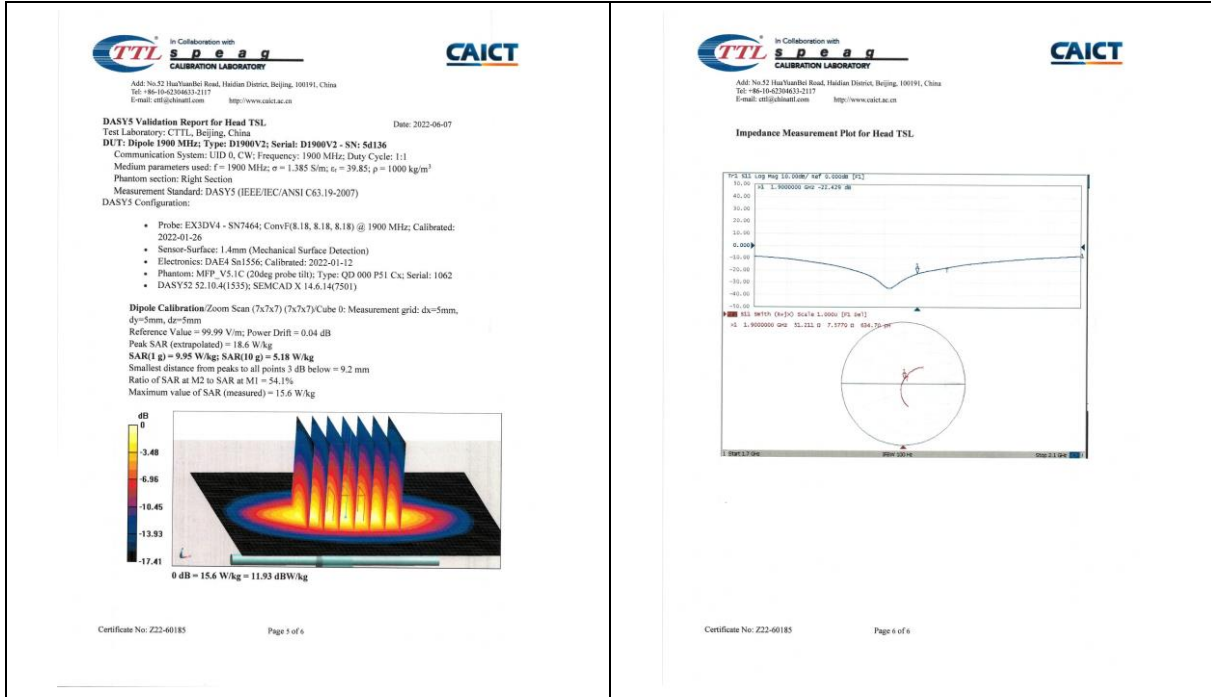
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## 1.8 D2000V2 - SN 1041

**Client: SGS-CN Certificate No: Z22-60186**

**CALIBRATION CERTIFICATE**  
 Object: D2000V2 - SN: 1041  
 Calibration Procedure(s): FF-Z11-003-01  
 Calibration Procedures for dipole validation kits  
 Calibration date: June 6, 2022

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±)°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	106277	24-Sep-21 (CTTL No.J21X06326)	Sep-22
Power sensor NRP35	104291	24-Sep-21 (CTTL No.J21X06326)	Sep-22
Reference Probe EX3DV4	SN 7464	26-Jan-22(SPEAG No EX3-7464-Jan22)	Jan-23
DAE4	SN 1556	12-Jan-22(CTTL-SPEAG No Z22-60007)	Jan-23

Secondary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	13-Jan-22 (CTTL No. J22X00409)	Jan-23
Network Analyzer E5071C	MY48110673	14-Jan-22 (CTTL No. J22X00406)	Jan-23

Calibrated by: Zhao Jing SAR Test Engineer  
 Reviewed by: Lin Hao SAR Test Engineer  
 Approved by: Qi Dianyan SAR Project Leader

Issued: June 13, 2022

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

**Glossary:**  
 TSL: Issue simulating liquid  
 ConvF: sensitivity in TSL / NCRMx.y.z  
 N/A: not applicable or not measured

**Calibration is Performed According to the Following Standards:**  
 a) IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices- Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020  
 b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"  
 Additional Documentation:  
 c) DASY4/5 System Handbook

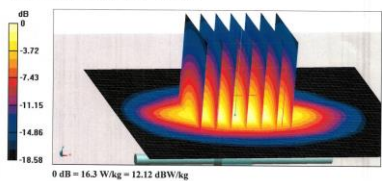
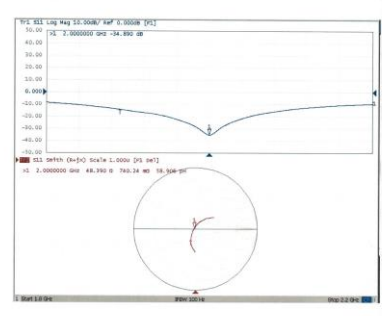
**Methods Applied and Interpretation of Parameters:**  
 • Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.  
 • Antenna Parameters with TSL: The dipole is mounted 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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<p>In Collaboration with <b>TTL S P E A G</b> CALIBRATION LABORATORY</p> <p>CAICT</p> <p>Address: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-4239683-2117 E-mail: ott@china.ttl.com http://www.caict.ac.cn</p> <p><b>Measurement Conditions</b> DASY system configuration, as far as not given on page 1.</p> <table border="1"> <tr> <td>DASY Version</td> <td>DASY52</td> <td>52.10.4</td> </tr> <tr> <td>Extrapolation</td> <td>Advanced Extrapolation</td> <td></td> </tr> <tr> <td>Phantom</td> <td>Triple Flat Phantom 5.1C</td> <td></td> </tr> <tr> <td>Distance Dipole Center - TSL</td> <td>10 mm</td> <td>with Spacer</td> </tr> <tr> <td>Zoom Scan Resolution</td> <td>dx, dy, dz = 5 mm</td> <td></td> </tr> <tr> <td>Frequency</td> <td>2000 MHz ± 1 MHz</td> <td></td> </tr> </table> <p><b>Head TSL parameters</b> The following parameters and calculations were applied.</p> <table border="1"> <tr> <td></td> <td>Temperature</td> <td>Permittivity</td> <td>Conductivity</td> </tr> <tr> <td>Nominal Head TSL parameters</td> <td>22.0 °C</td> <td>40.0</td> <td>1.40 mho/m</td> </tr> <tr> <td>Measured Head TSL parameters</td> <td>(22.0 ± 0.2) °C</td> <td>40.2 ± 0.5 %</td> <td>1.39 mho/m ± 0.5 %</td> </tr> <tr> <td>Head TSL temperature change during test</td> <td>&lt;1.0 °C</td> <td>---</td> <td>---</td> </tr> </table> <p><b>SAR result with Head TSL</b></p> <table border="1"> <tr> <td>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</td> <td>Condition</td> <td></td> </tr> <tr> <td>SAR measured</td> <td>250 mW input power</td> <td>10.4 W/kg</td> </tr> <tr> <td>SAR for nominal Head TSL parameters</td> <td>normalized to 1W</td> <td>41.8 W/kg ± 18.8 % (k=2)</td> </tr> <tr> <td>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</td> <td>Condition</td> <td></td> </tr> <tr> <td>SAR measured</td> <td>250 mW input power</td> <td>5.30 W/kg</td> </tr> <tr> <td>SAR for nominal Head TSL parameters</td> <td>normalized to 1W</td> <td>21.3 W/kg ± 18.7 % (k=2)</td> </tr> </table> <p>Certificate No: Z22-60186 Page 3 of 6</p>	DASY Version	DASY52	52.10.4	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	2000 MHz ± 1 MHz			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	40.2 ± 0.5 %	1.39 mho/m ± 0.5 %	Head TSL temperature change during test	<1.0 °C	---	---	SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition		SAR measured	250 mW input power	10.4 W/kg	SAR for nominal Head TSL parameters	normalized to 1W	41.8 W/kg ± 18.8 % (k=2)	SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition		SAR measured	250 mW input power	5.30 W/kg	SAR for nominal Head TSL parameters	normalized to 1W	21.3 W/kg ± 18.7 % (k=2)	<p>In Collaboration with <b>TTL S P E A G</b> CALIBRATION LABORATORY</p> <p>CAICT</p> <p>Address: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-4239683-2117 E-mail: ott@china.ttl.com http://www.caict.ac.cn</p> <p><b>Appendix (Additional assessments outside the scope of CNAS L6570)</b></p> <p><b>Antenna Parameters with Head TSL</b></p> <table border="1"> <tr> <td>Impedance, transformed to feed point</td> <td>48.4Ω ± 0.74jΩ</td> </tr> <tr> <td>Return Loss</td> <td>-34.9dB</td> </tr> </table> <p><b>General Antenna Parameters and Design</b></p> <table border="1"> <tr> <td>Electrical Delay (one direction)</td> <td>1.088 ns</td> </tr> </table> <p>After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point can be measured.</p> <p>The dipole is made of standard semi-rigid 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, spiral and 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.</p> <p>No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feed-point may be damaged.</p> <p><b>Additional EUT Data</b></p> <table border="1"> <tr> <td>Manufactured by</td> <td>SPEAG</td> </tr> </table> <p>Certificate No: Z22-60186 Page 4 of 6</p>	Impedance, transformed to feed point	48.4Ω ± 0.74jΩ	Return Loss	-34.9dB	Electrical Delay (one direction)	1.088 ns	Manufactured by	SPEAG
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## 1.9 D2300V2 - SN 1096

<p>Address: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-42304633-2512 Fax: +86-10-42304633-2504 E-mail: cti@china.ttl.com http://www.china.ttl.com</p>		<p>Address: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-42304633-3079 Fax: +86-10-42304633-2504 E-mail: cti@china.ttl.com http://www.china.ttl.com</p>	
<p>Client: <b>SGS-CN</b> Certificate No: <b>Z22-60106</b></p>			
<p><b>CALIBRATION CERTIFICATE</b></p>			
Object	D2300V2 - SN 1096		
Calibration Procedure(s)	FF-Z11-003-01 Calibration Procedures for dipole validation kits		
Calibration date:	March 31, 2022		
<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)°C and humidity &lt;70%.</p>			
<p>Calibration Equipment used (M&amp;TE critical for calibration)</p>			
Primary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration
Power Meter NRP2	108277	24-Sep-21 (CTTL No.J21X08328)	Sep-22
Power sensor NRP8S	104291	24-Sep-21 (CTTL No.J21X08328)	Sep-22
Reference Probe EX30/VA	SN 7307	26-May-21 (SPEAG No.EK3-7307_May21)	May-22
DAE4	SN 1556	12-Jan-22 (CTTL-SPEAG No.Z22-60007)	Jan-23
Secondary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	13-Jan-22 (CTTL No.J22X00406)	Jan-23
Network Analyzer E5071C	MY46110673	14-Jan-22 (CTTL No.J22X00406)	Jan-23
Calibrated by:	Name	Function	Signature
	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Diaryuan	SAR Project Leader	
<p>This calibration certificate shall not be reproduced except in full without written approval of the laboratory.</p>			
Certificate No: Z22-60106		Page 1 of 6	

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<p><b>Measurement Conditions</b> DASY system configuration, as far as not given on page 1</p>			
DASY Version	DASY52	52.10.4	
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	2300 MHz ± 1 MHz		
<p><b>Head TSL parameters</b> The following parameters and calculations were applied:</p>			
	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.5	1.67 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.8 ± 0.6 %	1.70 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	—	
<p><b>SAR result with Head TSL</b></p>			
SAR averaged over 1 cm <sup>2</sup> (1 g) of Head TSL	Condition		
SAR measured	250 mW input power	12.4 W/kg	
SAR for nominal Head TSL parameters	normalized to 1W	49.2 W/kg ± 18.8 % (k=2)	
SAR averaged over 10 cm <sup>2</sup> (10 g) of Head TSL	Condition		
SAR measured	250 mW input power	5.88 W/kg	
SAR for nominal Head TSL parameters	normalized to 1W	23.4 W/kg ± 18.7 % (k=2)	
Certificate No: Z22-60106		Page 3 of 6	

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<p><b>Glossary:</b></p>			
TSL	Issue simulating liquid		
ConvF	sensitivity in TSL / NORMx.y.z		
N/A	not applicable or not measured		
<p><b>Calibration is Performed According to the Following Standards:</b></p>			
<p>a) IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices- Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020</p>			
<p>b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"</p>			
<p><b>Additional Documentation:</b></p>			
<p>c) DASY4/5 System Handbook</p>			
<p><b>Methods Applied and Interpretation of Parameters:</b></p>			
<ul style="list-style-type: none"> <li>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.</li> <li>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.</li> <li>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.</li> <li>Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required.</li> <li>SAR measured: SAR measured at the stated antenna input power.</li> <li>SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.</li> <li>SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.</li> </ul>			
<p>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%.</p>			
Certificate No: Z22-60106		Page 2 of 6	

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<p><b>Appendix (Additional assessments outside the scope of CNAS L0570)</b></p>			
<p><b>Antenna Parameters with Head TSL</b></p>			
Impedance, transformed to feed point	49.2Ω -4.56jΩ		
Return Loss	-26.6dB		
<p><b>General Antenna Parameters and Design</b></p>			
Electrical Delay (one direction)	1.083 ns		
<p>After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point can be measured.</p>			
<p>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 and 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 feed-point may be damaged.</p>			
<p><b>Additional EUT Data</b></p>			
Manufactured by	SPEAG		
Certificate No: Z22-60106		Page 4 of 6	



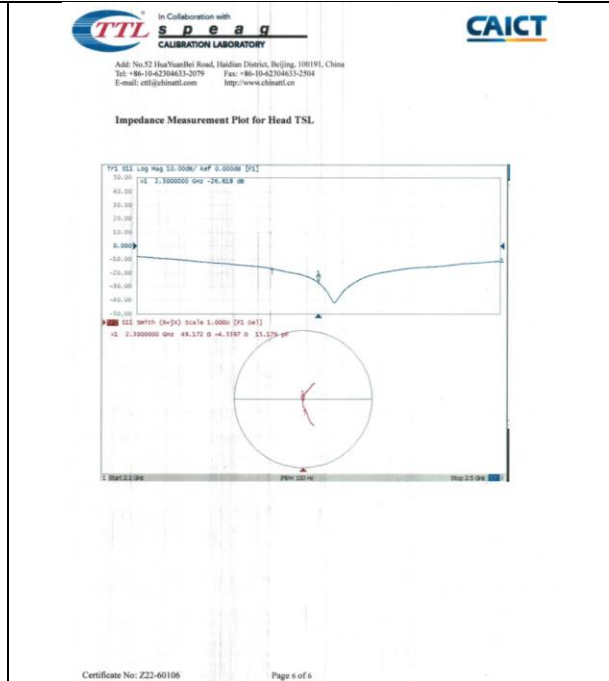
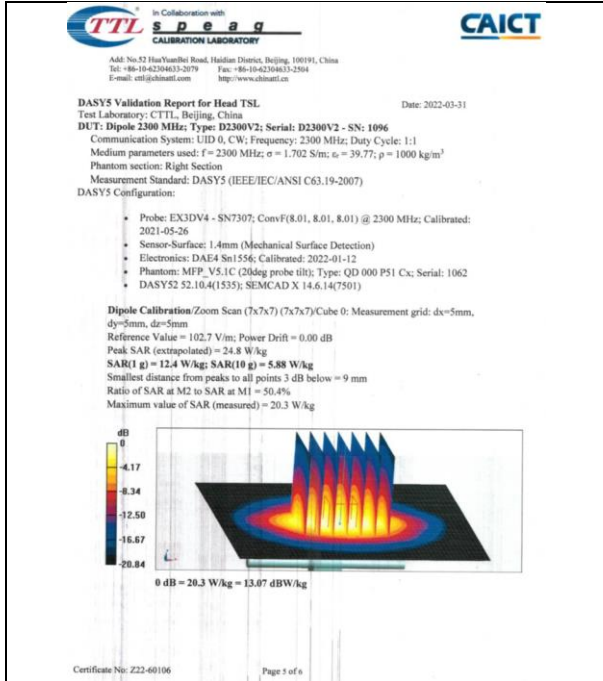
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## 1.10 D2450V2 - SN 817

**CALIBRATION CERTIFICATE**  
 Client: SGS-CN Certificate No: Z22-60107  
 Object: D2450V2 - SN 817  
 Calibration Procedure(s): FF-Z11-003-01  
 Calibration date: April 1, 2022  
 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	108277	24-Sep-21 (CTTL No.J21X08320)	Sep-22
Power sensor NRP8S	104291	24-Sep-21 (CTTL No.J21X08320)	Sep-22
Reference Probe EX3DV4	SN 7307	26-May-21(SPEAG.No.EX3-7307_May21)	May-22
DAE4	SN 1556	12-Jan-22(CTTL-SPEAG.No.Z22-60007)	Jan-23

Secondary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	13-Jan-22 (CTTL No. J22X00406)	Jan-23
Network Analyzer E5071C	MY46110873	14-Jan-22 (CTTL No. J22X00406)	Jan-23

Calibrated by: Zhao Jing (SAR Test Engineer)  
 Reviewed by: Lin Hao (SAR Test Engineer)  
 Approved by: Qi Dianyuan (SAR Project Leader)  
 Issued: April 6, 2022  
 This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

**Glossary:**  
 TSL: tissue simulating liquid  
 ConvF: sensitivity in TSL / NORMx.yz  
 N/A: not applicable or not measured

**Calibration is Performed According to the Following Standards:**  
 a) IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices- Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020  
 b) KDB 855664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

**Additional Documentation:**  
 c) DASY4/5 System Handbook

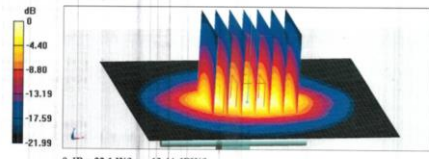
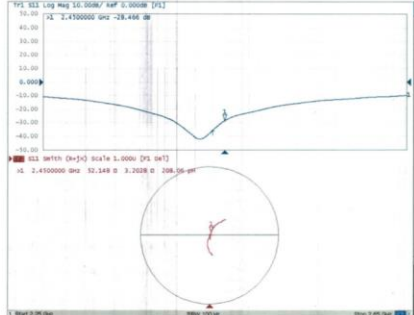
**Methods Applied and Interpretation of Parameters:**

- 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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<p><b>TTL Speaq</b> CALIBRATION LABORATORY</p> <p>In Collaboration with <b>CAICT</b></p> <p>Address: No. 52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-42304633-2079 Fax: +86-10-42304633-2504 E-mail: cti@chinaetl.com http://www.chinaetl.cn</p> <p><b>Measurement Conditions</b> DASY system configuration, as far as not given on page 1</p> <table border="1"> <tr> <td>DASY Version</td> <td>DASY52</td> <td>52.10.4</td> </tr> <tr> <td>Extrapolation</td> <td>Advanced Extrapolation</td> <td></td> </tr> <tr> <td>Phantom</td> <td>Triple Flat Phantom 5.1C</td> <td></td> </tr> <tr> <td>Distance Dipole Center - TSL</td> <td>10 mm</td> <td>with Spacer</td> </tr> <tr> <td>Zoom Scan Resolution</td> <td>dx, dy, dz = 5 mm</td> <td></td> </tr> <tr> <td>Frequency</td> <td>2450 MHz ± 1 MHz</td> <td></td> </tr> </table> <p><b>Head TSL parameters</b> The following parameters and calculations were applied:</p> <table border="1"> <tr> <td>Nominal Head TSL parameters</td> <td>Temperature</td> <td>Permittivity</td> <td>Conductivity</td> </tr> <tr> <td>Measured Head TSL parameters</td> <td>22.0 °C</td> <td>39.2</td> <td>1.80 mho/m</td> </tr> <tr> <td>Head TSL temperature change during test</td> <td>(22.0 ± 0.2) °C</td> <td>39.5 ± 6 %</td> <td>1.79 mho/m ± 6 %</td> </tr> <tr> <td></td> <td>&lt;+1.0 °C</td> <td>---</td> <td>---</td> </tr> </table> <p><b>SAR result with Head TSL</b></p> <table border="1"> <tr> <td>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</td> <td>Condition</td> <td></td> </tr> <tr> <td>SAR measured</td> <td>250 mW input power</td> <td>13.2 W/kg</td> </tr> <tr> <td>SAR for nominal Head TSL parameters</td> <td>normalized to 1W</td> <td>53.0 W/kg ± 18.8 % (k=2)</td> </tr> <tr> <td>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</td> <td>Condition</td> <td></td> </tr> <tr> <td>SAR measured</td> <td>250 mW input power</td> <td>6.15 W/kg</td> </tr> <tr> <td>SAR for nominal Head TSL parameters</td> <td>normalized to 1W</td> <td>24.7 W/kg ± 18.7 % (k=2)</td> </tr> </table> <p>Certificate No: Z22-60107 Page 3 of 6</p>	DASY Version	DASY52	52.10.4	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 ± 1 MHz		Nominal Head TSL parameters	Temperature	Permittivity	Conductivity	Measured Head TSL parameters	22.0 °C	39.2	1.80 mho/m	Head TSL temperature change during test	(22.0 ± 0.2) °C	39.5 ± 6 %	1.79 mho/m ± 6 %		<+1.0 °C	---	---	SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition		SAR measured	250 mW input power	13.2 W/kg	SAR for nominal Head TSL parameters	normalized to 1W	53.0 W/kg ± 18.8 % (k=2)	SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition		SAR measured	250 mW input power	6.15 W/kg	SAR for nominal Head TSL parameters	normalized to 1W	24.7 W/kg ± 18.7 % (k=2)	<p><b>TTL Speaq</b> CALIBRATION LABORATORY</p> <p>In Collaboration with <b>CAICT</b></p> <p>Address: No. 52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-42304633-2079 Fax: +86-10-42304633-2504 E-mail: cti@chinaetl.com http://www.chinaetl.cn</p> <p><b>Appendix (Additional assessments outside the scope of CNAS L0570)</b></p> <p><b>Antenna Parameters with Head TSL</b></p> <table border="1"> <tr> <td>Impedance, transformed to feed point</td> <td>52.10 ± 3.20Ω</td> </tr> <tr> <td>Return Loss</td> <td>-28.5dB</td> </tr> </table> <p><b>General Antenna Parameters and Design</b></p> <table border="1"> <tr> <td>Electrical Delay (one direction)</td> <td>1.066 ns</td> </tr> </table> <p>After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point can be measured.</p> <p>The dipole is made of standard serringid 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 feed-point may be damaged.</p> <p><b>Additional EUT Data</b></p> <table border="1"> <tr> <td>Manufactured by</td> <td>SPEAG</td> </tr> </table> <p>Certificate No: Z22-60107 Page 4 of 6</p>	Impedance, transformed to feed point	52.10 ± 3.20Ω	Return Loss	-28.5dB	Electrical Delay (one direction)	1.066 ns	Manufactured by	SPEAG
DASY Version	DASY52	52.10.4																																																											
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<p><b>TTL Speaq</b> CALIBRATION LABORATORY</p> <p>In Collaboration with <b>CAICT</b></p> <p>Address: No. 52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-42304633-2079 Fax: +86-10-42304633-2504 E-mail: cti@chinaetl.com http://www.chinaetl.cn</p> <p><b>DASY5 Validation Report for Head TSL</b> Date: 2022-04-01</p> <p>Test Laboratory: CTTL, Beijing, China</p> <p>DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 817</p> <p>Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1</p> <p>Medium parameters used: f = 2450 MHz; σ = 1.79 S/m; ε<sub>r</sub> = 39.52; ρ = 1000 kg/m<sup>3</sup></p> <p>Phantom section: Right Section</p> <p>Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)</p> <p><b>DASY5 Configuration:</b></p> <ul style="list-style-type: none"> <li>Probe: EX3DV4 - SN7307; ConvF(7.75, 7.75) @ 2450 MHz; Calibrated: 2021-05-26</li> <li>Sensor-Surface: 1.4mm (Mechanical Surface Detection)</li> <li>Electronics: DA14 Sn1556; Calibrated: 2022-01-12</li> <li>Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062</li> <li>DASY5 52.10.4(1535); SEMCAD X 14.6.14(7501)</li> </ul> <p><b>Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm</b></p> <p>Reference Value = 104.6 V/m; Power Drift = -0.03 dB</p> <p>Peak SAR (extrapolated) = 27.0 W/kg</p> <p>SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.15 W/kg</p> <p>Smallest distance from peaks to all points 3 dB below = 8.9 mm</p> <p>Ratio of SAR at M2 to SAR at M1 = -49.2%</p> <p>Maximum value of SAR (measured) = 22.1 W/kg</p>  <p>0 dB = 22.1 W/kg = 13.44 dBW/kg</p> <p>Certificate No: Z22-60107 Page 1 of 6</p>	<p><b>TTL Speaq</b> CALIBRATION LABORATORY</p> <p>In Collaboration with <b>CAICT</b></p> <p>Address: No. 52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-42304633-2079 Fax: +86-10-42304633-2504 E-mail: cti@chinaetl.com http://www.chinaetl.cn</p> <p><b>Impedance Measurement Plot for Head TSL</b></p>  <p>Certificate No: Z22-60107 Page 6 of 6</p>																																																												



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t(86-512)57355888 f(86-512)57370818 sgs.china@sgs.com



## 1.11 D2600V2 - SN 1158

<p><b>TTL S p e a g</b> CALIBRATION LABORATORY          Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China          Tel: +86-10-42304633-2512 Fax: +86-10-42304633-2504          E-mail: cti@china.ttl.com http://www.chinatit.com</p> <p><b>CAICT</b> 中国认可 国际互认 CALIBRATION CNAS 1079</p> <p>Client: <b>SGS-CN</b> Certificate No: <b>Z22-60108</b></p> <p><b>CALIBRATION CERTIFICATE</b></p> <p>Object: <b>D2600V2 - SN: 1158</b></p> <p>Calibration Procedure(s): <b>FF-Z11-003-01</b> Calibration Procedures for dipole validation kits</p> <p>Calibration date: <b>March 31, 2022</b></p> <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 (23±3)°C and humidity&lt;70%.</p> <p>Calibration Equipment used (M&amp;TE critical for calibration)</p> <table border="1"> <thead> <tr> <th>Primary Standards</th> <th>ID #</th> <th>Cal Date (Calibrated by Certificate No.)</th> <th>Scheduled Calibration</th> </tr> </thead> <tbody> <tr> <td>Power Meter NRP2</td> <td>102577</td> <td>24-Sep-21 (CTTL No.J21X08326)</td> <td>Sep-22</td> </tr> <tr> <td>Power sensor NRP8S</td> <td>104291</td> <td>24-Sep-21 (CTTL No.J21X08326)</td> <td>Sep-22</td> </tr> <tr> <td>Reference Probe EX3/DVA</td> <td>SN 7307</td> <td>26-May-21(SPEAG.No.EX3-7307_May21)</td> <td>May-22</td> </tr> <tr> <td>DAE4</td> <td>SN 1556</td> <td>12-Jan-22(CTTL-SPEAG.No.Z22-60007)</td> <td>Jan-23</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Secondary Standards</th> <th>ID #</th> <th>Cal Date (Calibrated by Certificate No.)</th> <th>Scheduled Calibration</th> </tr> </thead> <tbody> <tr> <td>Signal Generator E4438C</td> <td>MY49071430</td> <td>13-Jan-22 (CTTL No.Z22X00409)</td> <td>Jan-23</td> </tr> <tr> <td>Network Analyzer E5071C</td> <td>MY46110673</td> <td>14-Jan-22 (CTTL No.Z22X00409)</td> <td>Jan-23</td> </tr> </tbody> </table> <p>Calibrated by: <b>Zhao Jing</b> SAR Test Engineer</p> <p>Reviewed by: <b>Lin Hao</b> SAR Test Engineer</p> <p>Approved by: <b>Qi Dianyuan</b> SAR Project Leader</p> <p>Issued: April 6, 2022</p> <p>This calibration certificate shall not be reproduced except in full without written approval of the laboratory.</p> <p>Certificate No: Z22-60108 Page 1 of 6</p>	Primary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration	Power Meter NRP2	102577	24-Sep-21 (CTTL No.J21X08326)	Sep-22	Power sensor NRP8S	104291	24-Sep-21 (CTTL No.J21X08326)	Sep-22	Reference Probe EX3/DVA	SN 7307	26-May-21(SPEAG.No.EX3-7307_May21)	May-22	DAE4	SN 1556	12-Jan-22(CTTL-SPEAG.No.Z22-60007)	Jan-23	Secondary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration	Signal Generator E4438C	MY49071430	13-Jan-22 (CTTL No.Z22X00409)	Jan-23	Network Analyzer E5071C	MY46110673	14-Jan-22 (CTTL No.Z22X00409)	Jan-23	<p><b>TTL S p e a g</b> CALIBRATION LABORATORY          Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China          Tel: +86-10-42304633-2079 Fax: +86-10-42304633-2504          E-mail: cti@china.ttl.com http://www.chinatit.com</p> <p><b>CAICT</b></p> <p>Glossary:          TSL tissue simulating liquid          ConvF sensitivity in TSL / NORMx.y.z          N/A not applicable or not measured</p> <p>Calibration is Performed According to the Following Standards:          a) IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices- Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020          b) KDB 865864, "SAR Measurement Requirements for 100 MHz to 6 GHz"</p> <p>Additional Documentation:          c) DASY4/S System Handbook</p> <p>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.</p> <p>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%.</p> <p>Certificate No: Z22-60108 Page 2 of 6</p>																																								
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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 feed-point may be damaged.</p> <p>Additional EUT Data</p> <table border="1"> <thead> <tr> <th>Parameter</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>Manufactured by</td> <td>SPEAG</td> </tr> </tbody> </table> <p>Certificate No: Z22-60108 Page 4 of 6</p>	Parameter	Value	Impedance, transformed to feed point	49.90- 6.49jΩ	Return Loss	-23.8dB	Parameter	Value	Electrical Delay (one direction)	1.053 ns	Parameter	Value	Manufactured by	SPEAG
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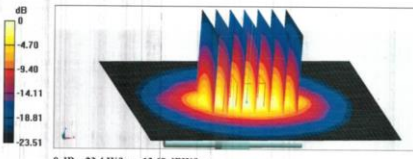
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 E-mail: cti@china.ttl.com.cn http://www.china.ttl.com.cn

Date: 2022-03-31

**DASY5 Validation Report for Head TSL**  
 Test Laboratory: CTTL, Beijing, China  
 DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1158  
 Communication System: UID 0, CW; Frequency: 2600 MHz; Duty Cycle: 1:1  
 Phantom parameters used:  $f = 2600$  MHz;  $\sigma = 1.955$  S/m;  $\epsilon_r = 38.68$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: Right Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)  
 DASY5 Configuration:

- Probe: EX3DV4 - SN7307; ConvF(7.5, 7.5, 7.5) @ 2600 MHz; Calibrated: 2021-05-26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2022-01-12
- Phantom: MFP-V5.1C (2ldag probe fill); Type: QD 000 P51 Cx; Serial: 1062
- DASY52.52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0; Measurement grid: dx=5mm, dy=5mm, dz=5mm  
 Reference Value = 103.3 V/m; Power Drift = 0.04 dB  
 Peak SAR (extrapolated) = 29.9 W/kg  
 SAR(1 g) = 13.7 W/kg; SAR(10 g) = 6.12 W/kg  
 Smallest distance from peaks to all points 3 dB below = 8.9 mm  
 Ratio of SAR at M2 to SAR at M1 = 47.5%  
 Maximum value of SAR (measured) = 23.4 W/kg



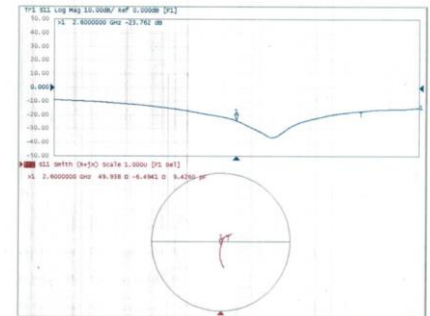
0 dB = 23.4 W/kg = 13.69 dBW/kg

Certificate No: Z22-60108 Page 5 of 6

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**Impedance Measurement Plot for Head TSL**



Certificate No: Z22-60108 Page 6 of 6

## 1.12 D5GHzV2 - SN 1095

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Client: **SGS-CN** Certificate No: **Z22-60187**

**CALIBRATION CERTIFICATE**

Object: D5GHzV2 - SN: 1095

Calibration Procedure(s): FF-Z11-003-01  
 Calibration Procedures for dipole validation kits

Calibration date: June 1, 2022

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 (23±1)°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	106277	24-Sep-21 (CTTL No. J21008326)	Sep-22
Power sensor NRP8S	104291	24-Sep-21 (CTTL No. J21008328)	Sep-22
Reference Probe EX3DV4	SN 7464	26-Jan-22(SPEAG No. EX3-7464_Jan22)	Jan-23
DAE4	SN 1556	12-Jan-22(CTTL-SPEAG No. Z22-60007)	Jan-23

Secondary Standards	ID #	Cal Date (Calibrated by: Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY46071430	13-Jan-22 (CTTL No. J22X00406)	Jan-23
Network Analyzer E5071C	MY46110673	14-Jan-22 (CTTL No. J22X00406)	Jan-23

Calibrated by: Zhao Jing, SAR Test Engineer

Reviewed by: Lin Hao, SAR Test Engineer

Approved by: Qi Dianyan, SAR Project Leader

Issued: June 6, 2022

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**TTL Speaq** CALIBRATION LABORATORY  
 In Collaboration with **CAICT**

Address: No. 52 HuaYuanBei Road, Haidian District, Beijing, 100191, China  
 Tel: +86-10-62104633-2079 Fax: +86-10-62104633-2504  
 E-mail: cti@china.ttl.com.cn http://www.china.ttl.com.cn

**Glossary:**

TSL: Issue simulating liquid  
 ConvF: sensitivity in TSL / NORMx.y.z  
 N/A: not applicable or not measured

**Calibration is Performed According to the Following Standards:**

- IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices- Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020
- KDB 665664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

**Additional Documentation:**

- DASY4/G 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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No. 10, Weiye Road, Innovation Park, Kunshan, Jiangsu, China 215300  
 中国·江苏·昆山市留学生创业园伟业路10号 邮编 215300

t(86-512)57355888 f(86-512)57370818 www.sgsgroup.com.cn  
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<p>In Collaboration with <b>TTL</b> CALIBRATION LABORATORY</p> <p>CAICT</p> <p>Address: No. 52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-62382117 E-mail: cti@ttsnail.com http://www.caict.ac.cn</p>																			
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Return Loss	-24.9dB				
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No. 10, Weiye Road, Innovation Park, Kunshan, Jiangsu, China 215300  
 中国·江苏·昆山市留学生创业园伟业路10号 邮编 215300  
 t(86-512)57355888 f(86-512)57370818 www.sgs.com.cn  
 t(86-512)57355888 f(86-512)57370818 sgs.china@sgs.com

<p>In Collaboration with <b>speaq</b> CALIBRATION LABORATORY</p> <p>CAICT</p> <p>Address: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-62021117 E-mail: <a href="mailto:ott@ttsnet.com">ott@ttsnet.com</a> <a href="http://www.caict.ac.cn">http://www.caict.ac.cn</a></p> <p><b>General Antenna Parameters and Design</b></p> <p>Electrical Delay (one direction): 1.101 ns</p> <p>After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point can be measured.</p> <p>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 feed-point may be damaged.</p> <p><b>Additional EUT Data</b></p> <p>Manufactured by: SPEAG</p> <p>Certificate No: Z22-60187 Page 7 of 10</p>	<p>In Collaboration with <b>speaq</b> CALIBRATION LABORATORY</p> <p>CAICT</p> <p>Address: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-62021117 E-mail: <a href="mailto:ott@ttsnet.com">ott@ttsnet.com</a> <a href="http://www.caict.ac.cn">http://www.caict.ac.cn</a></p> <p><b>DASY5 Validation Report for Head TSL</b></p> <p>Test Laboratory: CCTL, Beijing, China Date: 2022-06-01</p> <p><b>DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1095</b></p> <p>Communication System: CW; Frequency: 5200 MHz; Frequency: 5300 MHz; Frequency: 5500 MHz; Frequency: 5600 MHz; Frequency: 5800 MHz; Duty Cycle: 1:1 Medium parameters used: <math>f = 5200</math> MHz; <math>\sigma = 4.62</math> S/m; <math>\epsilon_r = 35.38</math>; <math>\rho = 1000</math> kg/m<sup>3</sup> Medium parameters used: <math>f = 5300</math> MHz; <math>\sigma = 4.73</math> S/m; <math>\epsilon_r = 35.19</math>; <math>\rho = 1000</math> kg/m<sup>3</sup> Medium parameters used: <math>f = 5500</math> MHz; <math>\sigma = 4.939</math> S/m; <math>\epsilon_r = 34.83</math>; <math>\rho = 1000</math> kg/m<sup>3</sup> Medium parameters used: <math>f = 5600</math> MHz; <math>\sigma = 5.051</math> S/m; <math>\epsilon_r = 34.68</math>; <math>\rho = 1000</math> kg/m<sup>3</sup> Medium parameters used: <math>f = 5800</math> MHz; <math>\sigma = 5.247</math> S/m; <math>\epsilon_r = 34.42</math>; <math>\rho = 1000</math> kg/m<sup>3</sup> Phantom section: Right Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007) DASY5 Configuration:</p> <ul style="list-style-type: none"> <li>Probe: EX3DV4 - SN7484; ConvF(5.6, 5.6, 5.6) @ 5200 MHz; ConvF(5.32, 5.32, 5.32) @ 5300 MHz; ConvF(5.11, 5.11, 5.11) @ 5500 MHz; ConvF(4.91, 4.91, 4.91) @ 5600 MHz; ConvF(5, 5, 5) @ 5800 MHz; Calibrated: 2022-01-26</li> <li>Sensor-Surface: 1.4mm (Mechanical Surface Detection)</li> <li>Electronics: DAE4 Sn1556; Calibrated: 2022-01-12</li> <li>Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P1 Cx; Serial: 1062</li> <li>DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)</li> </ul> <p><b>Dipole Calibration /Pin=100mW, d=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0; Measurement grid: dx=4mm, dy=4mm, dz=1.4mm</b> Reference Value = 60.80 V/m; Power Drift = -0.06 dB Peak SAR (extrapolated) = 29.8 W/kg SAR(1 g) = 7.73 W/kg; SAR(10 g) = 2.22 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 66.8% Maximum value of SAR (measured) = 18.3 W/kg</p> <p><b>Dipole Calibration /Pin=100mW, d=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0; Measurement grid: dx=4mm, dy=4mm, dz=1.4mm</b> Reference Value = 61.08 V/m; Power Drift = -0.07 dB Peak SAR (extrapolated) = 31.5 W/kg SAR(1 g) = 7.94 W/kg; SAR(10 g) = 2.27 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 65.5% Maximum value of SAR (measured) = 19.0 W/kg</p> <p>Certificate No: Z22-60187 Page 8 of 10</p>
<p>In Collaboration with <b>speaq</b> CALIBRATION LABORATORY</p> <p>CAICT</p> <p>Address: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-62021117 E-mail: <a href="mailto:ott@ttsnet.com">ott@ttsnet.com</a> <a href="http://www.caict.ac.cn">http://www.caict.ac.cn</a></p> <p><b>Dipole Calibration /Pin=100mW, d=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0; Measurement grid: dx=4mm, dy=4mm, dz=1.4mm</b> Reference Value = 61.92 V/m; Power Drift = -0.08 dB Peak SAR (extrapolated) = 34.7 W/kg SAR(1 g) = 8.28 W/kg; SAR(10 g) = 2.34 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 63.9% Maximum value of SAR (measured) = 20.2 W/kg</p> <p><b>Dipole Calibration /Pin=100mW, d=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0; Measurement grid: dx=4mm, dy=4mm, dz=1.4mm</b> Reference Value = 65.08 V/m; Power Drift = -0.07 dB Peak SAR (extrapolated) = 35.2 W/kg SAR(1 g) = 8.12 W/kg; SAR(10 g) = 2.3 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 62.5% Maximum value of SAR (measured) = 19.1 W/kg</p> <p><b>Dipole Calibration /Pin=100mW, d=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0; Measurement grid: dx=4mm, dy=4mm, dz=1.4mm</b> Reference Value = 62.13 V/m; Power Drift = -0.06 dB Peak SAR (extrapolated) = 34.8 W/kg SAR(1 g) = 7.71 W/kg; SAR(10 g) = 2.16 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 61.6% Maximum value of SAR (measured) = 18.7 W/kg</p> <p>0 dB = 18.7 W/kg = 12.72 dBW/kg</p> <p>Certificate No: Z22-60187 Page 9 of 10</p>	<p>In Collaboration with <b>speaq</b> CALIBRATION LABORATORY</p> <p>CAICT</p> <p>Address: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-62021117 E-mail: <a href="mailto:ott@ttsnet.com">ott@ttsnet.com</a> <a href="http://www.caict.ac.cn">http://www.caict.ac.cn</a></p> <p><b>Impedance Measurement Plot for Head TSL</b></p> <p>Certificate No: Z22-60187 Page 10 of 10</p>



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Compliance Certification Services (Kunshan) Inc.  
EMC Laboratory

No.10, Weiye Road, Innovation Park, Kunshan, Jiangsu, China 215300  
中国·江苏·昆山市留学生创业园伟业路10号 邮编 215300

t(86-512)57355888 f(86-512)57370818 www.sgs.com.cn  
t(86-512)57355888 f(86-512)57370818 sgs.china@sgs.com



## 2 DAE4 - SN 1245

<p style="text-align: center;"><b>s p e a g</b></p> <p style="text-align: center;"><b>IMPORTANT NOTICE</b></p> <p><b>USAGE OF THE DAE4</b></p> <p>The DAE unit is a delicate, high precision instrument and requires careful treatment by the user. There are no serviceable parts inside the DAE. Special attention shall be given to the following points:</p> <p><b>Battery Exchange:</b> The battery cover of the DAE4 unit is fixed using a screw, over tightening the screw may cause the threads inside the DAE to wear out.</p> <p><b>Shipping of the DAE:</b> Before shipping the DAE to SPEAG for calibration, remove the batteries and pack the DAE in an anti-static bag. This anti-static bag shall then be packed into a larger box or container which protects the DAE from impacts during transportation. The package shall be marked to indicate that a fragile instrument is inside.</p> <p><b>E-Stop Failures:</b> Touch detection may be malfunctioning due to broken magnets in the E-stop. Rough handling of the E-stop may lead to damage of these magnets. Touch and collision errors are often caused by dust and dirt accumulated in the E-stop. To prevent E-stop failures, the customer shall always mount the probe to the DAE carefully and keep the DAE unit in a non-dusty environment if not used for measurements.</p> <p><b>Repair:</b> Minor repairs are performed at no extra cost during the annual calibration. However, SPEAG reserves the right to charge for any repair especially if rough/unprofessional handling caused the defect.</p> <p><b>DASY Configuration Files:</b> Since the exact values of the DAE input resistances, as measured during the calibration procedure of a DAE unit, are not used by the DASY software, a nominal value of 200 MOhm is given in the corresponding configuration file.</p> <p><b>Important Note:</b> Warranty and calibration is void if the DAE unit is disassembled partly or fully by the Customer.</p> <p><b>Important Note:</b> Never attempt to grease or oil the E-stop assembly. Cleaning and readjusting of the E-stop assembly is allowed by certified SPEAG personnel only and is part of the annual calibration procedure.</p> <p><b>Important Note:</b> To prevent damage of the DAE probe connector pins, use great care when installing the probe to the DAE. Carefully connect the probe with the connector notch oriented in the mating position. Avoid any rotational movement of the probe body versus the DAE while turning the locking nut of the connector. The same care shall be used when disconnecting the probe from the DAE.</p> <p style="font-size: small;">TN_EH160306AE_DAE4.docx <span style="float: right;">07.03.2019</span></p>	<p style="text-align: center;"><b>Calibration Laboratory of Schmid &amp; Partner Engineering AG</b></p> <p style="text-align: center;">Zugzwisstrasse 43, 8004 Zurich, Switzerland</p> <p style="text-align: center;">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</p> <p style="text-align: center;">Accreditation No.: SCS 0108</p> <p style="text-align: center;">Client: <b>SGS-CN (Auden)</b> Certificate No.: <b>DAE4-1245_May22</b></p> <p style="text-align: center;"><b>CALIBRATION CERTIFICATE</b></p> <p>Object: <b>DAE4 - SD 000 D04 BM - SN: 1245</b></p> <p>Calibration procedure(s): <b>QA CAL-06 v30</b> Calibration procedure for the data acquisition electronics (DAE)</p> <p>Calibration date: <b>May 30, 2022</b></p> <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)°C and humidity &lt; 70%.</p> <p>Calibration Equipment used (M&amp;E critical for calibration)</p> <table border="1" style="width:100%; font-size: x-small;"> <thead> <tr> <th>Primary Standards</th> <th>ID #</th> <th>Cal Date (Certificate No.)</th> <th>Scheduled Calibration</th> </tr> </thead> <tbody> <tr> <td>Kelvin Multimeter Type 2001</td> <td>SN: 0810276</td> <td>31-Aug-21 (No:31368)</td> <td>Aug-22</td> </tr> </tbody> </table> <table border="1" style="width:100%; font-size: x-small;"> <thead> <tr> <th>Secondary Standards</th> <th>ID #</th> <th>Check Date (in house)</th> <th>Scheduled Check</th> </tr> </thead> <tbody> <tr> <td>Auto DAE Calibration Unit</td> <td>SE LWS 003 AA 1001</td> <td>24-Jan-22 (in house check)</td> <td>In house check Jan-23</td> </tr> <tr> <td>Calibrator class V3.1</td> <td>SE LWS 100 AA 1002</td> <td>24-Jan-22 (in house check)</td> <td>In house check Jan-23</td> </tr> </tbody> </table> <p>Calibrated by: <b>Dominique Shelten</b> (Name) / <b>Laboratory Technician</b> (Function) / <i>[Signature]</i> (Signature)</p> <p>Approved by: <b>Steen Kohn</b> (Name) / <b>Technical Manager</b> (Function) / <i>[Signature]</i> (Signature)</p> <p style="font-size: x-small;">This calibration certificate shall not be reproduced except in full without written approval of the laboratory. Issued: May 30, 2022</p> <p style="font-size: x-small;">Certificate No: DAE4-1245_May22 Page 1 of 5</p>	Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration	Kelvin Multimeter Type 2001	SN: 0810276	31-Aug-21 (No:31368)	Aug-22	Secondary Standards	ID #	Check Date (in house)	Scheduled Check	Auto DAE Calibration Unit	SE LWS 003 AA 1001	24-Jan-22 (in house check)	In house check Jan-23	Calibrator class V3.1	SE LWS 100 AA 1002	24-Jan-22 (in house check)	In house check Jan-23
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<p style="text-align: center;"><b>Calibration Laboratory of Schmid &amp; Partner Engineering AG</b></p> <p style="text-align: center;">Zugzwisstrasse 43, 8004 Zurich, Switzerland</p> <p style="text-align: center;">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</p> <p style="text-align: center;">Accreditation No.: SCS 0108</p> <p><b>Glossary</b></p> <p>DAE: data acquisition electronics</p> <p>Connector angle: information used in DASY system to align probe sensor X to the robot coordinate system.</p> <p><b>Methods Applied and Interpretation of Parameters</b></p> <ul style="list-style-type: none"> <li>• <b>DC Voltage Measurement:</b> 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.</li> <li>• <b>Connector angle:</b> The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.</li> <li>• The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.             <ul style="list-style-type: none"> <li>• <b>DC Voltage Measurement Linearity:</b> Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.</li> <li>• <b>Common mode sensitivity:</b> Influence of a positive or negative common mode voltage on the differential measurement.</li> <li>• <b>Channel separation:</b> Influence of a voltage on the neighbor channels not subject to an input voltage.</li> <li>• <b>AD Converter Values with inputs shorted:</b> Values on the internal AD converter corresponding to zero input voltage</li> <li>• <b>Input Offset Measurement:</b> Output voltage and statistical results over a large number of zero voltage measurements.</li> <li>• <b>Input Offset Current:</b> Typical value for information; Maximum channel input offset current, not considering the input resistance.</li> <li>• <b>Input resistance:</b> Typical value for information; DAE input resistance at the connector, during internal auto-zeroing and during measurement.</li> <li>• <b>Low Battery Alarm Voltage:</b> Typical value for information. Below this voltage, a battery alarm signal is generated.</li> <li>• <b>Power consumption:</b> Typical value for information. Supply currents in various operating modes.</li> </ul> </li> </ul> <p style="font-size: x-small;">Certificate No: DAE4-1245_May22 Page 2 of 5</p>	<p><b>DC Voltage Measurement</b></p> <p>AD - Converter Resolution nominal</p> <p>High Range: 1LSB = 6 mV, full range = -100...+320 mV</p> <p>Low Range: 1LSB = 61 mV, full range = -1...+3mV</p> <p>DASY measurement parameters: Auto Zero-Time: 3 sec; Measuring time: 3 sec</p> <table border="1" style="width:100%; font-size: x-small;"> <thead> <tr> <th>Calibration Factors</th> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>High Range</td> <td>405.265 ± 0.02% (k=2)</td> <td>403.974 ± 0.02% (k=2)</td> <td>406.092 ± 0.02% (k=2)</td> </tr> <tr> <td>Low Range</td> <td>3.99534 ± 1.50% (k=2)</td> <td>3.99508 ± 1.50% (k=2)</td> <td>4.01015 ± 1.50% (k=2)</td> </tr> </tbody> </table> <p><b>Connector Angle</b></p> <table border="1" style="width:100%; font-size: x-small;"> <tr> <td>Connector Angle to be used in DASY system</td> <td>30.0° ± 1°</td> </tr> </table> <p style="font-size: x-small;">Certificate No: DAE4-1245_May22 Page 3 of 5</p>	Calibration Factors	X	Y	Z	High Range	405.265 ± 0.02% (k=2)	403.974 ± 0.02% (k=2)	406.092 ± 0.02% (k=2)	Low Range	3.99534 ± 1.50% (k=2)	3.99508 ± 1.50% (k=2)	4.01015 ± 1.50% (k=2)	Connector Angle to be used in DASY system	30.0° ± 1°						
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Appendix (Additional assessments outside the scope of SCS0108)			
<b>1. DC Voltage Linearity</b>			
High Range			
Channel	Reading (µV)	Difference (µV)	Error (%)
Channel X + Input	19994.45	1.52	0.00
Channel X - Input	20004.58	2.22	0.01
Channel Y + Input	-20000.14	1.12	-0.01
Channel Y - Input	19994.72	1.58	0.00
Channel Z + Input	20001.22	-1.00	-0.00
Channel Z - Input	-20003.05	-1.57	0.01
Channel X + Input	19992.84	0.19	0.00
Channel X - Input	20003.09	0.58	0.00
Channel Y + Input	-20001.73	-0.27	0.00
Channel Y - Input	2001.91	0.41	0.02
Channel X + Input	202.54	0.65	0.32
Channel X - Input	-197.86	0.07	-0.04
Channel Y + Input	2002.05	0.58	0.03
Channel Y - Input	201.27	-0.57	-0.28
Channel Z + Input	-199.23	-0.06	0.03
Channel Z - Input	2001.98	0.08	0.00
Channel X + Input	200.09	-1.53	-0.76
Channel X - Input	-199.89	-1.57	0.79
<b>2. Common mode sensitivity</b>			
DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec			
Channel	Common mode Input Voltage (mV)	High Range Average Reading (µV)	Low Range Average Reading (µV)
Channel X	200	-8.87	-7.69
	-200	9.12	7.79
Channel Y	200	-8.68	-8.28
	-200	8.52	8.36
Channel Z	200	-5.36	-5.80
	-200	3.58	3.08
<b>3. Channel separation</b>			
DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec			
Channel X (µV)	Channel Y (µV)	Channel Z (µV)	
200	-	4.07	
200	9.36	-	
200	10.11	7.14	

4. AD-Converter Values with inputs shorted				
DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec				
Channel	High Range (LSB)	Low Range (LSB)		
Channel X	15984	17040		
Channel Y	16562	16768		
Channel Z	16035	15668		
<b>5. Input Offset Measurement</b>				
DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec				
Input 10MΩ				
Channel	Average (µV)	min. Offset (µV)	max. Offset (µV)	Std. Deviation (µV)
Channel X	1.00	-0.15	1.93	0.45
Channel Y	-0.18	-1.28	0.94	0.45
Channel Z	-0.58	-2.61	0.58	0.60
<b>6. Input Offset Current</b>				
Nominal input circuitry offset current on all channels: <25nA				
<b>7. Input Resistance (Typical values for information)</b>				
Channel	Zeroing (ΩOhm)	Measuring (MΩhm)		
Channel X	200	200		
Channel Y	200	200		
Channel Z	200	200		
<b>8. Low Battery Alarm Voltage (Typical values for information)</b>				
Typical values	Alarm Level (VDC)			
Supply (+ Vcc)	+7.9			
Supply (- Vcc)	-7.6			
<b>9. Power Consumption (Typical values for information)</b>				
Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)	
Supply (+ Vcc)	+0.01	+8	+14	
Supply (- Vcc)	-0.01	-8	-9	

## 3 EX3DV4 - SN 7767

<p>Calibration Laboratory of Schmid &amp; Partner Engineering AG Zürcherstrasse 43, 8004 Zürich, Switzerland</p> <p>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</p> <p>Client: <b>SGS-CN (Audien)</b> Certificate No: <b>EX-7767_Oct22</b></p> <p><b>CALIBRATION CERTIFICATE</b></p> <p>Object: <b>EX3DV4 - SN:7767</b></p> <p>Calibration procedure(s): <b>QA CAL-01-v9, QA CAL-12-v9, QA CAL-14-v6, QA CAL-23-v5, QA CAL-25-v7</b> Calibration procedure for dosimetric E-field probes</p> <p>Calibration date: <b>October 28, 2022</b></p> <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) °C and humidity &lt; 70%.</p> <p>Calibration Equipment used (MATE critical for calibration)</p> <table border="1"> <thead> <tr> <th>Primary Standards</th> <th>ID</th> <th>Cal. 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Date (Certificate No.)	Scheduled Calibration	Power meter NRP	SN: 104778	04-Apr-22 (No. 21 F20228-03564)	Apr-23	Power sensor NRP201	SN: 103844	04-Apr-22 (No. 21 F20224)	Apr-23	DCP DAK-S3 (Impedance)	SN: 1048	20-Oct-22 (DCP DAKS-1749_Oct22)	Oct-23	DCP DAK-12	SN: 1018	20-Oct-22 (DCP DAKS-1718_Oct22)	Oct-23	Reference 30 dB Attenuator	SN: 102682 (20)	04-Apr-22 (No. 21 F20227)	Apr-23	DAE4	SN: 981	19-Oct-22 (No. DAE4-980_Oct22)	Oct-23	Reference Probe E53702	SN: 3013	27-Oct-21 (No. E53702_0ct21)	Oct-22	Power meter E4418B	SN: GB41293874	05-Apr-18 (in house check Jun-20)	In house check Jun-24	Power sensor E4418A	SN: 101449889	05-Apr-18 (in house check Jun-20)	In house check Jun-24	Power sensor E4418A	SN: 100112910	05-Apr-18 (in house check Jun-20)	In house check Jun-24	RF generator HP 8548C	SN: US854017193	04-Aug-09 (in house check Jun-20)	In house check Jun-24	Network Analyzer E6656A	SN: 164198477	31-May-14 (in house check Oct-20)	In house check Oct-24	<p>Calibration Laboratory of Schmid &amp; Partner Engineering AG Zürcherstrasse 43, 8004 Zürich, Switzerland</p> <p>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</p> <p>Client: <b>SGS-CN (Audien)</b> Certificate No: <b>EX-7767_Oct22</b></p> <p><b>Glossary</b></p> <p>TSL: Issue simulating liquid sensitivity in free space</p> <p>ConfF: sensitivity in TSL, NORM<sub>M,z,z</sub></p> <p>DCP: diode compression point</p> <p>CF: crest factor (1/3 duty cycle) of the RF signal</p> <p>A, B, C, D: modulation dependent linearization parameters</p> <p>VR: rotation around probe axis</p> <p>Polarization: if rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., θ = 0 is normal to probe axis</p> <p>Connector Angle: information used in DASY system to align probe sensor X to the robot coordinate system</p> <p><b>Calibration is Performed According to the Following Standards:</b></p> <p>a) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.</p> <p>b) IEC 60888-6, "SAR Measurement Requirements for 100 MHz to 6 GHz"</p> <p><b>Methods Applied and Interpretation of Parameters:</b></p> <ul style="list-style-type: none"> <li>NORM<sub>M,z,z</sub>: Assessed for E-field polarization θ = 0 (f = 900 MHz in TEM-cell; f = 1800 MHz; R22 waveguide). NORM<sub>M,z,z</sub> are only intermediate values, i.e., the uncertainties of NORM<sub>M,z,z</sub> does not affect the E-field uncertainty inside TSL (see below ConfF).</li> <li>NORM<sub>M,z,z</sub> = NORM<sub>M,z,z</sub> * 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 ConfF.</li> <li>DCP<sub>M,z,z</sub>: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal. DCP does not depend on frequency nor media.</li> <li>PAR: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics.</li> <li>A<sub>M,z,z</sub>, B<sub>M,z,z</sub>, C<sub>M,z,z</sub>, D<sub>M,z,z</sub>, VR<sub>M,z,z</sub>: A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signals. The parameters do not depend on frequency nor media, VR is the maximum calibration range expressed in RMS voltage across the diode.</li> <li>ConfF and Boundary Effect Parameters: Assessed in far field phantom using E-field (or Temperature Transfer Standard for f &lt; 800 MHz) and media waveguide using analytical field distributions based on power measurements for f &gt; 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM<sub>M,z,z</sub> * ConfF whereby the uncertainty corresponds to that given for ConfF. A frequency dependent ConfF is used in DASY system 4.4 and higher which allows extending the validity from &lt;math&gt;±50 MHz&lt;/math&gt; to &lt;math&gt;±100 MHz&lt;/math&gt;.</li> <li>Spherical Antenna (SD) deviation from isotropy: in a field of low gradients realized using a flat phantom exposed by a patch antenna.</li> <li>Sensor Offset: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.</li> <li>Connector Angle: The angle is assessed using the information gained by determining the NORM<sub>M</sub> (no uncertainty required).</li> </ul> <p>Certificate No: EX-7767_Oct22 Page 2 of 9</p>
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EX3DV4 - SN:7767 October 28, 2022

Parameters of Probe: EX3DV4 - SN:7767

Basic Calibration Parameters

Items (all values) <sup>A</sup>	Sensor X	Sensor Y	Sensor Z	Unc (k = 2)
Norm (μV/(mm) <sup>2</sup> )	0.67	0.69	0.56	±10.1%
DCP (mV) <sup>B</sup>	103.4	107.3	105.7	±4.7%

Calibration Results for Modulation Response

URD	Communication System Name	A dB	B dB/μV	C	D dB	VR mV	Max dev.	Max Unc <sup>C</sup> k=2
0	CW	X 0.00	0.00	1.00	0.00	184.7	±3.5%	±4.7%
		Y 0.00	0.00	1.00	0.00	186.7		
		Z 0.00	0.00	1.00	0.00	179.3		

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>A</sup> The uncertainties of Norm X,Y,Z do not affect the E<sub>1</sub>-field uncertainty inside TSS. (see Page 5).  
<sup>B</sup> Uncertainty parameter uncertainty for maximum specified lead strength.  
<sup>C</sup> Uncertainty is determined using the max. deviation from three response readings and is expressed for the square of the field value.

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EX3DV4 - SN:7767 October 28, 2022

Parameters of Probe: EX3DV4 - SN:7767

Other Probe Parameters

Item	Value
Sensor Arrangement	Triangular
Connector Angle	144.9°
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337mm
Probe Body Diameter	10mm
Tip Length	3mm
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	1.4mm

Note: Measurement distance from surface can be increased to 3-4mm for an Area Scan job.

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EX3DV4 - SN:7767 October 28, 2022

Parameters of Probe: EX3DV4 - SN:7767

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) <sup>C</sup>	Relative Permittivity <sup>D</sup>	Conductivity <sup>E</sup> (S/m)	CompF X	CompF Y	CompF Z	Alpha <sup>F</sup>	Depth <sup>G</sup> (mm)	Unc (k = 2)
150	50.3	0.79	14.08	14.08	14.08	0.00	1.00	±13.2%
450	42.5	0.67	11.50	11.50	11.50	0.16	1.20	±13.3%
750	41.8	0.68	10.26	10.26	10.26	0.30	0.80	±12.0%
855	41.5	0.90	10.00	10.00	10.00	0.43	0.80	±12.0%
1750	40.1	1.37	9.32	9.32	9.32	0.36	0.86	±12.0%
1900	40.0	1.40	8.91	8.91	8.91	0.33	0.86	±12.0%
2100	39.8	1.49	8.60	8.60	8.60	0.30	0.86	±12.0%
2200	39.5	1.67	8.44	8.44	8.44	0.33	0.80	±12.0%
2450	39.2	1.80	8.24	8.24	8.24	0.32	0.90	±12.0%
2600	39.0	1.96	7.99	7.99	7.99	0.27	0.90	±12.0%
3300	38.2	2.71	7.55	7.55	7.55	0.30	1.25	±13.1%
3600	37.9	2.91	7.45	7.45	7.45	0.30	1.35	±13.1%
3700	37.7	3.12	7.20	7.20	7.20	0.30	1.05	±13.1%
3900	37.5	3.32	6.84	6.84	6.84	0.40	1.06	±13.1%
4100	37.2	3.53	6.63	6.63	6.63	0.40	1.00	±13.1%
4300	37.1	3.60	6.30	6.30	6.30	0.40	1.70	±13.1%
4400	36.9	3.84	6.17	6.17	6.17	0.40	1.70	±13.1%
4600	36.7	4.04	6.15	6.15	6.15	0.40	1.70	±13.1%
4800	36.4	4.25	6.13	6.13	6.13	0.40	1.90	±13.1%
4900	36.3	4.40	6.07	6.07	6.07	0.40	1.80	±13.1%
5200	36.0	4.66	5.65	5.65	5.65	0.40	1.80	±13.1%
5300	35.9	4.75	5.48	5.48	5.48	0.40	1.80	±13.1%
5500	35.6	4.99	5.30	5.30	5.30	0.40	1.80	±13.1%
5600	35.5	5.07	5.14	5.14	5.14	0.40	1.80	±13.1%
5800	35.3	5.27	5.10	5.10	5.10	0.40	1.80	±13.1%

<sup>C</sup> Frequency validly above 300 MHz at ±100 MHz only applies for DCP v1.4 and higher (see Page 5), else it is relevant to ±50 MHz. The uncertainty is the 95% of the CompF uncertainty of calibration frequency and the uncertainty for the relative permittivity and conductivity values below 300 MHz is ±15.25, 45.00 and 70.00% for CompF assessments at 30, 45, 125, 175 and 200 MHz respectively. Validity of CompF assessed at 600 Hz to 4.0 GHz, and CompF precision at 150 MHz to 0.1 MHz. Above 4 GHz the validity of CompF can be extended to ±100 MHz.  
<sup>D</sup> At frequencies below 3 GHz, the validity of the tissue parameters (α and ρ) can be related to a 10% liquid composition formula is applied to measured S10 values. At frequencies above 3 GHz, the validity of tissue parameters (α and ρ) is not related to 10%. The uncertainty is the 95% of the CompF uncertainty for individual target tissue parameters.  
<sup>E</sup> Alpha values are determined using calibration. SRFAD warns that the remaining residual due to the uncertainty when after composition is applied has 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 targets.  
<sup>F</sup> Alpha values are determined using calibration. SRFAD warns that the remaining residual due to the uncertainty when after composition is applied has 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 targets.  
<sup>G</sup> Alpha values are determined using calibration. SRFAD warns that the remaining residual due to the uncertainty when after composition is applied has 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 targets.

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Frequency Response of E-Field  
(TEM-Cell#119 EXL, Waveguide#22)

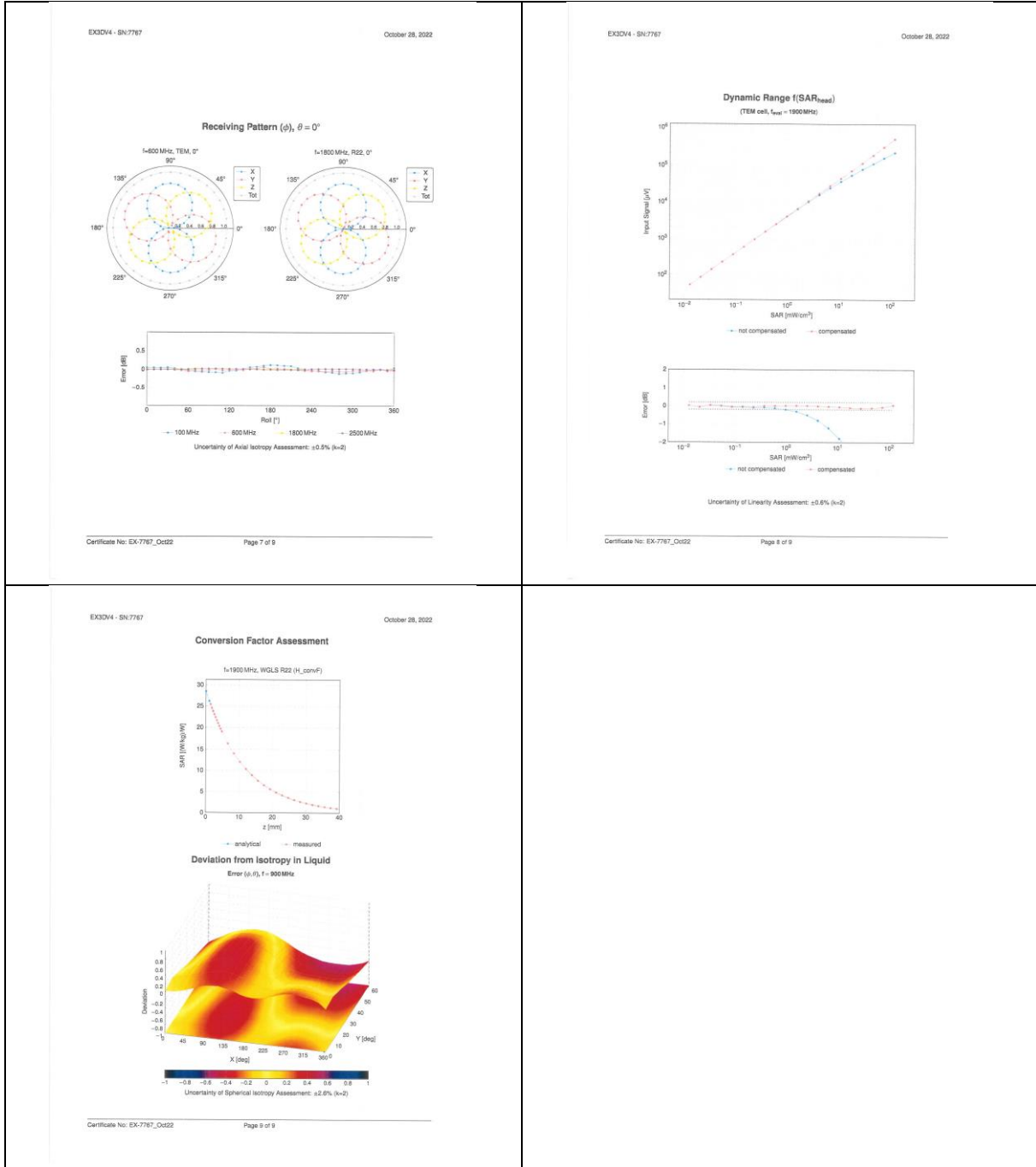
Uncertainty of Frequency Response of E-Field: ±5.3% (k=2)

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**4 Impedance and return loss**

Dipole CLA150 SN 4025				
Head Liquid				
Date of Measurement	Return Loss(dB)	$\Delta$ %	Impedance ( $\Omega$ )	$\Delta\Omega$
2021/4/26	-31.4	/	47.8	/
Dipole D450V3 SN 1103				
Head Liquid				
Date of Measurement	Return Loss(dB)	$\Delta$ %	Impedance ( $\Omega$ )	$\Delta\Omega$
2021/4/21	-23	/	57.1	/



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